

*Review*

# Integration of coastal and marine areas into sustainable development strategies: A case study of Africa

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The coastal and marine environments of the African region are uniquely situated to support a variety of activities and to serve diverse human needs for food, transport, and recreation. The pressures from growing populations in coastal zones of Africa, expanding coastal tourism, intensified fisheries, and a large number of other economic activities pose an increasing threat, which jeopardize the quality of these coastal and marine environments. Large-scale destruction of some of Africa's most valuable resources, the coastal forests and mangroves, the lagoons and coral reefs has caused serious degradation of the environment, thus affecting the life of the coastal inhabitants and the economic development of the countries of the African region. The Seychelles Island in the western Indian Ocean for example, was famous for its luxuriant forests and an incredible abundance of wildlife. But many reefs have been mined for coral for the purpose of construction. Mangrove forests on the granitic islands have been raised to the ground or drained and reclaimed. Severe erosion is as a result of this destruction. Many African countries are confronted with serious manpower problems, which are proving to be great impediments in the economic development, especially of their coastal and marine areas. In many cases, the most important cause underlying these problems is the lack of adequate training facilities for the type of manpower required. The teaching of marine science and marine technology in universities of the region is a recent development and in many of the universities, there are as yet no comprehensive study programmes covering the whole spectrum of marine science and technology at the undergraduate or postgraduate level. The situation in regard to research in marine science and technology is equally unsatisfactory. To implement sustainable development of coastal and marine resources of the African region, there is an urgent need to: (1) build human resources by undertaking short-term academic training to strengthen existing capabilities; (2) promote public awareness by producing educational materials on the ecological and socio-economic contributions of the marine resources and the consequences of unsustainable exploitation (3) organise policy workshops, seminar and/or conferences involving relevant policy and law-makers to increase their understanding of and commitment to the sustainable use of the resources in their coastal and marine areas, and (4) implement integrated coastal zone management programmes by establishing case studies in pilot sites in selected countries of the African region. The object of this paper is to review background information on the present status and trends of coastal and ocean development in Africa, and on the existing capabilities in the region to implement sustainable development strategies. It is intended to lay out the framework and strategy to be used in the design of an integrated management of coastal and marine areas in the region.

**Key words:** Coastal ecosystems, marine environments, sustainable development, population pressure, environmental degradation, sea level rise, capacity building, management planning.

## INTRODUCTION

At the Rio United Nations Conference on the Environment and Development (UNCED), protection of the coastal and marine environments to ensure

sustainable use of the natural resources was at the top of the agenda for action (Agenda 21). Under Agenda 21, coastal states should "commit themselves to integrated

management and sustainable development of coastal areas and marine environment under their national jurisdiction". The Rio Conference further pointed out the importance of coastal states to develop national policies and management capabilities for integrating the development and management of multi-sectoral activities in coastal and marine areas (UNEP, 1985). Coastal and marine areas are uniquely situated to support a variety of activities and to serve diverse human needs for food, transport, and recreation (UNEP, 1988). Some two-thirds of the world's population lives near the coast and a majority of the world's largest cities are in coastal areas (WWF, 2001a). Ninety per cent of the world's fish catch comes from the continental shelf and upwelling regions, and at present, approximately 10% of the world's total animal protein supply comes from the sea. Again, about 20 per cent of the world's oil production comes from offshore areas and it is estimated that about 70% of the world's ultimate recoverable hydrocarbon resources lie in coastal waters 200 m in depth or less (Mbaki, 1999). Finally, the coastal area is a source of many other raw materials in the form of sand, gravel and a variety of placer minerals such as diamonds. Salt for instance, as an extracted product from the oceans, contributes significantly in food processing and other industrial endeavors. Coastal areas are, therefore, an integral part of the development process in a large number of countries (Ngoile, 1997).

More than half of the world's population lives within 60 km of the shoreline, and in Africa trends in population indicate that this figure could rise to three quarters by the next century (FAO, 1998). The lives and reasonable aspiration for economic advancement of the population depend on these coastal and marine resources (World Bank, 1996b). The shallow tropical coastal areas bordering the African continent have traditionally supported highly productive ecosystems from which fish and other aquatic resources have been harvested. Furthermore, these natural systems provide valuable services in terms of recreation, coastal tourism, marine transportation in addition to their natural protective and defence functions against coastal erosion and flooding (WWF, 2001a). Unfortunately, in many parts of the region, most of the natural resources are over-exploited and the fragile coastal and marine systems severely degraded by unregulated human activities. As a result, the productivity and usefulness of these coastal and marine areas have dramatically diminished and the prospects for sustainable development are greatly jeopardized (Ibe, 1996). There are a number of reasons for this serious situation. In general there is lack of knowledge and understanding of the coastal and marine resources and their interaction with terrestrial and oceanic processes. This lack of information and awareness, together with ineffective coastal and marine planning and management further aggravated the situation (Sain and Knecht, 1998). In this paper, the

present status and trends of coastal and ocean development in the African region are examined. The existing capabilities in the region to implement sustainable development strategies are also assessed.

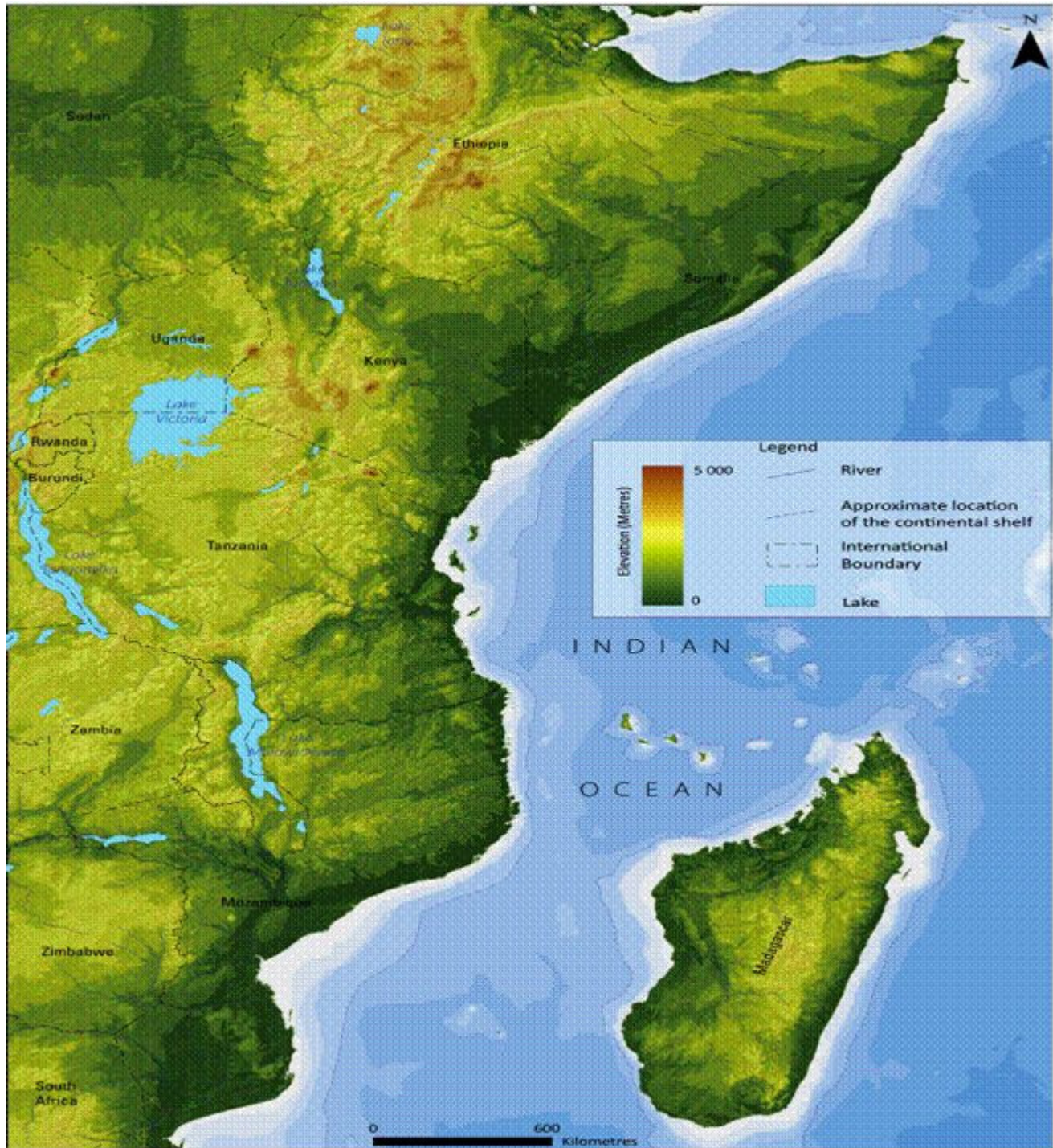
## REGIONAL SETTING

The Eastern Africa coastal and marine areas, for example, have some of the world's richest ecosystems containing exclusive coral reefs, lagoons, estuaries and mangrove forests (UNEP, 1998a). The seashores of Somalia, Kenya, Tanzania and Mozambique (Figure 1) are extremely rich in marine habitats and sheer numbers of marine plant and animal species. Within this tropical belt, some of the world's most extensive mangrove forests are found, as well as vast stretches of seagrass beds and several hundreds of kilometers of sand beaches, limestone cliffs, lagoons and subtidally some of the richest coral reefs (Odada, 1993). These ecosystems support a wide diversity of plants and animals and economic benefits derived from the coastal and marine environments are essential for a large part of the population in the countries of the sub-region (Obura et al., 2000). These coastal and marine environments provide coastal population and communities inland with essential requirements in life such as food, building materials, firewood and many other vital resources (UNEP, 1985).

The west and central African coastline for instance, stretches for approximately 8,000 kilometers and is characterized by marked diversity (Allersman and Tilmans, 1993). The climate ranges from desert in the north-the Sahara-through a humid tropical belt, which contains two of Africa's largest rivers, the Niger and Congo, to desert again in the south-the Kalahari. The coastal zone shows equal diversity, ranging from dunes through marshy delta lands and mangroves to Rias with steep cliff's (Ibe, 1996). The continental shelf also varies markedly in width from 70 km or so in the Gulf of Guinea to about 4 km off Angola and Zaire (Figure 2). Even the countries that make up the sub region differ markedly, from small island states like Sao Tome and Principe to large mainland countries like Nigeria and Senegal. Their state of development also differs. Some have economies based essentially on handicraft and subsistence farming, whereas others have quite well developed industries (Awosika et al., 1993)

## OBSERVED COASTAL AND MARINE ISSUES AFFECTING THE REGION

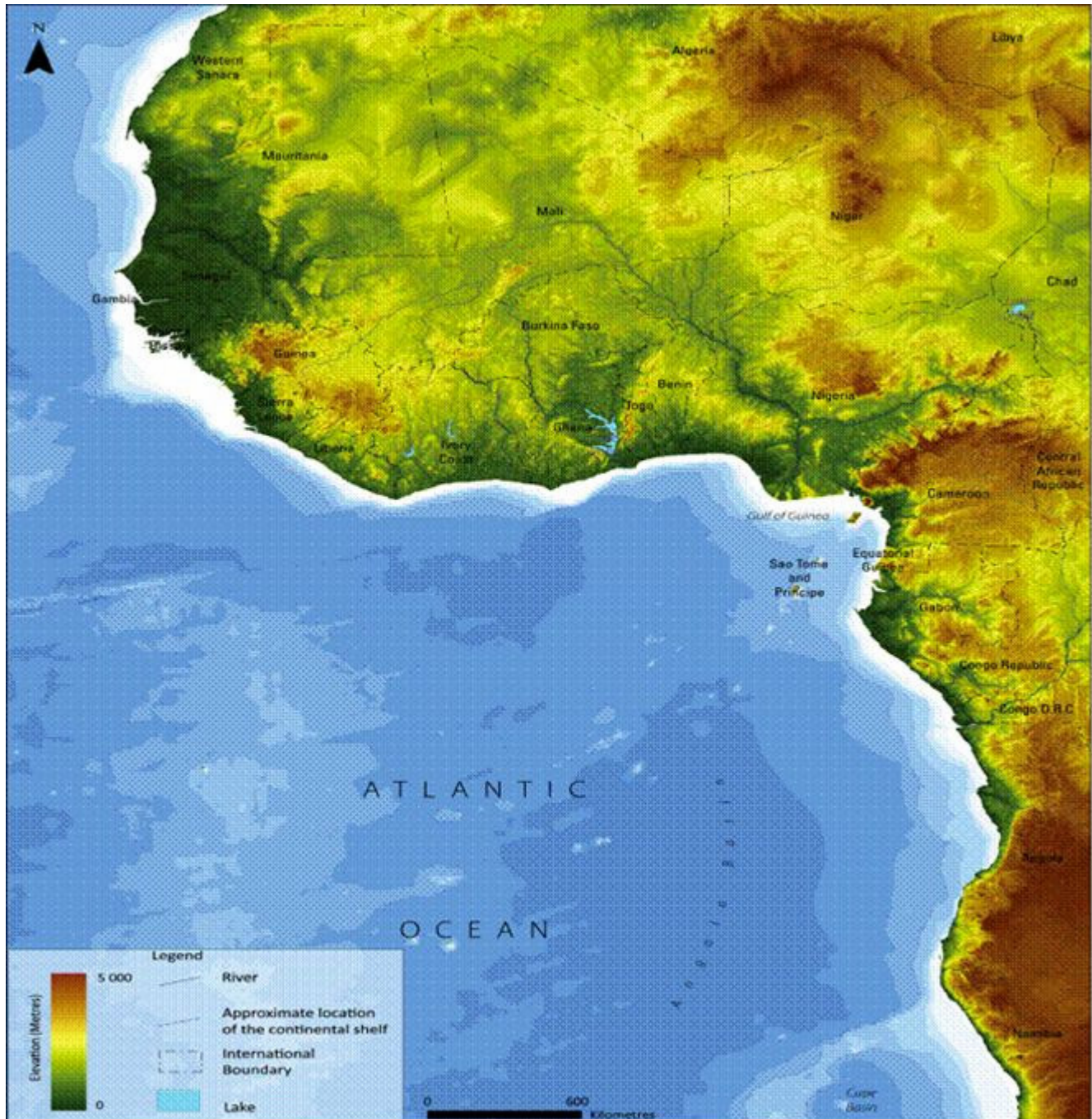
Africa is surrounded by four seas-the Atlantic of West and Central Africa, the Mediterranean, the Red Sea and the Indian Ocean/Eastern African maritime zone (WWF, 2001a). Throughout the region, the countries are facing a



**Figure 1.** The map of coastal zone of East Africa.

growing number of coastal and marine changes as a result of development and increased population pressure (FAO, 1998). The African marine environment is influenced by unregulated human activities on land and the changes can be viewed as taking place in a series of concentric circles-in the centre, desertification; towards the coasts, deforestation; on the coasts, erosion

and pollution of the beaches; on the high seas, over-exploitation of marine resources, dumping of toxic and hazardous wastes and oil spillages (Ibe, 1996). As the population increases, the African coastal and marine environments are assuming greater importance-hence the growing realization that they need to be protected from pollution, coastal erosion, over-exploitation of



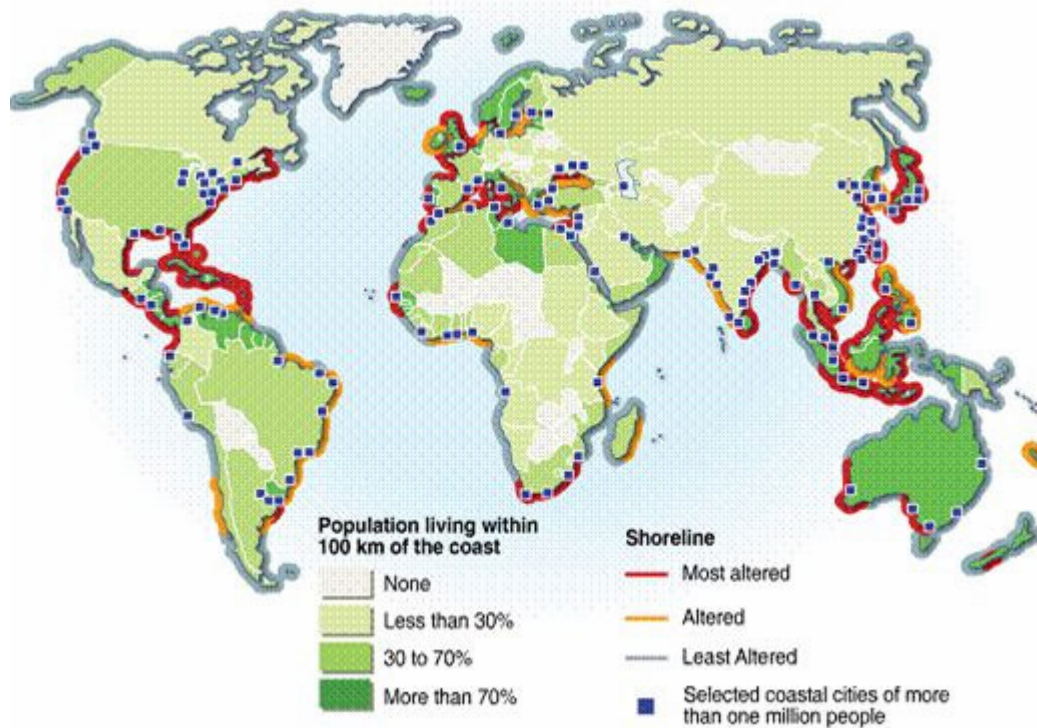
**Figure 2.** Map of coastal zone along West Africa.

marine resources, etc. through an integrated interdisciplinary and multi-sectoral approach in developing management plans for the coastal and marine areas of the region (Clark, 1996)

### **Rapid population growth**

The coastal areas of a number of countries in the African

region are becoming under increasing pressure as a result of population increase and expansion of economic activities such as agriculture, industry, and tourism and infrastructure development (Figure 3). For example, the total population of the countries in the west and central African sub-region is estimated to be around 309 million, of whom about 20% live in the town and villages of the coastal zone (PRB, 2010). Lagos with upwards of 18 million people and 85% of Nigeria's industry, and



**Figure 3.** Map showing coastal population and shoreline degradation in Africa and around the world within 100 km of coastline. SOURCE: UNEP/GRID-Arendal (2007).

Accra-Tema with 60% of Ghana's industry are good examples.

In Eastern Africa for example, a total of about 100 million people live in the coastal zone (Figure 3). The country with the most coastal population in the sub-region is clearly Madagascar with about 50.7% of the total population. The mounting concentration of peoples on the coasts of Africa for example has led to substantial increases in the volume of sewage and effluent being discharged into the near shore waters-most of it untreated or only very slightly treated. With sewage discharge taking place in this way there is obvious risk to human health through water contact and through the consumption of sea foods which might be contaminated by sewage organism (FAO, 1996). This potential problem seems to have received little attention in the region, although sporadic outbreaks of human diseases attributed to contact with faecal remains on beaches have been reported (UNEP, 1984). Thus, the rapid growth of population is an urgent problem to be addressed in affecting development in coastal and marine areas of the African region (FAO, 1998).

### Environmental degradation

Coastal environmental degradation is a major problem facing many countries in the African region (Figure 3). Sewerage and domestic and commercial discharges in

the vicinity of coastal and shallow waters, erosion and siltation, overcutting of forests products such as mangroves on the coastal strips and timber forests inland are mainly the sources of pollution from land (UNEP, 1996b). Poor agricultural practice, lack of agricultural land especially on the islands, over utilization, burning etc and mismanagement and over-exploitation of forest resources have resulted in extensive deforestation and severe soil erosion. This has caused severe siltation with the resultant destruction of coral reefs followed by erosion of the beaches and the destruction of the coastal mangrove and other trees. Examples of this are clearly seen in Madagascar, Comoros and many other parts of the African region (UNEP, 1999a). Development of ports and harbours, coastal construction such as reclamation for airport construction and dredging of the seabed also cause coastal erosion and especially siltation. There has been considerable work of this kind carried out in the African region in the past three decades or so and not enough environmental consideration has been given. For example, extensive dredging has been carried out in the Seychelles within the last decade and siltation of the coral reefs within the marine park and along the east coast of Mahe has been severe (Shah, 1995). In some coastal areas, dynamiting coral reefs as a means of catching fish is widely used. These include Tanzania, Mozambique, and formerly Mauritius, which resulted in serious environmental degradation of their coastal and marine areas (FAO, 1998; UNEP, 1996b).

## Sea level rise

The African coastal zone along the Atlantic and Indian Oceans have been more and more vulnerable to sea level rise and other impacts of climate change (Leatherman and Nicholls, 1995). The coastlines of the eastern African sub-region for example, have been retreating inward and seaward as a result of the rise and fall in sea level due to past climate change (Odada, 1991). According to the estimates of the WMO/UNEP Intergovernmental Panel on Climate Change (IPCC, 1998), an average rate of mean global sea level rise could be about 6 cm per decade over the next century. It means that the total sea level rise could attain as much as one metre in one century. In such case, hundred of thousands square kilometres of coastal wetlands and lowlands in the African region could be inundated. African beaches could retreat as much as a few hundred metres and prospective structures may be breached (Smith et al., 1996). Flooding would threaten lives, agriculture, livestock, buildings and infrastructure. Salt water would advance landward into aquifers and up estuaries, threatening water supplies, ecosystems and agriculture in coastal areas of the African region. Given the near certainty of an accelerated rise in sea level, the only hope left for the African government to avoid future chaos is through anticipatory planning and actions (Nicholls and Leinert, 2000).

## Development of coastal areas

A number of development activities are leading to major changes in coastal areas of the African region (Ibe, 1996). The most obvious of these are the actual construction of towns with associated industries and the creation or extension of ports and harbour areas. Although, these are confined to a few locations, they are frequently close to areas which could be exploited as tourist centres. For example, at Lagos in Nigeria, Victoria beach has been eroded 2 km inland since the construction of breakwaters (Ibe, 1985). Similar problems were created at the port of Abidjan when the Canal de Vridi was opened in 1950; since then the beach has eroded to the east of the canal and a road has been cut through in the area (Awosika et al., 1993). New or rapidly growing coastal zone activities often lead to the creation or rapid expansion of municipal centres on the coast.

When such rapid expansion occurs, it is extremely difficult for national or local authorities to respond by planning for and providing infrastructure and social services. In Malindi, Kenya for example, the growth of a large tourist-related section has occurred at a traditional small municipal centre with extremely limited services and infrastructure (Odada, 1993). Population growth rates have reached 20% per annum, and authorities are hard pressed to meet basic needs for sanitation,

education, and commercial organization. Similar situations do arise wherever new coastal zone activities stimulate extremely rapid growth in new or small existing municipal centres. The social or environmental effects of such development must be considered and dealt with in economic planning for sustainable development of coastal areas (Allersmann and Tilmans, 1993).

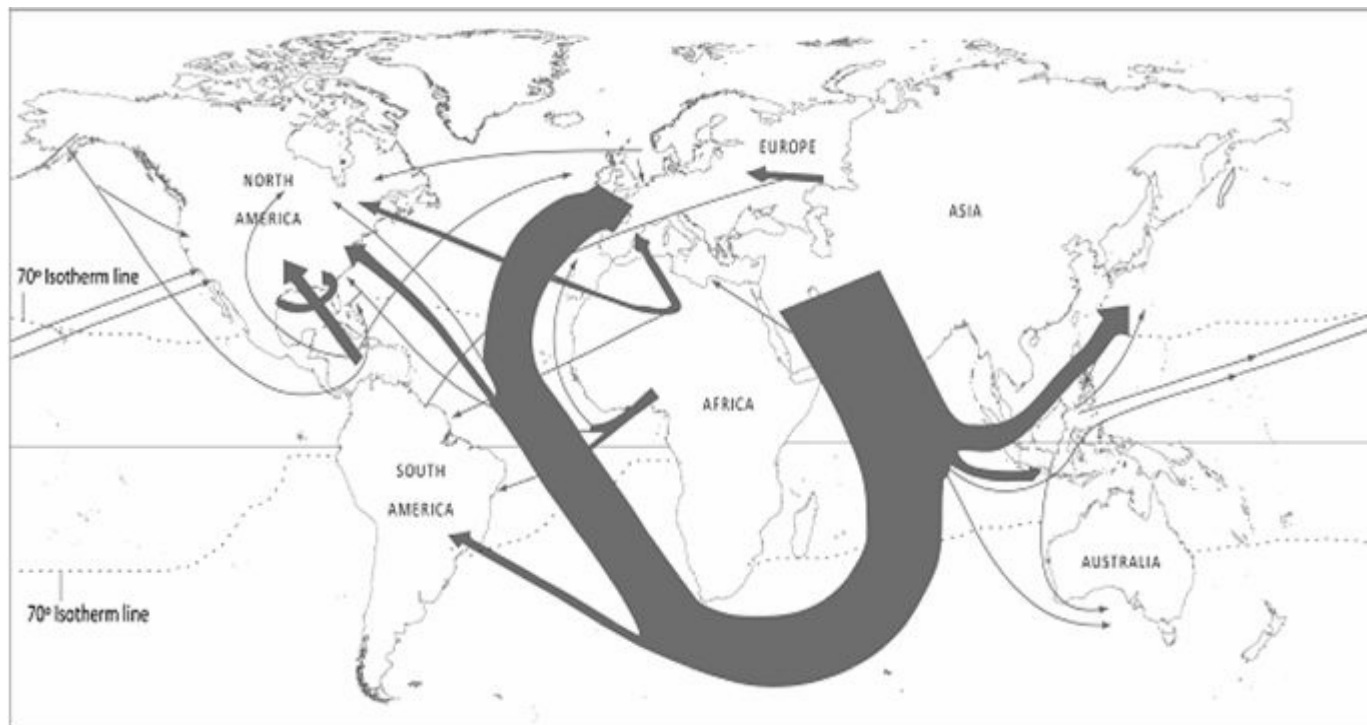
## Coastal erosion and flooding

This is prevalent problem especially in west and central Africa (Figure 3). The degree of seriousness of the problem and the attempts to mitigate the nuisance and negative economic consequences vary. In some places the problem has reached worrying proportions like in the above case of west and central Africa. Retreat of the coastline with the concomitant flooding cause's hazards by uprooting settlements, destroying agricultural and recreational lands, disrupting harbour and navigational structures and dislodging economic facilities located along coastal towns (Ibe and Quelennec, 1989).

Natural factors for erosion include: storm wave regime with sea level set-up, orientation and nature of the coastline, low relief of the coastal plain, vulnerable sediment budget, narrowness of the continental shelf, presence of off-shore canyons and gullies, global estuarine rise in sea level, etc. In many cases, man's intervention in the natural environment, by the construction of artificial structures on the coastline, mining of beach sand, the location of dams on rivers that normally would supply sediment replenishment to the coastline, the haphazard withdrawal of fluids from coastal aquifers and reservoirs, the destruction of mangroves etc., has served to exacerbate the impact of natural forces (Denis et al., 1995). There is, therefore, an urgent need to react timely and appropriately to coastal erosion and flooding problems in the African coastal areas (Ibe and Quelennac, 1989; Odada, 1993).

## Oil pollution

Marine pollution, especially from oil spillage, is a major regional problem and is often aggravated by leakage due to accidents, grounding, harbour operations and discharges from refineries (Portmann, 1998). With the increasing number and size of tankers traveling through the Indian Ocean area for example, fear of oil spills has also increased in the Eastern African subregion (UNEP, 1982). Some paths used by these tankers are shown in Figure 4. In 1981, 355 million tonnes of oil were transported through the main route from Arabian sea to the Far East. Tankers discharge operations in the sub-region are accident prone and many such accidents have been reported in Mombasa, Maputo and Dar es salaam where large areas of mangrove forests were completely



**Figure 4.** Main routes of oil transportation from the Middle East to the far East and the West around Africa.

destroyed (Munga, 1981). Oil refineries are found in most parts in Eastern Africa, which significantly contributes to oil pollution of the coasts and seas (International Ocean Institute, 2001).

The West and Central African sub-regions exports oil to Europe and America. The coastline lies to the east and is downwind of the main route of oil transport from the Middle East to Europe (Figure 4). The total volume transported annually along the Gulf of Guinea for example has been estimated to be 706 million tonnes (Portmann et al., 1978) and the discharge of tank washings from offshore traffic is a significant source of oil on beaches. However, a more recent investigation has indicated that much of oil found on beaches arises as a result of spills or tank washings discharged from tankers visiting ports in the region although other sources are also important (Portmann et al., 1989). Investigation of pollution in the Ebrie Lagoon (Ivory Coast) by Marchand and Martin (1985) produced a wide range of concentrations of total hydrocarbons in the lagoon sediments (1000 - 24000 mg/kg).

The highest concentrations were associated not with shipping but with industrial and domestic sewage discharges. However, a spill of 400 tonnes of oil at a refinery in 1981 was still clearly detectable at the time of their survey in 1983 (Portmann et al., 1989). There is, therefore, an urgent need not only for the development of national and regional contingency plans to combat oil pollution especially in cases of emergencies, but also for

monitoring the levels and effects of pollutants in the Eastern and Western Africa coastal and marine areas (UNIDO, 2000).

### Coastal tourism

The people of Africa have for a long time been associated with visitors from the Arabic and Persian nations, Europeans, and other distant lands (Ngoile, 1997). They are friendly and attractive with captivating life styles, customs and traditions, food preparation styles, costumes, artistic expressions. In addition, the coastline of the African region is an area of great physical beauty, rich in living resources. In the Eastern African sub-region for example, Palm fringed beaches of white coral reefs with their wealth of colourful fish, shell and corals. For many countries in the sub-region, coastal tourism is one of the most important sectors of their economies producing foreign exchange (Shah, 1995). Although, available evidence that before the 1980's, the growth of tourism in Africa occurred without significant deterioration in the fragile coastal ecosystem, this is rapidly changing (Odada, 1993). The impacts of tourism on both social and cultural environment and on the natural environment are causing serious concerns in the sub-region. To ensure that the importance of the tourism industry is maintained in the economies of African countries, there is need to develop and maintain environmental policies to govern

the industry. Protecting and conservation of tourist attractions must be observed through the formulation of sound laws and regulation governing tourism, especially in the Eastern African sub-region, and elsewhere in the African coastal areas (Okemwa and Wakwabi, 1993).

### **Coastal agriculture**

Agriculture is the main stay of the economy of most African countries. Agriculture contributes between 30 to 60% of their GNP and the majority of the population depends on it for their livelihood (World Bank, 1996b). The population is increasing rapidly with the subsequent increase in food demand. Simultaneously, in most African countries, the land that is available for agriculture is shrinking because of the use of the same land for non-agricultural purposes such as residential accommodation, industry, roads, playfields, hotels, etc., and also due to loss of good agricultural land through soil erosion, salinisation and sodification. As a whole, the net land resources available for agriculture are diminishing while population is rapidly increasing in the African region (Ibe, 1996). The expanding agriculture is having undesirable effects on coastal zone and marine habitats of the African region.

These effects are becoming more and more apparent as pollution increases and ecosystems deteriorate. For example, erosion related to deforestation and unwise agricultural practices is prevalent in the countries of the region (Odada, 1993). In Kenya, silt from rivers is affecting catches of fish, smothering coral reefs and is sulling beaches with serious consequences for fishing and tourism. The effects of pesticide pollution on marine life are now becoming apparent in many countries of Africa and are absorbed into living organisms (Mwaguni and Munga, 1997). The health of humans is threatened by these toxins reaching them through the fish they eat (UNEP, 1989). It is imperative, therefore, that soil conservation measures must be instituted particularly where agriculture is being developed in the coastal areas (UNEP, 1999b).

### **Over-exploitation of marine resources**

In general productivity of African coastal waters is dependent on the extent of the continental shelf, coastal upwelling, mangroves, coral reefs, and run off from rivers (FAO, 1996b). Fisheries in the countries of the region reflect the availability of these physical characteristics. The relatively extensive continental shelves of Madagascar and Mozambique for example, support lucrative shrimp fisheries, while the absences of such areas in island countries make them depend on offshore tuna resources. Shrimp and tuna are the main commodities supporting export ventures in the Eastern African coastal sub-region. For the west and central

Africa, the total annual catch of fish in coastal zone is estimated to be about 2.6 million tons per annum (FAO, 1987) about 10% of the coastal population engages in some form of fishing activity. At least 30% is canoe fishing, but larger fishing trawlers account for the bulk of the remaining catch in the sub-region (UNEP, 1989). The most serious problem, however, is over-exploitation of marine resources in most African coastal and marine areas. Fish, shells, beche-demer, dugongs and turtles are all subject to over-exploitation on a massive scale especially in many parts of Eastern and Western Africa, where agricultural land is in short supply and food is scarce. The over-exploitation is due in part to burgeoning human numbers coupled with a shortage of land-based jobs. Kenya's population of over 40 million for example, is increasing at unprecedented rate of 4.3% annually, and is expected to double around the turn of the century, with a consequent increase in demand for land, food, housing, water and social services similar situation prevail in other parts of the African region, straining both terrestrial and marine ecosystems to breaking point (WWF, 2001a). Therefore, solutions need to be found to this resource depletion problem which escalates as populations grow in Africa (FAO, 1997).

### **Institutional and administrative limitations**

The institutional and administrative capacities of the different countries for coastal and marine resources development vary widely in the African region. It ranges from countries with virtually no capabilities to those with a growing capability and considerable resources. There are however, two broad categories of the African coastal states as regards their present level of institutional and administrative capabilities (UNESCO, 1981). The first categories include countries like South Africa, Nigeria and Kenya, in which there are already good infrastructure for the development of coastal and marine areas, in the way of appropriate research and training institutions and other facilities, where the governments are well aware of the importance and crucial role of coastal and marine resources in the development of their economies, and where there are reasonable number of qualified national personnel to undertake an integrated management of coastal and marine areas (Ngoile, 1997; Ibe, 1996). The second category includes countries like Benin, Gambia and Djibouti which for various reasons are at low stage of oceanographic development, where there are not as yet any substantial infrastructure for the development of coastal and marine resources, in the way of research and training institutions and other facilities, and where there are great shortage of trained manpower (UNESO, 1981). In general, the present level of institutional and administrative capacities of practically all African coastal states is low, and far from being adequate in providing a sound and sustainable base for the rational exploitation of coastal and marine resources of these countries. Thus,



institutional and administrative capacity building in ocean affairs should be top priority in the African region (Sain and Knecht, 1998).

### **Awareness and management**

There are a number of reasons for this serious situation. In general there is a lack of knowledge and understanding of the coastal and marine resources and their interaction with terrestrial and oceanic processes (UNESCO, 1981). This lack of information and awareness together with ineffective coastal and marine planning and management further aggravate the situation. In the Rio United Nations Conference on the Environment and Development (UNCED) protection of the coastal and marine environments to ensure sustainable use of the natural resources was at the top of the agenda for action (AGENDA 21). Under chapter 17 of Agenda 21, coastal states should "commit themselves to integrated management and sustainable development of coastal areas and the marine environment under their national jurisdiction." UNCED further pointed out the importance of coastal states to develop national policies and management capabilities for integrating the development and management of multisectoral activities in coastal and marine areas (UNEP, 1985; 1988).

### **DISCUSSION ON INTEGRATION OF COASTAL AND OCEAN AREAS INTO SUSTAINABLE DEVELOPMENT STRATEGIES**

In general, in the African region, environmental values and natural resources factors have not always been integrated into national development plans. Development decisions and social trends appear not to have optimized the value of natural resources. Industrial expansion has often been carried out at the expense of the environment. Economic and social development, both in cities and countryside, has tended to deplete natural resources and damage the environment and amenities. Institutions to promote environmental and resource values and to assure that they are taken into account in the governmental decision making are just being created in some countries in the region (World Bank, 1996b; WWF, 2001a; Akpabli, 2000; O'Toole et al., 2001).

### **Environmental policies**

The general situation with respect to the environment and relationships to national development and the expansion of human settlement is exacerbated in the case of the coastal development (UNEP, 1999b). The states of the region have not by large developed explicit policies relating to coastal and marine related development. For

example, the West African coastal area has in the recent times acquired a more significant role in the overall economic development of the sub-region (World Bank, 1996b). For the land-locked countries in the sub-region, coastal ports and harbour represent the only natural outlet for their goods and services, both imports and exports. For the coastal states themselves this importance is reflected by the continuing desire to further locate industries within the coastal area to take advantage of the accessibility of the area to the main arteries of transport and communication (UNIDO, 2000).

Environmental concerns have not therefore played a significant role in the development of the coastal and marine areas of the sub-region (WWF, 2001a). Very little efforts has been expended in incorporating socio-environmental concerns in development planning and though widespread problems have generally been discerned in the coastal and marine areas, they have generally been shrugged off as being an inescapable part of the development process. In the African region as elsewhere, the dynamic and interactive nature of coastal and marine resources has meant that absence of adequate planning and management in these areas has been magnified in its effects on marine resources (Wilkinson et al., 1999). Although, serious environmental degradation of the marine environment has not yet occurred in many African coastal and marine areas, disturbing and perhaps irreversible trends are beginning to appear, some in connection with activities practiced outside the coastal zone. The marine and coastal aspects of these problems must therefore, be effectively incorporated into national policy and decision making (UNEP, 1999b).

### **Legislation and environmental law**

Many countries in Africa have formulated regulatory measures for their resources management in coastal and marine areas such as the issuance of permits for fishing, logging and mangrove harvesting. However, most of these measures have proven ineffective for various reasons mentioned earlier (FAO, 1997). Increasingly, the countries of the region are enacting environmental laws that can provide practical frameworks at the national level to implement environmental standards and to regulate activities of enterprises and people in the light of environmental objectives (DEA and T, 1998). At the international level, conventions like the Law of the sea, protocols and agreements such as the UNEP Regional Seas Programme have been providing a basis for co-operation among countries at bilateral, regional and global levels for the management of environmental risks, control of pollution and conservation of natural resources in coastal and marine areas are effectively tackled (UNEP, 1996b). Governments of the African countries should also be encouraged to settle their marine

environmental and other related disputes by peaceful means, making use of the existing and emerging agreements and conventions (UNEP, 1988).

### **Coastal zone management**

In the African region a few countries are in the process of developing management plans for their coastal and marine areas (Ngoile, 1997; Ibe, 1996). The Seychelles for examples initiated in 1992 a plan for coastal zone management under the UNEP Eastern African Regional Seas Plans (Shah, 1995). The objectives of this project are to prepare an inventory of the coastal and marine species, the state of coral reefs, mangroves and lagoons, to assess the extent, nature and causes of coastal and marine pollution and also to identify policy and remedial actions. The project components include training, institutional capacity building, workshops, provision of laboratory equipment, etc. It is managed from the Department of Environment that was created in June 1989 under the direct leadership of the President of the Seychelles to solve the environmental problems that stem from a general increase in the population and the rapid development of the island (Shah, 1995).

Tanzania is, as yet, only in the preliminary stages of the development of an integrated coastal zone management programme. In 1991, however, the country began the process of creating a protected area, to be known as the Mafia Island Marine Park (MIMP). This marine park will protect the last pristine coral reef ecosystem found in Tanzania's coastal waters-an area that is important as an economic resource upon which a significant coastal and island population group is quite dependent. The Tanzania government perceives that this project will serve as a preliminary or pilot project providing basic interaction and approaches for the development of Tanzania's integrated coastal zone management (Ngoile, 1997). Coastal and marine resources are valuable assets that can effectively contribute to sustainable development of the African region (Clark, 1996).

Nevertheless, uni-sectoral over-use of some resources has caused grave problems. For example, indiscriminate harvesting of mangroves might have large economic benefits to those countries in the Eastern African sub-region, but have proven detrimental to fisheries, agriculture, and coastal region tourism (Linden, 1993). Similarly, unregulated fishing efforts and the use of destructive fishing methods such as dynamiting have destroyed fish habitats and reduced fish stocks (FAO, 1997). Some African countries have formulated regulatory measures for their resources management such as the issuance of permits for fishing, logging, and mangrove harvesting. However, most of these measures have proven ineffective due to partly enforcement failure, but mainly to lack of support from the communities concerned (FAO, 1998). There is, therefore, an urgent need for an integrated interdisciplinary and multi-sectoral

approach in developing management plans for the coastal and marine areas of the African region (Ngoile, 1997).

### **Institutional and administrative limitations**

Practically, all African coastal states are at present making only minimal use of their coastal and marine resources owing to the limitations in the necessary scientific knowledge and technological know-how and to the lack of efficient organizational and administrative machinery (UNESCO, 1981). For example, the shipping and navigation services, which are so vital for the management, control and exploitation of marine resources and for the development of international trade, are still very much in their infancy in most African coastal states (World Bank, 1996a).

Marine technology is also very much underdeveloped in the region. In very few African countries there are marine technology training centres with comprehensive programmes concerning all aspects of marine technology-marine engineering, fishing and fishing gear, boat building and repair, navigation, instrumentation repair and maintenance (including electronic equipment), fish processing and preservation, economic and marketing. Thus, the development of sound training and research programmes and their effective linkages with the production system are basic and most important steps towards enhancing the capability of African states in making full use of their coastal and marine resources (UNIDO, 2000; DEA and T, 2000a).

### **Basic marine science**

Many African countries are confronted with serious manpower problems which are proving to be great impediments especially in the economic development of coastal and marine areas of these countries. In many cases, the most important cause underlying these problems, is the lack of adequate training facilities for the type of manpower required (UNESCO, 1981). Although, the majority of African countries now have national universities and other institutions of higher learning of their own, most of these institutions are young, and many are still facing teething problems concerning adequate staffing, adequate equipment, sound curriculum development, etc. In many of these countries, therefore, the universities are still grappling with the fundamental issues of producing adequate manpower of the vital organs of the civil service requiring high-level personnel, such as public administration, school education, public health and agriculture (Clark, 1996; Ibe, 1996; Sain and Knecht, 1998; World Bank, 1996b). In a considerable number of cases, even these vital sectors of the civil service are still far from being adequately staffed by qualified and experienced nationals. It is understandable, therefore, for

the universities in these countries to be pursuing for the present, narrow crash training programmes with the objectives of producing high-level manpower badly needed in key areas of the civil service. In such cases, other needs for manpower development for example training of marine scientists and technologists that would be beyond the capability of most African states working on their own should be met through regional and sub-regional co-operation. Seminars, workshops, conferences, etc. such as those organized by UNESCO-IOC would be needed, useful and appropriate for the development of manpower capable of sound management of coastal and marine areas of the African region (UNESCO, 1981; Mensah, 1994; Linden, 1993).

### **RECOMMENDED MEASURES FOR INTEGRATING COASTAL AND MARINE AREAS INTO SUSTAINABLE DEVELOPMENT STRATEGIES**

The coastal and marine areas of the African region have some of the World's richest ecosystems with extensive coral reefs, lagoons, estuaries, and mangrove forests (FAO, 1996; 1997; WWF, 2001a). These ecosystems support a wide diversity of plants and animals. The economic benefits derived from these areas are essential for the survival of a rapidly growing population (Ibe, 1996). As in many other coastal zones elsewhere, the balance of the ecosystem is threatened by unplanned industrial exploitation of marine resources, shore erosion, expanding coastal tourism, etc (Ngoile, 1997). As stated in Chapter 17 of Agenda 21 of the Earth Summit in Brazil, coastal and marine management must play an important role if resources are to be exploited in a way that ensures sustainable development to a growing population.

To implement sustainable development of coastal and marine areas of the region, therefore, African governments need to (1) develop human resources by undertaking short-term academic training to strengthen existing capabilities; (2) promote public awareness by producing educational materials on the ecological and socio-economic contribution of the coastal and marine resources and the consequences of unsustainable exploitation (3) organize policy workshops involving relevant policy and law makers to increase their understanding and commitment to the sustainable use of the resources in their coastal and marine areas, and (4) implement integrated coastal zone management programmes by establishing case studies in pilot sites of coastal and island states in the African region (UNEP, 1999a)

#### **Capacity building**

Many countries of the African region are confronted with serious manpower problems, which are proving to be great impediment in the economic development of

coastal and marine areas of these countries (UNESCO, 1981). In many cases, the most important causes underlying these problems, is the lack of adequate training facilities for the type of manpower required. Since the requirements for high level manpower in certain areas of marine science e.g., physical, chemical, biological oceanography, aquaculture, etc are not so great in terms of numbers needed by any one country at any one time, existing institutions (e.g. universities) in the region suited for teaching and research in these areas should specialize as regional or sub-regional training centres by enlarging their facilities to enable the enrolment of students from other member states, wanting to study the subjects of their specialization (UNESCO, 1981).

Oceanographic research should also be carried out on a regional or sub-regional co-operative basis using collectively-operated research vessels which are well equipped and well staffed for all types of oceanographic research and for the on-board training of marine scientific and technical staff (UNESCO, 1981). To start with one or two such vessels should be adequate for each of the sub-regions that is, Eastern and Western Africa. The co-ordination of research on a regional scale, the exchange and dissemination of research information and the storage of research data are important support activities in the protection and development of coastal and marine areas of the African region (International Ocean Institute, 2001).

#### **Public awareness**

The African governments need to increase public awareness through education. The public should be informed of long-term ramifications of coastal development. At present the general public is generally unaware of problems associated with the development of coastal and marine areas. In Madagascar for example, the wide beaches which previously attracted many tourists to the island have already disappeared (Odada, 1993). In spite of this, many structures are still being constructed on the eroding beaches. Campaigns should be instituted on a national basis to create greater public awareness of national and regional issues in the protection and development of coastal and marine resources of the African region. Education is the principle of protection and development of marine resources should be provided as part of the ordinary educational curriculum at the primary school, secondary school and university levels through training of special instructors or specialized training of general educators, and through seminars and courses offered to general public (UNESCO, 1981).

In the western Indian Ocean for example, marine science association has been formed with the secretariat at the Institute of Marine Science in Zanzibar (Ngoile, 1997). The aims of the Western Indian Ocean Marine Science Association (WIOMSA) are (1) to promote and

advance the educational, scientific and technological development of all aspects of marine science in the region, (2) to provide a forum for discussion and dissemination of information and organize meetings, seminars and workshops for the presentation of information, findings and experiences on all subjects related to marine sciences, (3) to encourage the support of marine science research, and the developments and educational activities by government agencies and private sector, and (4) to collect and disseminate scientific, technical and other information on marine sciences (Linden, 1993).

### Environmental legislation

Increasingly, environmental legislation has been providing practical frameworks at the national levels to implement environmental standards and to regulate activities in coastal and marine areas of the African region. At the international level conventions, protocols, and agreements have been providing a basis for co-operation among countries at bilateral, regional and global levels for the management of development activities, and control of pollution and conservation of marine resources (UNIDO, 2000).

However, African states urgently need to review and where necessary expand, update or strengthen national legislation and regulation pertaining to the protection and development of the coastal and marine areas (WWF, 2001a). The enforcement of national regulations related to coastal and marine resources protection and development needs to be improved. There is an urgent need to expand the accession to and ratification of international convention, such as the Law of the sea, and institute mechanism at the national level to ensure their application (UNEP, 1988).

### Management planning

The value of treating coastal and marine areas as planning entities within the overall framework of national development planning is not always fully recognized in the African region and very often countries lack the administrative and legislative basis for implementing such an approach. Industrial expansion, such as construction of ports and harbours, has often been carried out at the expense of the environment (Clark, 1996). Economic and social development, both in the coastal cities and the coastal zone, has tended to deplete natural resources and damage the environment and amenities. To solve these problems, the countries of the African region need to develop an integrated interdisciplinary and multi-sectoral approach in their management plans for coastal and marine areas. Pilot coastal sites can be selected in one or two countries in each sub-region and intensive interdisciplinary planning programme conducted,

involving several resources and scientific personnel from various institutions in those countries, including universities, government agencies and non-governmental organizations (Ibe, 1996). In addition, training courses, workshops and conferences should be organized, and publications and educational materials disseminated as part of the integrated coastal and marine resources management planning (Ngoile, 1997/3).

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