
Review of Planning and Implementation of Coastal Zone Management in Sri Lanka

Hettiarachchi, SSL¹ and Samarawickrama, SP²
Department of Civil Engineering, University of Moratuwa, Moratuwa, Sri Lanka

Email: samans@civil.mrt.ac.lk

Abstract

Sri Lanka is one of the island states to have developed very early and operated fully, a Coastal Management Plan on a national scale. The Coast Conservation Department, by Act of Parliament, has full responsibility for the implementation of the plan. The plan is periodically revised to incorporate emerging challenges, current and projected development trends, in refining policies and guidelines. The paper presents a review of planning and implementation of the coastal zone management in Sri Lanka. It focuses on the approach to coastal zone management via regulation of development activities and environmental protection, second generation and current initiatives, challenges and constraints. The paper concludes with the future outlook, focusing on the role of the Coast Conservation Department and the relevance of the use of integrated coastal zone management frameworks.

Coastal zone of Sri Lanka - its significance

Aligned with the UN convention on the Law of the Sea, which was ratified by Sri Lanka in July, 1994, the country enjoys a total extent of approximately 489,000 square km of maritime waters. The maritime zones consist of Internal waters, Historic waters, Territorial Sea, Contiguous Zone and an Exclusive Economic Zone (EEZ) as shown in Figure 1. The majority area (437,000 square km) belongs to the EEZ. The island, on the other hand, has a relatively small

land area of 65,000 square km which gives a land-to-ocean area ratio of 1 to 7.5. The coastal zone is therefore of strategic significance to its populace due to accessibility to the vast resource base of the marine environment surrounding the island, in principle, from any point on the 1585 km long coastline.

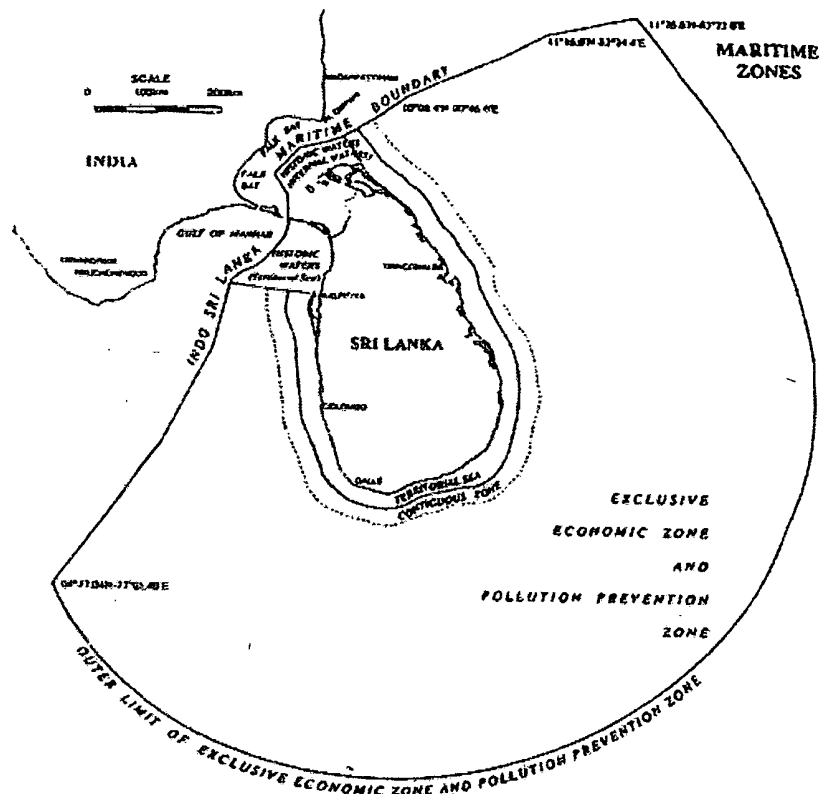


Figure 1 : Maritime Zones

The coastal zone can be defined based on either one or a combination of geo-physical, ecosystem and human development considerations. There are 67 coastal administrative units in the country and, if the coastal zone is identified landward by these administrative units and seawards by the narrow continental shelf, the coastal zone includes:

- a) Approximately 24% of the land area and 32% of the population (according to 1981 census)

- b) 65% of the urbanized land area, 65% of the industrial output, and 80% of fish production
- c) Principal road and rail transport infrastructure
- d) Principal commercial ports, fishery harbours and anchorages
- e) 80% of tourism related infrastructure with the majority being located in the western and south-western coastal regions and most of them within close proximity to the shoreline
- f) A significant extent of agricultural land, sizeable areas of usable land which remain undeveloped, substantial reserves of valuable minerals
- g) Some of the richest areas of biodiversity including coral reefs, seagrass beds, mangroves, lagoons, estuaries, wetlands and sanctuaries covering an extent over 160,000 hectares
- h) Areas subject to extensive water pollution associated with industrial pollution sources, domestic waste water and sewage disposal and garbage disposal
- i) Many areas of cultural, historical and religious significance and scenic beauty

The wave climate in Sri Lanka is characterized by two simultaneous wave systems, the long period swell and the shorter period sea waves as a result of the local (monsoon) winds. The average significant swell wave height during the south west monsoon is about 1 m and during the period October to April about 0.5 m. The average significant sea wave height is 1.12 m (at a water depth of about 20 m). The tides are predominantly semi diurnal with only marginal differences in the tidal constituents. Tidal range varies from 0.2 m (during the neap period) to 0.8 m (during the spring period). Tidal velocities are of the

order of 5 cm/s. Predominant littoral currents on the south west coast is from south to north and varies in the range of 5 cm/s to 30 cm/s.

It was in the early seventies that growing attention was focused on coastal problems in Sri Lanka because of their serious aggravation. When the initial response of seeking engineering solutions to control immediate coastal erosion problems- by the construction of ad-hoc protective structures – proved to be ineffective, it was realised that there was a need to adopt a coordinated approach to the problem within a wider coastal zone management framework. It was also realised that the legislative and administrative framework which was then in existence was insufficient to meet the demands of effective coastal zone management.

Approach to coastal zone management

In order to arrest the situation the Government of Sri Lanka established a separate Division in the Ministry of Fisheries in January 1978 and this Division was upgraded to Coast Conservation Department (CCD) in January 1984. The Government also introduced the Coast Conservation Act (1) which came into operation in October 1983. This act decreed the appointment of a Director of Coast Conservation with specific responsibilities for implementing the Act. It includes the administration and implementation of the provisions of the Act and the execution of schemes of work for coast conservation within the coastal zone as defined in the Act. It is important to note that the Coastal Zone as presented in the act has a very narrow geographic definition as illustrated in Figure 2. It was believed that by adopting this definition the CCD would be able to regain control and effectively manage a vital area of the coastal zone.

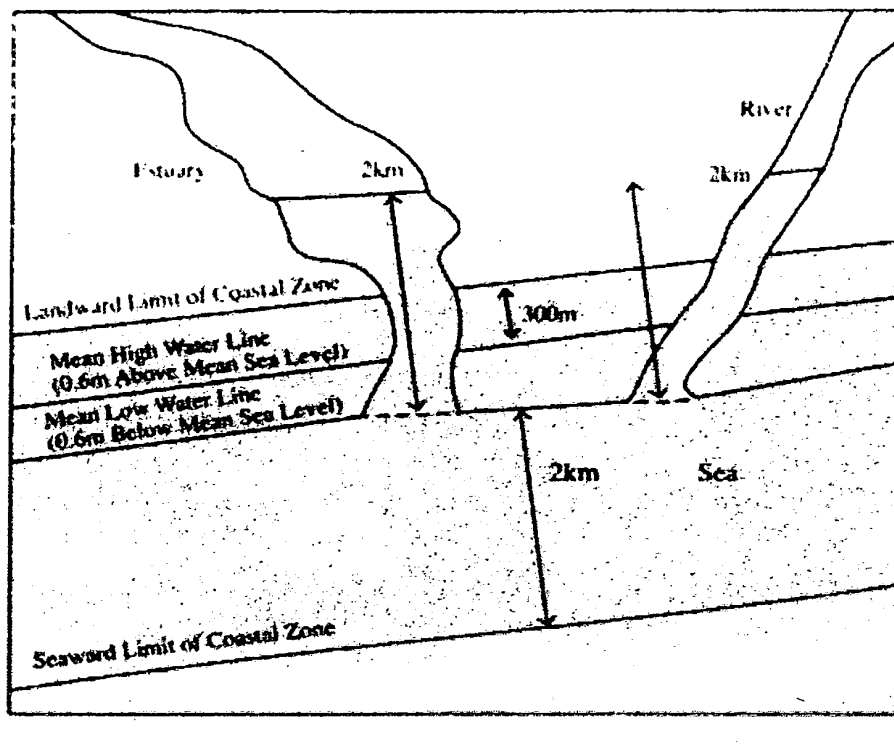


Figure 2: Coastal Zone as defined by Coast Conservation Act of 1981

The Act also required the Director of Coast Conservation to conduct a survey of the coastal zone as defined in the Act, and on the basis of the results of the survey to prepare a comprehensive Coastal Zone Management Plan (2), the objectives of which were,

- to identify and prioritise coastal problems and present a management programme to address these problems;
- to identify the measures which should be adopted by the Government and all stakeholders to reduce the scope and magnitude of coastal problems; and
- to identify research activities of immediate importance to enhance the management of coastal resources.

Within the context of the above objectives the Coastal Zone Management Plan focuses attention in three major concerns, namely,

1. Coastal erosion management;
2. Conservation of natural coastal habitats; and
3. Conservation of cultural, religious and historic sites and areas of scenic and recreational value.

The plan describes the nature, scope, severity and causes associated with each of these problems. Objectives and policies for the management of each problem are identified along with specific management techniques. To be effective in implementation, the plan is periodically revised and the first revision took place in 1997(4).

The CCD also prepared a Master Plan for Coastal Erosion Management (3) which was urgently required for the planning, design and construction of coast protection works in 1986. This plan too has been subsequently updated.

Regulation of development activity and Environmental protection

The management strategies adopted by the government accepted the need for some measure of regulation of development activity and conservation of natural resources in the coastal zone. Therefore the control and management of development activities (including natural resources utilization) constituted a major area in the implementation of the Coastal Zone Management Plan. 'Development Activity' is defined in the Coast Conservation Act as an activity likely to alter the physical nature of the coastal zone in any way and includes the construction of buildings and other structures, the deposition of waste, the removal of sand, seashells, natural vegetation, sea grass or other substances, dredging, filling, land reclamation and mining or drilling for minerals.

Regulation via the issue of permits

The principal means of regulation is via the appraisal of proposed development activities in the designated coastal zone by the CCD prior to the issue or refusal of a permit to proceed. The procedure for the issue of permits is laid down in the Act and is handled by the Department. Fishing, cultivation of crops and planting of trees or other forms of vegetation may be carried out in the coastal zone without a permit.

The CCD has decentralized several of its functions to the Divisional Secretaries under the terms of Public Administration Circular No. 21/92 of May 1992. The delegation of administrative authority has been made under Section 5 of the Coast Conservation Act No. 57 of 1981. This delegation of authority has been formulated to improve the efficiency of management programmes by permitting the local authority to issue permits for certain types of activity.

Prohibition of coral mining

The Coast Conservation (Amendment) Act No: 64 of 1988 prohibits engaging in mining, collecting, possessing, processing, storing, burning and transporting in any form whatsoever of coral within the coastal zone. Although considerable progress has been made in this respect, the ban on coral mining remains a difficult issue to implement without identifying and making available alternative means of livelihood for the coral miners. Active governmental support is required to resolve the socio-economic aspects of this problem by generating attractive employment opportunities in the same locality. If such opportunities are created elsewhere, due consideration has to be given to socio-economic impacts

arising from re-settlement issues. In November 2000, a decision was taken by the authorities to restrict the usage of coral-based lime in the construction work of the government sector and it is now implemented through the construction agencies in the country.

Control of sand mining

Sand mining has been controlled to a satisfactory degree by the Department and this activity is allowed only in selected areas of the coastal zone on certain days of the week and to an extent supervised by the staff. In many areas it is a prohibited activity. Sand mining is still extensively carried out in river estuaries and along reaches upstream of estuaries. This has certainly affected the sediment budget along the coastline leading to coastal erosion. The total estimated annual sand mining of the four main rivers in the north-western and western provinces of the island is in the order of 4 million cu. m. Violations and infringements of regulation relating to sand mining do occur and due consideration has to be given to resolving the socio-economic aspects of the problem.

Setback and Variance

With respect to physical infrastructure development in the coastal zone, setback guidelines have been included in the Coastal Zone Management Plan. A setback is defined as an area left free of any physical modification to allow for dynamics of seasonal and long term fluctuations of the coastline and to ensure public access to the water front and visual access to it. Setback for a given area is based on coastal erosion rates, beach dynamics, shoreline ecology and related activities. It is an effective and inexpensive approach towards coast protection and

conservation. In ‘no build’ areas, depending on site conditions, the developer can apply for a variance for setback reduction to build in that area. The setback guidelines introduced have been successful in ensuring the protection and security of assets which otherwise may be in grave danger due to coastal erosion.

Environmental impact assessment and Monitoring

In the case of larger development projects which could have significant impacts on the environment it is necessary for the developer to prepare and submit an Environmental Impact Assessment (EIA) report prior to obtaining approval for the implementation of the project.

The CCD has the responsibility to ensure compliance with the conditions stipulated in the permit through a monitoring system. Monitoring is achieved by direct supervision undertaken by the staff of the Department or a duly nominated state agency. In the case of large development projects, well-formulated monitoring programmes are incorporated in the EIA report and usually a monitoring committee is appointed to supervise all specified surveys, tests and field investigations.

Second generation initiatives in coastal zone management

The first generation efforts in coastal management in Sri Lanka have led to many follow up activities of national interest. The CCD and the Central Environmental Authority (CEA) have implemented special management projects in order to investigate critical problem areas. The following projects are examples of such positive initiatives.

- Special Area Management (SAM) Projects to study in detail the problems relating to specific areas which are under severe

development pressure. Strategies for management have been developed giving due consideration to all critical issues as well as impacts arising from their interactions.

- National Sand Study (5) and the follow up Interim Sand Study (6) to investigate the ways and means of preventing and mitigating environmental hazards and degradation caused by present practices of sand mining and investigating practical alternatives for river sand. The option of using cleaned sea sand pumped from deep offshore waters as a viable alternative is now being investigated.
- Environmental Quality Standards for surface water and air quality. These standards are being used to evaluate the present environmental quality, to assess environmental impacts due to discharges and to prepare environmental management plans.
- Wetland Conservation Project to assist in the conservation and management of Sri Lanka's wetlands, including several coastal wetlands which are under severe pressure due to rapid urbanization process.

Another important follow up activity was the preparation of Coastal 2000: A Resource Management Strategy for Sri Lanka's Coastal Region (7). This document has made recommendations on specific problems relating to the implementation of the Coast Conservation Act. These include the following.

- Single agency and sectoral approaches to solving coastal resources management problems to be replaced by a more comprehensive perspective approach.
- The reduction on the emphasis of regulation needs.

- The recognition of the interrelationships among important resource management concerns such as water quality, habitat degradation, use of natural resources and institutional weaknesses and the need to adopt effective strategies involving more than one agency and a range of management techniques.
- The inadequacy of the narrow geographic definition of the coastal zone in the Coast Conservation Act which does not reflect in actual terms the interconnections between coastal ecosystems and resources. This definition is inadequate for integrated land–use and water–use plans for coastal ecosystems or habitat management.
- The increase of participation by local and provincial officials and coastal communities in the formulation of plans and strategies for managing coastal resources.

In practical terms, the Coastal 2000 strategy enables planners to formulate individual coastal resources management efforts against the background of the entire coastal region that includes all critical coastal habitats and other valuable resources.

The CCD reviewed the Coastal Zone Management Plan and revised the main objectives and policies which led to the preparation of a revised plan in 1997 (4). The revised plan has taken into account the wide experience gained through the first plan and addresses in greater detail issues which had not received such attention earlier. The plan has also given consideration to the current and projected development trends in the country in refining policies and guidelines. This plan, like its predecessor of 1990, outlines interventions to reduce coastal erosion which may also increase through sea level rise, to minimize depletion and

degradation of coastal habitats, and to minimize loss and degradation of sites of archaeological, historical, cultural, recreational and scenic interests. Recognition has also been given to Coastal Pollution Control and Special Area Management.

Current initiatives in coastal zone management

The government authorities are currently implementing the Coastal Resources Management Project with donor funded assistance. The project comprises four components namely:

- Coastal Stabilisation relating to coast protection
- Fishery Management and Fishery Harbour Construction for improved management of the fishery industry
- Coastal Environment and Resources Management relating to conservation of coastal resources
- Institutional Strengthening relating to enhancing the organisational capabilities of governmental and other stakeholder agencies.

The project has a wide ranging portfolio of activities and it is expected that it will contribute very positively towards improved coastal zone management with considerable benefits to the coastal community at large and in particular to the fishing community. One of the project activities is the second revision of the Coastal Zone Management Plan.

Challenges and Constraints

The implementation of the Coastal Zone Management Plan imposed major challenges to and constraints on the government authorities. Environmental degradation of a high magnitude had already occurred by the time the implementation of the management plan commenced,

leading to adverse impacts on the coastal environment. There existed strong and often conflicting pressures for exploitation of the coastal region with crucial economic and social implications.

The lack of funding for implementation is a major constraint. The government authorities also had to educate and convince the coastal population of the causes of the environmental degradation and the need for them to accept some measure of regulation of development activity. The authorities were only too aware of the socio-economic implications of such regulation in the coastal zone, which will continue to provide opportunities for economic development across a wide field of activities. Generating alternative employment for those affected by regulations on coral and sand mining remains a challenge. Overall, the authorities have been successful in controlling environmental degradation while sustaining multiple uses of the coastal zone. However, increasing human pressure and unfavourable natural conditions will continue to impose adverse impacts on this fragile zone.

Coastal erosion management

Coastal erosion still continues to be a severe problem faced by Sri Lanka. This has led to the damage or loss of infrastructure, undermining of roads and the rail track, loss or degradation of valuable land and caused disruption to fishing, recreation and other activities. In economic terms the public and private costs of coastal erosion are enormous.

During the period 1983-84 the southwest coast of Sri Lanka was subjected to very severe erosion. It was recognised that any major coast protection work should form an integral part of an overall Coastal

Erosion Management Plan and/or a Coastal Protection Plan and that if this approach was not adopted it would only facilitate the transfer of the problem from one location to another. With Danish assistance, the Coastal Conservation Department prepared a Coastal Erosion Master Plan and undertook the construction of coast protection works in two stages. The sites were selected based on the severity of the erosion problem and the influence of the receding coastline endangering infrastructure and assets of the urban community. Most of the protection works were rock armoured revetments which provided a frontline defence. Offshore breakwaters were adopted at one location which offered substantial tourist facilities and had a strong fishing industry.

Although the construction of revetments may not be the best solution to meet the user requirements and the development of a healthy beach, the authorities had no option initially but to adopt this form of frontline defence to control large scale erosion. With limited funding available the Department also undertook emergency protection works at several locations to combat cases of severe erosion arising from heavy monsoonal wave attack. The shoreline was continuously monitored thus enabling the identification of other sites and areas to be protected.

The construction of protection works, the use of set back lines and thereby directing development away from eroding areas through a regulatory system have controlled erosion and in particular its impacts and potential impacts on assets/infrastructure. However, with increasing rates of erosion there was a strong need to implement well formulated coastal stabilization schemes. This has been achieved to a considerable extent through the Coastal Resources Management Project (CRMP).

Seven sites have been identified along the western and southwestern coastline.

One of the main objectives during the project planning phase was to change the prevailing erosion control methodology from a reactive/defensive approach to a proactive/preventive approach. The CCD has chosen to maintain the existing defence line where possible. Encroachment of beaches and lack of public access were concerns of the authorities. High priority has been given to stakeholder consultations in formulating designs to achieve sustainable multiple uses of the coastline. Varying demands of the stakeholders, often conflicting in nature, have been adequately met by adopting a 'hybrid' approach for coastal stabilisation. Such an approach enables the consideration of both stakeholder demands and the hydraulic/structural function of the protection measures. The 'hybrid' approach comprising an appropriate combination of hard structures, sand fill and beach nourishment have been adopted for each site to satisfy the design objectives.

Environmental management of coastal ecosystems

Sri Lanka's coastal zone consists of diverse shoreline and nearshore habitats. These ecosystems in their natural state not only support marine life but also provide a buffer against the erosive forces of the hostile ocean climate. The physical and ecological characteristics of many of Sri Lanka's coastal ecosystems, in particular lagoons, make them susceptible to degradation. They lack resilience and have a low threshold for irreversible damage. Once degradation exceeds the low threshold, rehabilitation becomes prohibitively expensive or impossible. Increased human settlements and development pressures have enhanced the stresses

on these unique ecosystems. The management policies of the CCD for these areas rely on regulatory and non-regulatory initiatives. Special management objectives identified by the Coastal Zone Management Plan include the preservation of coastal ecosystems and the promotion of sustainable development of resources available within these systems.

Mathematical modelling is widely used to assess the status of such ecosystems and in particular to determine the effectiveness and environmental impact of soft options, such as limited dredging, to improve their health. Solutions based on soft options are greatly encouraged in order to maintain a balance in the bio-diversity. Figures 3 and 4 illustrate results from recent investigations on the hydraulic behaviour of the Negombo Lagoon, a unique wetland north of the Port of Colombo. Unauthorised landfill, unplanned development along and in the waterfront, siltation, reduction of tidal exchange and flushing, discharge of industrial effluent and domestic waste are common problems which threaten the coastal lagoons such as Negombo. Management of coastal ecosystems to sustain multiple uses remains a challenge and in this context the government authorities will have to focus further attention on Special Area Management (SAM) Projects and Wetland Conservation Projects.

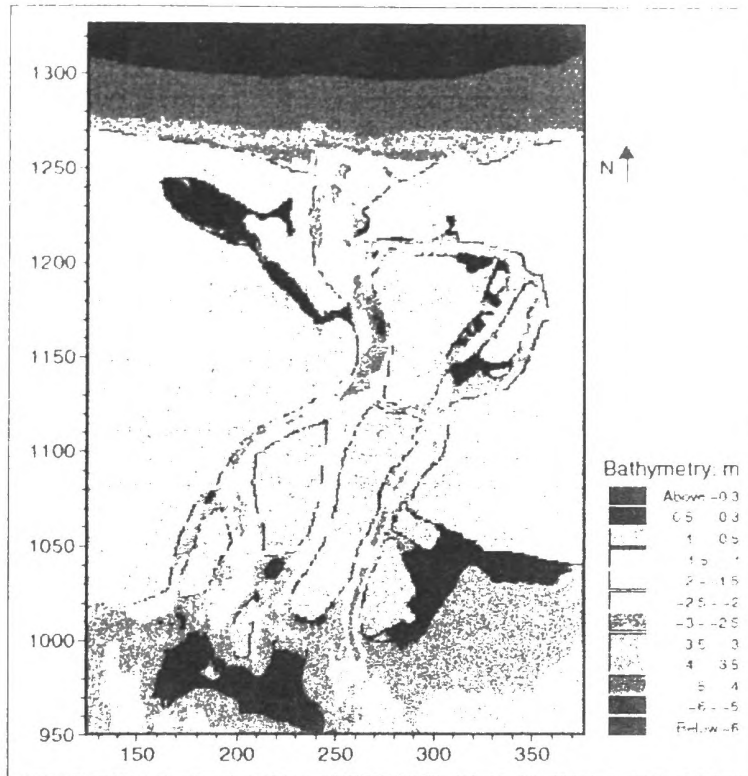


Figure 3: Plan view of the Lagoon entrance channels showing the depth contours



Figure 4: Velocity vector plot at the maximum flood discharge

Global warming and Sea level rise

Against the above background, Sri Lanka also faces the challenges of possible impacts of global climate change and sea level rise over the next

few decades leading to the aggravation of existing environmental pressures. These issues have been duly analysed in the National Action Plan for Climate Change and in the Initial National Communication (8). Global warming is expected to lead to a rise in sea level, higher temperatures, more frequent and prolonged droughts, high intensity rainfall and increased thunder activity. When assessing the impacts of global sea level rise on coastal regions, it is important to identify the connectivity of these inter-related issues. It is also important to recognize the global, regional and local scales of impacts as it would be the resultant that would finally affect a given environment.

According to the National Communication, some of the impacts of climate change and sea level rise on the Sri Lankan coastal zone which have to be given consideration are;

- Inundation of low lying areas, including coastal settlements and coastal wetlands;
- Coastal erosion;
- Flooding and storm damage;
- Quality of surface and groundwater;
- Salinisation of estuaries and freshwater aquifers;
- Degradation of marine ecosystems – coral reefs; and
- Changes in the hydraulic force regimes of sea defence structures and breakwaters leading to greater vulnerability to impacts of increased erosion and extreme events.

A rise of the mean sea level will also lead to increased wave height thereby disturbing equilibrium beaches and making them more prone to erosion and interfering with existing longshore sediment

transport rates and distribution. It would also result in further impacts such as undermining the stability of coastal structures, and the altering of circulation patterns inside coastal embayments and estuaries. It is also recognized that global warming would contribute to changes in the frequency and intensity of extreme events such as increased coastal flooding, thereby further complicating the analysis of overall impacts.

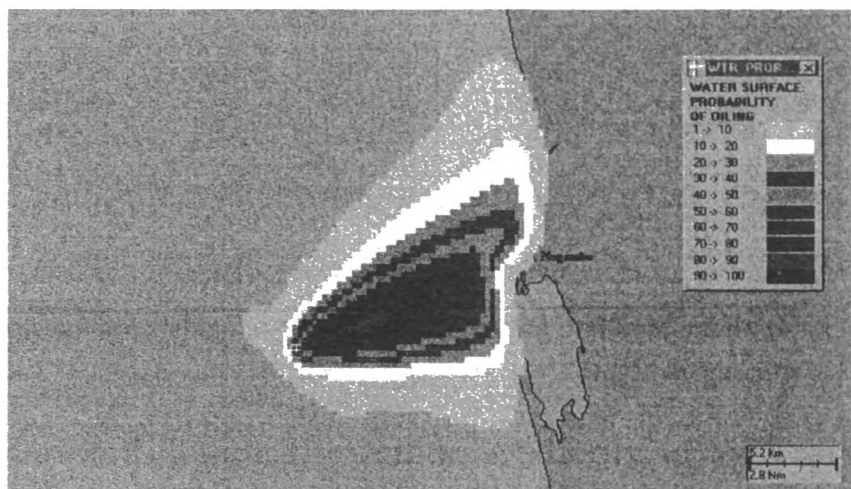
Climate change and sea level rise will also impose severe impacts on the Fishery industry and the Tourist industry. Impacts of sea level rise will have to be considered in the planning and design of land based infrastructure and land reclamation in nearshore regions. Preliminary estimates of land loss due to erosion and inundation by sea level rise have been estimated for the south west coast for two scenarios of sea level rise. For a 0.3 m rise the estimates are 6.0 and 41.0 square km. For a 1.0 m rise the estimates are 11.5 and 91.3 square km.

Disaster preparedness in the coastal zone

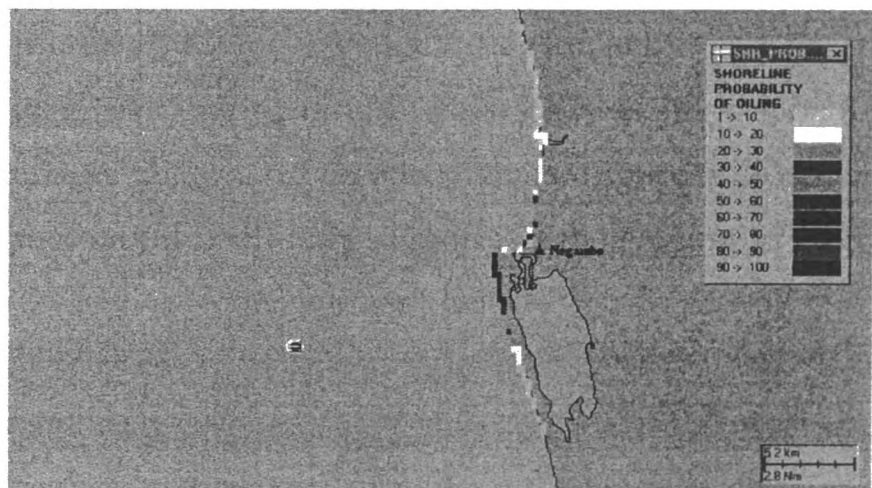
During the recent past attention have been focused on potential disasters and their impacts on the marine environment and the coastal zone. Until now the major concern was large scale erosion arising as result of storm attack. On many occasions coastal infrastructure such as road and rail networks have been damaged by storm attack. Strategies for the adoption of emergency works have been prepared and implemented. Fishery and tourism industries, and the conservation of natural resources demand pollution-free coastal waters and clean beaches. In view of the close proximity of the principal shipping routes to the south-western coastlines, there was a need to investigate the possible impacts of oil spills and their dispersion on coastal waters and the coastline. With Norwegian

assistance, the Marine Pollution Prevention Authority of Sri Lanka has implemented a successful project to model a range of scenarios relating to possible oil spills in order to investigate the impact of such spills on critical coastal areas (9). The outcome of this study is important for the environmental management of coastal ecosystems. Figure 5 illustrates the dispersion of a potential oil spill in the vicinity of the Negombo Lagoon.

(a) water probabilities



(b) shore probabilities



(c) time probabilities

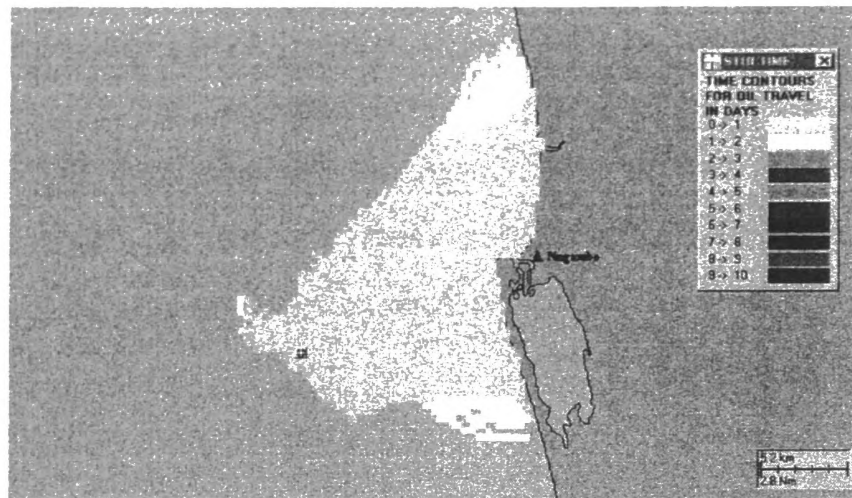


Figure 5: Dispersion of an oil spill in the vicinity of the Negombo

Future outlook

Role of the Coast Conservation Department

The experience gained in coastal zone management in Sri Lanka in the last decade has shown that an approach to resource management that focuses on regulation alone tends to alienate the coastal residents affected. It indicates that a collaborative effort on the part of governmental agencies, non-governmental organizations and the local community is required to address the root causes of environmental degradation in the coastal zone. Experience has clearly illustrated that local communities can be organised to manage their natural resources only if they perceive that they will derive tangible benefits from such management and therefore there is need to adopt management policies which can accommodate such interaction.

There is a greater demand for the CCD to transform itself from a primarily regulatory agency to a service-oriented organization. The

department should provide the leadership, coordination, technical assistance and training that is required for the successful implementation of a scientifically based coastal planning and management strategy. It needs to facilitate locally based planning and implementation efforts. Such an expanded agency must become proactive in its approach to coastal zone management and must cover a wider area and scope of coastal related activities.

Application of an integrated coastal zone management framework

Coastal zone management involves decision-making, based on effective strategies, encompassing a range of activities. It also includes effective monitoring and control procedures to sustain multiple uses of the coastal zone while protecting its resources and avoiding adverse impacts on the environment. In this context, the use of an effective integrated coastal zone management framework seems most relevant for Sri Lanka in order to accommodate the widely varying and interrelated issues of its coastal zone. Since many responses to sea level rise are very similar to those required to address existing coastal zone management problems, such a framework can also accommodate planning for sea level rise.

The application of an integrated coastal management framework is a dynamic process by which decisions are made for the use, development and conservation of coastal areas. Provisions are also made to achieve goals established in association with relevant authorities, both national and local, and with other stakeholders who utilize coastal resources. Due attention should be given to strengthening the public participation process for formulating national policies and developing a

coastal management plan leading to the establishment of a coastal governance system that applies these policies in an integrated manner.

To achieve success in the decision making process relating to engineering interventions, coastal engineers should have access to good quality data, simulation techniques and efficient data management systems. Therefore, the proposed framework should make provisions for a continuing process to collect and disseminate the necessary scientific information on coastal problems and issues, on functional uses and development, and on the needs of the private and public sector. It should also include information management systems which incorporate computational modelling tools for the analysis of data and simulation of coastal aquatic systems.

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