

Coral Reef Resources of East Africa: Kenya, Tanzania and the Seychelles

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Coral reefs are widespread along the East African coast and Seychelle Islands. Their roles in island building and coastal protection are often underestimated, they are also important fishery habitats and major tourist attractions. The East African marine fishery production, estimated at 1.4-4.9 tonnes per km², is principally a result of artisanal fishing. Siltation, trampling, and destructive fishing methods are the main cause of coral reef degradation along the East African coast and associated islands. Legislation has been implemented to protect coral reefs by establishing marine parks and reserves. However, poaching and anchor damage are widespread on these protected reefs. Legislative provision to increase the benefit to fishing communities may reduce poaching. The establishment of exclusive nature reserves may be one way to ensure preservation of some coral reefs in the region.

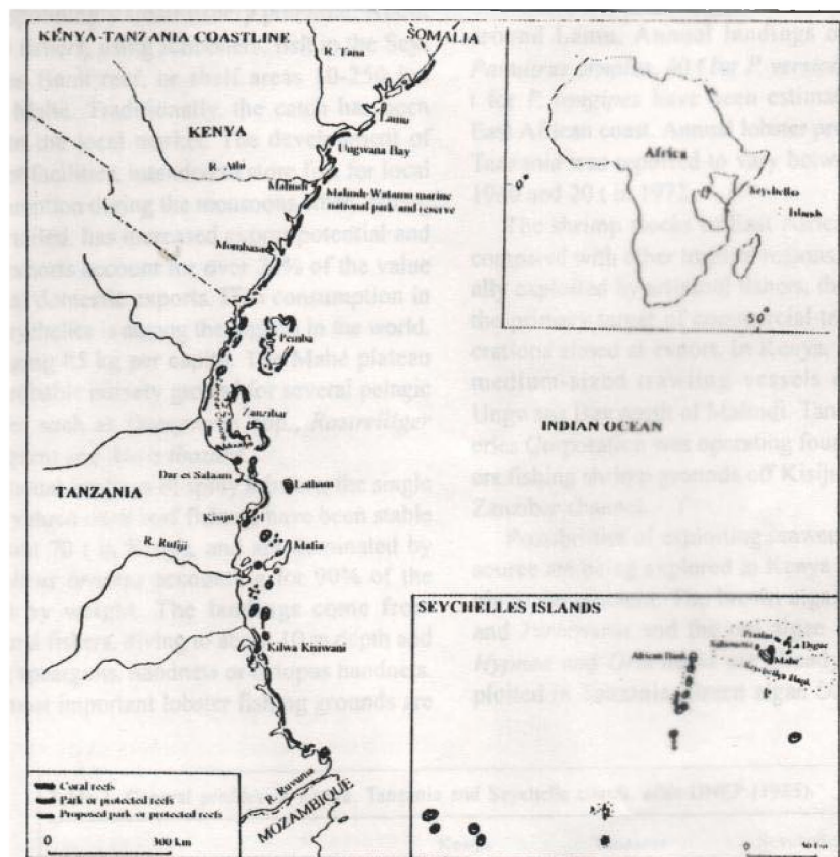


Fig. J. Coral reefs of Kenya, Tanzania and the Seychelles Island

Introduction

Coral reefs are a prominent feature of the East African coastline and associated islands. The Kenya-Tanzania coastline

stretches from 1°30'S, at the Somali border to approximately 10°S at the Mozambique border. The Seychelle Islands extend from 5°S to 10°S and 45°E to 56°E (Fig. 1). The climate along the East African coast is dominated by seasonal monsoon winds (northeast monsoon from November to February and southeast monsoon from March to October) and the equatorial currents dictated by the intertropical convergence zone.

The narrow East African continental shelf supports fringing and patch reefs which lie 0.5 to 2 km offshore. General profiles of East African coasts are given in Table 1. Gaps in the reefs occur near river mouths notably Tana, Athi and Rufiji, where extensive mangrove stands occur. The islands in the Seychelles group are geologically divided into two groups: the inner granitic islands to the northeast, and the outer coral islands to the south and west. The southern islands lie in the west-flowing South Equatorial Current, whereas the Seychelle Bank Islands lie in the path of the east-flowing South Equatorial Counter Current resulting in differences in climatic and hydrographic conditions.

The function of coral reef communities is often underestimated; they build islands and offer coastal protection. The majority of isolated islands and island archipelagos of the Indian Ocean are made exclusively of coral deposits. Fifty-one of the ninety-one Seychelle Islands owe their existence to coral growth. Reefs provide protection to beaches and provide calm boating and diving sites for recreation. Seagrass beds are often associated with clear shallow lagoons. The seagrass beds provide a habitat for economically important juvenile organisms.

Fisheries

The late John Gulland (1979) estimated the annual catch per km² at about 4.9 t in North Kenya reefs; 5.6 t in South Kenya reefs; 4.7 in North Tanzania; 4.8 t in southern Tanzania; 1.4 t in East Mahe; and 3.1 t in West Mahe. The maximum sustainable yield along this part of the coast is estimated at 5 t/km². The fishery is concentrated on inshore waters and reef habitats. Snappers, grunts, and parrotfish dominate in quantity, while spiny lobsters, shrimp and crabs dominate in value.

An estimated 2,050 artisanal nonmechanized fishing boats operated in the 12-mile limit of

territorial waters in Kenya. In the artisanal sector, gill nets, beach seines, bottom lines and traps are the principal fishing gears. Commercial trawling operations by medium-size Kenyan-owned vessels focus on the shrimp resources in Ungwana Bay. The reefs of Tanzania are used widely for fishing, especially near coastal towns where fish, shells, lobsters and octopus are taken. Fishing activities are concentrated inshore and around the islands of Zanzibar, Pemba and Mafia. Between 80 and 90% of the marine fish catch comes from the artisanal fishery which uses hooks, lines and cast nets from nonmechanized outrigger canoes. Edible molluscs such as clams, mussels and octopus are collected in Zanzibar for private consumption and shells are collected for sale to tourists and for export.

Fish are the most important natural resource on the Seychelles. The fishery potential around the granitic islands is substantial because of the extensive area of shallow water. Islands and atolls on the west and south of the Seychelle Bank generally have narrow continental shelves and a correspondingly small fishery potential. About 1,500 fishers, using schooners, fish in the Seychelles Bank reef, or shelf areas 10-250 km from Mahe. Traditionally, the catch has been sold to the local market. The development of freezer facilities, intended to store fish for local consumption during the monsoons when fishing is curtailed, has increased export potential and fish exports account for over 20% of the value of total domestic exports. Fish consumption in the Seychelles is among the highest in the world averaging 85 kg per capita. The Mahe plateau is a probable nursery ground for several pelagic species such as *Decapterus* spp., *Rastrelliger*, *sagurta* and *Auxis thazard*.

Annual landings of spiny lobsters, the single most valued coral reef fishery, have been stable at about 70 t in Kenya, and are dominated by *Panulirus ornatus* accounting for 90% of the catch by weight. The landings come from artisanal fishers, diving to about 10m depth and using spearguns, handnets or octopus handnets. The most important lobster fishing grounds are



A warning notice from Mombasa Marine National Park cautioning against collection of all marine life.

around Lamu. Annual landings of 60 t for *Panulirus ornatus*, 40 t for *P. versicolor* and 30 t for *P. longipes* have been estimated for the East African coast. Annual lobster production in Tanzania was reported to vary between 60 t in 1960 and 20 t in 1972.

The shrimp stocks of East Africa are small compared with other tropical regions. Traditionally exploited by artisanal fishers, they are now the primary target of commercial trawling operations aimed at export. In Kenya, around ten medium-sized trawling vessels operate in Ungwana Bay north of Malindi. Tanzania Fisheries Corporation was operating fourteen trawlers fishing shrimp grounds off Kisiju and in the Zanzibar channel.

Possibilities of exploiting seaweed as a food source are being explored in Kenya and Tanzania at the moment. The brown alga *Sargassum* and *Turbinaria* and the red algae *Eucheuma*, *Hypnea* and *Gracilaria* are already being exploited in Tanzania. Green algae *Ulva*, the red

algae *Hypnea* and the brown algae *Cystoseira*, *Turbinaria* and *Sargassum* are used as fish trap bait. The leaves of *Enhalus acoroides* are used for mats while the rhizomes are eaten, particularly in Lamu.

Recreation

Reef related recreational activities are an important source of revenue for the tourism industry. Reefs are easily accessible in Mombasa, Malindi and Watamu (Kenya). Malindi-Watamu Marine National Reserve is a principal recreational area in Kenya. A third of the tourist arrivals visit the coastal area, principally Malindi and Mombasa. Several of the Tanzanian reefs near Dar es Salaam are of considerable importance to tourism but Zanzibar is considered to have a higher potential.

The 1960s copra and cinnamon export-dependent economy of the Seychelles has gradually been replaced by tourism as the principal foreign income earner after the opening of an international airport in 1971. Tourism reached a peak of over 70,000 arrivals in 1979 but has since fallen. Tourism represents an estimated 70% of earnings, 46-55% of the domestic product and employs between 7,000 and 8,000 workers, approximately 12% of the population. Considerable capital expenditure has taken place on Mahe, Praslin and La Digue to improve the infrastructure necessary for tourism.

With an increase in coastal tourism, trade in marine souvenirs has developed; corals and

Table L. General profiles of Kenya, Tanzania and Seychelles coasts, after UNEP (1985)

	Kenya	Tanzania	Seychelles
Length of coastline (km)	500	800	600
Total shelf area (km ²)	19,120	18,908	48,334
Coral reef area (km ²)	?	>2,183	20,083
Trawlable area (km ²)	10,994	0	14,176
Marine fish landing (1980) (tonnes)	5,400	49,200	5,000

shells are the principal items. Tanzania exported over 250 t of coral and shells in 1979. Despite control, foreign trade statistics indicate 144 t of corals and shells were exported from Kenya in 1982. Stony corals, black and whip corals, sea urchins, turtle shells and sea fans are also sold as souvenirs. Many coral reef fish species including the scorpion, angler, puffer, angel, file, surgeon, damsel, box and trigger fishes are exploited for the aquaria trade.

Biological Diversity

Within their limited confines, coral reefs may support as many as 3,000 different species (Salm 1983). Over 850 species of fish have been recorded in the Seychelles. All the five species of turtles known from the Indian Ocean are found in Tanzania. The green turtle *Chelonia mydas* has a nesting population of around 300 individuals in Tanzania. A green turtle population of between 1,000 and 2,500 is centered on Aldabra and Cosmoledo Islands. The hawksbill turtle *Eretmochelys imbricata* occurs widely on reefs throughout the region. Both species are classified as endangered species by UNEP. The beaches on which they lay their eggs suffer degradation through removal of sand or recreational use. The olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*) and loggerhead turtle (*Carretta carretta*) are classified as threatened species. Their eggs are collected, nesting beaches have been lost and they are often caught in shrimp trawl nets. The dugong (*Dugong dugong*), a strictly shallow water mammal living in sheltered habitats, is classified as an endangered and vulnerable species. The principal problems are trawling and active hunting.

Disturbances to Coral Reefs

Pressure on the East African coral reef ecosystems has steadily increased with an increase in population, and development of industry, agriculture, fisheries and tourism. Poor land use methods lead to severe soil erosion and subsequent flushing through the river systems, particularly the Tana (an estimated 9.2 million t/year) and Athi rivers in Kenya. Deleterious effects are increasingly felt in coral reef areas particularly in Malindi and areas further south. Siltation due to inland deforestation may become an increasing problem in the coral reefs of Tanzania.

Use of chemical fertilizers and pesticides will increase as East African nations strive to increase food production to feed the expanding

populations (3.6 and 3.7% per annum for Kenya and Tanzania, respectively). Unfortunately, long-lived organochlorides are still extensively used. Nutrient enrichment in nearshore waters may cause phytoplankton blooms, and these may affect higher organisms. Increases in sea urchin densities in Kenyan coral reefs have been associated with fishing pressure. The effects of these anthropogenic inputs on the physiology and recruitment patterns of corals and other nearshore species are still unknown.

Siltation from land tilling and dredging operations may be the most serious threat to the coral reefs in the Seychelles. The granitic nature of the islands in the Seychelle Bank presents special problems for urban and residential development. The area east of Mahe has suffered from loss of mangroves from harbor, airport and industrial construction.

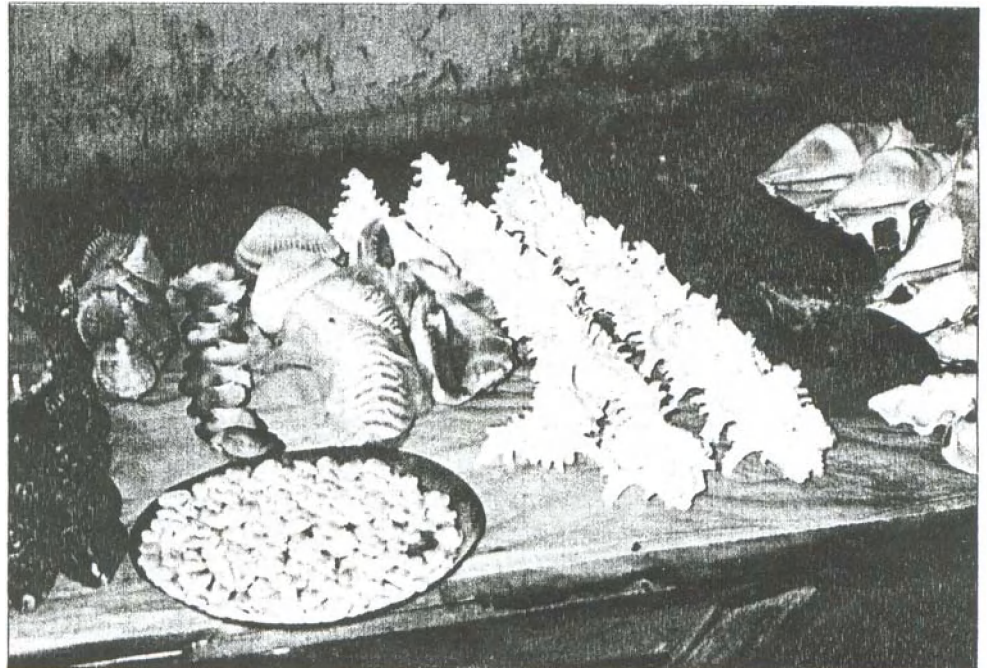
A potential exists for oil pollution from either heavy tanker traffic carrying crude oil from the Arabian Peninsula, or inland storage and refinery facilities. Oil refineries in Mombasa and Dar es Salaam are near extensive coral reefs. Oil spill control and clean-up facilities are extremely limited. Other potential pollution sources include the cement industry, chemical and textile plants and domestic effluent from rapidly growing urban populations. Coral mining, to meet the demand for lime and construction materials, has damaged reefs in Kenya and was proposed in the Seychelles (Salm 1983). Coral mining exposes the coast to erosive forces of the sea.

Tourism had already caused considerable reef destruction in several areas by the 1960s in Kenya. Trampling and anchor damage are major problems in protected areas. It is probable that most of the damage to reefs blamed on explosive fishing is in fact caused by commercial shell collection. In Tanzania, of the eight reefs recommended as marine parks in 1968, only two still have intact reefs - Latham and Mafia islands. Reef destruction by dynamite fishing may have caused rapid beach erosion along the coast of Dar es Salaam and Mbudya Island. The pressure on coral reefs from coral and shell souvenir collection, trampling and anchor damage is expected to increase as coastal tourism increases.

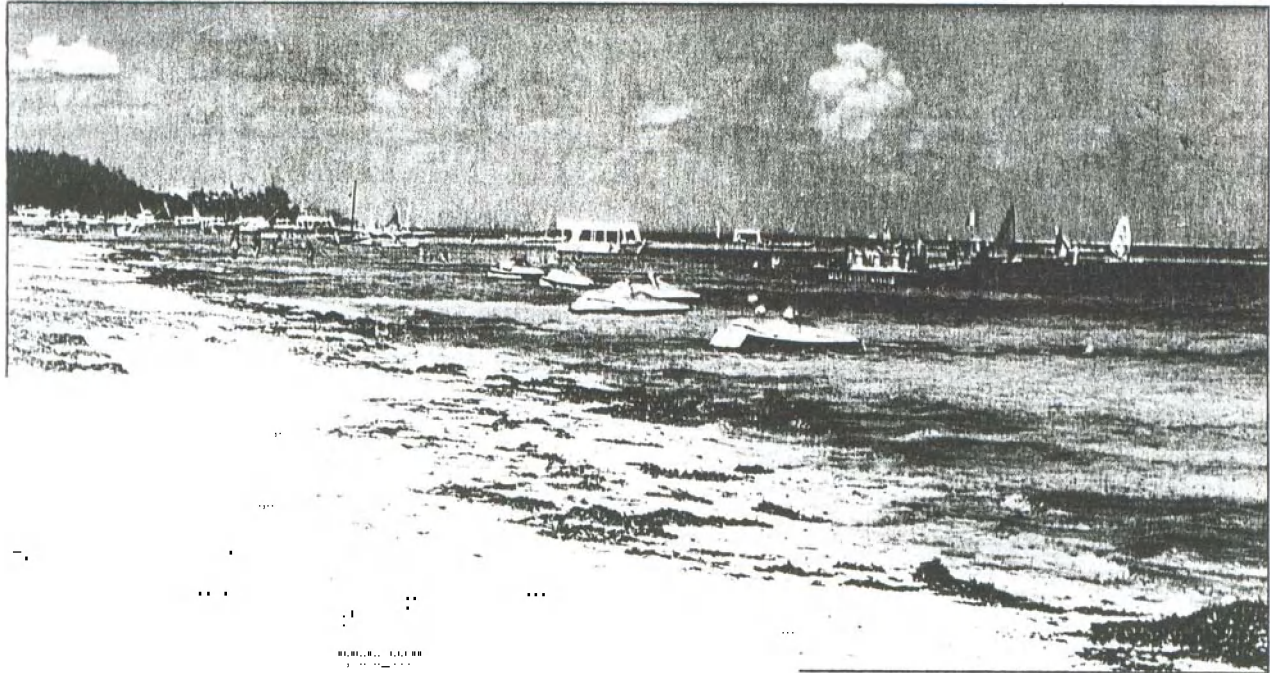
Mitigation

In recent years, the East African governments have demonstrated genuine concern regarding conservation and means to control the exploitation of the marine resources. Much attention has focused on coral reefs. Legislation designed to protect reefs and management institutions has been put in place. Some designated marine parks and reserves that include coral reefs are shown in Fig. 1. Fishing of some species has been banned or restricted to specific seasons when the populations are less vulnerable. Destructive fishing methods have also been banned.

Damming the Tana and Athi Rivers has been reported to reduce the siltation problem in the



Marine shell souvenirs on sale in a coastal town.



Heavy boating and diving activities are a major threat in most protected reefs.

reefs in Malindi and fisheries seem to be improving. However, the long-term solution is to deal with the problem at the source by reducing soil erosion. Use of suction dredges and geotextile silt curtains during local dredging operations would reduce the damage on nearby coral reefs.

National parks and reserves in Kenya are under the jurisdiction of the Kenya Wildlife Service. In marine parks, which constitute the core zones of marine reserves, the fauna and flora are fully protected. In marine national reserves, which form the buffer zone of marine parks, specified traditional methods of fishing are allowed but collection of corals and shells is prohibited as is fishing by poison, dynamite and by speargun.

The Ministry of Natural Resources and Tourism administers all natural resources in Tanzania through separate Divisions of Fish, Forestry, Tourism and Wildlife. Several coral reef areas around Dar es Salaam, Mafia Island, Maziwi and Tanga were protected in 1981 according to the 1974 Wildlife Conservation Act. However, they are yet to be implemented and appropriate regulations need to be drawn up. In contrast to Zanzibar, which has an effective patrol force fishing and other human activities, including dynamiting still take place in Tanzania because limited funds are available to enforce the regulations. Kilwa Kisiwani, Latham Island and an extension of Mafia Island reserve are some proposed protection sites that include corals

The Government of Seychelles 1971 'white paper' on conservation policy, established the intention to protect some coral reefs around the granitic islands of Mahe, Silhouette, La Digue and Praslin. The government objectives were to preserve examples of natural habitats, to protect natural resources and to protect and develop appropriate areas for public recreation. Parts of the Seychelles legislation relevant to marine conservation include items under which fishing is regulated, dynamiting is prohibited and spear fishing is illegal. All marine turtles have been protected since 1979 in the Seychelles. Collection of shells from shell reserves, except dead shells on the foreshore, is banned under the Conservation of Marine Shells Act 1981 which also bails coiled ion or protected species.

Legislation without enforcement offers little protection to coral reefs. Tanzania is a good example. Marine parks and reserve legislation were introduced to the region several decades ago. However, poaching continues. The reduction of fishing grounds used by local communities for centuries is often overlooked, especially when planning for protection of coral reefs, and this often leads to user conflicts. Legislative provision which ensures that the fishing communities benefit from marine parks would reduce poaching.

Most extractable coral reef resources in the region are maximally exploited. Designation of coral reefs as marine parks and reserves does not guarantee preservation. Establishment of exclusive nature reserves, where entry is only per-

milled for special purposes may be the only way of preserving some of the coral reefs in the region.

Acknowledgements

I would like to thank Stephen Mwangi for the photographs; the Recoscoix-wio Dispatch Centre, Mombasa, for providing valuable information; and Dr. R. van Woosik and Prof. Yamaguchi for encouragement.

Further Reading

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