REGIONAL SEAS

UNITED NATIONS ENVIRONMENT PROGRAMME

Coastal and marine environmental problems of the United Republic of Tanzania

UNEP Regional Seas Reports and Studies No.106

Annexes

UNEP 1989

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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INTRODUCTION

The Tanga region (Figure 1, annex X) extends from the Kenya border to a point just north of Mligasi River. In addition to the Mligasi River, the coastal area receives the Msangasi, Pangani and Sigo Rivers, these originating from two watersheds; the Pangani and Wami draining a combined 101,643 km^2 (Figure 5, annex X). The Wami River though draining into the sea south of the regional demarcation influences the coastal ecosystems of the Tanga region due to a continuous northerly flowing current of 1/2 to 4 knots depending on seasonal factors and climatic conditions. The coastal zone is much indented, having a complex system of bays and islands to the north and a partial barrier of reefs and islands from 1-5 nm offshore extending just south of Pangani.

There are two urban centres, Tanga, the regional headquarters and Pangani, a small fishing and agricultural centre.

The survey of the Tanga region included a representative sample of all marine environments and the urban area including an assessment of industrial development on the coastal zone. The information presented below is a digest of observations and the result of discussions with regional officers.

1. MARINE ENVIRONMENTS

1.1 CORAL REEFS

Coral reefs and fringing reefs around offshore islands were observed and their conditions assessed. These included from north to south: Boma Reef, Mwamba Shundo, Mwamba Wamba, Fungu Nyama, Niule Reef, Yambe Island, Karange Island and Fungu Tongone.

(a) Boma Reef

A reef situated 0.45 nm off Boma Peninsula. A large drying section with a sand bank, and a channel between the reef and the mainland with a minimum depth of 7m is exposed at low water spring. The sand bank spreads towards the mainland coast, indicating that current flow is stronger to seaward, in a northwesterly direction. During the period of observation, the visibility was approximately 6m and the sea calm.

Status

During the survey, 19 coral genera were observed, the dominant species being the Acropora spp. and Galaxea spp. with the main frame building corals being Favia spp., Porites spp., Pavona spp., and Galaxea spp.. Observed coral cover was 15% with little evidence of juvenile specimens, when seen, these were predominantly Pocillopora spp.

Impacts

The area has been severely damaged by dynamite, this is evident by the presence of fractured massive frame building coral colonies, craters and rubble patterns. In addition, the damage has been exacerbated by anchoring techniques employed by artisanal fishermen. Fishermen using anchors carved from limestone (pleistocene coral reef) crush and drag coral colonies when anchoring over their fishing grounds. As the anchors drag over the coral substrate, they push coral rubble before them. This then falls down the fore reef slope, damaging deeper corals which would otherwise be immune to the immediate effects of explosive fishing. Further impacts may be

due to storm damage and reef walking by fishermen at low tide. The latter is a common practice on all Tanzanian reefs and tidal flats and constitutes an important element of the artisanal fishery, for molluscs and octopus. (Table 13, annex IX).

Potential for recovery

With efficient control measures, recovery is possible given the presence of good substrate for attachment and the existence of juvenile colonies.

(b) Mwamba Shundo

Mwamba Shundo is a coral reef lying 6 nm offshore within the 100 fathom line which lies 0.5 nm to seaward.

Status

The coral reef is 2.5 nm long and 0.4 to 1.2 nm wide. The area observed was 1.0 nm from the southern tip. The structure consists of a narrow fringe of coral, forming a reef flat that does not dry during spring tides but has a minimum depth of less than 1 m. Towards the west off-lying patch reefs 10 to 20 m in depth rise to a maximum depth of 1 m at low water springs. There is a slope of 35^{o} to 45^{o} to the west which starts at the 10 m depth contour.

Impacts

The reef shows evidence of dynamite damage but has also been subject to storm surge damage. It is possible that through the use of dynamite, the structure of the reef has been altered and that damage due to storm surge is increased due to the movement of fractured colonies that then impact attached living colonies. The back reef slope was covered by calcareous algal rubble. Close observation did not reveal any coral cover. It was surmised that these may in effect be separate calcareous algal units that tumble during heavy weather conditions and hence do not adhere to each other. This surface having no visible cementation was judged unsuitable for coral attachment. The reef crest had previously been colonized by massive colonies but has since been colonized by encrusting growth forms. The main frame building genera seen were Porites spp., Pavona spp., Favia spp. and Montastrea spp., but few living specimens remain. During the survey 19 genera were observed, of these the Acropora spp. and Galaxea spp. were dominant. Maximum cover was 20% in 3,000 m^2 observed.

Potential for recovery

This reef is located some distance from the inshore coastal fishing grounds but is subject to severe storm conditions during both the north and south monsoons. With the present use and pressures on the reef, the prospects for recovery are slight.

(c) Mwamba Wamba

Mwamba Wamba is one of the designated reefs that form part of the proposed Tanga Coral Gardens Marine Reserve. It is a large reef and only the southwestern section consists of a fore reef area. Reef crest and back reefs were observed. The fore reef consisted of a climax of Galaxea spp. stands interspersed with Pavona spp., Porites spp., Favia spp. and associated species. There is a sharp drop from the reef crest to a sandplain at 10 m, and several patch reefs of similar structure were seen to seaward of the principal reef formations. The back reef, also previously covered primarily by Galaxea spp., extends for approximately 0.1 nm.

Status

Nine coral genera were observed on the fore reef area none of which occurred in large numbers to be considered dominant. On the reef flat and back reef area the same situation existed, but 17 genera were seen to be represented. Coral cover was less than 5% on the fore reef slope and between 5 to 10% on the reef flat and back reef areas.

Impacts

The entire area surveyed has been severely damaged by explosive fishing and by artisanal anchors. Primary damage has been due to explosive fishing, consequently movement of columnar rubble from damaged Galaxea spp. colonies by stone anchors has caused damage to the entire fore reef slope. It is also possible that Acanthaster planci (Crown of Thorns Starfish) may have been present in large numbers, and this may have contributed to the observed mortality. During the survey seven specimens of Acanthaster were seen, a larger number than on any other coral reef surveyed in Tanzania. It has been reported that localized population explosions of Acanthaster have occurred in Zanzibar, the most recent being in 1979.

Potential for recovery

It is the opinion of the consultant, based on the observations of the current conditions, fishing pressure and use of explosive fishing techniques, that the potential for recovery of this reef is poor.

(d) Fungu Nyama

Like Mwamba Wamba this reef was also proposed to form part of the Tanga Coral Gardens Marine Reserve. Fungu Nyama is a large coral reef formation drying at low water springs with sand bank formations drying to 3 m.

Two areas were observed. Firstly, the fore reef which consisted of a sloping coral platform at 10 to 15 m in spur formations bounded by sand channels. No living coral was observed, and concomitantly no fish were seen. The coral surface seemed to have been scoured reducing the available habitats for fish species associated with reef formations. The surface was similar to that observed in Jamaica following the passage of Hurricane Allen (1981); the reef surface was devoid of settlement and rubble accumulations were seen in the sand channels.

Secondly, the back reef area over a distance of 0.7 nm parallel to the reef crest was observed. The structure typical of back reef areas was once luxuriant and had a high diversity of coral species.

Status

Coral diversity was good with 21 genera represented, but as in the other reefs observed, the coral cover was low with a maximum of 15%. The density of living specimens in the area surveyed was also extremely low. Unlike other reefs observed, the molluscan species were well represented with Conus spp., Lambis spp., Strombus spp. and Cyprea spp. Two specimens of Acanthaster planci were seen, and these were feeding on Acropora spp. colonies. The dominant coral species on this reef were the Acroporiids and may also be the dominant species recolonizing the reef since juvenile specimens were observed. No major frame building coral was seen in their juvenile stages.

Impacts

Extensive and continued use of explosive fishing techniques 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. Artisanal fish traps were also seen to cause damage to the remaining coral colonies with traps being selectively dropped on or in the vicinity of living coral.

Potential for recovery

Since this reef is easily accessible to the artisanal fishermen who were observed to using dynamite, the potential for recovery is slight.

(e) Niule Reef

This reef is the third reef designated to form part of the Tanga Coral Gardens Marine Reserve and is the most accessible to Tanga. The area observed was at the northern pass close to Niule light. The reef is fronted by a large reef crest that dries to 1 m during low water springs. The area covered was 1,000 m^2.

Status

The area is covered by dense concentrations of Ulva and Sargassum, both growing on broken coral substrate. In the deeper areas surveyed, patches of Thallassia were seen, but here as in the coral areas evidence of dynamite blasts were seen.

Impacts

Explosive fishing damage has been very extensive, and only two living coral colonies were seen in the area surveyed. These were a Pocillopora spp. and a colony of Styllophora pistillata, both on broken coral substrates. The reef flat areas have been observed to be under intense fishing pressure during low tides with 30 to 40 fishermen observed searching for octopus and mollusc species, both during the day and night.

Potential for recovery

With the lack of suitable substrate for settlement, continued pressure and explosive fishing techniques, resettlement and growth of scleractinian corals seem extremely unlikely. The possibility of resettlement being slight only if the area were isolated and a suitable genetic pool existed downstream of this reef. There was, however, no genetic pool identified during the survey.

(f) Yambe Island

The survey of the southern part of the inward reef adjacent to this island was observed by scuba diving. The area consisted of a series of patch reefs separated by sand, rubble or silt channels. The silt channels being predominantly to the south and the rubble towards the north. The patch reefs rose from a depth of approximately 10 m to within 2 m of the surface.

Status

The patch reefs observed were represented by 32 coral genera with the dominant species being variable on each patch reef. However, the main frame building corals were Galaxea spp., Porites spp. and Pavona spp.. Coral cover was variable with a minimum of 5% and a maximum of 60%, the latter being single species patches of Galaxea spp. or Pavona spp. undamaged by either explosive fishing or improper anchoring. Regeneration was seen in damaged areas when they were not dominated by Galaxea spp. or Acropora spp. rubble. They seem to provide an inadequate substrate for resettlement. Regeneration by Pocillopora spp., Acropora spp., Galaxea spp. and

other encrusting species was seen in areas previously colonized by Pavona spp., Porites spp., Favia spp. and Diplocestrea spp. Regeneration was not, however, seen in areas recolonized by soft coral species, which have a faster growth rate and tend to reduce available substrate for settlement and overgrow juvenile colonies. In severely damaged areas soft coral cover was estimated at 60 to 80%.

Impacts

The patch reefs have been exposed to explosive fishing, with recent impacts observed. Sediment load was high and visibility poor. Coated sponges of the Siphonales spp. and corals of all species were unable to clear surface sediment. The latter were seen to be covered by a mucus sheath and showed evidence of bacterial infestation (Black Band Disease).

Potential for recovery

Given the diversity observed and the existence of undamaged patch reefs, damaged areas could be recolonized by the scleractinian species. But sediment loads are persistently high, and this in combination with overgrowth by soft coral colonies may reduce this potential. A further quantitative survey may classify the area to be suitable for isolation as a genetic reserve.

(g) Karange Island

The northern coast of Karange Island on the leeward side of the island was surveyed. The coastal strip was covered by dense mangrove forest of mixed species. The island consists of a series of uplifted pleistocene reef formations dissected at two places (north and south) by a pass which dries at low water. Three transects were run from the shore to a depth of 10 m, a distance of approximately 0.2 nm. In all cases, cover was similar following the same zonation patterns from shore to the maximum observed depth.

Status

Close to shore on a muddy substrate were dense stands of Thallassadendron interspersed with detached colonies of Goniopora spp., Seriatopora hystrix and Stylophora pistillata. The latter two were attached to hard substrate of some unidentified massive coral colonies. This area has begun to be colonized by soft coral forms.

To seaward of the seagrass and coral zone is an area previously colonized by a good cover of massive frame building corals long dead and subjected to normal bioerosional processes. The upper surfaces are now heavily colonized by soft corals both branching and encrusting. Little surface was available for the settlement of scleractinian species. The bioerosional processes have created micro-environments in crevasses and excavations, these areas are now colonized by new scleractinian growth of good diversity decreasing markedly to 5% or less, below 8 m. The dominant species over the entire area surveyed were Galaxea spp., Pavona spp. and Acropora spp..

Impacts

This reef is subject to heavy sedimentation which may account for decreased coral cover with increasing depth. It was seen that colonies with surface lesions were unable to clear sediments adequately, while uninjured colonies were well cleared. This observation tends to suggest that the corals are under continuous stress and that the system is inherently unstable. Sediment loads originate from the Pangani River and are transported north within the boundary of the off-lying reefs and islands. The sediment is then held and concentrated in the basin bounded on the east by Karange and Yambe Islands and on the west by the mainland of Tanzania.

Explosive fishing damage was seen to increase towards the northern part of the area observed. Damage attributed to explosive fishing was compounded by mangrove poles crushing and

abrading coral surfaces. The poles are cut illegally in the center of Karange Island and transported by canoe (Ngalawa) to the mainland. These canoes are overloaded and shed their load onto the reef in heavy weather.

Potential for recovery

A reduction in sediment load by improved agricultural techniques and reafforestation of the banks of the Pangani River should reduce stress factors and allow for the growth and resettlement of scleractinian species on the reef observed. The isolation of this area and control of logging operations on the island could stabilize this reef which could then serve as a genetic source for the resettlement of reef areas to the north (i.e. Yamba Island).

(h) Fungu Tongone

Fungu Tongone is an isolated sand bank fronted by an extensive fringing reef to seaward with a well developed back reef and off-lying patch reefs to leeward. The sand bank and the reef crest dry to 6 m and 1.5 m respectively during low water springs.

Status

The fore reef slope was observed to a depth of 10 m, no evidence of explosive fishing was seen, and coral cover was good at 45%. Normal reef zonation for a high energy reef was observed with little growth in shallow areas and a downward shift of all colonies with extensive growth and cover of Acroporiids spp. starting at 6 m. This area was fronted by massive frame building corals dominated by Porites spp., Pavona spp. and Diploastrea spp. Undamaged coral was seen to extend beyond the 10 m depth contour.

The back reef area was dominated extensively by Zostera and Thallassodendron spp. patches in the shallows. To seaward of the seagrass zone was a shallow slope covered by patch reefs of good diversity, 20 coral genera were observed, however, the cover was poor.

Impacts

The back reef area has been subjected to heavy explosive fishing, evident by distinct craters.

Potential for recovery

The reef is under continuous fishing pressure both with traditional and explosive techniques. Beach seining operations were observed to cause damage to bottom fauna and anchoring techniques, using traditional stone anchors have added to the damage caused by explosive fishing. The sediment load is also very high reducing light penetration on the back reef areas. Considering these factors, the potential for recovery of the back reef area is slight while the comparatively undamaged fore reef slope is subject to normal development patterns.

1.2 MANGROVES

The Tanga region has extensive mangrove cover in the Sigi River Delta, the bays and islands to the north of Tanga towards the Kenya border, Yambe and Karange Islands and the Pangani River Mouth.

In all areas visited, mangrove cutting was observed, most of the cutting is carried out without permits for use as building materials and firewood, some for export, but cutting of larger specimens is being carried out selectively by independent operators supplying the salt industry. There was no information available on the tonnage cut or the area cleared.

Mangrove areas in the vicinity of the Tanga urban limits are subjected to both cutting (which has led to coastal erosion of land fronting residential areas) and pollution from industrial and urban sources. The planned development of Tanga to the year 2005 does not take into account the importance of mangrove stands as biological units or as coastal stabilizers. Zones of industrial and urban development have been planned in areas fronted by mangrove forest, but no treatment facilities have been planned for the former, with effluents being discharged directly into watercourses leading to mangrove areas.

1.3 SEAGRASS BEDS

Extensive seagrass beds were found in all bays investigated and on the western side of all reefs and islands lying off the mainland coast. The dominant seagrass genera are Cymodocea, Thallassia and Thallassodendron and all are subjected to heavy artisanal fishing pressure by traditional techniques including bottom traps (Madema) and beach seines. The latter, as noted previously, causes considerable damage to bottom flora and fauna. Explosives fishing is also being carried out on seagrass areas, but here, unlike coral areas, the damage is restricted to compact craters with little apparent damage to adjacent areas. The lack of hard substrate seems to allow the shock waves from the explosion to pass unimpeded, while coral substrate form barriers to the waves and are broken.

The diversity and density of fish species normally found on seagrass areas were absent in all areas investigated, supporting the previous observation of excessive fishing pressures.

Apart from those genera of seagrass observed all coral areas and drying reef flats were covered by extensive stands of Sargassum, and Ulva. Samples of Euchema were also found suggesting the possibility of a natural stock of Euchema for mariculture development programmes in selected embayments.

1.4 FISHERIES

Artisanal fishing though an important activity of the coastal population of the Tanga region has contributed to the severe degradation of the marine environment with reduced catches already apparent (Table 1, annex IX).

Data from the Statistics Gathering Programme of the Fisheries Division of the Ministry of Natural Resources and Tourism show that there has been a decrease in landed catch with a slight increase in the number of fishermen and gear from 1985 to 1986. Table 1, annex IX, also shows the breakdown of gear and the number of fishermen for the year 1984 to 1985 with some values presented for 1986. Table 2, annex IX, gives a further account of the fisheries statistics from 1970 to 1986, showing the downward trend in catch per fisherman from 1981 to 1986.

From the data represented in table 2, annex IX, it can be seen that since 1981 there has been a decrease in the total catch per fisherman per year. When the composition of the total catch is analyzed, it shows that the major component of the landed catch has shifted from inshore demersal fish normally found on reefs and coastal areas to pelagic species, present and migrating in the offshore fishing grounds. The data corroborates with the observations, that the density and diversity of reef fish species have declined due to explosive fishing, improper anchoring techniques and careless fishing methods. The data also suggest that the resource base and productivity associated to coral reef areas has been reduced, possibly creating serious long term effects on the fisheries potential of the area.

Recommendations

The recommendations for improving the artisanal fishery sector are an integral part of the Action Plan. Adoption of the Action Plan will in time result in increased productivity, a

rational extraction process designed to increase the potential while protecting the stock and diversification of the fishery industry to include mariculture development. The fundamental improvement to the fisheries industry will be the elimination of explosives fishing techniques, the banning of artisanal stone anchors while providing an alternative and a stock assessment programme to permit rational management and control of all fisheries in the region. These points are all discussed in detail in the Action Plan (Section E).

2. TANGA URBAN REGION

2.1. INDUSTRIAL SOURCES OF POLLUTION

An inventory of pollution sources in the Tanga urban region, has been carried out by the National Environment Management Council (NEMC). The results of the inventory were verified during the consultant's survey and are included below. The following industries all influence the levels of pollutants in the Tanga Bay and adjacent waters:

- Tanga Fertilizer Company Ltd. (TFC);
- Sabuni Industries;
- Amboni Ltd.;
- TIP Soap and Glycerine Ltd.;
- Tanzania Dairies;
- Bombo Hospital;
- Commercial Industries and Combine Ltd. (CIC); and the
- Tanga Central Sewage System.

(a) Tanga Fertilizer Company

The company began operations in 1972 at a site immediately to the south of Ras Kazone, a low density residential area. It produces sulphuric acid by an absorption method in which sulphur dioxide (SO_2) and Sulphur trioxide (SO_3) are converted to sulphuric acid using vanadium as a catalyst in the reaction. Under normal operating procedures, the conversion rate using a fresh catalyst is 98.5% with 1.5% emitted to the atmosphere as processed sulphur. At present, the catalyst has not been changed for 6 years, and the conversion rate has dropped to 89.90%, resulting in 10% of the processed sulphur being emitted to the atmosphere from a 100 m high stack and numerous vents.

The company also produces phosphoric acid from rock phosphate treated with sulphuric acid emitting toxic hydrogen fluoride gas. The gas is not released to the atmosphere directly but passes through a treatment plant containing a water scrubber designed to dissolve the gas. This wastes water is washed away with the plant's effluents to be discharged on the beach fronting the plant. Serious pollution problems were identified on the coastal area to the north and south of its outfalls.

Air emissions

The NEMC personnel determined that from July to December 1986, for every tonne of sulphuric acid produced 55 kg of SO_2 and 2.1 kg of SO_3 are emitted. These values are approximately double the current Swedish guidelines of 20 kg of SO_2 of 0.6 kg of SO_3 per tonne of acid produced.

Emission to the sea

The effluent from the fertilizer complex is roughly 700 m^3/h of waste water containing acid leakages, fluoride, phosphorous, nitrogen, small amounts of cadmium and gypsum in suspension. This effluent composition has been analyzed in Sweden and has shown the following results:

pH	4.1
Chloride, g/l	15.8
Fluoride, g/l	25.0
TOT-N, mg/l	68.0
TOT-P, mg/l	27.0
TSS, mg/l	380.0 (This being mainly gypsum)
Cadmium, mg/l	0.016

When taken in relation to the effluent volume of 700 m^3/hour, the total discharge to the sea is:

Fluoride	420 kg/day
Phosphorous	454 kg/day
Nitrogen	1,142 kg/day

During the consultant's visit it was noted that sulphur particles were common on the beach and extended at least 1 km north of the outfall towards a pier and loading facilities belonging to the company. The seawater outfall consisted of a re-inforced concrete pipe set in carbonate bedrock; the pipe has now collapsed and the bedrock eroded to create a large cavern extending towards the main access road. The extent of erosion creates a risk to the road and a nearby house.

A mangrove stand adjacent to the outfall seemed unaffected but no infauna was seen in the intertidal zone or subtidal zone for 1 km north of the effluent discharge. A massive kill of burrowing worms and swimming crabs was observed, but this may be the result of a large oil spill observed coating the area. The source was probably from a departing freighter since a large slick was seen to sea prior to visiting the site. The chronic pollution has resulted in anoxid sediments 2 mm below the surface, and no infauna was found in 15 sites investigated.

The coastal area adjacent to the effluent discharge has been altered. The mortality observed, however, is not accountable to the effluent analysis carried out by NEMC. The possibility therefore exists that the effluent may contain other toxic substances intermittently and that these may be causing serious ecological problems. The question remains and further research is required.

(b) Sabuni Industries

The company is operational producing soap and detergents, however, its output is reduced due to the lack of raw materials. Emissions include sulphur dioxide and waste water, the former emitted to the air and the latter discharged into the storm drain system.

(c) Amboni Ltd.

The company produces sisal from raw material grown on several estates. During processing, waste products consisting of 90% of the weight of sisal leaves, about 100 tonnes per day, are dumped directly into the Sigi River, 2 km from its mouth. The organic material in suspension at the time of discharge has built up banks of waste material in the river.

No effects have been observed on the mangrove forests adjacent to the Sigi River Mouth, but secondary effects may result from increased levels of productivity due to higher nutrient loads, increased turbidity and increased sedimentation. The solution to these potential problems would

be to install a settlement tank for the organic debris, decant the waste water into the river and dispose of the solids on land.

(d) The Soap and Glycerine Ltd.

This soap factory discharges the waste products of soap and spent lye directly into the storm drain system.

(e) Tanzania Dairies

This factory producing 40,000 l of milk from imported milk powder and butter oil started production in 1980. 100 kg of butter are produced daily from fresh milk.

Caustic soda, chlorine and a phosphate detergents are used for washing tanks and pipes. Daily effluent is 150 m^3. A waste water treatment plant has been designed consisting of three waste stabilization ponds that will retain water prior to discharge for 105 days.

(f) Bombo Hospital

The Bombo Hospital situated south of Ras Kazone within the confines of Tanga Harbour empties its effluents and discharges into several septic tanks and soak pits which are at present overflowing. This discharge is washed into the harbour area during the wet seasons. No plans for improvement of facilities exist.

(g) Commercial Industries and Combine Ltd.

Commercial Industries and Combine Ltd. (CIC) is an integrated mill where carding, spinning, weaving, dying, finishing and garment making are carried out. The plant started operations in 1981 with a capacity of 8.5 million meters of cloth per year. At present, it runs at 55 to 60% capacity.

CIC consumes 15,000 to 16,000 m^3 of water per month discharging an equal amount of effluent into a storm water drain that falls into the sea south of Tanga. The company has released a list of chemicals used in their process including quantities used per month, these are:

- Starch	2,000 kg
- Sodium Hydroxide	190 kg
- Sodium Chloride	3,800 kg
- Sodium Carbonate	3 kg
- Acetic Acid	191 l
- Ciba-Chrome Dyes	-
- Helizeran Dyes	-
- Urea	-

Effluent analysis carried out by NEMC showed a pH of 5.9, total alkalinity 70 mg $CACO_3$ and an unquantified concentration of organic matter (permanganate) shown as being very high. NEMC and the consultant both recommend that a water treatment plant be incorporated into the future development plans of this industry.

2.2 MUNICIPAL WASTE WATER - URBAN WASTES

Thirty-three percent of Tanga is currently served by a central sewage system, the remainder being installed with septic tanks. There are no treatment facilities whatsoever, and raw sewage from the central system and that emptied into the system by septic tank empties all discharge directly into the sea near the jetty belonging to the Fertilizer Company. The outfall is situated adjacent to prime residential areas.

The Development Plan for Tanga to the year 2005 makes provision for sewage treatment facilities, the type of treatment was not known. It is of interest to note, that land that has been zoned for a treatment plant has already been subdivided and allocated as residential plots.

The population of the Tanga region stands at approximately 300,000 with a 3% annual growth rate. The population of Tanga municipality is 140,000, but there is a movement of the population towards the coastal plain and the lowlands adjacent to it. Tanga expects to have 250,000 inhabitants by the year 2005. Considering the levels of pollution, both urban and industrial, it is imperative that an integrated treatment system be installed to provide at least primary treatment and stabilization prior to discharge. The present situation creates a real risk to inshore marine habitats and a serious public health risk. Investigations of the levels of pollutants and their possible influences on the marine environment will be discussed in section E as part of the Action Plan.

2.3 THE PORT OF TANGA

The port of Tanga is the northernmost harbour facility in Tanzania capable of receiving large ocean going vessels. There are an average of 20 ship movements per month, these discharging containerized goods and received sisal, coffee and cotton for transport to world markets. There is also a dhow harbour servicing the local trade along the coast and the islands of Zanzibar and Pemba.

Oil and refined petroleum products are discharged by tanker into a standpipe close to the dhow harbour. Small hydrocarbon spills have been reported from the discharge process and from the anchored vessels. There are no cleaning and dispersing facilities available. These would be used, if made available and a recommendation to that effect will be made.

The harbour requires pilotage which at present is provided by an expatriate Pilot/Harbour Master. He is also responsible for the maintenance of navigational markers and leading lights. Local vessels including the tankers require no pilotage after having entered the harbour three times. The harbour is difficult to enter, and the potential for grounding exists.

2.4 OTHER IMPACTS ON THE COASTAL ZONE

Salt production is a major industry associated with mangrove areas in the United Republic of Tanzania. For the most part, salt works utilize the solar evaporation technique; however, in the Tanga region salt is extracted by a combustion technique.

The combustion technique is ubiquitarius to the Tanga region with small artisanal units spread over the entire coastal area. Each operator constructs pans from corrugated metal roofing sheets, 3 to 4 sheets per pan. These are then mounted on earthen supports, and wood is burned on a daily basis for 2 weeks, each month corresponding to the neap tides.

At two sites visited, 76 pans were in operation, each pan consumes 7 tonnes of firewood per week to produce 25 to 30 kgs of salt per week. On a yearly basis, the two areas visited consume in the order of 12,096 tonnes of wood to produce approximately 50,000 tonnes of salt. The profit margin, after expenses for fuel, wood, salaries and transport is approximately 500 TSh per week.

Firewood comes from two sources, inland sites such as Dima near Gombero where selective cutting of mature hardwood trees is being carried out and in the mangrove areas at the mouth of the Sigi River where the larger mangrove trees are also selectively being cut.

There is an associated coastal erosion problem created by the discharge of logs at the production site. The logs are rolled down the coastal slope denuding all surface vegetation over

wide areas. The rains then erode the slope transporting terrigenous sediments to the back mangrove areas.

It has been estimated that these operations have consumed the equivalent of 25 to 30 years of firewood otherwise destined for use as firewood in the Tanga region. A solution to this impact would be to:

- introduce demonstration solar production units using locally available materials all of which have been identified and create an information dissemination system for current operators;
- tighten up forestry logging regulations and institute controls;
- phase out the current combustion techniques as solar production units are instituted and operating successfully;
- zone back mangrove areas for salt production and pan construction; and
- provide an information booklet for producers including construction techniques, possible marketing alternatives, and encouraging co-operative ventures among existing operators.

3. PRIORITIES FOR MANAGEMENT AS DEFINED BY TANGA REGIONAL AND DISTRICT OFFICERS

At the request of the consultant, regional and district officers were requested to identify what in their opinion were the foremost problems needing attention within the context of a management plan for coastal resources. Priorities were identified as follows:

Fisheries Sector

(a) Explosive Fishing

- to implement an effective patrol system;
- to initiate fisheries extension programmes for fisheries officers and fisheries protection units;
- to initiate educational public awareness programmes on all matters relating to the marine environment; and
- to identify and control sources of dynamite.

(b) Legislation

- to amend existing legislation to make prosecution easier. In the Tanga region prosecutions have been unsuccessful, the last case took two years to come before the courts and a small fine was imposed.

(c) Water Pollution

- to reduce the levels of pollution; and
- to force existing industries to be responsible for their effluents.

(d) Mangrove Cutting

- to stop all unregulated mangrove cutting and enforce existing laws; and
- to develop an educational programme and general public awareness programme.

Recommendations

The problems of Tanga region have been discussed and their effects on the marine environment and coastal resources assessed. Based on this and the willingness of Tanga officials to act on recommendations, the region will be proposed to form part of a Pilot Management Zone in which the activities presented in the Action Plan will be implemented and amended as necessary (Section E).

4. MARINE RESERVES AND PROTECTED AREAS

Following the results of the survey, it is the opinion of the consultant that the proposed Tanga Coral Gardens Marine Reserve no longer warrants implementation. Furthermore, the survey failed to identify suitable areas for special protection.

An inventory of marine resources and habitats of the region contained in the Action Plan will identify areas suitable as genetic reserves and protected areas with the view that these may serve as genetic pools for the resettlement of damaged areas and improve the fisheries potential of artisanal fishing grounds. The necessary legislation to enact such sites when identified already exists.

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ANNEX II

REPORT ON THE COAST REGION

INTRODUCTION

The Coast region (Figure 1, annex X) extends from the southern border of the Tanga region to the north to Samanga in the south where it borders with the Lindi region. Contained within the Coast region is the Dar es Salaam region encompassing Dar es Salaam urban area and coastwise to the midpoint between Dar es Salaam and Bagamoyo, and the midpoint between Ras Ndege and Ras Buyuni.

The Coast region receives the Wami, Ruvu and Rufiji rivers, each draining a separate watershed (Figure 14, annex X). The Ruvu, Wami and Rufiji basins together drain an area of approximately 250,290 km^2, with the Rufiji basin contributing to 71% of this area.

The emergent pleistocene coast is varied with sand spits, mangroves, fringing and patch reefs, islands, banks and major deltaic features well represented.

There are three urban centers, Bagamoyo and Kisuju on the mainland of Tanzania and Kilindoni on Mafia Island.

The survey of the Coast region included a representative sample of all marine environments observed on the ground. The Rufiji Delta area was observed from the air on an overflight to Songo Songo Island and Kilwa Masoko to assess the potential impact of a planned gas field/industrial complex.

1. MARINE ENVIRONMENTS

Representative examples of all habitats found on the mainland coast and around the offshore islands were observed and their conditions assessed. The areas observed from north to south included Mbegani, the coastal area from Ras Ndege to Ras Buyuni, Sakuti Islands, Kwale, Koma, Mafia and Chole Bay.

1.1. CORAL REEFS

(a) Mbegani

Status

Mbegani Bay consists of an extensive mangrove system fronted by a stable sand dune spit unique to the Tanzania littoral. The bay is shallow with numerous small islands which are densely covered by mangroves. The shore is steep and covered by coconut palms. There are no coral reef formations in the bay, but to seaward of it is an extensive patch reef system.

Impacts

The area to the north of Mbegani towards Pangani is one of the prime prawn fishing grounds of Tanzania. Vessels from the Tanzania Fishing Company (TAFICO), the Bagamoyo Fishing Company (BAFICO) and the Zanzibar Fishing Company (ZAFICO) all fish this area where potential has not been adequately assessed. The breeding sites for this stock have not been identified, but it seems likely that Mbegani Bay and mangrove complex may have a role in stock cycling. Catch statistics are presented in table 3 & 4 annex IX. The extensive patch reef system is under intense artisanal fishing pressure and subject to explosive fishing resulting in damage such as that previously described in the Tanga region.

Potential for recovery

Since no major reef formations were observed at this site, it is difficult to assess the degree of damage caused by fishing pressure, both artisanal and commercial and by explosive fishing techniques. The area does present a unique range of habitats and as such is a prime location for consideration as a marine reserve. The patch reefs and rock reefs seen have low density cover, the major habitat being seagrass beds and mangrove forests.

(b) Ras Ndege to Ras Buyuni

The coast from Ras Ndege to Ras Buyuni running in a north-south axis consists of a pleistocene coral platform backed by a coastal slope with numerous beaches fronted by patch reef formations. The current runs in a northerly direction at approximately 3 1/2 to 4 knots carrying a heavy sediment load.

Status

Artisanal fishing pressure was nominal with few fishing villages seen. Most fishing activity was from the shore by beach seining and hand lines.

Small farm holders on the coastal slope have deforested areas for agriculture. These areas have since eroded to the beach with an associated degree of beach erosion visible as well. The beach has been eroded to expose the pleistocene coral bedrock.

Ras Buyuni consists of a mangrove covered peninsula with an extensive fringing high energy reef formation fronting it. There is a small lagoon between the reef and the mangrove area. It was not possible to see this reef, but from depth soundings it was found to be steep to the 10 fathom line being a short distance 20 to 50 m from the reef crest.

Ras Buyuni with its reef and mangrove formations seem to influence the coastwise transport of suspended sediments originating from the Rufiji watershed. Dense sediment concentrations were seen at Ras Buyuni with complex circulation patterns and vortexes visible. This accumulation and concentration of sediments was ground proved from observations made on a satellite photograph (Figure 18, annex X).

It can be assumed that the reef and peninsula are creating localized circulation patterns that feed sediment to the mangrove and back reef areas thus stabilizing and extending them and that a complex ecosystem interlinkage exists here. Furthermore, the possibility exists that coastal stability northwards towards Ras Ndege is maintained by the Ras Buyuni complex.

Impacts

Water depths in the back reef areas were approximately 1m and the area is under intense fishing pressure by ambulent artisanal fishermen.

Recommendations

Ras Buyuni is an area that is already protected due to its considerable mangrove cover. The area requires further investigation and the forest reserve area should be extended to include the off-lying reefs, Buyuni Bay and the area towards Ras Pembamnasi to the north. The limits are given in figure 18, annex X.

(c) Ras Buyuni to Koma Island

Southwards of Ras Buyuni, the coast arcs westwards to form Buyuni Bay, (Figure 18, annex X) then southwards to the Rufiji Delta and the southern limits of the Coast region at Samanga.

Status

The coastwise course followed in the survey was within the sediment plume emanating from the northern deltaic regions of the Rufiji River. The coast is covered by intermittent mangrove stands interspersed by coconut plantations and reafforested casuarina stands.

To seaward are dense seagrass beds composed mainly of Thallassia, Thallassodendrum, and Zostera. Patch reefs are infrequent and not expected due to the high sediment and turbidity levels.

Several small islets were seen, these being North Fanjove, Sakuti and Kwale. North Fanjove and Kwale are pleistocene coral platforms covered by dense vegetation, on the latter are also dense mangrove forests to the north and south of the island. These two islands and the Sakuti banks have sand accumulations of terrigenous origin. Koma Island to the south of Kwale has a similar structure, but here the mangrove areas are reduced. No cutting was apparent.

Impacts

Both Kwale and Koma have large fishing settlements with the former having a denser population and mixed agriculture of root crops and goat herding.

Artisanal fishermen have constructed fixed traps throughout the intertidal area from Ras Buyuni to Samanga. The density of fish traps is high with 3 to 4 traps erected from the high tide line to the low water spring level. An average of 21 fixed traps were counted in a 1 km area.

(d) Koma Island to Mafia Island - Kilindoni

Status

Sediment loads from the Rufiji were no longer apparent 7 nm offshore. There were no coral reef features between Koma Island and the reefs off Kilindoni in Mafia. These reefs are predominantly shallow patch reefs of low diversity and cover. Towards shore,the bottom banks consists of shallow sandy areas covered in Thallassia and Zostera.

Kilindoni does not qualify as a harbour. Yet, all goods coming to Mafia are brought in by dhows, this includes petrol and diesel transported in drums. The town of Kilindoni stands away from the shoreline and apart from the spillage of diesel at a storage tank off the beach, there are no visible pollution problems. Urban wastes are contained in cesspits and pit latrines; there was no sewage outfall.

Impacts

The reefs to the north of Kilindoni towards Ras Mkumbi in the north are subject to artisanal fishing pressure and explosive fishing has been reported. Coral cover is adequate at 25 to 30% with some juvenile Pocillopora spp. and Acropora spp. seen. Coral cover has been further damaged through the use of artisanal stone anchors.

(e) Chole Bay

The coral reef, mangrove and seagrass bed areas of Chole Bay (Fig 7, annex X), Juani Island southwards toward Tutia Reef are included in the declared Chole Bay Marine Reserve.

Status

The reef structures of Chole Bay were investigated as were the mangrove stands bordering the entire coastal strip contained by the bay. The reefs are of good diversity with 32 genera

observed. The dominant species were the Acroporiids. Reef structure is unique and consists of isolated patches on pleistocene coral substrate rising to within 1 m of the surface at low water springs.

Impacts

There was no observed damage that could be attributed to explosive fishing, but the scarcity of finfish species supported the view that the area is being overfished using traditional artisanal techniques. District officials reported that explosive fishing was common to the area.

The reefs to the south, including Tutia Reef were not investigated due to prevailing weather conditions, but it has been recently reported (November 1987) that the reef at Tutia has been severely damaged to the west, with the eastern and southern more exposed fronts remaining relatively undamaged. This remains to be confirmed.

The shallow bank area between Mafia and the off-lying islands of Juani and Chole is a sunken platform now covered by isolated coral formations. Water flow due to tidal currents is very high ensuring good transport and turnover of nutrient material. Corals appeared to be in good condition, but finfish species were scarce confirming the observed heavy artisanal fishing pressure.

1.2 MANGROVE AREAS

Mangrove cover was observed on the islands of Kwale and Koma, from Ras Buyuni to the Rufiji Delta, Mafia at Chole Bay, Mbegani and the Ruvu Delta.

On the islands including the mangrove areas of Mafia, no serious cutting was observed. Five species of mangrove were observed at Chole Bay and south of Ras Mkumbi following normal successional patterns from shore to the seaward edge.

At present, district officials on Mafia have no policy to follow regarding mangroves and would not be aware of cutting should this be carried out.

The major mangrove areas of the Rufiji Delta covering a reported 1,000 km^2 were observed during an overflight of the delta area. Cutting of mangrove forests was seen towards the interior where forest areas have been cleared to make room for rice production.

At present, it is illegal to clear further areas for this purpose without a licence, but existing areas in isolated locations seem to be expanding since enforcement of control regulations are difficult to exercise.

Salt production units were observed towards the south, all but one of these had been installed in back areas not requiring clearing, the remaining units had been sited in an area previously cleared of mangrove forest.

Reports from workers at the University of Dar es Salaam indicate that pesticide use in the delta rice production areas is high with unspecified volumes of DDT and organochlorides applied at frequent intervals. Further investigation are required to assess the long term effects of this practice and determine whether other insect control options exist which could be made available to the areas' rice producers.

The Rufiji Basin including the mangrove areas contained at the delta come under the jurisdiction of the Rufiji Basin Development Authority (RUBADA). The excellent work carried out by this parastatal should be in accordance with the general management plans for the region and to this end, close links should be maintained between RUBADA, the Tanzania Forestry Division of the Ministry of Natural Resources and NEMC.

Recommendations

The mangrove cover of the Coast region has not been adequately inventoried. This needs to be carried out to assess the current economic potential of this area, to isolate mangrove stands recognized as beneficial to coastal stability and those recognized as important for the maintenance of commercial species in particular Penaeus indicus, Penaeus monodon, the main prawn species landed at the Bagamoyo and the Rufiji grounds.

1.3 FISHERIES

Artisanal fishing is an important activity of the coastal populations of the region, but the sector is experiencing a reduction in the number of registered artisanal fishermen and catch. The area also contains the two main prawn fishing grounds in the United Republic of Tanzania, these being, Bagamoyo and areas adjacent to the Rufiji Delta.

Data from the Statistics Gathering Programme of the Tanzania Fisheries Division of the Ministry of Natural Resources and Tourism indicate that there has been a shift away from gill-netting operations towards share-netting operations indicating greater effort applied to catching high value pelagic species. Table 3, annex IX, shows the breakdown of gear and the number of fishermen for the years 1984 and 1985.

A Kenyan based fishing company has been licensed to fish the Rufiji grounds and reportedly is doing so successfully. A problem exists here in that the ground has been let to a foreign operator prior to any stock assessment. The four vessels operated by the company are fishing an average of 21 days per month and according to fisheries division sources, may be landing up to 1 tonne of prawns per haul. These figures are acceptable if the Rufiji stock is considered virgin. Inconsistencies have arisen as to the methods employed by the company and should be duly investigated by the Tanzania Fishery Division. The agreement with the company also stipulated that the catch will be made available to the local coastal population. At present, this is not taking place. Current licensing procedures and fees payable by the licensee should be reviewed. The revenue in foreign exchange earned could then be applied to fisheries development projects and upgrading the artisanal fisheries.

Recommendations

It is imperative that the Rufiji prawn stock be assessed, that spawning grounds and nursery areas be identified and isolated and where they are in close association with mangrove forests, that the adjoining mangrove area be included in the protected area. That the licensing procedures of foreign vessels be in accordance with accepted practices where the operator pay a fixed percentage of the value of the stock in the form of a licence.

A stock assessment can be carried out during commercial operations using simple length frequency relationships and currently available FAO prawn stock assessment computer programmes.

Existing legislation empowers the Tanzania Minister of Natural Resources and Tourism to declare closed areas and seasons if necessary.

1.4 OTHER FISHERIES

At present, there is an unregulated incidental turtle fishery being carried out in the Coast region and Mafia Island in particular. Capture of all marine turtle species is illegal, however, enforcement is difficult. Mafia District Officials suggest that the existing legislation provides inadequate guidance to fisheries officers and should be reviewed.

The lobster fishery is extensive and carried out by local artisanal fishermen and small scale commercial operators from Dar es Salaam. There are no regulations concerning this fishery, and no stock assessments have been carried out.

In Mafia, there are seven licensed shell collectors who may also hold licences for collection of edible Holothurian (Sea Cucumber) species. Both of these items are primarily for the export market and are unregulated. Severe damage to coral areas can be attributed to the former.

The extraction of coral species for trade and export was not seen on Mafia or in the Coast region, but the removal of massive frame building corals of the Porites spp. and Pavona spp. was seen. This coral is either burned to produce lime or is broken to be used as aggregate material in construction. It is the view of the consultant that this practice is unnecessary in view of the existence of a pleistocene coral bedrock from which aggregates can be quarried.

2. URBAN AREAS AND SOURCES OF POLLUTION

There are no large urban areas in the Coast region, the main coastal settlements are: Bagamoyo, Kisarawe and Kilindoni on Mafia.

Each of these towns is a district center primarily supplying local populations with goods and services. There are no major industrial developments but small scale industries, mainly metal work and soap production have been developed. The scale of operations and the location of these units have not created a pollution problem.

Mafia Coconuts Ltd.

The integrated coconut plantation processing plant and dairy farm is the major employer on Mafia. The process uses all parts of both the coconut and the palm to produce fibre, oil, cattle feed, timber and charcoal. The by-products are spread away from watercourses and are mainly residues, from the fibre separation process.

A dairy has been installed producing butter and cheese from fresh milk. No data was given for effluent discharged from the dairy plant. These will mainly be washing compounds in small quantities discharged directly to a watercourse leading to the beach.

TANESCO operate a generating station from within the Mafia Coconuts compound. Spent oils are dumped outside a perimeter fence and these have permeated the ground and are flowing via a small watercourse to a dried stream bed at the bottom of a valley. It is expected that during the rains this accumulating oily deposit will be transported to the sea some 500m away.

3. PRIORITIES FOR MANAGEMENT AS DEFINED BY MAFIA REGIONAL AND DISTRICT OFFICERS

At the request of the consultant, regional and district officers were requested to identify what in their opinion were the foremost priorities requiring attention within the context of a management plan, for the coastal resources. The priorities were identified as follows:

- to extend the limits of the declared marine reserve at Chole Bay to include the island of Bwejuu, the reef formations to the south of Mafia and the southern coast of Mafia;

- to institute an educational programme for artisanal fishermen and make gear available at nominal cost;

- to strengthen legislation to combat explosive fishing. It is of interest to note that Mafia District has successfully prosecuted fishermen using explosive fishing techniques and presently hold three offenders. They have also confiscated dynamite, plastic explosive and blasting caps. A reduction in explosive fishing was reported following the arrests; and

- to make surveillance vessels available.

Recommendations

Marine Resources of the Coast region are varied and for the most part not under heavy pressure. The main impact being that of artisanal fishing and explosive fishing. The priorities defined by district officers are catered for in the Action Plan, which if adopted, will address these sequentially as each defined phase is implemented.

4. MARINE RESERVES AND PROTECTED AREAS

The results of the survey have identified three areas which could be declared marine reserves and protected areas. These are the:

- proposed Mbegani Marine Protected Area;

- proposed extension of the Ras Buyuni closed mangrove forest area to include the offshore reefs and Ras Buyuni Bay; and

- proposed extension of the Chole Bay - Tutia Reef declared a marine reserve to include the reefs south of Mafia and Bwejuu Island.

The proposed areas would be zoned in accordance with the directives presented in the Action Plan. Other areas suitable for promulgation as reserves would be identified during the course of a quantitative resource and habitat inventory to be executed as part of the initial phases of the Action Plan and these should include identified prawn breeding and nursery areas at both the Rufiji and Bagamoyo grounds which would be zoned as closed areas in accordance to the Action Plan.

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ANNEX III

REPORT ON THE DAR ES SALAAM REGION

INTRODUCTION

Dar es Salaam (Figure 1, annex X) is bounded to the north by the regional demarkation line with the Coast region and to the south with the Coast region at the midpoint between Ras Ndege and Ras Buyuni.

Though the smallest of the coastal regions, it contains the largest urban and industrial complex in the United Republic of Tanzania. There is also a serious industrial and urban pollution problem, heavy artisanal fishing pressure by both traditional and explosive techniques, well established tourist facilities, gazetted marine reserves, a major harbour complex and a petroleum refinery.

The survey of the Dar es Salaam region included representative examples of island and bank ecosystems, mangrove stands, coastal features including the harbour area and the major effluent discharge points.

1. MARINE ENVIRONMENTS

1.1 CORAL REEFS

(a) Fungu Yasin

A gazetted marine reserve consisting of a sand bank drying to 3 m at low water springs. To the north the bank slopes rapidly to 25 m with no coral or algal cover due to shifting sediments. To the east is a well developed fringing reef system extending 1.8 nm to the south. The reef crest is exposed at low tides and devoid of coral cover, the drying back reef is covered by Ulva, Sargassum and Sonneratea spp. Fishing pressure is heavy and explosive fishing has been observed. Coral cover is extremely poor at 25%, and reef associated finfish fauna is depleted.

(b) Mbudya Island

A gazetted marine reserve consisting of a pleistocene coral island covered in brush, palms and recently planted casuarina groves. Recreational facilities for visiting residents and tourists have been erected. These consist of beach shelters, a small bar, open kitchen facilities and pit latrines.

The island is fronted by a high energy fringing reef with back reef formations dominated by Acropora spp. The fishing pressure in the area is very heavy, and explosive fishing is common. This and indiscriminate anchoring have resulted in a serious degradation of coral cover. No coral recruitment was seen. Damaged areas have been recolonized by a dense cover of Alcynorian coral species and luxuriant algal growth. Reef associated finfish stocks are rare, but seasonal fluctuations in density have been reported. This was not obvious during the survey. In addition to those impacts noted, coral cover has been further reduced by indiscriminate collecting by tourists. There is no information available to tourists identifying Mbudya as a marine reserve and no regulations regarding what activities they are permitted to enjoy whilst on the island.

Potential for recovery:

The island is a major attraction to tourists residing at the beach hotels on the mainland of Tanzania fronting it, however, the condition of the marine environment and the degradation of the terrestrial ecosystem through careless use has affected both the attraction and the coastal stability of the island. The regulations exist, within the Fisheries Act applicable to marine reserves, to control activities and prohibit all fishing activities on the island. If the

regulations were enforced, the coral fauna would recover by the colonization of juvenile scleractinian species. Coral cover was estimated at 20 to 25% with 26 genera represented.

(c) Bongoyo Island

Situated to the north of Ras Kankadya and elongated on a northwest, southeast axis, the island is fronted to the east (windward) by a dissected fringing reef system with sheltered reefs of variable structure to leeward.

The dominant corals are the Acropora spp., Platygyra spp., Galaxea clavus and massive Porites spp. Coral genera are well represented, but damage to the leeward less exposed sides of the island is extensive. Coral cover is estimated at 10 to 15%.

Bongoyo Island is a gazetted marine reserve, but no action has been taken to enforce this. A request has recently been submitted to NEMC to construct a day camp for tourists and visitors similar to that at Mbudya Island. A decision is pending and will be taken in view of the results of a quantitative survey to be carried out by a multi-disciplinary team assessing the present conditions of the reefs and islands in the Dar es Salaam region from Ras Kirimoni to Ras Ndege and assess the impact due to explosive fishing.

(d) Msasani Bay to Ras Kirimoni

The area from Msasani Bay in the south to Ras Kirimoni in the north is fronted by a beach broken occasionally by pleistocene coral outcrops. It is a major residential area with luxury houses and tourist beach hotels constructed over approximately 80% of the frontage. To seaward is an extensive seagrass bed dominated by Thallassodendron spp. interspersed by patch reefs of massive Porites spp. and other lesser species, primarily Pocillopora spp., Glaxea spp., Montipora spp. and Acropora spp.

The area contained by Msasani Bay to the south and north towards Ras Kirimoni including the islands of Bongoyo, Mbudya and Fungu Yasin is subjected to continuous explosive fishing. Up to three impacts per hour have been recorded, taking place during the morning. Fishermen in ngalawas (outrigger canoes) and small dhows drift slowly while a diver in the water locates a concentration of fish. Other divers then enter the water and form a loose ring some 20 to 30 m from the fish. An explosive charge is dropped on the fish which are then collected by the divers. The collected fish are then loaded on to a second vessel and presumably taken to a landing site for sale. Explosive fishing is being carried out openly during daylight hours in close proximity to residential areas. Action is seldom taken to prevent this activity.

A small watercourse enters the bay at Kunduchi, and a large accumulation of sand banks have appeared at the river's mouth. A recent survey commissioned by NEMC (but not yet released) suggests that the sand bank formations are the result of sand and aggregate extraction operations in areas adjacent to the river. Observations of beach dynamics, as suggested by current beach formations, and recent aerial photographs (June, 1987) suggest that current patterns in Msasani Bay and northwards to Ras Kirimoni have been influenced by the build-up of the banks at Kunduchi resulting in a serious beach erosion problem. The bank formations seem to suggest that coastwise currents are vortexing at the bank thus impeding the coastwise transport of beach material. Likewise, sediments moving northwards from Msasani Bay are trapped by the banks and hence do not feed the beaches north of Kunduchi.

(e) Ras Kankadya to Ras Ndege

The area from Ras Kankadya to Ras Ndege includes outer and inner Makatumbe and outer and inner Sinda Islands. The area represents a poorly developed fringing reef system fronting the coast from Dar es Salaam and the most serious levels of pollution both urban and industrial in the United Republic of Tanzania.

The marine environments were not observed during this survey, but the harbour area and effluent discharge points were seen. The islands and reefs south of Dar es Salaam will be assessed quantitatively from January to May, 1988. The results of this survey will be directly applicable to the formulation of an Action Plan and will identify programmes to be initiated in the Dar es Salaam region.

1.2 MANGROVE AREAS

Two mangrove areas were identified in the Dar es Salaam region. The first, a vestigial mangrove stand at Kunduchi has been severely cut back. Continued cutting for local use is further reducing what trees remain. The second, in the inner harbour of Dar es Salaam is in better condition with larger specimens and greater diversity (3 species counted), but these mangroves are subject to continuous chronic pollution by urban wastes flowing in from the Yembo River, chemical wastes from the Changombe area, oil spillages from the refinery at Kigamboni and oil and waste from ships in the harbour (Figure 9, annex X). The mangrove stands in the harbour are under continuous stress, and the forests are liable to collapse if the present load is maintained.

A mangrove stand which once occupied a prominent position at the southern entrance to Dar es Salaam Harbour was reportedly killed off by a large oil spill emanating from a tanker discharging crude oil at the single buoy mooring for the TIPER Refinery at Kigamboni. The beach behind the remaining stumps appears to be eroding, but this needs closer inspection and a profiling investigation of the current beach to assess change.

1.3 FISHERIES

The fisheries statistics for the Dar es Salaam region are incomplete, but the data suggest that there is a high density of registered fishermen in the region and that a large proportion of the landed catch consists of pelagic species. In 1984, pelagic species accounted for 22.19% of the landed catch, while in 1985 this increased to 26.35% which reflects the increase in both fishermen and gears. In both years, Lethrinus (Changu), a scavenging species, were caught in greatest numbers, 18.46 % of the total catch in 1984, and 35.60% in 1985.

The data for the Dar es Salaam region is presented in table 5, annex IX, but is incomplete and the differences suggest inconsistencies in the data gathering process. It is clear that an independent survey is required to accurately define the fishing effort in the Dar es Salaam region.

2. SOURCES OF POLLUTION, INDUSTRIAL AND URBAN

Dar es Salaam is characterized as having the highest levels of pollution in the United Republic of Tanzania. The effluents are from industrial discharges (with Dar es Salaam accommodating 80% of the national industrial base) and from urban wastes from both planned and unplanned residential developments. In all cases discharges are made directly to the sea or to water courses and drainage systems leading to it.

An inventory of polluting industries has been carried out by Tanzania Ministry of Lands, Tourism and Housing, Environment Section [which has since become the National Environment Management Council (NEMC)] and has been presented in UNEP Regional Seas Reports and Studies No. 8, 1982. NEMC is currently continuing this inventory and maintaining monitoring stations. Water analyses are carried out by the University of Dar es Salaam, the Government Chemical Laboratory or are analyzed abroad as part of an assistance programme in which SIDA provides NEMC with a senior environmental advisor and technical assistance as required.

Urban sewage is discharged directly without treatment through storm water drains into the harbour area at Keko, Kurasini, Mtoni, Shimo la Udango and via large pipes discharging to the mud flats fronting Ocean Road to the north of Banda Beach.

In both locations (Harbour and along Ocean Road to Oyster Bay (Figure 9, annex X) faecal wastes were seen to accumulate on the beaches. There is also an increased level of productivity associated with the persistent injections of organic waste, this has resulted in stimulated algal growth, primarily of Ulva, Thallassodendron and associated fauna. The increased productivity has likewise led to increased turbidity, siltation by detrital material of algal or planktonic origin and a foul smelling accumulation of rotting algal material and faeces on the beach and sand flats fronting the Selander Bridge.

Several beaches adjacent to the harbour, the main sewage outfall, and beaches a considerable distance from these (Oyster Bay) are popular swimming areas. The hazards of swimming at these beaches must be communicated to the public, and they must be made aware of the risk of contracting bacterial diseases such as typhoid, cholera, dysentry, giardiasis and viral diseases such as polio and infectious hepatitis. It should also be noted that the cysts of Ascaris lumbricoides can survive for several days in seawater.

The Tanzania Urban Planning Division of the Ministry of Lands, Natural Resources and Tourism commissioned a survey of the waters of Dar es Salaam to assess coliform bacteria content. The area investigated included the coastal area outside Dar es Salaam harbour, northwards to the Selander Bridge and the River Msimbazi and included sites in Msasani Bay to just south of Ras Kirimoni. The results of this survey carried out on the given dates is presented in table 6, annex IX.

The results seem to suggest that during high tides the dilution factor is enough to inactivate or reduce the density of the coliforms, Salmonella and Staphyllococci. Their presence becomes apparent during low tides when they are recorded outside the Aga Khan Hospital, Banda Beach and Oyster Bay. On the 25 of October 1987 coliforms, Staphyllococci and Salmonella were recorded at the Aga Khan Hospital and Banda Beach sites. The Aga Khan Hospital does not treat its effluents, and these are discharged on the beach fronting the hospital. It is likely that this area contains other pathogens creating a serious public health risk to swimmers, coastal fishermen using cast nets on the beach and their consumers.

It is recommended that swimming at Banda Beach and the Ocean Road Beach be prohibited and that the beach at Oyster Bay be posted with a warning. These are not solutions but measures taken to protect public health. Ultimately, all urban effluents must be treated and the discharge pipe located further offshore in a main northerly current stream where tidal cycling will not influence the dilution of the discharge.

(a) Tanzanian and Italian Petroleum Refining Co. Ltd. (TIPER)

This refinery located at Kigamboni to the south of Dar es Salaam Harbour receives approximately 750,000 metric tonnes of crude oil per year discharged from the tankers, into an offshore coupling pipeline located to the west of Inner Makatumbe Island. The currents at the discharge facility are predominantly west to north.

The crude oil is stored on shore and processed to produce super gasoline (60,000 tonnes/year), normal gasoline (54,800 tonnes/year), jet fuel (24,600 tonnes/year), Kerosene (51,000 tonnes/year), gasoil (116,900 tonnes/year), IDO (62,600 tonnes/year), fuel oil (129,800 tonnes/year), bitumen (30,000 tonnes/year) and a residue (183,000 tonnes/year). The residue is gravity separated by an API unit into hydrocarbon fractions (stored for further separation and waste water fractions, the latter being discharged into the harbour). See figure 16 annex, X.

Oil spills from the refinery have resulted in chronic pollution of the harbour area and the coastline around the effluent outlet. Oil spills from tankers and the TIPER Refinery have resulted in a noticeable degradation of mangrove cover. A tanker spill (50 to 100 Tonnes) in January, 1981, was closely studied by the Marine Biology Department of the University of Dar es Salaam and showed that there was an immediate mortality of sipunculids, hydroids, isopods and fish species. The longer term effect, resulted in 95% mortality of a mangrove area at the entrance to the harbour within 250 days of the event. Only a few Avicennia spp. remained.

A second oil spill accident from the refinery occurred on 14 May 1986. During this event the harbour area was severely polluted, but no investigations were carried out to assess the effects of the remaining harbour biota.

Pollution protection measures have been proposed by the Environment Section of the Tanzania Ministry of Lands, Water, Housing and Urban Development, now the NEMC (1984). These included:

(i) A regular water monitoring programme for measuring the volume of oil carried in effluent discharge. Previous records show that TIPER was dumping 1,000 mg of oil per litre of effluent. The temporary Tanzanian water standards for oil in effluents is set at 5 mg/l when the effluents are discharged directly into the receiving water.

The Central Government Chemical Laboratory was willing to use their infra-red spectrophotometer to this end. A new infra-red cell was purchased, but no water samples were received.

(ii) It was suggested that a boom be installed at the sea fall to collect all discharged oils within the boom area. This oil would then be collected by the twin hulled weir skimmer belonging to the Harbour Authority.

(iii) The refinery has the capacity to deal with the recovered oils and oil/water emulsions.

Recommendations

The TIPER Refinery causes unnecessary pollution of the harbour area and the coastal zone. The necessary legislation should be enforced and the recommendations of the NEMC adhered to.

2.1 TANZANIA HARBOUR

The harbour is a natural deep water facility subject to incomplete flushing (Bryceson, 1982). It receives the effluents from moored vessels, the TIPER Refinery and from storm drains carrying urban and chemical wastes including insecticides, pesticides, paint wastes, mercury and organic wastes.

The control of shipborne spills and discharge are the responsibility of the Harbour Master and the Tanzania Harbours Authority whose responsibility it is to handle all aspects of oil pollution including its prevention and control. To satisfy the requirements of this role, the authority has the following oil spill response equipment:

(i) a 500 Vikoma-Seapak inflatable boom with a fibreglass hull. This unit is not in working order;

(ii) a twin hulled self-propelled weir skimmer with a 30 m^3 onboard storage capacity for recovered oil - not in working order; and

(iii) a 15 m tender equipped for dispersant spraying in working condition and there is a stockpile of shell LTX dispersant.

A National Marine Oil spill Contingency Plan was proposed in December, 1984. However, it is not known if the plan has been adopted.

3. MARINE RESERVES AND PROTECTED AREAS

The Dar es Salaam region has four declared marine reserves which have been described in section 1, and includes the Islands of Mbudya, Bongoyo, Pangavini and the reef and sand bank formation at Yasin. Though gazetted, none of these reserves have been implemented, and the public is not aware of their status. Though gazetted in GN 137 of 1975, these islands have been subjected to continued fishing pressure and the removal of living specimens by visitors. The result has been a gradual deterioration of bottom fauna and associated finfish species to the present depleted levels.

It is recommended that these reserves be implemented and managed according to requirements of the Action Plan. Further deterioration can be avoided by the placement of fixed moorings for fishing and visiting vessels. No new reserves are planned for the Dar es Salaam region.

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ANNEX IV

REPORT ON THE LINDI REGION

INTRODUCTION

The Lindi region (Figure 1, annex X) extends from the regional line separating it from the Coast region to the north at Samanga to the regional line separating it from Mtwara region at the mouth of the Mambi River to the south.

There are four watersheds draining into the coastal zone of the Lindi region: Mavudji, Mbwemukuru and Lukuledi River Basins draining 53,370 km^2. The largest of these, the Matandu, drains 18,565 km^2 at a point just north of Kilwa Kivinje followed by the Mbwemburu draining 16,255 km^2 at a point south of Kisewere and the Lukuledi draining 12,950 km^2 into Lindi Bay (Figure 5, annex X).

The major coastal urban areas are Kilwa Kivinje, Kilwa Masoko and Lindi, the regional headquarters.

The survey of the Lindi region included the reefs and islands of Okuza, Nyuni, Songo Songo, the Kilwa area including the mangrove areas, a proposed industrial and residential development, the historical sites in Kilwa Kisiwani and the Lindi area. These sites are assessed based on direct observations and discussions held with officials at Kilwa and Lindi. The environmental implications of the proposed natural gas developments at Songo Songo and Kilwa Masoko were assessed in the presence of the Tanzania Petroleum Development Corporation (TPDC) officer and members of NEMC in the course of a site investigation organized by NEMC and funded by TPDC.

1. MARINE ENVIRONMENTS

1.1. CORAL REEFS

(a) Okuza Island

A sand island (Figure 7, annex X) covered by casuarina trees on a pleistocene coral platform surrounded by a well-developed fringing reef to seaward and extensive patch reef formations on all remaining sides. Coral cover was reduced to leeward of the island presumably due to sediment mobility. The island is used by transient fishermen who have erected a temporary camp using existing vegetation. Intermittent cutting to erect the camp has partially denuded the island which has destabilized and eroded substantially. The changes in profile due to erosion are evident from the fallen trees and exposed root systems of the remaining vegetation.

The back reef area is dominated by Acoporiids and Pocilloporiids, Pavona spp. and Montipora spp. colonies are also common. Cover was estimated at a maximum of 70% but this was reduced to less than 5% in areas above 10 m that had been subjected to explosive fishing and shell collecting. Dynamiting has been carried out on both shallow (less than 10 m) coral areas and on sand areas adjacent to patch reefs. Impacts on coral areas caused direct destruction of colonizing species while blasts on the sand areas lifted considerable volumes of sediment which then settled heavily on the adjacent corals. Mortality due to smothering by sediments was observed.

Damage due to shell collecting was also seen. This being easily diagnosed by the circular patterns of small debris created as the collector searches for cryptic mollusc species.

Artisanal anchors have further damaged coral areas in the back reef area, but this was not as serious as in other sites visited since the island serves as a refuge, and the vessels are anchored in specific protected areas to leeward of the island during both monsoons.

The island may have been an important turtle nesting site and they may still be landing, but the presence of fishermen eliminates all possibility of nesting. Three Chelonia myades (Green Turtle) shells were offered for sale.

Potential for recovery

Given a reduction in fishing pressure, the elimination of explosive fishing methods, fixed mooring for fishermen and prohibited settlement and disturbance of the island, there is no reason why damaged areas would not recover. A factor limiting possible reef regeneration is the settlement of damaged areas by soft coral species.

(b) Nyuni Island

A pleistocene coral island (Figure 7, annex X) covered in palm trees and bushes and surrounded by a well-formed fringing reef to seaward and back reef area of patch coral formations. The island is densely settled by temporary fishing camps.

Status

The back reef areas were observed and found to be in excellent condition with good cover, 45 to 50% below 10m but severely damaged by explosives, anchors and shell collectors above 10m. The area from a 2 m depth to low water spring levels was devoid of coral, but the damaged coral substrate had been replaced by an algal mat.

The area contained by the 10 m and 2 m depth contours had poor cover and diversity, 1 to 2% for the former and Acropora spp. dominance for the latter. There was no evidence of coral recruitment in the area contained by the 10 m depth contour, but a substantial new settlement of soft coral species was seen, cover of these could reach 60%.

Turtles are attempting to nest on the island, but these are slaughtered by the resident fishermen. A freshly killed adult Hawksbill Turtle (Eretmochelys imbricata) was seen and reportedly had been killed ascending the beach the previous night.

Impacts

Shell and coral collectors from Mtwara are constantly on the island, they supply boats every two weeks. Each group of collectors may stay on the island for up to six weeks.

Explosive fishing was observed on Nyuni Reef, and those fishermen observed were seen to be using what appeared to be an artisanal explosive device, the 'bomb', which was contained in a coconut. The vessels seen to be using explosives were large open boats with a central holding tank and powered by outboards. There were no visible registration numbers, and no traditional fishing gear was seen.

Fishermen once in receipt of a valid licence may fish any marine waters of the union. This mobility puts added pressure on distant fishing grounds and requires that a certain degree of control be applied. Fishing vessels observed (Ngalawas) outrigger canoes and outboard powered open boats, were from Dar es Salaam, Zanzibar and Mafia in the north, Kilwa, Lindi and Mtwara to the south.

Potential for recovery

The damage seen to the shallow coral areas will recover up to the 2 m depth contour line. Growth of scleractinian between low water springs and the 2 m depth contour are unlikely to recover due to substrate unavailability.

Nyuni forms part of a proposed zoned management area. Based on the results of the survey, a recommendation will be made that the area contained within a line drawn from Samanga and Okuza in the north to the southernmost point of Songo Manara Island in the south to the 100 fathom depth contour to the east and all adjacent coastal areas be considered for multiple use zoned management under the recommendations presented in the Action Plan.

(c) Songo Songo Island

Status

A pleistocene coral island (Figure 7, 14, annex, X) now the centre of a planned natural gas recovery and ammonia cracking plant complex to be constructed at Songo Songo (primary separation) and Kilwa Masoko (Ammonia Plant). The island is not freely accessible but has an excellent runway capable of accepting light commercial aircraft. Access from the sea is discouraged.

Impacts

The exploration phase has left three capped producer wells offshore and two capped producer wells onshore. There is a small village for Tanzania Petroleum Development Corporation (TPCD) employees and a local village on opposite sides of the island. (Figure 16, annex X). Two piers have been constructed. The first, a wooden structure (Point A, Figure 14, annex X) is used for discharge of petroleum products for use on the island, the second (Point B, Figure 14, annex X) a large concrete structure formerly used to discharge heavy equipment and load drilling pipe sections. The construction of the cement pier has already begun to cause erosional problems. The construction of the pier, in line with two pleistocene coral islets, has effectively created a barrier which has altered current flows and coastwise sediment transport. The beach area fronting the TPDC village is eroding despite a small retention wall of cement bags erected on the beach at the high water line. The village was constructed in 1976, the cement pier was completed in 1981, erosion of the beach fronting the village began in 1981. The only factor which had changed over that period was the pier. The planned developments are discussed in section 2.

(d) Kilwa Kisiwani, Kilwa Mssoko

Both of these settlements are at the mouth of the extensive mangrove and harbour area of Kilwa Harbour. Kilwa Masoko is the Kilwa District Headquarters, Kilwa Kisiwani on the opposite side of the harbour is an island of great historical and anthropological value.

Status

The harbour is fringed by a well-developed mangrove forest cover, which up to 1980 was cut for export to Iran. Since the start of the Gulf War this market was terminated, present cutting for domestic use is unregulated and estimated at 10 to 20 mangrove poles per person per year. There has been no recent inventory of mangrove resources.

The inner 'harbour' area is possibly an important breeding site of commercially important finfish species, Carangidae, Tunnidiae and Sardinella. There are no important coral reef formations in the inner harbour area, which is dominated by seagrass, Thallassia, Thallassodendron in shallow areas (less than 10 m). Extensive coral reef formations were seen fronting Kilwa Kisiwani Island to seaward and on the southern entrance to the harbour. The reef banks steeply from 35 to 50 fathoms. Likewise, there were important fringing reef formations fronting the mainland coast to seaward of Kilwa Masoko leading to a coral and sand island complex 7 nm to the east and north.

No pollution problems were observed, urban wastes being contained in septic tanks and pit latrines. There are no industrial developments on the Kilwa Kisiwani or Kilwa Masoko.

Impacts

District officers report that the use of explosive fishing is common, but no evidence of this was seen. The removal of frame building Porites spp. and Pavona spp. for use as aggregate material and lime production was seen. Fossil coral is commonly available and should be used in preference to living coral whose use should be discouraged.

A well preserved complex of ruins dating to the 11th century are found on Kilwa Kisiwani. The site is unique, representing a range of architectural styles, tracing the historical and anthropological development of the region. Given the right conditions, this site could well be developed as a major tourist attraction. With this goal in mind, it is suggested that it be zoned appropriately within the framework of the multiple use management area. The proposed zones within the management area are shown in figure 12, annex X, and described in the Action Plan (Section E).

2. SONGO SONGO - KILWA MASOKO - NATURAL GAS/AMMONIA/UREA INDUSTRIAL COMPLEX

Explorations for hydrocarbon deposits in Tanzania have identified a major natural gas field under the island and in the coastal waters adjacent to Songo Songo. Initial exploration has estimated that the recoverable gas reserves is in the order of 762 billion standard cubic feet and could last 25 years under the present extraction and processing plans.

At present, there are five procuder wells, two on the island of Songo Songo and three offshore. These have been capped pending implementation of the management plan.

The plan calls for feeder pipelines from the five producer wells to be taken to a dehydration and separation plant to be constructed on Songo Songo. The raw gas will be treated with triethylglytrol which will separate water (0.5 barrel/million SCF) and hydrocarbons (0.5 barrel/million SCF) from the raw gas which will then be piped to the ammonia/urea cracking plant to be constructed at a site adjacent to Kilwa Masoko (Figure 13, annex X). The water will be discharged directly to the ocean via a piped outfall and the hydrocarbons shipped to the TIPER Refinery in Dar es Salaam for processing. A 50 km pipeline having a 22 km submerged section will be constructed from Songo Songo to the Kilwa Masoko complex. Delivery rate will be 65 million SCF/day or 56,797 m^3/hour.

The Kilwa Masoko ammonia/urea plant (KILAMCO) will be constructed as per (Figure 13, annex X). The plan calls for the construction of harbour facilities with a pier to run from the shore over pleistocene coral substrate to a deep berth at 20 fathoms. The area chosen for this is currently devoid of mangrove cover, but they are present, both to the east and west of the planned site. It was noted that the existing mangrove cover (of mixed species) was an important coastal stabilizing factor, and their removal should be avoided during the construction phases.

The planned ammonia/urea complex will have a capacity of 515,000 tonnes NH_3/year from which 535,000 tonnes of urea will be produced. The complex will use 29,000 m^3 of seawater/tonne of product as cooling water. The urea plant will utilize an estimated 48 m^3 of seawater and 55 m^3 of freshwater per tonne of product, the ammonia plant an estimated 126 m^3 of seawater and 80 m^3 of freshwater per tonne of product.

The plant proposes to use the Haldor Topsoe Ammonia process and the Snaprogetti urea process which reportedly will add 500 kg of ammonia and 1,000 kg of urea to discharge waters per day. The proposed discharge site will be via a 200 to 300 m pipeline directly to the sea adjacent to the jetty.

A residential area and hotel complex are also planned. The former located to the north of the plant and the latter on a plot adjacent to the plant (Figure 14, annex X).

Recommendations

Prior to construction of the complexes on both Songo Songo and Kilwa Masoko, it will be strongly recommended that a full baseline study be carried out and that guidelines in accordance with the areas management priorities be produced. The study should be long term entailing an initial investigation to include:

(i) a determination of physical and chemical oceanographic factors, in particular investigating current patterns and velocities, turnover rates, salinity, temperature, pH, sediment load, productivity;

(ii) a full inventory of coral reef and mangrove resources;

(iii) the identification of representative habitats and faunal associations for use as benchmarks. These will serve as indicators of environmental change for a long term monitoring programme; and

(iv) a full cost/benefit analysis of the planned developments.

3. LINDI

Lindi, the regional headquarters and main urban area of the Lindi region is situated at the mouth of Mto Lukuledi in a well-developed estuarine system bordered by mixed mangrove forests. Lindi Bay fronting the urban area is a wide geographical feature with shoaling banks of alluvial origin close to shore and fringing coral reef formations on both the northern and southern shores (Figure 11, annex X).

Status

Coral reef areas were investigated at a location west of Ras Rungi (Figure 11, annex X). The reef consists of a well-formed fringing reef subject to heavy artisanal fishing pressures. There is a shallow bank leading to the reef crest from the 8 m depth contour to a drying crest. This area had been severely damaged by explosive fishing and artisanal anchoring techniques, the degree of damage attributable to each being approximately equal. Coral cover was less than 5% with Montipora spp., Porites spp., and Galaxea spp. being dominant. To seaward of this damaged zone was a fore reef slope of about 40^{0} densely covered by a diverse coral fauna to a depth of 25 m. 38 genera were observed with no clear zonation or dominance. Porites spp., Favia spp., Porites spp., Pavona spp., Montipora spp., Oulophyllia spp., Plerogyra spp., Phisogyra spp., Millepora spp., Acropora spp. and other genera were all well represented. Cover in this area was estimated at 75 to 80% with no evidence of dynamiting. Reef fish were abundant and herbivorous species normally found in shallow reef areas were present on the fore reef slope. It is possible that, due to fishing pressure and habitat degradation on the shallow reef, the reef fauna has shifted downward to stable reef zones away from direct pressure.

It is recommended that fixed moorings be placed in suitable areas on the deep reef to provide access to the finfish stocks while allowing the shallow reef flat to regenerate.

Shallow areas had been colonized by soft coral species and Sargassum. The cover of these was estimated at 35 to 40%. The dense cover precludes settlement by scleractinian species, however, the presence of a diverse genetic source on the fore reef slope makes rehabilitation of the reef flat distinctly possible. Juvenile Acropora spp., Pocillopora spp. and Gardinoseris spp. were observed.

Impacts

In addition to explosive fishing and anchoring practices, coral reefs in the Lindi area are also subject to damage from shell collectors of which there are several dealing with one licensed exporter, exporting to Hong Kong, Japan, India, West Germany, China, Canada, Singapore, France and the United Arab Emirates. In addition to shells mostly Murex, Turban and Cypraeid, export markets have been found for Holothurian species, shark fins and jaws. Corals are also collected for use as aggregates and building materials. This practice is unregulated.

The mangrove areas in the Lindi region have not been recently inventoried. The cutting of mangrove areas has been extensive to clear areas for salt production using solar evaporation basins. A conflict between the Division of Forestry of the Tanzania Ministry of Natural Resources and Tourism and the Industry Ministry has become apparent. The Forestry Division considers all mangrove areas to be closed forests and extends considerable effort in controlling cutting operations in accessible areas where surveillance is possible. The Ministry of Industry promotes regional development and so encourages new projects. A licence to operate a salt work can be issued by the Ministry of Industry without consulting the Forestry Division as to site selection. The operator in possession of a valid licence is then free to develop the property specified in his licence.

It is clear that the NEMC, a supra ministerial body which can liaise with the ministries, should be in a position to assess different project proposals having an influence on the coastal zone, assess site selection and request impact statements where situations are unclear or unknown. It will be suggested that NEMC assume this role and that in consultation with the ministries concerned evaluate all proposed developments.

District officials expressed concern over a considerable beach erosion problem. On investigation, it was found that the two areas in question, the beach fronting Lindi town and an area backed by a sandstone cliff, were subject to normal beach dynamics. The beach fronting the town has built up over the past 10 years to within one metre of the top of a retaining wall, reportedly four metres of accumulation. Sand accumulation can be expected in this area which is influenced both by riverine sediments and shifting sand banks of alluvial origin. The beach has small dune formations covered by stabilizing vegetation. It was suggested to district officers that the beach was stable and that investment in a further sea-wall was not required, but that beach profiles should be studied. The second site is undergoing continuous erosion but contours suggest that this has been the case prior to any settlement of the area. The cliff is of compacted alluvial sediments of terrigenous origins which was exposed by receding sea levels. This erosional process may have generated much of the current beach and bank accumulations. Construction of a sea-wall to prevent this process will prove difficult with the collapse of the construction likely, in a short period. It was suggested that a better alternative would be to prevent construction of new residential areas in that land fronted by unstable cliff formations.

Sand extraction is not allowed in the beach area, but small scale extraction was seen to be taking place. A larger site (3 extraction faces) was found on the northern shore of Lindi Bay. Excavation was being carried out in an alluvial cliff formation backing a low density mangrove stand. The sand at the site was capped by approximately 2 m of red clay/loam topsoil, a 3 to 4 m band of recoverable sand was below. Excavation of the sand caused the collapse of the heavier topsoil which was then shunted to the beach area. Two of the excavation faces were approximately five to eight metres from the high water spring line, the third was at the high water spring level. It was suggested that excavations should be abandoned as it poses a greater threat to coast stability than the two upper sites which are fronted by a substantial protective platform. There should also be a sediment trap constructed, consisting of a simple ditch approximately 1.5 m deep with drainage on the top. Rainwater and sediment will collect in the ditch, the sediment will settle out and water with only fine suspended particulate material, will drain out the top of the ditch. A second drainage system can be constructed to decant water once rain ceases, this being necessary to avoid a mosquito problem. The sediment once dry can be removed.

4. URBAN AND INDUSTRIAL POLLUTION

There are no major operating industrial developments in Lindi. Cashewnut processing factories have been erected, but these are no longer functioning. A small industrial complex is now operating, but there are no effluents being discharged at the moment.

There is a slight problem, easily rectified, which is caused by the indiscriminate dumping of waste oils at a garage fronting the estuary and backing onto a mangrove stand. The oil was seen to be coating the root systems of trees adjacent to the garage. The oil is washed away from the dumping site to the mangrove stand during high water springs.

Lindi has no treatment facilities for urban wastes. Raw sewage is carried by a drainage system to open streams that then empty into the estuary. The effluent sites are all within the town limits and as such pose a serious public health risk. The beach area fronting the town had a thick cover of Ulva in the intertidal area. The sediments were anoxic 1 cm below the surface, burrowing organisms were rare. The area is used for fishing, cleaning landed catches and cooking utensils.

LINDI HARBOUR

The harbour contained to the south by a drying sand bank has recently undergone a rehabilitation programme. The alongside berth can accept one shallow draught vessel. There are no cleaning facilities in the event of an accidental oil spill. Harbour regulations for Lindi must prohibit the pumping of bilges into the estuary, and a storage facility must be provided.

5. FISHERIES

The Lindi region having no inshore bank areas and a narrow fringing reef system has correspondingly fewer number of registered artisanal fishermen. The Statistics Programme of the Tanzania Ministry of Natural Resources and Tourism collects data on a regular basis, however the data for the Lindi region must be taken with scepticism. The District Natural Resources Officer reported that the data gathering system is unreliable.

The statistics presented in table 6, annex IX, do raise questions about their validity since there was a reduction in the number of vessels by 47% yet an increased number of gear and catch. The only vessel type showing an increase is the dhow of which there are 53 in 1985 as opposed to 46 in 1984. This slight increase cannot account for the increased number of nets. Furthermore, the general complaint of fishermen is the difficulty in obtaining this type of gear hence justifying their use of explosives. The data from the Lindi region requires verification by an independent frame survey.

6. PRIORITIES FOR MANAGEMENT AS DEFINED BY LINDI REGIONAL AND DISTRICT OFFICERS

At the request of the consultant, regional and district officers were requested to identify what in their opinion were the foremost problems needing attention within the context of a management plan for coastal resources.

Priorities were identified as follows:

- to establish a surveillance unit to combat explosive fishing;

- to inventory the mangrove resources of the region and to curb the illegal cutting by unlicensed operators;

- to declare a protected area from Ras Banura to Mchinga Bay;

- to institute an extension programme for artisanal fishermen; and

- to make fishing gear available at nominal cost to artisanal fishermen.

The priorities identified by regional officers are all addressed in the context of the proposed Action Plan.

7. MARINE RESERVES AND PROTECTED AREAS

Two areas have been identified as suitable for marine reserves. The first is that area described from Okuza Island to Songo Manara (Figure 12 annex X) which would be treated as a multiple use zone managed reserve, and the second, the area contained by Mching Bay to the north and Ras Banura to the south which would be classified as a strict marine reserve. (Figure 11, annex X). The proposed site is a complex of embayments, islands, fringing reefs and mangrove forest that reportedly, is an identified spawning and nursery area for pelagic and reef finfish and also an identified turtle nesting area.

At present, the second site is subject to intense artisanal fishing pressure by both traditional and explosive techniques. Carcasses of Green (Chelonia myades) and Hawksbill (Eretmochelys imbricata) Turtles are common at all established fishing camps.

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ANNEX V

REPORT ON THE MTWARA REGION

INTRODUCTION

The Mtwara region (Figure 1, annex X) borders the regional demarkation line with Lindi region to the north at the mouth of Mambi River and borders Mozambique at the Ruvuma River to the south.

Mtwara is the only major coastal urban area and contains the southernmost deep water harbour in Tanzania and the regional headquarters.

Due to current political tensions in the area, it was not possible to carry out a coastwise survey of the Mtwara region. The harbour area and Mikindani Bay were observed from shore in the presence of Mtwara Regional Natural Resources Officer.

1. MARINE ENVIRONMENT

1.1. COASTAL FEATURES

The coast is characterized by a deep embayment at Mikindani Bay, a bank area fronted by fringing reefs and islands extending from Ras Msamgambku to the north, and Ras Ruvura to the south. The Ruvuma River which marks the border with Mozambique has formed an extensive deltaic plain which is well covered with mangroves.

The major impact to coastal resources was reported to be explosive fishing. This was confirmed by site observations reported by qualified divers who reported a general decrease in coral cover and reef fish populations in shallow coral reef areas (less than 10 m).

The general reason given for the increase in explosive fishing is the shortage of gear availability, in particular that of fishing nets produced by the Dar es Salaam Fish Net Factory. It was reported that artisanal fishing groups have been complaining to fisheries officers that there is a noticeable decrease in available fish stocks when using traditional fishing methods.

The sources of explosives according to regional officers are the Dar es Salaam Cement Factory at Kunduchi, and the Finnwater Project who use explosives for seismic surveys. There have been reports of a robbery of several hundred kilos of dynamite from the stores of the Finnwater project.

There is no reported explosive fishing activity in the reef and bank area south of Mtwara, from Ras Msamgamku to the Ruvuma River. This area consisting of extensive fringing reef systems, offshore islands (with coast watching stations), mangrove forests and banks is reputedly a potential prawn fishing area. The area is under strict control by the military. Regional officers suggest that the area south of Ras Msamgambku could be gazetted a marine reserve under a multiple use management plan (Figure 15, annex X). This must, however, be verified by an on site inspection.

The mangrove areas observed are subject to unregulated cutting by the local population using the poles as building materials. Several salt works were seen in back mangrove areas, but no mangrove clearing was observed. There has been no recent inventory of mangrove resources. The only available figure is 7,998 ha. in 1957.

As in the Lindi region there is a well established shell, Holothurian and marine curio collection system organized by licensed exporters. The extent of this trade has not been quantified.

1.2. FISHERIES

Data collected through the Statistics Gathering Programme of the Tanzania Ministry of Natural Resources and Tourism are given in table 7, annex IX.

As in the Lindi region it is doubtful that the data can be treated with confidence. Between 1984 and 1986, there has been a reduction in boats with a reduction in total landed catch, yet there has been an increase in the number of fishermen and in all gear except for gill nets whose numbers have decreased from 1,292 to 428.

2. MTWARA URBAN AREA

The population of the Mtwara region as of 1984 was 869,095 with 54,000 residing in urban Mtwara and 162,562 in adjacent rural areas. The annual population growth is 3.0%.

There are no major sources of pollution in Mtwara, urban wastes and sewage are collected in cesspits which are intermittently pumped out but the discharge sites were not identified.

There are no operational industrial developments in the Mtwara region. The cashewnut processing factories have been closed for several years. A small industrial estate is currently under construction but little interest has been expressed regarding occupancy. The handling of effluents and discharges were unknown.

The Mtwara Harbour, a deep water facility with little traffic was found to be clean and no evidence was seen of past oil spillage. A potential for spillage of processed petroleum products does exist in that they are discharged from a tanker to a standpipe 3 m from the dockside and piped to storage tanks a short distance from the shore. The valves and pipes both show evidence of corrosion and any breakage will result in a substantial oil spill into the harbour area. At present, the harbour authorities possess no cleaning or dispersing equipment, but if made available would be prepared to use it.

3. PRIORITIES FOR MANAGEMENT PRIORITIES AS DEFINED BY MTWARA REGIONAL AND DISTRICT OFFICERS

At the request of the consultant, regional and district officers identify what in their opinion were the foremost priorities requiring attention within the context of a management plan, for the coastal resources.

The priorities were identified as follows:

(i) education: fishermen extension services and a limited public awareness programme;

(ii) fishing gear: make fishing gear available to artisanal fishermen;

(iii) surveillance: provide vessels for coastal surveillance and control operations; and

(iv) marine Reserves: investigate the possible gazetting of a marine reserve area to include all the coastal areas to the 100 fathom line south of Ras Msamgamku. (Figure 15, annex°X).

Recommendations

Since the coastal zone of the Mtwara region was not properly assessed due to existing tension and controls, it is not possible to recommend actions specific to the needs of the region within the context of the Action Plan. But those aspects dealing with public awareness programmes, the control of explosive fishing and inventory programmes are all applicable to the region.

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ANNEX VI

REPORT ON ZANZIBAR

INTRODUCTION

Zanzibar comprising the islands of Zanzibar (Unguja), Pemba and other minor islands, united with Tanzania in 1964, but still retains its own Parliament and Government. The population of Zanzibar and Pemba is approximately 589,000, divided relatively equally. The annual population growth is 3% in rural areas and approximately 5% in urban areas. Geologically, the islands are very different.

Zanzibar (Figure 2, annex X) consists primarily of an exposed pleistocene platform backed by an extensive bank formation to the mainland of Tanzania. Several islands of pleistocene coral origin can be found to the west, these being Kepandiko, Chapani, Chango, Bawi, Chumbe, Kwale and Pungume. To the north is the island of Tumbatu, which may once have been attached to the main island and 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. There is a large embayment of shoaling water at Chwaka. The bay is covered primarily by Thallassodendron and is surrounded by mangrove forest on its southern fringes.

A fringing reef fronting the east coast is continuous from Ras Nungwe to the north and Ras Kizimkazi to the south. This is a high energy reef, backed by a small back reef/lagoon system that may dry at low water springs. Fishing villages (Figure 6, annex X) can be found the length of the east coast, but the communication infrastructure is not well developed.

There are no rivers in Zanzibar. The main urban area is Zanzibar Town with lesser rural agglomerations, Mkokotoni to the north, Chwaka on the east and Makunduchi to the south.

Pemba Island (Figure 2, annex X) lies between the latitudes 04° 50'S and 05° 30'S, bisected by the longitude 39° 45'E. It is a true oceanic island surrounded on all sides by deep water reaching a maximum depth of 546 fathoms (1,092 m).

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 Upembe to the south, the coast consists of a low lying pleistocene reef structure, with three breaks, fronted by low mangrove covered islands.

The south coast from Ras Upembe to Matumbe Makupa is a drying bank area with a series of dissected pleistocene coral islets. The islets may have eroded to their present position explaining the structure of the bank which is likewise a pleistocene coral platform.

The west coast of the island from Matumbe Makupa to Ras Kigomasha in the north, is a unique indented coast fronted by low lying pleistocene coral islands (Mesali, Fundu and Njao). To the west of these islands are embayments, fringed by mangrove forest with poor reef development, mainly small patch reefs, but extensive seagrass beds. The coral reef areas to seaward consist of narrow ribbons of fringing reefs from Mesali Island to Ras Kigomasha. The 100 fathom line lies close to shore with the distances varying from less than 0.5 to 1 nm.

Pemba has three main urban areas, all situated on the west coast, almost equidistant from each other. From north to south they are: Wete, Chake Chake and Mkoani. There is a single tarmac road linking these urban areas with tracks through the bush.

Latham Island (Fungu Kizimkazi), located at 06° 54'S and 39° 56'E is a low coral island lying 23 1/2 miles east of Ras Kimbiji. The maximum height is 3 m. To the south, there are numerous eroded and collapsing blocks of sandstone which seem to be the primary bedrock material, no pleistocene coral was seen. Northwards of the sandstone block area is a flattened plateau

approximately 1 m from the high water spring line. This area has be flattened by the constant treading of seabirds and has been built up by guano accumulation. At the time visited, Gannets, Brown Booby and Sooty Terns were breeding.

To the north of the plateau is a beach sloping sharply from the high water spring line to a platform interspersed with uplifted slabs of beachrock and coral boulders. This suggests that the island was subject to violent storm conditions.

To seaward of the island is an extensive bank of coral and sand, sloping gradually to the 100 fathom line. The extent of coral growth has not been recorded. The bank on the same northwest/southeast axis as Zanzibar is approximately 11 nm long and 5.5 nm wide. Currents are very strong reaching 4 to 6 knots in a northwesterly direction.

Representative examples of all marine and coastal environments were surveyed on Zanzibar and Pemba including an assessment of urban and industrial development. The information presented below is a digest of observations and discussions held with Zanzibar Government officials. The survey included Latham Island to the south of Zanzibar.

1. MARINE ENVIRONMENTS

1.1. ZANZIBAR

The reefs and islands fronting Zanzibar town and extending to the southwest of the island are arranged in a loose formation which can be represented by three rings.

(i) The ring formed by the islands of Chapani, Kepandiko and Chango to the north and the reefs of Fungu Chawamba, Pange and Kisiki arching to the southwest;

(ii) The ring consisting of Danzi Reef to the north, Bawi Island, the reefs known as Murogo and Nyange and the reef and island formations of Chumbe and Kwale to the southwest; and

(iii) The ring to seaward of Zanzibar Town formed by Fawatu Reef to the north and towards the south, Fungu Mapape, Mwamba Mapape, Pwakuu Reef and the Tambare and Boribu Reefs (Figure 2, annex X).

These reefs and islands have all been extensively surveyed and the data for these are available. Only those habitats of interest to this survey will be discussed.

(a) Chapani - Kepandiko - Chango Islands

These islands to the north of Zanzibar Town (2 to 2.8 nm) are surrounded by extensive bank areas with poorly developed patch reef cover, consisting of 26 genera with Acropora spp., Pocillopora spp., Goniopora spp., Galaxea spp. and Seriatopora spp. being dominant. The coral distribution can be compared to a standard back reef development.

The bank areas are also covered by luxuriant growths of Thallassia, Thallassodendron and Zostera. These seagrass areas far outweight the corals in total cover, with corals showing a maximum of 20% cover.

The water around these islands are characterized by high turbidity levels with visibility seldom exceeding 4 m. The turbidity can be attributed to planktonic and suspended organic material due to increased levels of productivity fueled by raw sewage effluents from Zanzibar Town. The current patterns are predominantly northwards, but the islands forming a barrier to the north create a circular counterclockwise localized flow pattern.

Poor water quality, increased productivity and heavy artisanal fishing pressure have resulted in a continuous mortality of the coral fauna. This seems to suggest that the coral fauna are surviving marginally in stress conditions.

Changu Island, formerly a quarantine post and a prison, has recently been developed as a tourist facility consisting of a guesthouse, a restaurant and bar. The island receives frequent visitors, and a marked degradation in coral fauna has been observed.

(b) Pange Reef

Pange Reef which dries to 2 m, is an extensive bank formation covered by shallow patch reefs in poor condition. Twenty-four genera have been observed with the dominant species being Galaxea spp., Porites spp. and Acropora spp. Coral cover is variable with undamaged areas having a 60 to 70% cover while other areas, subjected to Acanthaster planci (Crown of Thorns) pressure approximately 10 years ago, have not recovered and show 5 to 10% cover. Damage to coral in the shallow (less than 10 m) areas has been exacerbated by artisanal fishing pressure (use of traps) and the use of the artisanal stone anchor.

To the west of Pange, there is a deep reef development to 30 m which is undamaged. Thirty-nine genera were observed with the dominant corals being the Montepora spp., Porites spp., Galaxea spp. and Favites spp. and cover 70 to 90%. Sediment load is high with the non colonized surfaces coated in fine particulate material. Living corals do not show sediment accumulation and seem to be adapted to low light levels.

Finfish species are abundant on the deep reef and large schools of adult yellowfin tuna are common at this site.

(c) Bawi Island

Bawi Island is a pleistocene coral island covered in dense shrub vegetation with a well developed beach on its southwestern tip. It is fronted by a well developed coral reef formation to the north and southeast. The northwest and southwestern sides are composed primarily of loosely aggregated patch reef developments on a shallow sand bank extending northwest for 2 nm. Seagrass cover is poor with low density stands of Zostera and Thallassodendron.

The reef to the north and southeast is steep reaching a depth of 30 m. Thirty-six genera are represented with coral cover variable between 30 to 90%. The dominant species is Galaxea, while the main frame building corals are the massive Porites spp. Other corals showing dominace are the Acropora spp., Plerogyra spp., Pocillopora spp., Fungia spp. and Montipora spp.

This island having been a naval base until quite recently was a closed area and as such the reef has not been severely disturbed by artisanal fishing pressure. The collection of shells, corals and marine curios is limited due to strong currents reaching 4 knots and surprising turbulent flows below 10 m. Hawksbill Turtles (Eretmochelys imbricata) and Green Turtles (Chelonia myades) are commonly seen on the reef. It is not known if they nest on the island.

(d) Murogo Reef

Murogo Reef is a circular reef surrounding a drying sand bank to the south of Bawi Island. The coral formations are continuous over the circumference of the reef and consist of a fringe of diverse corals extending from 1 m to 10 m and varying in width from 2 to 30 m. There are well developed patch reefs to seaward rising 10 to 15 m to within 1 m of the surface.

Forty-eight genera were observed with coral cover variable from 60 to 100%. There is no apparent damage to the coral surfaces, though a 20 to 40% mortality of shallow specimens mainly Acropora spp., Millepora spp. and Plerogyra spp. was observed. The cause is attributed to

increased water temperatures during the months of February and March, 1987, when the water temperature rose by 1.5 to 2°C. Mortality was preceded by mucus accumulations, sloughing of the tissue surfaces and a population explosion of zooxanthellae. The area was surveyed again in October, 1987, and the coral mortality was arrested. Colonies killed during this event have begun to be settled by Alcyonarian species.

(e) Nyange Reef

This reef is similar in all aspects to the Murogo Reef but approximately twice as large. Coral cover and dominance is virtually the same, but on Nyange Reef the coral cover is more extensive and the fore reef slope is well developed to 15m.

Recommendations

The Murogo and Nyange Reefs constitute the most diverse intact coral reefs seen on the coast of the United Republic of Tanzania and as such, it is proposed that they be zoned as a marine park and genetic reserve area within the limits of the proposed Zanzibar Reefs and Islands Marine Reserve.

(f) Chumbe Island

A pleistocene coral island with an extensive coral reef and seagrass bank towards the southeast. The area observed to the north and east of the island, consisted of extensive Thallassodendron and Zostera beds to the north, with pleistocene coral promontaries rising to within 3 m of the surface. These were covered with recent coral growths of 26 genera. No dominance was seen. To the east is a dense seagrass bed interspersed with loosely aggregated coral colonies mainly of the genus Goniopora spp., Seriatopora hystrix and Pocillopora spp.

Artisanal fishing pressure is very high, and damage due to shell collecting, the indiscriminate use of fish traps and stone anchors was identified.

(g) Kwale Island

A wooded island 9 m high surrounded by a bank and reef formation that extends northwards to Ras Fumba.

The island has a well established fishing camp, and damage due to it is visible on the reef to the west of the island. Damage to coral areas have reduced the cover to less than 15% and is due to the use of stone anchors and shell collecting. The area has been severely overfished with low observed finfish densities. Seagrass beds predominantly of Thallassodendron are the main bank features.

(h) Pwakuu Reef

A large coral reef bank to seaward of Nyange Reef and separated from it by a 7 fathom channel. The coral development on Pwakuu Reef has been influenced by a continuous northerly flowing current which has restricted settlement to the sides of pleistocene coral mounds. The coral growth is stunted, and likewise growth forms are seen to be influenced by the flow with encrusting forms of Porites spp. and Montepora spp. The conditions have also scoured all sediment from the pleistocene substrate and these have been colonized by encrusting red calcareous algae.

The shallow reef has been damaged by shell collecting and anchoring, and drying reef flats have been denuded by reef walkers.

(i) Mangapwani

A hotel development has been planned for Mangapwani to be constructed on two beaches separated by an exposed pleistocene cliff formation. The beaches are fronted by a narrow ribbon of coral, which have been found to be in poor condition. The survey conducted at this site showed that the coral fauna was under stress, and this was attributed to temperature and salinity fluctuations. It was found that volumes of fresh water are seeping under the beach through the permeable carbonate bedrock and are reducing the temperature and salinity of the water fronting the beaches. There was a marked temperature reduction 50cm below the surface which was coupled to a distinct density band.

Recommendations

The coral development fronting the beaches has a considerable stabilizing effect and is probably responsible for the accumulation of beach material. In view of this, it is recommended that a complete impact assessment be commissioned prior to development of the site.

(j) Nungwe

The reef to the northeast of Ras Nungwe (the northernmost point of Zanzibar) was surveyed. The fringing reef falls off sharply to seaward from a drying reef crest consisting of broken and accumulated coral debris, evidence of extreme wave energies impinging on this coast.

Coral cover was poor, 15 to 30%, and those colonies present were encrusting a scoured pleistocene coral substrate. Sand accumulations were rare, but the fore reef had been extensively colonized by soft coral species. The back reef area devoid of living coral is covered by Zostera. There is heavy pressure on the area by local villagers who litterally swarm onto the back reef in search of octopus and mollusc species.

(k) East Coast Fringing Reef

Access to the seaward reef is difficult, and to date, only the back reef areas have been observed. These areas have been destroyed south of Chwaka Bay with those areas observed at Bwejuu being devoid of living coral. Likewise, seagrass bed cover is poor. As a result, the finfish fauna normally associated with back reef systems were not present.

The back reef areas to the north at a point opposite Mnemba Island are good representative examples of back reef coral ecosystems. Isolated patches of Acropora spp. dominate with foliose Pavona spp. and Gardinoseris spp. common. The reef area observed is subject to increasing fishing pressure as back reef areas to the south become depleted. Coupled to this is an increase in the use of beach seines which will accelerate the degradation of this fragile ecosystem.

(l) Chwaka Bay

The only major embayment on the east coast of Zanzibar is an important seagrass bed dominated by Thallassodendron. The bay is fringed to the south by extensive mangrove cover of mixed species. During low water springs the entire bay dries. Coastal fishery exploitation is currently being carried out.

1.2. PEMBA

The marine environments on the west coast of Pemba were surveyed. These included the fringing reef running southwards from Ras Kigomasha fronting Njao Island including the Njao Gap, fronting Fundu Island including the Fundu Gap, the Uvinje Gap and Mesali Island.

The waters contained by the outer islands including Port Kiuyu to the north and Mkoani Bay to the south were all surveyed. The reef fronting Mtangani Gap on the east coast was observed as were the mangrove areas to the east of Mtanga Island.

The fringing reef from Ras Kigomasha to just south of the Uvinje Gap are all characterized by very narrow reef flats with depths of 1 to 7 m, leading to a very steep fore reef slope lying on the 100 fathom line.

At all eight sites surveyed, there had been severe damage by artisanal fishermen using stone anchors. Diversity and cover was extremely low (17 genera, 5% cover), the dominant species being Galaxea spp. and Pocillopora spp. This degree of destruction is to be expected since all the artisanal inshore fisheries are restricted to this narrow band of coral, with beach seining operations being the predominant technique used in the embayments between the offlying islands and the main island.

To seaward of the reef flat is a steep fore reef slope with excellent cover more than 60% in all cases. There was no obvious dominance or zonation but 46 genera were counted.

(a) Mesali Island

To the south of Uvinje Gap there is a unique reef flat area to the west that descends to the fore reef slope in a stepwise manner. Coral cover was 40 to 60% with 40 genera observed, the dominant species being Porites spp. Montipora spp., Montastrea spp., Diploastrea spp., Acropora spp. and Galaxea spp. Fishing pressure has upset the finfish fauna and resulted in an excess of herbivorous species. The Pomacentrus and Chaetodun spp. have grazed on coral surfaces leaving lesions which are causing bacterial infections and mortality of Montastrea spp. and Favia spp., 70% of these genera had been affected. The fore reef slope from 15m has a luxuriant coral cover similar to that seen in all other fore reef areas.

Recommendations

In view of the uniqueness of the habitats and the remaining coral cover, it is recommended that Mesali Island and the coral reef areas surrounding it be designated a strict marine protected area.

(b) Protected Inshore Area from Njao Gap to Port Cockburn

The inshore waters are shallow bank areas some of which dry at low water springs. There is a deep water channel with a maximum depth of 7 fathoms from Uvinje Gap to the harbour at Wete.

Coral cover is restricted to very isolated patch reefs, but the entire area is covered extensively by algal and seagrass species. As such and bearing in mind the productivity levels which are high, the area would be highly suitable for diverse mariculture developments, in particular that of Euchema and the Oyster Crassostrea.

(c) Mtangani

The fringing reef fronting Mtangani was observed and found to be in poor condition. Coral cover is variable and never exceeded 15%. Diversity is poor with only 16 genera represented. Shallow back reef areas consisting of Galaxea spp. and Acropora spp. had been damaged by storm surge and stone anchors. No resettlement was seen.

Of greater interest is the mangrove area contained within the inlet separating Mtanga Island from Pemba. The channel between the two islands is deep (7 fathoms) and may be a breeding site for finfish species. The mangroves mainly Avicennia have not been recently cut and are the habitat of a highly varied bird fauna (Hornbills and tropical birds were seen).

Recommendation

It is recommended that Mtangani be surveyed and declared a coastal protected area and that the limits of the area extend to the 100 fathom line to seaward.

(d) Mangroves

The coastal zone of Pemba is well covered by dense mangrove forests of mixed species. These are currently not under heavy cutting pressure and are subject to a rational management programme by the Zanzibar Ministry of Marine, Tourism and Forestry.

Cutting mangroves is permitted under licence and only in one of three specified areas, which are rotated at 5 yearly intervals. Cutting is selective and only for personal use.

1.3. LATHAM ISLAND

Latham Island is unique to the coast of Tanzania both as an offshore geologic feature and as a seabird rookery. It is unclear who has jurisdiction over Latham Island with both the mainland of Tanzania and Zanzibar claiming rights. A thorough search of historical records will be necessary to determine legal rights.

The biological importance of Latham Island has been well recorded (Cooper, et. al., 1984) and was confirmed during this survey.

It is of interest to note that artisanal fishing pressure has increased and that there have been reports of explosive fishing. Evidence of this was seen on the beach where seven reef fish were observed on the high tide line. These fish had disrupted blood vessels around the eyes and gills. In addition, a recent turtle nest had been disturbed and the eggs removed.

Recommendations

In view of the uniqueness of Latham Island, it is recommended that it be declared a strict reserve area and that all access to the reefs and the island be prohibited and that scientific research be licensed on a limited annual quota. The reserve area should extend to the 100 fathom line.

1.4. FISHERIES

Fish protein accounts for approximately 90% of the annual intake of animal proteins by the Zanzibar populations. With this in mind, the Zanzibar Government's policy is to increase the supplies of fish by encouraging increased productivity in the artisanal fishing sector. This policy has been implemented by making gear and engines available to fishermen and by developing a distribution infrastructure to make the catch available to the rural populations. The government also seeks to stabilize prices at a low levels and to this end freezes and stores fish (mainly sardines and mackarel) caught by the state fishing company (ZAFICO). ZAFICO operates a small fleet of commercial vessels but the catch attributed to the commercial vessels is small (169 tonnes during the first quarter of 1987).

The available statistics from data (Table 8, annex IX) collected at designated landing sites (Figure 6, annex X) by the Zanzibar Ministry of Marine, Tourism and Forestry do not give details of catch by species, hence it is difficult to assess the importance of the various species. The principal groups contributing to the present catches are the demersal fish (breams, parrotfish, emperors, snappers, mullets, groupers, sharks, rays etc.) which are caught with hand lines, traps

and nets, the small pelagic fish (sardines, anchovies and mackarels) which are caught with purse seines, scoup nets and beach seines and the large pelagics (tuna, kingfish, rainbow runner, sailfish, marlin, etc.) which are caught by lines, drift gill nets and purse seines (FAO, 1987).

From the data, it can be seen that the artisanal fishing pressure is substantial and the general trend from 1980 to 1985 is an increase in both vessels and gear. It is interesting to note that there is a decrease in the number of beach seines on both Zanzibar and Pemba which is in line with government policy prohibiting their use. Yet, discussions with fisheries officers seem to suggest that this technique is once again being used.

Zanzibar has a rational development plan for the fisheries sector, and consultations with the FAO South West Indian Ocean Project are continuous to that end.

1.5 OTHER FISHERIES - SHELL COLLECTING

Shell collecting is currently being carried out on all Zanzibar and Pemba coral reefs. The methods used are extremely destructive and should be discouraged.

The government's policy should be to encourage rational utilization of this resource while maintaining the existing stock. To achieve this, a population survey of the major harvested molluscan species should be carried out. Designated collection areas should then be identified and these rotated at set intervals or at shorter intervals if the stock is in danger of being overfished.

(a) Sea Cucumbers

There is an active sea cucumber extraction fishery by a licensed exporter employing field collectors. As with the seashells, no assessment of the stock has been carried out, and it is suggested that this be carried out to assess the resource potential and institute management policies.

Recommendations

Little can be said to fault the long term view of the Zanzibar Government with regard to their Fisheries Policy. A note of caution should be necessary in the issuance of licences to foreign fishing vessels and these if licensed should also be responsible for stock assessments in accordance to the requirements of the government.

The Zanzibar government should actively prohibit the use of beach seines and artisanal stone anchors. The latter being replaced by manufactured fisherman type anchors as proposed in the Action Plan.

It should be a government policy to require stock assessments of all currently exploited species as a pre-requisite for management.

2. TOURISM

It is the policy of the Zanzibar government to expand tourism in the islands and to achieve this goal they are actively marketing the islands. Several investors have expressed an interest to develop sites at Mangapwani, Nungwe (Kendwa) and Matemwe on the east coast. A beach cottage hotel is currently being completed at Chuini.

It is recommended that prior to development, a complete assessment be carried out to determine the possible effects on the coastal marine habitats and preventative safeguards issued.

3. SOURCES OF POLLUTION - URBAN AND INDUSTRIAL

NEMC has conducted a recent survey of polluting industries in Zanzibar. These include the State Leather and Shoe Factory, Cotex Textile Mill, Afrochem Ltd, Aluminium Utensils Factory, Soap Factory, Oil Refinery (hydrogenated oils), Coconut Oil Factory and the Mahonda Sugar and Perfume Corporation. The NEMC team did not investigate the raw sewage discharges from Zanzibar Town.

(a) State Leather and Shoe Factory

The factory was constructed in 1968 with Chinese aid, but production stopped in 1984 due to mechanical problems. Process chemicals in the tannery operations include chromic acid, and discharges are fed into a stream 100 m from the sea. A factory rehabilitation programme is currently being considered by Czechoslovakia.

It is recommended that a waste stabilization system be constructed prior to restarting the production line.

(b) Cotex Textile Mill

The factory, located some 2 km from the sea, discharges its wastes into the same stream as the Shoe Factory. The factory is equipped for spinning, warp neating and dying with yarn. It has a capacity to produce 6,000 m of cloth per day but is currently not operating.

When operating at capacity, the factory consumes 300 m^3 of water per day and discharges wastes of equivalent volumes containing hydrogen peroxide, soda-ash, caustic soda and various dyes. There are no treatment facilities.

(c) Afrochem. Ltd.

This factory producing polyurethane foam mattresses and detergent powders started operations in 1982. The processes used do not produce any waste water.

(d) SIDO Estate

A small industrial estate consisting of 13 factories started operating from 1976 to 1981. But only 4 factories were currently in operation. The estate area is provided with well designed waste stabilization ponds consisting of two primary 100 m^2 ponds and two secondary 2,000 m^2 ponds. The waste from all the factories is treated in these ponds.

(e) Aluminium Utensils Factory

The production process uses two acid treatment baths, the first containing concentrated phosphoric acid (400 kg) and the second with concentrated sulphuric acid (200 kg). Both acids are changed regularly every 1 or 2 weeks depending on the volumes processed. The acid flows to the waste stabilization ponds.

(f) The Soap Factory

The capacity of the plant is 34 tonnes of laundry and toilet soap per month from 540 tonnes of animal fat and 100 tonnes of caustic soda. The wastes are disposed of to ponds. The factory is currently not operational.

(g) Coconut Oil Factory

All wastes are flushed to the waste stabilization ponds. The factory produces oil from copra produced locally.

(h) Mahonda Sugar and Perfume Corporation

The factory started operations in 1973 with Chinese aid. It is designed to produce sugar, liquor and perfume. The capacity being 6,000 tonnes of sugar and 540 m^3 of liquor annually. Current production stands at 1,000 tonnes of sugar annually.

Waste water is discharged to a drain flowing into a small river, 2 to 3 fish kills have been reported in recent years. The causes of these are unknown and there has been no analysis of the effluents.

Two pesticides stores have been identified on the sugar cane plantations. These contain a mixture of different pesticides some in leaking containers. 2.5 tonnes of sodium trichloracetate were found in one store. In addition, there are expired pesticides from China (5,000 boxes each containing 10 glass bottles), the labels are all in Chinese, therefore no identification was possible.

(i) Zanzibar Wharfage Co.

The company is responsible for all movements in Zanzibar harbour and also maintains a workshop and fuel depot adjacent to the harbour. Diesel oil contained in one of these tanks was seen to be discharged into the harbour prior to cleaning. The volume discharged is unknown, but it created a slick several kilometers in area, encompassing the harbour area and recreational beaches to the south of the harbour. No cleaning or dispersing of the slick was considered.

It is recommended that the fuel contained in the storage tanks be removed, containerized and transported to the refinery in Dar es Salaam for re-processing or disposal should the storage tanks require cleaning or servicing in the future.

(j) Fuel Discharge Points

Submarine discharge points for refined fuel products are located at Mtoni in Zanzibar and south of Chake Chake in Pemba. Spillages have occurred during discharge operations at both sites. In Zanzibar the spill coats the beaches at Mtoni during the south monsoon and a small mangrove forest to the south of the discharge point during the north monsoon. In Pemba the mangrove forests adjacent to the discharge point have become seriously coated, and some mortality is now apparent. A tanker in Zanzibar was observed flushing its tanks within the harbour area.

Recommendations

There are no cleaning or dispersing facilities and no facilities for the storage of ship discharges in the harbour. It is recommended, therefore, that:

- cleaning and dispersing facilities be purchased and that an oil spill contingency plan be devised to handle all manner of hydrocarbon pollutions;

- all discharges within the harbour should be prohibited and offenders heavily fined and made to bear the costs of the cleaning operations;

- the Zanzibar Government should enter into discussions with the Mainland Government to produce an integrated co-operative control programme; and

- that similar discussions be held with relevant Kenyan authorities to the same end.

3.1 URBAN POLLUTION

There are currently no facilities to treat urban and domestic wastes on either Zanzibar or Pemba. In all urban areas domestic wastes are discharged directly into the sea.

Raw sewage discharge points in Zanzibar are at sites fronting the town normally used for recreational bathing. Hospital refuse and liquid wastes are discharged into the sea directly in front of the hospital and are transported northwards to public bathing areas 150 m away. All the beaches around Zanzibar town are contaminated by fresh faeces. There are increased levels of productivity as evident by luxuriant growths of filamentous green algae and Ulva. The embayment to the north of the dhow harbour (Malindi) which dries at low tides produces a foul odour of faeces and hydrogen sulphide. The sediments are anoxic 0.5 cm. below the surface.

Recommendations

In view of the public health risk posed by the current disposal practices, it is recommended that:

- a long term policy be adopted where every effort is made to divert all present discharge points to a treatment facility prior to being discharged to the sea; and

- a pipeline with a submarine discharge be constructed westwards from Ras Shangani to the midpoint between Ras Shangani and Pange Reef. At this location there is a southernly bottom flowing current at 15 m. which will dilute and disperse the treated effluent away from Zanzibar Town.

4. OTHER IMPACTS - SALT PRODUCTION

Salt works using the combustion technique identified in the Tanga region were observed in the mangrove areas north of Bumbwini (Figure 8, annex X). The scale of operations is small with only one pan producing continuously and others operating if the market price for salt is high. It was found that the technique is new to Zanzibar and was introduced by the Tanga region.

The operators are keen to participate in a pilot solar evaporation demonstration project. The Ministry of Marine, Tourism and Forestry is willing to provide the necessary funds for this programme.

5. PRIORITIES FOR MANAGEMENT AS DEFINED BY ZANZIBAR (UNGUJA) AND PEMBA GOVERNMENT OFFICERS

At the request of the consultant, Officers of the Zanzibar Ministry of Marine, Tourism and Forestry and ZAFICO were encouraged to identify what in their opinion were the foremost problems needing attention within the context of a management plan for coastal resources. These were identified as follows:

- to conduct baseline research and resource assessment programmes in all coastal areas of Zanzibar, Pemba and Latham Island;

- to identify and designate marine parks and reserve areas in line with the government policy of expanding the tourism sector;

- to develop and implement a public awareness programme at the village level;

- to erect a surveillance system and guidelines to enable officers to check gear, vessels and licences;

- to commission a consultative report on sources of pollution and possible control measures;

- to investigate possible areas for diversification of the fisheries such as mariculture schemes and the identification of new stocks;

- to improve the productivity of the artisanal fisheries sector; and

- to include an addition to the proposed fisheries legislation for Zanzibar concerning marine parks and managed areas.

In addition, the ministry representatives in Pemba would like to see a complete inventory of mangrove resources and guidelines issued for rational management.

Recommendations

The Zanzibar Government is well placed to act on the guidelines and policies of a National Action Plan for the Management of Marine Resources but is quite clear that all activities taking place in Zanzibar waters would be under the exclusive control of the government or appointed officials.

Within the context of the proposed Pilot Management Zone, Zanzibar is eager to co-operate fully and enter into discussions with Tanga regional officers and the central government to develop and implement the programme at an early date.

It is expected that the programmes in the Pilot Area would be implemented in parallel, with funding allocated accordingly.

6. MARINE RESERVE AND PROTECTED AREAS

At present, Zanzibar has no marine parks, reserve areas or managed areas, but it is government policy that these be identified and gazetted in 1988.

As a result of this mission several suitable areas have been identified and these are described fully in section E.

The identified areas are as follows:

1. Latham Island protected area	- gazetted as a strict marine
2. Zanzibar Reef and Islands Multiple Use Management Area - Murogo Park proposed	- gazetted as a management area
3. Mwemba Island Marine Reserve area	- gazetted as a strict protected
4. Mesali Island Marine Reserve - Pemba	- gazetted as a strict reserve
5. Mtangani Marine Reserve	- gazetted as a strict reserve.

Recommendations

It is important that these reserve areas be gazetted at an early stage and given the surveillance necessary to safeguard identified coral areas. These reefs represent the only identified intact shallow coral reef formations in the United Republic of Tanzania and as such are critical and unique habitats.

ANNEX VII

MARINE RESERVES

INTRODUCTION

1. Fungu Yasin Marine Reserve

All that area consisting of land and ocean waters centered at latitude 06° 36' 00" south and longitude 39° 14' 30" east and extending to a depth of 5 fathoms below the mean low tide mark from the center point.

2. Mbudya Island Marine Reserve

All that area consisting of land and coastal waters centered at latitude 06° 39' 30" south and longitude 39° 15' 00" east and to 5 fathoms.

3. Bongoyo Island Marine Reserve

All that land and coastal waters centered at latitude 06° 43' 12" south and longitude 38° 16' 00" east extending to a depth of 5 fathoms.

4. Panavini Island Marine Reserve

All that area consisting of land and coastal waters centered at latitude 06° 40' 42" south and longitude 38° 14' 12" east extending to a depth of 5 fathoms.

5. Chole Bay Marine Reserve

(a) All that area of land and ocean waters bounded by a line commencing at the southernmost tip of Miewi Island which bears north 08° 00' 00" west and which extends to the mainland of Mafia Island, thence along the mean high tide line to the nearest point on the outer fringing reef to the 5 fathom contour, and thence in a southerly direction generally parallel to the western shore of Miewi Island at the 5 fathom contour to the point of origin at the southernmost tip of Miewi Island.

(b) All that area of land and ocean waters bounded by a line commencing at the northernmost tip of Chole Island extending towards the southernmost tip of Miewi Island to its point of intersection with a line commencing at the northernmost tip of Juani Island which bears north 50° 00' 00" west, thence along this line to the northernmost tip of Juani Island and thence in a southerly direction along the mean high tide line of land on Juani Island to the point of origin on Chole Island.

6. Tutia Island Marine Reserve

All that area of land and ocean waters centered at latitude 08° 07' 30" south and longitude 39° 39' 30" east and to the 5 fathom contour.

7. Maziwi Island Marine Reserve

All that land and ocean waters centered to the north and south by 05° 29' 48" south and 05° 31' 00" east and extending to a depth of 5 fathoms below the mean low tide.

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ANNEX VIII

ENVIRONMENTAL LEGISLATION

INTRODUCTION

UNEP Regional Seas Reports and Studies No. 49, 1984, has reviewed the current status of legislation as applicable to the marine environment. This work though a thorough analysis needs to be re-iterated in the context of a Action Plan with existing inconsistencies addressed.

INTERNATIONAL AGREEMENTS

Although many international agreements exist for the environment, Tanzania is a party to some, but has not ratified many of them.

Ratified Agreements

Treaty Banning Nuclear Weapons Tests in the Atmosphere, Space and Under Water, Moscow, 1963

Tanzania ratified this treaty in 1964, but has yet to enact legislation covering this treaty.

African Convention on the Conservation of Nature and Natural Resources, Algiers, 1968

Tanzania accepted this agreement in 1974, after it had come into force in 1969. The Convention's objective is the adoption of measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with regard to the best interest of the people (Article II).

No specific legislation exists to cover this Convention, but existing legislation, The Wildlife Conservation Act (GN No. 12 of 1974), The Water Utilization Act (GN No. 2 of 1974), The Land Ordinance (Cap IB), The Town and Country Ordinance (Cap 378) and The Range Management Act (GN No. 51, of 1964) all serve to support Article II of this Convention.

Tanzania is not a party to the 1979 Convention on the Conservation of Migratory Species of Wild Animals that migrate across National Boundaries but has agreements with neighbouring countries which have wildlife conservation legislation.

Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 (CITES)

Tanzania became a party to this Convention in 1980, the Convention came into force in 1975. No legislation has been produced to deal specifically with this Convention, but the Minister of Natural Resources supported by the Wildlife Conservation Act can declare any area to be a game controlled area.

SIGNED AGREEMENTS

The United Nations Convention on the Law of the Sea (UNCLOS), Kingston, 1982

Tanzania signed this Convention in 1982 and is in the process of ratifying it, but as yet, no legislation exists to cover and support the implementation of this Covention.

Tanzania has since declared territorial waters extending 50 miles, and will soon extend its jurisdiction to a 200 mile Exclusive Economic Zone (EEZ). Zanzibar has requested the Union that it be granted jurisdiction and control of the EEZ from the agreed Kenya Border southwards to the midline betweem Latham Island and Mafia. Final approval of this request is pending.

International Convention for the Prevention of Pollution from Ships, London, 1973 (MARPOL)

Tanzania has signed this Convention but as of yet has not ratified it. The Convention defines marine pollution as 'Harmful Substances', as defined by GESAMP and 'Discharge' was made to include any escape, disposal, spilling, leaking, pumping, emitting or emptying of harmful substances arising from ceased explorations and the release of harmful substances resulting from sientific research into pollution abatement.

If Tanzania accedes to this Convention, it will be faced with a heavy financial burden to satisfy (Annex XI) the Regulations for the Prevention of Pollution by Oil and (Annex II) the Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk, both of which are compulsory. These annexes include the provision of reception facilities at oil loading terminals, repair ports and in ports where vessels have residues to discharge.

International Convention for the Safety of Life at Sea, London, 1974

Through the Merchant Shipping Act (1967), the Minister of Communications can declare regulations for the prevention of collisions (Part V) and load line regulations in keeping with the provisions of the Convention.

Convention on the High Seas, Geneva, 1958, and the Convention on the Continental Shelf, Geneva, 1958

Tanzania has not ratified either of these Conventions. The Convention on the High Seas provides for freedom of the seas, but is strict about pollution of the high seas. Tanzania proposed a clause in the convention regarding flags of convenience, stating that there must be a definitive link between vessel and flag.

The Convention on the Continental Shelf, deals with the exploration and exploitation of natural resources on the continental shelf while limiting resources and not interfering with oceanographic and scientific research. The points of interest in this Convention have since been covered by the Law of the Sea Convention of 1982.

Convention on the Prevention of Marine Pollution by Dumping of Wastes or other Matters, London, 1972

This Convention recognizes the rights of a state to exploit its natural resources while prohibiting damage to the environment of other states. The Convention lists prohibited items (mercury and mercury compounds) and other substances such as lead, arsenic etc. which are allowed to be dumped with specific controls.

Tanzania has no legislation regarding dumping and views this as a problem of industrialized states.

Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil thereof, Washington, London, Moscow, 1971

This Treaty and the Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques (1977) have both been accepted by Tanzania but as yet not ratified.

NATIONAL LEGISLATION - TANZANIA MAINLAND

Most aspects of environmental management and control are covered by existing legislation, but in many cases this legislaton needs amending and updating. It would also be useful to compile all existing legislation pertaining to the environment into a single reference handbook for use by implementing agencies and enforcement bodies.

It must, however, be noted that the following outlined national legislation is based on information available and is by no means exhaustive of the existing national legislation relevant to the protection, management and development of the marine and coastal environment of the United Republic of Tanzania.

NATURAL RESOURCES

THE FISHERIES ACT 1970 - GN 6 OF 1970

The Fisheries Act under the control of the Minister of Natural Resources and the Director of Fisheries provides for the development, protection, conservation of marine products, namely finfish, shellfish, marine algae and invertebrates including turtles and dugongs.

The Act is implemented by the Fisheries Division which is responsible for issuing licences to vessels, fishermen, exporters, dealers and with ministerial approval, the granting of licences to foreign operators. The Act also deals with the use of explosives, poisons and water pollution The Fisheries Regulation, (GN 109, of 1986) where fishing with explosives, electrical devices and poisons is prohibited. Salient points of the Act are included below as reference material.

THE FISHERIES ACT, 1970 GN 6 OF 1970, THE FISHERIES (GENERAL) REGULATIONS, 1973

PART ii - Registration of Fishing Vessels

(a) Every vessel to which these regulations apply shall be registered in accordance with the Act and be subject to the provisions of the Act.

(b) This Regulation applies to every vessel other than dugout canoes used for fishing purposes.

PART ii - Section 20

(a) The Director of Fisheries, notwithstanding anything contained in the regulations, may grant to any person, without a fee, a licence to be called a special licence which shall entitle the holder to engage in fishing and to do such other things as may be specified therein for any of the following purposes:

- scientific research;
- complementary purposes;
- educational services; and
- the supply of food in cases of emergency where no other adequate food supplies are available.

(b) A special licence may authorize fishing in any water for any species of fish provided that a special licence issued for complementary purposes shall not authorize the fishing of any fish declared protected under any Regulations made under the Act of Fishing in any marine reserve.

PART iv - General Provisions Relating to Prohibitions, Restrictions and Exemptions

Section 23 - Restrictions on Import, Export and Introduction of New Species

(a) No person shall, without obtaining a written permit or other authorization of the Director of Fisheries, and except with the conditions specified:

- import any live fish into Tanganyika other than fish indigenous to Tanganyika;
- introduce into the waters of Tanganyika Blue Gill Sunfish (Heliopora macrochira), Carp of all species of Cyprinus including Goldfish or any species of fish not indigenous to Tanganyika or the eggs thereof;
- transfer any species of fish not indigenous to Tanganyika or eggs thereof from one water to another; or
- export any live fish from Tanganyika.

Section 25 - Prohibition of the use of Explosives etc, and damaging of Dams

(a) No person shall use or be in possession of any explosives, electrical device or any poisonous or noxious substance with intent thereby to capture, kill or injure fish in any waters, or to render any such fish easier to capture.

(b) No person shall cut through, break down or destroy any dam in any water with intent to capture, kill or injure fish.

Section 26 - Prohibition of Disturbance of Spawn

(a) No person shall willfully disturb any spawn or spawning fish or any bed, bank or shallow in which there is any spawn or spawning fish.

(b) Provided that nothing in this Regulation shall affect any legal right to take any material or water from any waters.

Section 27 - Prohibition of Throwing Overboard of Certain Substances

(a) No person shall throw overboard ballast, coal ashes, stones or other prejudicial or deleterious substances in any lake, river, harbour or road stead, or any other water where fishing is carried on.

Section 28 - Prohibition of Effluents and other Deleterious Substances

(a) No person shall cause or knowingly permit to flow or pass into, or put or knowingly permit to be put in any waters, lime, chemical substances or drugs, poisonous matter, dead or decaying fish or remnants thereof, mill rubbish or saw dust, or any other deleterious substance or thing to such an extent as to be injurious to fish or to the spawning grounds, spawn or food of fish.

(b) The minister may by order declare any substance to be deleterious for the purpose of this Regulation.

Section 29 - Exemptions from certain Prohibitions

(a) Notwithstanding anything contained in these Regulations, a person shall not be guilty of an offence against any of the provisions of Regulation 25, 26, 27 or 28 by reason only of any act done in exercise of any legal right, or in continuance of any process

or method which he has been lawfully employing from before the commencement of these Regulations, if he proves to the satisfaction of the court that he had used all available and practicable means to render any substance, matter or thing used by him harmless to fish or to the spawning grounds, spawn or food of fish.

Section 39 - Nets or Weirs not to Obstruct the Passage of Fish

(a) No person shall erect, construct, use or maintain in the territorial waters any net or weir or other fishing gear which unduly obstructs the passage of fish. An authorized officer may order the removal or cause to be removed any such net, weir or other fishing gear.

Section 40- Prohibition of Use of Certain Sizes of Seine and other Types of Nets, Rockets, Explosives, Harpoons, Spear Guns

(a) Notwithstanding anything contained in these Regulations, no person shall use for fishing:

- monofilament nets in all fresh water fisheries;
- rockets, explosive materials or explosive projectiles, except for fishing whales; and
- harpoon guns, spear guns.

THE FISHERIES ACT - HARPOON FISHING (MAFIA ISLAND) REGULATIONS 1973

These Regulations came into operation on the 14th of July, 1973 and expired on the 31st of December, 1974.

Every person who is the holder of a valid fishing licence issued to him pursuant to the Fisheries (General) Regulations (1973) and who is, in the opinion of the authorized officer, a "bona fide" tourist may at any time while these Regulations are in force and subject to the Provisions of the Fisheries Act (1970) and of Regulations made thereunder, engage in fishing by using harpoon or spear guns without air bottles within the area described in the schedule:

AREA 1: Commencing at point "A" which is 7° 55' 05" south and 39° 51' 03" east of Greenwich, thence following the shore to point "B" which is 7° 10' 54" south and 39° 50' 00" east of Greenwich approximately 2.1 km in a straight line north-east of point "A".

AREA 2: On Juani Island, commencing at point "C" which is 7° 45' 57" south and 39° 29' 51" east of Greenwich, thence following the shore to point "D" which is 7° 36' 58" south and 39° 29' 51" East of Greenwich approximately 1.6 km in a straight line of point "C".

THE FISHERIES ACT, 1970 - THE FISHERIES (MARINE RESERVES) REGULATIONS, 1975, GN OF 137, 1975

(a) The areas described in this schedule of these regulations are declared marine reserves.

(b) No person unless authorized by the director shall fish in a marine reserve.

(c) No person shall enter or reside in a marine reserve without the prior consent in writing of the director. This Regulation shall not apply in relation to:

- a public officer on duty within the marine reserve or a member of his family or domestic employee;

- a person who resides at any place within the boundaries of a marine reserve;

- any person engaged in work being lawfully carried out within the boundaries of a marine reserve; and

- any person who is a "bona fide" tourist or visitor.

(d) No person shall collect any fish or other marine organism within a marine reserve.

(e) No person shall cut, carve, injure, mutilate, remove, displace or break off any undergrowth or formation or other flora within a marine reserve.

(f) No person shall dig any hole within a marine reserve or in any other way impair any natural habitat or underwater scene within a marine reserve.

(g) No person shall swim, wade, dive or use any diving equipment within a marine reserve, except for any purpose connected with scientific study or if otherwise specifically authorized by the director.

(h) No person shall destroy, mark, deface, displace, remove or tamper with any sign, float or placard within the boundaries of a marine reserve.

(i) No person shall within the boundaries of a marine reserve carry on, or permit, or cause to be carried on any operation involving dredging, excavating, drilling or filling of any kind, or use a permit, or cause to be used any equipment, machinery or equipment normally used for dredging, drilling or excavating or deposit construct or install any such machinery or equipment.

(j) No person shall within a marine reserve operate, anchor, cast or drag any vessel, water craft, mooring device in such manner as would likely strike, injure or otherwise cause damage to any marine life or underwater feature.

(k) No person shall within a marine reserve use or have in his possession any type of fishing equipment save with the permission in writing of a fisheries officer in charge of such a reserve.

(l) Any person who contravenes any provision of these Regulations shall be guilty of an offence and shall be liable a conviction to a fine not exceeding twenty thousand shillings or imprisonment for a terms not exceeding five years.

AN ACT TO MAKE PROVISION WITH RESPECT TO EXPLORING FOR AND PRODUCING PETROLEUM (GN 27, OF 1980)

Section 1 - This Act shall apply to Zanzibar as well as mainland Tanzania.

Section 2 - This Act shall apply to and in respect of the seabed and subsoil of the continental shelf.

Section 34 - Investigation of Locations

(a) Where a location has been declared under section 33, the minister may, by written notice served on the registered holder of an exploration licence, direct that the holder carry out, within a period specified in the notice of not less than two years,

such appropriate investigations and studies as the minister thinks proper to assess the feasibility of the construction, establishment and operation of an industry for the recovery of petroleum from the location.

(b) The investigations and studies referred to in subsection (a) may include if appropriate;

(i) technical and economic feasibility studies relating to the recovery, processing and transport of petroleum from the location;

(ii) studies of proposed sites for facilities that would be required by the industry referred to in subsection (a);

(iii) studies of port and berthing facilities and roads, pipelines and other transportation facilities; and

(iv) investigations into:

- suitable water facilities and reticulation systems for industrial and town purposes;

- the location and design of a suitable airstrip and associated landing and terminal facilities if so required by that industry; and

- the generation and transmission of electricity so required by that industry.

(v) investigations of any other works, services or facilities that may be so required for that industry in relation to the location;

(vi) investigation into the development, if so required, of a suitable town for the industry;

(vii) studies on future labour requirements for the industry; and

(viii) physical impact studies into the possible effects of the industry on the environment.

(c) The registered holder of an exploration licence shall furnish to the minister, within the period specified in the notice under subsection (a) such reports, analysis and data resulting from the investigation and studies carried out under this section as the minister, by written notice on the holder, may require.

THE WATER UTILIZATION (CONTROL AND REGULATION) ACT 1974

The Act confers powers to the Central Water and Basin Water Boards to grant water rights in the country. Also under the terms of the Act, any person who pollutes the water of any river, stream, or watercourse, or in any body of surface water to such an extent as to be likely to cause injury directly or indirectly to public health, livestock, fish, crops, etc., will be guilty of an offence.

THE WATER UTILIZATION (CONTROL AND REGULATION) (AMENDMENT) ACT OF 1981

Confers on the Central Water Board the power to control and regulate water pollution and to carry out and promote research and investigations into the causes of and the control and regulation of water pollution. It can also recommend to the government plans, for the control of effluents by all water users and advise users and government on control and prevention of water pollution.

Users must submit to testing procedures laid down by the board and maximum permissible standards for effluents have been laid down. For domestic water the standards are comparable to those specified by WHO (1963).

AN ACT TO PROVIDE FOR THE ESTABLISHMENT OF THE NATIONAL ENVIRONMENT MANAGEMENT COUNCIL, (GN 19 OF 1983)

The National Environment Management Council was enacted on September 10, 1983, by the Parliament of the United Republic of Tanzania.

PART II - Functions of the Council

The main function shall be to advise the government on all matters relating to the environment and in particular the council shall:

- formulate policy on environmental management and recommend its implementations by government;

- co-ordinate the activities of all bodies concerned with environmental matters and serve as a channel of communication between those bodies and government;

- evaluate existing and proposed policies and the activities of the government directed to control pollution and the enhancement of the environment and to the accomplishment of other objectives which affect the quality of the environment and on the basis of that, formulate policies and programmes which will achieve more effective management and enhancement of environmental quality;

- recommend measures to ensure that government policies including those for development and conservation of natural resources take adequate account of environmental effects;

- stimulate public and private participation in programmes and activities for the rational and benefical use of natural resources;

- seek advancement of scientific knowledge of changes in the environment and encourage the development of technology to prevent or minimize adverse effects that endanger man's health and well-being;

- specify standards, norms and criteria for the protection of beneficial uses and the maintenance of the quality of the environment;

- establish and operate a system of documentation and dissemination of information relating to the environment;

- formulate proposals for legislation in the area of environmental issues and recommend their implementation by the government; and

- undertake or promote general environmental educational programmes for the purpose of creating a national public opinion regarding the environment and the role of the public in its protection and improvement.

PART III - Power of the Minister to Impose Duty

(a) If the minister considers it necessary in the public interest, he may, after consultation with the minister for the time responsible for finance, by order published in "The Gazette", impose a duty payable to the council by any person or body of persons benefiting of the activities of the council or whose activities affect the activities of the council, and every such person or body of persons

specified in the order shall have all necessary measures to pay to the council such amount of duty and in such manner as may be specified in the order.

(b) Every amount of duty required to be paid under subsection (a) shall be paid by the specified person or body of persons and the amount so payable shall be a debt due to the council and may be recovered by the person or body of persons as a civil debt by a suit at the instance of the Director General or any person authorized by him on that behalf.

The legislation described in the above section comprises a compendium of information available on existing regulations dealing with the environment and natural resources. Not included in this section is a regulation from the Forestry Act stipulating that areas of mangrove in coastal areas are all to be considered as reserve areas.

NATIONAL LEGISLATION - ZANZIBAR

Zanzibar is part of the United Republic of Tanzania, a federal state comprising the former People's Republic of Zanzibar and the Republic of Tanganyika. The interim constitution of Tanzania 1965 (CAP 596), as amended in 1975 and 1977, notes that the United Republic of Tanzania is a Parliamentary Republic based on the fundamental principles of socialism and self-reliance. There is a single political party, the Chama Cha Mapinduzi (CCM), a President and Vice President one of which must come from Zanzibar. The National Assembly which includes members from Zanzibar legislates for the mainland on all matters and for the United Republic on the following:

- Constitution and Government of the United Republic;
- External Affairs;
- Defence;
- Police;
- Emergency Powers;
- Citizenship;
- Immigration;
- External Trade and Borrowing;
- Public Service of the United Republic;
- Income and Corporation Tax, Customs and Excise;
- Harbours, Civil Aviation, Post and Telegraph;
- Currency;
- Industrial Licensing and Statistics;
- Higher Education;
- Hydrocarbons;
- National Examination Council; and
- Matters listed in the East African Treaty for Co-operation.

All other matters affecting Zanzibar are within the exclusive jurisdiction of the Zanzibar Executive and Revolutionary Council. These will include control of all activities within its territorial waters which at present remain undefined since the declaration of a 50-mile territorial limit by the Union. The existance of this separate legislation concerning the development and current use of territoral waters is important in the formulation of a National Action Plan for the management of the coastal zone of the United Republic of Tanzania.

FISHERIES LEGISLATION

At present, Zanzibar Fisheries are legislated by the Fisheries Protection Decree, 1948, (CAP 125), as amended by the Fish Protection Amendment Decree, 1964 (P.D. No. 18).

The decree empowers the minister to make rules for the more effectual control, protection and improvement of fish, and the government and management of any declared area in which fishing may be carried on. It also includes the following powers of the minister and fisheries officers:

- to impose and prescribe the condition for the regulation of fishing;
- to register all boats, nets, stakes employed in fishing;
- to register all transactions relating to the sale and the dealing in nets;
- to determine the times and seasons at which the taking of any species of fish shall commence and cease;
- to issue licences and certificates of registration to persons authorized to take any species of fish;
- to prescribe the fees payable in respect of any licence or registration issued;
- to provide for and regulate the description and form of nets to be used in fishing and to prohibit any special description of nets or meshes or any tackle, instrument or appliance whatsoever tending to impede the lawful taking of fish or being in any manner detrimental to the preservation or increase of fish; and
- to prohibit or regulate the sale of any fish.

There are also rules that regulate the importation of live fish and a prohibition on the use of beach seines (Fish Protection, Importation Restriction Rules, 1951 (N95), and the Fish Protection (Seine Net Fishing) Prohibition Rules, 1914.

Zanzibar has also formulated and enacted the Wild Animals Protection Decree (CAP 128), which applies to any animal listed on the schedule and which includes the Hawksbill Turtle (Eretmockelys imbricata), the Wild Birds Protection decree (CAP 129), which protects listed birds throughout Zanzibar and provides for sanctuaries. Sanctuaries have been declared on the shore at Chwaka and Zanzibar Town (Wild Birds Protection sanctuaries Order (G.N. #53, of 1944). Other legislation currently in force affecting the coastal zone and marine resources includes:

THE WOODCUTTING (AMENDMENT) DECREE, 1968, PRESIDENTIAL DECREE #4, OF 1968

This Decree provides restrictions on woodcutting on government land and includes the cutting of mangroves. It specifies that cutting on government land can only be carried out on receipt of a proper licence and the payment of a specified fee.

THE FOREST RESERVES PRINCIPAL LEGISLATION (CAP 120), AND THE WOODCUTTING (PROTECTION AND CONTROL OF THE CHWAKA MANGROVE FORESTS) RULES (GN. 99 OF 1946) (CAP 1210)

Provides in the former for the minister to declare any area of government land a forest reserve with a notice of intent being published in the gazette giving the limits of the land. Under this Legislation, Zanzibar has declared eight forest reserves, these being:

- Kichwele Forest Reserve	GN 28 of 1955
- Pangeni Forest Reserve	GN 29 of 1955
- Pangeni Kwa Wokomi Forest Reserve	GN 30 of 1955
- Walezo Ckumbani Forest Reserve	GN 31 of 1955
- Dunga Forest Reserve	GN 34 of 1959
- Ngezi Forest Reserve	GN 66 of 1959
- Unguja Uhuu Forest Reserve	GN 102 of 1959
- Jozani Forest Reserve	GN 63 of 1960

The rules concerning the mangrove forests of Chwaka Bay specify that no person can cut poles (mangrove poles) from the reserve area except by permit, while exempting these having traditional rights. The Legislation also names areas promulgated as Mangrove Forest Reserves, these being:

(a) All these areas of mangrove forests in Chwaka Bay known as: Mapopwa area and the Mto wa Serikali area (GN 71 of 1949).

(b) All that area of mangrove forest in Chwaka Bay Kinani extending to Chuzi Island (G.N. 59, 1955).

(c) All these areas of mangrove forests in Kisakasaka Bay and Kiwani Bay (GN 59 of 1955).

(d) On Pemba, all that area known as Mwitu Kikuu and that area known as the Ngezi Forest (GN 71 of 1947).

THE PUBLIC LAND DECREE (CAP 93) - REMOVAL OF NATURAL PRODUCTS RULES (1984) UNDER SECTION 610

Specifies natural products as being stones, sand, gravel, lime and any other natural produce of the same groups. This Decree may be applicable directly to a coastal management programme since it rules that no person may excavate, remove, transport or sell any natural produce from public land without permit, while specifying hours during which a person may excavate or transport. It also give powers to the minister to declare such areas of land or sea shores surrounding the islands of Zanzibar and Pemba to be protected areas, where a prohibited area means any area declared by the minister to be closed for any activities of an excavation or removal of natural produce.

Zanzibar has recently commissioned FAO through a series of consultancies from 1980 to 1987, to analyze the existing institutional and legal framwork of the Zanzibar Fisheries and to propose general fisheries regulations in order to give effect to proposed legislation. The results of these consultancies are given in FAO Document FL/IOR/82/7 and are currently being considered by the Zanzibar Government prior to adoption.

The proposed Fisheries (General) Law will provide for the management and development of fisheries in the marine waters under the jurisdiction of Zanzibar and for matters connected therewith and incidental thereto. To this end, the law will be administered by the minister who may delegate his powers to the Director of Fisheries who will then confer with an advisory board.

(a) The Law makes provisions for the establishment of a Fisheries Development Fund. The formulation and review of management plans which may include the following management measures:

  (i) closed seasons of designated areas, species of fish or methods of fishing;

  (ii) prohibited fishing areas for all species of fish or methods of fishing;

  (iii) limitations on methods and gear, including mesh sizes; and

  (iv) limitations on the amount, size, age and other characteristics and species or compositions of species of fish that may be caught, landed or traded.

(b) The Law makes provision for the protection and development of both artisanal and commercial fishing sectors.

(c) The proposed Law covers all aspects of licensing including foreign vessels, with stringent controls applied to the latter. It was noted though, that the proposed legislation provides for permits issued for beach seining in specified areas,

Part VI, Section 12 of the proposed Fisheries (General) Law. This section should be carefully considered prior to enactment as Law, considering the detrimental effect of this fishing method on bottom fauna.

(d) The Law specifies conservation measures and prohibited fishing techniques where all explosives, poisons or other noxious substances for the purpose of killing, stunning or disabling fish so as to render such fish more easily caught or where the possession of these materials to be used in fishing are considered illegal. This part of the Law also prohibits the use of spear guns, except under licence the catching of undersized fish or the use of specified prohibited gear as may be prescribed at the time.

(e) The proposed legislation goes a long way towards satisfying the requirements of Zanzibar Fisheries Policy, but following a recent meeting between the FAO consultant, this consultant and Zanzibar officials, it was decided that the conservation section be expanded to include the declaration of marine parks and reserves, the formation of a Fisheries Protection Unit and the requirement of licensed commercial vessels to provide data on the length and frequency of those species caught in order that the stock assessment be carried out to enable sound management policies to be developed.

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ANNEX IX

TABLES

Table 1. Fisheries Statistics of the Tanga Region

	1984	1985	1986
Total no. of fishermen	4,191	2,926	3,311
Total no. of vessels	959	718	841
Total weight catch in m.tonnes	6,219.3	4,547.3	4,504.4
Total value in '000' TSh.	164,346.5	145,117.6	171,090.3
Gill nets	451	515	-
Shark nets	563	467	-
Seine nets	35	33	-
Cast nets	287	157	-
Hand lines	1,215	1,148	-
Long lines	38	38	-
Traps	2,310	1,995	-
Fixed traps	95	124	-

Table 2. Fisheries Statistics of the Tanga Region from 1970 to 1986

Year	No. of gear	No. of boats	Catch m. tonnes	Value TSh.	No. of fishermen	Catch per fisherman
1970	2,263	634	798.9	7,211.7	1,874	0.39
1971	4,780	885	4,885.5	6,396.9	2,599	1.90
1972	4,730	985	6,471.5	9,526.2	2,642	2.45
1973	2,246	787	4,221.0	9,440.2	2,213	1.90
1974	3,848	828	5,416.7	16,036.8	2,338	2.30
1975	4,368	846	5,377.9	15,761.9	2,642	2.00
1976	6,955	1,011	7,392.0	23,849.3	3,129	2.36
1977	4,692	882	6,186.1	28,780.7	3,111	2.20
1978	4,441	785	6,715.8	37,332.4	2,871	2.34
1979	4,442	786	6,144.2	38,152.3	2,901	2.22
1980	3,525	793	7,058.6	37,604.7	2,879	2.45
1981	3,461	624	7,392.0	23,849.3	2,302	3.20
1982	4,121	880	6,944.8	111,988.	2,727	2.50
1983	4,825	904	6,074.8	157,318.0	3,314	1.80
1984	4,994	959	6,219.3	164,346.5	4,191	1.48
1985	4,335	718	4,547.3	145,117.6	2,926	1.55
1986	5,492	841	4,504.4	171,090.3	3,311	1.36

Table 3. Fisheries Statistics of the Coast Region

	1984	1985
Total no. of fishermen	3,848	2,644
Total no. of fishing vessels	585	673
Total weight catch in m. tonnes	11,463.4	10,739.6
Total value in '000' TSh.	211,558.2	194,753.4
Fishing vessels		
Mashua	160	140
Ngalawa	365	390
Mitumbwi	49	45
Boats	-	23
Fishing gear		
Gill nets	3,885	991
Shark nets	991	1,197
Beach seines	114	35
Cast nets	87	47
Hooks	1,102	879
Basket traps	1,586	984
Fixed traps	350	12
Engines		
Outboard	10	17
Inboard	5	6

Table 4. Commercial Fishery Statistics for the Marine Waters of the Tanzania Mainland

Company Name	TAFICO	DAR FISH	TOTAL
No. of fishing vessels	16	2	18
Operational vessels	8	2	10
Weight catch in m. tonnes	542.1	419.9	962
Catch value in '000' TSh.	13,147,600	11,733,200	24,870,800
Weight of prawns	114.6	-	114.6
Value of prawns	8,227,800	-	8,227,800
Total			
Weight m. tonnes	660.7	419.9	1,080.6
Value TSh.	21,375,400	11,733,200	33,098,600

Table 5. Fisheries Statistics of the Dar es Salaam Region

	1983	1984	1985
Total no. fishermen		na	2,0722,568
Total no. fishing vessels	191	393	601
Total weight catch m.tonnes	5,306.5	4,814.7	6,833.8
Total value in '000'TSh.	61,928.8	136,448.2	299,325.0
Fishing vessels			
Ngalawa	na	na	248
Mitumbwi	na	na	77
Dhow	na	na	130
Planked Boats	na	na	107
Mashua	na	na	39
Fishing gear			
Gill nets	na	139	428
Shark nets	na	155	664
Seine nets	na	1	936
Hand lines	na	401	5,395
Traps	na		3171,930
Cast nets	na	na	518
Fixed traps	na	na	8
Engines			
Outboard	na	87	81
Inboard	na	0	26

na: not available

Table 6. Fisheries Statistics of the Lindi Region

	1983	1984	1985
Total no. of fishermen	1,232	1,938	1,403
Total no. fishing vessels	305	921	438
Total weight catch m. tonnes	6,129.7	9,802.1	11,589.4
Total value in '000' TSh.	55,438.8	275,097.6	610,011.1
Fishing vessels			
Mashua	na	38	30
Ngalawa	na	429	147
Dhow	na	46	53
Mitumbwi	na	392	194
Boti	na	16	14
Fishing gears			
Gill nets	na	1,188	1,480
Shark nets	na	239	392
Seine nets	na	100	228
Cast nets	na	30	-
Hand lines	na	3,237	4,207
Long lines	na	70	49
Traps	na	842	304
Other gear	na	153	116
Engines			
Outboard	na	12	20
Inboard	na	6	6

na: not available

Table 7. Fisheries Statistics of the Mtwara Region

	1983	1984	1985
Total no. of fishermen	2,820	1,734	2,568
Total no. of fishing vessels	377	680	601
Total weight catch m. tonnes	3,970.20	7,510.0	6,833.90
Total value in '000' TSh.	50,170.90	329,004.30	299,325.00
Fishing vessels			
Ngalawa		na	1248
Mitumbwi		na	50777
Dhow	na	149	130
Mashua	na	23	39
Boti	na	na	107
Fishing gear			
Gill nets		na	1,292428
Shark nets	na	394	664
Seine nets	na	121	936
Hand lines	na	802	5,395
Cast nets	na	4	518
Traps	na	1,363	1,930
Fixed traps	na	37	8
Engines			
Outboards		na	481
Inboards		na	026

na: not available

Table 8. Unguja and Pemba Islands
The Number and Type of Fishing Units

	1980	1985	1980	1985	1980	1985
Fishing vessels						
Mashua	192	362	37	85	229	447
Ngalawa	1,052	1,149	661	758	1,713	1,907
Mitumbwi	273	247	1,290	1,026	1,563	1,273
Dhow	336	379	49	121	385	500
Total	1,853	2,137	2,037	1,982	3,890	4,127
Fishing Gear						
Handlines	4,023	4,939	3,954	4,552	7,977	9,490
Troll lines	774	1,129	877	612	1,651	1,741
Basket Traps	4,399	4,814	3,995	4,394	8,394	9,208
Weir traps	152	312	94	65	246	377
Gill nets	4,877	2,884	2,606	2,738	7,483	5,622
Seine nets	1,086	691	1,552	27	2,608	718
Beach seines	104	0	122	3	226	3
Cast nets	118	50	616	177	734	227
Scoop nets	122	187	0	15	122	202
Spear guns	208	262	72	106	280	368
Engines						
Outboards	147	146	15	6	162	152
Inboard	na	20	na	0	na	20
Total	na	166	na	6	na	172

na: not available

SOURCES: Ngoile M.A.K. (1981), A Survey of fishing units in Zanzibar and Pemba. Tanzania Notes and Recods (No.88 and 89, 89 to 96p.)
Carrara 6. (1986) Artisanal Fishery catch assessment survey Plan Zanzibar FAO/raf/79/065 (unpublished Mineograph).

Table 9. Coliform Bacteria Content in Dar es Salaam Waters

STATION	H_2OTemp. 27-31°C 4/7/84 Low Tide Ebbing Flow		H_2OTemp.24-27°C 10/7/84 High Tide		H_2OTemp. 26-31°C 25/10/84 Low Tide Flooding	
	E-Coli Samonella	E-Coli Staphylococci	E-Coli Samonella	E-Coli Staphylococci	E-Coli Samonella	E-Coli Staphylococci
Bahari Beach	-	-	-	-	0	0
Masasani Beach	-	-	-	-	0	0
Yacht Club	-	-	-	-	0	0
Oyster Bay	-	-	-	-	+	-
Ocean road Aga Khan Hospital	+	-	-	-	+	+
Banda Beach	-	-	-	-	+	+
Kigamboni Beaches	-	-	-	-	0	0
Msimbazi River Selander Bridge	0	0	0	0	+	-
Morogoro Road	0	0	0	0	+	-
Kigogo Road	0	0	0	0	+	-
Port ACC ESS RD	0	0	0	0	+	-
Upstream	0	0	0	0	+	-

0: no investigation
-: not present
+: present

Table 10. Summary Table: Marine Products for Export 1976 - 1986

	1976		1977		1978	
	Tonnes	TSh.FOB Val.	Tonnes	TSh.FOB Val.	Tonnes	TSh. Val.
Seashells	446.6	2,658,911	427.3	8,878,138	306.4	2,276,753
Beche-de-Mer	-	-	-	-	-	-
Turtleshells	1.8	212,843	26.6	237,562	1.2	170,224
Crustaceans	283.6	5,351,980	186.7	5,332,398	83.9	2,839,774
Sharkfins	-	-	-	-	-	-
Molluscs	-	-	-	-	-	-
Totals	732.0	8,223,734.0	640.6	6,457,980.0	391.5	5,286,721.0

	1979		1980		1981	
	Tonnes	TSh.FOB Val.	Tonnes	TSh.FOB Val.	Tonnes	TSh. Val
Seashells	281.3	1,248,150	1,241.0	1,565,898	457.5	4,705,130
Beche-de-Mer	-	-	-	-	1.8	29,665.3
Turtleshells	2.9	54,008.3	1.1	158,223	0.6	95,596
Crustaceans	169.1	3,972,730	149.9	2,330,720	194.3	3,632,836
Sharkfins	0.6	61,736	1.7	57,431	-	-
Molluscs	-	-	-	-	-	-
Totals	453.9	5,336,624.3	1,393.7	4,112,272.0	654.2	8,463,227.3

	1982		1983		1984	
	Tonnes	TSh.FOB Val.	Tonnes	TSh.FOB Val.	Tonnes	TSh. Val
Seashells	216.8	142,962.3	68.6	1,135,624	129.1	1,911,992
Beche-de-Mer	4.4	91,223.5	21.0	438,722.1	36.9	1,084,755.1
Turtleshells	-	-	-	-	0.37	207,741
Crustaceans	84.4	2,128,819	22.6	8,772,489	132.3	14,393,680
Sharkfins	-	-	-	-	0.1	47,823
Molluscs	-	-	-	-	-	-
Totals	307.6	2,363,004.8	112.2	10,346,835.0	298.8	17,645,991.0

Table 10 Cont'd

	1985		1986	
	Tonnes	TSh.FOB Val.	Tonnes	TSh.FOB Val.
Seashells	141.1	10,604,692	157.2	6,900,969.9
Beche-de-Mer	132.7	6,914,440	162.6	9,281,271.7
Turtleshells	-	-	0.26	7,100
Crustaceans	124.9	17,060,231	216.4	36,290,311
Sharkfins	1.8	64,026	2.7	772,096.9
Molluscs	-	-	2.4	49,800
Totals	400.5	34,643,389.0	541.6	53,301,550.0

Table 11. Summary Table

Destructive Impacts on the Marine Environment

Impact	Tanga	Dar es Salaam	Latham	Mafia	Rufiji	IS.S.Mafia	Kilwa	Lindi	Mtwara	Zanzibar	Pemba
Urban pollution	X	XXX		X	-	-	-	XX	-	XX	X
Industrial pollution	XX	XXX	-	-	-	-	-	-	-	X	-
Explosive Fishing	XXX	XXX	X	XX	-	XXX	X	XX	XX	-	-
Beach seining	X	XX	-	X	X	X	X	XX	X	LI	X
Fishing pressure											
Heavy	X	X			X	X		X		X	X
Moderate			X			X		X			
Light			X								
Mangrove cutting	X	X	-	X	XX	-	XX	XXX	X	X	XX
Salt works	XX	X	-	-	X	-	-	XXX	X	X	?
Fishing species prohibited											
Turtles	X	X	X	XX	X	XX	X	X	XX	XX	XX
Dugongs	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Shell collecting	X	X	X	XX	-	XXX	X	XX	XX	XXX	XX
Beche-de-Mer	X	X	-	X	NR	X	X	XX	X	XXX	XX
Tourism	LI	XX	-	XX	-	-	LI	-	LI	XX	-
Reserve areas	NE	NE	NE	NE	NE	-	-	-	-	-	-

NR: Not recorded
NE: Not enacted
LI: Light
X: Medium
XX: Heavy
XXX: Extensive

Table 12. Personnel Structure for the Division of Coastal Resources and Management

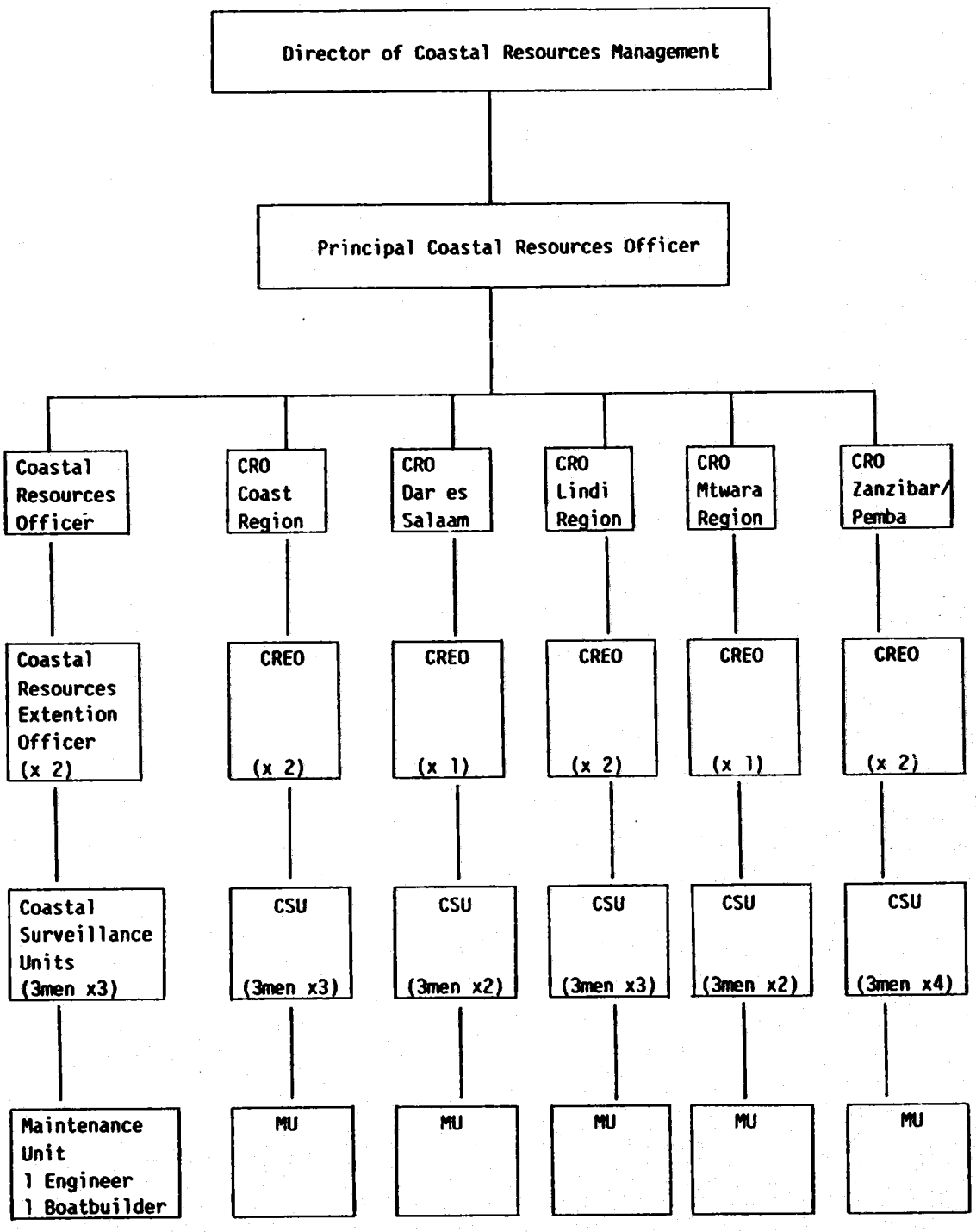

Table 13: Planning and Phasing Chart for the Implementation of the Action Plan

P R O G R A M M E	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
A. Public Awareness Programme	=========	———	———	———	———	———	———	———	———	———	———	———	———	———
B. Inventory Coastal Resources		====	———	———	———	———	———	———	———	–	–	–	–	–
C. Fisheries														
Workshops	========		———	———	———	———	———	———	———	———	———	———	———	———
Stock Assessment		==========	———	———	———	———	———	———	———	———	———	———	———	———
Explosive Fishing Deterrent			———	———	———	———	———	———	———	———	———	———	———	———
Anchor Factory			———	———	———	———	———	———	———	———	———	———	———	———
D. Surveillance														
Pilot Management Zone		+++	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo
Coast Region			+++	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo
Dar es Salaam Region				+++	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo
Lindi Region					+++	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo
Mtwara Region						+++	ooo	ooo	ooo	ooo	ooo	ooo	ooo	ooo
E. Pollution Control Programme			.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
F. Marine Reserves		==========	———	———	———	———	———	———	———	———	———	———	———	———

—— National
=== Pilot Zone
+++ Training phase
ooo Boat building
.... Ongoing National Programme
– – Environ Asses. of fixed sites

ANNEX X

FIGURES

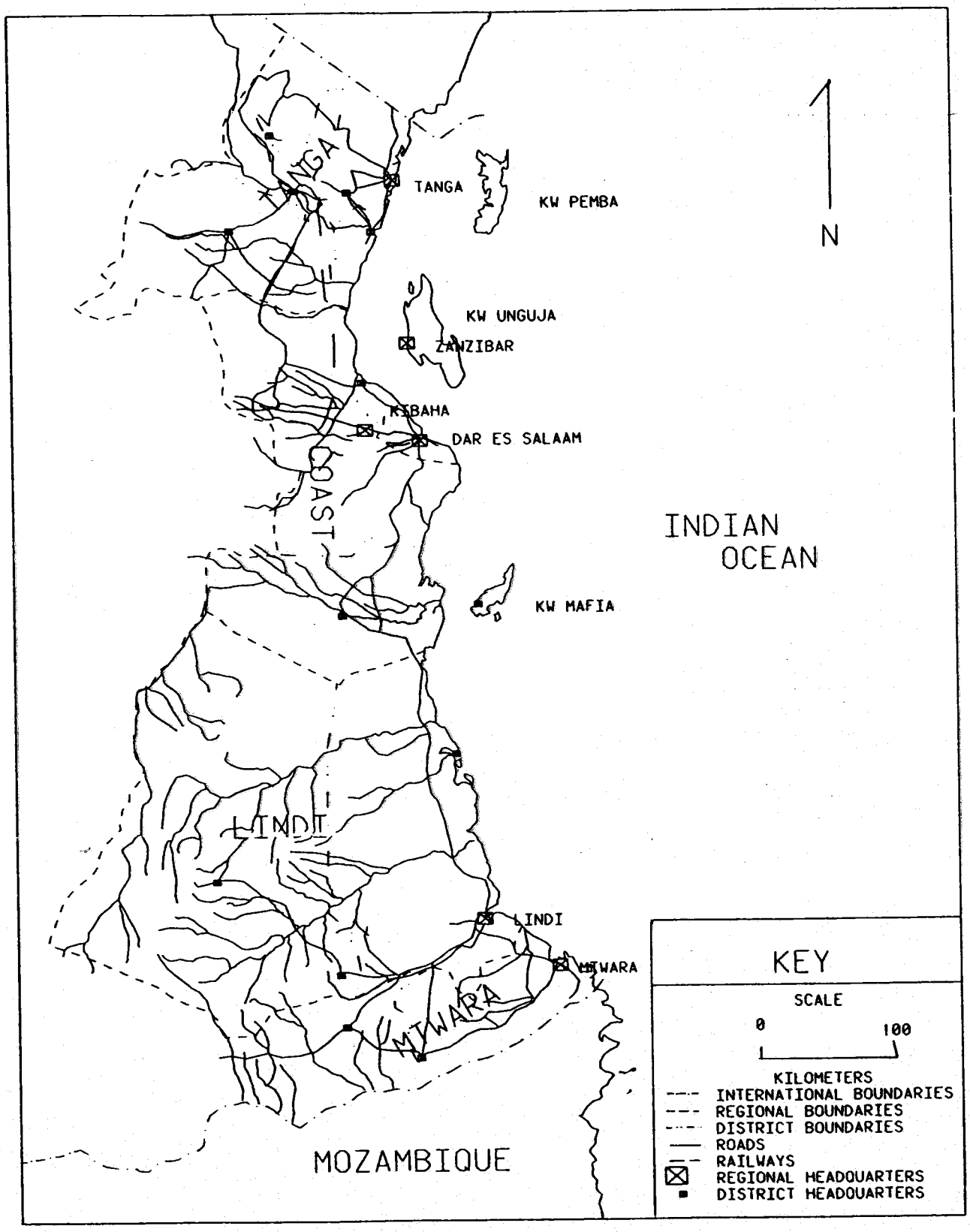

Figure 1. Regions and Districts

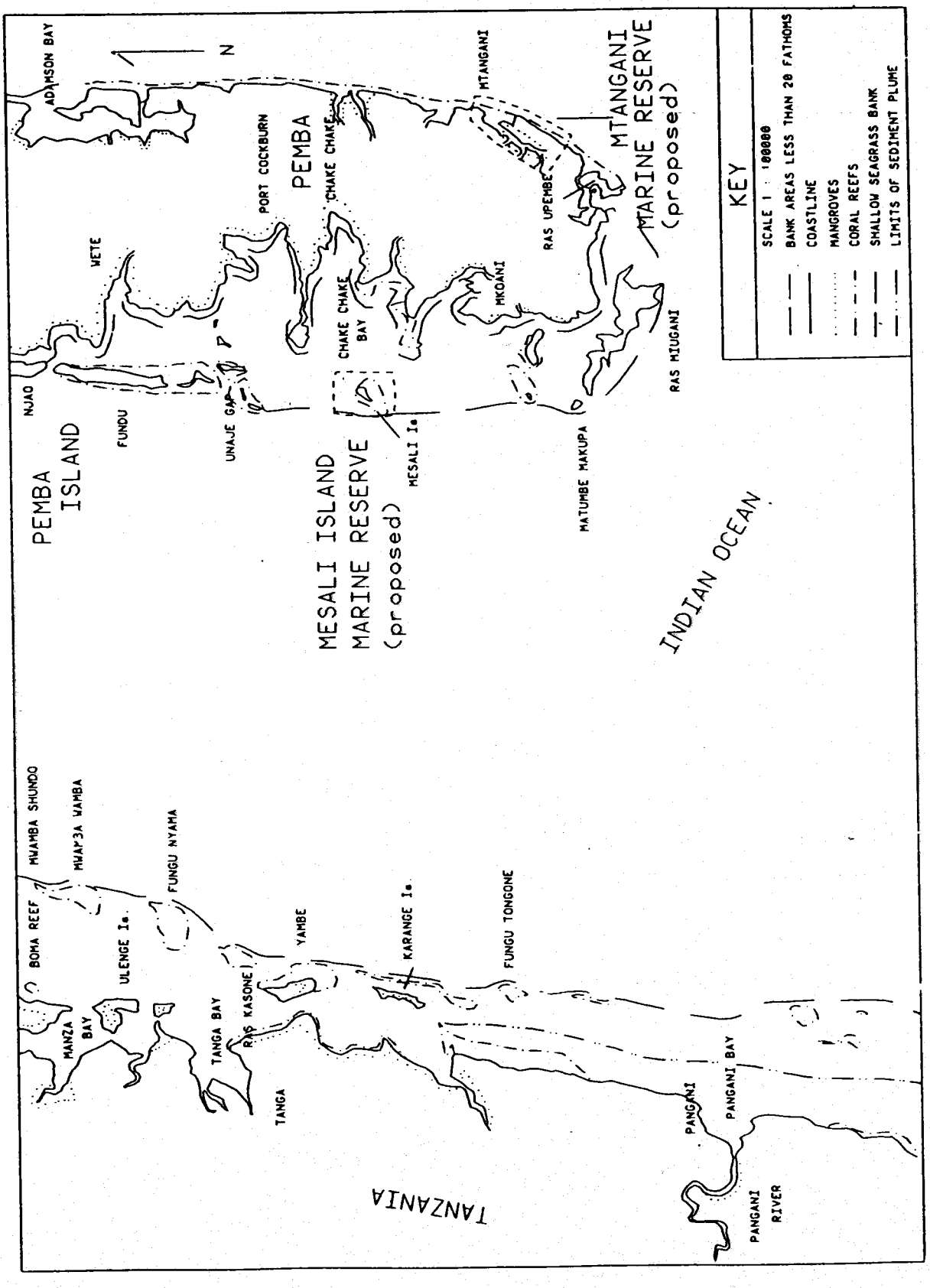

Figure 2a. Marine Protected Areas of Pemba and the Mainland Coast 26 July 1985 NASA ERTS E-2185-86588-501)

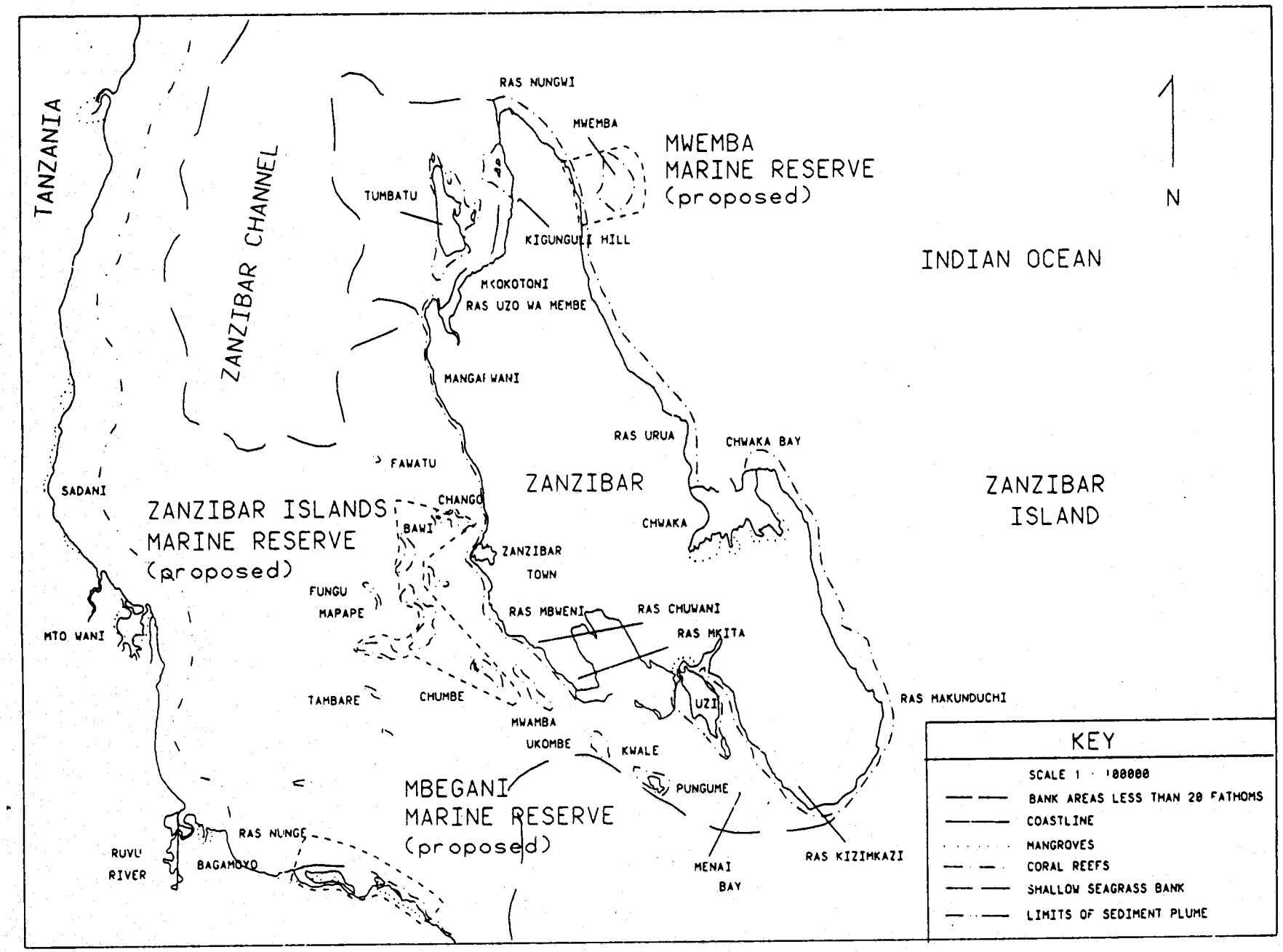

Figure 2b. Marine Protected Area of Zanzibar and the Mainland Coast (26 July 1975 NASA ERTS E-2185-86588-501)

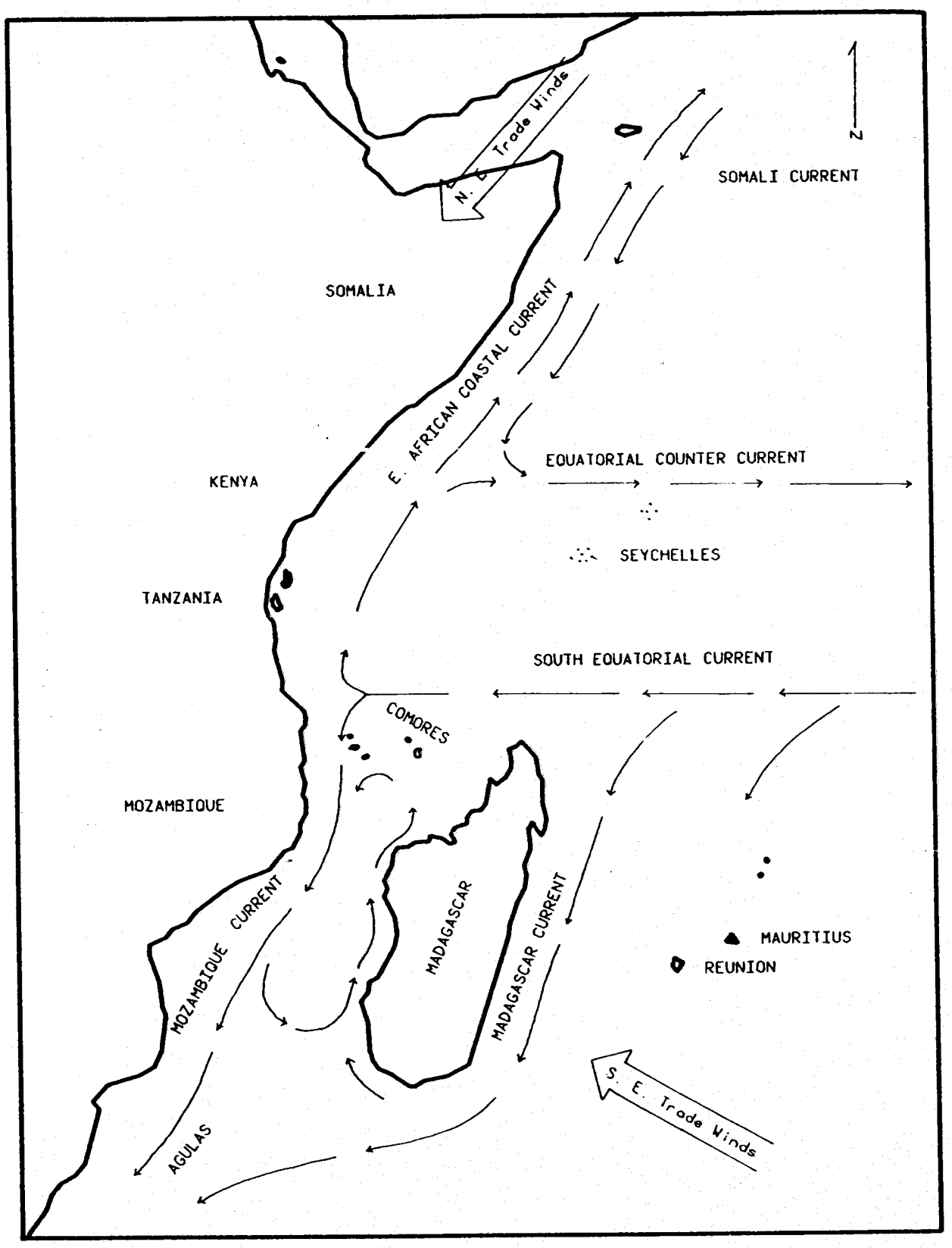

Figure 3. Ocean Currents and Winds / Eastern African Region (after IUCN / UNEP, 1982)

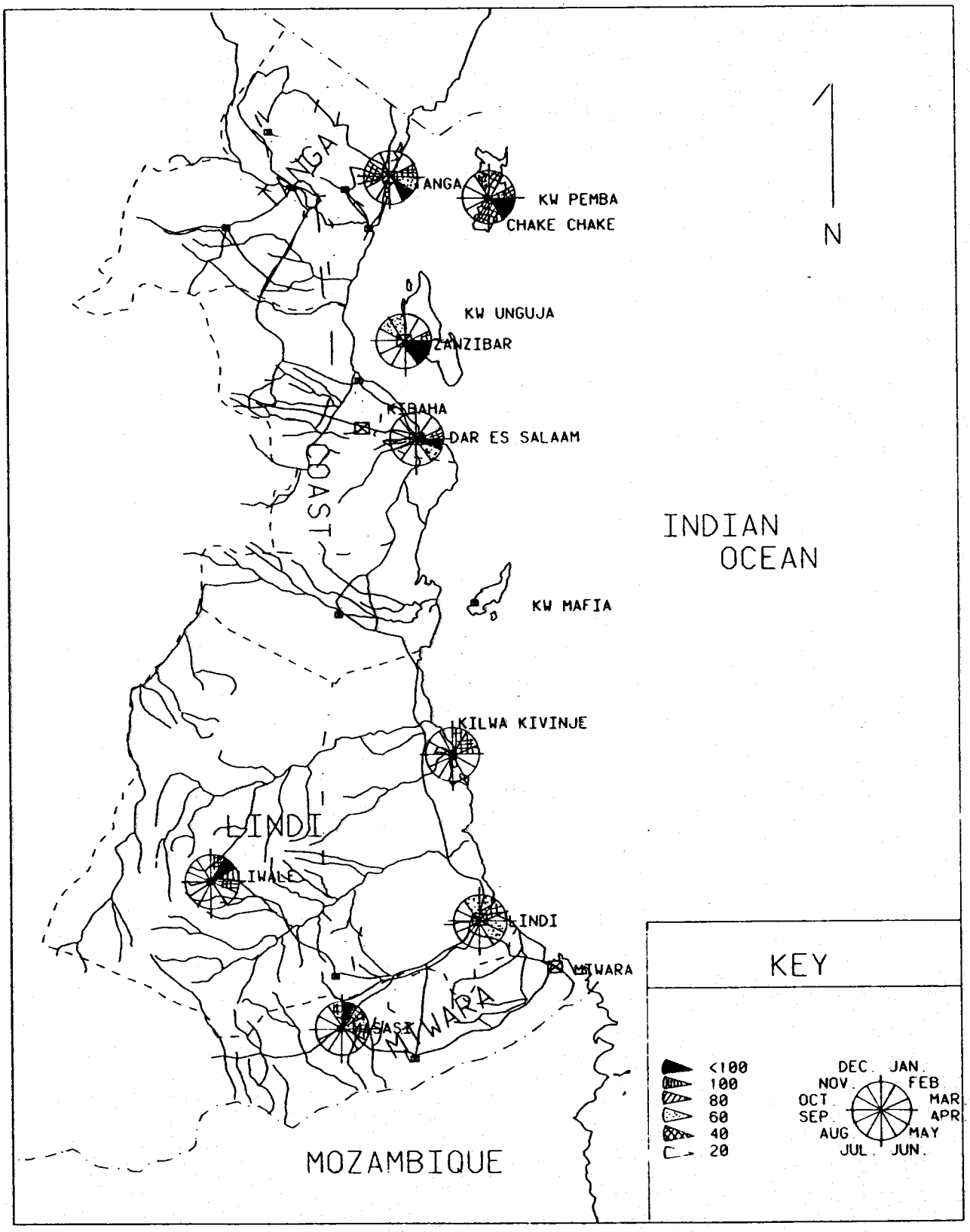

Figure 4. **Climate of the Coastal Region (Maps compiled by S. Nieuwolf, University of Dar es salaam)**

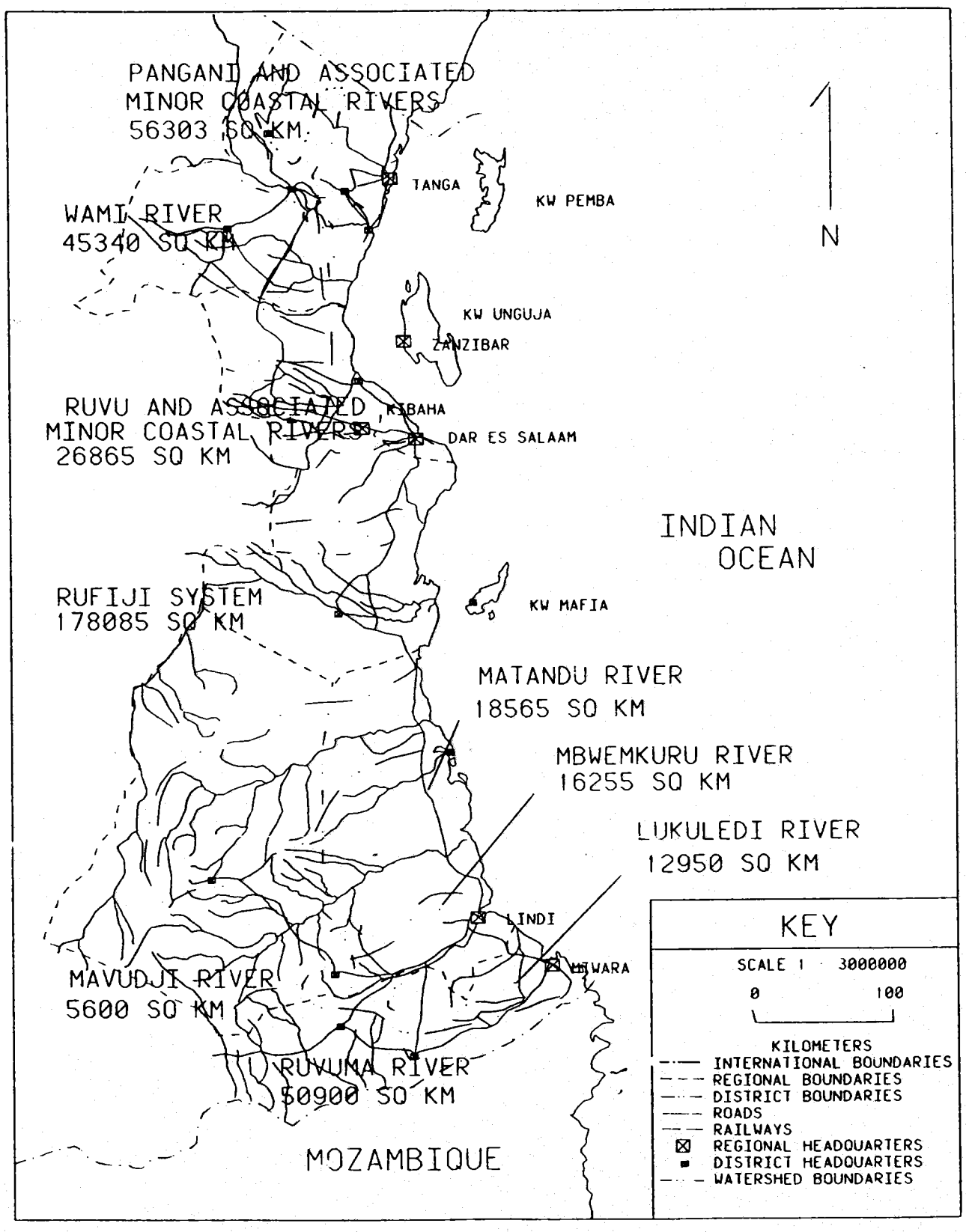

Figure 5. Indian Ocean Drainage Basin Watershed (compiled from information supplied by the Ministry of Water Development and Power, 1972)

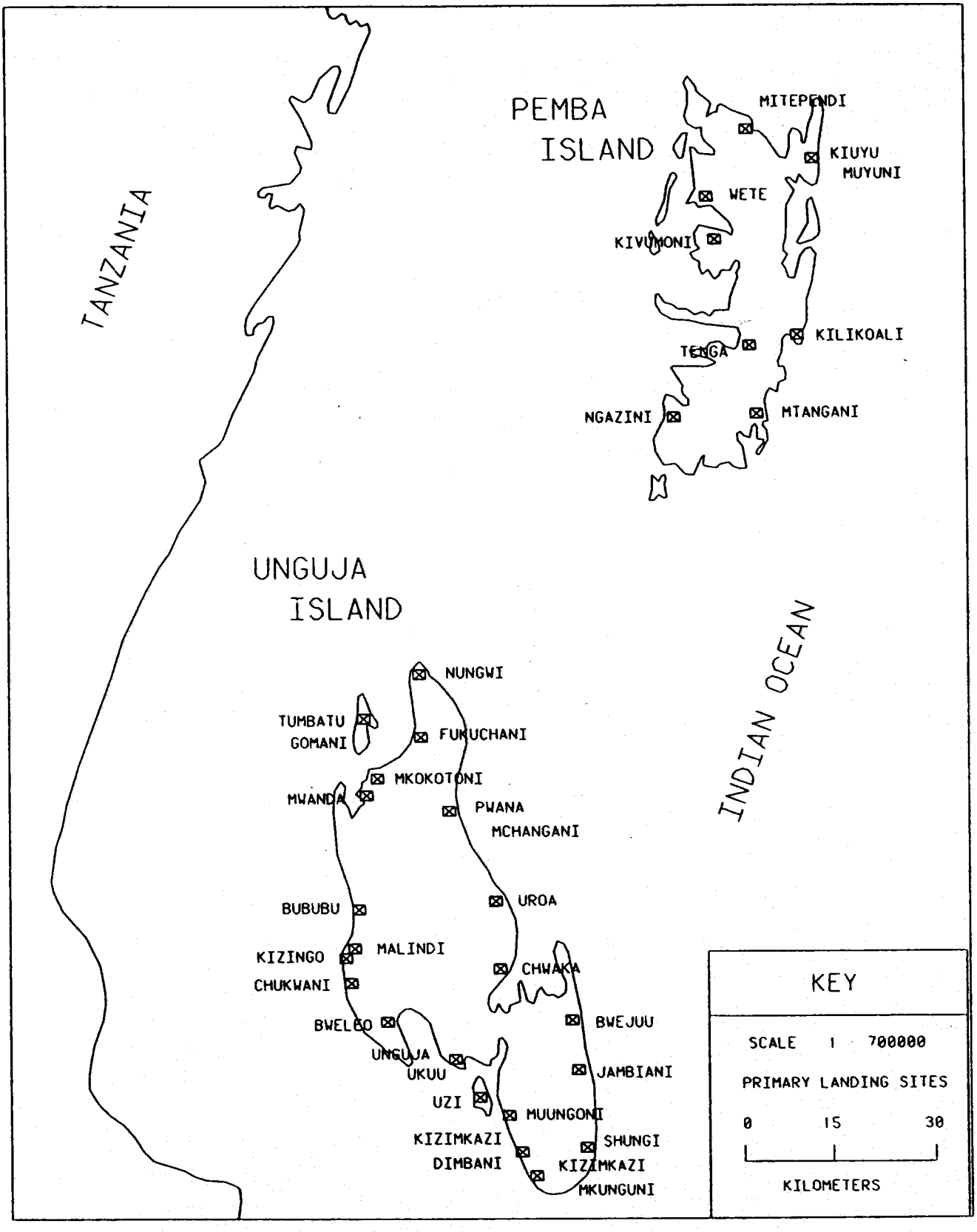

Figure 6. Fish Catch Landing Sites of Zanzibar and Pemba (Zanzibar Ministry of Marine Tourism and Forestry)

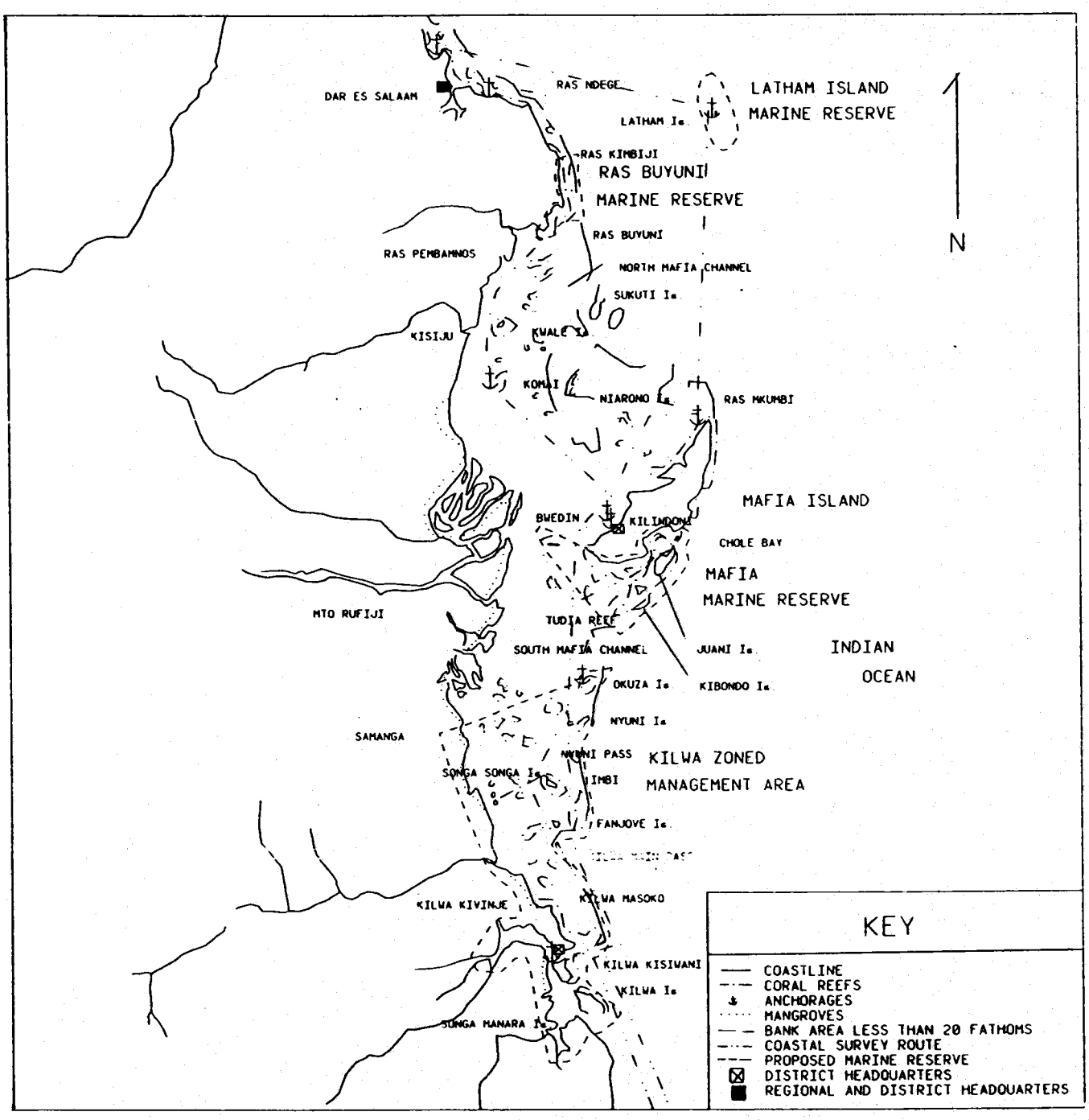

Figure 7. Proposed Mafia Marine Protected Area (Admiralty Chart 2951)

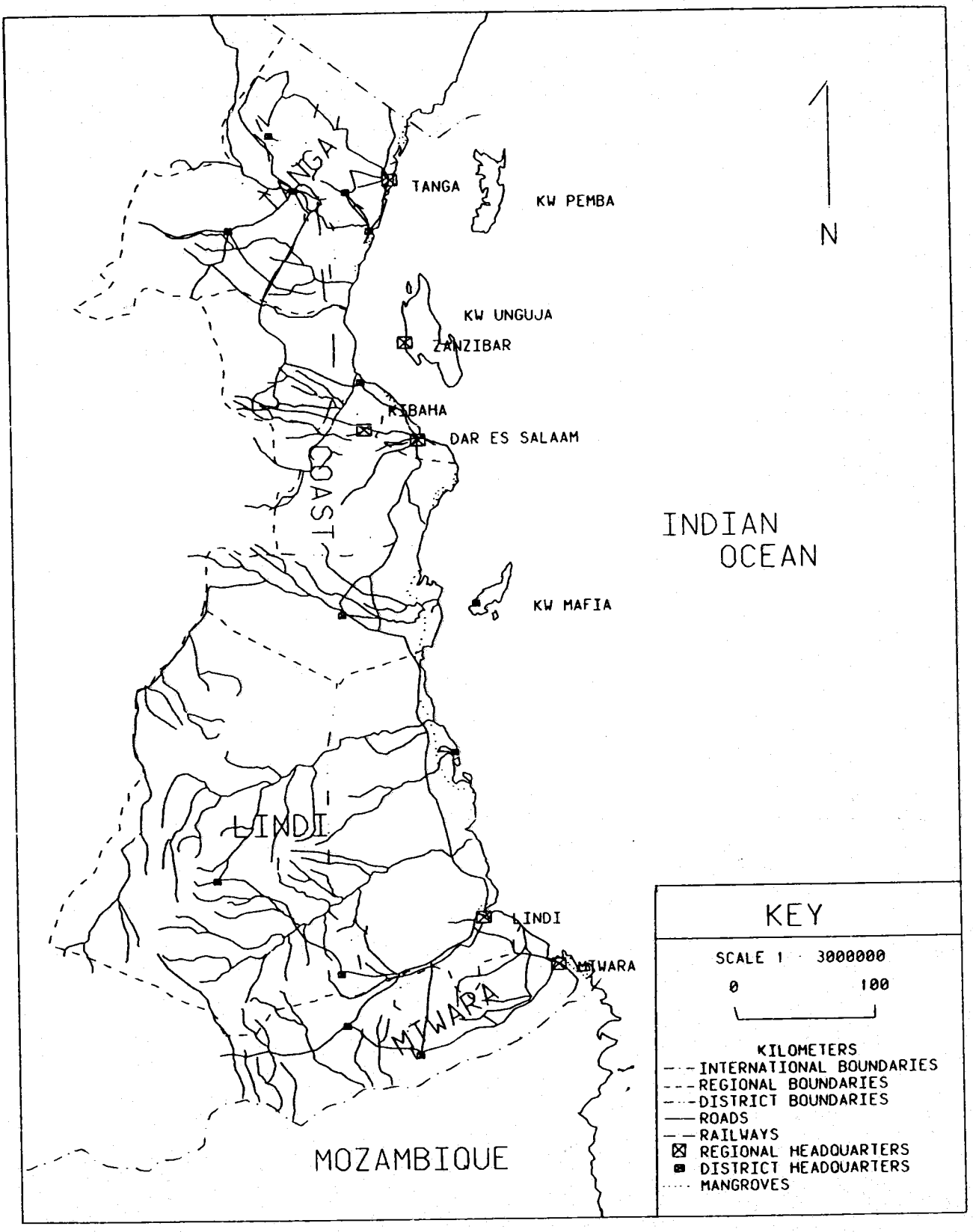

Figure 8. **Mangrove Reserves (Compiled from information supplied by Forestry Division, 9 August 1972)**

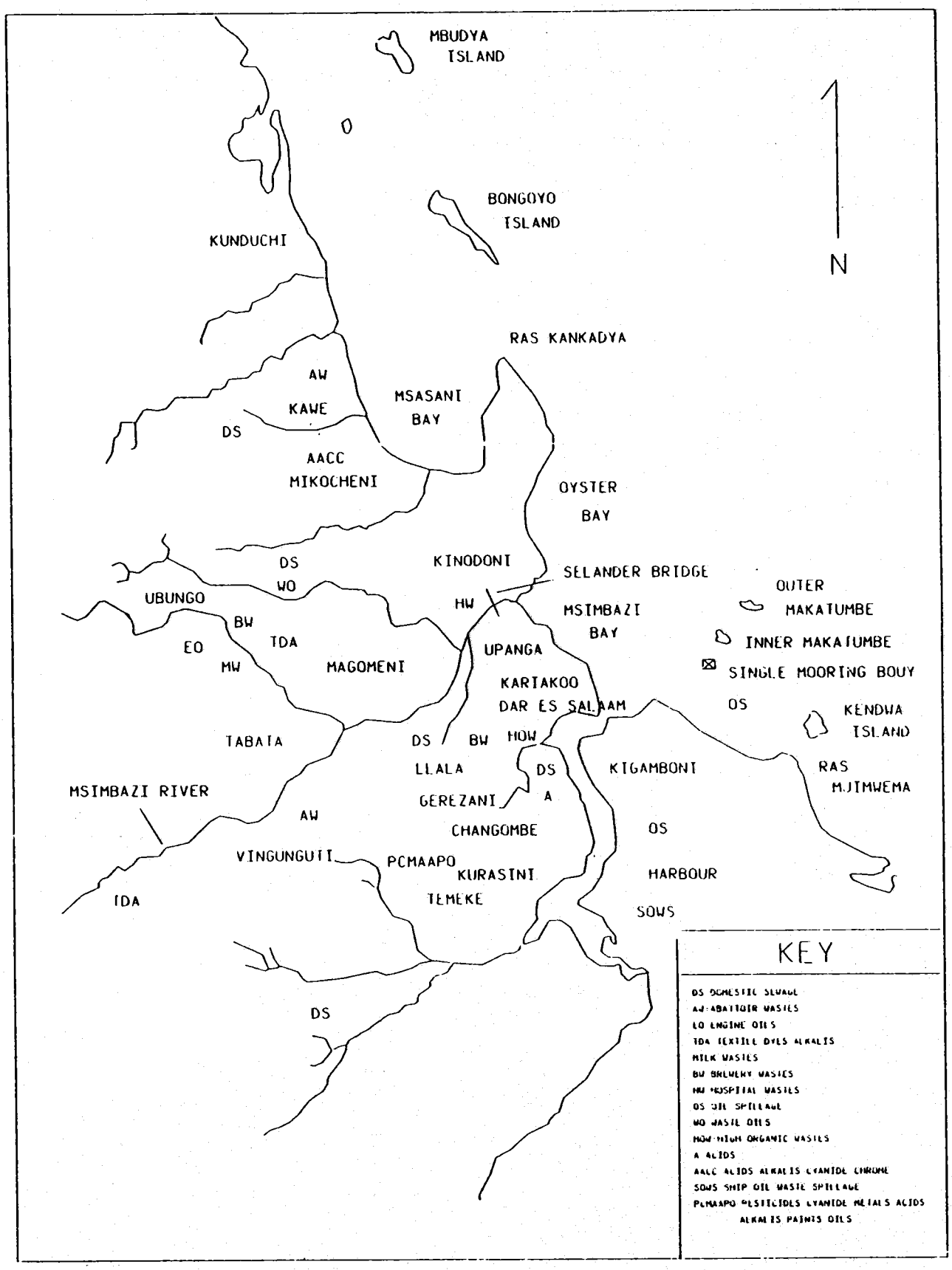

Figure 9. Types of Polluting Effluents found in the Dar es Salaam Region (National Environment Management Council Dar es Salaam 1987)

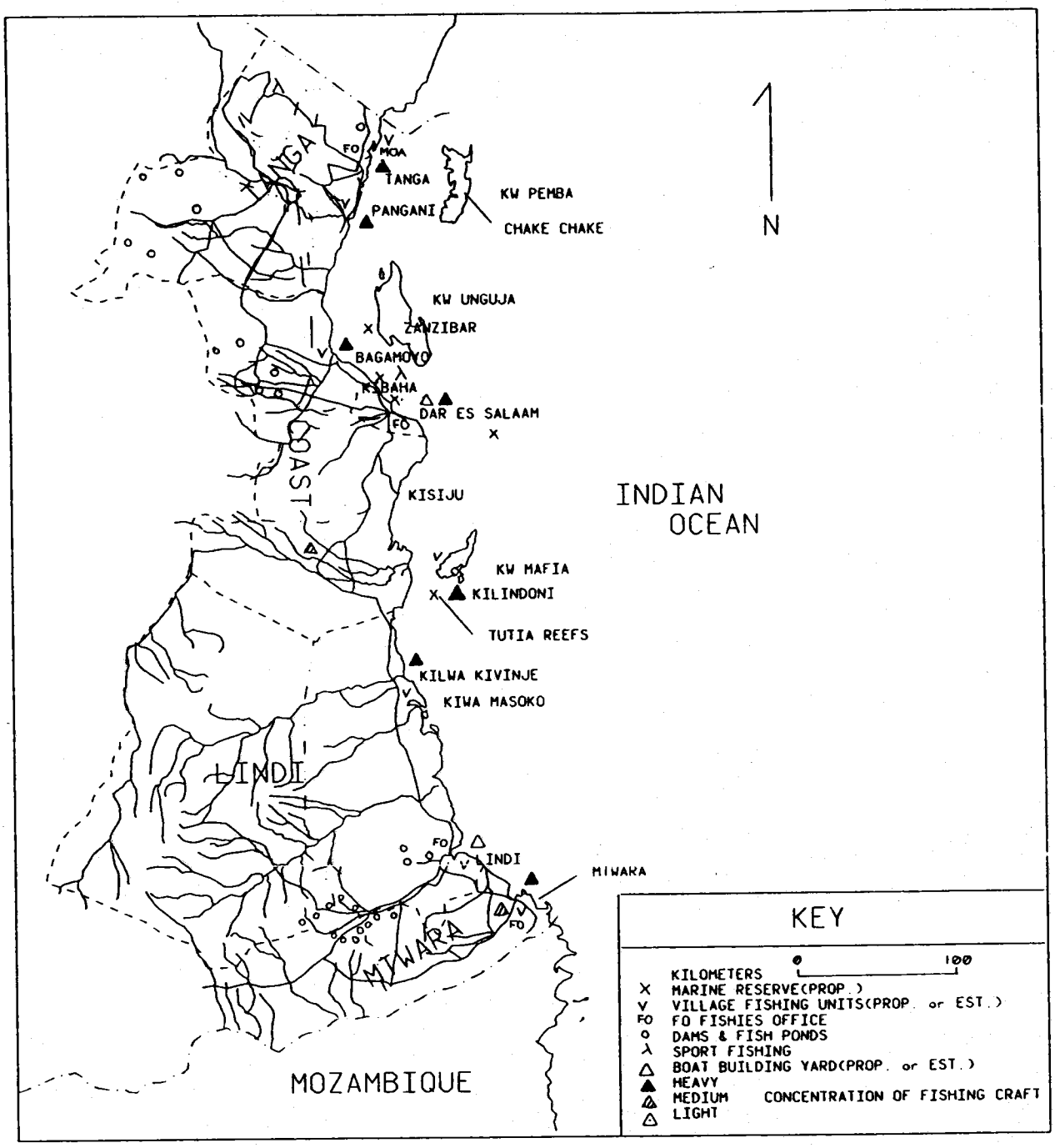

Figure 10 Concentration of Fishing Activities

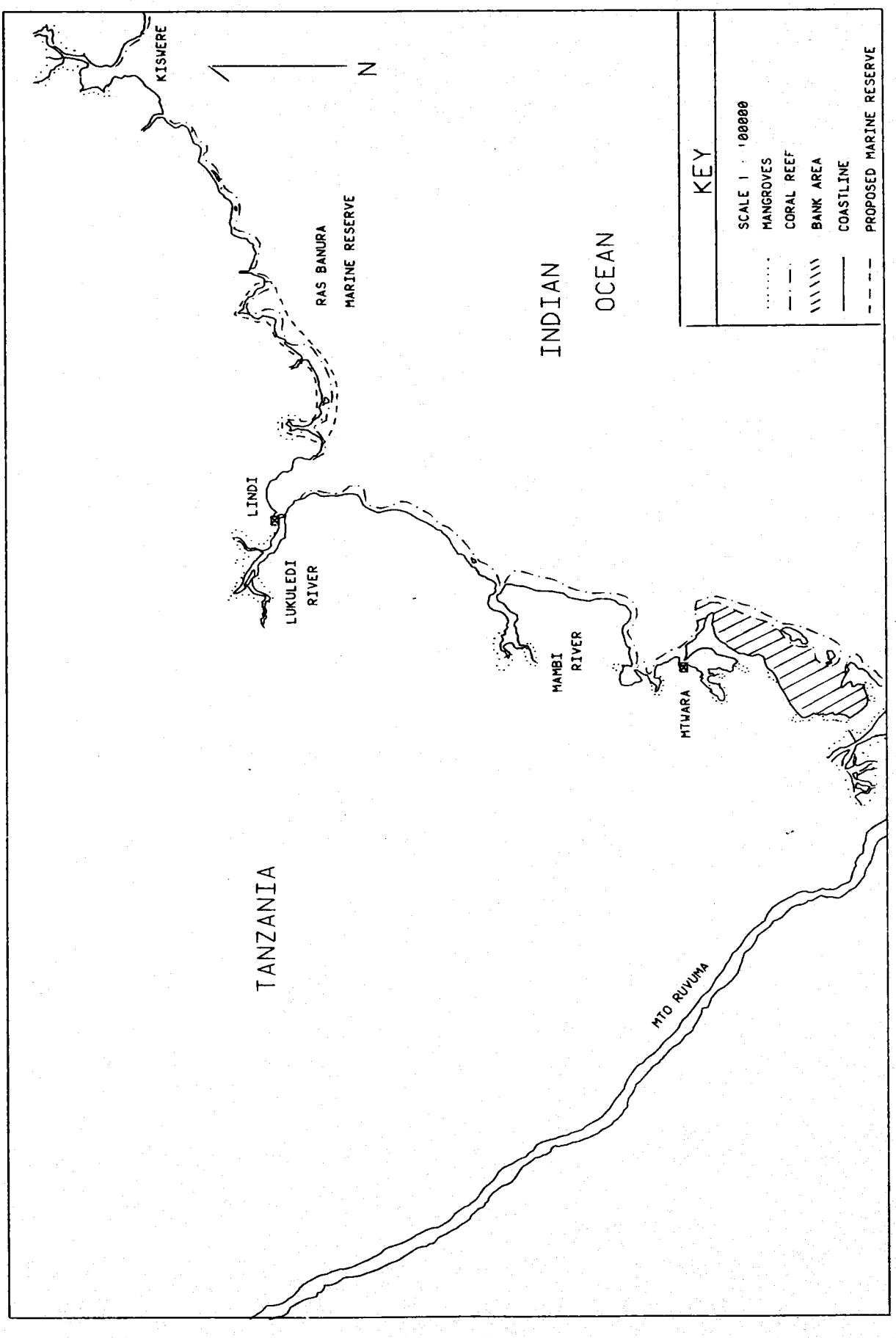

Figure 11. South Lindi and Mtwara Region (16 November 1972 NASA ERTS E-1116-06574-501)

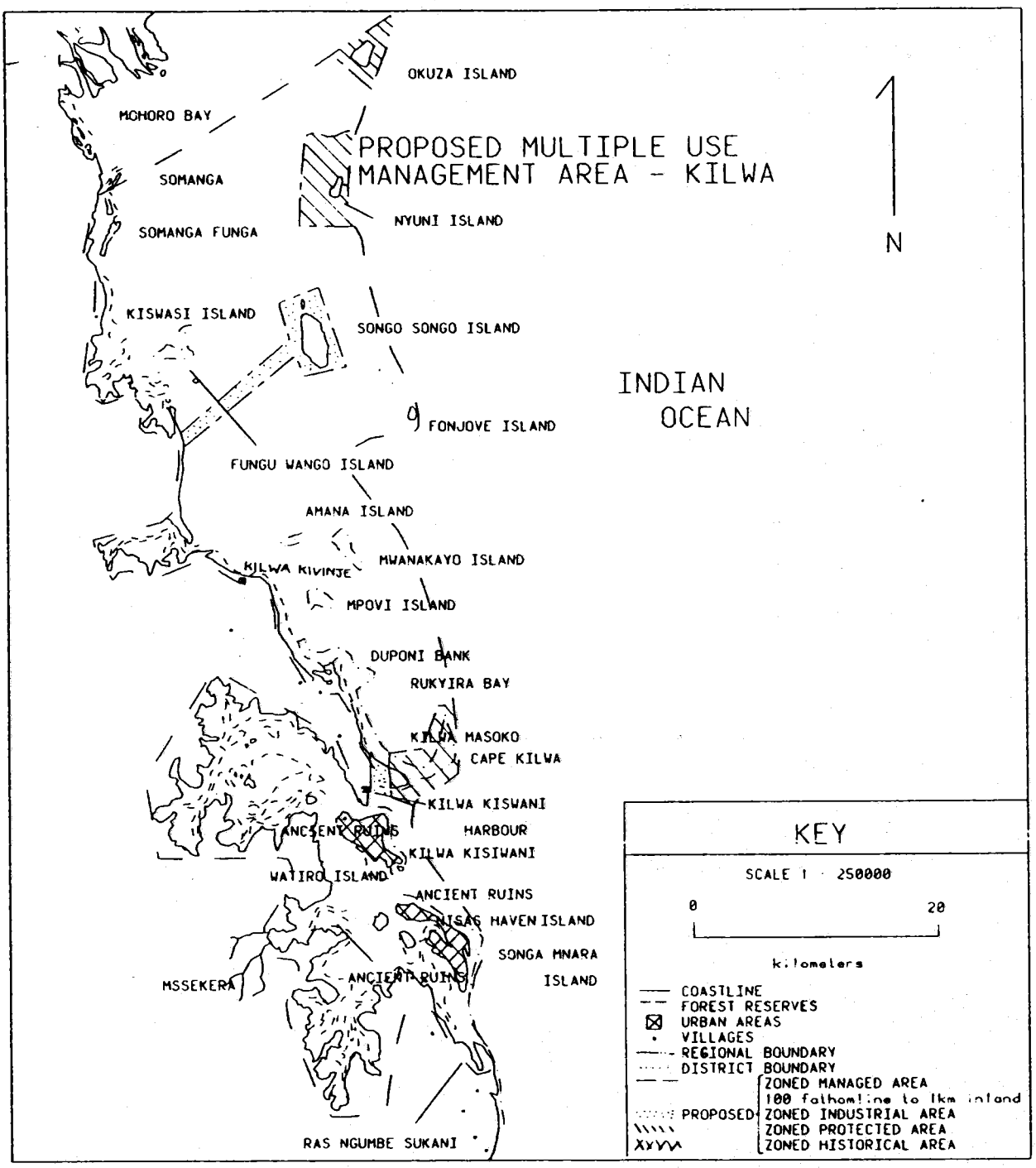

Figure 12. Proposed Multiple use Management Area - Kilwa (Compiled, drawn and printed by Surveys and Mapping Division, Ministry of Lands, Housing and Urban Development Tanzania, 1969)

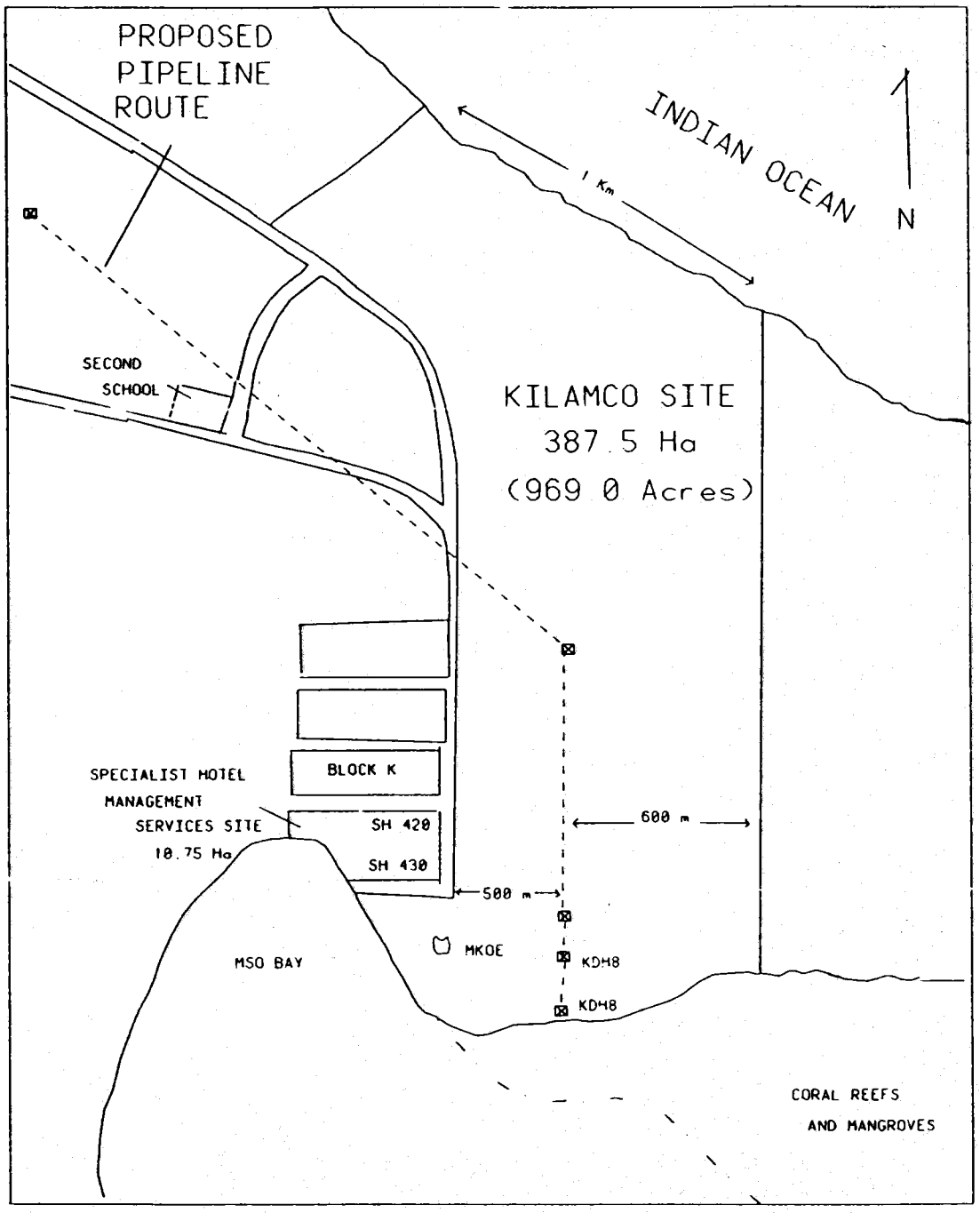

Figure 13. Status of Land Allocation near Kilamco Site, Kilwa Masoka

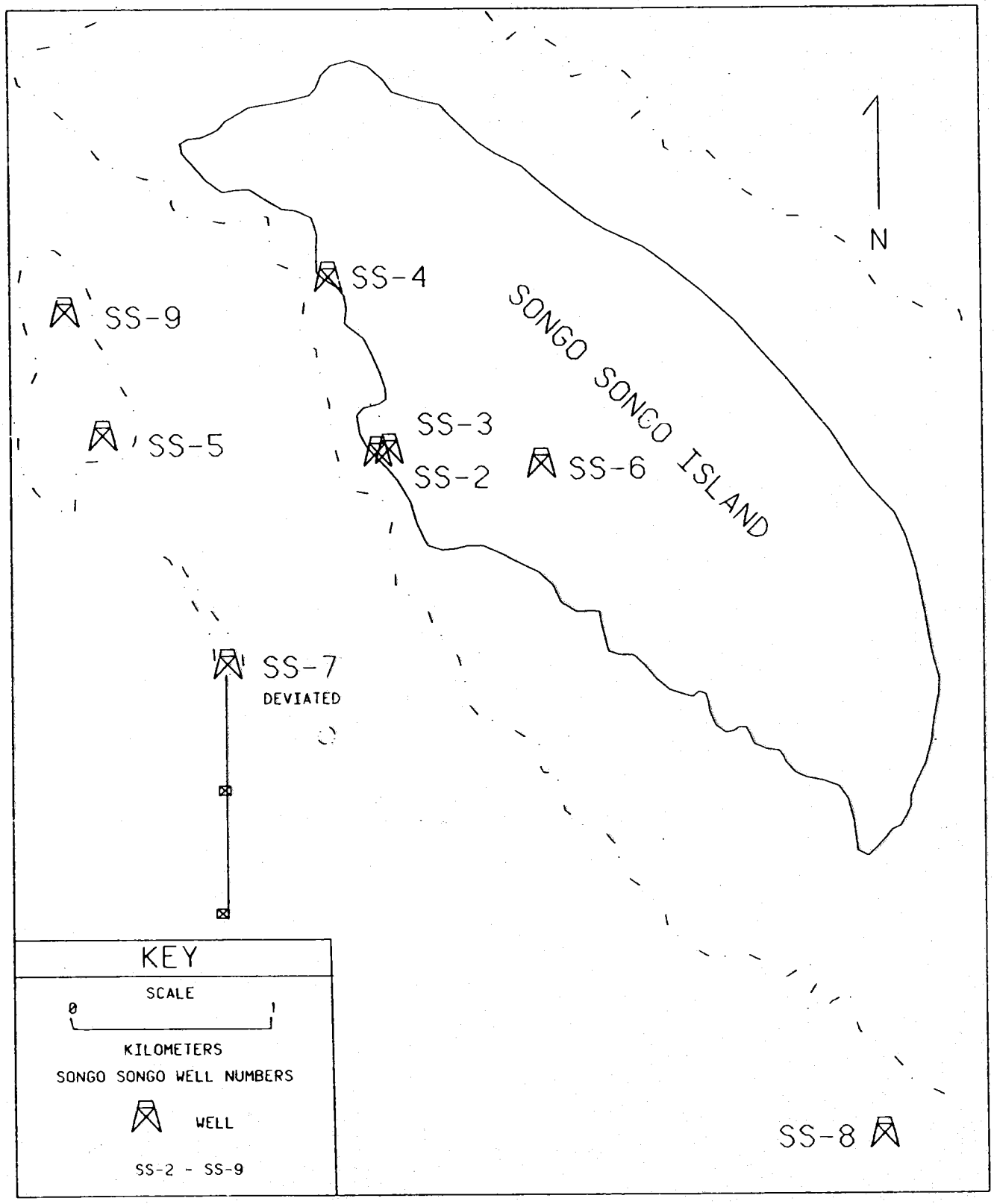

Figure 14. Songo Songo Island, Existing Gas and Producer Wells
Tanzanian Petroleum Development Cooperation

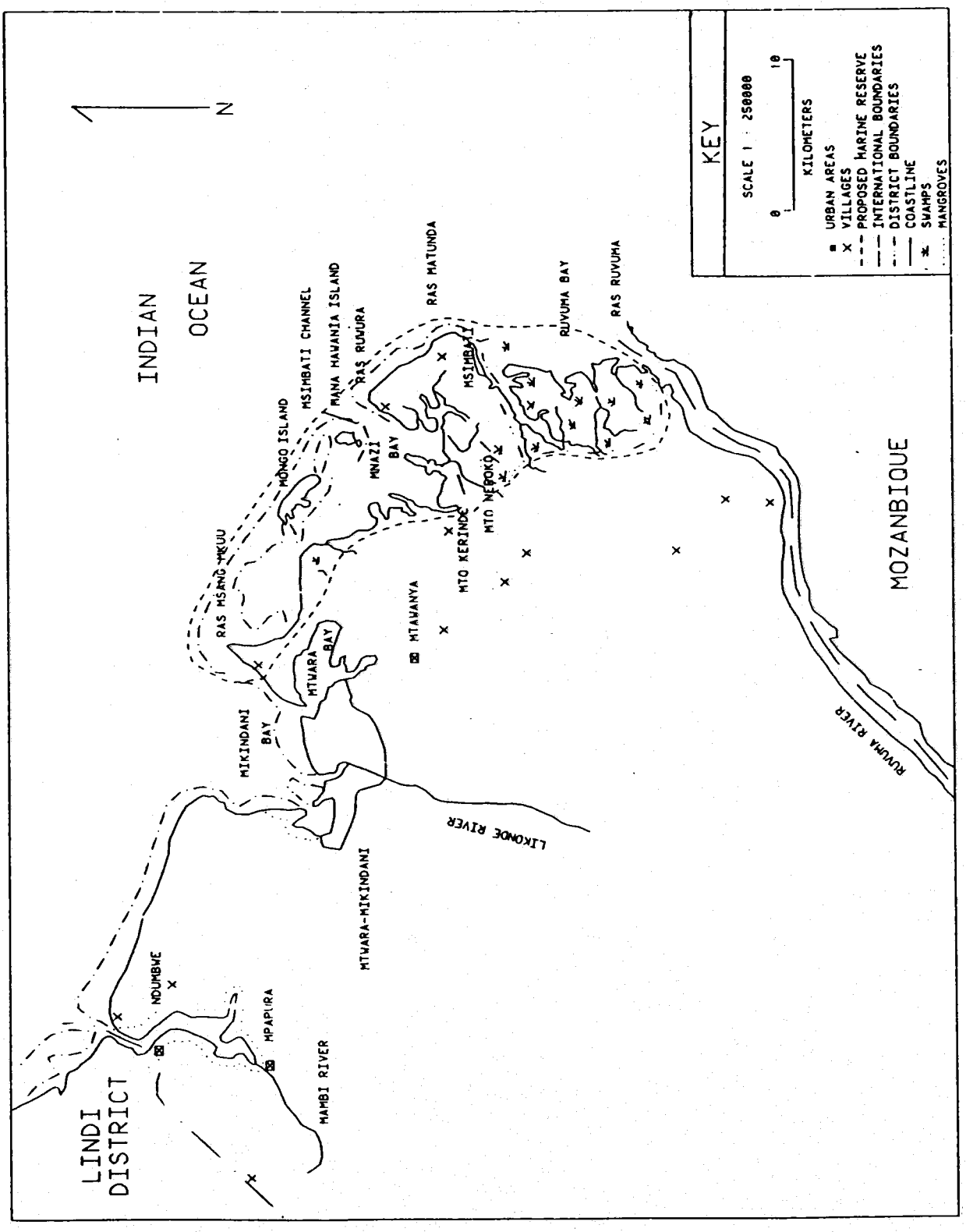

Figure 15. Mtwara District (Surveys and Mapping Division, Ministry of Lands, Housing and Urban Development, Tanzania)

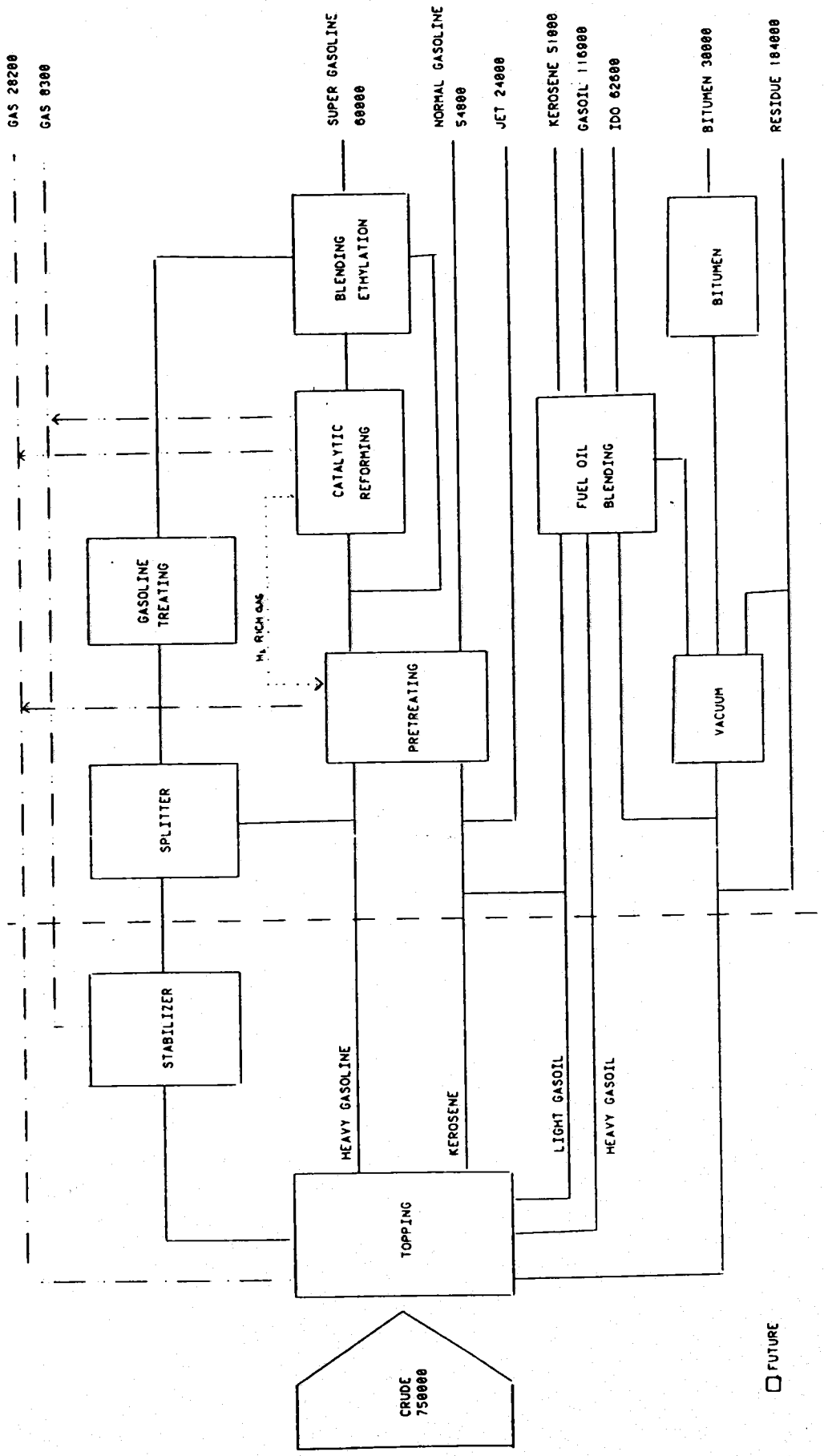

Figure 16. Refinery Flow Chart Based on Annual Designed Capacity in Metric Tons (Daily News, January 1987)

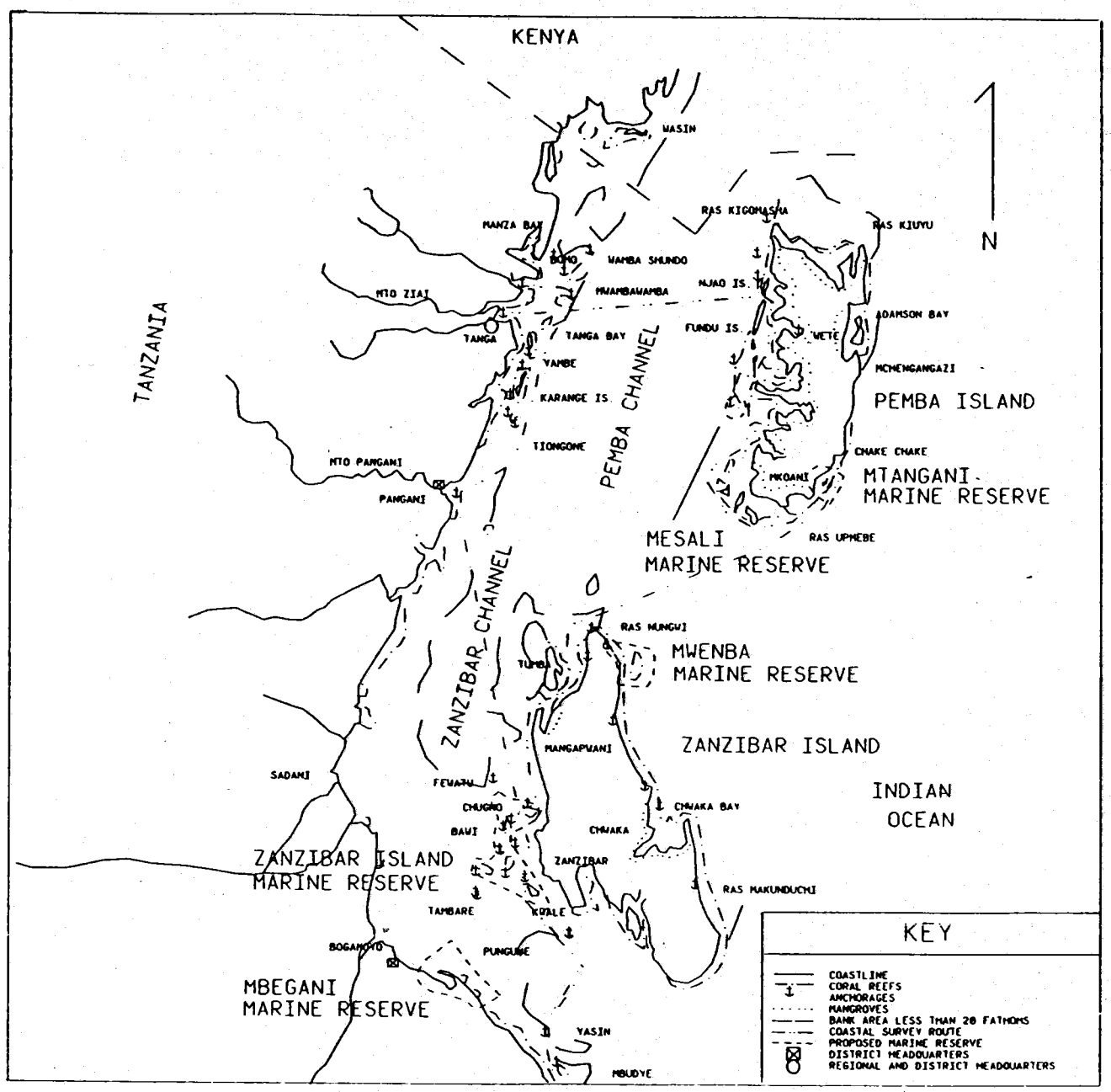

Figure 17a. Proposed Marine Reserves (Admiralty Chart 2951)

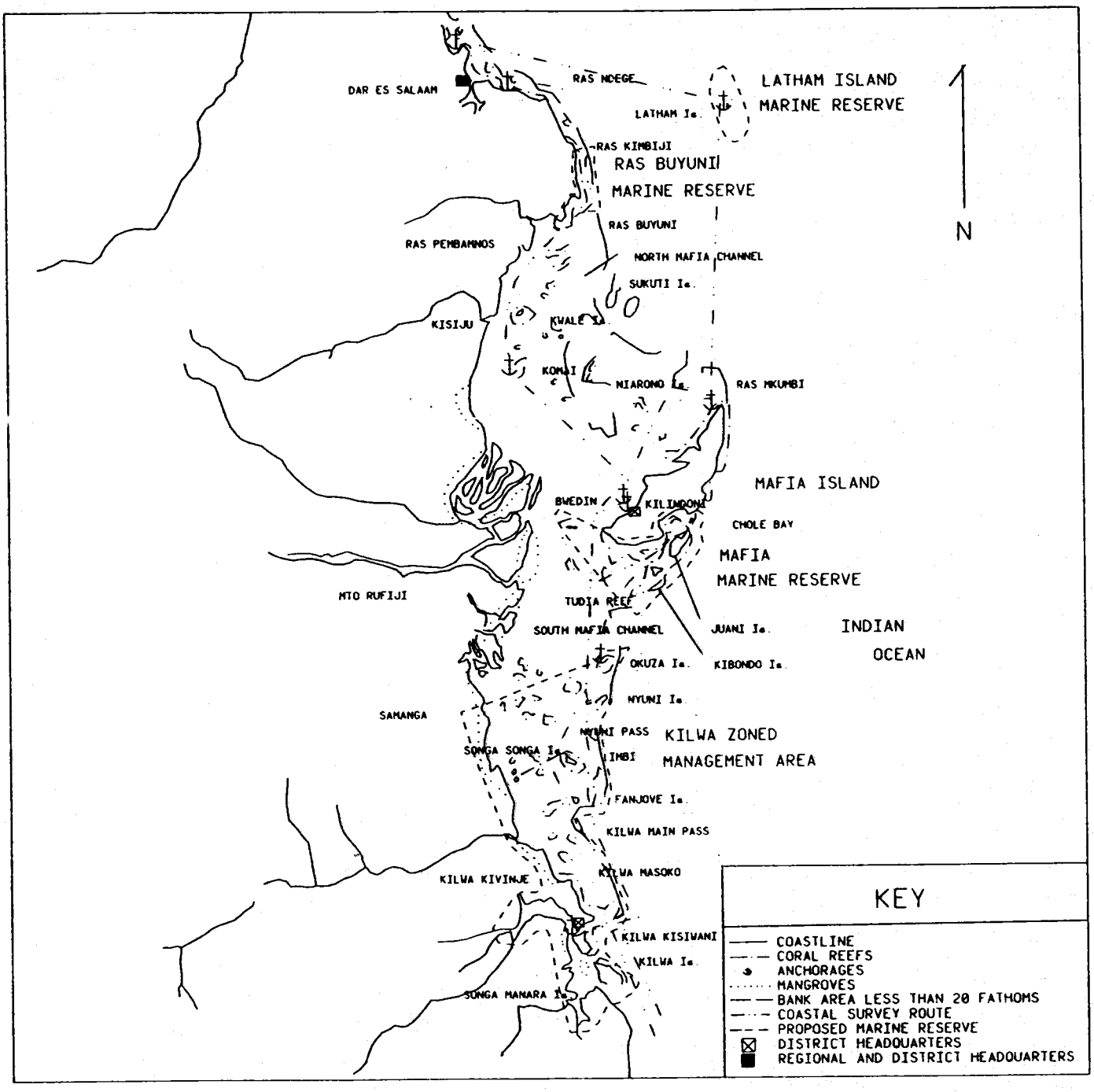

Figure 17b. Proposed Marine Reserves (Admiralty Chart 2951)

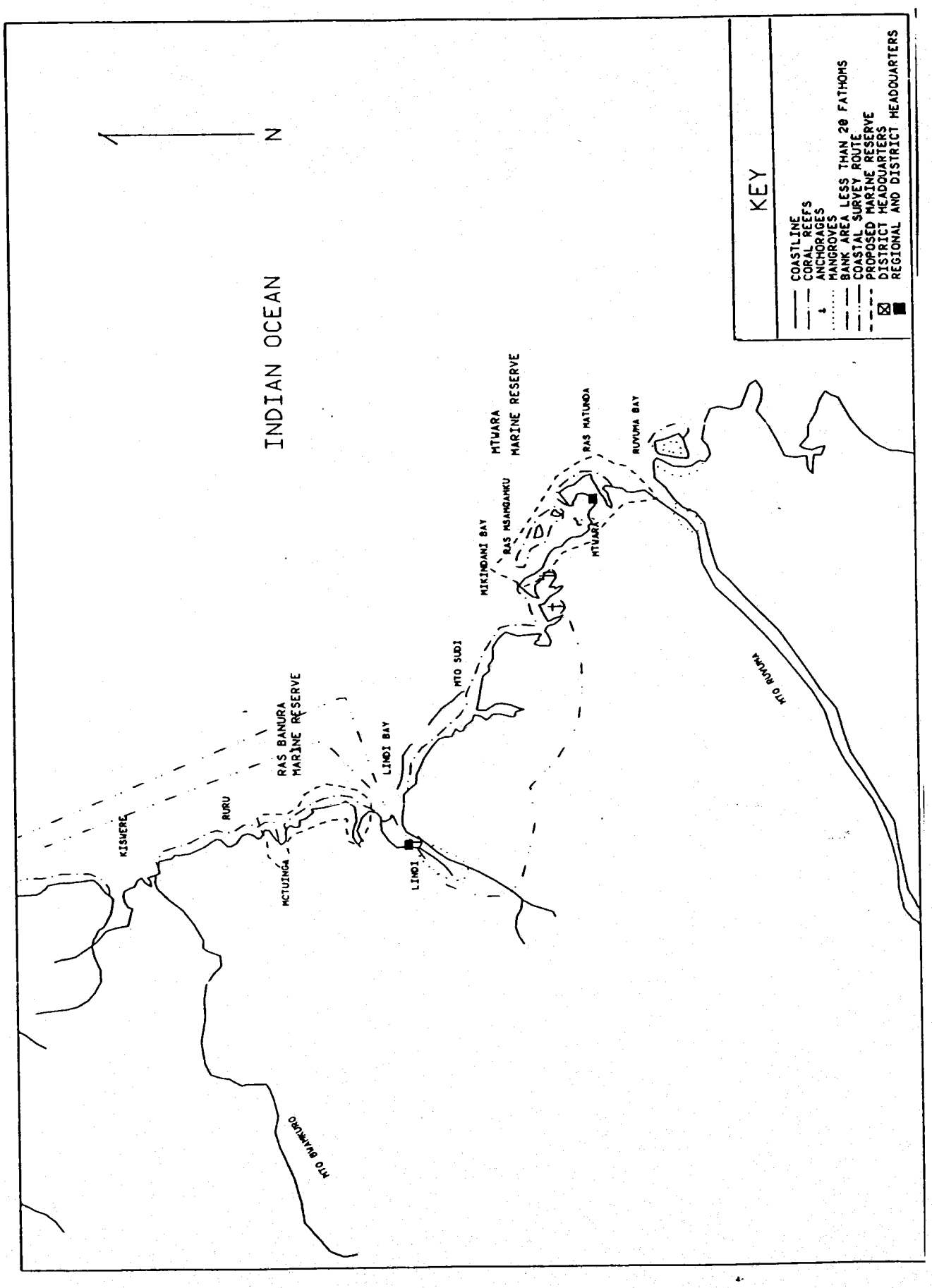

Figure 17c. Proposed Marine Reserves (Admiralty Chart 2951)

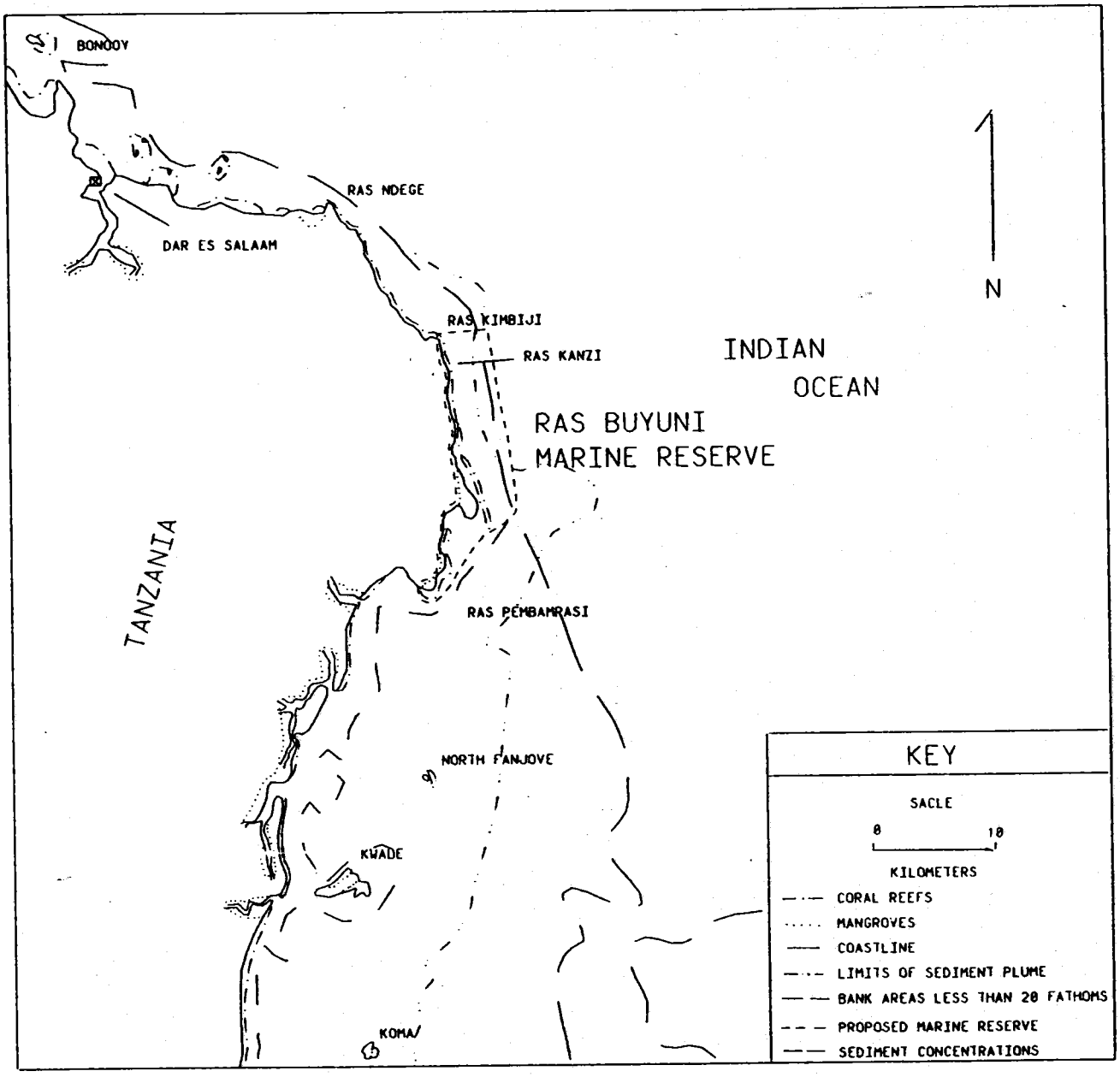

Figure 18a. The Coastline of Tanzania from Kunduchi to Samanga (24 June 81 LANDSAT MSS SCENE ID 22345-06472)

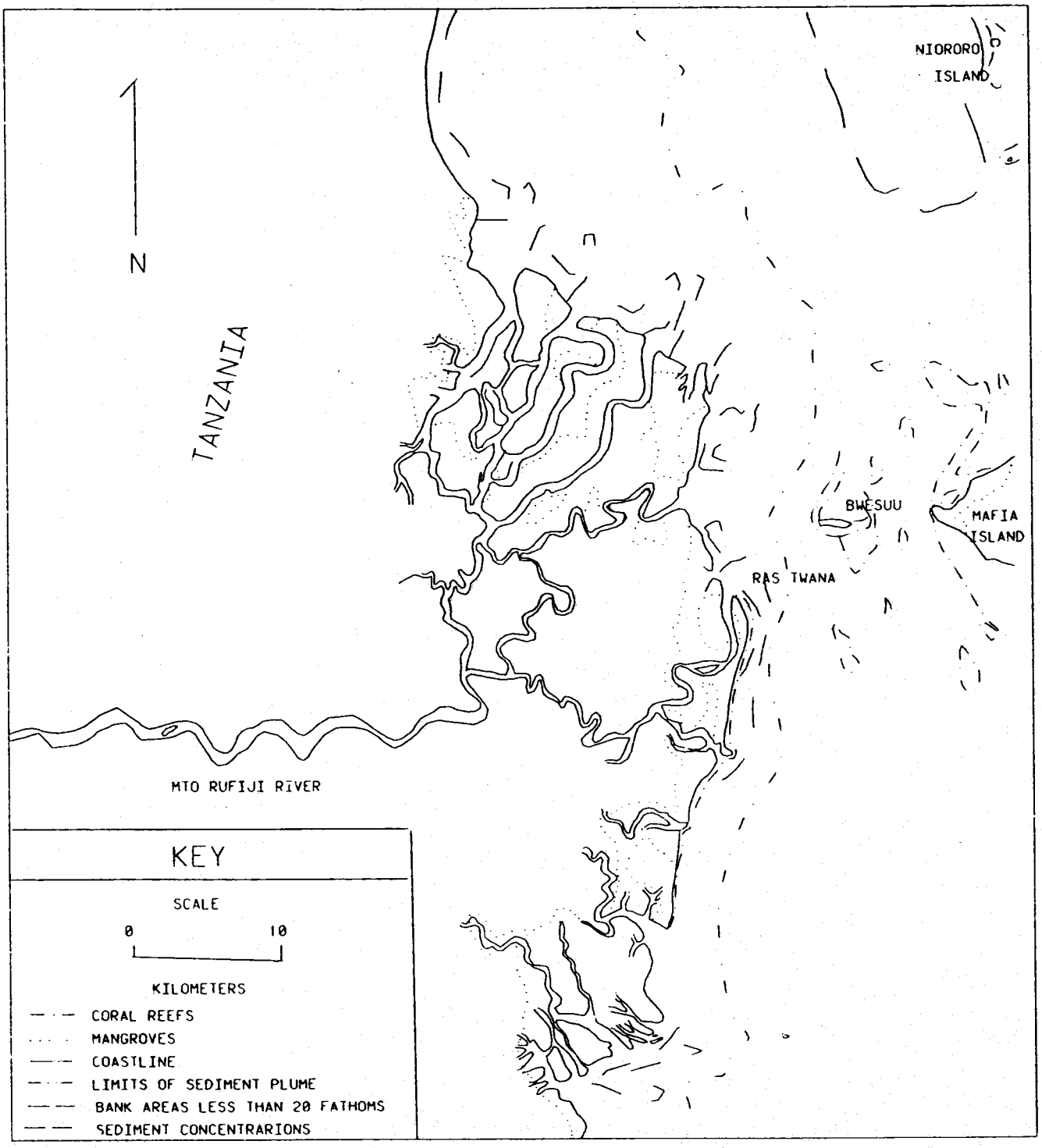

Figure 18b. The Coastline of Tanzania from Kunduchi to Samanga (24 June 81 LANDSAT MSS SCENE ID 22345-06472)

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