

The coastal zone and oceanic problems of Sub-Saharan Africa

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Introduction

The coastal zone and oceans surrounding Sub-Saharan Africa, with their vast resources of food, energy, and minerals, not only are composed of various fragile ecosystems, but are scenes of a variety of often conflicting uses. At present, the uncontrolled development of the coastal zone and ocean and the almost haphazard exploitation of their natural resources threaten to turn the promise of economic prosperity into an environmental nightmare that portends great dangers for present and future generations. There is the urgent need to put in place national management policies that address the environmental controls and procedures to be applied in pursuit of economic development. However, the oceans have no physical boundaries corresponding to national jurisdiction and problems originating from one country easily become those of another. Consequently, although it is recognized that remedies should be effected at the national level, such remedies should be undertaken in the framework of and as part of wider regional and global agreements and policies aimed at the sustainable development of the entire coastal and ocean environment.

The value of the coastal zone and oceans

The coastal zone and oceans of Sub-Saharan Africa constitute a huge storehouse of food, energy, and mineral resources that, if exploited rationally, could be the basis for sustainable development. The coastal zone is in addition a site of human habitation and of concomitant infrastructures for agriculture, industrial development, recreation, and communication (including harbours and ports).

The northern and southern sectors of the western African coastline are the scene of periodic profound upwelling, and upwelling, although weaker, has also been reported in the equatorial sections (Longhurst 1962; Ibe and Ajayi 1985). On the eastern African coast, the picture is much the same, and the Ras Hafun upwelling off the northern coast of Somalia has been extensively described (Newell 1957, 1959; Winters 1976). These

areas of upwelling are particularly rich in fish production. Various species of crustacea, including lobsters, deep water shrimps, and prawns, are common. In the coastal lagoons, fish, prawns, and molluscs are also abundant and help to sustain the needs of local populations.

In addition to species of economic importance, there are vulnerable and endangered species such as sea turtles, dugongs, and manatees whose preservation contributes to marine biological diversity (Howell 1988a). Waterbirds are also important; over 100 species from over 25 families are associated with the eastern African coast but are threatened (Howell 1988b).

Some of the coastal countries in Sub-Saharan Africa are, to varying degrees, oil producers and a few, such as Nigeria and Gabon, are important exporters; others have important refineries and the potential for the development of further production and refining appears substantial. Besides oil and gas, commercial energy production is dominated by hydropower and coal. A survey of the potential of ocean energy in the West and Central African region noted that attractive resources exist for ocean thermal energy conversion, oceanic bioconversion, tides and salinity exchange, but the prospects for wave and current energy are rather poor, except along the southern African coastline, where it has been determined that a favourable 10 kW/m of waterfront is available up to 1 km offshore and about 50 kW/m of waterfront up to 30 km offshore (UNEP 1983).

Non-energy mineral resources are exploited in the coastal zone of Sub-Saharan Africa. These are mostly placer minerals (e.g. in Sierra Leone and Tanzania) and vast deposits of construction materials, including sand, gravel, and limestone. Phosphate mining and salt extraction are ongoing activities in some sectors of the African coastline, as is open-pit mining. Lead-silver ores were previously quarried in Kinangoni, Kenya. In addition, the coastal zone of Africa is known to have the potential to produce the vast array of minerals that would be expected from Africa's present-day geology and evolutionary history (Ibe 1982; Ibe et al. 1983).

The coastal zone and oceans, with their ecosystems of coral reefs, seagrass beds, mangroves, etc., are repositories of biological diversity in addition to serving as food "regenerating" factories.

Owing to the pattern of early contacts with the outside world, which were mainly coast based, most African cities of note are coastal cities. For example, in western Africa, the capitals of all but three of the countries from Mauritania to Namibia are situated on the coast and it is on the coast that the major industrial developments are taking place. In Ghana, 35 per cent of the population live in towns and 60 per cent of industry is concentrated in the coastal Accra/Tema metropolis. In Nigeria, about 10% of the total population of over 80 million live in Lagos, which is also the centre for 85% of the country's formal industry. The picture of coastal development in eastern Africa follows a similar pattern (Portmann et al. 1989). To promote international and national communication (transport) and trade, harbours and ports have often been constructed that are "out of tune" with the natural environment. Tourism is a booming industry in eastern

Africa and a promising one in western Africa. Agriculture, including fishing and aquaculture, is practiced on a largely artisanal, sometimes industrial, scale.

The coastal zone and oceans serve a number of indirect functions that nevertheless add to their usefulness as an integral component of a country's socio-economic fabric. Such functions include the removal of wastes, protection from storms, absorption of atmospheric carbon dioxide (CO₂), mediation of climate, purification of air, and recreation.

The main problems and their causes

It is perhaps ironic that the problems of the coastal zone and ocean in Sub-Saharan Africa derive from their usefulness and in particular from the settlement of humans on or near the coast.

The open ocean, however, seems as yet to be largely unaffected by either the environmental degradation wrought by humans or the overexploitation of its natural resources. For living resources in the open ocean, the only danger signal comes not from the activities of coastal states but from foreign fleets (from Japan, South Korea, Taiwan, and the former USSR, among others), which "poach" fish from these waters. For example, tuna in the western Indian Ocean (eastern Africa) is heavily exploited by these foreign fleets and recent indications are that yellow and southern blue fin tuna and bill fish are overexploited and that bigeye tuna and albacore are fully exploited (Ardill 1984). Bryceson et al. (1990) stated that this fishing pressure with highly sophisticated gear has an adverse impact on smaller-scale operations conducted by the fishing fleets of the region, and that artisanal fishermen have noticed marked decreases in catches of large pelagic migratory species.

On the Atlantic coast of Africa, similar pressures exerted by foreign fishing fleets have produced similar consequences (e.g. depletion of deep water prawn/shrimp resources) for the local fishing industry (Ajayi, personal communication).

Besides the operations of foreign fishing fleets, which are sometimes illegal, many of the fisheries of the region are artisanal and based mainly in the coastal zone. Here population pressures have increased consumption and demands and led to the use of destructive fishing methods.

In the coastal zone of eastern Africa, the most environmentally destructive method of fishing is dynamite blasting, mostly associated with coral reef habitats. Bryceson (1978a) reported that repeated blasting over a long period of time has meant the destruction of extensive areas of coral reef and the decline of their fisheries' productivity. The livelihood of artisanal fishermen who employ more traditional methods is threatened. Bryceson (1978a) also reported that spear-fishing had been banned in most countries of the region owing to its damaging effects on reefs and on populations of particularly vulnerable species. For the same region, Kayambo (1988) points out that depletion of the mollusc

population as a result of its intensive collection for export and sale to tourists has been a cause for concern.

In the coastal zone of western Africa, in response to increasing demands for fish and fish products, trawling now prevails in areas formerly dominated by traditional fishermen. However, these operations are largely unregulated (or do not conform to regulations where they exist), with incorrect mesh sizes resulting in destructive fishing, including the catching of undersized fish (Ajayi, personal communication).

It is, perhaps, pertinent to mention that on the eastern and western coasts of Sub-Saharan Africa, the potential for aquaculture development is great and people are being urged to take it up as a way of increasing overall fish production. However, experience from its limited practice shows that the potential for environmental degradation (e.g. associated with clearing mangroves) is also great.

Mining of sand (siliceous and calcareous), gravel, and other construction materials (e.g. limestone) from estuaries, beaches, or the nearshore continental shelf is common (Ibe 1982, 1987a,b; Ibe and Queleennec 1989) in the coastal states and islands of Sub-Saharan Africa. The mining of sand and gravel from coastal rivers and particularly from estuaries tends to diminish the amount of fluvial sediment input to the coastline, thereby accelerating shoreline retreat. Sand extraction directly from beaches seriously depletes the sediment pool available, and beach retreat is either induced or accelerated. Dredging of sand from the inner continental shelf is an obvious cause of beach erosion in Africa. This is because the beaches along these coasts exist in dynamic equilibrium with the nearshore continental shelf. Therefore, dredging of sand/gravel for replenishment, land reclamation, or other civil engineering construction from the shore area or, for that matter, anywhere else within the dynamic system inevitably disrupts this equilibrium and enhances shoreline retreat. Countries where this problem has been documented include Liberia, Sierra Leone, Cote d'Ivoire, Nigeria, Mauritius, Tanzania, Kenya, the Seychelles, and Mozambique (Ibe et al. 1983; Ibe 1986c; Ibe and Queleennec 1989; Bryceson et al. 1990).

Besides the increased threat of erosion, the mining of construction materials from the coastal zone has a tendency to disrupt fragile ecosystems such as coral reefs and mangroves and affect their productivity (Ibe 1982; Ibe et al. 1985).

Lead-silver ores were quarried in Kinangoni, Kenya, and were a cause for concern as regards metal pollution, so that the quarries had to be closed (Muslim 1984).

The exploration, exploitation, refining, and transportation of oil and gas in Sub-Saharan Africa, although contributing to economic development, bring worrying problems because these activities routinely contribute a variety of pollutants to the coastal zone and oceans. These include hydrocarbons from occasional spills but, perhaps more importantly, from chronic low-level releases associated with leaking valves, corroded pipelines, ballast water discharges, and production water effluents. Drilling fluids contain diesel and some toxic chemicals that cause pollution. Heavy metals, particularly

vanadium and nickel, are introduced through oil-field operations and are known to affect life forms.

Another impact of oil production is the initiation or exacerbation of subsidence in the fragile coastal zone. The main effect of fluid extraction is the reduction of fluid pressure in the reservoir, thus leading directly to an increase in the "effective stress" (or grain to grain stress) in the system. Compaction results and the sedimentary basin subsides (Cooke and Doornkamp 1974). The subsequent progressive inundation of the coastline results in accentuated erosion. Ibe et al. have documented this phenomenon in Nigeria's oilproducing Niger delta (Ibe et al. 1985; Ibe 1988b).

In oil-producing coastal states, a network of canals for hydrocarbon exploitation and transportation, on or near the coast, constitutes a visible structural modification of the coastal zone that has adverse effects on coastline migration.

As stated elsewhere, perhaps the greatest problem in the coastal zone arises from development activities linked with coastal settlements. Coastal towns are by far the most developed in Sub-Saharan Africa and, by implication, the location of residential, industrial, commercial (including harbour and port construction), agricultural, educational, and military facilities in the coastal zone is high (Ibe 1988a, 1989). The increasing awareness of the revenue-generating potential of tourism has also led to increased construction of tourist facilities on beaches along the coast. Construction activities in the coastal zone loosen the sediment binding by removing the surface revetments and increasing rainwater runoff. Thus soil erosion is enhanced. On the other hand, structures constructed on the coast, by strengthening the soil, may lead to decreased sediment supply to the shoreline. The opposite problems of increased siltation and sediment starvation along the coast result, depending on the local physiographic conditions.

The pollution caused by these settlements and the accompanying development activities threatens to make nonsense of the concept of sustainable development. The pollution results primarily from raw or insufficiently treated domestic sewage and from untreated toxic and deleterious wastes from industries, which generally discharge directly into rivers, estuaries, and the nearshore ocean. Preliminary results from pollution-monitoring projects instituted by United Nations agencies, including the Intergovernmental Oceanographic Commission of UNESCO in Eastern and Western Africa, show that pollution by pathogenic organisms, pesticides, chemical fertilizers, and petroleum hydrocarbons is widespread, while metal pollution occurs as hot spots close to industrial sites.

Solid matter (litter) from industries, households, shipping, and the tourist trade poses a problem of an unsightly and irritating nature, but it also has serious public health implications.

The construction of ports, harbours, and piers for national and international trade has a direct negative impact on the environment. This is because, for the most part, these

structures lie perpendicular, or nearly so, to the littoral zone, thereby causing acute down-drift erosion. This problem has been documented in Benin, Togo, Nigeria, Liberia, Ghana, Cote d'Ivoire, South Africa, Tanzania, and Somalia, among others. In most of these cases, attempts at solving the harbour-induced erosion have further exacerbated the problem (Ibe 1986a,b).

Increased clearing of coastal vegetation at construction and mining locations or for the establishment of agricultural farms or the expansion of settlements leads to increased surface runoff and makes the exposed area extremely vulnerable to mass movement and to erosion by winds, currents, and water. Large areas of mangroves have been cleared in Kenya, Tanzania, Ghana, and Mozambique for the production of salt by evaporation (Ibe 1987a; Semesi 1988). In Mauritania, Guinea, Sierra Leone, Liberia, Togo, and Angola, open peat mining in littoral zones also contributes to the destruction of vegetation and the acceleration of coastal erosion. The clearance of mangroves is particularly serious because mangroves, in addition to serving as windbreaks, provide excellent spawning and nursery grounds for a variety of coastal organisms, including fish, crustaceans, and molluscs. The loss of mangroves therefore has serious implications for the productivity of coastal ecosystems.

An additional possible problem in coastal areas relates to the expected effects of global warming on shallow ocean and coastal zones, in particular the impact of the associated rise in sealevel. The negative implications of global warming, if they occur, will be considerable for natural and man-made ecosystems, human and animal health, and the spatial and temporal characteristics of natural and human resources (Ibe 1989; Ibe and Ojo 1993; Ojo 1992; Tobor and Ibe 1992).

Remedies

Owing to the abundant natural resources with which they are endowed, the coastal zone and oceans of Sub-Saharan Africa hold the key to the social and economic well-being of the coastal states. This is on condition that these resources are exploited in a rational and prudent manner that ensures economic gains while preserving the integrity of the environment. This is the central thrust of the concept of sustainable development.

Today, the exploitation of the natural resources of the coastal zone and near-shore ocean is almost haphazard and has very little respect for the quality of the environment. A degraded environment cannot sustain the renewable resources needed to support the teeming populations that have thronged to coastal areas on account of the presence, in the first place, of these resources; the quality of life of the people deteriorates, and the ensuing struggle for human survival puts additional pressures on the environment and the increasingly limited natural resources. A sort of vicious cycle comes into play. The need is therefore urgent to break this cycle. As has been emphasized elsewhere, the problems of Sub-Saharan Africa as far as the open ocean is concerned are few but they are multifarious for the coastal zone. It would appear reasonable, therefore, to focus suggested remedies on this critical zone.

Attempts at piecemeal solutions of coastal zone problems seem to have failed woefully on account of their intricately interwoven nature. The resulting conflicts are sometimes difficult to solve unless institutionalized frameworks exist. National coastal zone management policy, with adequate legal provisions and providing linkages between the exploitation of natural resources, the conservation of these resources, the preservation of environmental quality, and the promotion of human well-being, seems to be a pressing need. Such a policy, which should have as a core objective the relief of population pressures on the coastal environment, must state clearly not only the concern of a given country for rational coastal zone development but also the procedures to be applied in the coastal zone. In this regard, inspiration and lessons should be drawn from the prevalent practice in most countries in the industrialized world where, despite a variety of existing controls to reduce pressures on the coastal zone, specific laws have been passed to give greater precision to the legal status of coastal zone management and control. The Coastal Zone Management Act of 1972 in the United States of America and Decree no. 79-716 of 17 August 1979 in France are particularly instructive (Ibe 1987c, 1988a).

There will be a need to create (where they are lacking) or to strengthen (where they exist) appropriate national infrastructures to ensure effective compliance with such policies. However, although action at the national level is desirable, it must be borne in mind that, spatially, the oceans and the coastal waters (lagoons, estuaries, bays, creeks) that are in communication with them have no physical boundaries conforming to national jurisdiction. The transportation of pollutants originating from land-based sources in one country to neighbouring countries cannot be prevented physically; the downdrift erosion generated by structures perpendicular to the shore in one country will easily affect another country. The same goes for atmospheric inputs. Oil or toxic chemical accidents at sea transcend national boundaries in their impacts. The meaningful approach therefore should favour integrated and coordinated global resource development and global environmental protection strategies.

Even before but particularly since the 1972 Stockholm Conference on the Human Environment through the United Nations Law of the Sea Conference in 1982 to the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, existing international agreements have implied this global view and contain, for the most part, explicit provisions for capacity building and the transfer of technologies and experience as well as financial assistance, and these issues are of legitimate concern to developing countries. It would appear prudent for coastal states in Sub-Saharan Africa to be parties to existing conventions aimed at the protection of the global ocean and coastal zone and to seek to negotiate from "within" in order to change any provisions that are not in their best interests. In the same vein, these states are encouraged to join the negotiations for future conventions to ensure that their specific concerns are catered for within the global view. Increased global solidarity is imperative in the quest for a healthier ocean and coastal zone and the rational exploitation of their resources towards sustainable development.

As a manifestation of this solidarity, the rich industrialized countries, despite their own troubles (real or perceived), should be willing (even enthusiastic) to assist developing

countries, and in particular countries in Sub-Saharan Africa, in their attempts to alleviate poverty. As a developing country leader put it very lucidly many years ago, "poverty is the greatest pollution" in developing countries. Poverty is indeed the key element in the vicious cycle responsible for persistent environmental degradation in developing countries, and it would seem logical that any credible policy aimed at restoring and preserving the environment in Sub-Saharan Africa should have as a principal target the elimination of poverty. This could be done through a combination of the many schemes already proposed - for example, debt forgiveness, debt for nature swaps, interest-free loans for the installation of improved pollution-free technologies in Sub-Saharan Africa. In making the commitments called for, the rich industrialized countries must recognize that there are few or no other options open to them, because, if the developing countries "sink in a polluted ocean," the bonds and interrelationships that have made the world a global village mean that the developed world would be dragged down as well.

The time for concerted action is now. Fortunately, the Agenda 21 (Chapter 17) programme approved at the 1992 United Nations Conference on Environment and Development (UNCED 1992) affords an effective framework of global action towards the sustainable and equitable development of the entire ocean and coastal areas. It is hoped that the implementation of the provisions of Agenda 21 (Chapter 17) will bring significant improvement and protection to the ocean and coastal environment of Sub-Saharan Africa and will ensure, as was hoped for in the 1985 Brundtland Commission Report, that, in exploiting the resources of this environment, "the needs of the present generation should be satisfied without compromising those of future generations" (WCED 1987).

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