Integrated Coastal Zone Management Plan for Sierra Leone

2016 - 2020




Environment Protection Agency – Sierra Leone

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Foreword

Sierra Leone has one of the world's most spectacular coastal and marine ecosystems that contribute not only to the natural stability of the area, but also to the livelihoods of the people. Coastal ecosystems provide important functions and support various economic activities such as tourism, maritime industry, agriculture, fisheries, forestry and mining among others that form the economic backbone of the coastal region and contribute to the national economy in general.

The coastal resources of Sierra Leone are however under threat from variety of causes that if not addressed immediately, will in the long-term impair the resource base, undermining livelihoods. Among the major threats include pollution, physical alteration and destruction of habitats, over-exploitation of resources, uncontrolled development, coastal erosion and climate change. These threats are anthropogenic in origin and have to be contained in order to restore the health and functions of the ecosystems; sustain livelihoods and achieve sustainable development.

The first State of the Marine Environment (SoME) report was used to inform the process for drafting this Integrated Coastal Zone Management (ICZM) Action Plan. The goal of the ICZM Action Plan is to conserve the coastal and marine environment and to ensure that its resources are utilized in a sustainable manner for the benefit of coastal communities and the country as a whole. Inspired by the need to balance environmental management interests with economic development interests, the ICZM Action Plan is set to foster a coordinated and integrated approach to resource utilization and management for sustainable development.

The ICZM Plan is rooted in the understanding that the coastal and marine environment is a limited spatial area and a distinctive system in which a range of environmental and socio-economic interest interconnect in a manner which requires a dedicated and integrated management approach. Its preparation was participatory, involving stakeholders from various sectors including government agencies, private sector, NGOs, expert groups and local communities at district, provincial and national levels, contributing key information and data required in the drafting process.

The ICZM action plan has proposed a number of interventions that are to be incorporated into sectoral development plans and programmes which, if adopted, will result in a healthy coastal ecosystems that will sustain socio-economic development, contributing to the achievement of the objectives of the Agenda for Prosperity.

The Government is committed to implementing the ICZM action plan and recognizes the importance of close collaboration and partnership, the Environment Protection Agency therefore looks forward to working closely with all government institutions, private sector, civil society and the general public in the implementation of this plan.

Haddijatou Jallow (Mrs.)
Executive Chairperson, Environment Protection Agency

Acronyms

AfP = Agenda for Prosperity
EIA = Environmental Impact Assessment
EPA-SL = Environmental Protection Agency in Sierra Leone
GDP = Gross Domestic Product
GEF = Global Environment Facility
GOSL = Government of Sierra Leone
ICZM = Integrated Coastal Zone Management
ICZM = Integrated Coastal Zone Management Plan
IPCC = Intergovernmental Panel on Climate Change
IUCN = International Union for the Conservation of Nature
MDAs = Ministries, Agencies and Departments
MPAs = Marine Protected Areas
NGO = Non-governmental Organization
NPAA = National Protected Areas Authority
NTB = National Tourism Board
REDD+ = Reducing Emissions from Deforestation and Forest Degradation
UNDP = United Nations Development Programme
UNEP = United Nations Environment Programme
UNESCO = United Nations Scientific, Educational, and Cultural Organization
WWF = World Wildlife Fund

Acknowledgement

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Executive Summary

The integrated Coastal Zone Management Plan (ICZMP) has been developed pursuant to the implementation of the recommendations of the State of the marine Environment Report. It is the first ICZM Plan for Sierra Leone and has identified key priority themes and activities that will be implemented in the period 2016 - 2020 to address the numerous issues and resource management challenges facing the coastal and marine environment with a view to realizing sustainable development of Sierra Leone's coastal zone. In general, it provides a broad framework for sound management of the coastal zone through inter- sectoral coordination and integration of environmental considerations into socio- economic planning and implementation at all levels. This is brought about by the desire to balance environmental management interests with economic development interests. In implementing the ICZM Plan, the country will not only manage its coastal resources effectively, but also contribute to regional and international obligations in the protection of important fragile ecosystems and maintaining their integrity for sustainable development in line with the Agenda for Prosperity.

This ICZM Plan is a product of an extensive and highly participatory process involving stakeholders from the government sector, NGOs, private sector, experts from the University and local community groups. The State of the Marine Environment Report and the Coastal Sensitivity Mapping Report provided key information in terms of highlighting the key issues that the Plan seeks to address. Other documents such as the National Biodiversity Conservation Action Plan, the Climate Change Response Strategy, and reports by various research institutions also provided crucial information in drafting of the ICZM Plan.

The Plan is divided into six sections. Section one gives the introduction and presents the coastal and marine environmental profile. The bio-physical and socio- economic characteristics of Sierra Leone's coastal zone, outlining the sensitivity of its habitats, and identifies the issues and management challenges that need to be addressed. The section also describes the rationale for and preparatory process of the ICZM Plan.

Section two presents an overview on the characteristics of one Sierra Leone's coastal marine environment; the socio-economic opportunities available, the national governance framework, and the relevant international agreements that give impetus to coastal and marine zone management. The section also highlights the various tools supporting management of coastal and marine environment.

Section three introduces the vision expected of the Sierra Leone coastal zone as an area with healthy coastal systems supporting both ecosystem functions for maintenance of environmental integrity and for provision of livelihoods and sustainable development. The overall goal and guiding principles and strategic objectives for achieving the goal and the vision are also outlined.

The thematic areas, strategic objectives and strategies for the ICZM Plan are articulated in detail in section four. The thematic areas of the action plan include Integrated Planning and Coordination; Promotion of Sustainable Economic Development; Conservation of Coastal and Marine Environment; Environmental Risks and Management of Shoreline change; Capacity Building, Information and Public Participation; and, Institutional and Legal Framework needed to operationalize the Plan.

Section five presents the ICZM Plan implementation framework/modalities. Articulated in the implementation framework is the need for wide stakeholder involvement; capacity building and resource mobilization to MDAs in order to ensure effective and efficient implementation process.

A detailed implementation matrix is also tabulated in this section showing the activities to be undertaken, expected outputs, performance/M & E indicators, the agencies responsible, time frames and activities estimate costs. The estimated cost of implementation of the ICZM Plan for the five years is US$79,415,000

Monitoring and evaluation of the ICZM Plan are discussed in Section six. This is in recognition of the fact that the successful implementation of the strategies given in the Plan will depend on how effectively the planned activities are executed, monitored and evaluated to ensure that whatever is to be implemented remains on course, or, if amendments are made, then they are put in place in order to achieve the desired outcomes.

Section 1: Introduction and Objectives for the development of an Integrated Coastal Zone Management Plan for Sierra Leone

Background

Sierra Leone is home to the largest natural harbour in Africa, and some of the best sandy beaches in the world. The Sierra Leone coastal zone is 560km long and contains a rich diversity of habitats (several coastal lagoons and mangrove forests). Over 60% of the Sierra Leonean population live and work within 20 miles from the shoreline, which supports thriving fisheries, agriculture and tourism industries.

The coastal zone is one is one of Sierra Leone's greatest assets and its large natural harbor, magnificent sandy beaches, and historic sites where slaves were kept before they were transported to Europe and the Americas is a renowned World Heritage Site. The coast extends approximately 560 km from the northern around Yeliboya (at the border with Guinea) to the south at Sulima at the border with Liberia.

Sierra Leone's coastal zone has complex and dynamic marine ecosystems that support innumerable ecological processes and a vast array of marine life and habitats. In addition to its important ecosystem functions, the coastal zone is vital to the Sierra Leonean way of life Early morning exercises along the beach road and weekends and public holidays are often celebrated on the beach and newly wedded couples most often take memorable photos on the beautiful sandy beaches.

The highly productive coastal zone is the resource base for a broad range of economic activities, such as fishing, maritime and inland water transport, tourism and leisure, sand and gravel extraction, agriculture production in mangrove swamps, fuel wood for household energy needs and fish smoking and poles/timber for housing, boat and furniture construction.

Fishing contributes approximately 10% of the country's gross domestic production and employ over 10 % of the country's population (directly as fishers and fish processors and indirectly as transporters, boat builders, fishing gear repairers, fuel wood dealers and fish traders), whilst ports and harbor management are placed under transport and Aviation, these commercial activities take place within the coastal marine environment. Sierra Leone has 4 commercial harbours (Queen Elizabeth the II Quay, Pepel, Niti 1 and Niti 2). The last 3 are used by the mining companies (African Minerals, London Mining, Sierra Rutile and Vimetco. The coastal zone also has important social and cultural values to the Sierra Leonean people, especially to the approximately 60% of the population that reside within 20 miles off the coast and in offshore islands.

After the civil war that ended in 2002, rapid economic development and population growth have taken place in the coastal zone and inland areas of Sierra Leone. Freetown, which was originally planned for a population of 800,000 is now home to over 2,000,000 inhabitants. These occurrences have led to increasing pressures on coastal and marine resources including land space for housing construction, with implications to the livelihoods of those that depend upon living and non-living coastal marine resources. These anthropogenic threats stem from various developmental activities associated with population growth and expansion, utility supply, dredging and mineral extraction (including sand and gravel), land clearance, pollution, waste disposal, fisheries and aquaculture, tourism and recreational facilities. These threats are compounded by natural hazards of landslides and flooding, global warming and rising sea levels, and the vulnerability of sensitive ecological systems to climate change. Thus, it is imperative now more than ever to ensure that the coastal zone is utilized in a manner that will continue to support important ecological functions, as well as social, cultural and economic prosperity for current and future generations.

Circumstances and Needs for an Integrated Coastal Zone Management Plan

Many coastal countries, including Sierra Leone, have recognized the deficiencies of standalone sectoral plans for management of the coastal zone and have identified the need for a national cooperative and collaborative approach for achieving ecologically-sustainable development. The need for an integrated approach to optimally manage Sierra Leone's coastal resources was identified at a multi-stakeholder consultative meeting with representatives from various sectors, including scientists, marine managers, private sector, and coastal communities invited by the Environment Protection Agency (EPA) Sierra Leone. The approach identified in this consultative workshop was the integrated coastal zone management (ICZM) - an approach that brings together all decision-making agencies to resolve issues so as to ensure integration among their existing policies and plans to ultimately maintain, restore and improve the quality of coastal ecosystems and the communities they support. The integrated approach also recognized that many different players (i.e. government agencies, non-governmental organizations, industry, business, private sector, community groups, and indigenous communities can make a difference in the long-term management of the coastal zone and aims to gain commitment from these key players to a common vision.

Creating an Informed ICZM Plan

The Sierra Leone Integrated Coastal Zone Management Plan is a planning framework that calls for national action to facilitate the improved management of coastal and marine resources, and to address the concerns of those people that visit, live in or work within the coastal zone. There is provision for review of the Plan every four years, supporting the ideals of adaptive management, this Plan is prepared with a twenty-year vision of sustainable marine & coastal resources use and management.

The specific issues and themes addressed herein, and the proposed action steps, are the outcomes of stakeholder involvement throughout its development. Coastal and marine issues in Sierra Leone are wide ranging and cover social, economic, and environmental aspects. The task of addressing some of these complex issues is not a light one, and EPA recognizes the importance of its partners and key stakeholders in implementing the plan. Thus, this Plan addresses and reflects people's real concerns and views, as much as possible.

The Environment Protection Agency in Sierra Leone (EPA-SL) values the sector legislations, policies, plans, and strategies currently in place that are relevant to coastal zone management. The intention of EPA-SL is to ensure that all existing plans with a relevance to the coast are integrated in this Plan. The ICZM Plan lays out policies for managing all aspects of the coastal zone. The aims of this Plan are twofold: (i) to focus management activities that are already being undertaken, ensuring these are integrated; and (ii) to highlight additional activities and actions that could be undertaken to help meet the challenge of ensuring a sustainable future. The result is a coastal zone where healthy ecosystems support and is supported by thriving local communities and a vibrant economy.

Iterative coastal zone planning process

i. identify the competing interests among stakeholders for conflicting resource uses;
ii. set up an advisory committee representing interest groups/stakeholders to guide the process;
iii. set out a flexible work plan that made knowledge- building, ecosystem services, and stakeholder engagement central to the process;
iv. spend several weeks gathering existing data about biodiversity, habitats, and marine and coastal uses in collaboration with universities, government agencies, industry associations, citizens' groups, and non-governmental organizations;
v. Comprehensively map out the information for both the coastal and marine environs;
vi. Coastal Advisory Committees and other stakeholder groups in the eight coastal district councils communicated their values and goals for marine and coastal management through meeting minutes, surveys, and interviews;
vii. With this information, the team determined how to group marine and coastal uses into useful zoning categories, which could be used by government agencies and stakeholders to guide implementation of the ICZM Plan;
viii. Zones included locations set aside for marine protected areas, as well as areas prioritized for fishing, coastal development as part of urbanization, marine tourism, recreation and leisure, future Mari-culture development/production, and maritime and inland water transport, and other human uses;
(i) The team also began to develop three possible zoning scenarios, beginning at the local level and scaling up to countrywide. Each of these three schemes emphasizes different priorities of stakeholders (village community level, the district council level and the national level)

In order to understand the implications of each zoning criteria, the team used the coastal sensitivity maps produced as part of the disaster preparedness and management effort of the Environment Protection Agency. The maps had classified the entire coastline into biodiversity index sensitivity, socioeconomic index sensitivity and shoreline profile and habitats characteristics sensitivity.

The socioeconomic index sensitivity maps show dominant socioeconomic activities in different areas along the coastline, so this planning process had used the values and benefits that humans obtain from natural coastal ecosystem as zoning criteria for entire coastline.

With the socioeconomic and development activities along the coastline used as one on the criteria for planning the management of the coastline, we would be able to regulate activities based on informed management principles and resources and biodiversity conservations consideration.

Based on available data and the key services of interest to stakeholders, the team identified several ecosystem goods and services, including catch and revenue from fisheries, coastal and marine tourism and recreation, and coastal protection from inundations and storms, as well as risks to the habitats that provide these services. Results of the available data review and fieldwork were then used to communicate options to stakeholders for a zoning scheme that would spatially locate permissible activities and human uses in some areas of the coastal zone, but not in others. The results provided the scientific basis to support the Informed Management Zoning Scheme, which optimally minimizes risks to critical habitats and the potential loss of important ecosystem goods and services while also maintaining use of the coastal zone and its resources.

Why Informed Management?

The Informed Management Zoning Scheme, to be implemented through to 2020 (5 years period), is proposed over the Conservation and Development Zoning Schemes because this scenario represents a medium-term vision of sustainable development of coastal resources that will ensure future economic benefit for Sierra Leoneans, through the minimization of environmental impacts and the maximization of ecosystem service returns. Informed Management especially acknowledges current and future needs for economic development and continued human use of the coastal zone. This zoning scheme is designed to reduce current user-conflicts, which supports the wise use and allocation of coastal and marine resources support. While the Conservation Zoning Scheme could enhance long-term ecological health through environmental preservation, it is largely anti-development and does not align with national economic aspirations.

The Development Zoning Scheme, on the other hand, lacks vision and is focused on maximizing economic returns from key coastal resources in the very short term. In other words, the Development Zoning Scheme embraces a vision of fast-paced economic development, based on natural resource utilization and urban expansion. It prioritizes immediate development needs over long-term sustainable use

and future benefits from nature.

Furthermore, the conflicts and overlapping coastal and marine uses by various industries and interests becomes increasingly greater compared to current conditions. Example sand extraction for construction industry as against use of sandy beaches for tourist attractions or conservation of marine turtles that can create opportunities for eco-tourism.

Harvesting of coastal mangrove wood for fish smoking, domestic energy needs and construction as opposed to conserving the mangroves for costal protection from wind, storms and waves and as spawning and breeding habitats for marine organisms including fish.

Goals and Objectives of the coastal zone management planning

Coastal Zone Management planning aims to map out actions that can lead to effective management of coastal resources and strengthening the national capacity for effective coastal resources management through Integrated Coastal Zone Management (ICZM). Integrated Coastal Zone Management is a system for controlling development and other human activities that affect the condition of economic resources and the quality of environment in coastal zones.

The overall objective of integrated coastal zone management is to provide for sustainable use of natural resources in the coastal zone and for maintenance of biodiversity. Environmentally planned development is reputed to add to economic and social prosperity of a coastal community in the long term. Fisheries productivity, increased tourism revenues, sustained mangrove forestry, and security from natural hazard devastation are among the practical benefits of integrated coastal zone management.

Integrated coastal zone management incorporates modern principles of planning and resources management, intensive information based on interdisciplinary processes. A major objective is to facilitate the interactions of different coastal economic sectors (e.g., shipping, agriculture, fisheries) toward optimal socio-economic outcomes, including resolution of conflicts between sectors.
Integrated coastal zone management may be initiated in response to a planning mandate but more often because of a crisis - a use conflict, a severe decline in a resource, or a devastating experience with natural hazards.

The Strategic outcome of this planning would be the first step of the ICZM; which would provide the framework to guide development and future investment, while ensuring the protection of important natural habitats and existing human uses of coastal resources. Thus, under a sectoral planning and management regime, decisions made for one location can have significant impacts on the condition of the natural environment in that location and elsewhere.

Implementing integrated management is much harder than planning for it; it requires a combination of skills, and commitment from the people involved. Integrated management can only be achieved through a collaborative decision-making process that joins the interests, knowledge and experiences of all stakeholders from civil society, the private and public sectors. This is the core function of integrated coastal area management.

The National Integrated Coastal Zone Management Strategy spells out the goal of coastal area management in Sierra Leone as follows:

- To support the allocation, sustainable use and planned development of Sierra Leone's coastal resources through increased knowledge and building of alliances, for the benefit of all Sierra Leoneans and the global community

The fundamental goal of ICZM, then, is to facilitate the improved management of coastal and marine ecosystems so as to maintain their integrity while ensuring the delivery of ecosystem goods and services/benefits for present and future generations. A defining feature is that ICZM seeks to balance economic development needs with conservation in a spatially defined area within a specified timeframe. This feature also makes ICZM an ideal approach that can be applied to managing challenges that are national in scale and scope. Furthermore, for ICZM to be effective in Sierra Leone, the Plan must possess the following attributes:

- A proactive and adaptive approach to address national marine and coastal issues that go beyond departmental mandates and jurisdictions;
- A specified year timeframe over which certain objectives and targets must be met in this case five years has been proposed; and
- A thorough and comprehensive means by which to track, monitor and evaluate progress

Section 2: The Coastal Area of Sierra Leone and its Governance

Definition of the Coastal Zone

The coastal plains of Sierra Leone form the strip of land bordering or co-terminus with the sea. They are subdivided into estuarine swamps, alluvial plains and beach/coastal terraces. The coastline of Sierra Leone is a submergence coast with many drowned valleys and offshore islands (Yeliboya, Banana, Plantain, Bonthe and Turtle). The coastline is indented with creeks, bays and estuaries. There are extensive mudflats in the estuarine systems. The freshwater input of the wide bays and creeks are so low, that the extensive sand and mudflats are under the influence of tides and ocean currents.

The Sierra Leone Coastal Zone Management plan defines the coastal zone as "the area bounded by the shoreline up to the mean high-water mark on its landward side and by the outer limit of the territorial sea on its seaward side, including all coastal waters" (Coastal Zone Management plan draws from the United Nations convention on the Law of the Sea, which defines the territorial sea as part of the costal state and subjected to all the laws that applies to the land area. This definition, however, limits the understanding of the coastal area as being comprised solely of the marine environment; it does not consider the influence from the terrestrial environment. Factors, including human activity, natural processes, and their interactions, greatly influence the condition and characteristics of the coast, thereby limiting or promoting ecosystem function (Kremer et al. 2005). The geographic area where activities affect the properties and functions of the coastal ecosystem and the delivery of goods and services is referred to as the zone of influence (Merriam-Webster.com 2012). The use of a zone of influence in coastal planning is a common practice internationally (Naish & Warn 2001). Sierra Leone, like many other countries, is undergoing a period of growth and expansion in its economic, productive, and social sectors. Hence, there is an exponential change in the magnitude of the impacts associated with these developmental activities. This coupled with the threat of global climatic change increases the stress on the coastal ecosystem (Flood & Cahoon 2011).

Marine Boundaries

As defined in the United Nations convention on the Law of the Sea, the territorial sea of Sierra Leone (also the outer limits of the coastal zone) is the limit provided by law measured from the mean low water mark to 12 nautical miles outward. The other boundary within the territorial sea is the 6 nautical miles Inshore Exclusion Zone provided for the management of the country's coastal fisheries resources under the Fisheries Management and Development Act of 1994, which is currently under review and now at the stage of a bill- the Fisheries and Aquaculture Bill. These boundaries pertain to issues of conservation in which the specified areas have distinct ecological importance. Within these boundaries, activities can be regulated and extraction of any kind may be restricted.

Terrestrial Boundaries

All features found within five kilometers landward from the mean high water mark are considered in this Plan as representative of the zone of influence, which immediately affects the coastal environment. The zone encompasses all coastal communities as well as the distribution of natural features and resources found in marine and coastal ecosystem where water levels (a) are influenced by tidal action, (b) are contiguous with sea-level, (c) have a saline influence, or (d) facilitate migration of fauna between fresh and saline water. This includes extensive riverine, estuary, and wetland systems of the coastal area.

Oceanic Habitat/Territorial Waters

The Continental shelf of the coast of Sierra Leone is about 100 km wide in the north and tapers to about 13 km in the south towards Liberia. The total continental shelf area covers about 30,000 km^2 and it is perennially enriched by nutrients from the river networks, rendering the coastal environment a unique ecosystem, which serves not only as an important habitat for assemblages of marine organisms but also as a feeding and breeding ground for most economically targeted species.

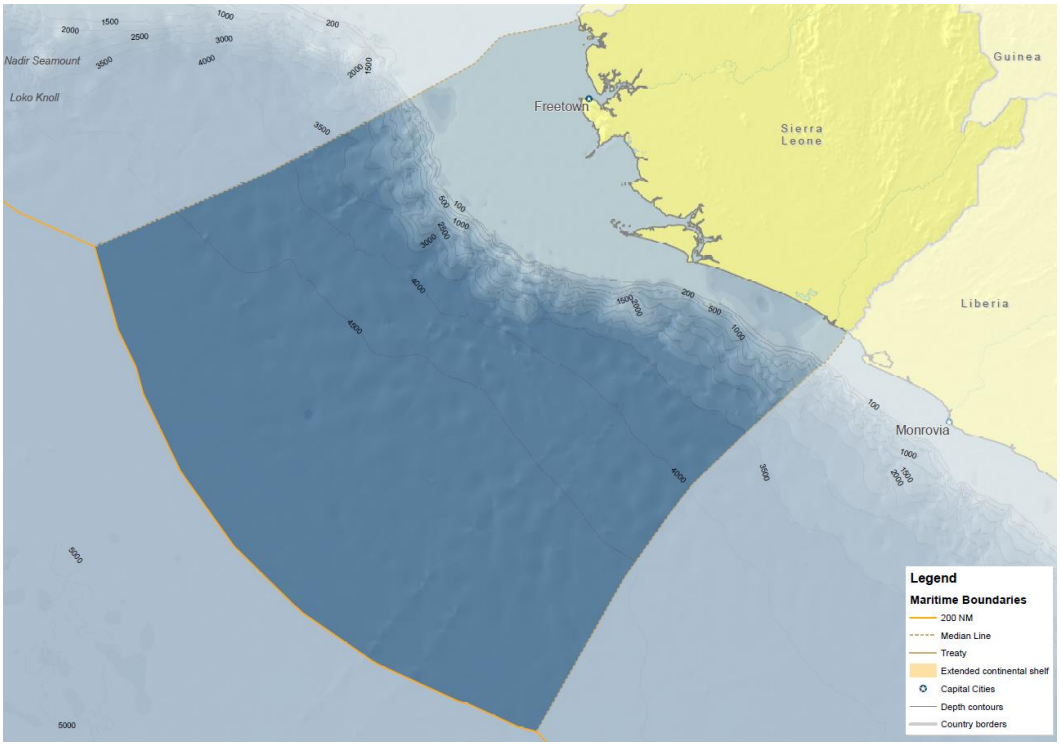

Figure 1: Maritime boundaries of Sierra Leone (source: GRID-Arendal)

The Sierra Leone continental shelf like the shelf of the West African region can be divided into four zones; viz: the inner shelf, the middle shelf, the outer shelf and the shelf edge. The shelf is characterized by relatively plain surfaces inclined at angles of some few minutes and with an average width of about 30 miles (62 km). The outer shelf limits lies at an average depth of 160m and is characterized by an abrupt slope of the bottom. Each shelf zone is characterized by different angles of inclination of the bottom and they lie parallel to the coast in extensive strips. The inner shelf zone could be traced up to depths of about 20-30m, and is the zone of active wave activity. The geomorphology of this zone is closely related to that of the adjacent coast with compact underlying.

Major relief features include the coastal valleys of the Futa-Jallon highlands composed mainly of Paleozoic sands. The coastal valleys are covered with weathered and erosion products of the Futa-Jallon highlands. High temperature and moisture enhance intensive chemical weathering which find their way into rivers and are carried to the coast where they find their way into rivers and are carried to the coast where they are transported alongshore. The relief of the rivers catchments areas helps the movement of large quantities of terrigenous material (mainly quartz) into the ocean with waters of the surface flow. The other sources of sedimentary material, which include biogenic sediment formation, are of secondary importance to the region. The chemical composition of the sedimentary material has a wide range and various types can be identified.

The middle shelf zone lies at depths between 20-30m and 60-70m and is usually the widest part of the shelf with a comparatively smooth surface. The bottom slopes at an angle of some few minutes and at some locations it is less than a minute. The outer shelf lies between 60-70m depth and is smaller in width with greater angles of inclination of the bottom. In some parts basic rocks are common features.

This part of the shelf is commonly incised by the heads of canyons. The northern portion of the Sierra Leone continental shelf is fairly wide about 30-60 miles on average. Its central part is incised by laterally sloping valleys, which have connections with present day river valleys and may well be their submarine continuation. Prominent features on that part of the shelf include the submarine deeps of Konkoure and Yellibuya (Atlant Niro, 1983). The southern portion of the shelf is narrow being part of the Liberian shield and is about 15 miles (45 km) wide. The bottom slope is steeper than in other parts of the shelf, probably due to its narrowness.

Table 1: Basic Information of the Sierra Leone Exclusive Economic Zone
(Source: SeaAroundUs.org)

Exclusive Economic Zone (EEZ) shelf	**215,611 (28,625) km²**
Coral Reefs	0.03 % of world
Sea Mounts:	0.0400 % of world
Primary Production:	643 $mgC \cdot m^{-2} \cdot day^{-1}$

Water column systems

The water column systems comprise of the internal and continental shelf waters. The hydrological structure of the waters of the Sierra Leone Exclusive Economic Zone appears to be made up of an above thermocline upper mixed quasi-homogeneous layer, the vertical extent of which varies over the entire shelf. On the average it occupies a layer from the surface to a depth of 20 to 25m, depending on location and season. It is otherwise called the shoreline water column.

Below this mixed layer is the thermocline, which is a layer of sharp temperature gradient. The roof of the thermocline coincides with the base of the upper isothermal mixed layer and lies at some 20 to 25m also varying with location and season. The upper boundary of the thermocline is sharp with gradient of more than 3^0C/10m but gradually decreases towards the floor to less than 0.4^0C.

Below the thermocline are subsurface layers of the Tropical Atlantic and the Central waters of the North and South Atlantic. It was observed that during the rainy season, the quasi-homothermal waters are found in the quasi-homothermal layer as a result of mixing between the oceanic tropical water masses and the inshore waters from river discharge. Surface waters are characterized by horizontal inhomogeneity resulting perhaps from the diluting effect of river discharge and increased precipitation. The possible diluting effect of river discharge is revealed to the West and South of Sherbro Island where zones separating dilute shallow water from seawater of high salinity can be clearly distinguished. A sub-surface salinity maximum is a prominent feature possibly resulting from horizontal advection from the sub-tropical and equatorial zones of high salinity waters and the fresh water diluting effect. During the dry season the main features described above are characteristic of the study area but with less prominence as the effects of high atmospheric precipitation, river discharge and solar radiation are diminished. The possible diluting effect of river discharge is revealed to the west and south west of Sherbro.

Mangroves

The mangrove forest is a saltwater wetland dominated by mangroves which are halophytic, evergreen woody plants, tall and shrubby, belonging to several related families that share common habitat preferences, physiognomy, functional and structural adaptation. They are found along the shores of estuaries, sheltered creeks, lagoons, deltas and the brackish water zones. The mangrove ecosystem is a complex comprising of biota similar to that found on muddy intertidal flats and include invertebrate and vertebrate fauna, micro-organisms and the interacting biotic factors such as temperature, salinity and chemical constituents of the muddy deposits. Such a system is noted for its high productivity.

Mangrove woodland in Sierra Leone occupies 47% of the Sierra Leone coastline, covering a total area of 183,789 ha (Chong, 1987). In Sierra Leone the mangroves occur along the Scarcies River, Sierra Leone River, along creeks and bays in the Western area, the Yawri Bay and along the Sherbro River. The aerial (ha) extent of the mangroves in these locations is summed up in Table 2. The rich mangrove forests of Sierra Leone have for long been exploited by the local populace of the coastal areas whose main preoccupation is fishing. The mangroves forest and trees had been used basically for fish smoking which is an indigenous traditional way of preserving fish caught for sale, and also as an important sources of fuel wood (Chong, 1987, Johnson and Johnson, 1991, 1992). The environmental role of this natural resource includes, coastal barriers in storm protection, flood and erosion control, and as habitat nursery ground for fish, shrimps and other marine fauna.

Table 2: Distribution of mangroves in Sierra Leone (Source: Chong 1987)

Location	Area (ha)	Percent
Scarcies River	13,007	7.1
Sierra Leone River	34,234	18.6
Western Area	7,189	3.9
Yawri Bay	29,505	16.1
Sherbro River	99,854	54.3
Total	183,789	100%

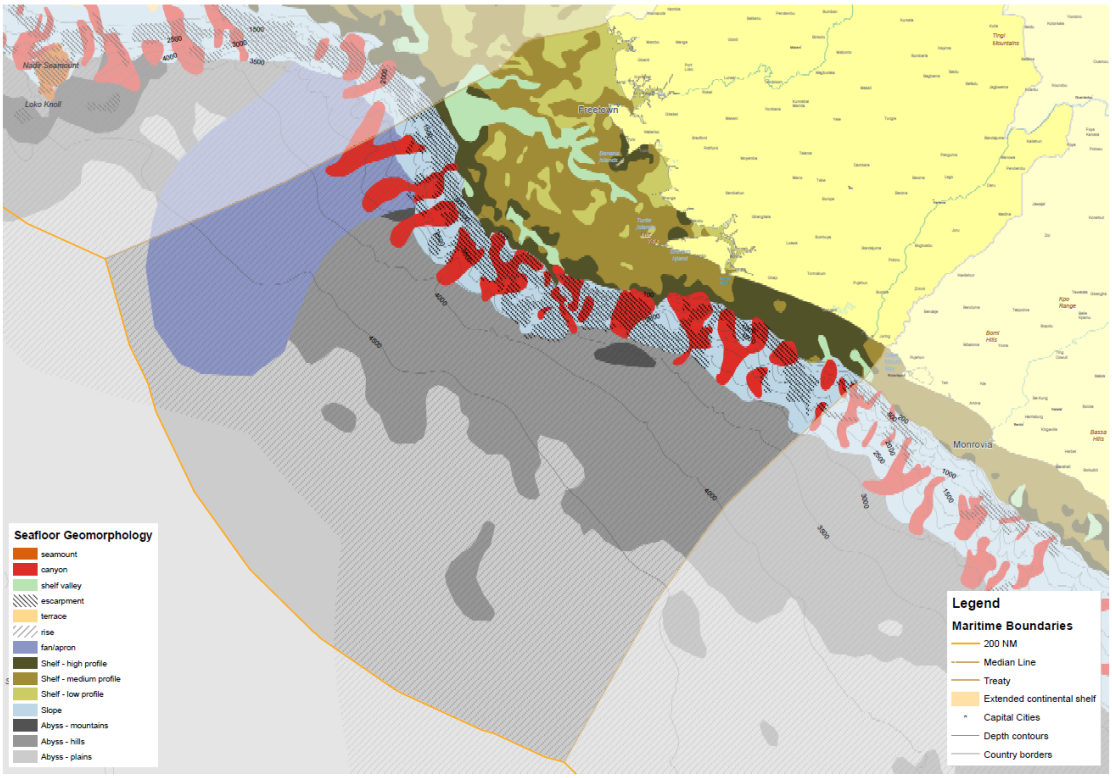

Figure 2: Geomorphology of the Sierra Leone maritime zone

(Source: GRID-Arendal, Harris et al 2014)

Structural Systems

Canyons and Shelf Break

According to surveys conducted by a number of international institutions, the Sierra Leone continental margin is incised with a number of canyons, which serve as sediment traps. The outer shelf lies between 60-70m depth and is smaller in width with greater angles of inclination of the bottom. In some parts basic rocks are common features. This part of the shelf is commonly incised by the heads of canyons. The state of these canyons is stable.

Seamounts

Seamounts are not characteristic of Sierra Leonean waters and constitute only 0.04% of the world's seamounts.

Large gulfs

Large gulfs are also not characteristic of Sierra Leonean coastal and marine areas.

Offshore banks, shoals, islands

Amongst the prominent geomorphic features in the southern part of the shelf are the St. Ann shoals and Galinas delta. The St. Ann shoals trends northwest from Sherbro Island, reaching the outer shelf at the southern edge of the areas. This shoal is roughly 30km wide, rises to depths of 5-14m and the surface is marked by several linear sand ridges oriented northeast southwest which are 3-5m wide and up to 7m high.

The upwelling system along the coast of Sierra Leone

In the Gulf of Guinea the majority of offshore phytoplankton production occurs at the surface during upwelling and along the thermocline during more stable conditions (Longhurst, 1962). The coastal ocean of North-West Africa is one of the world's major upwelling regions, with production of small pelagic fish thriving on nutrient-rich waters rising to the surface and enabling plankton blooms, the principal food of small pelagics. Sierra Leone is located in the southern extension of the north-west African upwelling zone, but its influence is reduced compared to that in areas further north (Longhurst, 1962). Average primary productivity values recorded from various sources including ; Watts (1958); Bainbridge(1963); Aleem (1974) ;IMBO (1996); MESA (2014) are 100 – 150 g C/m ^{2}/yr.

The productivity of Sierra Leone waters is to a large extent influenced by the circulation and current patterns occurring in the area and also by the upwelling of deep, cold, high salinity water caused by the Harmattan and the north-west wind (Johnson and Johnson, 1996). Coutin (1989) also states that strong upwelling occurs each year along the coasts of North-West Africa between December and April and especially between October and February for the Dakar Freetown region during the Harmattan. Analysis by Johnson and Johnson (1996) suggests that upwelling off the Sierra Leone coast is characterized by a shallow thermocline and nutrient enrichment below the surface at 20 m depth.

Attempts by Johnson and Johnson (1994) to analyze some hydrographic data obtained from the continental shelf of Sierra Leone suggest the occurrence of upwelling (even if localized and weak) in the continental shelf area of Sierra Leone. This observation is in line with those made by Longhurst (1962) and Berrit (1959, 1966).

Coastal Lagoons, River, Bays, Deltas/Wetlands and Estuaries

The coastal water resources include the bays and estuaries of the rivers of the Rokel (Sierra Leone River), Great and Little Scarcies, Sherbro, Jong, Sewa, Moa and Mano. Nearly all these rivers flow parallel to one another right across the country from the high interior plateau in the east towards the lowland coastal areas before debauching into the Atlantic Ocean.

The bays and estuaries support diverse ecosystems for which inhabitants of the coastal areas and beyond derive their livelihood. Around these coastal water bodies can be found extensive fringes of mangroves, tidal swamps and intertidal mud flats. Because of their location near terrestrial sources of sediments, the estuaries and bays contain large amounts of nutrients. The combination of this nutrient supply with generally shallow water gives rise to a diverse and large flora and fauna. The substrata in these areas serve as a source of recreation, transportation and food and also they serve as a receptacle for waste disposal.

The Sierra Leone River Estuary

The Sierra Leone River comprises major rivers such as the Rokel River, the Bunce River and the Port Look creek. It is 16 km wide and 40 km long. The Queen Elizabeth II Quay, which is the major port, is situated on this river. It is a marine protected area and bordered with main fishing villages or coastal villages which include *Fernandopo, Gbonkobankala, Kirima Village, Rogberay, Kakim, Mayagba, Shylor, Robana, Kasanko, Mathamkiya, Benkia, Tumba, Kegbeli, Makainkay, Makambo, Manday, Aberdeen creek,* around *Mange, Ropolon, Tumba, Makipte, Kasuko, Mene town, Beke bana, Makambo, Manday, Kegbele, Makainkay*.

The Sierra Leone River is the combined estuary of many smaller creeks and few major rivers, with over 110 km of mud or mud-sand foreshore, essentially backed by mangroves and 1800 ha of intertidal mud and muddy sand (Tye, A. and Tye, H. 1987). Only three areas were found to have extensive mudflats: Aberdeen Creek, Bunce Creek and mudflats south of Tasso Island. All other areas were exposed sandbanks or smaller mudflats bordering mangrove coasts. The sand flats are less extensive here than at the Scarcies River. An area of 295,000 hectares of the Sierra Leone River estuary is classified as a Wetland of International Importance (RAMSAR convention) in the west of Sierra Leone (UN EPWCMC, 2004, RAMSAR Sites, 1999).

The Scarcies River Estuary

The Scarcies Rivers constitute the great and little Scarcies, in the northern region of Sierra Leone coastline. The two rivers merge towards their mouth before emptying in the Ocean. The area is bordered with coastal villages that include *Kychom, Katik, Balansera wharf, Kpunga, Sasiyeck, Mayoro, Makoumpan, Marabou, Kortimaw Island, Yeli-kom, the Mahela Creek, Kakonki and Benkiya wharf.*

The Scarcies River exhibits both marine and intertidal environmental regimes. The Great Scarcies (*Kobuter* River) is relatively narrow and its banks are lined with mangroves. The Little Scarcies (Kaba River) has a large mud bank at its entrance south-south-eastward of *Kortimaw* Island. This river is tidal and during the rainy season it rises about 2.7 m, (Ssentongo. and Ansa-Emmim, 1986). The most extensive mudflats in the area occur near the coast of Yeliboya and Kortimaw Island. Both rivers have a total catchment area of 20.230 km^2 with an estimated total annual discharge 750 m^3yr-1 (Ndomahina, 2002). The figure below gives a pictorial view of the Scarcies River Estuary. Both rivers merge and form a single discharge into the ocean.

The Yawri Bay and Kargboro Creek

It is situated south of the western area (7^0 52', 8^0 20'N 12^0 45', 13^0 10' W). Three rivers empty their banks into the Bay these are Ribi, Kukuli and Kargboro. Their total area is estimated 29,505 ha. The Yawri Bay is bordered by coastal fishing villages that include Kent, Mama beach, *Tombo, Tissana, Kpango, Mosseh, Baba Barmot, Mokoni,* Seaport, and around the *Kargboro* Creek the villages include *Taintain, Thengbeh, Shengebole, Shuen Shenge* and Plantain Island. *Yawri* Bay is a huge shallow inlet with few creeks entering it. It is categorized as Marine/Coastal Wetland with permanent shallow water that is less than 6 m deep at low tide. Several small creeks such as *Calmont, Batbana* etc are linked to the sea and river systems. The bay is subjected to intertidal movements and fluctuations in volume of inflow according to the season. During the wet season, the tidal influence will rise up to 10 km inland at the time of high flow. The banks have extensive mangrove forests with about 60 km of mudflats bordering it. The bay is shallow; creating exceptionally wide intertidal flats of approximately 9100 ha in area (Tye and Tye, 1987). The Bay is about 56 km long from Tombo to Shenge (Chong, 1987). The mudflats consist of soft clay sediments. The coastal area of the mouth of the *Kargboro* Creek has a band of sand flat which continues 20 km to the Sherbro River mouth. The figure below shows the area of the Yawri Bay site.

Sherbro River Estuary (Bonthe District)

Sherbro Island shelters a broad waterway about 60 km long and 3-7.5 km wide known as the Sherbro River into which the Bagru, Jong and Kittam Rivers discharge together with a number of minor streams. Both banks of this waterway are cloaked by mangroves up to 10 km deep, and in total there are about 39 000 ha of tidal forest in the locality.

Sherbro Island is at the end of a long sand spit, Turner's Peninsula which has being built up by the powerful north-westward flowing longshore drift. The island exists because the waters of the Jong and Kittam Rivers have breached southeast to the mouth of the Moa River (6^0 58'N/11^0 35'W) and behind it the Sewa and Wanje Rivers unite to form the Kittam River which has been diverted north-westwards alongshore. This river is separated from the sea by dune ridges in the swales of which towards Sherbro Island, swamp grasslands and swampy forests occur, the latter rich in *Pandanus* and *Raphia* spp. Inland the entire area between the Jong and Sewa Rivers is swampy, with great patches of herb, palm or tree swamps covering a total of 71 000 ha in a mosaic with dry land.

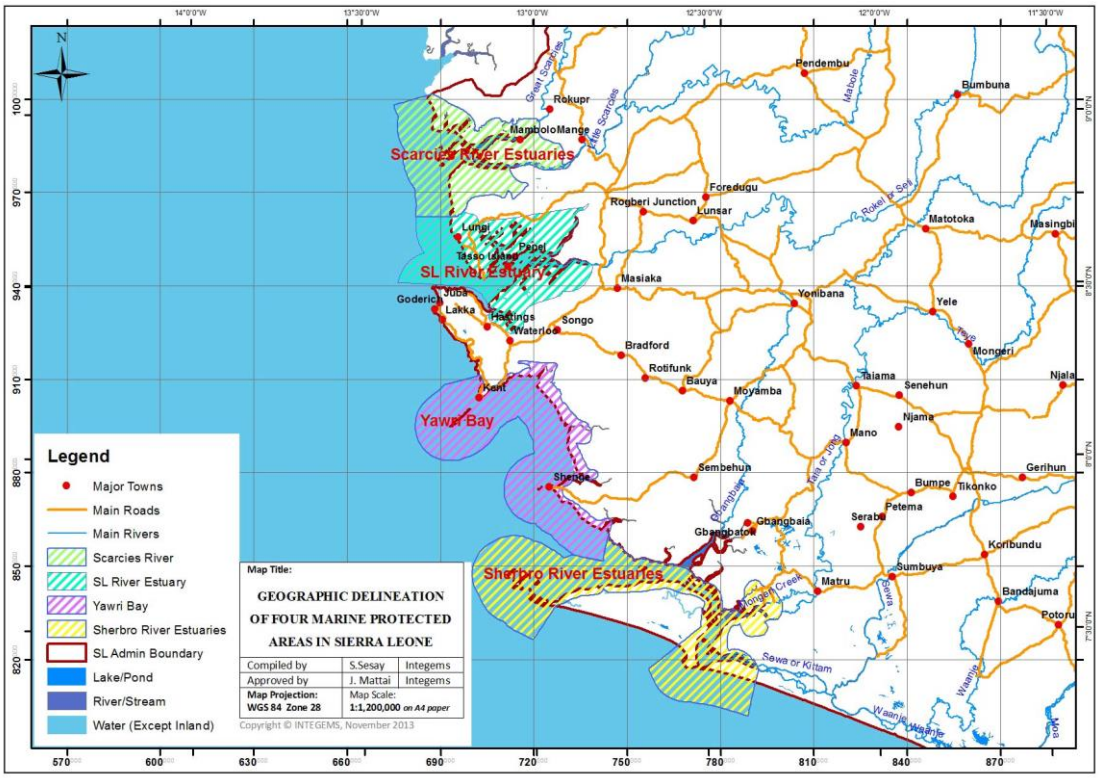

Figure 3: Scarcies River Estuary, Sierra Leone River Estuary, Yawri Bay and Sherbro River Estuary

Southeast of the Sewa River behind the sandpits, mangrove swamps, palm swamps, grass swamps, lagoons and dry are interspersed in a belt 60 km long and 25 km deep, as far as the right bank of the Moa River. Wetlands occupy most of the 150 000 ha territory of low lying sandy land.

The extensive Sherbro Island is fringed by mudflats and sandbanks. Extensive mudflats dominated by clay soils occur mainly at the northern border of the peninsula (Delken-Baoma area). In the vicinity of Bonthe and its surroundings, smaller mudflats occur mostly mixed with sandy soils. The abundant islands near Bonthe hold mostly at one side some mudflats and are bordered by small strips around and rest of the island. The Turtle Islands are at the western outskirt of the Sherbro River Estuary. In this area sandbanks and sandy areas dominate with clear shallow water. Along the edges of the islands some small mudflats occur with a relative sandy structure.

Gallinas and Mano rivers Basin

The Mano River divides Sierra Leone from Liberia and drains a large catchments area in the south. The strong surf and currents have formed an 8 km spit between the open sea and the narrow lagoon fed by the rivers.

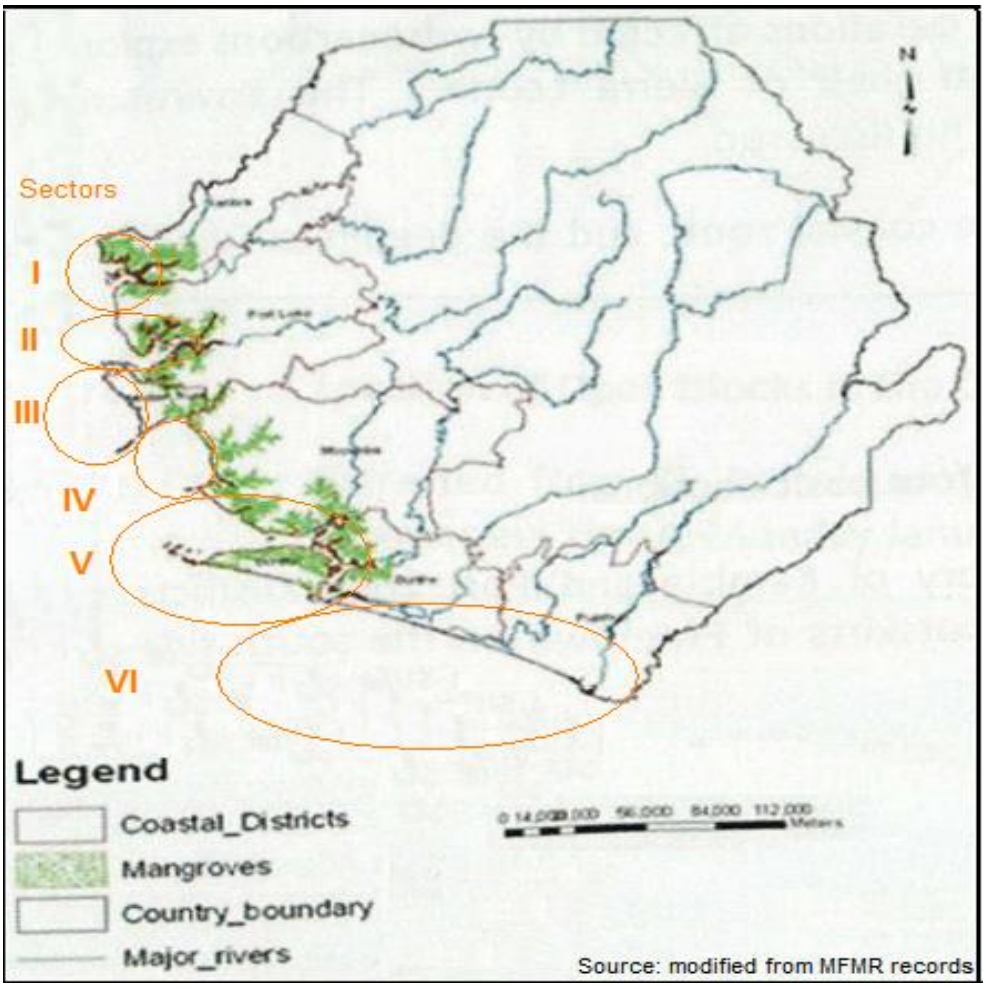

Figure 4: Sierra Leone's major river deltas/wetlands

Coastal landforms

Beaches

The coastline of Sierra Leone can be divided into two sections: The section to the north of Bonthe characterized by a series of indentations representing estuaries, bays and creeks and the section south of Bonthe Island which has about 200km of nearly unbroken steep sandy coast, and beach ridge backed with coastal swamps.

Sierra Leone is endowed with beautiful expanses of yellow sandy beaches. They occur all along the Freetown Peninsula interrupted only by a few rocky headlands and bays. Some areas of the Sierra Leone coastline are dominated by mangroves and are devoid of beaches, or if present they are generally narrow and composed of fine-grained sand. The total length of the beaches is approximately 350km.

Beaches along the Freetown peninsula are all-natural and are mainly sandy facing the Eastern Atlantic. The beaches comprising of mainly fine-grained sand, which offers a suitable habitat for a variety of infauna. They also serve as nesting grounds for turtles and birds. These birds include gulls, sandpipers, terns and pelicans.

Cliffs

The coastal environment also consists of low cliffs (5-20m high) of poorly consolidated clay, sand, silt and gravel of Eocene to upper Pleistocene age, some of which have been subjected to intense erosion e.g. at Konakridi, Tisana, Shenge and Sulima point.

Rocky shores

In some areas along the Sierra Leonean coast, rocky shores are a prominent feature. There may be not more than a few kilometers of rocky shorelines (<10km) but the most impressive is the cape Sierra, Juba-Hamilton complex (Adam, 1987). Rocky shores along the Sierra Leonean coast are of two types viz; those composed of granitic rocks and those of lateritic rocks. Granitic rocky shores are associated with Cape Sierra, Goderich, York, Kent and Hamilton along the shores of the Freetown Peninsula as well as Banana Island. Lateritic rocky shores are found along the Southeastern shores around the Kagboro creek at Shenge.

The biodiversity of the rocky shores include molluscs (barnacles, oysters, mussels, periwinkles, limpets, and gastropods), algae and coralline sponges.

Habitats

Overview of benthic oceanic habitats

Benthic oceanic habitats include the seabed of the inner shelf, outer shelf, shelf break and upper slope. Oceanic habitats extend from the sub-tidal to the abyssal and include both pelagic and benthic habitats. As stated earlier, the edge of the continental shelf seems appropriate for this study as the seaward extent to Sierra Leone's oceanic habitats. The obvious reason being the fact that most of the biodiversity that our human and financial resources could enable us study and exploit occur on the continental shelf. Surface marine waters in the tropics are generally depleted in nutrients but in certain coastal regions, the nutrients are locally enhanced as a result of upwelling. The Sierra Leone coast as part of the Guinea Current coast is characterized by such an upwelling which is seasonal and occurs from Cape Palmas to Benin Republic.

The shallow coastal waters of the Sierra Leone have a highly diverse fish and invertebrate fauna, many of which are important in commercial fishing. Fish diversity in the coastal waters is reasonably well documented (FAO, 1990). What is poorly known is the diversity of the benthic macro-fauna i.e. animals that live on the bottom or within the bottom sediment and can be retained on a 0.5mm sieve. The situation is much worse for the meiofauna i.e. organisms smaller than 0.5. Sub-tidal benthic habitats are among the least studied in the waters of the Sierra Leone Continental shelf.

Species Diversity

Overview of marine biodiversity

Plankton

The plankton of the Sierra Leone River estuary and parts of its creeks and bays have been studied by many researchers including (Watts, 1958; Bainbridge, 1968; Aleem, 1973, Leigh, 1973, Findlay, 1978; COMARAF, 1990; Conteh, 2001)

Horizontal distribution and seasonal fluctuations in plankton production are intricately linked with the changes in climate during the rainy and dry season. During the rainy season (May – September), there is a reduction in solar insolation, increased discharge of freshwater, increase in dissolved and suspended solid deposition on the shelf and the lowering of the temperature. During this period there is instability. Stability returns in November after a complete mixing of the estuarine water in October by strong winds. In the dry season (November – April) there is a reduction in river discharges, reduction in stream velocity, increase in wave and tidal effects, and increase in solar radiation and temperature leading to stratification.

Phytoplankton production increases in December followed by an increase in numbers of zooplankton in January and February. There is rapid reduction in nutrients due to corresponding uptake by phytoplankton and loss from surface waters due to dying plankton sinking to the bottom. There is a gradual increase in salinity due to intrusion of oceanic waters and high evaporation rate reaching a maximum in May or June. Cold oceanic water intrusion during the prevailing harmattan depresses temperature at optimum salinities, thus favouring high standing stocks of plankton during the middle of the dry season at the middle reaches (Leigh, 1973). Seawater temperature reaches a second peak in April and May during which period plankton production decreases.

In general high plankton production is between the end of the rainy season to the middle of the dry season (October-February). There is a decline from March to June, which extends into the rainy season.

The major phytoplankton species are: *Thalassiosira*, *Nitzchia*, *Pleurosigma*, *Coscinodiscus*, *Thalassoinema*, *Skeletonema*, *Amphora*, *Ceratium*, *Peridinum*, and *Oscillatoria*. Some blue green algae may occur in the rainy season.

Dominant phytoplankton species in the dry season appears to be *Coscinodiscus*, and *Thalassiothrix*. In the rainy season the dominant species are *Thalassiothrix*, *Coscinodiscus* and *Thalassiosira*. Average primary production levels of 100-150g C/m^2yr have been recorded.

Macro-algae

There are three major categories of algae each containing about thirty species in Sierra Leonean waters belonging to the following groups viz; Chlorophyta, Phaeophyta and Rhodophyta. In 2011, the seaweed *Sargasso vulgare* invaded the country's coastal waters in unusually large amounts for the first time littering the entire coastline beaches. Since then that phenomenon seems to be a usual occurrence appearing around June and disappearing around October. During this period, activities such as fishing, navigation and tourism suffer most. The decaying plants produce an offensive odour on the beaches. This occurrence is now a national concern triggering studies initiated by the Environment Protection Agency Sierra Leone.

Benthos

Longhurst (1958) has identified the following assemblages of benthic organisms in the Sierra Leone River Estuary:

(i) Venus community (ii) Amphioplus sub-community (iii) Venus /Amphioplus transition (iv) Pachymelina community (v) Estuarine Gravel community.

(ii) The venus community is found near the mouth of the estuary and in the deep channel on shelly-sand and fine lateritic gravel. It is dominated by poriferans, nemerteans, small crustaceans, brachyuran, pagurids, procellanids, lamellibranches, asteroids, echinoderms and ascidians.

(iii) The most important members include: *Brachiostoma leonense, Aloidis sulcate, Astroecten michaelseni, Tris carbonorea, alternate, Modiolus stutorum. Astrangia* sp.

(iv) Oliva *accuminata* and *Rotula orbiculus*. The species diversity was 23 per sample and 12g/m^2 (fresh weight) Longhurst. 1958)

(v) The Amphioplus sub-community occurs on mud, Shelly-mud and sandy mud in the lower reaches. It is a much more diverse group and may consist of periferans, brachyurans, Crustaceans, gastropods, bivalves polychaetes ophuiroids. The representative members may include: *Upogebia furcata, Callianassa balssi, Clymene monilis, Pectinoria sourei, Goniada multidentata, Glycera convolute, deopatia neapolitanea, Nereis senegalensis, Notomastus Latericeus, Nephthys polygranchia, Marginella, amygdale, Natica Mapochiensis, Cerebratulus sp. Iphigenia laevigata, Cutellus tenuis, Clibenarius cooki, Tellina angulayus, Talona explanata, Macoma* and *Tellina nymphalis*. There were 17 species per sample and 15g/m^2.

(vi) The Venus/Amphioplus transition is a mixture around the lower and middle reaches in the sand-mud regions. It consists mainly of an Amphioplus sub-community with the addition of isolated individuals from the Venus community. Dominant members of this community are *Nassa tritoniformis, Olivia sp, Pusionella rifat, Luidia alternate, Astropecten michaelseni, Rotula orbiculus, Branchiostoma leonese, Upogebia furcata*.

(vii) The Pachymelina community occurs on deposits of coarse sand in the upper reaches of the estuary. It contains the bulk of the truly estuarine communities. The members are found on sand and muddy sand with the filter feeding gastropod; pachymelina aurita being the most dominant. Other gastropods may include *Aloidis trigona, Neritina glabrata, Neritina owenians, Neritina rubricata and the bivalue Iphigenia truncate*. There were 4 species per sample and 137g/m^2.

(viii) The Estuarine gravel communities are a specialized community consisting mostly of sedentary, epifaunal organisms found on patches of lateritic gravel. The characteristic species found on estuarine gravel community are Astrangia sp. *Actinian sp. Thelepus sp. Balanus amphirite, Aspidosipton venatulum and Arca imbricate.*

(ix) At the Bunce River the benthic fauna recorded consisted of the following: *Pectinaria sourel, Uca tangeri, Tympanotonus fuscatus, Metagrapsus curvitus*. Benthos densities on the average were 12 individuals /m^2.

The following major categories of zooplankton have been noted for the Sierra Leone River estuary: Copepoda (*Temora turbinate, Cenropages furcatus, Schmackeria serricaudatus, Cladocera, Evadne tergestina, Penilia avirostrius*) Mysiidacea; Bracchyuran larvae; Brachyuran megalopa, Amphipoda Hyperiidae, Gammaridae; Decapoda (Lucifer faxoni), Chaetognatha (Sagitta enflata; S, frideric), Appendicularia, Thalacea, Polychacta (Leigh, 1973, Findlay, 1978). There are also minor representative of other benthic larvae (Molusca, Echinoderms and fish larvae (Yillia, 1995 unpublished).

The Copepoda are the dominant category (40%-70%). Total zooplankton volumes varied from 1278 individuals /m^3 in dry season (February) to 540 individuals /m^3 in the rainy season (September). The Table below provide the list of benthic animals recorded in estuaries in Sierra Leone.

Table 3: List of dominant benthic fauna found in estuaries in Sierra Leone.

POLYCHAETA	*Rhophipholis cincia*	CRUSTACEA
Clymene monilus	*Ophiuroidea sp*	*Squilla Africana*
Glycera convulata	*Astropecten michelseni*	*Callianassa balssi*
Diopatia neapolitanea		*Alpheus pontederiae*
Pectinaria sourei	MOLLUSCA	*Pensaeus notialis*
Lumbrinereis impatieas	*Ihiohegenia truncate*	*Parapenaeus atlantica*
Goniada multidentata	*Tellina nymphlis*	*Lyosquilla*
Terribellid sp	*Donax owe*	*Septemspinosa*
	Mactra specia	*Upogebia furcata*
GEPHYREA (SIPUNCULIDAE)	*Glycimenis*	*Latreutes parvulvs*
Ochetostoma Mercator	*Aloidis dauzenbergi*	*Polyonyx sp*
Sipunculus titubens	*Surcula coerulea*	*Diogenes pugilator*
	Pachymelana aurita	*Paguristes*
BRANCHIOPODA	*Neritina owenians*	*Manretanicus*
Ligula parva	*Neritina rubricata*	*Uca tangeri*
	Neeritina glabrata	*Heteropanope caparti*
ECHINODERMATA	*Aloidis trigona*	*Menippe nodifrons*
Rotula orbicularis		*Porcellanna*
Holothurians sp	CEPHALOCHORDATA	*Longicornis*
Amphioplus congensis	*Brachiostoma leoense*	*Clibenarius cooki*
Acrocnida semiguamta		

Pests, introduced species, diseases and algal blooms

The current lack of information on how many alien species have become resident in the region is attributable to shortage in expertise in taxonomy for the relevant research. Furthermore, until the species show signs of invasiveness, they generally may go unnoticed in the environment (Armah, 2006). Fortunately, the number of species documented to date are few, about 4-5 in the region. However, the problem of coastal and marine invasive species is likely to worsen over the coming decade due to increases in shipping activities throughout the region. Ship traffic is projected to continue growing into the coming decade with economic growth and therefore the outlook for transfer of alien organisms through ship‘s ballast water could be expected to grow.

Fish Species of the Sierra Leone coastal estuarine environment

The Sierra Leone River Estuary has been studied in Sierra Leone with respect to its fisheries resources (Watts, 1957b, Longhurst, 1957, 1960, 1965, Bainbridge, 1961,
Sentengo and Ansa-Emmin, 1986, individual studies on single species or assemblages have also been undertaken by various workers including: George, 1982 (*Pseudotolithus senegalensis* and *P. typus*). Beresford-Cole, 1982 Drepane African, Fofana, 2000 (*Pseudoltolithus elongalensis* and *P. Brachygnathus P. Typus, Pterocion peli, Pomadasys jubelini, Drepane africana Chaetolipterus goreensis, Psettodes selchen, Galeoides decadatylus* and *Pentanemus quinquarus*).

As a matter of convention shrimps and crabs are also included here. Only 3 (*Penaeus notialis, Penaeus atlantica and Penaeus kerathurus*) out of 6 species of shrimps are found in the coastal waters of Sierra Leone. There may be post larval stages and juveniles found in plankton. The species of crabs of commercial importance found in the Sierra Leone River estuary are all of the genus Callinects and are *Callinectes pallidus*, C. *Amnicola* and *C. maginatus*.

Icthyofauna

A large number of species of fish have been recorded for the Sierra Leone River estuary (as high as 80 species). The fishes of Sierra Leone estuary belong to two (2) types of categories (1) Pelagic fish community and (11) Estuarine and Creek sub-communities (Longhurst, 1969; Fager and Longhurst, 1963; Longhurst and Pauly, 1987).

Pelagic Fish Community

This is a rather diverse group and has been the subject of investigation for several years (Longhurst, 1963; Williams, 1968, 1969, Brainnard, 1978; CECAF, 1983, Nieland, 1980, 1982, Sentengo and Ansa-Emmin,, 1986, Anyangwa, 1988, Coutin, 1989, FAO, 1995 unpublished; IMBO, 2000-2002 (on-going research). The dominant members of this group are the Clupeidae (*Ethmalosa fimbriata, Sardinella maderensis, Ilisha farina*). Others include: carangidae (Caranx). *Chloroscombrus chrysurus*. Some members of the carngidae may make periodic incursions into the estuary at high tide *Decepterus rhonchus* and *Trachurus tracea*.

Estuarine and Creek Community

This community consists mostly of demersal fish species. It is diverse but in terms of abundance is dominated by sciaenidae. The prominent members of the Scianidae are *Pseudotolithus elongatus, P. senegalensis, P. brachygnatus, P. typhus*; Polynemidae (*Galeiodes decadactylus, Pentanemus quinquarius, Polydactylus qadrifilis*), Drepanidae (*Drepane Africana*); Monodactylidae (*Monodactylus sebae*): Pomadasyidae (*Pomadasys Jubelini*; *P. peroteti*); Lutjanidae (*Lutjanus goreensis*); tetraodontidae (*Lagocephalus cephalus, Liza falcipinis*); Sphyraenidae (*Sphyraena barracuda*); (Prislispristis) Dasyatidae (*Dasyatis margarita*).

The fish production in this estuary is not known. However, Blaber (1997) and Baran (2000) have calculated that West African estuarine fish production ranges around 15-16 tonnes/km^2/yr. Based on available information, fish production in the estuary is between 3,855 mt and 4,144 mt/yr.

Marine fisheries

Inshore Pelagics

Among the inshore pelagics, the most important species are the clupeids (*Ilisha africana, Ethmalosa fimbriata, Sardinella maderensis* and *Sardinella aurita*), the carangids and the scombrids. This category of fisheries is mainly migratory and closely related to the fluctuations of the environmental conditions within the estuaries and near-shore.

Offshore Pelagic Fisheries

The offshore pelagic fisheries consist mostly of species associated with three types of hydrographic regimes.

Engraulis encrasicolus, Sardinella aurita and *Decapterus* species are found associated with the thermocline; *Scomber japonica* and *Trachurus* species are found in the upwelling zones. Here also are found the tuna species, which include: *Thunnus albacores* (yellowfin tuna), *Katsuwonus pelamis* (skipjack) and *Euthynnus alletterates* (little tuna).

Inshore Demersal Fisheries

The inshore demersal stocks include mainly the sciaenid fauna. Members of the sciaenid assemblage live above the thermocline on shallow muddy bottoms. Although some 60-80 species have been identified as belonging to this community, only some species are dominant. These include *Pseudotolithus elongatus, Drepane africana, cynoglossus goreensis, Arius latisculatus and Dasyatis maragarita*.

Offshore Demersal Fishery

The offshore demersal fishes include the sparid fauna (the continental slope community) and shellfish. The sparid fauna normally inhabit the regions below the thermocline on sandy and rocky bottoms. The shallow shelf luthjanid sub-community is dominated by species, which include *Balistis capriscus, Pagellus bellotti* and *Dentex canariensis*. The deep shelf sparid community includes the *Dentex* species.

Shell Fish (Invertebrates, Squid, crustaceans etc)

The crustacea and mollusc consist of the shrimps, cuttlefish and squid. Of the six (6) shrimp species of commercial importance *Penaeus notialis* accounts for about 96% of the landings and occurs of the Freetown peninsula especially around Banana Island. *Penaeus kerathurus* occurs in the southern part of the coast. Both species inhabit the mangrove swamps, estuaries and inner continental shelf to a depth of 55m. Other species occur in deeper waters of 40-70m and above the continental slope.

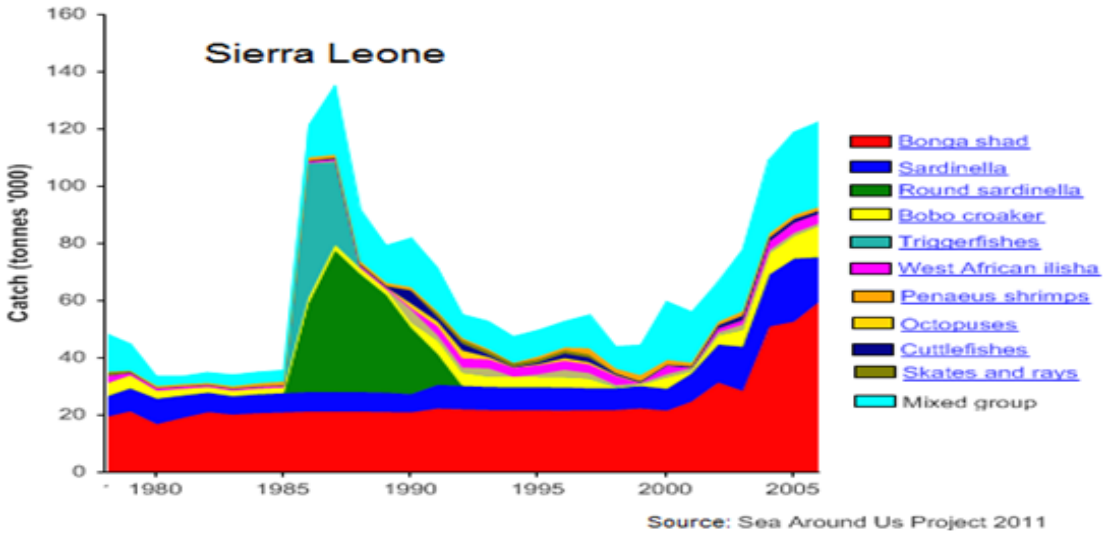

Figure 5: Fish landings Sierra Leona (Source: Sea Around Us Project 2011)

The two species of cuttle fish, *Sepia officinalia* and *Sepia berthelott* are found in the north and south of the EEZ on coarse ground at depths of 17-18m. There are four squid species; *Thysanoteuthis rhombus* and *Toderopsis eblanae* are demersal below 1000 m. depth.

Molluscs such as bivalves are commercially important shell fish resources for the coastal communities. Mangrove oyster (*Crassostrea gasar*) can be found on the roots of mangrove trees in coastal swamps and estuaries where they are harvested for subsistence as well as for commercial purposes. Other bivalves exploited include clams such as *Senilia Senilis*, *anadara senegalensis*, cockles and periwinkles (*Tympanotonus* spp.)

Sharks and rays

Sharks and rays are exploited using bottom set nets respectively and their fishing efficiencies are subject to environmental variability. The artisanal fish landings for sharks appear to be at a peak in the dry season (March – April) and generally lower in rainy season (June – August). The reason for the apparent differences in seasonal shark landings has been attributed to the turbulence in the water column as a result of the ensuing tidal current caused by the rains. The situation would normally create difficulty in setting the net and hence undermine catchability and landings of shark species.

The dominant ray species in shrimp trawl fisheries are *Dasyatis pastinaca* (44%) and *D. margarita* (23%). The shark species are dominated by *Sphyrna lewini* (72%) and *Carcharhinus obscurus* (15%). In the case of finfish demersal trawl fisheries, the dominant shark species are *Carcharadon carcharias* (44%). *Carcharhinus brevipina* (15%) and *Sphyrna lewini* (15%).

Tuna and billfish

Three species of tuna commonly caught in Sierra Leonean waters are yellow fin (*Thunnus albacares)*, skipjack (*Katsuwonus pelamis)* and big eye (*Thunnus obesus*) tuna.

Yellowfin tuna are a relatively large tuna, easily distinguished as adults by their large second dorsal and anal fins which, along with finlets, are typically bright yellow. Yellowfin tuna typically spend most of their time in the warmer mixed surface waters (above the thermocline). Small yellowfin are caught on the surface by a range of gears including handline, ringnet, purse seine and pole/line gear and are used mainly for canning, while the majority of larger/older fish are caught by both purse seine and longline fisheries, with the longline catch often shipped fresh to overseas markets.

Skipjack (*Katsuwonus pelamis*) are a surface–schooling tuna which are easily distinguished from other species of tuna due to their small size, small dark pectoral fins and three to six distinct dark longitudinal lines (stripes). It is found year-round concentrated in warmer tropical waters. Skipjack are caught mainly on the surface by purse seine and pole-and-line gear and are used for producing canned tuna. The typical capture size for skipjack is between 40 and 70cm, corresponding to fish between one and three years of age, with very few captured fish exceeding 80cm.

Bigeye (*Thunnus obesus*) tuna are among the largest of tuna species with a relatively broad distribution due to their tolerance of low oxygen levels and low temperatures. Juvenile bigeye tend to inhabit shallower waters and can form mixed schools with skipjack and yellowfin, which results in catches by the surface fishery, particularly in association with floating objects.

Other components

In addition an estimated 20,000 migrant Palaearctic wading birds are reported use the area. The factors controlling the richness or poverty of estuarine biota are climate (rainfall and solar radiation), erosion that determines the rate of siltation, the width and permanence of the estuary mouth, geology and temperature. Based on their tolerance to salinity, estuarine biota especially fauna consists of five (5) components:

- Freshwater salt tolerant components derived from the river
- Stenohaline marine component usually restricted to the mouth of the estuary
- Euryhaline marine component extending throughout the estuary
- The estuarine component evolved from marine forms (restricted to estuaries but not found at sea)
- Migrant forms (birds, reptiles, fish, prawns and cephalopods).

Marine mammals (Whales, dolphins, porpoises, manatees)

Much is not known about the status of populations in Sierra Leone with the exception of sporadic sightings. The Atlantic Humpback dolphins (*Sousa teuszii*) frequently occur in the artisanal by catch. Other cetaceans include the Clymene and common dolphins which are often sighted in deep waters beyond the 50 m isobar. A single representative of the sirenean, the African manatee (include scientific name) has been found in river estuaries.

Birds

Like with marine nektons birds have a huge and well documented biodiversity. There are twenty three species of seabird of globally important conservation status which frequent Sierra Leone's coastal waters, including, Lesser Flamingo, Damara Tern, Avocet to name a few in addition to the list on the table above. These birds congregate around the mouths of rivers and estuaries on mud and sand foreshores, which provide good feeding and nesting areas. According to WIWO there are 89 species of marine and coastal birds. Also Sierra Leone lies on the Eastern Atlantic Flyway making it very important internationally (http://www.imf.org/external/pubs/ft/scr/2011/cr11195.pdf).

Migratory sea birds at River Number 2

Table 4: List of water birds (Column A: In the world; Column B: In Sierra Leone)

Common name	Family/Order	Number of species	
		A	B
Ducks, geese and swans	Anatidae/Anseriformes	14	
The fish-eating falcon	Osprey Ciconidae	19	7
Cormorants	Pelecaniformes Phalacrocoracidae	38	1
Boobies and gannets	Pelecaniformes Sulidae	9	2
Darters	Pelecaniformes Anhingidae	4	1
Bitterns, herons and egrets	Ciconiiformes Ardeidae	61	16
Storm petrels	Procellariiformes Hydrobatidae	21	5
Shearwaters and petrels	Procellariiformes Procellariidae	75	4

Reptiles

Sierra Leone's coast is home to five species of marine turtles, viz., the Green Olive Ridley, (*Lepidochelys olivecea*) loggerhead (*Caretta caretta*), Leatherback (*Dermochelys coriacea*) and hawksbill (*Eretmochelys imbricate*). These species nest directly on the beaches mainly in the south, around Turtle and Sherbro islands.

The Green, Olive Ridley's, and Hawksbills turtles have been confirmed to be nesting in Sierra Leone (Fretey 2001). There have been a report of turtles in Sierra Leone been endangered Wright, F. 2006.

Nesting sites have been reported along the Peninsula but the expanding tourism industry have driven away much of these species from the beaches.

There are three species of Crocodiles, the Nile crocodile, the Slender-snouted Crocodile which lives in streams found in the coastal areas for example No II River; Dwarf crocodile found in mangrove swamps. All the species of sea turtles live in the waters of Sierra Leone with the Green olive Ridley Turtle (*Lepidochelys olivecea*) and Leatherback Turtle (*Dermochelys coriacea*) laying eggs on the shores including on Sherbro Island and Turtle Island.

Table 5: Diversity of organisms in the Yawri Bay.
(Source: MPAs Baseline Studies by IMBO)

Taxonomic group	No. of species
Fish	130 species
Birds	30 species of Palaearctic migrants 15 species of Afrotropical migrants 20 species of resident birds
Mammals	4 species of primates 4 species marine mammal 1 species of antelope (duiker)
Reptiles (crocodiles and turtles only)	1 species of crocodile 3 species of marine turtles
Rocky shores and edge diversity	25 species including green and brown algae (14 species of plants and 11 species of invertebrates)
Mangroves	7 species of mangroves (5 families)
Intertidal substrate diversity	10 species of Gastropods 8 species of Bivalves 6 species of Crustaceans
Other flora (edge of coastline)	35 species of higher plants

Ecological processes

Description of ecological processes

Spatial/physical disjunctions

Marine and Coastal space is utilized for transportation, fishing and aquaculture, trade, mining, tourism and recreation, communication, ports and harbours etc. Both marine and river transportation facilities have to be improved with regards to port facilities safety standards and quality of service mainly for local coastal transport. Proper pollution control measures should also be put in place. All of these processes cause special and physical disjunctions to various ecological systems and biological migration flyways.

Marine Minerals, Oil and Gas

There is a limited variety of minerals found and extracted from the coastal area of Sierra Leone. Minerals such as diamond, gold, iron, ore, platinum, copper, cobalt, zircon and manganese nodules are reported to be present offshore (ref). Apart from alluvial diamond, which is currently being explored, the deposits of other suspected mineral resources exploited from the coastal zone of Sierra Leone are shown in table 4. It is however worth noting that mineral production is entirely in the hands of foreign companies and the national programmes for development and use of these marine based minerals are not advanced. These quantities of minerals are likely to be conservative estimates as exact data are not always available. Exploration and prospecting for oil and gas in progress.

Coarse Aggregates

Alluvial gravel deposits in the coastal zone of Sierra Leone have not been assessed and no data are available regarding its exploitation in areas within and outside the zone.

Fine Aggregates

Beach sand is being extracted from beaches along the entire Sierra Leone Coast as construction material. However, data on the quantity extracted is anecdotal.

Table 6: Sierra Leone Annual Estimate of Some Mineral Resources exploited from the Coastal Zones.
The figures are indicative. (Source: Johnson and Johnson 1993)

Location	Mineral	Quantity (Metric tons)
Konakridi	Sand and gravel	80,000
Tisana	Rutile	2,300,000
Shenge	Ilmenite	1,800,000
Sulima point	Zircon	230,000
Pujehun district	Monazite	2,500

Clay

Clay soil is being extracted near beach areas and rivers. Traditionally, the clay soil is used for brick and ceramic making. The clay factory in Freetown used to produce about 130,000 bricks annually for both local consumption and export. If clay extraction is not controlled, the result will be a change in land-use to a non-vegetable open area vulnerable to erosion and a reduction in nearby water quality due to runoff.

Granite Rock

Hard rock has been mined along the banks of coastal streams as a source of construction material for the development of road networks and for export by foreign companies.

Salt

Salt production is gradually developing with a few ponds but is still at a rudimentary stage. However, there is a need to improve the national capacity to produce more and better quality salt with well-developed national programmes for development and use of the resource.

Harbour Infrastructure

Harbour infrastructure has been recognized as a possible threat to coastal and marine ecosystems through the modification of the coastal water dynamics, sediment dynamics and disruption of benthic habitats, flyways and coastal vegetation. Harbour infrastructure can interfere with community structure of benthic communities. Worst areas include the Sierra Leone harbour at the mouth of the estuary, Nitti port in the Sherbro estuary and around Pepel in the upper reaches of the Sierra Leone River (Rokel).

Urban Expansion

One of the consequences of urban expansion is the increase in sand extraction and the risk of accelerated coastal erosion. Urbanization is also associated with increase in population and the attendant problems of waste generation and disposal as well as putting pressure on the use of other coastal resources e.g. mangroves.

Table 7: Sierra Leone Annual Estimate of Some coastal Resources exploited from the Coastal Zone
(Source: Johnson and Johnson, 1991, NB: These figures are indicative

Location	Mineral	Quantity(Metric tons)
Konakridi	Coarse aggregates	80,000
Tisana	Fine aggregates	2,300,000
Shenge	Clay	1,800,000
Western area	Hard rock	230,000
Moyamba district	Salt	2,500

Tourism, Recreation and Seaside Residences

Tourism, recreation and seaside residences also contribute to the degradation of coastal ecosystems through increased effluent discharge into coastal waters and beach litter as well as to coastal population increase. These development activities may interfere with biological migration flyways and flyway stop over sites. Worst areas include the Freetown peninsula tourist area.

Transportation,

The Freetown harbour is the best natural harbour along the West African coast. International commercial vessel traffic to and from Sierra Leone has however been low over the past years since the rebel war started in 1991.

Fishing

The most common methods of fishing involve the use of cast and ring-nets, and hook and line. Since the common method of catch preservation is drying, fuel wood is widely used, the main source of which is the mangroves. Different kinds of fish drying kilns are used but the traditional 'bandas' are the most popular. Fish landing sites are often polluted with huge piles of rubbish as inhabitants of the fishing communities often try to reclaim land from the sea. Worst areas include all fishing villages along the coast.

Trade

Traders and other business class of people travel by sea to neighbouring countries (Guinea and Liberia) mainly by medium size boats, ferries and catamarans. This limits the amount of goods they transport. It is also an important means of transporting goods to and from Freetown to landing sites in the north and south of the country. Two other ports, port Sam and Nitty mainly serve the mining industry.

Mining

The extraction of a limited variety of minerals from the coastal area of Sierra Leone particularly zircon, coltan, illmenite, hard rock and sand aggregates have led to an increase in the sediment load of the shoreline water column. Worst areas include the northern and southern coastal districts.

Sea Temperature

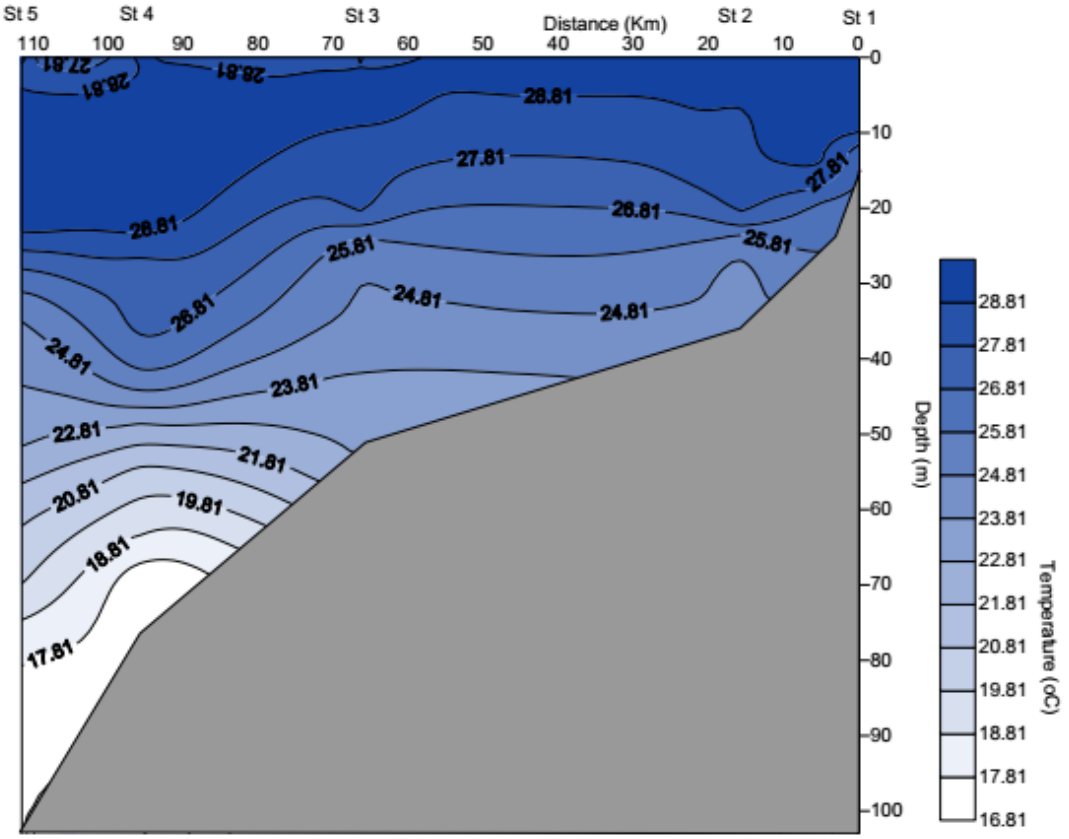

*Figure 6: Section map of **surface** temper**ature** in Nov 2008*

(Source; Lamin2012)

The average temperature of the sea surface (waters) off the Sierra Leonean coast is generally greater than 26^{o}C (Fig. 5). Mean annual cycle of sea surface temperature off Sierra Leone (7^{o}N to 9^{o}N and 11^{o}W to 14^{o}W), derived from COADS 195^{o} to 1990 show that between February and May, sea surface temperatures range from 27^{o}C and 28.5^{o}C between May and August temperatures drop from 28.5^{o}C to around 26.8^{o}C and between August and November the temperatures again rose from 26.8^{o}C to 27.0^{o}C and the average water temperature in December is around 28.5^{o}C and around 27.8^{o}C in January. The peaks in May and December are associated with seasonal cycles and closely related to the solar heights.

Mean temperature profiles up to 500m depth in the area of the continental shelf show the development of a sharp thermocline below the warm surface waters. The gradient of temperature here sometimes exceeds 3^{o}C/10m. Below the thermocline temperatures continue to fall gradually with depth.

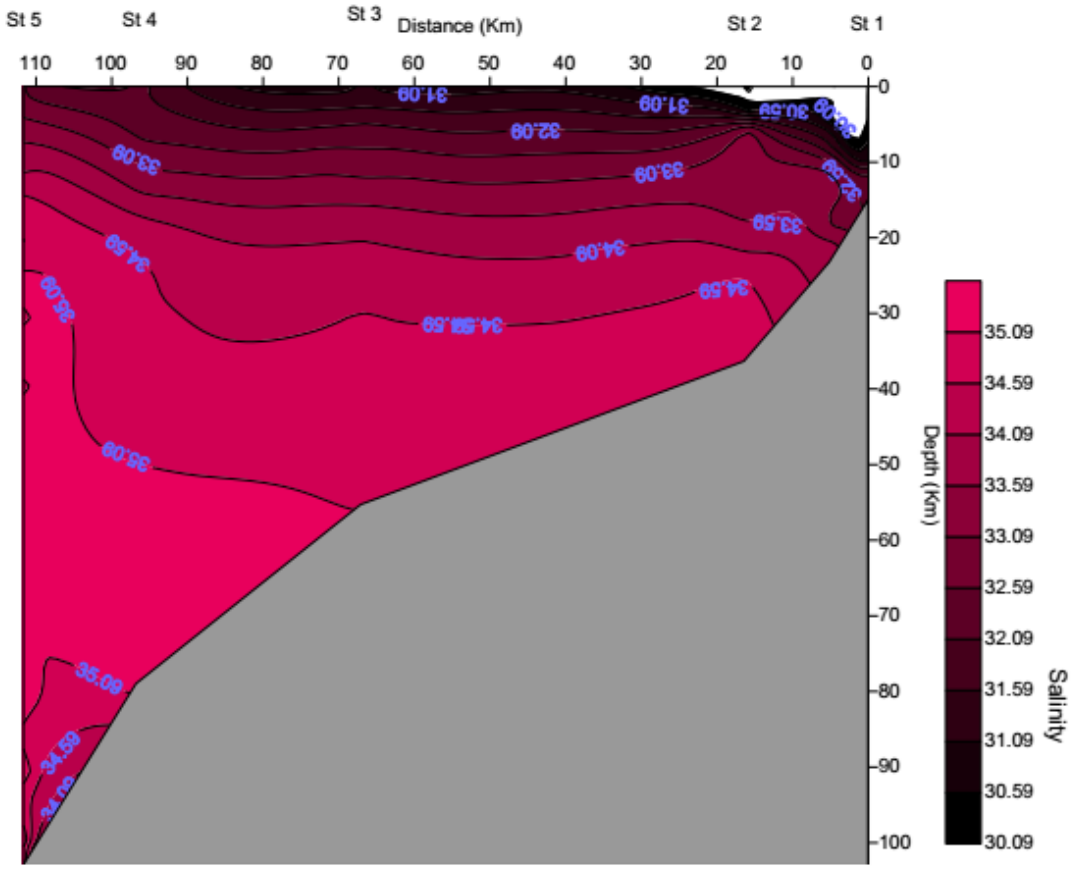

Figure 7: Section map showing surface salinity in Nov 2008

(Source: Lamin, 2012)

Salinity

The average salinity of the sea surface waters off the Sierra Leonean coast is generally less than 35.5ppt. The salinity is influenced by fresh water run-off from land and rainfall especially during the rainy season. Mean salinity profiles in the shallow areas close to the coast are characterized by low salinities at the surface, which result from the inflow of fresh water. The limits of the salinity homogeneous layer correspond to the upper limits of the thermocline showing that the salinity and thermal structures are similar in the surface layer. Below the surface a sub-surface salinity maximum of 35.7ppt exists between 60 – 70m depth. Below the maximum, salinity gradually decreases to a minimum around 500m depth.

Ocean Currents

Currents are dynamic features of coastal waters of Sierra Leone and affect the coastal zone in a number of ways. The general water circulation along the Atlantic coast of Sierra Leone is shown in Figure 6. The surface currents are significantly influenced by the Southeast and Northeast trade winds. During the spring in the Northern Hemisphere when the Southeast Trades noticeably weakens, the Northeast trades are fully developed. During this period the Canary current intensifies bringing cool water to the coast of Sierra Leone. This current generally flows in a south-easterly direction at the surface in the near-shelf regions.

The Canary current is mainly southward from August to April. When this current approaches the equator, it turns westward as the North equatorial current. The monsoon period generally lasts from July to August; during the Northern Hemisphere summer. During this period, the equatorial counter current is strongly developed and is the source of much water joining the Guinea current. In the winter months (December to February) however, the equatorial counter current ceases to be of importance and the canary current is the main source of water joining the Guinea current. In the autumn the southeast trades strengthens reaching maximum strength in August. During the May – July period, the canary current slows down temporarily northwards carrying low salinity Liberian surface waters to the north as far as Senegal (Berrit, 1969).

Seasonal Upwelling and Productivity

The Sierra Leone coastal zone lies at the southernmost extension of the up welling system which occurs along the entire northwest African coast in the Dakar – Freetown region. In Sierra Leone, the continental shelf is isolated from the seasonal coastal upwelling areas of North-West Africa and central Gulf of Guinea by a complex of shoals (submerged sand banks) that comprises the Bissagos Archipelago, off Guinea-Bissau in the North and the shoals of Saint Ann to the South. The area of the continental shelf up to a depth of 200 m is about 27 500 km^2.

The western tip of Sherbro Island delimits two contrasting coastal waters. The narrow southern shelf has limited fish resources and is influenced by the eastward flowing Guinea current. The northern Sierra Leonean coast on the other hand constitutes the productive shelf of Sierra Leone. Therefore, most of the artisanal fishing activities in Sierra Leone occur in the North. Here, there are three major estuaries: the Scarcies River, the Sierra Leone River and the Sherbro River, as well as the Yawri Bay. The continental shelf has good yield potential for demersal and pelagic fish as well as shrimps.

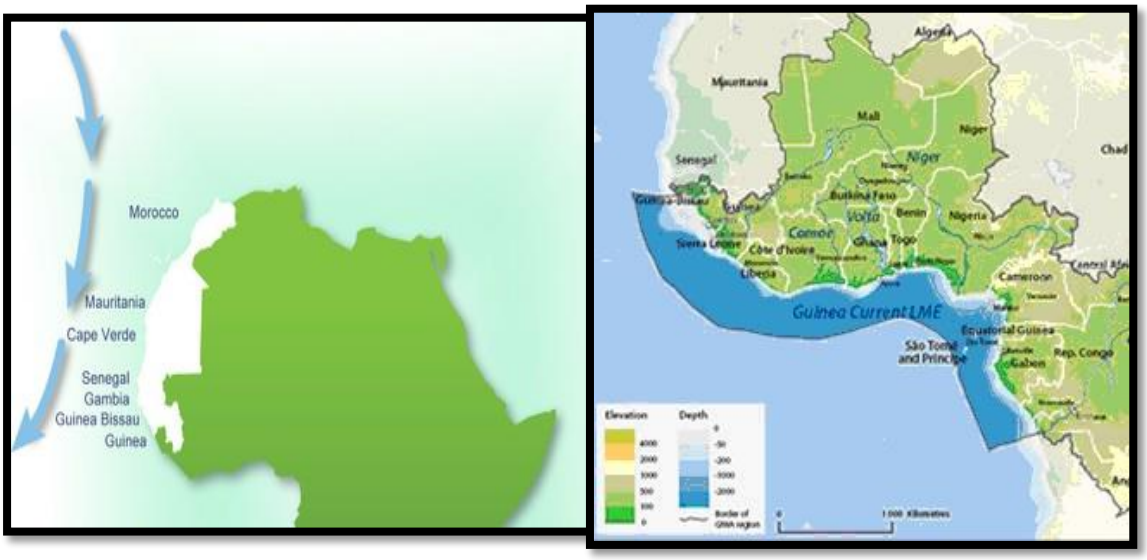

Figure 8: The GCLME. (Source: UNIDO and CCLME Project website)

According to Coutin (1998), a strong upwelling occurs each year along the coast of North-west African between December and April and especially between October and February for the Dakar – Freetown region during the Harmattan. These harmattan winds cause aerobic upwelling along the entire northwest African coast.

Longhurst (1968) indicated that the continental shelf waters of Sierra Leone are influenced by the Cape Verde divergence to the north and the convergence at the northern margin of the Equatorial Counter Current (ECC) further south of the equator. Upwelling is characteristic of the former whilst down welling is a feature of the latter.

Analysis of limited hydrographic data suggests that upwelling off the Sierra Leone coast is characterised by a shallower thermocline and nutrient enrichment below the surface at 20m depth (Johnson & Johnson, 1996).

Productivity and upwelling are inextricably interwoven. The Guinea Current Large Marine Ecosystem (GCLME), which stretches from the coast of Guinea Bissau to Angola, embodies some of the major coastal upwelling sub-ecosystems of the world and is an important center of marine biodiversity (with an estimated 239 fish species) and marine food production. It is ranked among the most productive coastal and offshore waters in the world with rich fishery resources, oil and gas reserves, precious minerals, a high potential for tourism and serves as an important reservoir of marine biological diversity of global significance.

The Canary Current Large Marine Ecosystem (CCLME) is one of the world's major cold water upwelling boundary current Large Marine Ecosystem. It ranks third in the world in terms of primary productivity and has one of the highest fisheries production of any African large marine ecosystem with an annual production ranging from 2-3 million tons.

The marine fish stocks in these waters constitute a significant natural asset for the countries of West Africa, which is transboundary in nature; more than 1.6 million tons of fish are legally captured in West African waters each year, with an estimated wholesale value of US$2.5 billion, contributing significantly to regional and national economies.

The densely populated coastal region of West Africa is heavily dependent upon the biological resources of these LMEs for their food security and wellbeing. In 2011, the sector provided direct and indirect employment to over 3.2 million people. Rivers, lagoons, and inshore and offshore waters serve as important sources of animal protein in the form of fish and shellfish.

Table 8: Fisheries sector in West Africa – statistics

(Sources: FAO Yearbook of Fishery and Aquaculture Statistics Summary tables (2011-2012), World Bank Mauritania ESW (2008), World Bank Senegal ESW (2005), FAO Governance Study (2009), MRAG Estimation of the Cost of Illegal Fishing in West Africa (2009).

Country	Annual Reported Fish Catch (tons)[1]	Contribution to GDP (%)	Employment (direct & indirect)	Contribution to Protein Supply (%)[2]
Cabo Verde	20,189	4.0	18,000	10.2
Gambia	36,062	4.0	6,000	46.2
Ghana	364,949	4.5	2,200,000	51.9
Guinea	132,233	6.0	112,000	32.5
Guinea-Bissau	6,550	7 - 10	15,000	3.6
Liberia	9,500	3.2	33,000	14.9
Mauritania	437,709	6.0	39,000	9.3
Senegal	460,871	4.9	600,000	42.5
Sierra Leone	204,000	9.4	230,000	67.8
TOTAL	**1,672,063**		**3,253,000**	

[1] 2012 data. Capture of Fish, crustaceans, molluscs, etc. (exclusive of aquaculture).
[2] 2011 data.

Tides and Tidal Currents

The astronomical tide manifest itself as a periodical rising and falling of the sea level which results from the attracting forces of the celestial bodies, mainly those exercised by the sun and moon on the adjacent water masses.

Off the Sierra Leone coast, the tide is mainly semi-diurnal, with two daily maximums and minimums, the mean height of the tide or mean tidal range is between 18m to 2.6m. The tidal currents are generally of moderate velocities of between 0.1m/s to 0.2m/s. At the northern mouth of the estuary, a sand bar of considerable magnitude obstructs the flow of water from and into the estuary and consequently the velocity of the tidal stream is very great. In the dry season, during spring tides, the flood stream runs from 1 to 1.5 knots lasting for about 5 hours, and the stream on the ebb tide varies from 2 to 2.5 knots for about 7 hours. In the wet season, however, when the tidal prism is augmented by the flood discharge from the river, the ebb stream attains velocities in the region of 5 knots. The tide brings in fair quantities of silt from the upper reaches of the estuary.

The highest astronomical tide of maximum tidal range goes up to 3.38 metres above the Lowest Astronomical tide or the admiralty chart datum. Mean High Water Neaps (MHWN) are 3.0 metres above Chart Datum whereas Mean Low Water Neaps (MLWN) are 1.0 metre above Chart Datum.

Waves and Swells

Almost a perennial swell of moderate height, coming in from the Atlantic disturb ships at their moorings within the estuary. This phenomenon is particularly evident during the wet season when both frequency and amplitude are greatest. The maximum amplitude is in the region of 1.0 metre. Wind generated waves, usually not higher than 1.0 metre, only occur for brief spells usually just before the change of seasons around May and October.

Sediment Transport Processes

Longshore drift current is the main mechanism by which sediments are transported along the Sierra Leone coast. The sediment transport takes place mainly within the 1-10m water depth. Three main longshore drift current directions can be recognised along the Sierra Leone coastline. These currents flow in a north-eastern direction causing erosion of the northern coastline around Yelliboya Island and Konakridee. Similar south easterly flowing currents in the south carry sediments from the Freetown Peninsular beaches and along the entire southern coastline of Sierra Leone.

Tidal currents also influence the sediment transport dynamics particularly those of very fine sand and mud mainly at the entrances of bays and estuaries.

Longshore Currents

Along the Sierra Leone coast, longshore currents accompany large swell waves breaking obliquely to the coastline. These currents flow in a northeast direction along the northern shores causing a fairly serious erosion of the northern parts of the coastline around Yelibuya Island and Konakridee. In the south, similar south-easterly flowing currents carry sediments from the coastal beaches of the Freetown Peninsular and all along the southern part of the Sierra Leone coastline to the Liberian border enhancing beach erosion.

The waves, which generate these currents, are themselves generated by wind force of 3-4 beaufort, which are strongest during the harmattan (Northeast trades) months of December and February and August to October during the monsoon winds from mainly the Southwest. Longshore current velocities along the Freetown Peninsular can range from 0.20m/sec to 1.5m/sec.

Rip Currents

These are localised out flowing currents through occasional depressions or 'lows' in offshore bars resulting from the outflow of water that would otherwise accumulate inside the zone of breakers after wave breaking. Rip currents may sometimes appear as long lanes of foamy or turbid water stretching out to sea. They weaken and gradually die out further out to sea. These currents have not been studied along the coast of Sierra Leone.

Storm Surges

Storm surges manifest themselves in periodic often seasonal flooding events of low lying coastal areas along the Sierra Leonean coastline. However, reports of such events are lacking. These flooding events occur mostly during the months of June to September and are usually associated with the development of low pressure systems far out in the south Atlantic which result in high winds and the generation of large swells at sea.

The northern areas of Sierra Leone along parts of the Kambia district as well as close to the southern border with Liberia are frequently affected.

The Freetown peninsula coastline has also suffered from these storms although to a lesser extent. These events are particularly severe when reinforced by high and spring tides.

Developmental Activities (construction, manufacturing)

Construction of housing units, industry, roads, health centres, security posts, schools etc. is on the increase in the coastal area of Sierra Leone particularly in the Freetown area due to government's attempt to implement the Freetown Infrastructure Plan. As a result a number of quarrying industries located close to the coast have emerged as well as settlements.

The character of the coastlands (fairly high population and recent economic growth) has encouraged road development along the coast, and at the same time permitting considerable transportation by coastal and inland waterways. Such coastal areas as are served by road and linked eastward, along watersheds, to an incomplete transverse axis of roads extending some 30 miles inland from north of Kambia via Ribi Ferry, Moyamba, Mattru and Pujehun to Zimmi.
On the Freetown Peninsular the Peninsular villages on the Atlantic coast are linked by carriageway running close to the beach in most areas.

The manufacturing sector in Sierra Leone is small and accounts for about 6-7% of the Gross Domestic Product (GDP) in the country. These industries of mainly small-scale import substitution manufacturing ones are located on or near the coast.

They include, food, cement, paint, nails, detergents, pulp, mineral water, beer, matches etc. Solid and liquid wastes derived from production activities are usually disposed off close to source.

Table 9: Significance of factors affecting the coastal environment of Sierra Leone

Issue	Significance	Remarks
Manufacturing Industries	Moderately high	< WHO standards
Recreation and Tourism	High	GCLME reports & studies
Fishing Industry	High	NBSAP reports & studies
Development of Urban settlements	Moderately high	Fisheries reports & studies
Harbour infrastructure	High	
Transport		
Road infrastructure		
Climate change vulnerability	High	IPCC 5th Assessment report.
Agriculture		
Oil and gas exploration		

Population Pressure

The poor in urban areas tend to be concentrated in congested areas or marginal landscapes such as steep hill slopes or depressed river valleys. They lack access to vital services such as water and sanitation, road network, electricity, educational and health facilities as well as municipal waste collection services. These communities have to literally coexist with their own excrement. The urban poor often have to use local streams for the multiple purposes of washing, bathing, and refuse and faecal waste disposal.

The Water Quality is important at the national level in sustaining the marine living resources. The quality of the continental shelf waters of Sierra Leone is satisfactory. The adjacent coastal water bodies receive most of the effluents from the nearby settlements located in Freetown. Pesticides from agricultural run-offs may also enter the estuary as well as silt from river mining activities and the indiscriminate clearing of the mangroves.

Forest resources in the coastal zone are exploited for a variety of uses. Prominent amongst these is the fuel wood trade in mangrove forest wood as well as poles for building and other purposes. Coastal forests are exploited for boat building and handicraft. Oyster harvesting from mangroves and other hard sub-strata is another activity of coastal dwellers: Oysters are harvested for both commercial and subsistence purposes.

The coastal swamps where basically the mangroves are found, consists of alternating banks of silt, sand, gravel and clay. Silt is predominant in the northwest. In the south, large areas of coarse sand are alternately waterlogged or very dry.

The soils in the Scarcies estuary area are characterized by partly compacted, cohesive silts and clays. The clays have a good salt-fixing capacity and therefore provide an ideal base for the development of potentially acid sulphate soils and also because of the marine influence. Generally acid sulphate palacosols tend to occur in the contact zone between the tidal flats and pre-holocene non-estuarine deposits usually colonised by fresh water grasses and herbs.Peri-urban agricultural practices are common in Sierra Leone and are a usual feature of the coastal area. Swamp rice is one of the main crops cultivated in the coastal area. In some areas notably in the Kambia district, rice has been cultivated in areas previously occupied by mangroves.

Other resources exploited from the coastal area include coarse aggregates, fine aggregates, clay, hard rock and salt. Alluvial gravel deposits in the coastal zone of Sierra Leone have not been assessed and no data are available regarding its exploitation in areas within and outside the zone. Beach sand is being extracted from beaches along the entire Sierra Leone Coast as construction material. However, data on the quantity extracted is anecdotal. Clay soil is being extracted near beach areas and rivers. Traditionally, the clay soil is used for brick and ceramic making. The clay factory in Freetown used to produce about 130,000 bricks annually for both local consumption and export. If clay extraction is not controlled, the result will be a change in land-use to a non-vegetable open area vulnerable to erosion and a reduction in nearby water quality due to runoff.

Granite rock has been mined along the banks of coastal streams as a source of construction concrete material for the development of road networks and for export by foreign companies. Salt production is gradually developing with a few ponds but is still at a rudimentary stage. However, there is a need to improve the national capacity to produce more and better quality salt with well-developed national programmes for development and use of the resource.

Marine and Coastal space is utilized for transportation, fishing, trade, mining, recreation etc. Both marine and river transportation facilities have to be improved with regards to port facilities safety standards and quality of service mainly for local coastal and inland water transport. Proper pollution control measures should also be put in place.

Table 10: Status/Level of degradation of coastal ecosystems of Sierra Leone.

Location	Mangroves	Rocky shores	Sandy shores	Water quality	Aquatic Organisms
Kambia	severe	Less severe	severe	Moderate	**moderate**
Port Loko	severe	Less severe	Less severe	Severe	**severe**
Western Area	severe	Less severe	severe	Moderate	**severe**
Moyamba	severe	Less severe	severe	Moderate	**Less severe**
Pujehun	severe	Less severe	Less severe	Severe	**severe**
Bonthe Sherbro	**severe**	**Less severe**	**Less severe**	**Severe**	**severe**

Climate change

The IPCC in their Fourth Assessment Report, Working Group 1, tells us that "climate is often defined as 'average weather'. Climate is usually described in terms of the mean and variability of temperature, precipitation and wind over a period of time, ranging from months to millions of years (the classical period is 30 years)" (Chapter 1, page 96). The unimpeded growth of greenhouse gas emissions is raising average temperatures. The consequences include changes in precipitation patterns, more and more extreme weather events, and shifting seasons. The accelerating rate of sea level rise as a result of climate change, combined with global population and income growth, threatens coastal area integrity everywhere in Sierra Leone.

Risks to the marine environment

Some projections regarding the outlook/risks for the Sierra Leone's coastal and marine environment based on observed trends are important as they may serve to further enhance general awareness and understanding of current and emerging issues, and perhaps act as wake-up call for appropriate governance, or enable adequate planning and strategy.

The specific outlook/risk issues considered here relate to coastal and marine ecosystem conservation strategies, water quality, natural resources (especially fisheries and mangroves), coastal development, coastal erosion, marine litter, invasive alien species, petroleum and mineral resources, natural hazards, climate change, environment-related conventions and protocols including those of the Abidjan Convention.

Section 3: Coastal and Marine Ecosystem Conservation and Management Strategies

Introduction

The general outlook for the coastal and marine environment of Sierra Leone could be said to have improved over the last six years. This is due to considerable awareness and positive national and regional actions which have resulted in conscientious environmental stewardship and its sustainability nationally and within the region. This has been borne out of increased political will and commitment by successive governments to mainstream environmental considerations into every aspect of governance at the local/provincial, national and regional levels.

Common national environmental issues, such as declining fish stocks, land-based and sea-borne pollution, coastal erosion, physical alteration and degradation of habitats, etc pose critical challenges both nationally and regionally and efforts to address specific transboundary issues are achieving the desired results through regional and international agreements and conventions developed and facilitated through bilateral and multi-lateral International and intergovernmental institutions. The United Nations agencies (FAO, UNEP, UNDP, UNIDO, UNESCO/IOC etc) have been particularly active in facilitating and supporting such initiatives within the region.

Water quality

Recent monitoring of coastal waters of Sierra Leone suggests that coastal water quality will continue to deteriorate unless actions to reverse the degradation are implemented and enforced. Land-based sources and activities are on the increase affecting near shore waters, estuaries, lagoons, creeks, etc and invariably the adjacent seas. With increasing population and drift to coastal areas, coastal water degradation will persist for the foreseeable future.

Fisheries

The major fish resources in the area are round sardinella, skipjack tuna, Bigeye grunt, and Bonga shad. The countries have several shared fish stocks and identified a need for cooperation and shared management of these resources.

In general, capture production decreased by more than 10 percent after 2000 in both the Western and Eastern Central areas of the Atlantic Ocean, The preliminary results of the assessments of the FAO CECAF Working Group on the Assessment of Small Pelagic Fish (WGASPS) Sub-Group South indicate the overexploitation of *S. aurita* (northern and western stocks) and *S. maderensis* (northern stock); *S. maderensis* (western stock). The *Ethmalosa fimbriata* (southern stock) is underexploited while *Trachurus trecae* (southern stock) is fully exploited.

Mangroves

A wide range of commercial and non-commercial fish and shellfish also depends on these coastal mangrove forests. The role of mangroves in the marine food chain is crucial. The average yield of fish and shellfish in mangrove areas is about 90 kg per hectare, with maximum yield of up to 225 kg per hectare (FAO, 1994).

Recent monitoring of mangroves of Sierra Leone suggests they will continue to decline unless actions to reverse their degradation are implemented and enforced. Deforestation activities are on the increase due to urban expansion, coastal agriculture (mainly rice production), poles for construction, salt production and fish drying/smoking. With increasing population and drift to coastal areas, mangrove degradation is likely to persist for the foreseeable future. However, a regional mangrove charter has been adopted by Sierra Leone which if implemented together with other conservation measures; the trend will be significantly reversed.

Coastal development

The pace of coastal development is dictated by economic growth in the country. Of importance is recent development of export processing zones and ancillary handling facilities such as ports and harbours, jetties, oil terminals, ship repair yards etc for industrial parks within the zone. There is concern for deforestation of mangroves, dredging for approach/access channels and for coastal sand for reclamation of sometimes vast areas. The main coastal degradation problems arising from uncontrolled coastal development are coastal erosion, flooding, storm surges and in a few cases landslides in the region. These issues are likely to be of greater importance with rapid development in the coastal areas.

Coastal erosion

Coastal erosion is the most prevalent coastal hazard in the GCLME. It has received some attention through research and engineering options in the last three decades. Natural coastal dynamics such as long shore currents, high wave energy, the nature of sediments and low coastal topography are responsible in some locations. Anthropogenic activities such as construction of harbour protecting structures (e.g. moles), jetties, beach sand mining, construction of dams upstream depriving the beach of sediment nourishment, and deforestation are causes of high rates of erosion. Human activities aggravate the erosion problem on most coastlines when coastal development is undertaken without due cognizance to near shore ocean dynamics and shoreline evolution.

Periodic monitoring of the coastline of Sierra Leone suggests that it has been subjected to periodic erosion which is severe at some locations due to both natural and man-made causes. Coastal erosion will continue to be aggravated unless actions to reverse the trend are implemented and enforced. Sand extractions from beaches are on the increase due to urban expansion. With increasing population and drift to coastal areas coastline erosion is likely to persist for the foreseeable future.

Coastal erosion has been and is still posing a serious problem for coastal managers in Sierra Leone. This phenomenon which is very evident along the Sierra Leone coastline has attained rates of some 4-6 metres per year at some locations. E.g. Konakridee, Lumley, Lakka, Hamilton, Plantain Island, etc.

Coastal Erosion in Lakka, Shenge and Hamilton

Marine debris

The results of field observations and qualitative assessments have so far clearly indicate that the Sierra Leonean beaches will be constantly polluted by debris items, so long as coastal population increases daily, and fishing, tourism, leisure and vessel transit activities continue. The outlook of the country‘s marine litter issue over the coming decade is is expected to be an increase as a result of ongoing urban and coastal industrial development, gradual increases in shipping activity and exponential growth in oil prospecting and production nationally as well as within the region. This prediction is based entirely on examination of related trends and relationships predicated on the sources, causes, quantities and distribution of marine litter at the national and regional levels.

The implementation of MARPOL 73/78 is ongoing in some of the countries in the region with regard to the provision of adequate waste reception and processing for ship garbage and port waste reception facilities in major ports. When fully implemented this would contribute to reducing the threat of marine debris at both the local, national and global levels.

Solid wastes generated on land washed to the coastal areas to become marine debris at Susan’s Bay in Freetown

Fortunately, the number of species documented to date are few, about 4-5 in the region. However, the problem of coastal and marine invasive species is likely to worsen over the coming decade due to increases in shipping activities throughout the region. Ships traffic is projected to continue growing in the coming decade with economic growth and therefore the outlook for transfer of alien organisms through ship‘s ballast water is expected to grow.

Active participation by Sierra Leone in programmes such as the Globallast Programme through the GCLME Project and the implementation of the newly adopted IMO Ballast Water Convention, including the involvement of her private sector with partners from major maritime companies, should reduce the regional exposure to the global threat of invasive species.

Petroleum and other mineral resources

The outlook for the oil and gas sector over the coming decade is very likely to involve significant increases in exploration and exploitation of proven reserves by current producers and prospecting by emerging energy endowed countries in the region such as Sierra Leone which has untapped reserves which could contribute to the general economic development of the country in the nearest future. Sierra Leone could become a major oil producer in the future. It is evident that a wide variety of policy tools and strategies will be needed in order to protect the marine environment from unacceptable pollution levels derived from oil and gas exploration and production activities.

Projected impact of climate change

Climate change is widely accepted as a real threat and developing countries are already being affected. For the region, climate change is a development issue. Climate risks are highest in poor countries and the poorest countries and communities stand to suffer the earliest and the most. Climate change threatens the development gains and achievement of the Millennium Development Goals (MDGs). African countries are highly vulnerable to climate change which is expected to affect all key sectors such as agriculture, water, health, disaster risk reduction, coastal zones, and ecosystem management.

Key impacts would include drought, dust and sand storms, water resources (water stress), agriculture/food security (reduction in soil fertility, livestock productivity and increased incidence of pest attacks), and coastal zone (flooding and extreme weather events). UNDP (2009b) reported that the African continent is vulnerable to climate change because of its large population living along the coast, 25 per cent within 100 km of the coast and in low lying areas. With a heavy reliance on rain-fed agriculture, and high dependence on natural resources and poor access to modern and sustainable energy services, the continent is particularly vulnerable.

The risks of catastrophic events will increase with temperature. Perhaps, these are sufficient assessment of projected environmental impacts for formulating actions for mitigation and adaptation.

Section 4: Approaches and Methodology

Introduction

The approach taken by the consultants for the development of Sierra Leone's ICZM Plan involved four key steps:

- Desktop review,
- Stakeholder engagement,
- Data acquisition (through fieldwork),
- Ecosystem-based coastal and marine spatial planning using the coastal sensitivity maps

Desktop Review

A comprehensive review of existing and relevant sector plans, Policies and legislative documents was undertaken. In particular the National Action Plan for the conservation of biodiversity were reviewed. In addition the Coastal Sensitivity Maps prepared for the management of coastal oil spill hazards were used to identify Socio-economic activities and bio diversity hot spots along the coastline.

Stakeholder Engagement

In every step of the process, stakeholder participation has been critical, especially for the data acquisition, ecosystem assessments and marine spatial planning processes. Stakeholder consultations were held countrywide at strategic locations during the planning phase. These consultations included community level group meetings, and interviews (face to face) with local experts in coastal zone management. These consultations were crucial for identifying existing conflicts of interest with respect to resources use. At the national level, 3 consultative workshops were organized from which a National coastal Zone Management Planning Committee was formed. This committee has actively participated in the entire planning process.

First meeting with representatives of stakeholder institutions in Sierra Leone

Data Acquisition from fieldwork

Field research was undertaken to acquire primary information on issues affecting the sustainability of coastal marine resources exploitation, use and management, in addition to data layers captured in the coastal sensitivity maps, which identified biological, infrastructural, geopolitical, and socioeconomic data related to the coastal and marine area of Sierra Leone. Every effort was made to acquire the best available data and validating them with local experts and communities along the coastline. Due to limitation of time and resources, rapid qualitative research methodology ws used to quickly capture relevant date required for the planning process as follows:

Participatory Rural Appraisals (PRAs) and Rapid Rural Appraisals (RRAs)

Participatory Rural Appraisal (PRA) is a group of methods used to collect information from rural communities in a participatory fashion (Chambers, 1992). It is an intensive, systematic semi-structured learning exercise carried out in samples of coastal communities and has a range of applications in participatory/co management of natural resources.

PRA methods were adopted in the study because the plans we have developed from this study would be implemented through a participatory/co-management process. The advantage in using the methods is that it allows a wider participation of the local people. PRA allows local people to present their priorities for development and get them incorporated into development plans (Townsley 1996). Where fishing is identified as a priority activity during the course of the PRA, planners can be more certain that this respond to real need among local people in their strive for increased incomes and regular/ reliable fish supply. Participatory Rural Appraisals (PRAs) tools used in the study included:

- Transect walks,
- Interviews with natural groups,
- Focus Group Discussions (FGD),
- Seasonal calendars,
- Key Informant interviews,
- Group brainstorming,
- Ranking exercises and
- Strength, weaknesses, opportunities and threats (SWOT) analysis.

Transect walks

Transect walks are a highly participatory and relaxed technique that enhance local knowledge and was considered appropriate in low-literacy coastal communities in Sierra Leone. Transect walks are observational walks, during which attention is specifically paid to people, activities, resources, environmental features, etc. The team walked along the beaches to verify the information provided on maps, both through direct observation and discussions with people met along the way.

There were two broad categories of transect walks:

Social transects- focused on housing types, infrastructure and amenities (e.g. private residential homes, hotels, restaurants and jetties), historic, religious and cultural features and behaviours (e.g. slave pens, churches, mosques), economic activities (fishing, leisure boating, and maritime and inland water transport), skills and occupations.

Land-use transects- focus on environmental and agricultural features (freshwater discharge into the sea, cultivated land, mangrove forests, soil and crops, slopes and elevations, etc.). The transect walks in this study recorded both social and land-use information, using a digital cameras and field notebooks. Before setting out for the walks, PRA team members were given basic training and a decision made as to what issues to focus on and what information needed to be collected and why. During the walks, digital photos and notes on relevant features observed were taken/recorded. Problems and opportunities were discussed with local people and clarification sought. After the walks on each day, notes taken during the walks were discussed.

Talking with natural groups

Natural groups interviews were casual conversations with groups of people met during Transect walks and other forms of participant observation sessions. Typical natural groups were youth groups, Sand mining labour groups that load the sand into trucks, fishermen who had just landed their fish at the beach and fish processors waiting at the beach for the fishermen to land their catch.

Natural group interviews were used to get verbal comments about the situation in which the groups or individuals were engaged. The interviews helped the PRA team discovered problems and expectations related to the situation as perceived by local people, as well as common interests and relationships in villages. Gender specialization of household duties and occupation was also clearly recorded, example sand miners were all males, fish processors were all women/girls and fishermen were all men, although some women owned fishing boats or sand trucks but men are employed in loading and transporting the sand to construction sites. The interviews were guided by a list of questions in order to keep them focused. If further clarifications were required, follow-on questions not in the list were asked.

Focus group discussions (FGD)

Focus groups are semi-structured discussions with a small group of persons sharing common features e.g. fishermen, sand miners, fish processors etc. Participants of focus group discussions were people who were knowledgeable and interested in the topics discussed. Six focus groups discussions with 4 to 10 participants were held in sampled coastal areas visited (Western Area Peninsular coastline, Konakridee - Bailor, Yeliboya, Rokupr, Sierra Rutile and Bonthe. Each discussion lasted for approximately one hour. Group members were asked to identify livelihoods activities undertaken in their areas and to rank those activities. They were also required to outline the seasonality of the different activities identified. Focus group discussions also included coastal land and water resources access and tenure, livelihoods options and gender roles in the different livelihoods activities.

Men and women groups were held separately and then mixed, because women spoke more freely when their men folks were not around and tended to keep quiet in the presence of the men.

Seasonal calendars

Understanding seasonal changes is crucial to determining where and when certain coastal resources are best exploited and how resources exploitation and use activities might fit into the livelihood strategies of coastal communities/households, how it might be combined with other elements in those strategies and whether it is the best option. In this exercise, the seasonality of farming, fishing, and other livelihood activities, variation in catches throughout the year and the types of fishing method and gear used were discussed (focus groups and brainstorming sessions). The ways in which different seasonal activities are woven together to form livelihoods through the year were also discussed. The main aim of this exercise was to work out how multiple resources uses in a single area of the coastal zone can be managed without conflicts.

Key issues analysed in seasonal calendars included livelihood activities in different seasons, gender roles in the different livelihoods, flooding, coastal erosion, drinking water shortage and spread of waterborne diseases, waste management and other household problems affecting coastal/island communities were also analysed.

Key Informant interviews

These were semi-structured interviews using lists of broad, open-ended questions. Individuals interviewed were identified by other community members as being knowledgeable in various aspects of the research e.g. local knowledge on waves and tidal regimes, which could either be constructive waves (leading to sand accretion on the coast) or destructive waves (leading to sand erosion and associated damages to coastal infrastructure), involvement in development projects at the local level, land owners and community leaders, village headmen, chief and youth leaders.

The interviews were conducted in a conversational, relaxed and informal way. The interviewees were people identified in their communities to be very knowledgeable on exploitation, uses and local management of natural resources, and traditional methods of fishing/farming. This form of interview is said to be much more likely to yield in-depth opinions and perceptions than a closed-ended questionnaire interviews (Barton, 1997 972).

Interview guidance notes were prepared and the community elders, chiefs, headmen, youth leaders and women group leaders asked to identify individuals they think were knowledgeable on the relevant issues in their communities. The names of identified individuals were pooled and the most popular individuals were selected as key informants for semi-structured detailed interviews. Once the list of key informants in a given community was finalised, members of the RRA team were assigned each to a key informant. Using the guidance notes, the key informants were interviewed and at the end of the exercise, the responses were pooled together and analysed.

Group brainstorming

Brainstorming is a basic idea-gathering technique employed in many group exercises. It is based on a free-wheeling discussion started by an open-ended and somehow provocative question forwarded by the facilitator (Furnham & Yazdanpanahi, 1995). This RRA tool was occasionally employed in the study, especially in Sierra Rutile and Bailor.

RRA Team visited the company canteen/bar in the evening and bought some cold drinks. Whilst drinking, privilege conversations on topics like the effect of the Ebola on the production levels of the company and cooperate Social responsibilities of the company. These conversations had yielded very useful information on the problems caused by the mining companies on the livelihoods of local people, conflicts in use of the river channel used by the companies to ship the ore and the local fishermen whose fishing gears were often destroyed and the fatal accident that had occurred two years ago when a ship carrying the rutile ore ran into a fishing boat that had two fishermen and killed both of them instantly.

Other discussions were triggered by commenting on the conditions of access roads and bridges to these communities e.g. questions like why are access roads to the villages in such a bad state. Brainstorming sessions conducted in this study were very informal and most times the discussions were recorded on notebooks by all members of the RRA/PRA team. In some cases, use of local facilitator was helpful in building the confidence of the participant not to suspect any detective work. In other cases brainstorming was more focused, e.g. discussion about water quality in the drinking wells, environmental damages caused by mining companies.

Ranking exercises

Ranking exercises were done with groups (as in focus group discussions) and individuals as in key informant interviews. The ranking of livelihood activities were done with groups and individuals. The ranking exercises enabled people to express their preferences and priorities about which livelihoods activities were most dominant in their areas and why. They were able to rank livelihood activities both individually with reasons, and as groups with consensus reasons.

Ranking exercises can help planners to understand how people decide about resources use and look at the priorities of different groups of people in the coastal communities. For the livelihood activities, group members started by listing all their livelihoods activities. These activities were then written on pieces of papers or black board. The community members then split up into smaller groups and ranked the listed activities with reasons. They returned to the main gathering with their ranking by writing on the piece of papers 1,2,3,4,5,6,7,8 etc. against each of the listed activities with “1” being the most important and the least important assigned the biggest number. Where the activities were too many, a pair-wise comparison of items in the list ('Is A better than B?') was used and scores assigned to items on the list on a black board or pieces of papers.

Strength, Weaknesses Opportunities and Threats (SWOTs) analysis in stakeholder consultative workshops

SWOT analysis is a method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or development undertaking. It involves specifying the objective of the project and identifying the internal and external environmental factors that are expected to help or hinder the achievement of that objective (Suh & Emtage, 2005).

SWOT analysis involved gathering/collecting information from Coastal communities (local farmers and fishers), stakeholder MDAs and non-governmental agencies (INGOs LNGOs) on all strengths and weaknesses that existed at the time of the coastal zone management planning. This was achieved through the last stakeholder consultative workshop with active participation of all stakeholders. As in the separate PRA methods above, a breakout session groups of the workshop were presented with check-list of questions that relate to resources exploitation, land tenure/access and permit system, infrastructure and support services etc. and all these questions were posed to the workshop participants in the groups. Once the strengths, weaknesses, opportunities and threats were identified and listed, the discussions were then centred on the following questions:

- How useful are each of the listed strengths to coastal zone management and development?
- How can listed weakness be overcome?
- How can identified opportunities be exploited?

How can identified threats be defended against?

Section 5: Results and findings

Issues of relevance/interest in the coastal zone management plan

- ✓ Land reclamation and Estuarine urbanization
- ✓ Effluent discharge into the estuaries
- ✓ Coastal landscape and poor waste management problems
- ✓ Population growth and rural urban migration.
- ✓ Deforestation, coastal agricultural production and urbanization/poor city planning
- ✓ Drainage/irrigation in agriculture fields
- ✓ Bulk tanker terminal for refined oil import and export of Iron ore, rutile, bauxite, zirconium and ilminite.
- ✓ Transport links and Cross-channel ferry crossings
- ✓ Redundant docks/jetties and shipwrecks
- ✓ Wetland conservation/ nature reserve (including Marine Protected Areas (MPAs), Ramsar Sites and important Bird Areas (IBAs))
- ✓ Scientific interest (Coastal Environmental Research)
- ✓ Estuarine reclamation for housing construction and agriculture
- ✓ Coastal and Island settlement
- ✓ Fish landing sites/ Fishing harbour
- ✓ Eroding cliff
- ✓ Hotel/apartment development
- ✓ Beach and sand bank mining and Aggregate extraction
- ✓ Coastal trade and commerce
- ✓ Lighthouse
- ✓ Industrial wastewater discharge and Solid wastes dumping including plastics
- ✓ Offshore navigation and national and international sea trade
- ✓ Dredging of navigation channel
- ✓ Military activities, e.g. firing range
- ✓ Buoys in marking navigation channel
- ✓ Offshore oil/gas rigs and undersea pipelines (future)
- ✓ Submarine Communications cables (fiber optics cables)
- ✓ Use of fertilizers and toxic chemical for control of crop pests (e.g. crabs)
- ✓ Dynamite fishing and use of chemical for fishing
- ✓ Use of illegal fishing gears
- ✓ Sanitation problems and potential contamination of fish and fish products
- ✓ Use of open bandas and fish contamination from flies and other pests
- ✓ Upstream dam for electricity Rokel River

Institutional Arrangements for ICZM in Sierra Leone

Many MDAs traditionally have interests/are traditionally charged with the responsibility of managing aspects of the marine and coastal environment as follows:

1. Environment Protection Agency Sierra Leone
2. Ministry of Fisheries and Marine Resources- All living and physical non-living marine resources of the sea excluding oil and gas reserves and minerals?
3. Ministry of Transport and Aviation (SLMA and SLPA)
4. Ministry of Lands, country Planning and the Environment
5. Ministry of Works, Housing and Infrastructure
6. Ministry of Local Government and Rural Development (Local Councils)
7. Ministry of Agriculture, Forestry and Food Security
8. Ministry of Mines and Mineral Resources (NMA)
9. Ministry of tourism and cultural Affairs (National Tourist Board)
10. Republic of Sierra Leone Armed Forces (MW)
11. Sierra Leone Police (Marine)
12. Joint Maritime Committee
13. Petroleum Directorate
14. National Protected Area Authority
15. Environmental NGOs and Private Sector including mining companies, oil companies and manufacturing industries

Table 11: Members of the ICZM Planning Committee

Name	Institution	Email address	Telephone No.
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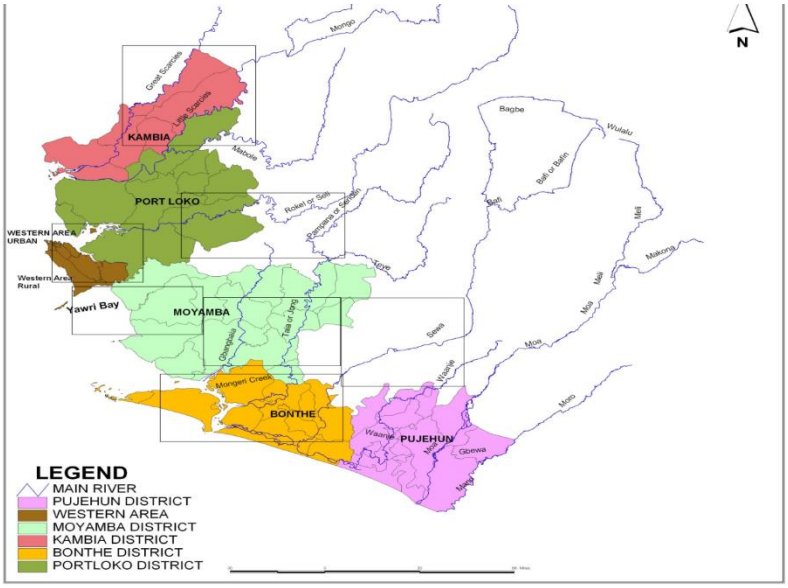

Figure 95: Coastal Planning Districts of Sierra Leone

(Note: Western Area is divided into Western Area Urban and Rural and Bonthe is divided into Bonthe Municipal and Bonthe District Council)

In 2009 a pilot Coastal Zone Management Project (PRCM) was implemented for the Yawriba Bay by the Wetlands International in collaboration with Conservation Society of Sierra Leone. This was the first multi- sectoral approach to coastal resources management in Sierra Leone. A Technical Steering Committee was formed under this project and from this the need for expansion of the pilot to truly carry out the functions of integrated coastal zone management became clear. Subsequently in 2012, the Ministry of Fisheries and Marine Resources under the West Africa Regional Fisheries Programme declared four Marine Protected Areas and supported the organization of communities bordering these protected areas into community management associations (CMAs) The Project focused on strengthening coastal communities to manage coastal resources under a new management approach known as Territorial Use Right Fisheries (TURFs).

Under this project, 31 CMAs were formed and legally registered with central and local government and were to start the development of bylaws for the management of coastal resource, when the Ebola Virus stuck.

Zoning scenario

Table 12: Zoning Scenario

Zone	Description	Purpose	Permitted use	Restricted use
Maritime and inland water transport	Marine area that is delineated for the use of watercraft to transport people, goods and cargo between multiple destinations	Trade, tourism, water commute	Transportation of people, goods, and cargo	Anchorage in sea lanes, and transportation of illegal goods
Fishing areas for industrial trawlers and artisanal fishers	Marine area defined for the extraction of fish for food and commercial trade, except for sport fishing which only involves the catch and release of fish	Food, commercial exportation; tourism-related revenue; recreational/sport activity	Catch and release of bonefish, tarpon, permit; wild capture of lobster, and finfish for commercial and artisanal uses	Extraction of catch and release species, endangered marine species and organisms under seasonal management regime; no extraction within legally specified "no-take" zones, dredging example no trawler fishing within the 6 nautical miles IEZ
Areas for swimming, diving and recreation	Marine areas especially suited to swimming, diving, kayaking, and other water sports	Tourism revenue, recreational pursuits, aesthetic beauty	Swimming, snorkeling, diving, kayaking and other water sports	Aquaculture, oil exploration, dredging, and in select areas fishing and some types of marine transportation
Agricultural Runoff Zoning Scheme	Crops, orchards, ranchland and associated structures	Food and revenue	Planting of agricultural crops, rearing of animals	Urban and commercial development, planting of illegal crops, non-prescribed use of agrochemicals, introduction of non-native, invasive species
Sand and gravel extraction	Areas for the excavation of bottom sediments	Maintenance of waterways, ports, beach re-nourishment, minerals for the construction industry	Extraction of minerals in the solid, liquid or gaseous form occurring naturally, and formed by geological processes	Extraction of petroleum, water from wells and natural saltpans, soil without a commercial value
Coastal Aquaculture zones	Farm ponds for shrimp, Tilapia, Cobia, and associated structures	Food and revenue	Operations for the production of farm-raised fish via land-based pond systems	Introduction of non-native, invasive species, excessive use of chemicals and release of huge volumes of untreated effluents

Zone	Description	Purpose	Permitted use	Restricted use
Oil and gas exploration and exploitation	Exploration for the deposits of crude oil and natural gas beneath the earth's surface and sea bed	energy and revenue	Searching for petroleum and natural gas, determining the quantity present and economic value	No type of human use activity
Coastal and Marine Protected Areas including wetlands and Ramsar Sites	Includes coastal and marine protected areas, spawning aggregation sites, shoals, critical habitats, biodiversity areas	Protection from storms; biodiversity maintenance; tourism revenues; climate regulation, habitat; clean water, aesthetic beauty	Scientific and educational research, recreational activities, nature appreciation	Commercial and urban development, oil exploration activity, fishing in "no-take" zones and spawning aggregation sites, destruction of critical habitats, development in shoals, dredging
Cultural and Historic Areas and Special Development Zones	Historic and Archaeological sites or cultural monument	Preservation of culture and natural heritage, aesthetic beauty, tourism revenue, recreational activities	Archaeological research and educational trips, recreational activities	Commercial and residential development, major infrastructural modifications
Areas for tourism development	Areas with specified development activity as per the Land Use plan for Sierra Leone	Agriculture, tourism revenue, reserves, residential development, commercial use, environmental protection, and forestry	A combination of uses as per the Land plan	Any human use other than those specified in the Land use plan for each special development area

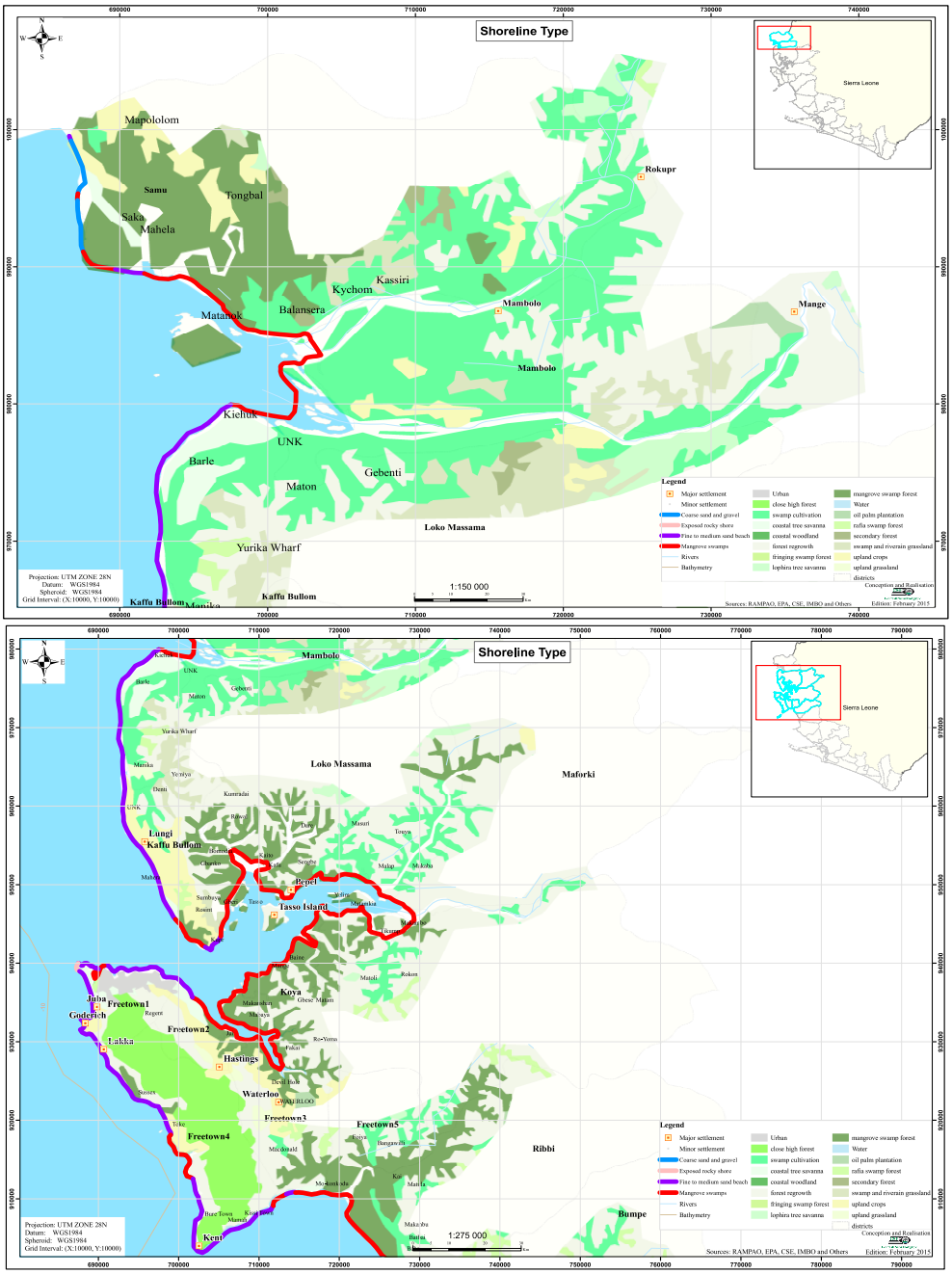

Figure 10: Shoreline profile and coastal habitat characteristics (North-west coats)

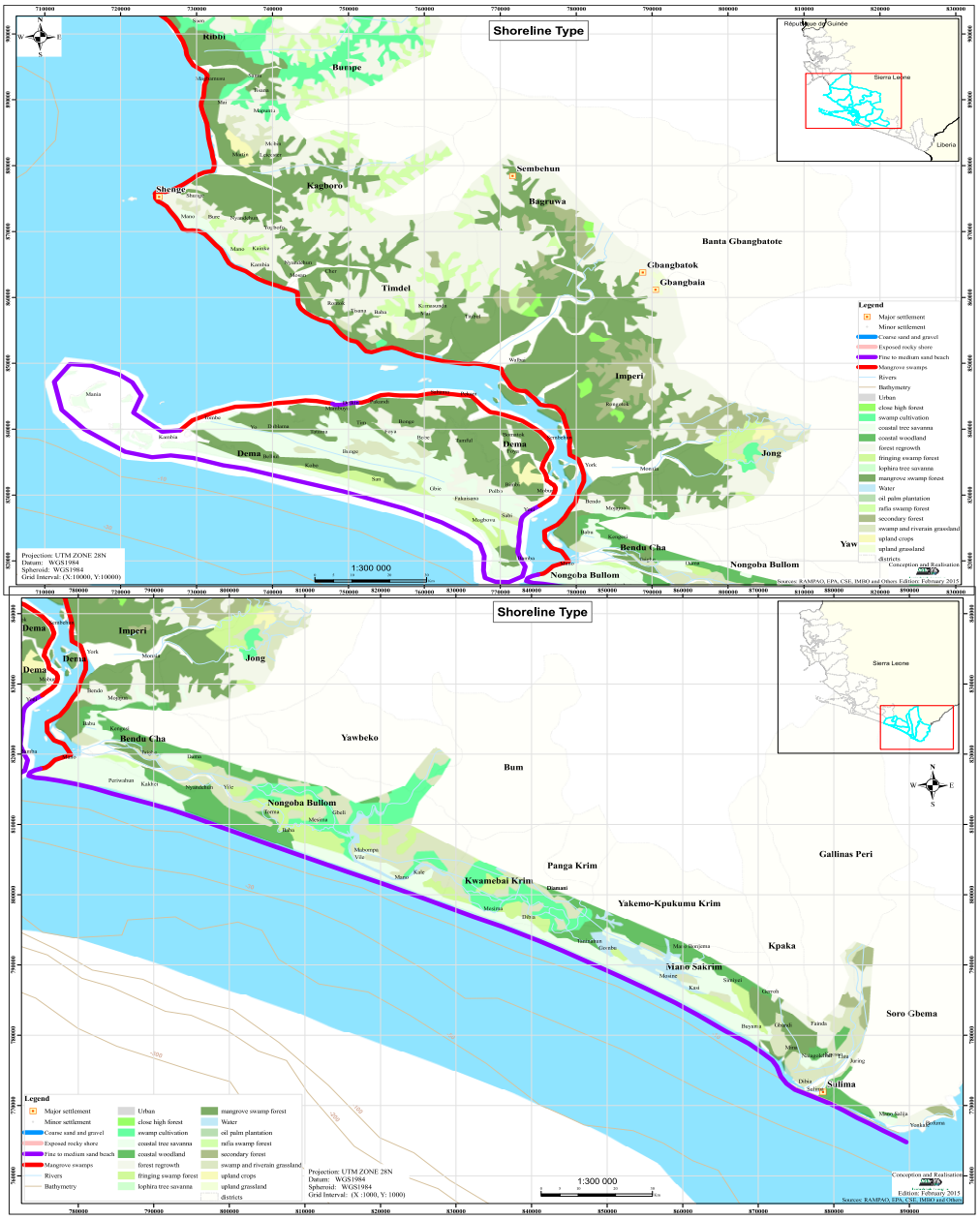

Figure 11: Shoreline profile and coastal habitat characteristics (Southern Coastline)

Section 6: Management Structure of the ICZMP and Roles of stakeholders in the co-management process of the ICZMP

It is identified that each stakeholder has specific functions to cover in the process of planning and managing the coastal zone. The following is a compilation of collected responsibilities and functions identified for the respective stakeholders:

Ministry of Fisheries and Marine Resources (MFMR)

Overall development and management responsibility for fisheries and marine resources (including aquaculture/mari-culture development and management)

- to inform fishing communities and other stakeholders involved about the co-management process to be employed;
- to organize local fishing communities in CMO/CMAs and provide necessary assistance to get them operational;
- to utilize, where and when appropriate, existing structures/organisations in the community;
- to negotiate with communities about possible fisheries management regulations as well as on pilot project activities;
- to develop together with the communities alternative livelihood options and package them in form of pilot projects for consideration by WARFP-SL/MFMR;
- to technically advise the communities on all aspects of MPA establishment, utilising information packages that may have to be developed;
- to assist in formulating by-laws, following existing traditional management approaches as well as the legal approach through the Local Councils;
- to ensure harmonisation of by-laws within one MPA, not imposing but suggesting that harmonised regulations are cheaper for all fishers and easier to enforce;
- to identify and, if possible, to mark traditional fishing grounds, using existing traditional landmarks and borders;
- once functioning, to hand-over management functions for pilot project implementation as well as fisheries management by-law development and implementation to the CMAs;
- to devolve official functions to local councils and fishing communities to further the fisheries co-management approach employed;
- to legalize Marine Reserves (Fisheries Act 1994) or Marine Protected Areas (draft Fisheries Act);

- to justify the existence of a MPA (scientific, social and economic)
    - including the purpose and
    - objective of the MPA
- ✓ to identify the area (together with the communities)
- ✓ to define boundaries (together with the communities)
- ✓ to include a mandate for total or partial regulation (maps with zones, if necessary)

    - ✓ to describe management measures employed in the MPA or specific zones within the MPA
    - ✓ to assist in defining decision making responsibilities
    - ✓ to prescribe procedures for the coordination of stakeholders
    - ✓ to define and discuss with the communities procedures on conflict resolution
    - ✓ to define procedures for monitoring and review of pilot projects,
    - ✓ in close consultation with the communities to prescribe fines and penalties

Local coastal Communities

- to get organised into Coastal Zone Management Committees CMO/CMAs and to make this newly formed organisation functional;
- to actively participate in the management process and provide inputs for the development of community-by laws;
- to contribute traditional/indigenous knowledge in the management process;
- to gain ownership in the fisheries resources through the co-management process;
- to formulate the community by-laws with the help of the extension service providers;
- to legalize by-laws in accordance with the described methods;
- to enforce fisheries laws and regulations as well as the developed community by-laws;
- to identify, plan, implement, manage and account for pilot projects with help and support from extension service providers;
- to develop a horizontal network of fishing communities actively involved in the fisheries co-management process;
- to participate and support a vertical network, traditional and governmental, for communication and information exchange at all levels of ‘government’.

District/City Councils

- To collect canoe license fees;
- To ensure that issued canoe licenses are in support of developed by-laws in respective fishing communities;

- To legalize community by-laws through the procedures prescribed in the Local Government Act 2004;
  - To use the authority provided to promote sound fisheries co-management in line with community needs;
  - To work together with the MFMR, seeking the devolution of functions to the District/City Councils, including fisheries staff and fisheries management functions;
  - To effectively address conflicts in the fisheries beyond chiefdom level;
  - To harmonise canoe licensing schemes and the resulting problems;

Traditional/Local Government Institutions (Village Headman, Town Chief, Section Chief, Paramount Chief)

These native or traditional rulers are the custodians of all land, wetlands and adjacent waterbodies. They have the mandate to arbitrate and enforce local/traditional by-laws and are well respected persons within the community. These leaders should be briefed about the implementation process and should also receive regular updates on the progress made. Further details of their functions are detailed in Annex VI.

Traditional/local community by-law development

a. Based on community decisions the Village Headman or the Secretary or someone else appointed by the community writes down the draft by-law
b. Once written, this draft by-law will be presented again to the community for approval;
c. Once approved, the Village Headman or the Secretary or someone else appointed by the community will sign the draft by-law;
d. Copies of this by-law will be send to the Section Chief, the Paramount Chief and MFMR for endorsement and copies and the signed document should be returned to the Paramount Chief for onward transmission to the Local Council;
e. The Local Councils process the developed fisheries by-laws in accordance with the Local Government Act 2004.

Civil Society Groups within the Community

Where and when appropriate utilize civil society groups in the process of informing, organising and getting fishing communities actively participate in the co-management process. Whenever possible, existing structures and/or organisations of civil society groups in the fishing communities should be utilised in the co-management process. The aim is to work together and develop synergies and not to duplicate structures or work in parallel.

Non-Governmental Organisations (NGOs)

Where and when appropriate utilize NGOs in the process of informing, organising and getting the communities actively participate in the co-management process. The term extension service providers frequently used in this strategy explicitly includes skilled community workers from NGOs. These NGO field workers will be crucial in the process of setting up MPAs and close cooperation should be sought at any time. Such close cooperation requires frequent exchange about the approach to be used and agreement on the process to be employed. Such exchange also helps to identify new developments in the respective fisheries and allows to respond by all field workers in a coherent manner.

MFMR Extension staff does not need to move into fishing communities that are already 'serviced' by an NGO which shares the same views and employs the same processes. Using NGO serviced fishing communities as lead communities in the facilitation of fishing community exchange visits may help to better identify underlying problems in fisheries management. Such exchange visits are also a tool for expansion, i.e. phase III, in the developed co-management approach.

Sierra Leone Maritime Administration (SLMA)-

The Sierra Leone Maritime Administration (SLMA), in collaboration with Sierra Leone Ports Authority, has the legal mandate for the registration of industrial fishing vessels as provided for in the 2003 SLMA ACT.

Institute of Marine Biology and Oceanography (FBC, USL) and Department of Aquaculture and Fisheries Management (NU) and SLARI-

- Fisheries and Marine Scientific Research

Ministry of Health and Sanitation-

- Competent Authority responsible for fish health certification

National Revenue Authorities (NRA)-

- Collects monies from Industrial fishing vessels and fish processing establishment licenses, royalties, transshipment and landing fees.

The Maritime Wing/JMC-

- Responsible for MCS, Security patrols, SAR (in collaboration with SLMA)

CMAs-

- Community management of fisheries at local level

Harbour Masters, Master Fishermen and traditional leaders

- development and enforcement of bylaws and dispute settlement at community level

Section 7: Review of the existing Policy and Legal Framework

Review of National Policy Framework

In this section a review of national level policy instruments that are relevant to the management of the coastal and marine environment has been carried out. The objective is to single out those policies that add synergy, or, require harmonization for successful implementation of the ICZM Action Plan.

The Environmental Policy

The National Environmental Policy (NEP) was approved by cabinet since 1990 and was subsequently revised in 1994 (GOSL, 1994). The NEP aims at achieving sustainable development in Sierra Leone, through sound environmental and natural resources management. The policy objectives are to:

- *Secure a quality of environment adequate for the health and well-being of all Sierra Leoneans;*
- *Conserve and use the environment and natural resources for the benefit of present and future generation; restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere; to preserve biological diversity, and uphold the principle of optimum sustainable yield in the use of living natural resources and ecosystems;*
- *Raise public awareness and promote understanding of the essential linkages between the environment and development and to encourage individual and community participation in environmental improvement efforts*

The NEP also contain among others sector policies on land tenure, land use and soil conservation; forests and wildlife; biological diversity and cultural heritage; mining and mineral resources; coastal and marine resources; settlements, recreational space and greenbelts and public participation. The policy goal for the land tenure, land use and soil conservation is to "use available land in such a way that its quality is conserved so as to enhance its potential for continuous productivity and to prevent degradation". One of the major strategies which government is now pursuing to achieve the goals of the NEP is *"to make as priority Environmental Impact Assessment (EIA) of proposed activities which may significantly affect the environment and the use of a resource*.**"**- (GOSL, 1994).

The NEP also has a specific goal and policy for water resource management which ensures adequate quantity and acceptable water quality to meet domestic, industrial, transportation, agricultural and fisheries by accelerating programmes for the utilization of water for the various uses and expending water quality management, monitoring and assessment programmes. Although laws prohibiting pollution of water bodies exist they are hardly enforced.

The Fisheries and Marine Resources Policy Objectives

The Ministry of Fisheries and Marine Resources (MFMR) manages, develops and conserves all fisheries and marine resources. The fisheries Management and Development Act of 1994 and the Fisheries Regulation of 1995 prescribe the preparation of management and development plan, specific procedures for licenses, and measures for conservation, enforcement, monitoring controlling and surveillance. The five policy objectives are:

Objective I Conservation and sustainable use of fisheries resources

Conservation of living aquatic resources and habitat (in both marine and freshwater environments), and rebuilding of resources and restoration of habitat where necessary, will be the highest priority for the management of all fisheries. Within the limits of available knowledge, all fishing activities will be conducted in a manner that leads to sustainable levels of resource use.

Objective II: Increased co-management through committed, informed and involved stakeholders

All interested parties have the opportunities to be effectively involved in fisheries management decision-making processes at appropriate levels; to express their views on both direction and pace of change; contribute specialized knowledge and experience, and share in accountability for outcomes.

Objective III: Diversification and increase in international trade of fish and fishery products

The foundation for fish and fishery products that meet international norms and standards is established and stakeholders of the sector are more self-reliant, economically viable and self-sustaining on a long term basis, capable to contribute to the well-being of coastal communities and to survive downturns without government assistance and with only a normal business failure rate.

Objective IV: Functional extension service capable of delivering cost- effective and efficient management tools

Dynamic, vibrant and highly motivated extension service working in partnership with resource users and other stakeholders for the sustainable development of the fisheries of Sierra Leone

Objective V Promote sustainable aquaculture development

Harness the immense potential in the country for sustainable aquaculture development with the view to increasing food supply, create employment, generate wealth, improve the country's balance of trade, reduce pressure on wild fish stocks, stimulate regional development and contribute to increased efficiency of water use and the protection of the environment.

The core policy outcomes are as follows:

i. Good governance, sustainable commercial fisheries development and economic growth;
ii. Sustainable artisanal fisheries commercialization and effective extension support;
iii. Access of fish products to the EU markets;
iv. Promotion of sustainable exploitation of fish resources and development;
v. Sustainable promotion of inland fisheries and;
vi. Sustainable aquaculture development;

National Land Policy

Currently, a comprehensive Land Policy has been formulated and Lands Commission Act is being formulated by the Ministry of Lands, Country Planning and the Environment and approved by Cabinet. The land policy aimed at ensuring "the judicious use of the nation's land and its natural resources by all sections of the Sierra Leone Society." The policy also provides the framework to 'ensure equal opportunity of access to land and security to tenure in order to maintain a stable environment for the country's sustainable, social and economic development.'' The land policy if effectively implemented will ensure sustainable land use and enhance land capacity and conservation.

Ministry of Lands, Country Planning and the Environment (MLHCPE)

There is an overall institutional and legal framework for the management and protection of our environment in the national context. The responsibility for the management and protection of the environment formerly lay with the Department of the Environment of the Ministry of Lands, Country Planning and the Environment. The political head of the Department of the Environment was the Minister of Lands, Country Planning and the Environment.

In 2005 the GOSL created the National Commission for the Environment and Forestry (NaCEF) and appointed a Commissioner. The Forestry Division of the Ministry of Agriculture, Forestry and Food Security Safety (MAFFS) and the Department of the Environment (DOE) of the Ministry of Lands, Housing, Country Planning and the Environment (MLCPE) functioned essentially within the NaCEF framework. The administrative structures and staff had been taken over by NaCEF.

In July 2008 the NaCEF was dissolved and replaced by the Environment Protection Agency (EPA) to be headed by an Executive Director. The EPA was established by an Act of Parliament: the Environment Protection Agency Act (EPAA – 2008). The Minister of Lands, Housing, Country Planning and the Environment (MLHCPHE) was still the overall responsibility of the EPAA (2008). The DOE and not the Forestry Division will now under the EPA. The Forestry Division reverts to MAFFS. The EPA is now called SLEPA (Sierra Leone Environment Protection Agency) and it now functions under the office of the President.

Policy Goals

The environmental policy goals and objectives are:

- To secure a quality of environment adequate for the health and wellbeing of all Sierra Leoneans;
- To conserve and use the environmental and natural resources for the benefit of present and future generations;
- To restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere; to preserve biological diversity and the principle of optimum sustainable yield in the use of living natural resources and ecosystems; and
- To raise public awareness and promote understanding of the essential linkages between environment development and to encourage individual and community participation in environmental improvement efforts.

Strategies

The following strategies are pursued in order to achieve the policy goals and objectives.

(a) To establish and/or strengthen environmental protection standards, monitor changes in, and publish relevant data on, environmental quality and resource use;

(b) To make prior environmental impact assessment (EIA) of proposed activities which may significantly affect the environment or use of a natural resource and to provide relevant information, in a timely manner, to persons likely to be significantly affected by a planned activity and to grant them equal access and due process in administrative and judicial proceedings; and

(c) To promote environmental management through the creation of administrative and infrastructural support with appropriate financial backing;

(d) To cooperate in good faith with other countries and agencies to achieve optimal use of trans-boundary natural resources and effective prevention or abatement of trans-boundary environmental protection.

The legal basis for the implementation of environmental Management and protection in Sierra Leone the Environmental Protection Act, 2008 as reviewed in 2010.

The Draft Environmental Protection Policy

The aim of the draft National Environment Policy (2009) is to provide a framework for sound environmental and natural resource governance by mainstreaming environmental considerations into sectoral policies and strengthening regional and international cooperation in environmental management. Key objectives of the policy include:

(a) Providing a framework for integration of environmental considerations into the various sectoral policies, development plans and decision making processes.

(b) Ensuring sustainable management of terrestrial and aquatic resources for national economic growth and improved people's livelihood and well-being.

(c) Promote and enhance collaboration, synergy, partnerships and participation in the protection and conservation of the environment by all stakeholders.

The key issues addressed by the policy include the harmonization of sectoral policy instruments with the framework environmental law (EMCA) 1999 in order to enhance sustainable environmental management.

Ministry of tourism and cultural affaires

Sierra Leone is endowed with abundant and diversified natural and cultural attractions, including beautiful beaches, picturesque landscape (islands, hillsides, mountains, and waterfalls), wildlife sanctuaries and parks, fine weather, a rich cultural heritage, and hospitable people. There is a strong potential for the tourism sector to emerge as a major revenue earner for the country.

In the eighties, the country had a booming tourism industry. There were strong branded operators like Sofitel and Caledonian Hotels operated, tourism services like guided tours, fishing expeditions and trained staff were active. These services together with the tourism infrastructure collapsed during the ten year civil war.

Since the end of the war, the tourism industry has been served by a small but vibrant group of entrepreneurs and community organizations providing a variety of services like guesthouses and tour operations. There has also been a steady increase in the number of arrivals by air, mainly business travelers and nationals living in the Diaspora on vacation during festive seasons. Meanwhile the tourism infrastructure still remains weak. Total room capacity in the country is 1100. There are only 10 Principal Hotel operators in the capital city, Freetown. Three are Class 1(Business Standard) offering 105 rooms and the other seven are non-Class 1 operators offering 405 rooms. The remaining 510 rooms in the country are accounted for by Class 3 hotels and guest houses. Tourist attractions and camp sites are insufficient and under-developed and the sector suffers from a lack of trained manpower at managerial and skilled levels.

The main form of tourism in Sierra Leone is beach tourism which remains under developed and needs investments. Development of eco-tourism and cultural tourism is gaining ground particularly outside the Western Area. Other sectors in the tourism sector which include restaurant services, night life, air transport, ground transport, travel agencies, arts and crafts, and small scale handicrafts are also under developed.

The tourism industry is regulated by the Ministry of Tourism and Cultural Affairs through the National Tourist Board.

Strategic Vision

During the war, tourism infrastructure and services were badly affected which has resulted in a reduced demand for Sierra Leone as a favourite tourist destination. The vision for the tourism sector is:

The vision will be accomplished by strong investments in tourism infrastructure and services and capacity building within the sector.

The following is a SWOT analysis for the tourism sector.

The overriding objective of the SWOT analysis is to identify the sector strengths so that efforts and initiatives can be employed to optimize on these strengths; to identify weaknesses so that initiatives can be put in place to overcome them; to identify sector opportunities so that efforts and initiatives can be made to exploit them and to identify threats so that the strategy is aware of them and any intervention takes their existence or potential for existence into account.

Draft Forestry Policy, 2009

The draft Forest Policy envisages a radical change in the way forests are managed. It provides mechanisms for mainstreaming the private sector and community participation in the management of state forests to reduce forest destruction and ensure sustainable supply of forest ecosystem services. The policy recognises multiple uses of forest resources for socio-economic development. Implementation of the policy will result in sustainable management of coastal forest resources thus contributing to achievement of the action plan objectives.

Draft Wildlife Policy, 2008

The draft Wildlife Policy provides a framework for conserving Kenya's rich diversity of species, habitats and ecosystems for the benefit of its people and the global community. It recognizes the role of various actors in wildlife management including giving responsibilities to local communities and land owners. The draft policy further offers incentives to promote community participation in conservation which is in line with the ICZM principles.

Draft Tourism Policy, 2009

The draft National Tourism policy provides for stakeholders to partner with government to develop the tourism sector and deliver sustainable growth in the industry. Implementation of the policy will address impacts of sectoral activities on the environment as well as socio-cultural degradation related to tourism activities.

Regional Development Authorities Policy, 2007

The Regional Development Authorities (RDA) Policy (2007) was formulated to provide framework to guide the implementation of the mandate of the Ministry of Regional Development Authorities. The goal of the policy is to achieve equitable and balanced national socio-economic development through the promotion of sustainable utilization of natural resources for economic development in the regions. The policy has redefined functions of the RDAs to include:-

- Formulation of integrated regional development plans in close consultation with other stakeholders,
- Management of natural resources, specifically addressing gaps in regional resource mapping, promotion of resource based investments and formulation of a framework through which communities would benefit from such investments.

The RDA Policy and legal provisions have a direct bearing on streamlining and strengthening the roles and functions of CDA and TARDA in coastal zone development and management.

Incentives, Fines and Penalties Program for Ship Owners and Ship Managers

1. Transfer of Ship Incentives Scheme

This Incentives scheme applies to ships aiming to be registered under Sierra Leone that meet the criteria presented in the table below. Owners may contact their nearest Registration Officer who can provide quotation through our online fee calculator.

The discount applies to:

- Initial Registration Fee
- Casualty Investigation and Emergency Response

- Flag Safety Inspection

Vessel's age:	GRT		
	Up to 10,000	**10,001 – 30,000**	**30,001 and above**
Up to 10 years old	80%	90%	100%
Between 11 and 15 yers old	40%	60%	90%
Between 16 and 20 years old	20%	40%	80%

2. Group Owner Incentives Scheme

This scheme aims to provide incentives to ship owners who will register 3 or more ships under Sierra Leone flag. The registration should be completed within 12 months from the date of registration of the first vessel. Group Owners are entitled to discounts both on Initial and Annual Registration fees. The application form for Group Owners (AFGO01) must be submitted to your nearest Registration Officer for obtaining our quotation.

3. No Detention Incentives Scheme

No detention incentives scheme aims to provide discounts to existing vessels under Sierra Leone that had recorded a good Port State Control (PSC) performance without any detention.

The discounts are shown in the table below and apply to:

- Annual Tonnage Dues
- Casualty Investigation and Emergency Response

- Flag Safety Inspection
- Renewal of Registry Fee, if applicable

Item Discounts

- No detention for 3 years
  15%
- No detention for 2 years
  10%
- No detention for 1 year
  5%

4. Detention and Late Payment Penalties Scheme

This scheme aims to improve the performance on Port State Control inspections of Sierra Leone flag. Also this scheme aims to ensure that all payments of annual dues and consequently renewal of flag certificates are done on time. Penalty applies to total fees paid on Annual Registration or Renewal of Registry

Item Discounts Penalties

- 1 detention within 1 year -- 10%
- 2 detentions within 3 years -- 20%
- 2 detentions within 1 year -- 30% + US$ 3,500
- Up to 3 months late payment of Annual Dues -- 10%
- More than 3 months late payment of Annual Dues -- 20%

5. Other Fines & Penalties

This scheme aims to ensure that any fraudulent certificate is brought to the attention of the Administration. Also, this scheme aims to penalize those ship Owners involved in smuggling, human trafficking and other illegal transportation.

- Issuance of fraudulent certificate issued by SL Flag $1,500
- Fishing Vessels conducting illegal fishing or transhipment $8,500
- Vessels involved in smuggling, human trafficking and other illegal transportation. S10, 000

The above discounts and penalties are valid from 1st May 2015 until 31st December 2015.

IMO Requirements on Carriage of Publications on Board Ships

All the publications as per the above mentioned table shall be available on board, regardless of format, should be the latest editions or duly corrected up to date. In case where copies of national regulations incorporating the provisions of the required instruments are provided on board, publications of such instruments need not be carried on board. The publications may be carried in the form of electronic media such as CD-ROM in lieu of hard copies. Publications in electronic form are only accepted if issued by IMO or an Administration or a body authorized by an Administration to ensure correctness of their contents and to safeguard against illegal copying.

The media shall be treated in accordance with the document control procedures in the Ship's SMS including procedures for timely update. Furthermore *publications for emergency use such as International Code of Signals and the IAMSAR Manual shall be always available in the form of Hard Copies and be ready for use without being restricted to a specific place and by the availability of a computer.

Review of the National Legislative Framework

Introduction

Sierra Leone's socio-economic activities and processes are organized into sectors. As such, policy statements, legislations and corresponding institutions are also sector based. In this section, the relevant sectoral laws governing the coastal marine environment are briefly analysed and these include:

1. The Environmental Protection Act 2008
2. The Fisheries Management and Development Act (1994)
3. The Forestry and Wildlife Act (1988)
4. The Mines and Minerals Act (1994)
5. The Public Health Act (1993)
6. Sierra Leone Maritime Agency Act (2000)
7. Local Government Act (2004)

The Environmental Protection Act 2008

The Environmental Protection Act 2008 empowers the Environment Protection Agency in Sierra Leone to perform the following tasks amongst others:

- Screen projects for Environmental Impacts (EIA);

(f) Undertake or cause to be undertaken specific studies and

- Issue environmental Impact Assessment Licenses; and
- Formulate or promote the formulation of, and monitor the implementation of environmental policies, programmes, projects, standards and regulations.

Environment Protection Board (EPB)

The EPAA 2008 also provided for the establishment of an environmental protection Board. This Board, which was set up had the following functions:

(a) Facilitates coordination, cooperation and collaboration among government ministries, local authorities and other agencies in areas of environmental protection;
(b) Review national and sectoral policies and make such recommendations or proposal it may think necessary to the Minister.
(c) Review environmental impact assessments prepared pursuant to this Act and make appropriate recommendations to the Executive Chairperson.
(d) Investigate or cause to be investigated, any activity, occurrence or transaction which it considers is likely to have or result in harmful consequences to the environment and advise on measures necessary to prevent or minimize such consequences;
(e) Advise the Minister on areas of environmental protection and control requiring special or additional measures indicating the priorities and specific goals to be achieved;
research aimed at developing strategies for the protection of

the environment and make appropriate recommendations to the Minister; and

(g) Consider any other matters which may be referred to it by the Minister and make appropriate recommendations or proposal thereon.

The Environment Protection Agency in Sierra Leone (EPA-SL)

The EPA-SL has been set up by an Act of Parliament (The Environment Protection Agency Act 2008). This Agency now functions under the office of the President. Under the EPAA (2008) the SLEPA has wide ranging functions and powers including:

- Formulation of policies on all aspects of the environment;
- Co-ordination of activities of all MDAs that impact the environment;
- Prescription of environmental standards and Guidelines;
- Issuance of environmental permits;
- Enforcement of compliance; and
- Studies and Research.

Other sector instruments relevant in the management of the coastal zone in Sierra Leone include:

1. The Forestry and Wildlife Act (1988)
2. The Mines and Minerals Act (1994)
3. The Fisheries Management and Development Act (1994)
4. The Public Health Act (1993)
5. Sierra Leone Maritime Administration Act (2000)
6. Local Government Act (2004)
7. The Tourism and Cultural Affairs Act (?????)

Local Level

At the local level, the environmental Sanitation functions are carried out by provincial officers of the DOE (formerly under NaCEF but now under the SLEPA) of the then MLHCPE through its Assistant Environmental officers in the Northern, Southern, Eastern Provinces and an officer for the Western Area. At present the main tasks of the Assistant Environmental officers operating at provincial levels basically include monitoring of environmental programmes and projects, evaluation of environmental degradation and completion of reports. With the inception of the City and Town Councils in 2005, part of the Environmental Planning, Monitoring and Evaluation has been devolved to the councils.

City and Town Councils are charged partly with the responsibility of Environmental Management and Sanitation. Assistant Environmental Health Officers are attached to the councils to offer professional advice and training on the cleaning and physical removal of garbage and disposal by council employees.

The local councils inline with the decentralization process, are engaged in a wide range of activities including civil works for infrastructure (Schools, Health Centres, etc), Water and Sanitation, Irrigation, Agriculture, and Roads. The local councils are expected to screen and partly monitor their projects for environmental management. At the chiefdom level each household is encouraged to clean their environment and remove refuse to safe sites.

Sanitary officers and chiefdom police are empowered to enforce chiefdom byelaws rigorously. Training for chiefdom staff are provided by EHU and NGO's. GOSL through NaCSA and other NGOs (UNICEF, Action Aid etc) provide services to communities.

The Fisheries development and management Act, 1994

The Fisheries Management and development Act of 1994 and its subsidiary regulations of 1995 and 2010 are the instruments for fisheries management in Sierra Leone. The Act restricts destructive practices and protects fish breeding areas. It has outlawed use of under-size nets, beach seining, use of dynamite fishing among others.

Sea Turtles, Manatees, sharks and rays are protected from hunting and harassment under the Fisheries Act. The Act prohibits any person or vessel in Sierra Leone waters from fishing sea turtles. A number of restrictions including restrictions on trawling in the six miles inshore exclusion zone and the 4 declared marine protected Areas, ban on the use of monofilament nets, seine nets in the 1994 fisheries Act. Other measures include the immediate release of gravid lobsters and crabs and other marine mammals.

Merchant Shipping Act of 2009

The Merchant Shipping Act 2009 makes provision for, among others, the registration and licensing of ships. It further has a crucial role in regulating shipping activities in the inshore areas and extending to the EEZ, provides for maritime safety, security, pollution control and environmental conservation.

Sierra Leone Maritime Administration Act 2000

The Administration was established to regulate and develop improved standards of performance, practice and safety in the shipping industry in Sierra Leone, including the coastal and inland water transport system, and in the maritime environment. The Administration will fulfill the flag state and port state responsibilities in an effective manner, having regard to the relevant international maritime conventions and codes and other instruments.

The Administration is also in charge of pollution prevention and control, protection of the marine environment and response to marine environment incidences including search and rescue and response to distress calls. The Administration will cooperate with other MDAs to pursue the ratification, accession and implementation of international maritime conventions

The Petroleum (Exploration and Production) Act, 2011

An Act to provide for the management of petroleum operations (including coastal and offshore exploration and exploitation), to regulate and promote petroleum exploration, development and production; to regulate the licensing and participation of commercial entities in petroleum operations; to provide for proper supervision of petroleum operations, to promote the participation of Sierra Leoneans in the petroleum industry; to provide for efficient and safe petroleum operations; to provide for an open, transparent and competitive process of licensing; and for other related matters.

Functions of the Directorate

(1) The object for which the Directorate is established is to monitor petroleum operations in Sierra Leone.

(2)Without limiting the generality of subsection (1), the Directorate shall –

(a) assist in the assessment of prospective holders of petroleum rights for purposes of prequalification pursuant to this Act;
(b) review proposed reconnaissance, exploration, and appraisal work plans, plans for development and operation and decommissioning plans submitted by holders of petroleum rights, as the case may be, and make recommendations to the Minister;
(c) review budgets submitted by a holder of petroleum rights in respect of a work programme and make recommendations to the Minister;
(d) participate in the tender process and negotiations of petroleum licenses, and in the administration of petroleum rights;
(e) participate in the measurement of petroleum to allow for assessment of royalty and bonuses due to the State;
(f) ensure that holders of petroleum rights uphold laws, regulations, rules and contract terms;
(g) ensure optimal levels of recovery of petroleum resources;
(h) promote well planned, well-executed and cost-efficient operations;
(i) ensure optimal utilisation of existing and planned facilities;
(j) contribute to national budgetary planning and control;
(k) ensure the establishment of a central database of persons involved in petroleum operations, manage petroleum data and provide periodic updates and publication of the status of petroleum operations;
(l) encourage, monitor and enforce the standards of operation and code of practice for petroleum operations;
(m) review all tariffs for third party access to petroleum facilities and make recommendations to the Minister;
(n) ensure that holders of petroleum rights, comply with health, safety and environmental standards;
(o) ensure and facilitate access and utilisation of facilities by third parties;
(p) monitor conditions of operators and their trade practices to ensure that competition and fair practice is maintained;
(q) provide information relevant to the National Revenue Authority for the collection of taxes, royalties and fees from petroleum operations;
(r) assess tail-end production and cessation of petroleum operations and decommissioning;
(s) prepare an annual report on the status of petroleum activities in Sierra Leone, for submission to the Minister for further submission to Parliament and publication in the *Gazette* and in such other manner as the Minister may determine; and
(t) perform any other function incidental or consequential to its functions under this Act.

(3) The Directorate shall, to the greatest extent possible and consistent with this Act, consult and co-operate with ministries, departments and agencies of Government having duties, aims or functions related to those of the Directorate.

The Mines and Minerals Act 1994

The Mines and Minerals Act of 1994, which came into operation on 4 March, 1994 addresses mining leases and licenses requirement for open – pit and industrial mining. When a Proponent/Miner applies for a mining lease, information on the period of time for which the lease is sought; estimated mineral deposits, reserves, and mining conditions; mining treatment options and those selected for use in the mining project; specific details of the mining operation such as the schedule, nature of production, potential environmental and social impacts, forecast of capital investment, operating costs and revenues, and the anticipated source of financing, proposed mitigation programs and marketing arrangements for the sale of the mineral production should be provided and forwarded to the Director of Mines in the Ministry of Mines and Mineral Resources.

Other requirements under the Mines and Minerals Act include illegal exploitation and disposed of any radioactive mineral except under and in accordance with the terms and conditions granted by the Minister of Mineral Resources.

The Forestry Act of June 1988

The Act contains special protection provisions under which the Minister is empowered to declare any area to be a "protected area for purpose of conservation of soil, water, flora and fauna". The legislation stipulates that 'no person may cut, burn, uproot or destroy trees that are in protected areas or trees that have been declared as being protected.'' It also states that the Chief Conservator/Director of Forest may issue a license or concession to fell and extract a protected tree.

The Lands Commission Act, 2004

The aim of this act is to establish a commission with its composition and functions and for other purposes including the management of state lands, the execution of a comprehensive programme for the registration of title to land throughout Sierra Leone.

The Wildlife Conservation Act, 1972

The Wildlife Conservation Act of 1972 was enacted to help regulate the utilization and protection of wildlife resources, but is outdated and deserves urgent review and update. Notwithstanding the level of comprehensiveness of most of these frameworks, they lack strength because they are out of tune with current best practices and approaches to resource management and conservation. Prescriptions, guidelines and management practices are flouted with impunity also because of weak governance and accountability structures that permeate particularly the state management structures.

In spite of this seemingly impressive array of environmental laws, the legislation has not fully provided a platform for sustainable use of our natural resources and proper management of the environment. This can be attributed to the following reasons:

- Lack of implementation, enforcement and compliance;
- Potential conflicts of interest within sectors by not linking environmental and natural resources management responsibility with other development interest;
- The relative absence of an autonomous Environmental Protection Agency vested with both advisory and executive

- authority at all levels of
- design, monitor and implement environmental policies;
- Lack of a mechanism that ensures environmental and natural resources management issues in the sectoral ministries and line agencies provide information to the main Environment Department to carry out effective monitoring of environmental policies that are to be implemented by the former.
- Enforcement has been very ineffective, due to institutional weaknesses such as understaffing, inadequate management skills and insufficient funding).

The country has a number of sectoral laws relating to environmental protection. There is an urgent need to harmonize legislation and create an enabling policy framework for effective environment and natural resources management in the country. It appears that much of the current legislation is merely empowering and does not contain specific provisions and detailed criteria for the preservation and/or sustainable harvesting of particular natural resources.

There is now a clear need for a framework environmental act which would delineate roles and responsibilities of different actors involved in environmental planning and management in Sierra Leone. As a coordination framework, the new framework act should define mechanisms for linkages between government to
different roles as well as legal limitation of each MDA in the new ICZM system

Review of International Agreements and Conventions

Sierra Leone has also endorsed and signed several international Conventions and Protocols including:

- Convention on Biodiversity (CBD),
- United Nations Framework Convention on Climate Change (UNFCCC),
- United Nations Convention to Combat Desertification (CCD),
- Convention on International Trade in Endangered species of Wild Fauna and Flora (CITES),
- Convention on Wetlands of International Importance (Ramsar),
- Convention on Bio-safety, United Nations Convention on the Law of the Sea (UNCLOS),
- Bassel Convention, Vienna Convention, and Montreal Protocol.
- Stockholm Convention on Persistent Organic Pollutants

These Conventions and Protocols are it different stages of implementation but in general implementation is slow as many have not been ratified or harmonized with the laws, policies and programmes of Sierra Leone. As a result Sierra Leone trails far behind in the implementation of the provisions of these conventions.

Table 13: Status of some multilateral environment Agreement

Convention/ Treaty	Adoption date	Ratification Date	Objectives	Implementation Programmes/projects
1. Convention on Biological Diversity (CBD)	June, 1994	12th Dec., 1994	1. Promote Conservation of Biological Diversity 2. Sustainable use of its components 3. Fair and equitable sharing arising out of the utilisation of genetic resources	1.Development of National Biodiversity Strategic Action Plan (NBSAP).
2. The Cartagena Protocol on Biosafety to the Convention on Biological Diversity	Jan, 2000	2003	1. To contribute to ensuring an adequate of protection in the field of living modified Organisms resulting from modern biotechnology	1. National Biosafety Framework Project launched in 2002 2. Establishment of Biosafety Clearing house
4.United Nations Convention to Combat Desertification	June 1994	25thSept. 1995	1. To combat desertification and mitigates the effect of drought in countries experiencing serious droughts and or desertification	1. Development of National Action proramme (NAP). 2. Development of Medium Size Projects (MSP) to combat land degradation
5. The United Nations Framework Convention on Climate Change	May 1992	April 1996	1. To achieve stabilisation of green house gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climatic system	1. Initial Communications to Fulfil the Country's Obligations to the UNFCCC.
6. Kyoto Protocol	Dec. 1997	(Advanced stage)	1. To strengthen the commitment of developed country Parties with a view to reduce their overall emissions	1. National Capacity Self Assessment
7. The Vienna Convention on Protection of Ozone Layer and Montreal Protocol on Substances that Deplete the Ozone Layer	Sep. 1987	Apr. 1993	1. Protect human Health and the environment against adverse effects resulting from modifications of the ozone layer form anthropogenic emissions of substances proved scientifically to have high ozone depleting potential	1.Phasing out of Ozone Depleting Substances (ODS) by 2010. 2.Capacity building of Institutions dealing with ODS
8. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Mar.1989	Apr. 1993	1. To reduce trans- boundary movements of hazardous and other wastes to a minimum consistent to their environmentally sound management 2. To treat hazardous wastes and other wastes 3. To minimise the generation of hazardous wastes.	
9. Protocol on liability and compensation on damages resulting from trans-boundary movements of hazardous waste and their disposal	Dec 1999	Not yet	1. To provide for a comprehensive regime for liability and for adequate and prompt compensation for damages resulting from the trans-boundary movements of hazardous wastes and their disposal including illegal	

Section 7: Implementation Framework

Overview

The ICZM Action Plan provides the framework to guide the work of stakeholders involved in conservation and development of the marine and coastal area in an effort to foster a more coordinated and integrated approach to management of the coastal zone. Its preparation was guided by national priorities as contained in major policy documents including the Agenda for Prosperity and the National Environment Action Plan. Full and effective implementation of the Integrated Coastal Zone Management Plan will require embracing a participatory approach as well as investing in capacity building and mobilizing adequate resources for its implementation.

Stakeholder involvement

Implementation of the ICZM Plan will adopt a participatory approach to ensure that implementation of the activities is a national and local priority with strong involvement of all actors including government agencies, NGOs, Learning institutions, Private sector, CBOs, general public and development partners. In light of its mandate to supervise and coordinate environmental programmes in the country, EPA-SL will take a lead role in the implementation of the plan including stakeholder engagement and coordination. The engagement of stakeholders in the implementation process will be guided by their statutory mandate and capacity. Stakeholders will be involved at all stages of project preparation and implementation including monitoring and evaluation. The activities implementation matrix coming later in this chapter has identified the stakeholders to be involved in implementation of various activities enumerated therein.

Capacity building

It is recognized that various institutions involved in coastal zone conservation and management have considerable technical capacities in various disciplines. These capacities, which are found within specialized MDAs, state corporations, private sector, research and learning institutions will be utilized in implementation of the ICZM Plan. It is however recognized that not all disciplines and MDAs have adequate capacity and therefore the need for the government to continue investing in capacity building is imperative. Training shall be undertaken to build capacity at both national and local level institutions that will be involved in implementing the ICZM Plan. This will be achieved through short course training; refresher courses; seminars and exchange visits among others. It is expected that implementation of the plan may also seek technical support from international research and development partners.

Resource mobilization

Effective implementation of the ICZM Plan requires allocation of adequate human as well as financial resources. Potential sources of funding include Government budgetary allocations; District Councils Development Funds; Support from NGOs, Private Sectors, CBOs and religious organizations. The Government of Sierra Leone supported the preparation of the ICZM plan and therefore their involvement in supporting the implementation phase

will contribute to the realization of the government's vision for sustainable development in the coastal zone as inscribed in the Agenda for Prosperity.

It is imperative to note that scarcity/inadequacy of resources is often a key constraint in implementation of projects and programmes in many sectors of the economy and hence the need for prioritization of activities implementation.

Implementation plan

The detailed Implementation Plan is presented in the Matrix provided below. The matrix has outlined the key activities to be implemented under each thematic area. The matrix has also highlighted the activities' expected outputs, performance/monitoring and evaluation indicators, actors and timeframe for activity implementation. Included in the matrix is also an estimated cost for each activity. The Plan Implementation Matrix will be a critical and important tool for:

i) Informing the development of project concepts and proposals
ii) Mobilizing, allocating and utilizing resources during plan implementation;
iii) Efficiently and effective management and coordination of plan implementation process;
iv) Soliciting collaboration and support from partners and all other stakeholders in the coastal zone;
v) Monitoring progress, evaluating results/outputs and assessing outcome/impact, documentation and dissemination of results of impact;
vi) Facilitating mid-term and end-of-plan reviews/evaluations

Implementation Plan

Table 14: Implementation Matrix

Integrated Planning and Coordination							
Strategic Objective	**Action Strategies**	**Expected output**	**Actions**	**Performance/M & E Indicators**	**Responsibility & Partners**	**Cost (US$)**	**Duration (years)**
1. Planning & Management of Coastal Development	1. Guide and coordinate planning and management of development in the coastal zone	1. Guidelines developed and published	1. Develop guidelines for integrated coastal area management and planning	Integrated coastal area management and planning guidelines	(EPA-SL) and stakeholders (MAFFS,MLCPE, MWHI, MFMR, LC)	10,000	2years
		2. Baseline GIS for coastal zone spatial analysis developed	2. Develop and maintain baseline GIS for coastal zone resources, land use, and critical ecosystems	Up-to date baseline coastal zone GIS system	(EPA-SL), MAFFS, MFMR, NMA, MWR, MLCPE, MWHI, LC	100,000	2
		3. Zone plans developed	3. Develop action area/zone plans for various ecosystem and development areas	3. At least 5 action area/zones included in the regional, local and special area plans	(MFMR), NMA, MWR, MLCPE, MWHI, LC	10,000	2
		4. Urban environmental profiles for all towns developed	4. Develop urban environmental profiles to facilitate planning for various activities	4. State of the urban environment profiles (Freetown, all district HQ towns)	EPA-SL) , MFMR, MLCPE, MWHI, LC, ME, MAFFS	150,000	2
		5. Coast regional physical development plan generated	5. Develop physical development plan for the coast	5. Coast regional physical development plan	MLCPE,	50,000	2
		6. Land capability and land-use plans developed	6. Develop land capability and land use plans	6. Land capability and land-use plans	(MLCPE), MAFFS, MWHI	50,000	2
		7. A strengthened ICZM committee	7. Strengthen the ICZMP Steering committee to assist in development and environmental control	**7.** A strong ICZMP committee	(EPA-SL), MLCPE, ME, MAFFS	75,000	2
		8. Management Information System in place	8. Establish a shared natural resource management information system	8. NRM Information management system	(EPA-SL)	10,000	2
		9. Environmental and socio-	9. Mainstream environmental and	9. Development plans	(EPA-SL), NMA,	15,000	**2**

		economic concerns mainstreamed in planning	socio-economic concerns including climate change in planning and development	incorporating environmental and socio-economic concerns	MLCPE		
	2. Put in place appropriate strategies for managing development and growth in the coastal zone	1. Harmonized development plans for Coastal Districts and Cities	1. Harmonize Coastal District development plans and Coastal Cities development plans	1. Harmonized county and Coastal District development plans	LC, EPA-SL, MLCPE, SLPA,	50,000	**3**
		2. Coastal District Development plans implemented	2. Support implementation of Coastal District Development Plans in the Coast region	2. Coastal District Development plans implementation Programme	LC, EPA-SL	100,000	4
		Inventories of various coastal natural resources prepared	3. Inventorise and profile the available stocks with respect to natural resources	3. Inventories and profiles of available natural resources	(EPA-SL), Relevant MDAs	50,000	2
		4. Critical habitats/ecosystem carrying capacity established	4. Establish the carrying capacity of key critical habitats/ecosystems to control development in critical habitats	4. Critical habitats carrying capacity assessment reports	(EPA-SL), Consultant	150,000	3
		5. Joint enforcement operations	5. Support collaborative enforcement of EIA/ EA and other regulations	5. Number of joint enforcements	(EPA-SL), NMA	50,000	5
		6. M &E tools developed	6. Develop ICZM Monitoring and Evaluation tools	6. ICZM M & E tools	(EPA-SL), Consultant	20,000	1
	3. Strengthen the capacity of institutions responsible for coastal planning and development	1. Capacity for institutions with planning mandate supported	Support capacity development plan for all institutions with planning mandate	Capacity development plans	MLCPE, LC/ Authorities and all stakeholders	20,000	1
	4. Coordinate implementation of the national land policies to address issues of land tenure	2. Land tenure issues in the coastal region addressed	Implement Land policy to address land tenure issues in the coastal region	Reduction in land tenure issues in the coastal zone	(MLCPE), LC/ Authorities and stakeholders	50,000	2
2. Provision of	1. Promote and	1. Environmental standards	1. Enforcement of environmental	1. Compliance with	EPA-SL, private	50,000	5

infrastructure based on spatial planning	support the provision of amenities and infrastructure based on spatial planning	mainstreamed in infrastructure development projects	regulations and standards in the provision of infrastructure and amenities	environmental quality standards by infrastructure development projects	sector, industries, government agencies, NGOs and all stakeholders		
	2. Promote private-public partnership to undertake ICZM programmes	ICZM PPP strategy	Mainstream the government policy on PPP in ICZM	Number of PPPs initiatives in support of ICZM	(PPP Secretariat) EPA-SL, PPP Secretariat, Private sector	25,000	1
		Mechanisms/incentives to encourage private sector investment developed	Develop mechanisms/incentive s to encourage private sector investment in the use and conservation of natural resources	Number of mechanisms/incentives developed and implemented	EPA-SL, private sector, lead institutions and stakeholders	100,000	2
3. Coordination and Communication Mechanisms amongst stakeholders	1. Ensure the support and involvement of relevant administrative bodies and sectors concerned with the management of the coastal area	Environmental management committees strengthened	Strengthen environment management committees (county, regional, etc) to discharge their mandates	Number of environment management committees trained	EPA-SL, LC and ICZM Committee	200,000	5
		ICZM activities included in Performance contracts (PC) of lead and partner institutions	Mainstream ICZM proposed activities into performance contracts of lead and partner institutions	Number of PCs with ICZM activities incorporated	All participating agencies	20,000	5
	2. Ensure the inclusion of communities and all other stakeholders in the planning of coastal zone management programs	Community and other stakeholders planning forum established	Establish a forum for community and other stakeholders participation in planning and access to information	Number of meetings and diversity of participation	EPA-SL and stakeholders	50,000	1
		Community- based development plans	Embrace community demand driven developmental planning approach	Number of Community-based development plans	CMAs, CSOs MLCPE, local government, stakeholders	100,000	1
	3. Promote strategies that will enhance communication among stakeholders	Communication Strategy developed and implemented	Develop and implement communication strategy that supports participatory development planning at all levels	Communication strategy	EPA-SL, MFMR, MTCA, SLMA and other stakeholders, Consultant	40,000	1
Promotion of Sustainable Economic Development							
Strategic Objective	**Action Strategies**	**Expected output**	**Actions**	**Performance/M & E Indicators**	**Responsibility & Partners**	**Cost (US$)**	**Duration (years)**

1. Promotion of community empowerment and sustainable livelihoods	Promote off- shore fishery	Increased exploitation of off-shore fisheries by local fishers	Empower local fishers to venture off-shore	Landings from off-shore fisheries	MFMR, LC, CMAs, NGOs, fisher folk, Private sector	15,000,000	5
	Promote alternative livelihoods	Diversified economic base	Empower local communities to diversify means of livelihood	Number of livelihood options	MFMR, MAFFS, MWR, MoE, LC, All Stakeholders	5,000,000	5
	Introduce mechanisms for co-management, rehabilitation of ecosystems, and sharing of benefits	Well conserved MPAs by CMAs	Establish community managed areas (CMAs) in marine and terrestrial environment	The number of MPAs and CMAs legally registered	NPAA, MFMRLC, CMAs, CBOs and NGOs,	5,000,000	5
	Promote traditional values and practices that ensure sustainable management of resources	Community based ICZM initiatives	Community involvement and participation in ICZM planning & implementation	Number of community based ICZM initiatives	MFMR, LC, CMAs, NGOs, fisher folks	50,000	1
2. Resolving Resource use conflicts and benefit sharing	1. Ensure equity in access to land and water space and use of coastal resources	1. Traditional knowledge and best practices documented and mainstreamed	Document traditional knowledge as well as best practices and mainstreaming into natural management systems	Report & publications on traditional knowledge and best practices	IMBO, NPAA, MFMR, MAFFS, CMAs, CBOs & NGOs,	100,000	1
		2. Equitable access to marine & coastal resources	Promote access and establish benefit sharing schemes	Benefit sharing schemes in place	EPA-SL and all stakeholders	100,000	1
		3. Conflict resolution mechanisms developed	Develop conflict resolution mechanisms	Number of conflict resolution mechanisms	MFMR, EPA-SL, CMAs, NGOs and stakeholders, local authorities	250,000	5
		4. conflict resolution awareness programs conducted	conduct awareness and education programs on conflict resolution	Number of awareness and education programs in regard to conflict resolution	MFMR, NPAA, EPA-SL, CMAs, NGOs and stakeholders	50,000	5
		5. human- wildlife conflicts measures implemented	Support programmes to address human/wildlife conflicts	Number of human/wildlife conflicts incidences	MFMR, NPAA, EPA-SL, CMAs, NGOs and stakeholders	500,000	5
		6. Visitors sensitized on	Establish acceptable code of	Codes of conduct	Traditional leaders,	50,000	0.5

		cultural and religious values	conduct to safeguard cultural and religious values	related to cultural and religious values	Cultural Societies, Consultant		
Conservation of the Coastal and Marine Environment							
Strategic Objective	**Action Strategies**	**Expected output**	**Actions**	**Performance/M & E Indicators**	**Responsibility & Partners**	**Cost (US$)**	**Duration (years)**
Preserve, Protect and Restore the Integrity of Coastal and Mangrove forests	Ensure mainstreaming of the management of critical habitats including coastal forests and mangroves into land use planning	Critical habitats inventories and valuation carried out	Conduct inventories and valuation of critical habitats including coastal forest to generate accurate baseline information	Critical habitats inventories and valuation reports	MAFFS, MLCPE, SLPA, SLMA, MFMR, EPA-SL, NPAA, Research Institutions, Universities, MLCPE, MWR	500,000	3
		Ecologically sensitive areas (ESAs) mapped and Management Plans developed and implemented	Map ecologically sensitive areas (ESA) and develop management plans for the areas	ESA maps and survey reports, Site specific EAS management Plans	MAFFS, MFMR, EPA-SL, MLCPE, University, SLARI, Consultants	100,000	5
		Socio- economic assessment of utilization of critical habitats carried out	Conduct socio-economic assessment of utilization of critical habitats including coastal and mangrove resources	Critical habitats assessment Reports	MAFFS, MFMR, EPA-SL, NPAA, University, Consultants	50,000	1
		Integrated management plans for critical coastal habitats developed	Develop integrated management plans for critical habitats including coastal and mangrove forests	Integrated critical habitats management plans	EPA-SL, MAFFS, NPAA, MLCPE	25,000	0.5
		Existing MPAs network expanded through co-management approach	Expand the current MPAs network through establishment of co-managed MPAs	At least 4 new co-managed MPAs	MFMR, NPAA, MAFFS, in collaboration with relevant stakeholders	50,000	5
		Critical habitats monitoring and evaluation plan developed and implemented	Develop and implement a critical habitats and shoreline monitoring and evaluation plan/strategy	Critical habitats monitoring and evaluation plans	EPA-SL, MAFFS, MFMR, SLMA, NPAA, CMAs, NGOs and CBOs, LC.	500,000	5
		Coastal zone environmental change	Develop indicators for monitoring and reporting on State of the Coast	Coastal zone environmental change	EPA-SL, MAFFS, MTCA, MFMR,	30,000	0.5

		indicators developed	Environment	indicators	NPAA Universities, SLARI, ,		
		MEAs relevant for coastal zone conservation domesticated and implemented	Domesticate and implement MEAs relevant for coastal zone conservation	Number of MEAs domesticated and implemented	EPA-SL, MFMR, MOJ, LRC, Consultant	200,000	0.5
	Promote IWRM strategies to conserve water catchments; coastal and mangrove forests	Stakeholder inventory developed	Develop inventory of stakeholder involved in coastal forest and catchment areas	Inventory of stakeholders involved in coastal forest and catchment areas conservation	MAFFS, MLCPE, MWR, MFMR, NGOs, CMAs, LC	20,000	0.5
		Catchment areas mapped; degraded areas rehabilitated	Map catchment areas and rehabilitate degraded	Catchment maps; rehabilitated areas	MAFFS, MLCPE, MWR, MFMR, NGOs, CMAs, LC, CSOs Traditional leaders,	500,000	2
	Promote multi- sectoral approach in managing coastal and mangrove forest areas	Functional forest conservation PPPs	Forge private- public-partnerships in forest conservation	Number of PPPs in coastal forest conservation	PPP Secretariat, MAFFS, MFMR, LC, CMAs, Private Sector, NGOs	500,000	0.5
		alternative uses of critical habitats fully explored and promoted	Develop and implement alternative critical habitats uses e.g. bee keeping, tourism, etc.	Sustainable alternative uses for critical habitats in place	MAFFS, MFMR, NPAA, Universities, private sectors, consultant,	500,000	2
		Payment for Ecosystem Services (PES) schemes developed and implemented	Develop and implement schemes on Payment for Ecosystem Services (PES)	Number of PES in place	MAFFS, MFMR, NPAA, Private sector	50,000	0.5
	Promote co-management of coastal and mangrove forests	Co- managed conservation areas established	Strengthen community involvement in coastal forest management	Co-managed conservation areas	MAFFS, NPAA, MFMR, LC, CMAs,	100,000	0.5
		Healthy forest systems	Restore degraded critical habitats	Critical habitats rehabilitation plans	MAFFS, NPAA, LC, MFMR, CMAs LA	500,000	0.5
		Developments in forest areas adhering to environmental standards	Enforce EIA and other regulations to conserve forest areas	EIA/Audit reports,	EPA-SL, and lead government MDAs	1,000,000	5

	Strengthen capacity and enforce regulations to foster critical habitats conservation	Enhanced capacity in enforcement of regulations	Invest in capital and human capacity on critical habitats	Capacity building plans	MAFFS, MFMR, NPAA, EPA-SL		0.5
		Critical habitats management guidelines developed	Develop and implement critical habitats management and use guidelines	Critical habitats management guidelines	EPA-SL, MAFFS, MFMR, Universities,	50,000	0.5
		Best practice guidelines for coastal mining developed	Develop best practice guidelines for coastal mining	Best practice guidelines for mining in the coast	EPA-SL, MMMR, NMA,	50,000	0.5
		Informed public on conservation of critical habitats	Undertake critical habitats conservation education and awareness programs	Number of training and awareness programs	MAFFS, NPAA, MFMR, EPA-SL, CMAs, LC,	30,000	0.5
		Established PPP	Forge public private partnerships to co-manage coastal and marine resources	Number of functional PPPs	MAFFS, NPAA, MFMR, CMAs, LC PPP Secretariat,	20,000	1
		Bylaws strengthened to address critical habitats conservation	Strengthen bylaws to provide for critical habitats conservation	Bylaws providing for conservation of critical habitats	LC, MAFFS, MFMR, NPAA, CMAs, CSOs, CBOs, NGOs, EPA-SL,	150,000	2
	Strengthen guidelines on management of wildlife to avoid human /wildlife conflict	wildlife corridors secured and buffer zones established	Secure wildlife corridors and create buffer zone to stem human/wildlife conflict	Number of wildlife corridors secured and buffer zones established	MAFFS, NPAA, NGOs, CBOs, stakeholders	150,000	2
To Preserve, Protect and Restore the integrity of MPAs	Regulate fishing, including trawling, and tourism activities in MPAs	Maximum Sustainable Yields (MSY) established	Assess fisheries sustainability status through stock assessment	Status report	MFMR, MAFFS, LC, NPAA, MTCA, CMAs, Consultants	5,000,000	5
		Critical habitats vulnerability studies conducted	Conduct critical habitat vulnerability studies	Vulnerability assessment reports	MFMR, EPA-SL, MAFFS, MTCA	50,000	1
		Improved management of MPAs	Develop MPAs management plans	MPAs management Plans	MFMR, NPAA, KWS, NGOs Universities, consultants	50,000	0.5
		Enhanced compliance with fishing regulations	Enforce law and regulations on fishing gear	Number of fishing gear complying with fishing regulations	MFMR, LC, CMAs, CSOs, RFOs	1, 000, 000	5
	Promote good land	Improved water quality in	Develop and implement river basin	Healthy River basins	MAFFS, MLCPE,	250,000	5

	management practices that address the erosion problem, causing siltation in River Estuaries	River Estuaries and MPAs	management plans	and MPAs ecosystem	NMA, MMMR, MFMR, NPAA, CSOs, NGOs		
	Ensure good land use practices to manage erosion and minimize sediments loads in river basins	Improved management of both River Estuaries and MPAs	Develop and implement Integrated Management plans for River Estuaries and MPAs	Integrated management Plans for River basins and MPAs	MAFFS, MLCPE, NMA, MMMR, MFMR, NPAA, CSOs, NGOs	1,000,000	5
		Sustainable use of accreted areas	Develop guidelines on use of accreted lands on river banks, beaches e.g. Lumley and Aberdeen	Guidelines on use of accreted land	MLCPE, MTCA, EPA-SL, SLPA	50,000	0.5
Preserve, Protect and Restore the integrity of Estuaries and river basins	Declare estuaries and river basins as conservation/ protected areas with zoning regimes to ensure protection of biodiversity	3 River Estuaries and one Bay declared as Marine Protected Areas and mapped and areas for designation as Ramsar site delineated	Map and designate Sierra Leone River and Aberdeen as a Ramsar site	MPAs, Aberdeen Creek baseline map; Ramsar site	EPA-SL, MFMR, MWR, NPAA, SLPA, MAFFS	50,000	0.5
		Improved management of estuaries	Develop and implement management plans for estuaries e.g. Sierra Leone, Scarcies and Sherbro River Estuaries	MPAs management Plans	MFMR, MAFFS, NPAA, LC, CMAs, EPA-SL in collaboration with relevant stakeholders	5,00,000	5
		Vulnerability and land capability maps developed	Map and zone the Aberdeen Creek based on vulnerability and land capability map	Coastal sensitivity and Zoning maps	EPA-SL, MLCPE, MFMR, MAFFS, NPAA, MTCA, LC, CMAs	100,000	0.4
To improve the Management of Solid waste	Strengthen local authorities to effectively manage urban waste	Strategic installation of solid waste receptors	Strategic installation of solid waste receptors with regular collection programs	Improved waste management	Municipal and local Councils, Masada, MWR, MHS	2,000,000	5
		Solid waste dumping site in place	Acquire, designate and develop landfill	Number of landfills in place	Municipal and local Councils, Masada, MWR, MHS	2,000,000	5
		Solid waste dumping sites relocated for Freetown and identified and	Identify and designate solid waste dumping sites	Number of designated solid waste dumping sites	EPA-SL, Private sector Municipal and local	50,000	0.4

		designated for other coastal towns and villages			Councils, Masada, MWR, MHS		
		Best waste management practices recognized and up scaled	Develop and implement Award schemes for best waste management practices	Award schemes for best waste management practices	AWOL, EPA-SL, SPU STATE HOUSE, Lead MDAs, Municipal and local Councils, Masada, MWR, MHS NGOs, private sector	200,000	5
	Promote public- private sector- partnership in waste management	Improved waste management	Establish solid waste sorting and collection programs based on PPPs	Number of successful partnerships	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS,	1,000,000	5
		Youth groups actively participating in solid waste management	Encourage youth groups to participate in garbage collection and disposal	Number of youth groups actively participating in solid waste management	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	500,000	5
		Pilot Waste recycling programmes developed	Develop and implement garbage recycling projects	Number of pilot Waste recycling programmes	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	500,000	5
	Promote public awareness on good waste management practices	Public training and awareness programs implemented	Develop and implement waste management education and awareness programs	Awareness/ Training reports	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	250,000	5
		Improved public awareness on waste management	Sensitize the public and private sector on EMCA regulations on waste management	Awareness reports	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	200,000	5
		Demonstration sites on best waste management practices	Develop demonstration sites on best waste management practices	Number of demo sites on best waste management practices	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	100,000	5
	Enforce environmental and Public Health regulations (Waste Management) Regulations	Solid waste management regulations enforced	Enforce solid waste management regulations	Number of licenses issued, inspection reports, prosecution reports	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	250,000	5
		Improved compliance with environmental standards	Undertake joint inspection and monitoring missions	Inspection and monitoring reports	LC, Traditional rulers, EPA-SL, MASADA, Private sector, MHS	200,000	5
		Pollution hot spots in the coastal zone mapped	Identify and map pollution (solid wastes and effluent discharge) hot	Inventory of pollution hotspots in the coastal	EPA-SL, LC, Universities, SLMA,	100,000	0.5

			spots	zone	SLPA, MTCA, NTB,		
		Coastal zone pollution prevention and control guidelines developed	Develop coastal zone pollution prevention and control guidelines	Coastal zone pollution prevention and control guidelines	LC, Local Authorities, EPA-SL, Universities Research Institutions,	50,000	0.5
		Classification and zoning of sites based on pollution sources done	Classification and zoning of sites based on pollution sources, levels, types and potential threats	Sites classified and zoned	EPA-SL, Universities, Consultants	50,000	0.5
Improve Water quality	Promote Integrated wastewater management strategies to safeguard water quality	Sewerage infrastructure in place and functional	Expand and refurbish the sewerage infrastructure and connectivity	Number of sewerage infrastructure refurbished	MWR, Local Authorities, EPA-SL, Research Institutions	1,000,000	1
		Best practice models for Municipal Waste Water Management (MWWM) developed and implemented	Develop and implement best practice models for Municipal Wastewater Management	MWWM models in place	MWR, LC, Municipal councils, EPA-SL, MASADA, Private sector	1,000,000	1
		Pilot areas for interventions identified	Identify pilot areas for interventions: including collection, treatment and disposal of effluent	Pilot areas for collection, treatment and disposal of effluent	MHS, MWR, LC, Municipal councils, EPA-SL, MASADA, Private sector	100,000	0.5
		Adoption of appropriate MWWM systems and cleaner production technologies	Build capacity and create stakeholder awareness on appropriate MWWM systems and cleaner production technologies	Number of training and awareness meetings	MHS, MWR, LC, Municipal councils, EPA-SL, MASADA, Private sector	250,000	1
		MWWM systems improved	Improve/rehabilitate existing wastewater systems where necessary	Number of wastewater management systems improved	MHS, MWR, LC, Municipal councils, EPA-SL, MASADA, Private sector	1,000,000	1
		Improved wastewater management	Construct appropriate wastewater management systems in Freetown and other coastal cities	Number of new sewerage systems constructed	MHS, MWR, LC, Municipal councils, EPA-SL, MASADA, Private sector	2,000,000	2
	Enforce Environmental and health & water quality management Regulations	Improved public awareness and compliance to Water quality regulations	Create public awareness on Water quality regulations	Awareness reports	MHS, MWR, LC, EPA-SL, MASADA, Standards Bureau, Municipal councils,	200,000	5

					Private sector		
		Regular inspections carried out	Carry out regular inspections to enforce Water Quality Regulations	Number of inspections	MHS, MWR, LC, EPA-SL, MASADA, Standards Bureau, Municipal councils, Private sector	250,000	5
		Amount of ground water resources in the coastal zone established	Carry out an assess of available ground water resources in the coastal zone	Ground water resources data and assessment reports	MHS, MWR, LC, EPA-SL, MASADA, Standards Bureau, Municipal councils, Private sector	250,000	0.5
		Water harvesting pans established	Establish water harvesting pans	Number of pans established	MHS, MWR, LC, EPA-SL, MASADA, Standards Bureau, Municipal councils, Private sector	1,000,000	2
		Improved awareness on rain water harvesting technologies	Sensitize the public on rain water harvesting technologies	Number of sensitization meetings	MHS, MWR, LC, EPA-SL, MASADA, Standards Bureau, Municipal councils, Private sector	250,000	2
	Promote public awareness on the importance of protecting natural water systems	Enhanced public awareness	Undertake public sensitization and awareness programmes	No. of sensitization meetings	EPA-SL, MWR, NPAA, LC	250,000	5
		Increased water availability	Restoration of degraded water catchments	Size of water catchment area restored	MWR, MAFFS, LC	500,000	2
		Enhanced capacity on IWRM	Capacity building on integrated water resource management (IWRM) through training	Number of trainings/forums	MAFFS, MWR, MFMR,	250,000	2
		Waste water treatment plants established in urban centers	Establish waste water treatment plants and promote waste water recycling in urban areas	Number of new wastewater treatment plants established	LC, NGOs, MWHI, MWR, Municipal Councils	2,000,000	5
	Promote the implementation of oil spill contingency plan	Petroleum Directorate capacity strengthened	Strengthening capacity of Petroleum Directorate and other institutions to respond to Oil Spill incidents	Effective Petroleum Directorate	EPA-SL, SLPA, SLMA, MFMR, JMC, Petroleum Directorate, other stakeholders	2,000,000	5

		Valuation of key resources/habitats done	Conduct resource valuation to inform processes seeking compensation	Resource valuation reports	Universities, SLARI, IMBO MAFFS, Consultant, SLMA, SLPA, MOJ	150,000	0.5
Environmental Risks and Management of shoreline change							
Strategic Objective	**Action Strategies**	**Expected output**	**Actions**	**Performance/M & E Indicators**	**Responsibility & Partners**	**Cost (US$)**	**Duration (years)**
To Minimize the Impacts of Shoreline Change	Develop and implement a Shoreline Management Plan/Strategy	Assessment of extent and magnitude of shoreline change assessed	Conduct assessment of extent and magnitude of shoreline change and impacts on bio- physical and socio- economic dimensions	Assessment reports and maps on shoreline change	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants	50,000	2
		Information available to guide development of future shoreline change mitigation measures	Document successes and failures of mitigation measures for the purpose of sharing information and informing future mitigation plans	Defined setback requirements; Shoreline change mitigation plans	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants	100,000	2
		Improved shoreline management	Implement Shoreline restoration measures on selected areas as well as monitor the status of restored habitats	Number of successful shoreline restoration measures	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants	50,000	5
		Information on available expertise on shoreline management	Develop awareness and network of existing expertise on shoreline management in the region	Database of experts and institutions	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants	50,000	0.5
		Enhanced capacity in shoreline change management and restoration	Building and strengthen scientific and technical capacity on shoreline change management, mitigation, restoration and monitoring	Training reports; number of trained staff	EPA-SL, MLCPE, SLPA, Universities, LC, NGOs, Consultants	500,000	5
		Increased capacity to address shoreline change	Build partnerships and collaborate with regional and international bodies to address shoreline change in the country	Existing partnerships and agreements to address shoreline change	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants, Private Sector	100,000	5
		Informed public about shoreline change and its effects	Create awareness among stakeholders to ensure key concepts/aspects of shoreline change are understood	Awareness reports	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants	250,000	5
	Harmonize, strengthen and	Compliance with shoreline development regulations	Enforce existing regulations on shoreline management and	Planned and controlled shoreline development	EPA-SL, MLCPE, SLPA, Universities,	100,000	1

	enforce the regulations guiding shoreline development		development		LC, LRC Consultants, AG' Office,		
		Shoreline change mitigation measures developed	Develop guidelines for implementation of shoreline change mitigation measures	Guidelines for shoreline change mitigation	EPA-SL, MLCPE, SLPA, Universities, LC, Consultants	200,000	2
To mainstream climate change mitigation and adaptation measures into coastal development plans and programmes	Develop and implement a strategy for protection of the coastal area against the impacts of climate change	Extent and magnitude of climate change in the coastal zone established	Assessment of the extent and magnitude of climate change and its impacts in the coastal zone	Assessment reports	MTA, EPA-SL Lead MDAs, NGOs, CBOs, Universities, Consultants, Met and Climate Change Office	5,000,000	5
		Sensitive and vulnerability areas established	Undertake sensitivity and vulnerability assessment of the coastal area against the impacts of climate change	Sensitivity and vulnerability assessment reports/maps	MTA, EPA-SL, NGOs Lead MDAs, CBOs, Universities, Consultants, Met and Climate Change Office	100,000	1
		Climate change mitigation/adaptation measures implemented in selected areas	Develop and implement climate change mitigation & adaptation measures in selected areas (mangroves planting, water conservation measures, etc)	Climate change mitigation and adaptation plans; Adaptation and increased resilience to climate change	MTA, EPA-SL, NGOs Lead MDAs, , CBOs, Universities, Consultants, Met and Climate Change Office	500,000	5
		indicators for climate change developed and put into use	Identify and develop appropriate indicators for climate change in the coast	Checklist of climate change indicators	MTA, EPA-SL, NGOs Lead MDAs, , CBOs, Universities, Consultants, Met and Climate Change Office	100,000	1
		Informed public in on climate change and its impacts	Compile and dissemination of information on climate change to stakeholders and general public	Information materials on climate change, impacts, mitigation and adaptation measures; sensitization meetings reports	MTA, EPA-SL, NGOs Lead MDAs, , CBOs, Met and Climate Change Office Universities, Consultants,	250,000	5
		(Improved information sharing and response to	Document successes and failures of climate change mitigation and	Documentation of successes and failures	MTA, EPA-SL, NGOs Lead MDAs,	50,000	1

		climate change	adaptation measures for sharing lessons and inform future plans	of climate change mitigation and adaptation measures	CBOs, Universities, Consultants, Met & Climate Change Office		
		Improved capacity to address climate change issues	Building and strengthen scientific and technical capacity to respond to climate change	Capacity building plans; number of scientists/specialists in climate change;	MTA, EPA-SL, NGOs Lead MDAs, ONS, CBOs, Universities, Consultants, Met & Climate Change Office	250,000	2
		Partnerships with regional and international bodies established	Build partnerships and collaborate with regional and international bodies to address climate change in coastal zone	Number of partnerships;	MTA, EPA-SL, NGOs Lead MDAs, MFAIC, CBOs, Universities, Consultants, Met & Climate Change Office	200,000	2
		UNFCCC domesticate and implemented	Domesticate and implement UNFCCC provisions to address climate change in coastal zone	Reports on UNFCCC domestication and implementation status	MTA, EPA-SL, NGOs MOJ, CBOs, LRC, Lead MDAs, Universities, Consultants, Met and Climate Change Office	250,000	2
		Improved management of disasters/enhanced response to disasters	Prepare and implement disaster Response Plans (including early warning systems- Tsunami, droughts, floods)	Disaster Response Plans; disaster early warning systems	MTA, EPA-SL, ONS, NGOs Lead MDAs, CBOs, Universities, Consultants, Met and Climate Change Office	1,000,000	5
Capacity Building, Information and Public Participation							
Strategic Objective	**Action Strategies**	**Expected output**	**Actions**	**Performance/M & E Indicators**	**Responsibility & Partners**	**Cost (US$)**	**Duration (years)**
1. Education, Awareness and Information	1.Develop and implement an ICZM education and	1. Capacity and training needs established	1. Conduct ICZM capacity and training needs assessment for different target groups	1. ICZM Capacity and training needs Assessment Report	EPA-SL, Lead institutions, NGOs, Universities	10,000	0.5

Programs on Coastal Zone Management	awareness strategy	2. ICZM education and awareness materials developed	2. Develop assortment of ICZM education and awareness materials for different target groups	2. Assortment of ICZM Education and awareness materials	EPA-SL, Lead institutions, NGOs, CBOs, MEST, TEC, Universities	500,000	2
		3. Active participation by schools and community groups in conservation – clean-ups, etc.	3. Conduct training and awareness on ICZM targeting different groups- schools, community groups, public, managers and policy makers	3. Awareness reports; numbers of groups, schools, managers, policy makers sensitized	EPA-SL, Lead institutions, NGOs, CBOs, Universities	50,000	5
		4. Key sites identified and conservation measures instituted near urban centers	4. Establish flagship conservation sites and environmental education centers especially near urban settings	4. Key conservation sites; conservation plans; Environmental. Education centers	EPA-SL, NGOs, Lead MDAs, Universities, Research Institutions,	500,000	5
		5. ICZM mainstreamed in learning institutions curricular	5. Promote coastal zone management as a topic for study and career development in learning institutions to ensure future capacity	5. Experts/ specialists in ICZM	Ministry of education, Academia, NEMA	500,000	5
		6. Environmental Science Degrees (ESD) adapted in ICZM	6. Adapt ESD in ICZM	6. ESD adapted in ICZM	MEST, Universities	1,000,000	5
	2. Mainstream traditional knowledge and practice in the conservation & management of coastal zone	7. Document role of traditional knowledge and practice in conservation & management of coastal resources	7. The role of traditional knowledge and practice in conservation appreciated	7. Publications and reports role and application of traditional knowledge and practice in conservation	Research Institutions, Universities, EPA-SL, MFMR, SLMA, SLPA, MAFFS, NPAA, MTCA, MLCPE	500,000	5
	3. Promote the integration of environmental best practices into socio-economic development	8. Best environmental practices identified and documented	8. Identify and document environmental best practices and EMS	8. Report on Environmental best practices and EMS	EPA-SL, All lead Institutions, Consultant	500,000	5
		9. Best environmental practices recognized and appreciated	9. Develop and implement incentives and awards schemes for best environmental practices	9. Best environmental practices Award Schemes	EPA-SL, All lead institutions, Universities, NGOs	50,000	5

	activities	10. Best practices adopted widely by public, private sector	10. Promote adoption of best practices in the coastal region through education & awareness projects	10. Best environmental practices monitoring reports	EPA-SL, All Lead institutions	250,000	5
2. Research and monitoring programs on the coastal zone	4. Promote coordinated generation and dissemination of data and information for use in planning and decision making	11. Knowledge and understanding of the coastal zone fostered through research	11. Promote and support research to inform policy and resource management projects and programmes	11. Research Reports, Policy briefs	Universities, NGOs, Research Institutions, CBOs, private Sector	100,000	2
		12. Networking and lesson sharing Forum established	12. Establish a Forum for networking and lesson sharing between research scientists, managers & policy makers	12. Active Forum sharing information of coastal zone management	EPA-SL, NGOs, Media, Universities, Research Institutions	500,000	5
		13. Baseline Coastal zone GIS developed and maintained regularly	13. Develop and maintain baseline GIS for coastal zone to support ICZM activities	13. Up-to date baseline coastal zone GIS system	EPA-SL, Consultant	25,000	0.5
		14. Inventory of Stakeholders involved in coastal zone conservation	14. Prepare inventory of Stakeholders involved coastal zone conservation and programmes undertaken & update it regularly	14. Web-based inventory of Stakeholders involved in coastal zone conservation and management	EPA-SL, Consultant,	20,000	0.5
Institutional and Legal Framework for ICZM							
Strategic Objective	**Action Strategies**	**Expected output**	**Actions**	**Performance/M & E Indicators**	**Responsibility & Partners**	**Cost (US$)**	**Duration (years)**
Instituting Legal Framework for ICZM	Review and harmonize sectoral laws and develop ICZM legal framework	Integrated Coastal zone Management Legislation developed	Enact Integrated Coastal zone Management (ICZM) Legislation	ICZM Legislation	(AG's Office), LRC, House of Parliament, EPA, Legal Consultant	**100,000**	**1**
Strengthen institutional framework in support of ICZM	Put in place and strengthen institutional framework in support of ICZM	ICZM Steering Committee legalized and strengthened	Legalize & strengthen ICZM Committee to assist EPA-SL in overseeing implementation of the ICZM framework activities	Gazetted ICZM Steering Committee	AG's Office, House of parliament, EPA, and all stakeholders represented at the committee	40,000	**2**

		Lead institutions & Environmental Committees strengthened to implement ICZM activities	Strengthen capacity of Lead institutions & Environmental Committees to implement ICZM framework activities	Lead institutions & Environmental Committees capacity building plans and reports	(EPA-SL), MFMR, SLMA, SLPA, MAFFS, NPAA, NGOs, MLCPE, MMMR,	1,500,000	**2**
	Finance the operations of the ICZM institutional framework	OICZM framework activities funded	Develop and implement funding mechanism for ICZM framework activities	Funding mechanism for ICZM activities	(MoFED), EPA-SL, GEF, Envtl. NGOs, Private sector	5,000,000	**5**

Section 8: Monitoring and Evaluation

Introduction

Successful implementation of the strategic plan will depend on how effectively the planned activities and outputs are monitored and evaluated with a view to ensuring that the plan implementation remains on course. The purpose of monitoring and evaluating the ICZM Action Plan will be to ensure effective and efficient implementation as well as ensure environmental concerns are mainstreamed into development process. An effective and results based monitoring and evaluation system will be set up that will guarantee continuous monitoring using the identified indicators.

Institutional Framework for Monitoring and Evaluation

EPA-SL jointly with MFMR will spearhead a process to have the ICZM Steering Committee legalized and strengthened to assist in ensuring effective implementation, monitoring and evaluation of the action plan. EPA-SL will ensure monitoring and evaluation of activities is done in the most efficient manner with regular meetings held to discuss the action plan implementation. It will be organizing meetings of the ICZM Steering Committee once every quarter where progress towards achievement of the various strategic objectives will be evaluated and necessary recommendations made to ensure implementation of the Plan is on the right track. The Committee will advise on whether existing or new approaches that have been developed and adopted are working effectively, implementation challenges encountered and possible remedies.

Data Collection, processing and storage

Data will be collected through secondary sources, field visits, workshops, exchange visits, rapid surveys and in depth investigation. All collected data will be processed and analyzed through use of computerized system. In order to guarantee efficient repository of generated information, EPA-SL will maintain databases that capture the information needed for M & E.

Progress Reports

Monitoring of the plan implementation will be done on a continuous basis and an annual report prepared at the end of each financial year. The report shall capture information on achievements made against set targets; documentation of best practices for purpose of replication; challenges and recommendations on the way forward. There will be a mid-term evaluation of the ICZM Action Plan and a review of the same after five years.

Communication and dissemination of information

EPA-SL shall put in place an information sharing and communication strategy to ensure that information derived from projects implementation is widely disseminated to inform and influence policy decisions; foster community awareness; change attitude towards environment and promote replication of best practices. Forums like meetings, review workshops, retreats and seminars will be organized regularly for the ICZM Committee, the Environment Board and stakeholders to share findings and recommendations from different projects.

Other channels like newsletters, news releases, press conferences, public debates and electronic (e-mails internet, websites) transmission mechanisms will also be used.

Conclusion

In the last decade a great number of actions and important management measures have been taken to improve the state and outlook of Sierra Leone's coastal and marine environment by different sectors of government. Several other initiatives within the country, by development partners and collaborators, have augmented and assisted in the realization of a healthier environment for sustainable economic and social development. The actions advocated in this plan are towards addressing the gaps which have resulted I the stand alone management regimes that have been implemented in the past and to coordinate the efforts and actions of all stakeholders in the management of the coastal and marine environment.

Sierra Leone is already developing and implementing improved management strategies in order to mainstream environmental concerns into national policy, regulatory, and institutional mechanisms that are critical to achieving sustainable results. These include improvements in many of the regulations governing the marine environment, designation of new Marine Protected Areas and proposals for several coastal protected areas. Improved regulations also require focused enforcement efforts to assist in sustaining gains in environmental protection, rebuilding stocks, and maximizing the long-term benefits of the goods and services provided by the ecosystem.

Overexploitation of natural resources from the coastal and marine areas is still the single greatest threat to the marine environment. This is predicated on overwhelming dependence by rural and coastal communities on such resources in the face of widespread poverty and limited opportunities for alternative livelihoods. The resultant environmental degradation could however be reversed by a strong political will to addressing the identified trans-boundary issues as demonstrated by the participating countries in the GCLME within the last decade. Notable is the increased awareness of environmental problems by both the government and the populace and a growing commitment to allocate the necessary resources to resolving current problems and tackling proactively other emerging issues.

Such issues requiring priority attention include the potential threats of invasive species, marine litter, increasing uncontrolled coastal development leading to habitat degradation and changing land-use patterns, and climate change. There is increasing evidence that global climate change is beginning to affect the GCLME region and Africa at large by its impacts, although there is still some uncertainty about the extent and severity of such impacts.

However, the vulnerability of the region and risks associated point to a need for adequate preparedness through long-term integrated and cost effective adaptation policies and plans that are robust within a wide range of possible changes in climate conditions.

Recommendations

1. Sierra Leone should develop and implement local and national policies and strategies for long-term environmental protection. These should include measures for regular attention, weekly and monthly, by entire communities, municipalities and cities to collective actions and strict compliance to such by the populace.

2. Sierra Leone should review some of the sector policies and legal frameworks in the light of the required collaboration and coordination of the roles and functions of the MDAs. It is now clear that no one Agency can efficiently function as a standalone agency. Some of the policies and legal frameworks reviewed in the work require a review.

3. There is need to improve municipal water treatment and disposal to prevent microbial waterborne pathogens from causing epidemic as well as endemic disease through contamination of seawater and seafood.

4. Develop a coastal monitoring system to capture the trends in coastal erosion, pollution loading by pesticides, industrial contaminants and any new contaminants being introduced into the coastal environment.

5. Build the capacity of the Universities to be able to provide the expertise and services required to support effective environmental management by policy makers and implementers.

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