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Coastal and marine environmental problems of the United Republic of Tanzania

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PREFACE

The Government of the United Republic of Tanzania approached UNEP in late 1987 with a request for assistance in assessing the coastal and marine environmental problems of the country and in drawing up a national action plan for the protection, management and development of its marine and coastal environment.

In response to this request, and in close co-operation with the Tanzanian National Environmental Management Council (NEMC), a mission was organized by UNEP. The terms of reference of the mission was to:

- review the status of the United Republic of Tanzania's capabilities in the field of marine sciences including the identification and description of national institutions engaged in marine science and pollution studies;

- survey coastal and marine living resources;

- identify species, habitats and ecosystems that may require protection in order to:

  (i) maintain essential ecological processes and life supporting systems and the preservation of genetic diversity;

  (ii) ensure the sustainable utilization of living resources;

- identify possible sites for the establishment or improved management of specially protected areas such as marine parks and reserves;

- identify major sources of marine and coastal pollution and assess the present levels of marine pollution in the coastal areas including identification of changes in the environment that may be ascribed to pollution; and

- make an inventory of major ongoing and planned development activities which have or may have an impact on the quality of the coastal and marine environment.

The surveys were undertaken in late 1987. They were carried out in consultation with local experts, to ensure that proper consideration was given to local, regional and national problems and priorities in the drafting of the National Action Plan.

The report consists of a summary describing specific coastal and marine environmental problems of the United Republic of Tanzania such as, coral reef destruction, mangrove cutting, fisheries over-exploitation and unnecessary intrusion in and disturbance of marine reserves. This summary is based on six sections on various regions of the United Republic of Tanzania, with their findings and recommendations; and of a proposed Action Plan for the protection, management and development of the marine and coastal environment of the United Republic of Tanzania, developed in the context of the regional Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region.

Dr. M. Pearson (Institute of Marine Science in Zanzibar) carried out the surveys and wrote the six sections of the report. Mr. P.K. Akiwumi prepared the consolidated report. The assistance of the national authorities and counterparts of the United Republic of Tanzania is gratefully acknowledged.

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ANNEXES*

*See separate volume.

A. PHYSICAL ENVIRONMENT

Tanzania lies south of the equator between the Great Lakes (Victoria, Tanganyika and Nyasa) and the Indian Ocean, stretching from the border of Kenya to Mozambique. There are five coastal regions: Tanga, Dar es Salaam, Coast, Lindi and Mtwara. The coastline stretches 800 km along the Indian Ocean from the Kenyan to the Mozambiquan border with a 200 nautical mile (nm) wide Exclusive Economic Zone. The coast has a very narrow continental shelf varying from approximately 3.2 nm wide to a maximum of 34.5 nm at areas around Mafia, Zanzibar and Pemba Islands. The coastline is primarily characterized by sweeping sand beaches, rocky outcrops, and developed fringing coral reefs and is also punctuated by extensive growths of mangroves particularly near the mouth of larger rivers (L.Berry, 1980).

1. GEOMORPHOLOGY OF THE COASTLINE

The coastline of Tanzania can be divided into three main categories, these are:

(i) indented coastlines with off-lying reefs and islands;

(ii) shallow bank coastlines, little indentations with off-lying large islands;

(iii) indented coastlines with narrow shelf fringing reefs with deep oceanic waters to seaward.

From the Kenyan border southwards to Pangani the coastline is indented with off-lying reefs and islands with shelves extending to the western coast of Zanzibar (Figure 1, annex X). From Dar es Salaam (Ras Ndege) to Ras Buyuni the coastline is indented with narrow shelf fringing reefs and deep oceanic waters to seaward. The coastline from Ras Buyuni to Kilwa Masoka (Ras Tikirini) is a bank area of deltaic origin indented by deep channels and interspersed by coral reefs (patch reefs) and coralline islands of pleistocene origin. This area is influenced by the Rufiji rivers north and south deltas depositing sediments of alluvial origin and by carbonate sediments of reefal origin. South of Mafia island and to the east of the southern delta of the Rufiji is a bank and patch reef area extending 16 nm to a series of islands to the east: Okuza, Nyuni, Limbi, Fanjore and Songo Songo. All the islands are fronted by extensive fringing reef formations. The 100 fathom line (600 ft or 300 m) is located immediately to seaward of these islands and approximately 2 nm to seaward of Mafia and Zanzibar. The 100 fathom line can be 4 nm offshore in the latter. South of Kilwa the coastline is indented with a narrow shelf, fronted by fringing reefs with the 100 fathom line lying 1 to 3 nm offshore. From Mtwara to Ruvuma (Mozambique border) the coastline is a narrow banked area fronted by fringing reefs and islands leading to the Ruvuma estuary south of Ras Matunda.

Pemba (Figure 2a, annex X) is a true oceanic island surrounded on all sides by deep oceanic waters with a maximum depth of 546 fathoms (3,276 ft or 638 m) in the Pemba channel which separates the island from the mainland coast. The east coast of the island consists of a narrow fringing reef with the 100 fathom line lying 1 to 2 nm offshore. Between Ras Kiuyu to the north and Ras Upemba to the south, low lying pleistocene reef structures are found along the coast with three breaks fronted by low islands well covered by undisturbed mangrove forests. The south consists of a drying bank and a series of coral islands (pleistocene) to seaward with the coast dropping off very rapidly to 200 fathoms less than 1 nm offshore. The west coast is a unique indented coastline fronted by low lying coral islands and fringing reef formations which are dissected by five passes characterized by high water flows during the ebb and flood tides. The area contained within these reefs and islands consist of patch reefs and seagrass beds bordered by dense mangrove cover.

Zanzibar (Figure 2b, annex X) consists primarily of an exposed pleistocene platform backed by an extensive bank formation to the mainland of Tanzania. There are no rivers in Zanzibar.

Several islands of pleistocene coral origin can be found to the west, they are Kepandiko, Chapani, Changa, Bawi, Chumbe, Kwale and Pungume. To the north lies the island of Tumbatu. It may once have been attached to the main island but is now separated by a channel 1.5 to 3 nm wide with a maximum depth of 8 fathoms and a minimum depth of 1 fathom. The east coast is generally straight on a northwest-southeast axis. To the north is a small pleistocene coral island (Mnemba) surrounded by extensive coral formations and deep water to seaward. At Chwaka there is a large embayment of shoaling water. The bay is covered primarily by Thallassia and Thallassodendron and is surrounded by mangrove forests on its southern fringes. From Ras Nungwe to the north and Ras Kizimkazi to the south, the coastline is fronted by a fringing reef. This is a high energy reef, backed by a small back reef/lagoon system that may dry at low water springs. No information was available on the geomorphology of Mafia Island.

2. CLIMATE, CURRENTS AND HYDROGRAPHIC CONDITIONS

The primary influencing factors affecting the climate, currents and hydrographic conditions of the coast of Tanzania are the seasonal monsoon winds (Figure 3, annex X). The climate of the region may be described as moderately warm tropical.

Between the months of May and November the monsoon winds known as the southeast trade winds approach the coast of Tanzania from a south, southeast direction. They are then deflected along the coast in a northerly direction. Besides the incidental conventional precipitation frequently associated with the coast and islands, (Figure 4, annex X), rainfall pattern is closely associated with the southeast trade winds which blows over a large body of water, (Indian Ocean), and has the greatest impact on the region. Most of the moisture carried by the winds falls in the southern and central parts of the East African coast and is depleted of much of its moisture by the time it reaches northern Kenya and Somalia. Between the months of December to April the prevailing monsoonal winds, are from the northeast. These northeasterly trade winds are principally continental in nature and therefore relatively dry except for the moisture picked up in the northern Indian Ocean and the Arabia Sea. Northeastern Tanzania benefits from the water deposited by these winds. Because of the effects of the two trade winds and Tanzania being close to the equator it has one long and one short rainy season.

The principle ocean currents affecting the Tanzanian coast are the South Equatorial Current, the East African Coastal Current and the Somali Current (Figure 3, annex X). As the South Equatorial Current approaches the African continent it splits to form two coastal currents, the Mozambique Current which flows southwards and the East African Coastal Current (EACC) which deflects along the African continent flowing northwards.

Between the months of May to November the EACC is under the strong influence of the southeast trade winds which causes it to flow northwards. The current continues to flow along the Somali coast but due to strong offshore winds north of the equator results in the upwelling of cold nutrient rich water. The northeast trade winds generates the southward flowing Somali current which meets and reverses the EACC. The currents deflect to the east usually at or just south of the equator (Newell, 1957).

It has been found that inshore coastal features such as banks, reefs and islands all influence the flow of the EACC, creating eddies, vortexes and layer counter currents all within the depth of shallow biological features, Harvey (1977), Newell (1957), Mwaipopo (in press).

The temperature of the coastal waters average at 27^{0}C but may reach 25^{0}C during July to September and rise to 28^{0}C to 29^{0}C in shallow areas during January to March. The average value of salinities was measured at 34.5^{0}/oo.

To date, there has been no study of the mixing characteristics of the Rufiji waters and that of other major rivers with off-lying saline coastal waters and the patterns of sediment fallout along the Tanzanian littoral. There is a need for such studies to be undertaken in order to

B. SPECIFIC MARINE ENVIRONMENTAL FEATURES AND PROBLEMS

1. ASSESSMENT OF THE CONDITIONS OF THE MARINE ENVIRONMENT

1.1 Coral Reefs

Fringing reefs are the main characteristic reef formation of the Tanzanian coastline. Due to the narrowness of the continental shelf all the coral reefs of the region are close to land and as a result are strongly subjected to natural and human influences and are particularly vulnerable to changes in land use and coastal development.

The coral reefs of the United Republic of Tanzania showed severe damage due to the use of explosive fishing techniques. The extensive and continued practice of this fishing method has reduced much of the substrate normally suitable for recolonization to unconsolidated rubble. This rubble is now colonized extensively by soft coral species inhibiting the possible settlement of the more energetically important scleractinian species.

The soft coral species having a faster growth rate tend to reduce available substrate for settlement and overgrow juvenile colonies. In severely damaged areas, soft coral cover was estimated at 60-80%. The areas contained by Msasani bay to the south and northwards to Ras Kirimoni is one example of a reef area being subjected to continuous explosive fishing, up to three impacts per hour were observed. The use of explosive fishing techniques is carried out quite openly during daylight hours and in close proximity to residential areas. Action is seldom taken to prevent this activity.

Explosive fishing does not only cause direct destruction to the reef. When used on sand areas adjacent to patch reefs considerable volumes of sediment are lifted which then settle heavily on the adjacent coral. Mortality of corals due to smothering by sediments was observed with high reef mortality due to this method on the reefs of Okuza Island. There are areas, however, where no explosive fishing activities have been reported such as in the reef and bank areas south of Mtwara, from Ras Msamgamku to the Ruvuma river. The general reasons given for the increase in explosive fishing are the shortage of fishing gear available and the noticeable decrease in available fish stocks when traditional fishing methods were used. The coral diversity is, however, good but the cover is low, with no major frame building coral observed in its juvenile stages.

Damage to the reef attributed to explosive fishing is also increased by mangrove poles,