



ETUDE DE SUIVI DU TRAIT DE COTE
ET SCHÉMA DIRECTEUR LITTORAL
DE L'AFRIQUE DE L'OUEST

DIAGNOSTIC NATIONAL
EN SIERRA LEONE



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Dr. Raymond G. Johnson

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ACKNOWLEDGEMENT

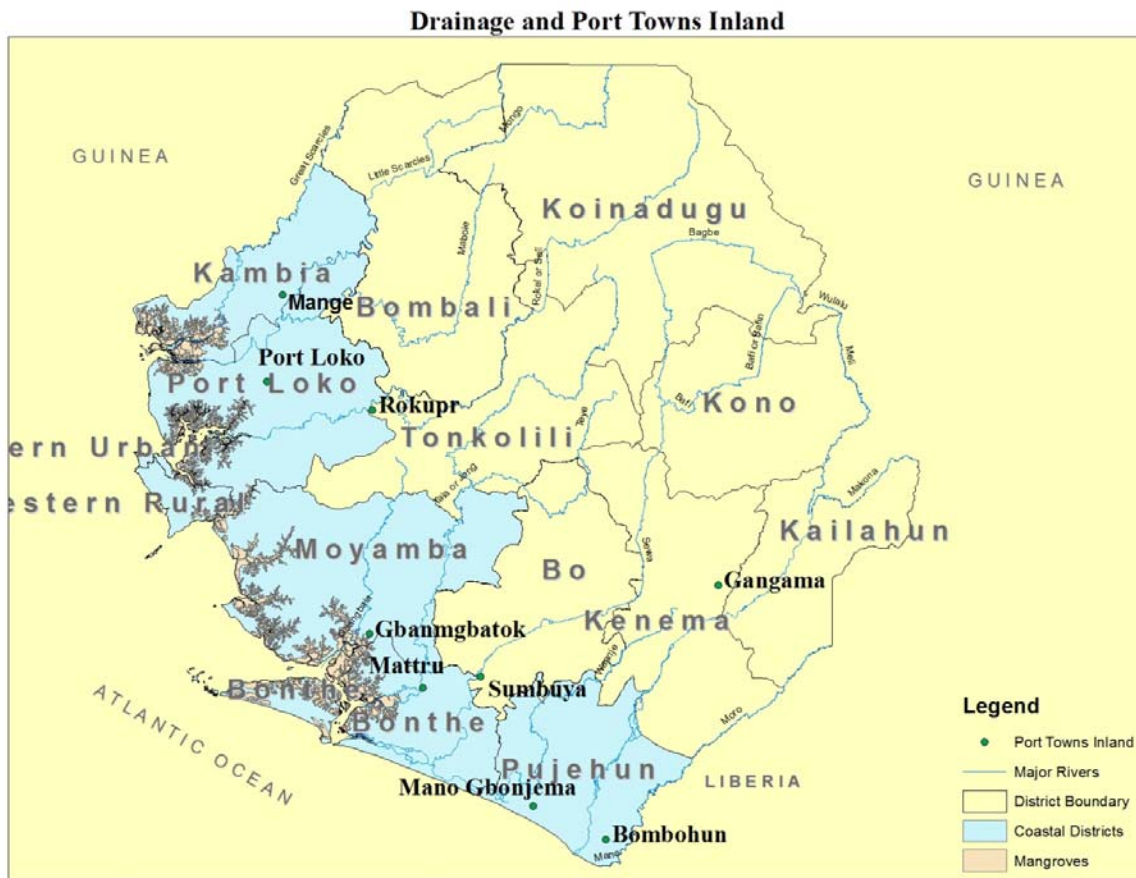
Sierra Leone lies between latitude 7°N and 10°N and longitudes 10°W and 13°W. The estimated total area is 72.325km². The continental shelf is about 125km wide in the North around Yeliboya and tapers to only 13km at Sulima in the South. The coastline is part of the submerged coast along West Africa, stretching from Dakar (14° 13N/17° 27W) to Monrovia (6° 20 N/10° 46 W). The shelf itself is about 560km long and the shelf covers an area (to 200m depth) of 30,000km².

The Exclusive Economic Zone (EEZ) is 155,700km². The shoreline consists of a Western and Eastern part. The Western part has two (2) large estuarine systems separated by Rocky and Sandy coastline and the Eastern part consists of about 280km of almost unbroken steep sandy coast, backed with swamp communities. There is one large estuary in the Eastern part of the coastline. Some 200,000 – 300,000ha of mangrove swamps fringe the coastline. The drainage system consists of a series of rivers from North to South including the following: Great Scarcies, Little Scarcies, Rokel, Jong, Sewa, Moa and Mano. In addition there are numerous streams including Ribbi, Kukuli, Gbangbar and Wanje. The three (3) main estuaries are part of the following riverine systems; Scarcies, Rokel, and Sherbro. There are also numerous small estuaries, creeks and lagoons. All rivers flow from North – East to South-west. The river flow is not smooth and there are many interruptions by sand banks, rapids and rocks. Navigable aspects are usually confined to the lower reaches and the mouth.

Table 1 : Major Rivers and Navigable Portions Upstream.

River Basin	Length (km)	Navigable Distance (km)	Port Town Inland
Great Scarcies	160	38	Rokupr
Little Scarcies	280	48	Mange
Rokel	380	75	Port Loko
Jong/Taia	300	39	Mattru
Sewa	430	103	Sumbuya
Wanje	200	115	Mano Gbonjema
Moa	320	19	Gangama
Mano	180	26	Bombohun
Bagru	84	36	Gbangbatoke

Map 1: map of Sierra Leone showing the major river networks, coastal districts and locations of Port Towns Inland.



The periodic and non-periodic movements of the waters of the Sierra Leone continental Shelf play a very important role in the erosion, transport and redistribution of the sedimentary material in the coastal area.

The surface waves and the long waves, among these mainly the tidal waves, belong to the periodic water motions. The non-periodic water motions include wind-generated currents, gradient and density currents as well as the currents of the surf zone, especially long-shore currents.

On the shores of Sierra Leone waves are generated by the local monsoon especially during the squally period of May-June and August-September and the swell generated by storms during the dry season in the southern part of the North Atlantic (Johnson, R.G. Unpublished dissertation, 1988). The swells reaching the coast have periods varying between 8 to 13 seconds with an average of 10 to 12 seconds. Wave heights in deep water average 0.25 – 1m. However, heights of 2 to 3 meters or more occur with directions between south and southwest especially during stormy months.

The eroding effects of the surface waves in the region seldom reach deeper than to a water depth of 10m, which means it is effective only in the shallow offshore zone. The area influenced by breakers is restricted to the still smaller strip of the surf zone, but here it is extremely effective and acts together with the long-shore current that carries the sediment

which has been put in suspension by the breakers. Locally, the horizontal component of the tidal waves, the tidal current is also capable of eroding and carrying off the eroded material into the deep water even by weak residual currents. The region is dominated by the semi-diurnal tide with an appreciable daily inequality (0.04 to 0.34 meters) and an average range of about one meter.

Currents are driven by the south-west monsoon and flow generally from northwest to southeast. Local variations in the strength and even temporary reversal of the current near the coast are caused by corresponding variations in wind force and direction. The meeting of the fresh river water and the saline sea water gives rise to density currents which can be effective in transporting sediments to great depths.

Coastal currents, and mostly the Guinea current here, are responsible for the redistribution of the sedimentary material brought down to the ocean by the rivers and the large amounts of mainly terrigenous material also made available through intensive erosion by constantly breaking waves of high destructive force. Surface current velocities are between 0.3 m/s to 0.55 m/s with a predominant north easterly direction. Near-bottom current velocities were between 0.05 m/s and 0.15 m/s with a north-westward flow. The influence of the tidal current is greater in the coastal areas and needs to be given more attention.

The effects of sea level rise is clearly manifested in the south along Turner's Peninsula where the church at Ma-Bap which was some 100m inland about 20 years ago is now almost in the sea. A rough estimate indicates that sea level has been rising at a rate of between 0.2 – 0.5cm/yr. Plantain Island has reduced to one third (1/3) of its original size in the last 100 years.

The maritime sub-sector is currently unable to play an effective role in trade, economic development and regional integration due to challenges posed by aviation security, safety concerns, deteriorating physical infrastructure and lack of technical expertise to remove the silts, sand bars and wrecks in the coastal and inland waterways of Sierra Leone.

During the past fifty (50) years, the coastline of Sierra Leone and the inland waterways have experienced severe erosion and heavy siltation thereby posing a series of problems and challenges in the maritime sector.

Consultants have made quick assessments of the erosion and siltation on the coast and inland waterways.

Sierra Leone has a submergence coastline with many drown valleys and offshore Islands (Yeliboya, Banana, Plantain, Bonthe and Turtle). The coastline is indented with creeks, bays and estuaries. With the exception of a few rocky out-crops, there are extensive sand and mud flats in estuarine systems.

The coastal geomorphology is such that there is a seaward advance of shore line (propagation) leading to the deposition of sand, silty clays and clays seaward to beyond 20m (depth) and 50m offshore in the North and 5km South. It is such sediments that are colonized by mangroves. Siltation is particularly high at the mouth of estuaries.

However in some areas including bays and open ocean fronts there is increased wave activity and coastal erosion.

Conservative estimates of coastal siltation and sedimentation rate during the last 50 years is between 2cm per annum on the coast to as high as 4cm per annum in estuaries. Coastal deposition and erosion depends on ocean dynamics (wave and tidal activity) as well as on anthropogenic activities including coastal infrastructural development (construction) and loss of mangroves through deforestation. There is loss of habitat including fish breeding and nursery sites.

Figure 1 : map of Sierra Leone coastline

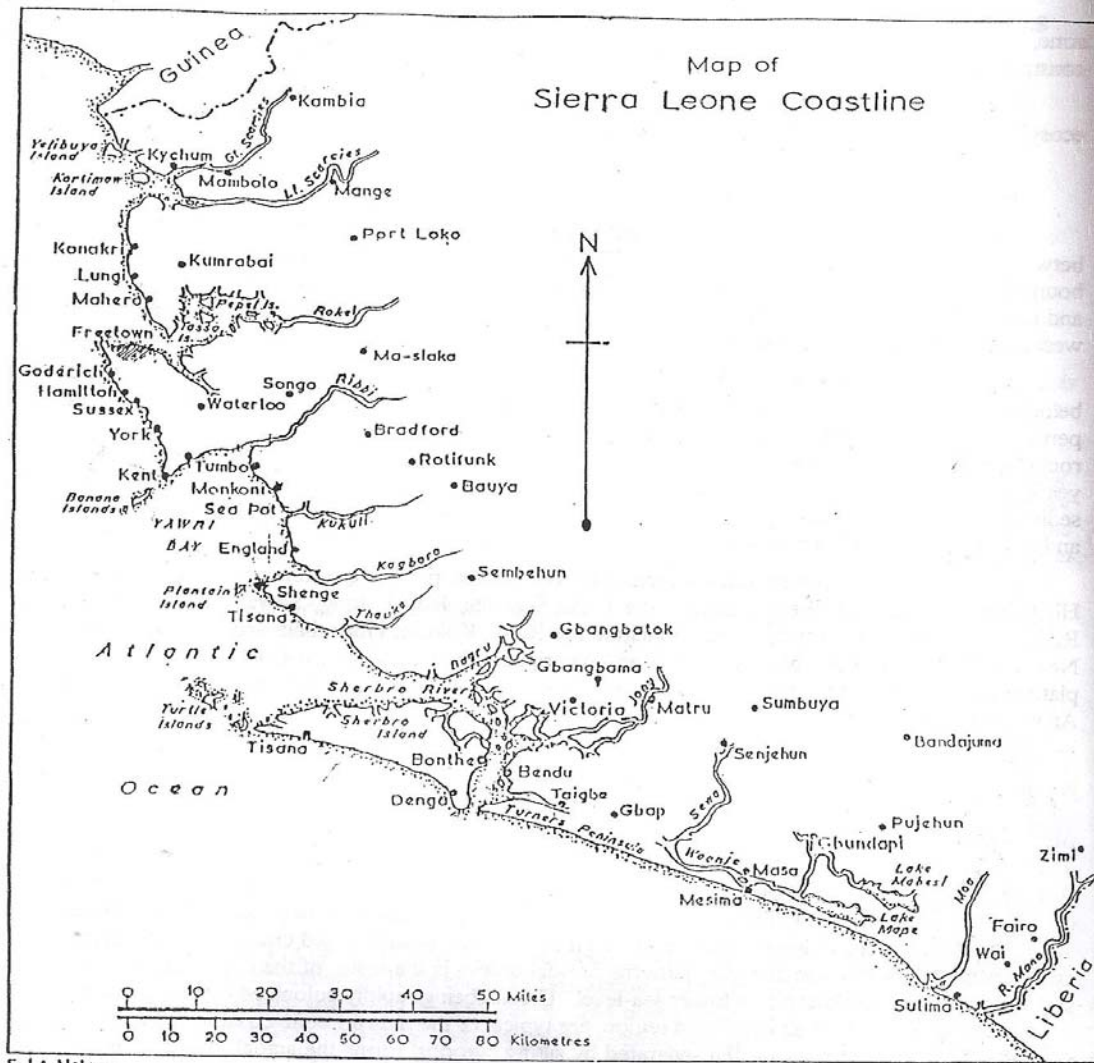


Fig. 1. Map of Sierra Leone coastline

The Bullom Peninsula is a distinctive sub-region, comprising both swamp and sand ridge areas, but dominated by a low, laterite-capped plateau which terminates seaward in cliffs. It is possible that this is an uplifted deltaic deposit, although it lies at approximately the same level as the main raised beach of the Freetown Peninsula, and may be of similar origin.



Some coastal towns including Goderich, Tombo, Hamilton, Lakka, Shenge and Bonthe pose engineering challenges when landing sites must be constructed due to siltation and sedimentation. The advancing wave fronts at Hamilton, Lakka, Shenge, Bonthe, Plantain Island, Banana Island, Kortimaw, Konakridi, etc have led to destruction of coastal infrastructure, sites of historical and archaeological importance and threaten others.

In the estuaries the rate of siltation and sedimentation is generally determined by the type and size of estuary, the volume of river discharge and the prevailing ocean dynamics influencing the mouth of the estuaries. Anthropogenic activities vary from place to place within a particular estuary and coastline.

Two rivers (Great and Little Scarcies) located in the North merge towards their mouth before emptying into the Eastern Atlantic through a shallow coastal plain as the Scarcies Estuary. Both rivers have a total catchment area of 20,230km² and a total annual discharge of 750,000m³ year⁻¹.

In the Scarcies system, some 35,000ha of mangrove swamps have been lost to swamp rice farming, construction and fuel (fire wood and charcoal) production. Fishing is also prevalent. Important rice production areas include Babara, Mambolo and Rokupr. The Yeliboya Island has changed contours several times. The Jetty at Kychum has almost been destroyed and new one is to be constructed.

The Rokel River Estuary is a drowned river estuary that is formed from three (3) main rivers (Port Loko, Rokel River and Bunce River), many creeks and streams.

The Estuary is about 259km² in area at its widest point (mouth) before it empties into the Eastern Atlantic is 11km. The deepest channel (35m) occurs in the south at the lower

reaches at Cline Bay. The tidal amplitude at Freetown ranges from 0.9m at lowest to 3m at highest springs, with a mean of about 1.9m. Tidal currents are appreciably strong.

It is these currents that keep the Queen Elizabeth II Quay clean and deep. The bottom deposits of the estuary is from sand or shelly sand from outside the mouth through mud in the middle reaches to coarse in the upper reaches.

In the Rokel River estuarine systems, coastal infrastructures (Jetties, Ports, Tourist Resorts, Bridges, Waste Disposal Facilities), rice farming and fuel wood activities have compounded the siltation problems in addition to the estuarine dynamics. Fishing is also prevalent.

Numerous sand bars have emerged leading to shallow and narrow water lanes. Important landing sites that have been affected include Port Loko, Peppel, Queen Elizabeth II Quay, Kissy Ferry Terminal and Government Wharf. In the Yawri Bay at Shenge and Katta the sea frost is advancing and threatens coastal infrastructure.

The Sherbro estuary is an estuarine complex located in the south. It receives discharges from various rivers and streams among which are the Kittan, Jong and Wanje. The Kittan forms a common estuarine channel with the Sewa and Wanje rivers. The estuary is of considerable commercial importance as a navigable waterway. The mouth of the estuary is about 6km at Bendu and the opposite bank (Bonthe Island) where Bonthe Town, the District capital is found. The estuary is about 80km long as far as Lake Mape. The average depth is about 3m and not more than 7m around Gbap (20km from mouth).

The Sherbro Estuary is under the influence of semidiurnal tidal regime that would be as high as 2m. There is heavy siltation at the mouth of the estuary around Bonthe thereby reducing the depth to less than 2 – 3m at high tide in the rainy season. The sand is coarse and extends for more than 5km up the Sherbro River. In the middle courses are mud sand/sediments. Siltation rate may be as high as 4cm yr⁻¹. Bonthe District has ocean fronts as well as extensive waterways.

There are intense fishing activities in Bonthe District in addition to Rice and Vegetable farming and palm oil production. There is intense alluvial diamond mining activities going on along the Sewa River leading to increased siltation. The Jong is close to rutilite and bauxite production sites. There are sites of mangrove swamp rice farming and fuel wood production. There are also numerous landing sites and jetties (Bonthe, Gbangbatoke, Mattru Jong, Gbondapi, Tei, Gbap etc).

Heavy siltation can lead to shallow and narrow waterways and channels. This limits access to navigation and landing facilities to only smaller narrow bodied vessels with small draughts. Smaller boats carry only limited load and the numbers must keep increasing to meet with increased demand if siltation is allowed to continue unabated. Increased traffic increases the risks of accidents at sea. Sierra Leone's coastal waters have a significant number of wrecks and the navigation aids are yet to be fully deployed along the major waterways.

PART I. ANSWERS AND DEVELOPMENTS

1.1 PROTECTION AGAINST COASTAL EROSION

- Lumley Beach (often floded during the rainy season along the Freetown Coast) Shoreline Defence Revetments/Gabions (Have been washed away due to sea erosion/wave attack), palm trees and acacia planted to serve as defence structures in this erosion prone beach along the Western Shore of the Freetown Coast
- Erosion is prominent at the central portion of the Lumley Beach which necessitated the erection of the gabion/revetments at Lumley Beach – the main tourist beach area in the Freetown Peninsular
- In the navigable portions of the major rivers in Sierra Leone, most jetties and defence structures have collapsed and the Sierra Leone Maritime Administration (SLMA) responsible for sea transport and navigation has started rehabilitating some of these jetties

1.2 STRUCTURAL HABITAT PROJECTS OR COASTAL INFRASTRUCTURE

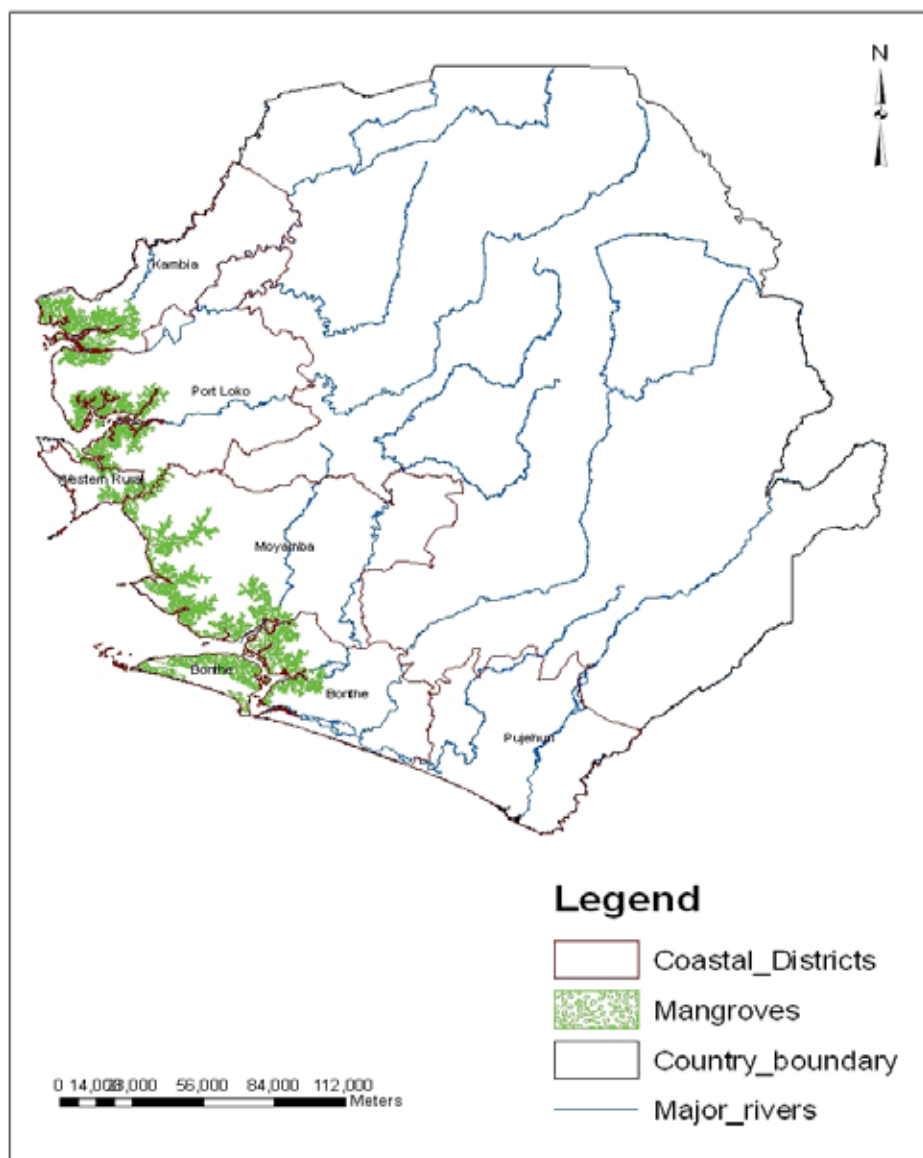
- Goderich Fishing Jetty Complex – Cold Room, Riprap shoreline defence structure, landing strip, etc – in progress
- Tombo Fishing Jetty Complex – Cold Room, Riprap shoreline defence structure, landing strip, etc - in progress
- Shenge Fishing Jetty Complex – Cold Room, Riprap shoreline defence structure, landing strip, etc - in progress
- Bonthe Fishing Jetty Complex - Cold Room, Riprap shoreline defence structure, landing strip, etc - in progress
- Sierra Leone Maritime Administration plans to rehabilitate the structures/jetties in the major navigation rivers
- Fish Landing Port at Ferry Dockyard, Kissy for transshipment - to be funded by UNIDO - 2010

1.3 LEGISLATORY AND LEGAL FRAMEWORK

The ratification status of international conventions and the enabling activities of the conventions

Convention	Ratification	Documents produced and approved	Names and coordinates of focal points
UNCCD	25 th Sept. 1997	National Action Plan to Combat Land Degradation	SLEPA
UNCBD	6 th Dec. 1996	National Biodiversity Strategic Action Plan	SLEPA
UNFCCC	Sept 1995	Initial National Communications, National Adaptation Programme of Action	Meteorology Department, Ministry of Transport and Aviation
UNCLOS	1988		Ministry of Transport and Aviation
RAMSAR	Nov, 1999	Designation of two Ramsar sites	Forestry and Wildlife Department
ABIDJAN CONVENTION	7 th June, 2007	GCLME Project financed the production of a Coastal Profile and now a National Action Plan is development is underway	SLEPA

Map 2 : Sierra Leone Coastal district



1.4 WEATRHER FORECAST AND CLIMATOLOGY

The mean long-term wind regime over Sierra Leone is influenced by the distribution of atmospheric pressure over the tropical zone of the Atlantic Ocean in spring. (Fig. 1.2a) and in autumn (Fig.1.2b) respectively due to two major atmospheric high-pressure systems: the St. Helena or South Atlantic Maximum and the Azores or North Atlantic Maximum. The equatorial atmospheric depression between these two high-pressure systems exerts a less prominent influence on the wind regime over Sierra Leone.

Local changes in atmospheric pressure resulting from temperature differences between land and the adjacent ocean as well as to orographic and land cover differences exert local changes in wind patterns on a diurnal and other short-term periods.

The Northeast trades otherwise known as the Harmattan are relatively cool and humid. In May to November, the winds are unstable in terms of direction and from June to October

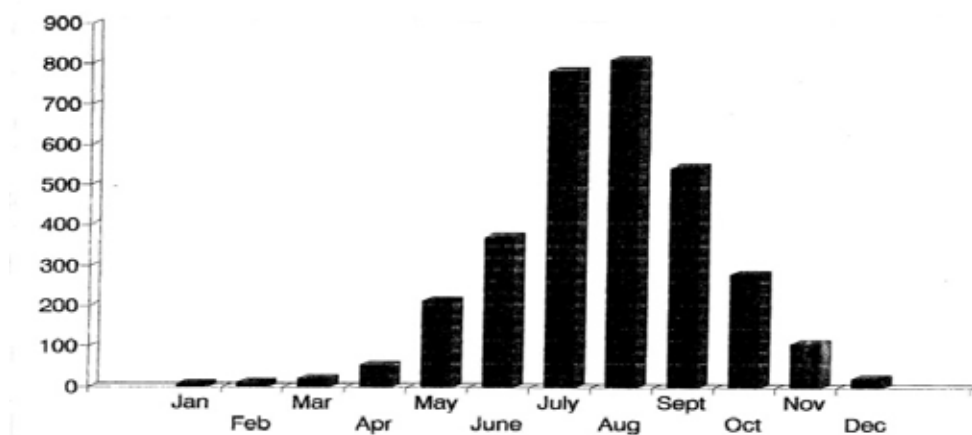
Southwest monsoon winds dominate. These are the Southeast trades from the Southern hemisphere deflected at right angles as they cross the equator.

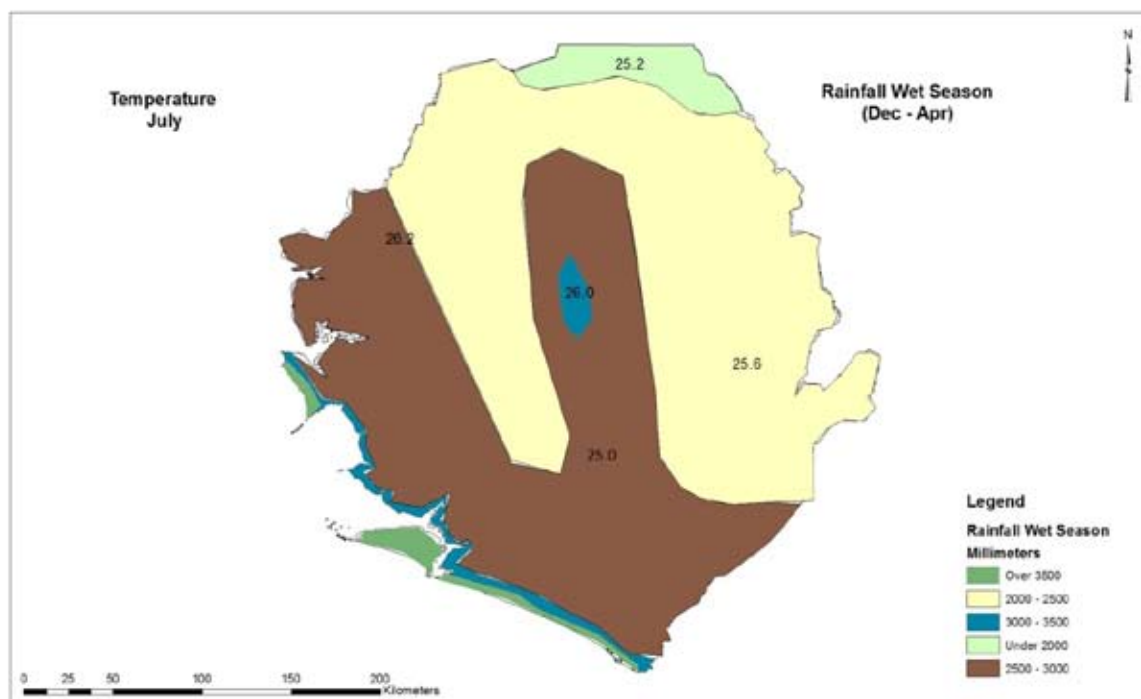
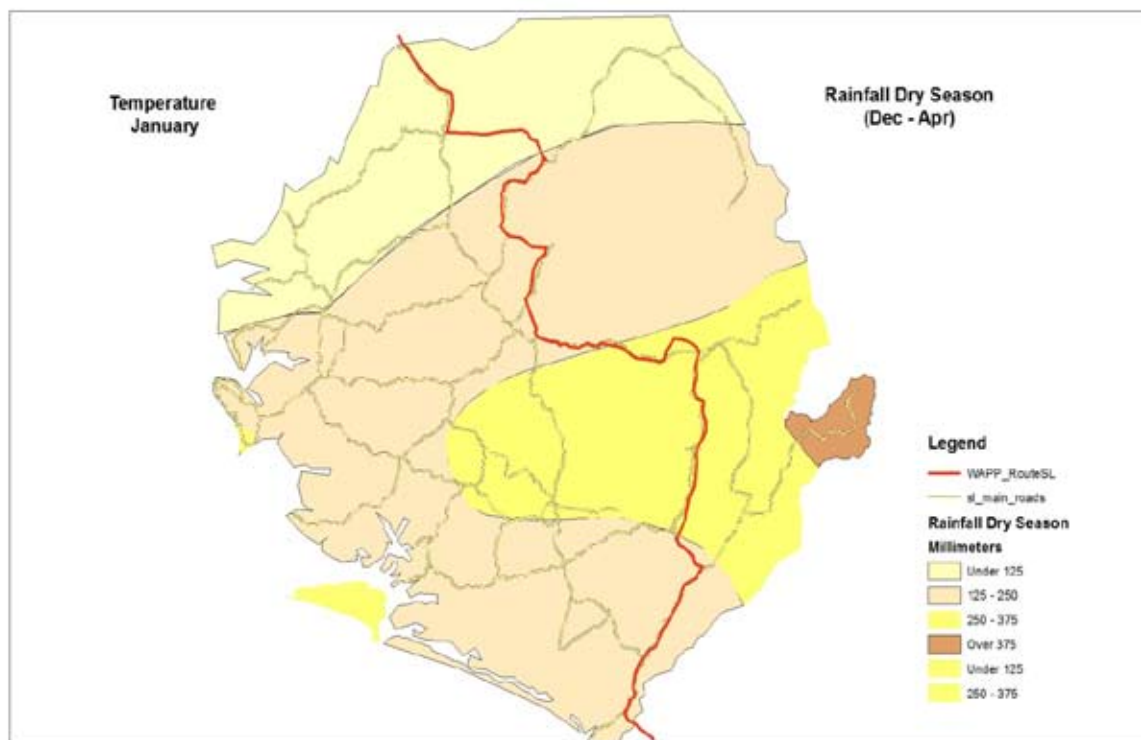
The climate is tropical and there are two well-defined seasons of wet and dry weather. The wet season generally lasts from May-November with two periods of squally weather, in March-April and May, and again in September-October.

During the rainy season, clouds of vertical development of 8-10% general prevail every day. These are usually accompanied by rainfall. The highest observed cloudiness from the area 6-7 and are closely related to the influence of the equatorial monsoons blowing from June to November. The cloud amount decreases to 3-5 a month during the months of December to April.

The highest amount of rainfall occurs during the rainy season, which lasts from May to November. The heaviest rains occur in July and August. The mean monthly amount of rainfall reaches its maximum in July and August, when the average number of rainy days is 27.

Figure 2 : Rainfall (mm) distribution at Falcon Bridge (1958-1981), Freetown



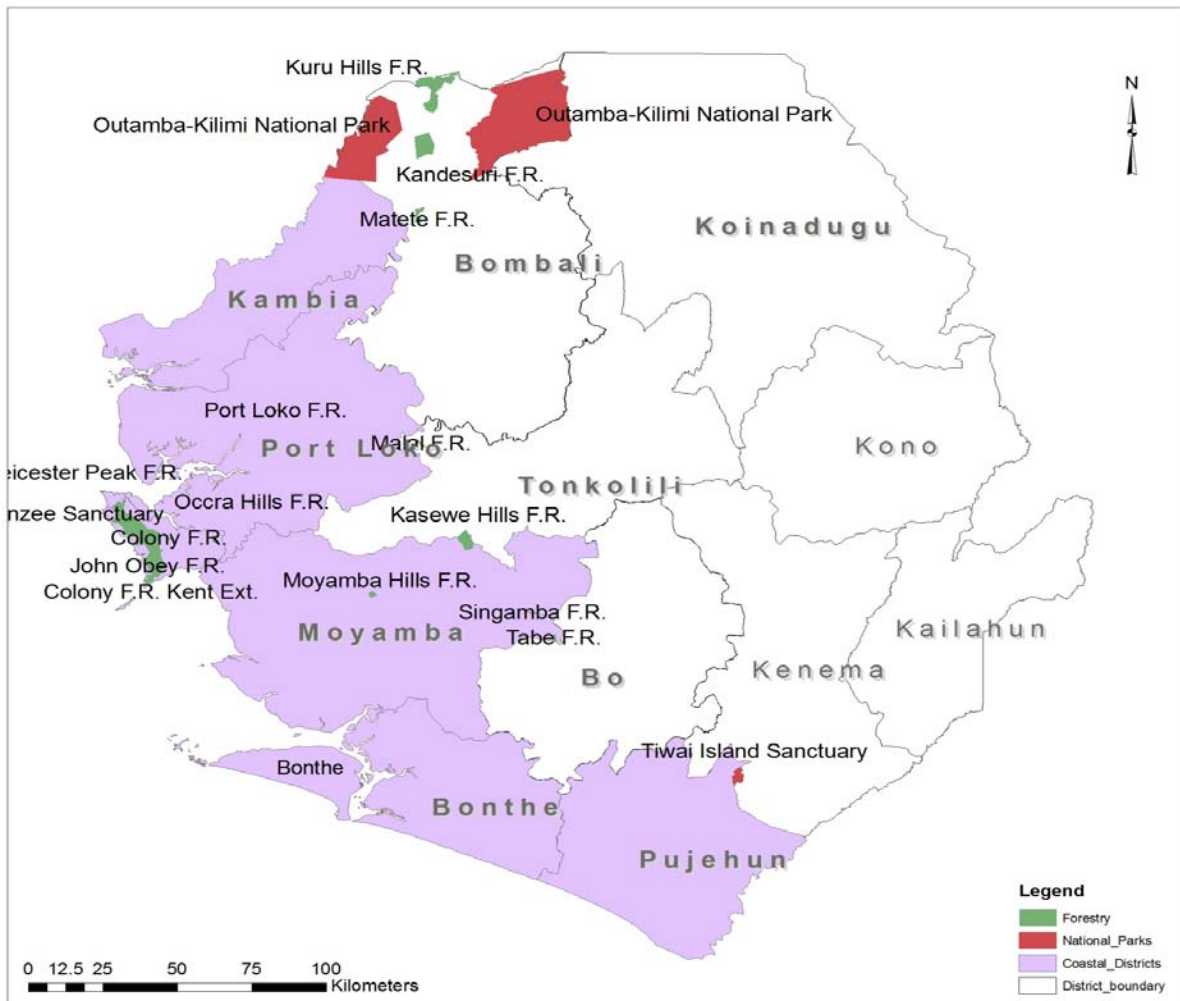


The mean long-term air temperature regime shows an average monthly temperature of between 26-28°C from June to October, with a maximum temperature of 32°C. Temperatures of up to 36°C have also been recorded especially during the month of March. A minimum temperature of 20°C has also been recorded.

Air humidity according to monthly means can be as high as 80-90% during dry season and decreased to 70-80% during the rest of the year. The mean monthly occurrence of mist is approximately 1%. The visibility is obstructed by haze, the frequency of occurrence of which increases from 25% to 40% during the period from December to May. Its frequency from June to September is 3-5%. From December to February (Northern Winter), mist occurrence in the area increase to almost 2% a month

1.5 MARINE AND LAND PROTECTED AREAS

Figure 2 : Forest reserves and national parks



Marine protected areas

- Sierra Leone River Estuary
- Yawri Bay
- Tiwai Island

Land protected areas

- Gola Forest
- Outamba Kilimi Natinal park
- Loma Mountains
- Western Area/Freetown Peninsular Forest
- Nimini Forests

Architectural, built, historical and archeological heritage

- Bunce Island – Slave Fortress/Pen – HISTORICAL SITE
- Plantain Island – Slave Fortress/Pen – HISTORICAL SITE
- Banana Island – Slave Fortress/Pen – HISTORICAL SITE

1.6 ARCHITECTURAL, BUILT, HISTORICAL AND ARCHEAOLOGICAL HERITAGE

PART II. CAPACITIES

2.1 RESEARCH AND GEOMORPHOLOGY OF THE COAST

Geology

Sierra Leone is divided into two main stratigraphic units. The eastern one is part of the stable West African Precambrian Craton and consists of high-grade metamorphic rocks and granitic gneisses. The western unit contains the elements of an orogenic belt named the Rokelides that was deformed during the Pan-African tectonothermal event, about 550 Ma ago. A 20 – 40 km wide coastal strip is made up of Pleistocene to recent sediments.



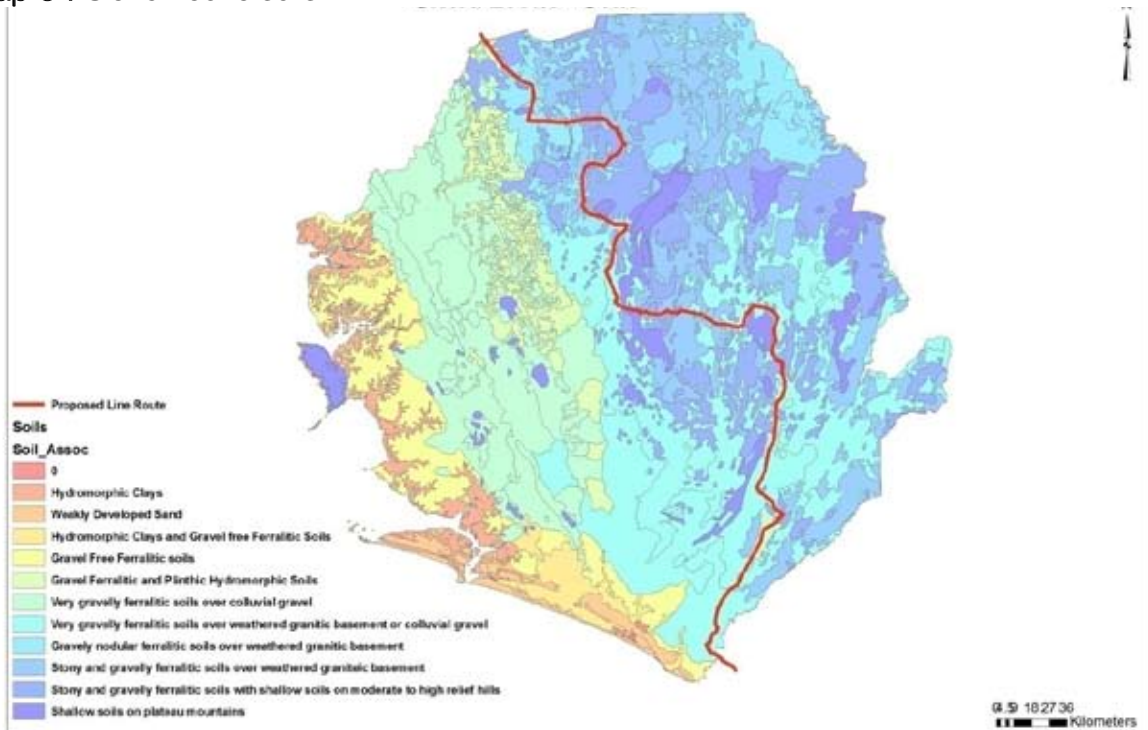
The coastal regions of Sierra Leone are in the western unit orogenic belt, the Rokelides. The Freetown igneous complex forms an intrusive body on the coast, with arcuate outcrop concave towards the west. It is composed of a layered complex of gabbro, norite, troctolite and anorthosite. Platinum occurs in the gravels of many of the streams that cut the outcrops of anorthosite and anorthositic gabbro in the noritic gabbro complex of the Freetown Peninsula. The relationship of this complex with the other units is obscured by the coastal veneer of Tertiary sediments of the Bullom Group which lies unconformably on the basement. Tertiary and more recent weathering has led to lateritisation across a large part of Sierra Leone, affecting mainly the greenstone belts and the extensive dolerite intrusions. The bauxite deposits formed within the Kasila Group are a result of this weathering process.

Soils

Soils in Sierra Leone have been grouped into 12 soil associations by the Land and Water Development Division (LWDD) each with different attributes. Figure 6 below is a map of Sierra Leone showing soil associations. Most soils in Sierra Leone are acid (pH 4-5). The soils of Sierra Leone, like most tropical soils, are ferralitic and excessively leached as a result of the humid tropical conditions.

The coastal area is underlain by a range of soil associations, with dominance of hydromorphic clays, weakly developed sand and gravel-free ferralitic soils. These areas are covered by mangrove type vegetation.

Map 3 : Sierra Leone soils



The coastline of Sierra Leone is part of the general coastline of the west and central Africa region, which is a low plain, sandy and surf beaten. The general coastline orientation for Sierra Leone (according to Edward Anthony) is north-west-south-east and is strongly de-

terminated by the local structural and litho logical framework four broad coastal geomorphic types are recognized in this region which is also typical of the Sierra Leone coast :

1. Drowned coasts in the northern area;
2. Sand bar or lagoon coasts along the north of the Gulf of guinea;
3. Deltas associated with most rivers (e.g. Niger Delta) usually with mangrove swamps;
4. Coasts with sand spits (and tombolos) formed by accumulation of longshore transported sand in bays and estuaries.

RESEARCH

- R. & R. Johnson - Coastal Erosion Monitoring – Lumley Beach and Lumley Highway Area, 1996
- Salieu Sankoh – Coastal Erosion Monitoring – Lakka and Hamilton Beaches

Human and scientific resources

Here, list the principal institutions, researchers or laboratories working on the problem issues related to coastal erosion and geomorphology.

Institution	Contacts	Contact details	Coastal research and monitoring programmes in progress
Marine Biology and Oceanography, FBC, USL	Dr. Raymond Johnson	Email: traymond12001@yahoo.com Tel: +23276629355	Coastal Erosion, Coastal Zone Management
Department of Geography	Dr. Reynold Johnson	Email: treynold12001@yahoo.com Tel: +23276629040	Coastal Erosion, Coastal Zone Management
Ministry of Fisheries and Marine Resources	Mr. Ibrahim Turay	turay.ib1264@yahoo.com Tel:+23233454196	Fisheries pollution

Shoreline monitoring systems implemented over the past 10 years and currently operational

Institution	Names and contact details	Sites monitored (localisation and extension-periodicity of measures) – current status of system	Period covered by the data	Measurement methods
IMBO		Lumley, Goderich, Lakkah, Hamilton Beaches	Seasonal	Visual & Instrumental (Episodic), Remote Sensing
IMBO		Lumley, Goderich, Lakkah, Hamilton Beaches	Seasonal	

2.2 RISK REDUCTION

National platform (ISDR) for disaster risk reduction? If yes, give the composition. Indicate who the leader is.

Institution	People in charge	Contact details	Headcount
Disaster Management Department, Office of National Security (ONS)	Mary Mye-Kamara	Director, Disaster Management Unit	20 Officers
Meteorology Department	Dennis Lansana	Director, Met. Department	18 – 25 Met. Officers headed by a Director
Sierra Leone Environment Protection Agency	Momoudu A. Bah	modbah@yahoo..com Tel:+232 78 35 06 27 Tel+232 88 35 17 25	8 Senior Officers
Sierra Leone Environment Protection Agency	Edward P. Bendu	edwardpbendu@yahoo.co.uk +232 76 74 90 24	8 Senior Officers

Appreciation of how the national platform currently functions.

PART III. PRESSURE ON COASTAL MILIEUS

3.1 DEMOGRAPHICS AND POPULATION MOBILITY, URBAN FRAMEWORK

Population

The population of Sierra Leone was reported at 4.9 million in the latest 2004 National Population and Housing Census, with an average growth rate of 2.6% per annum. According to the 2004 census, the population is relatively young; 15.3 percent are aged less than 5 years, and 41.7 percent are aged 0-14 years. In contrast, 53.9 percent are aged 15-64 years and only 4.4 percent are aged 65 years and over.

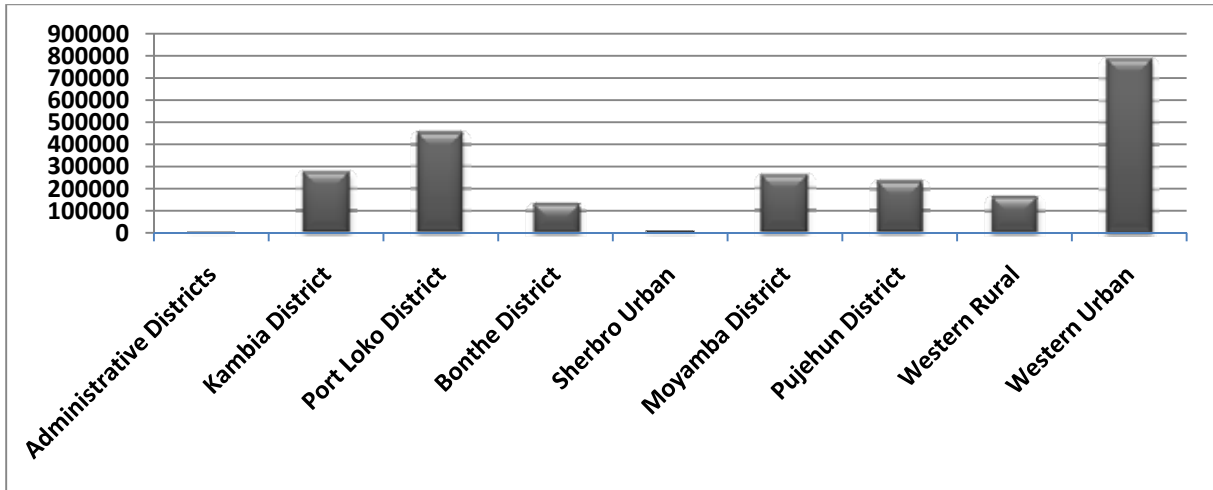
Quite a large percentage of the population is found in the coastal area of Sierra Leone. The 2004 census reported 2316621 as total population for the coastal districts. This accounts for 46.2% of the total population. This is nearly half the national population, and that they make substantial use of the coastal resources, need not be overstated. As the coastal population continue to grow, these resources correspondingly experience an increasing stress. However, the degree of coastal resources exploitation is to a large extent influenced by the population of the entire country and by the coastal population in particular.

Sierra Leone's territorial water is subject to heavy siltation and is full of wrecks. Coastal erosion leading to heavy siltation has led to waterways becoming shallow and narrow thereby posing severe navigation risk to ships and artisanal vessels. The birth rate per 100 of population is around 46 and the national growth rate is estimated at Mw.50% per year. There is an overall density of approximately 58 persons per km². Pop. Report, 1986).

Table 3.1: Population size of coastal districts of Sierra Leone

Administrative Districts	1963	1974	1985	2004
Kambia District	137,806	155,341	186,231	276,989
Port Loko District	247,463	292,244	329,344	455,025
Bonthe District	73,245	80,606	97,975	130,297
Sherbro Urban	6,894	6,955	7,032	9,535
Moyamba District	167,425	188,745	250,514	259,617
Pujehun District	84,869	102,741	111,185	234,234
Western Rural	67,106	40,065	84,467	164,024
Western Urban	127,917	276,247	469,776	786,900

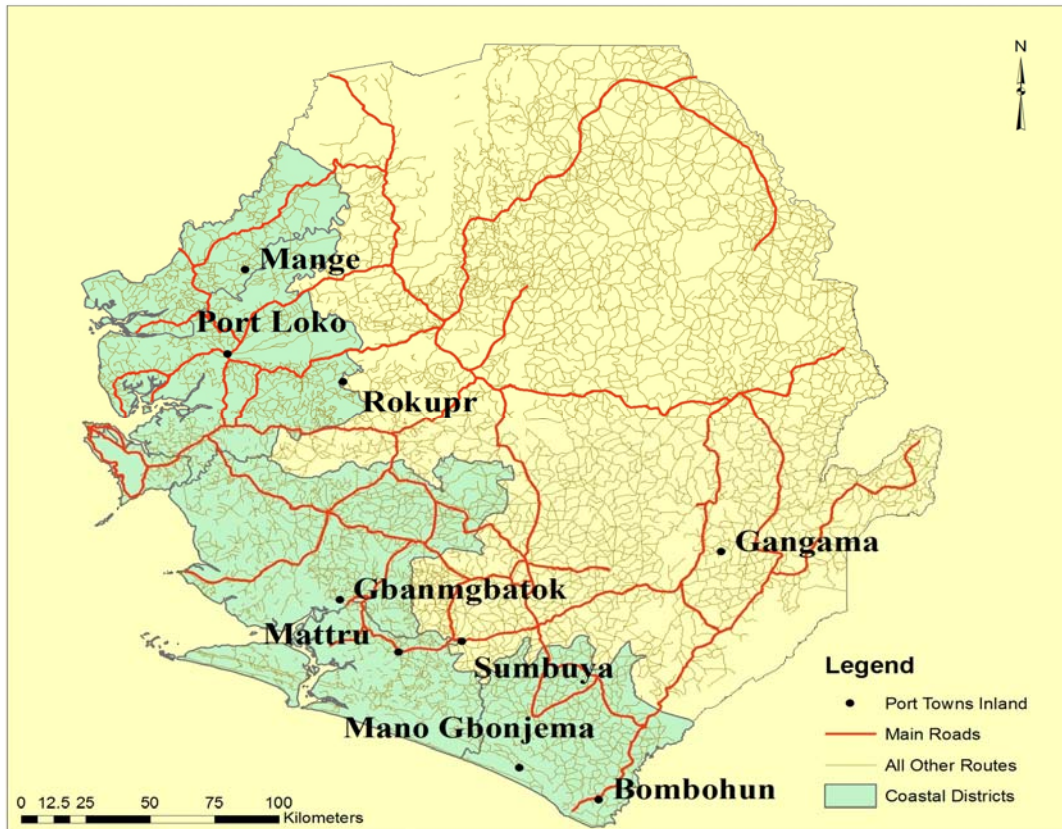
Source: Census Data, GoSL, 1963, 1974, 1985, 2004



The coastal population is not uniformly distributed. In the north, around the Scarcies River and Lungi areas, the population is around 60,000 whilst in the Freetown Peninsula areas, it is about 250,000. In the south around Shenge, the population is close to 9,000 inhabitants and is around 8,000 in the Bonthe Sherbro area. The population of the coastal area is therefore approximately 340,000 persons. With an annual growth rate of about 2.5%, it is important that a sound policy for the rational exploitation of the coastal resources be pursued, with the parallel development of appropriate institutional framework. The population density of the coastal districts is given in Table 3.1 above.

3.2 ROAD INFRASTRUCTURE

Map 4 : Port Towns Inland within the National Transport Network



3.3 DOCKS AND AIRPORT INFRASTRUCTURE

3.4 FORMS OF COASTAL TOURISM

The beaches along the coast of the Freetown Peninsula are favourite sites for tourists. There are various hotels, beach bars, entertainment centres and interesting landscape which offer tourists a relaxing and enjoyable atmosphere.

There are several sandy beaches along the Sierra Leone coast most of which are made up of fine white sand. However, there is comparatively limited hotel accommodation in the country for overseas tourists and low-density beach front development.

Boat building is one of the pre-occupation of the coastal dwellers. These are mostly fishing crafts either dug-out or made with planks of wood. The bigger crafts are used mainly to transport people and goods. Other leisure activities include handicraft by which mainly household items are produced. These include mats, bags, baskets, trays using traditional designs and patterns. Recreational fishing is also practiced along parts of the coast. Oyster farming from mangroves and other had sub-strata is another activity of coastal dwellers. Oysters are harvested for both commercial and subsistence purposes. Peri-urban agriculture is also a common practice along the coastal area. Swamp rice is one of the main crops cultivated in the coastal area.

Tourism activities are fairly low in spite of the rich natural tourist resources. There is limited hotel accommodation in Freetown for overseas tourists and beachfront development although gradually increasing in density is still appreciably low. Construction of housing units, industry, roads, health, centres, security post, schools is on the increase in the coastal area of Sierra Leone particularly in the Freetown area due government's attempt to implement the Freetown Structure Plan. As a result a number of quarrying industries located close to the coast have emerged as well as settlements.

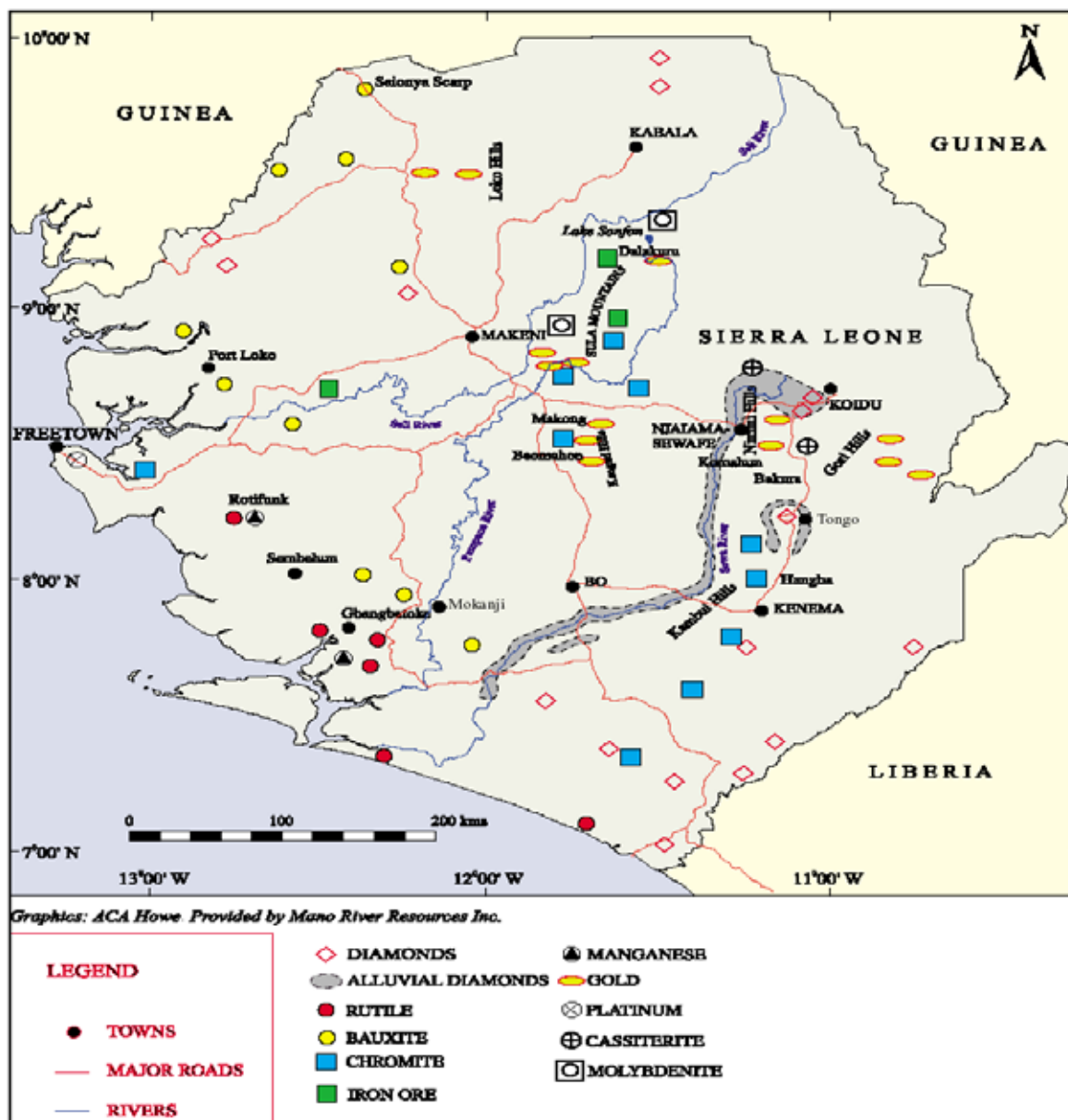
3.5 INDUSTRIAL, MINING AND EXTRACTION ACTIVITIES

About 95% of all industries in the country are located in Freetown. Among these Oil Refinery, Sierra Leone Brewery, Whitex, Wellington Distilleris, Aurel Tobacco and Paint Factories. Effluents from these factories are discharged directly into the Sierra Leone River estuary. There are plans to extend the operations of the industries into the hinterland and coastal areas including Pepel ad Bonthe.

The variety of mineral resource found and extracted from the coastal zone of Sierra Leone is limited. Along the Sierra Leone coastal, apart from clay, the major extractive industries are based on deposits of sand, which are used for construction (both civil and military and brick-earth clays for brick making.

Sand extraction is perhaps the single main development activity responsible for the degradation of the coastal beach environment. In different areas in the country, beach sand exploitation has been and still is haphazard with ultimate undesirable environmental consequences.

Map 5 : Mining Activities



3.6 COASTAL FISHING

The fishery of Sierra Leone can from a management perspective be divided into 2 sections: Artisanal and Industrial. The artisanal fisheries operates in the coastal waters particularly within five miles of the in-shore exclusive zone. The artisanal sector utilizes crafts ranging from one man dug-out canoe to canoes accommodating up to ten and even twenty fishermen commonly called standard five to ten. The artisanal fishermen employ the following fishing gears: beach seine, surface set net and bottom set net, surface drift net and bottom drift net, hook and line, cast net both surface and bottom, ring net amongst others. The fishing employs between 300,000 to 400,000 workers including fishermen, processors and marketers.

Principal projects and institutions involved in fishing

Project name	Period start-end	Donor(s)	Authority	Name and contact details of person in charge	References on the web	Remarks
Artisanal Fisheries Development Project	15 Million USD – Started in 2001/02 – June 2010	ADB	Ministry of Fisheries and Marine Resources (MFMR)	Director – Mr. Alpha Bangura		Ended in June 2010 with possible extension
Strengthening Capacities in Fisheries Management	UNIDO PROJECT	1 000 000 USD since 2010	MFMR	Director – Mr. Alpha Bangura		
EU Project – Institutional Support for Fisheries Management	EURO 3, 000,000 since 2007	European Union	MFMR	Director – Mr. Alpha Bangura		
Ecosystem Approach to Fisheries Management (EAF)	FAO USD \$ 25,000 since 2010	FAO	MFMR	Director – Mr. Alpha Bangura		
Establishment of MPAs	EURO 84,000 since 2009	PRCM	MFMR and Conservation Society of Sierra Leone (CSSL)	Director – Mr. Alpha Bangura		
Wetlands International Manatee Project	EURO 61,000 since 2010	Wetlands International	MFMR	Director – Mr. Alpha Bangura		

Principal issues :

Over fishing.
 Illegal fishing
 Unauthorized fishing

3.7 FISH FARMING

With regards to aquaculture development, little has been done due to limited resources. However, the Ministry of Fisheries and Marine Resources benefited from the Chinese Government by way of building the capacity of senior and middle level professional staff in aquaculture development as well as other management disciplines.

The European Union is presently assisting the ministry by way of Institutional Support for Fisheries management in Sierra Leone.

3.8 AGRICULTURE AND LIVESTOCK BREEDING

Rice growing is predominant in the northern and eastern part of the country whilst fruit and vegetable are more common in the western area in the Freetown peninsular. 75% of the land is arable with 15% of it in lowlands and inland valley swamps suitable for swamp rice cultivation. The traditional methods of bush fallow, shifting cultivation, slash and burn are the common farming practices

Sierra Leone has a population of about 5 million with a land area of 72,000 square kilometres. About 70% of the population practices farming.

3.9 OTHER TYPES OF PRODUCTION IN THE COASTAL AREA

Salt ponding is rather popular along the Sierra Leone coast. It is carried out all along the coast with varying intensities and scales. In the north for example, it is carried out along approximately 0.5km of Shoreline. In some instances, salt ponding may result directly from the conversion of mangrove forest, whilst in others it is during the later phases of evolution of mangrove forests after the development of fish ponding.

Other types of production include coarse aggregates (alluvial gravel), fine aggregates (beach sand), clay soil, silica sand and hard rock amongst others.

PART IV. ETAT DES MILIEUX LITTORAUX

The data below concerns the coastal strip and area only and not all national information.

4.1 CHARACTERIZATION OF CLIMATE

4.2 GEOLOGY, GEOMORPHOLOGY AND PEDOLOGY

The coastline of Sierra Leone is part of the general coastline of the west and central Africa region, which is a low plain, sandy and surf beaten. The general coastline orientation for Sierra Leone (according to Edward Anthony) is north-west-south-east and is strongly determined by the local structural and litho logical framework four broad coastal geomorphic types are recognized in this region which is also typical of the Sierra Leone coast :

- Drowned coasts in the northern area;
- Sand bar or lagoon coasts along the north of the Gulf of guinea;
- Deltas associated with most rivers (e.g. Niger Delta) usually with mangrove swamps;
- Coasts with sand spits (and tombolos) formed by accumulation of longshore transported sand in bays and estuaries.

Geology

South-Western Sierra Leone is characterized by north-west trending belts of lithological units paralleling the coast (Fig. 3). Older rocks from the Precambrian Kasila System consist mostly of felsic gneisses in the granulite facies, charnokites, garnet, hornblende, gneiss, and garnet-plagioclase gneiss (Allen, 1968, 1969).

The Kenema assemblage is composed of the Kambui Schist, metasediments, Volcanic and ultra-basic rocks, and the granite and acid gneiss zone predominantly foliated granodiorite gneiss that contains small bodies of intruded granite. The Rokel river group, Ordovician or older in age, is composed mainly of folded, unmetamorphosed to moderately metamorphosed sedimentary and volcanic rocks. The northwest strike of the major structural elements associated with these rock groups reflects the Pan-African thermotectonic episode which ended about 550 million years ago (Allen, 1969). Elsewhere in coastal Sierra Leone the Kenema assemblage, predominantly granodioritic gneisses, migmatites and granulites, shows a north-east structural trend and is considered to be part of the Liberian age province (about 2, 700, M. Y. Hurley et al, 1971). North west to north-north west striking diabase dikes, inferred from magnetic data are present in the Kenema assemblage (White and Lee, 1969). These dikes are a continuation of the mapped Precambrian Mesozoic rocks of coastal Liberia.

On the continental margin Moody (1973) disclosed several faults, trending dominantly west north-west. From magnetic surveys, faults have been inferred on the shelf west of the Freetown basic complex, and the Sierra Leone fracture zone extending from the shelf offshore has been identified (McMaster et al, 1970, 1973). Off Turner Island at the shelf edge, the bathymetric contours bend symmetrically seaward and define what is called the drowned Gallinas delta.

Geomorphology

The shelf of the coast of Sierra Leone is part of the North African platform and widely believed to be the submarine extension of that part of the African continent and therefore its peculiarities are to a large extent determined by the geology and the tectonic history of the adjacent continent. It is situated in the tropical zone between the great Senegal Synclines to the north created by sedimentary processes of the Mesozoic age and the Liberian shield in the Precambrian platform. This is a zone as well developed Palaeozoic structures. Within these structures are embedded the Ordovician sands morphologically derived from the Guinean highlands and the Palaeozoic rocks.

These general structural features were formed towards the end of the Palaeozoic. Much later, tectonic movements of the platform produced a series of transgressions and regression of the ocean, involving separate areas of the continental boundaries. This region experienced submergence in the recent geological past, traces of which can still be seen in the strong indentation of the coastline with a number of islands along the coast. 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 characterised 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 lie at an average depth of 160m and is characterised by an abrupt slope of the bottom. Each shelf zone is characterised 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 Palaeozoic sands. The sea coastal valleys are covered with weathered and erosion products of the Futa-Jallon highlands. High temperature and moisture enhance intensive chemical weathering which finds its way into rivers and are carried to the coast where they find their way into rivers and are carried to the coast there they are transported alongshore. The relief of the rivers catchment 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 to 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. Amongst the prominent geomorphic features in that part of the shelf are the St. Ann shoals Galinas delta. The St. Ann shoal trends northwest from Sherbro Island, reaching the outer shelf at the southern

edge of the areas. This shoal 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.

Soils of the Sierra Leonean Coastal Zone

No extensive and intensive soil survey has yet been fully carried out in Sierra Leone though various efforts have been made in particularly localised areas to analyse the soil types of the country. With the exception of those in the swamps and valleys, the soils elsewhere in the coastal zone are found to be light and penetrable. They are acidic, lateritic and low in potassium content. Also characteristic of these soils is the prevalence of lateritic hard pans. Along the river banks and flood plains and in the tidal estuaries are found deposits of rich alluvial soils very suitable for rice cultivation.

The factors responsible for the composition and formation of the soil types of the coastal zone of Sierra Leone include climatic (rainfall and temperature) and geomorphic (weathering process). Soil types identified include the following:

Mangrove Swamp soils

Figure 2 : Mangrove Swamp Soils



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 Sherbro estuary area are characterised 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 (sulfaquents) 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.

Saline Sands

Saline sands contain about 75% of sand with the clay content ranging from between 4 to 29% and with an organic matter content of 0.25 to 15%. They are usually the product of erosion of sandy deposits of the older sand suite. Their colour can vary from dark grey to light brownish grey.

Beach Ridge Sands

The beach ridge sands are derived mainly from terrigenous sources as a result of chemical weathering. These sands are brought to the coastal zone of Sierra Leone by rivers such as the Scarcies, Rokel, Jong, Sewa and Waanje that discharge into the ocean. Some of these sands either settle as river mouth bars and others are distributed by waves and currents along the shoreline to build up as beach ridges. Non-acid sulphate soils are typical and sandy and/or high energy environments.

Fresh Water alluvium levee slope soils

The mouths of most rivers in Sierra Leone are deposited with rich alluvial saline-clay soils of the mangrove swamps. Along the river banks and flood plains, and in the tidal estuaries can be found deposits of rich alluvial soils suitable for rice cultivation.

4.3 HYDROLOGICAL AND HYDROGEOLOGICAL CHARACTERIZATION

Hydrology

The Sierra Leone coastal area can be divided into four main hydrological areas (Johnson & Johnson, 2004). These are the Scarcies River, Sierra Leone River, Sherbro River and the Gallinas and Mano Rivers hydrological areas.

Scarcies river

The river is tidal and during the rainy season rises about 2.7m. The wide estuary mouth has mud banks and sand bars forming Yelibuya and Kortimaw islands. Further inland, it splits into the Great and Little Scarcies rivers which are relatively narrow and lined with mangroves.

Sierra Leone River Hydrological Area

The main rivers entering this hydrological area are the Rokel, Port Loko creek and Kumrabe creek.

Sherbro River Hydrological Area

Three major river systems, the Taia, Sewa and Wange rivers enter the Sherbro River Estuary through a complex system of brackish water channels draining an extensive area behind the ancient beach ridges in the south east region. The water divides around Sherbro Island and flows west into Yawri Bay and south along Turner's Peninsula.

Gallinas and Mano rivers Hydrological Area

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 8km spit between the open sea and the narrow lagoon fed by the rivers.

4.4 CHARACTERIZATION OF THE COASTAL MARINE MILIEU

Ocean Currents

Currents are dynamic features of coastal waters of Sierra Leone and affect the coastal zone in a number of ways. It consists of Ocean currents, Long shore currents, Tidal currents and Rip currents.

General Circulation

The general water circulation along the Atlantic coast of Sierra Leone is shown in fig. 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 full developed. During this period the Canary currents intensifies bringing cool water to the coast of Sierra Leone. This current generally flows in a southeasterly 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 lows temporarily northward carrying low salinity Liberian surface waters to the north as far as Senegal (Berit, 1969).

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.

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 0.1mls to 0.2mls.

Rip Currents

These are localised out flowing currents through occasional depressions or 'lows' in off-shore 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 reported along the coast of Sierra Leone.

Sea Temperature

The average temperature of the sea surface waters off the Sierra Leonean coast is generally greater than 26°C (Fig. 5). Mean annual cycle of sea surface temperature off Sierra Leone (7°N to 9°N and 11°W to 14°W), derived from COADS 195° to 1990 show that between February and May, sea surface temperatures range from 27°C and 28.5°C between May and August temperatures drop from 28.5°C to around 26.8°C and between August and November the temperatures again rose from 26.8°C to 27.0°C and the average water temperature in December is around 28.5°C and around 27.8°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°C/10m. Below the thermocline temperatures continue to fall gradually with depth.

Sea Salinity

The average salinity of the sea surface waters off the Sierra Leonean coast is generally less than 35.5. 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 characterised 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 (S=35.7°) exists between 60 – 70m depth. Below the maximum, salinity gradually decreases to a minimum around 500m depth.

4.5 LAND BIODIVERSITY

The review process for assessing biodiversity and identification of priorities for biodiversity conservation in Sierra Leone has led to the identification of 5 ecosystem types including lowland rain forests, savanna, montane, wetlands (freshwater, inland valley and mangrove) and marine ecosystems.

Information on the level of species richness and endemism is incomplete for all ecosystem types in the country, but available data points to the lowland rainforest ecosystem as being biologically diverse in terms of species richness and endemism than all other ecosystems. Typical endemic mammal species in the lowland rainforest ecosystem include *Cephalophus zebra*, *Cephalophus Jentinki*, *Hyperolius picturatus*, *Agelastes meleagrides* and *Cercopithecus diana Diana*. Nearly every ecosystem recorded at least one species of special conservation significance (Red Data List species), including threatened, vulnerable and endangered (under IUCN categorization). The lowland rainforest ecosystem had the highest number of endangered species (10) including *Pan troglodytes verus*, *Loxodonta Africana cyclotis*, *Piliocolobus badius badius*, *Procolobus verus*, *Cercopithecus Diana Diana*, *Atheru-*

rus africanus, *Panthera pardus*, *Hylochoerus meinertzhageni ivoriensis*, *Scotopelia ussheri* and *Malimbus balmanni* than all other ecosystems. Threatened and endangered three species of the lowland rainforest ecosystem include *Didelotia idea*, *Copaifera salinkounda*, *Mansonia altissima*, *Antrocaryon micraster*, *Pterygota macrocarpa*, *Azelia Africana* and *Tieghemella heckelii*.

Typical fauna of the **montane ecosystem** include *Pan troglodytes verus*, *Piliocolobus badius badius*, *Cephalophus niger*, *Cephalophus maxwelli*, *Hexaprotodon liberiensis*, *Geotrypes angeli*, *Bufo christiglans*, *Hyperolius fusciventris fusciventris*, *Illadopsis rufescens* and *Schitolais leontica*. Endemic plants of the montane ecosystem include *Afrotrilepis jaegeri*, *Digitaria phaeotricha var. patens*, *Dissortis sessilis*, *Schizachyrium minutum* and *Scleria monticola*. Endangered species of the montane ecosystem include *Scotopelia ussheri*, *Pan troglodytes verus*, *Piliocolobus badius badius*, *Loxodonta Africana cyclotis* and *Cercopithecus Diana Diana*.

Typical fauna noted for the **savanna ecosystem** include *Atherurus africanus*, *Orycteropus afer*, *Hippopotamus amphibius amphibius*, *Cephalophus rufilatus*, *Syncerus caffer*, *Loxodonta Africana cyclotis*, *Galago senegalensis*, *Cercopithecus aethiops*, *Cercopithecus campbelli*, *Erythrocebus patas*, *Papio papio*, *Phyllastrephus baumanni*, *Criniger olivaceus*, *Prinia leontica* and *Illadopsis rufescens*. Endangered species of the savanna ecosystem include *Pan troglodytes verus*, *Loxodonta Africana cyclotis*, *Piliocolobus badius badius*, *Scotopelia ussheri*, *Hylochoerus meinertzhageni ivoriensis*, *Panthera pardus* and *Atherurus africanus*.

Representative fauna of the **wetland ecosystem** includes *Trichechus senegalensis*, *Cephalophus niger*, *Hexaprotodon liberiensis*, *Sterna balaenarum*, *Tringa nebularia*, *Sterna maxima*, *Oesteolamus tetrapsis*, *Crocodylus cataphractus*, *Crocodylus niloticus*, *Protopotamus annectens*, *Heperopisus occidentalis*, *Hemichromis fasciatus* and *Mormyrus rume*. Only the Nile crocodile (*Crocodylus niloticus*), is known to be endangered in this ecosystem. The plant, *Habropetalum dawei*, is an endemic species in the wetland ecosystem of Sierra Leone.

The phenomenon of coastal erosion is evident along the entire Sierra Leone landscape and coastline, and has reached alarming rates at some locations. One of the few quantitative measurements of coastal erosion was made by the Darwin Initiative project Habitat Audit and Change Detection, where they recorded a maximum rate of 45 meters per year at Lakka north beach in 2003-4 (see figure 1). Other notable sites are at: Konakride, Yeliboya Island, Kortimaw, Plantain and Banana Islands, Bonthe, Turtle Islands, Mobay (Turner's Peninsula) and the Kingtom peninsula. In some of these areas, coastal erosion has resulted in the loss of private and public property worth millions of Leones. A recent example is the collapse of the church along the cliff at Moa Wharf and in areas like Kingtom one of the oldest Secondary schools in the country; The Prince of Wales School is under threat along with several commercial and recreational facilities.

Issues

- Deforestation
- Agriculture/Farming
- Land reclamation from the sea
- Other human activities including mining (minerals, sand, stone), development projects

4.6 MARINE BIODIVERSITY (INCLUDING MANGROVES)

Aquatic Flora and Fauna

The aquatic flora and fauna of the Sierra Leone are well represented by numerous plants and animal communities. The flora consists of phytoplankton and macrophytes, while the fauna consists of zoo-planktons, macrobenthos and invertebrates/vertebrates. RPI/NNPC (1985) recorded 91 freshwater phytoplankton from the Sierra Leone Coastal Zone.

The aquatic flora and fauna of the Sierra Leone are well represented by numerous plants and animal communities. The flora consists of phytoplankton and macrophytes, while the fauna consists of zoo-planktons, macrobenthos and invertebrates/vertebrates. RPI/NNPC (1985) recorded 91 freshwater phytoplankton from the Sierra Leone Coastal Zone. Predominant 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 171,600 ha (Chong, 1979). 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 7. 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.

Other Types of Coastal Vegetation

Apart from mangroves, the coastal vegetation inventory is inadequate. However along the coast, farm bush often has an abundance of the climbing bush *Dioncophyllum dawli*. Coastal tree savannah, a form of savannah woodland species is also found primarily from Sherbro Island to the south of the Moa River, and is characterized by scattered shrubs or trees predominantly of *Parinari* trees up to 15 metres in height and low grasses up to 15 metres tall (FAO/UNDP-MANR. 1976). The coastal savannah is interspersed with fringing swamp forest and closed canopy coastal woodland forest. Behind the coastal fringe of mangrove, there usually lies a belt of grassland swamps. Except for the mangroves, the marine plants are not significant resources.

Table 2 : Distribution of mangroves in Sierra Leone

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%

Source: Chong, 1987

The impacts of coastal erosion to coastal marine biodiversity and structures have not been comprehensively assessed in Sierra Leone. Some studies on coastal marine biodiversity carried out in 2004 by Sankoh, Fofana and Sherrif showed that biodiversity was higher in more stable coastal features like rocky shores than unstable shores like sandy and muddy shores. The study also recorded a diverse range of human activities that play a significant role in aggravating coastal erosion along the entire stretch of the country's coast line.

ISSUES

- Deforestation
- Sand and stone mining
- Land reclamation from the sea
- Illegal and unauthorized fishing

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