REGIONAL SEAS

UNITED NATIONS ENVIRONMENT PROGRAMME

Environmental Problems of the East African Region

UNEP Regional Seas Reports and Studies No. 12

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PREFACE

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans.

The Regional Seas Programme at present includes ten regions 1/ and has over 120 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental degradation and encompassing a comprehensive approach to combating environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities.

Decision 8/13(C) of the eighth session of the Governing Council of UNEP called for the development of an action plan for the protection and development of the marine and coastal environment of the East African region. As a first activity in the region, UNEP organized in October and November 1981 a joint UNEP/UN/UNIDO/FAO/UNESCO/WHO/IMCO/IUCN exploratory mission which visited the eight States of the region 2/ in order to:

- assess each State's interest in participating in a future regional programme;
- consult with Governments with a view to identifying activities that may usefully be included as part of a comprehensive action plan;
- make a preliminary assessment of the environmental problems in the region, including the problems related to the environmentally sound management of marine and coastal natural resources and activities influencing the quality of the marine and coastal environment;
- collect available scientific data and information pertaining to the development and implementation of the action plan planned for the region; and
- identify national institutions that may participate in implementing an action plan once it is adopted.

1/ Mediterranean, Kuwait Action Plan Region, West and Central Africa, Wider Caribbean, East Asian Seas, South-East Pacific, South-West Pacific, Red Sea and Gulf of Aden, East Africa and South-West Atlantic.

2/ Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, and United Republic of Tanzania.

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CONTENTS

Contents continued...

INTRODUCTION

1. The United Nations Conference on the Human Environment (Stockholm 1972) adopted, inter alia, the principle that "the marine environment and all the living organisms which it supports are of vital importance to humanity" and recognized that "proper management is required and measures to prevent and control marine pollution must be regarded as an essential element in this management". Furthermore, the Conference recommended that Governments take early action to adopt "effective national measures for the control of all significant sources of marine pollution, including land-based sources, and concert and co-ordinate their actions regionally and where appropriate on a wider international basis" (recommendation 92).

2. The subsequent meetings of the UNEP Governing Council repeatedly endorsed the regional approach to the control of marine pollution and requested the development of regional action plans for the parts of the ocean where such plans do not yet exist. Consequently, in 1974 the Regional Seas Programme of UNEP was initiated.

3. The overall strategy to be followed in the development of regional action plans was defined by UNEP's Governing Council as:

- promotion of international and regional conventions, guidelines and actions for the control of marine pollution and for the protection and management of aquatic resources;

- assessment of the state of marine pollution, of the sources and trends of this pollution, and of the impact of the pollution on human health, marine ecosystems and amenities;

- co-ordination of the efforts with regard to the environmental aspects of the protection, development and management of marine and coastal resources;

- support for education and training efforts to make possible the full participation of developing countries in the protection, development and management of marine and coastal resources.

4. Since each regional programme is aimed at benefiting the States of that region, Governments are involved from the very beginning in the formulation of the action plan. After acceptance, the implementation of the programme is carried out, under the overall authority of the Governments concerned, by national institutions nominated by their Governments.

5. Although the Regional Seas Programme is implemented predominantly by Government-nominated institutions, specialized United Nations bodies, as well as the relevant international and regional organizations, contribute to its formulation and may provide assistance to these national institutions. UNEP acts as an overall co-ordinator for the development and implementation of regional action plans although, in some cases, this role is limited to the initial phase of the activities. In the framework of UNEP a Regional Seas Programme Activity Centre has been established (1977) to co-ordinate the efforts of those involved in the Regional Seas Programme. Financial support to the regional programmes is initially provided

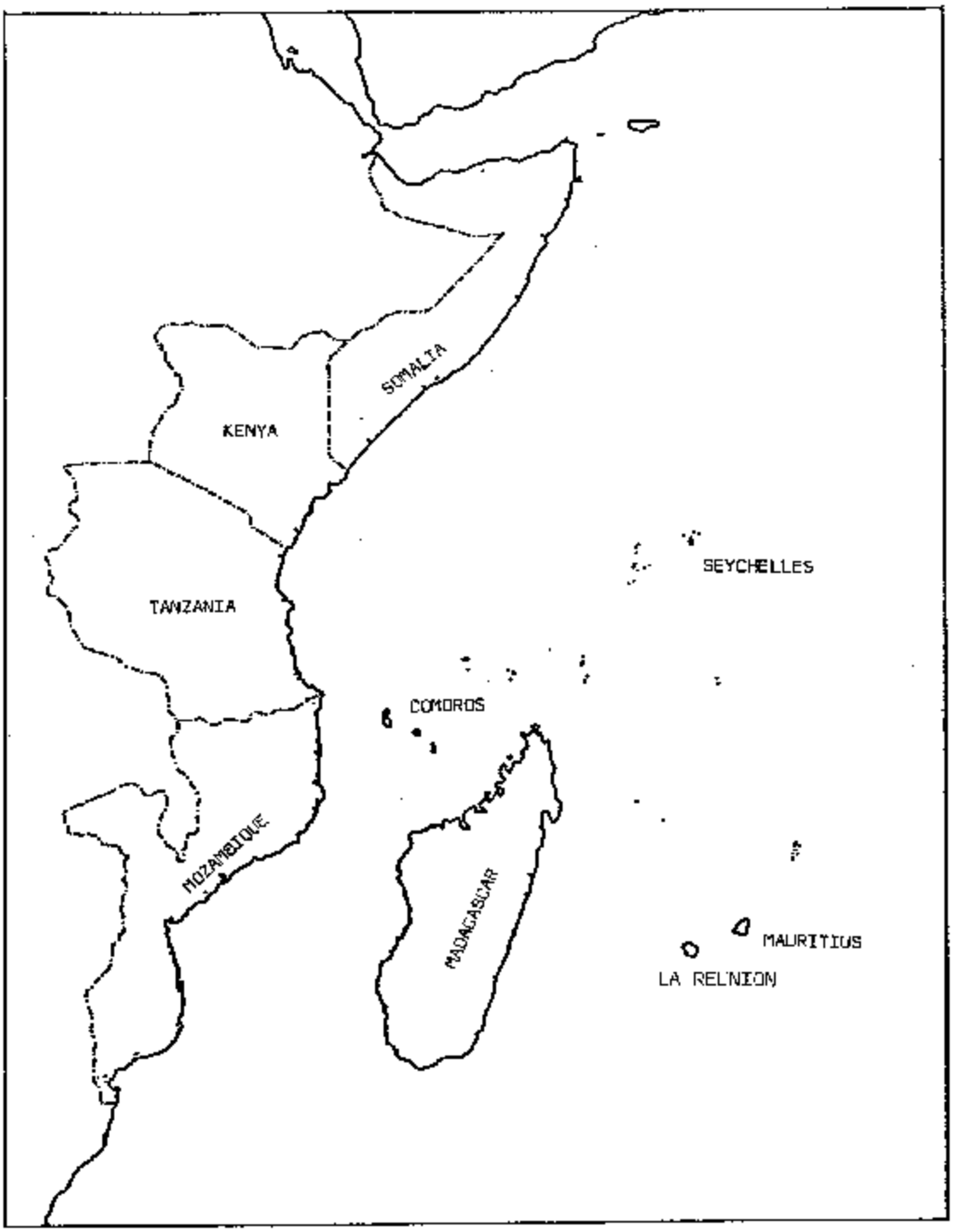

Figure 1 : The East African region

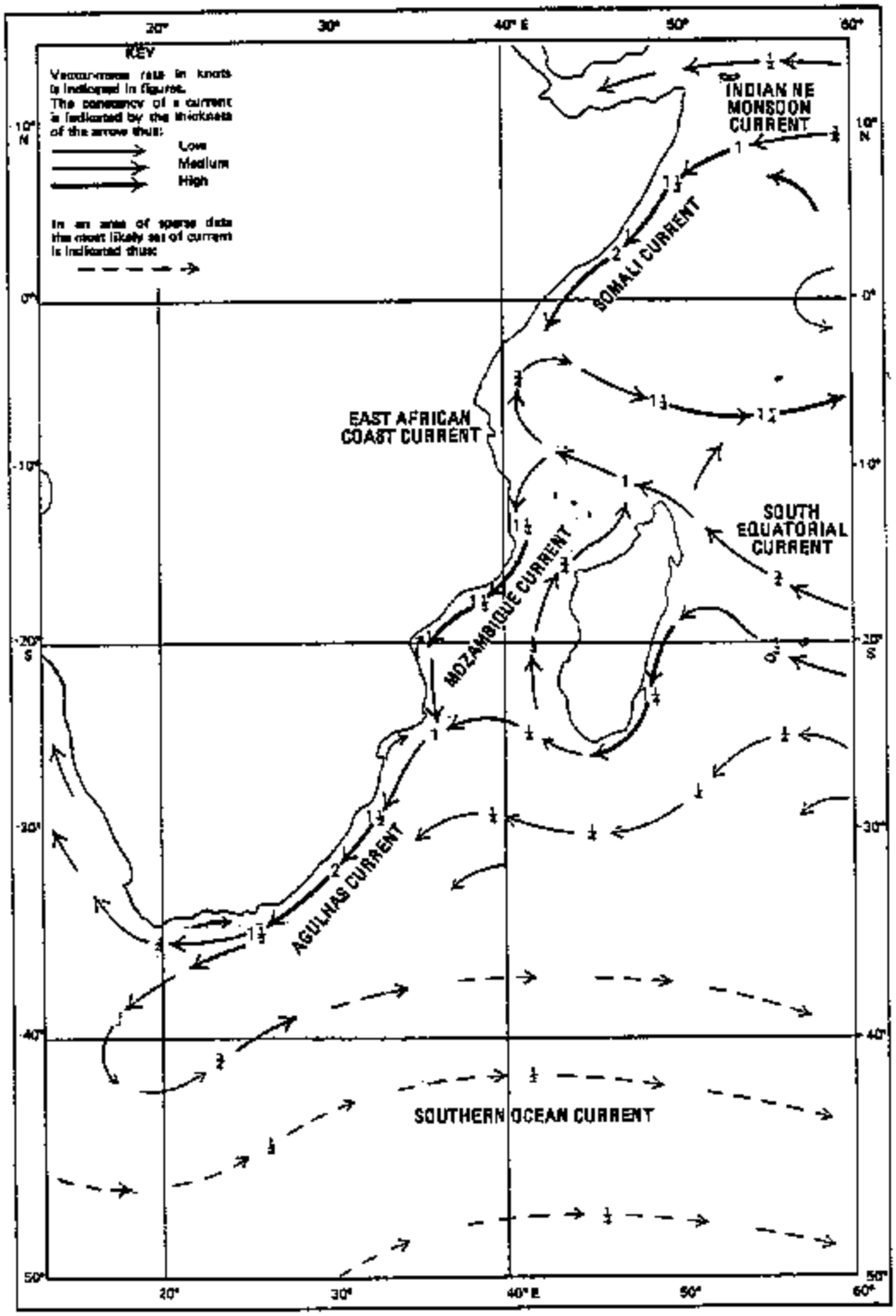

Figure 2(b) : Vector-mean currents for January

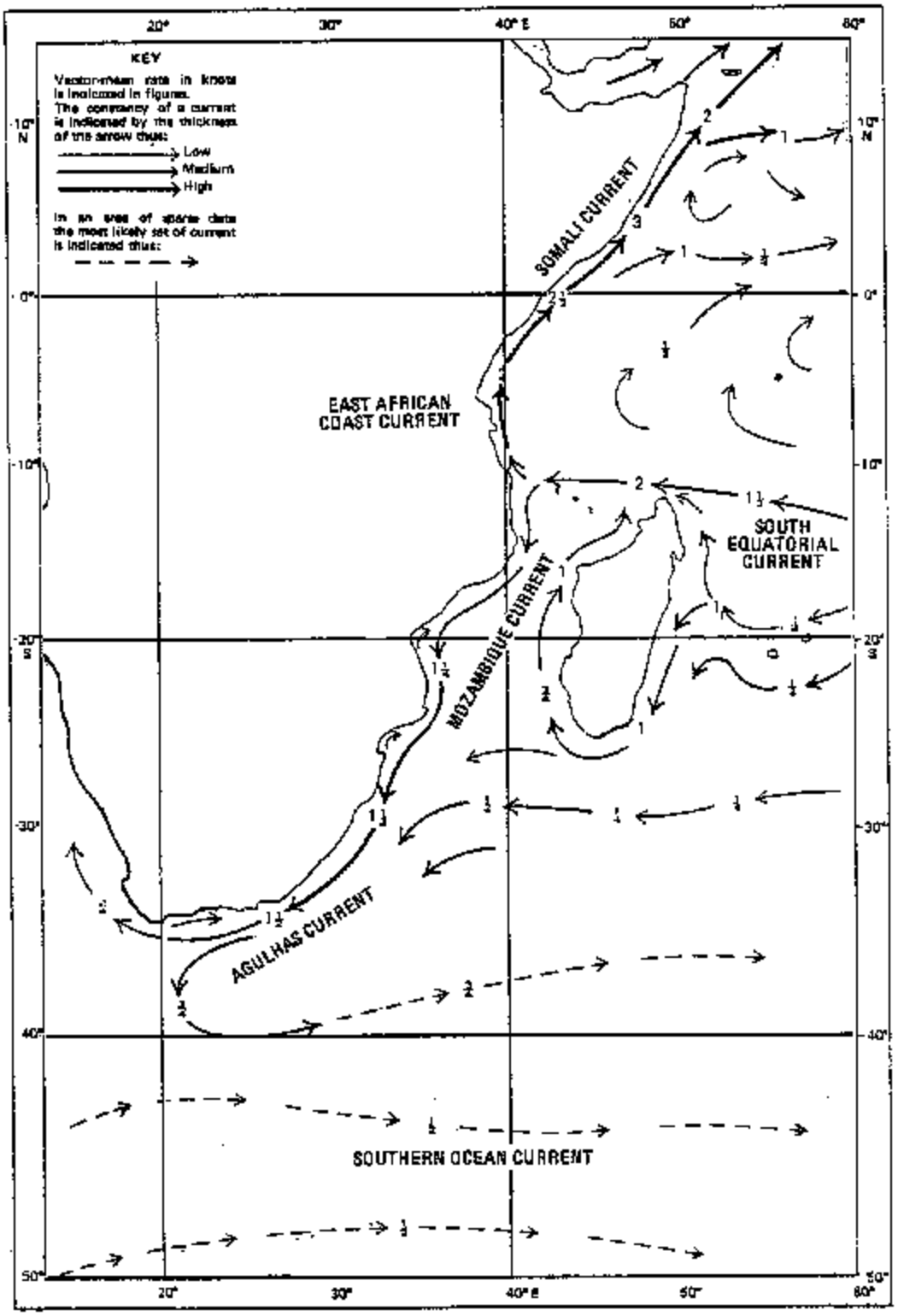

Figure 2(d) : Vector-mean currents for July

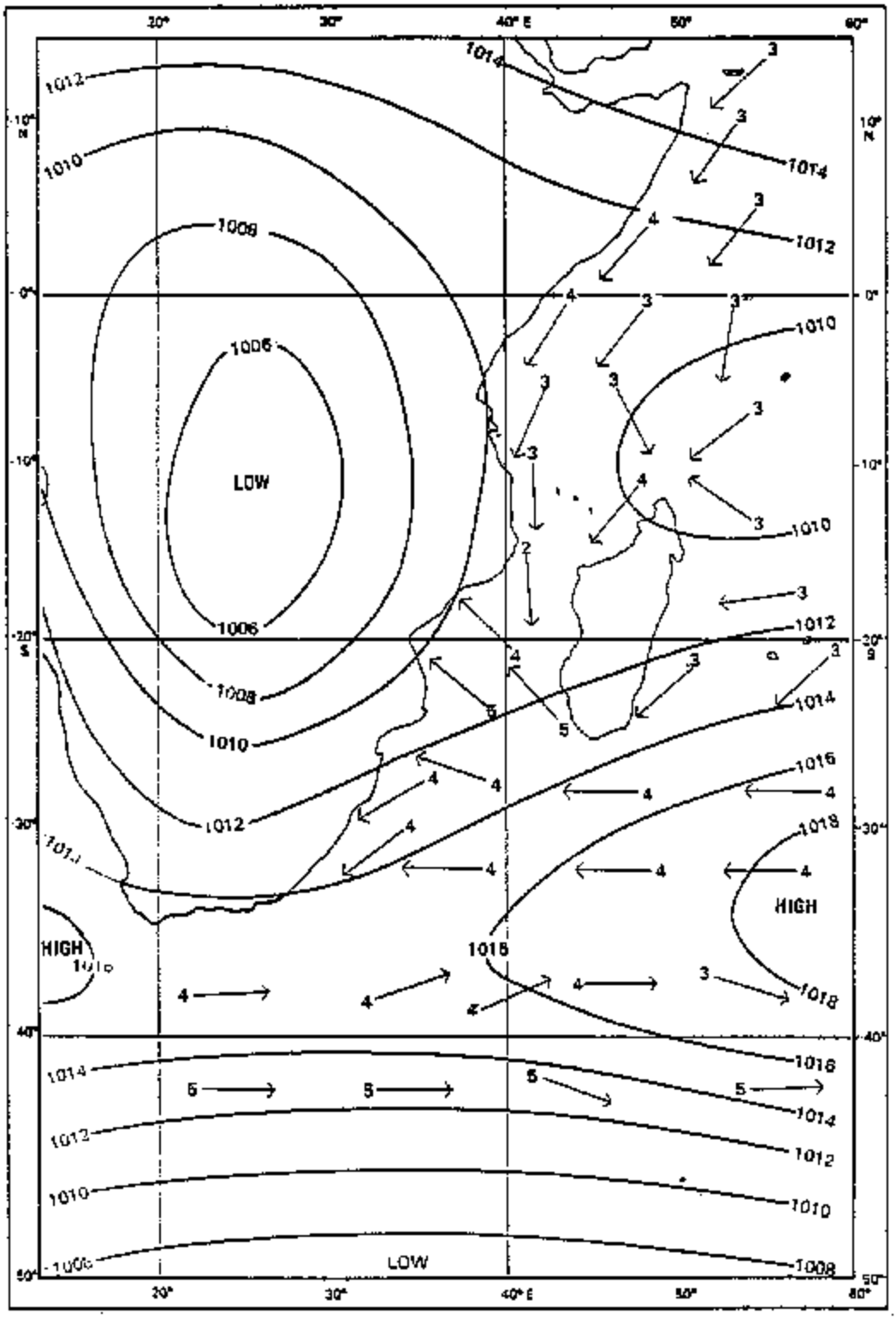

Figure 2 (f): Mean barometric pressure (mb) and dominant wind (meen force) - January

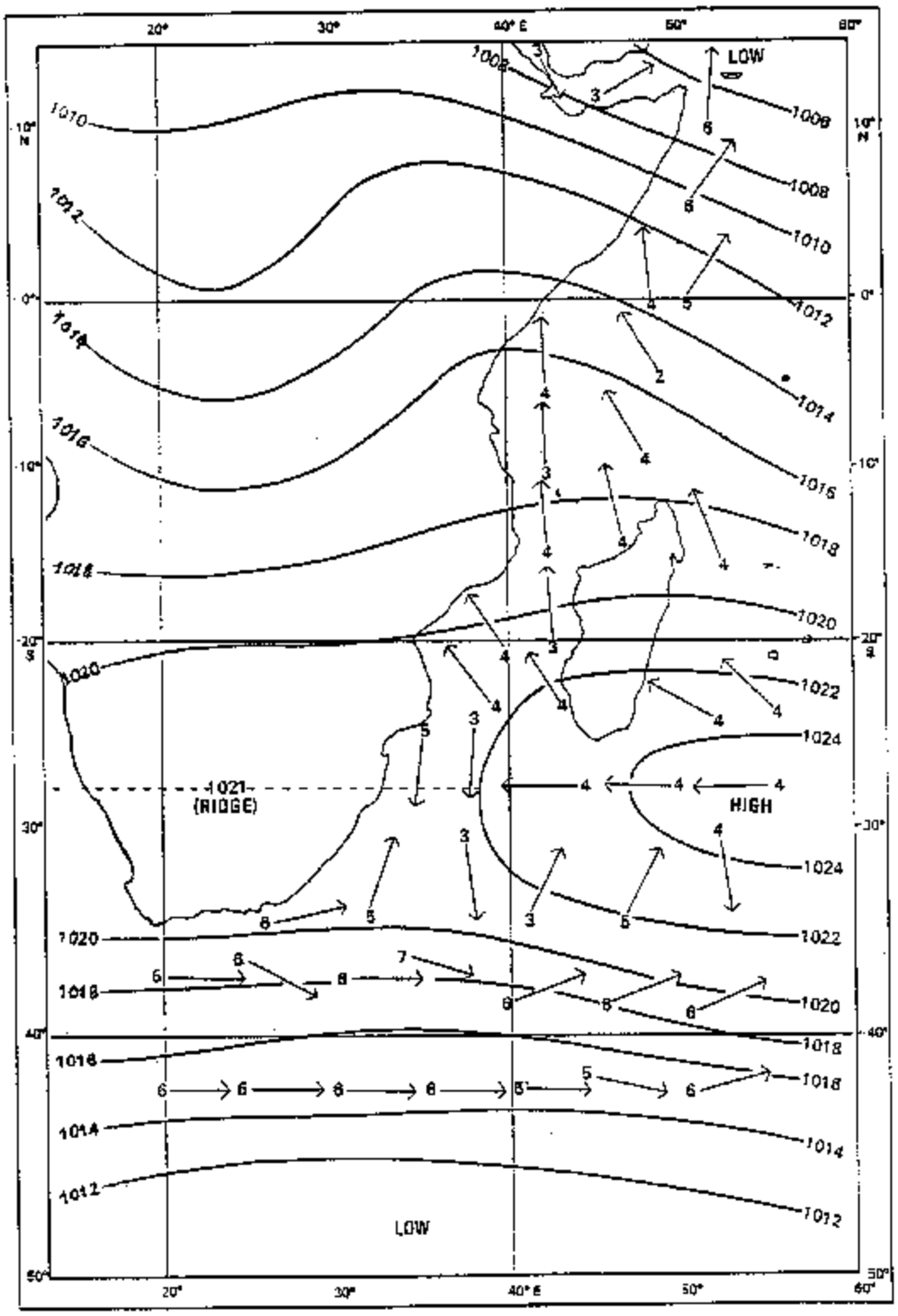

Figure 2(h): Mean barometric pressure (mb) and dominant wind (mean force) - July

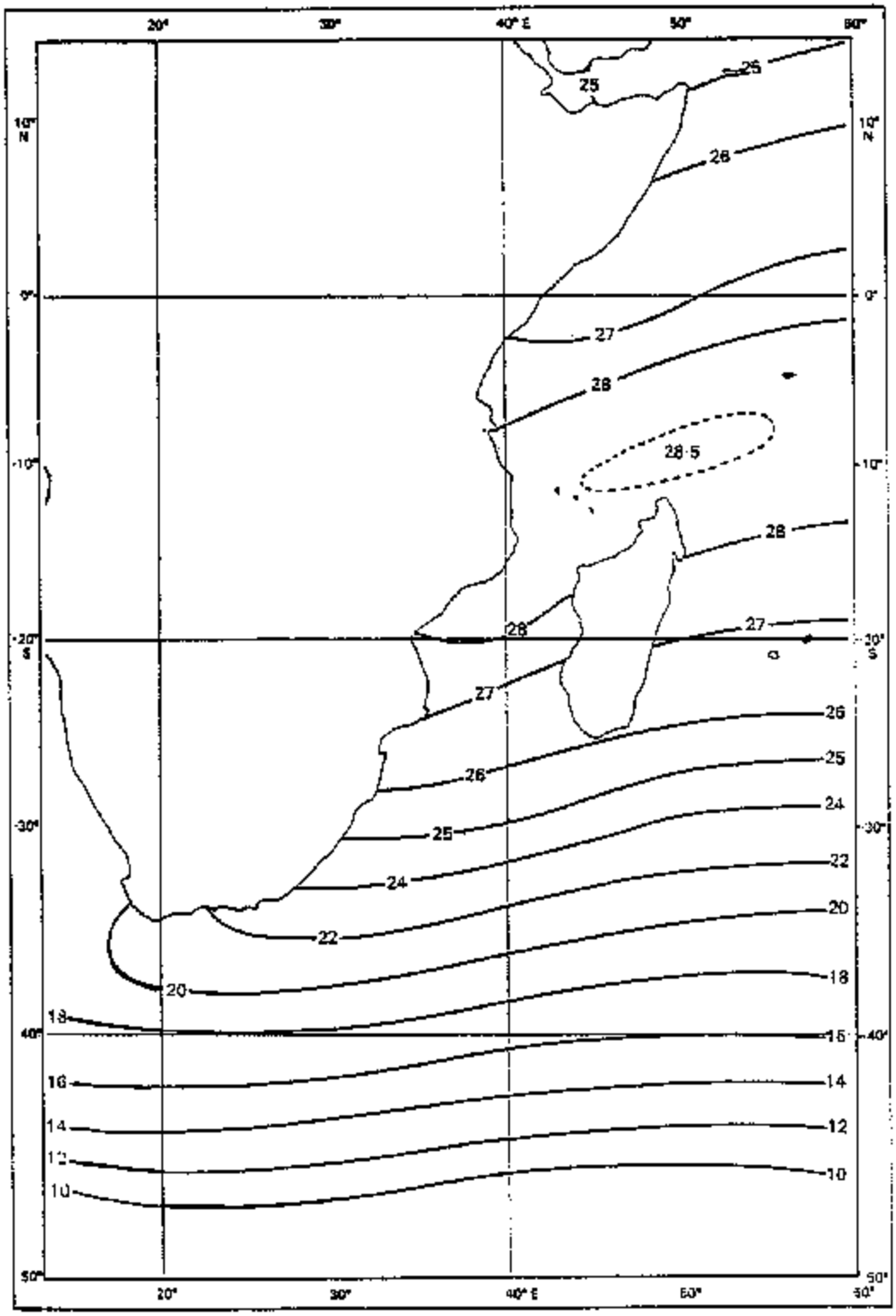

Figure 2(j): Mean sea surface temperature (°C) - February

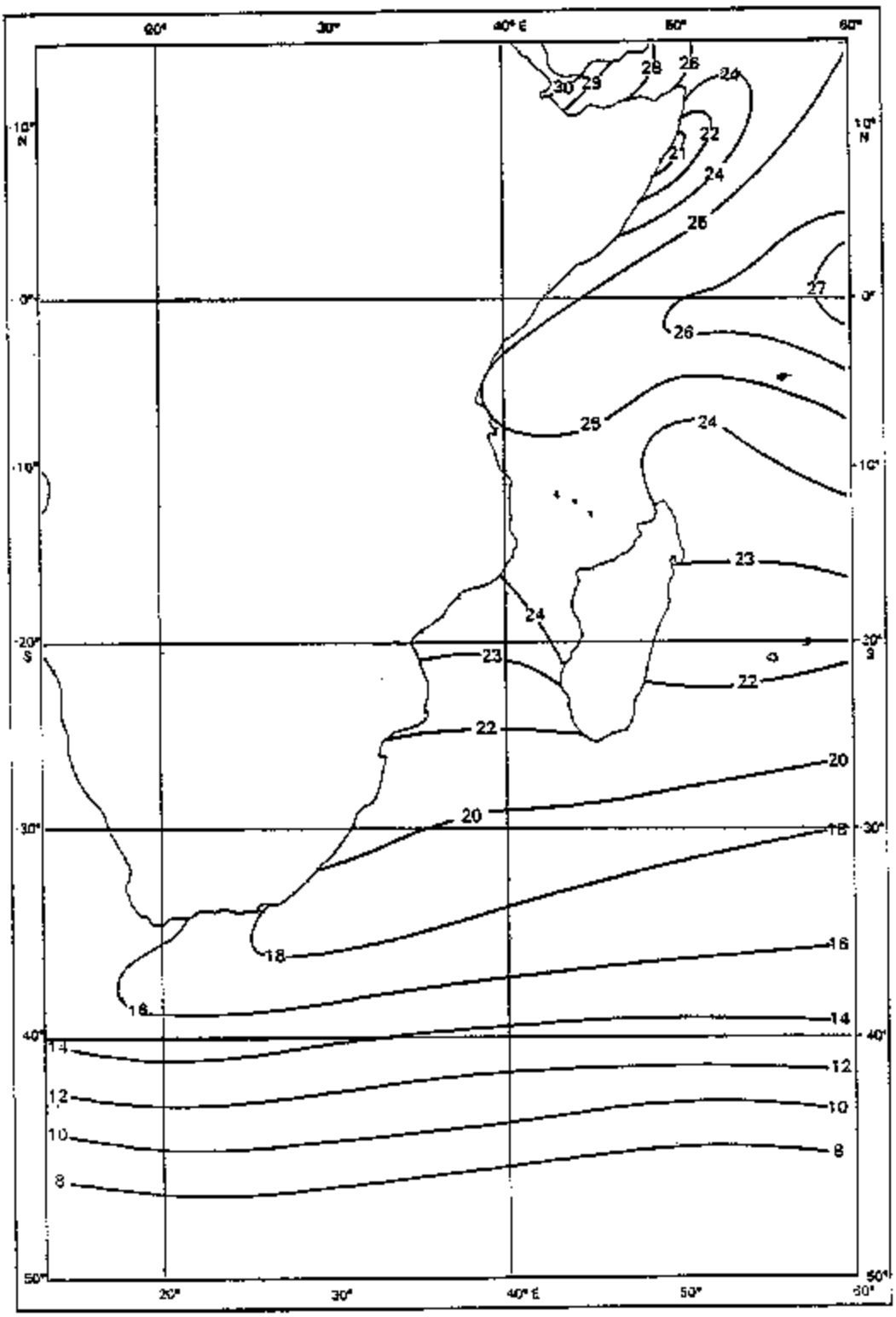

Figure 2(1) : Mean sea surface temperature (°C) - August

low biological productivity along this coast. South of Madagascar, the East Madagascar Current and the Mozambique Current join at about 26°S to form the Agulhas Current. South of 30°S the West Wind Drift is predominant.

11. The current flow in the Northern hemisphere changes direction with the seasonal reversal of the monsoon winds. During the period of the south-west monsoon (April to October), an eastward flowing surface current, the South-west Monsoon Current, prevails extending southward to about 7°S. The East African Coastal Current, which becomes the Somali Current, is influenced by the prevailing strong wind with a speed of over 600 cm/sec (over 10 knots) and causes the Somali Current to continue its northerly flow, bending eastward off the Somali peninsula into the Arabian Sea. The fast-flowing Somali Current, with a speed of about 300 cm/sec (or over 8 knots), transports about 50-65 million m^3/sec of water, penetrating deep into the oceanic water mass and causing an upwelling along its left flank along the north-east Somali coast. The upwelling induces the comparatively high productivity off the Somalian Coast and is most intense between 5°N and 11°N. This turbulent phenomenon brings nutrient-rich, cold subsurface waters with temperature below 20°C to the surface. The average temperature of the surface water during the upwelling period in this area is about 24°C and the salinity some 35.0 ppt.

12. During the north-east monsoon (November to March), the surface flow pattern is changed from its normal clockwise flow pattern to counter-clockwise in the Northern Indian Ocean. The North-east Monsoon Current, sometimes called the North Equatorial Current then dominates, flowing in a westerly direction with its southern border at 3°S. The Somali Current, now less strong, partly reverses its flow to form the Equatorial Counter Current with its axis at 7°S and partly flows downwards to join the Mozambique Current. The turbulence of the waters is minimal because of the weakness of the Somali Current during this period (less than 10 cm/sec), and a thermocline develops at about 60-80 m depth, with the surface waters having a uniform temperature of between 28-30°C and salinity of 34.5 ppt. A weak upwelling on the right flank of the Somali Current is presumed to occur in the region of previous upwelling, while for reasons of continuity downwelling occurs on its left flank.

13. Thus the region may be divided into three hydrographic zones:

(a) Somali upwelling zone: North-east Somali coast

(b) Monsoonal current zone: Tanzania, Kenya and Seychelles

(c) Agulhas and Mozambique current zone: Mauritius, Madagascar, Comoros, and Mozambique. In this zone, the current flow patterns would be subject to seasonal cyclonic influence in the period December-April (see figure 3).

Continental shelves

14. The width of the continental shelf varies markedly through the region, but is generally extremely narrow (see figure 4 and table 1). On most headlands and straight stretches of coastline along the East African littoral, there is virtually no shelf, with steep drop-offs beginning only a few kilometres out to sea. The shelf is more extended off the north-east Somali coast and where there are major indentations, such as in the Bight of Sofala, Mozambique, where the shelf widens to nearly 145 kms. The average width of the shelf is some 15-25 kms.

15. The sediments of the East African shelf are generally sandy especially in shallower areas, changing to mud in deeper areas and in the vicinity of river mouth

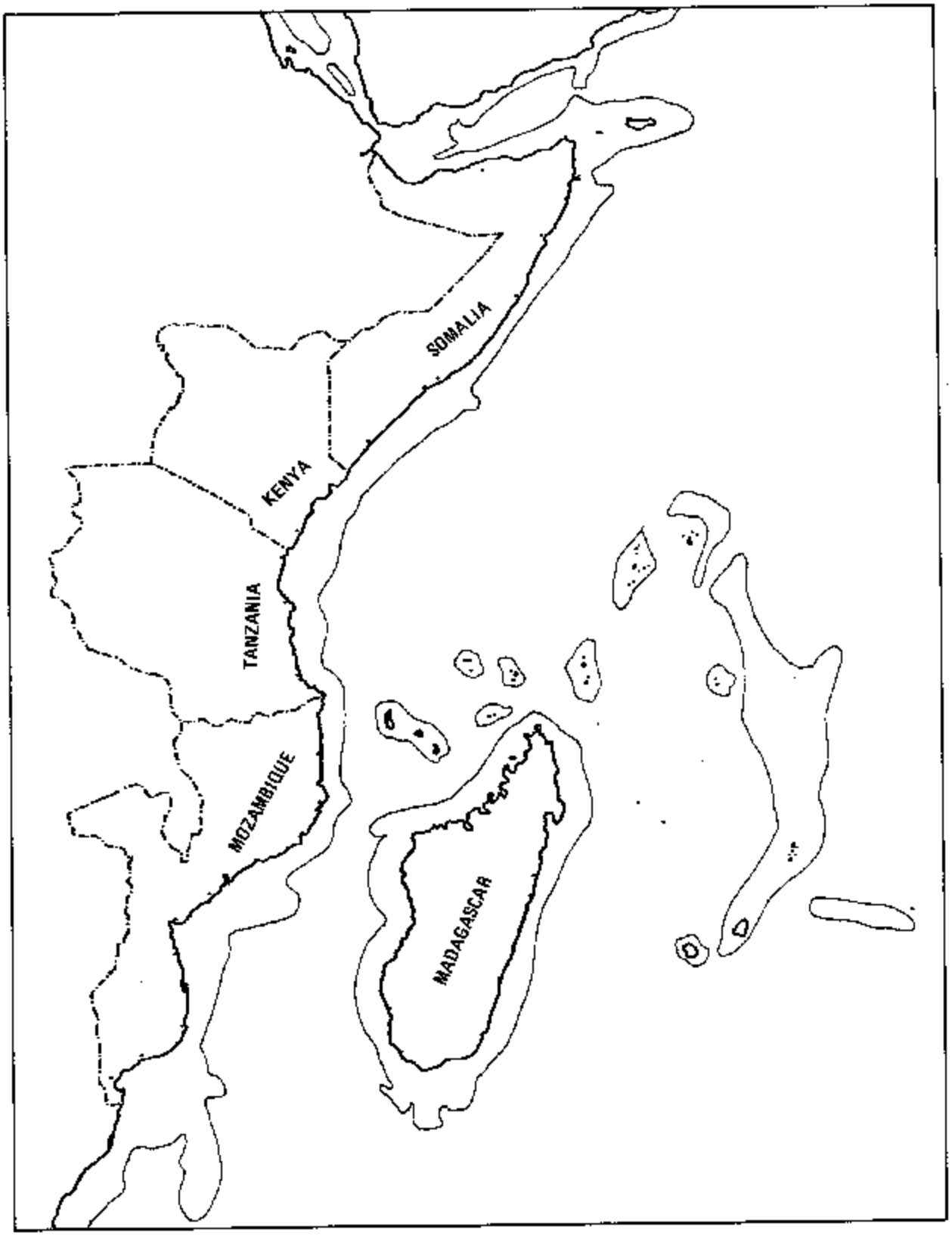

Figure 4 : Contintental shelves in the Western Indian Ocean

and estuarine areas. Shallower regions are characterized by extensive growths of coral, and there are numerous rocky outcrops. For these reasons, only a small percentage of the continental shelf is trawlable.

16. The continental shelf of Eastern Madagascar is even narrower and steeper than that of the mainland, with the 500 m and 2000 m contours being located just some 12 km and 32 km off Toamasina (Tamatave). The shelf in the western part of the island is broader, some 80-95 kms, but is still characterized by steep drop-offs. Off the northwest coast, however, the shelf widens to nearly 100 km and, generally, both here and on the western coast the existence of a broader shelf sheltered from the forces of the open ocean allows the accumulation of sedimentary deposits.

17. Comoros and the island of Mauritius are surrounded by sudden drop-offs a few hundred metres to several kilometres offshore. Some shallow banks occur around the Island of Rodriguez and other dependencies of Mauritius, however, including the Chagos Archipelago which is subject to Mauritian jurisdiction. The outlying coral islands under Seychelles jurisdiction, such as Aldabra and the Cosmoledos, are also generally characterized by the absence of extensive shelves. However, the central granitic islands of Seychelles, including Mahé, are surrounded by an extensive shelf area which is actually continental in nature, and similar formations exist within a few hundred kilometers of this area. The Banks Reefs around the central islands, with a depth rarely exceeding some 80 m, are approximately 27,000 km^2 in extent. While generally characterized by sand, gravel or marl deposits they also contain numerous coral and rock formations.

COASTAL AND RELATED TERRESTRIAL GEOGRAPHY

The coastal zone

18. The coast of East Africa is generally characterized by a coastal plain some 15-20 km wide rising to upland savannahs and plateaux. This plain widens toward the south and in areas traversed by the valleys and floodplains of large rivers such as the Juba and Shebelle (Somalia), Tana (Kenya), Rufiji (Tanzania), and Zambezi (Mozambique). While relatively small percentages of the national populations of the States of the region (about 10-15 per cent), generally inhabit the narrow coastal plain in the north, in Mozambique fully three-quarters of the population is concentrated in a strip some 40 km wide along the coast. A similar situation exists in western Madagascar, but along the east coast of the island the coastal area is much narrower and rises steeply to mountains which are subject to extensive shifting cultivation.

19. Depending on rainfall and other factors such as the prevalence of the tsetse fly, the coastal plain is generally used for agricultural or pastoral activites. There is little irrigation land along the coast, however, and outside floodplains there is rain-fed cultivation of cassava and maize as well as such export crops as cashews, coconut, coffee, cotton, pineapple, sugar cane, and spices. Mixed cropping, as well as paddy rice cultivation, is practised in river plains. A variety of schemes including hydrodevelopment projects accompanied by irrigation works, centralized agricultural projects, integrated development plans and social and economic re-organization have been attempted to improve agricultural conditions along the coast and in the river plains. In drier areas used for pasturage, considerable soil destabilization has occurred on coastal bluffs, dunes and plains with non-alluvial soils.

condition through slow but constant growth that permits an orderly succession of colonial vegetation - primarily mangroves - to develop as land slowly becomes consolidated through the establishment of vegetation. Sudden loss of sedimentation or change of flow characteristics due to construction of dams or other major water-diversion projects upstream can disrupt the dynamic equilibrium of estuaries, curtail or reverse delta-formation, and affect the marine organisms whose life cycles depend on certain flow and nutrient regimes. The major dams planned or being constructed in East Africa (see figure 5) - the Bardera Dam on the Jube River in Somalia; the existing and planned dams on the Tana River in Kenya; the planned dam at Stiegler's Gorge on the Rufiji River in Tanzania; and the Cabora Bassa on the Zambezi and other planned dams in Mozambique - thus cause concern about the effects of these projects on estuarine productivity on the continental coastline.

MARINE FAUNA

26. Fishery productivity is limited due to a deficiency in nutrients and primary biological productivity and to the oceanographic characteristics of the region: only some 0.037 t/km^2 of surface area and 0.412 t/km^2 of shelf area compared to 0.189 and 3.987 t/km^2 for the Pacific, and 0.219 and 2.699 t/km^2 for the Atlantic Ocean, respectively. Even along the long extensive coastlines on the continent and Madagascar, national catches total only from several to several tens of thousands of tonnes per year, including shrimp catches (see table 1). On the smaller islands, catches are much lower even when there are commercial fisheries for demersal or pelagic species.

27. Regardless of the limited current catches, however, the marine fisheries are important to the livelihood of artisanal fishermen who usually live in small communities along the coast. Enhancement of the artisanal fishery would appear to depend primarily on providing improved commercial organization, physical facilities, and transportation that would effectively link the efforts of fishermen, who often live in remote coastal communities, to regional or urban markets. Similar constraints impede the development of commercial or semi-industrial fisheries. Even if such efforts were undertaken, however, it is unlikely that there would be major improvements in the catch from nearshore waters. Although a variety of fishing methods are used in various areas, so that it is difficult to make a comparative overall assessment of the condition of the stocks, it is thought that the potential for significantly increased catches is very small.

28. For commercial operations, increased catches are similarly impeded by physical and biological factors. There is little trawlable area on the continental shelves throughout the region as seen in table 2 and limited commercially-exploitable stocks. Large unexploited stocks of commercial species do not appear to exist. Still, it is possible that in some areas improved surveys and development of currently under-utilized species could provide the basis for expanded commercial efforts.

29. Similarly, the regional shrimp fishery, which makes a major contribution to national revenues, especially in Madagascar and Mozambique, appears to be operated at near to maximum levels. Nevertheless, there is room for improvement in the management of this fishery through improvement of regulations intended to protect the species and better catch monitoring and enforcement. The connection of shrimp productivity to the condition of the region's mangrove forests needs to be explicitly recognized so that actions are not taken affecting these areas which would cause a decline in shrimp catches. Studies of the relationship of shrimp

Table 2 : Area of shelf off the mainland and island countries of the East African region and their trawl potentials

(extracted from FAO/IOP 1979)

Country	Total shelf area (km^2)	Trawlable area (km^2)	Coral km^2	Trawl surveys (d) Biomass density t/km^2
Somalia	n.a.	n.a.	n.a.	n.a.
Kenya	19,120	10,994	not indicated	2.12 (d)
Tanzania	18,908	nil	over 2,183	1.82
Mozambique	86,090	71,592	2,500	1.33
Madagascar (a)	130,700 (b)			1.21
Comoros	900 (b)	nil		
Mauritius + banks	117,102	61,625	36,073	
Seychelles (c)	48,334	14,176	20,093	2.08
TOTAL	421,154	158,387	68,859	

(a) from 0-400 m depth
(b) from 0-400 m
(c) area over 200 m negligible
(d) averages

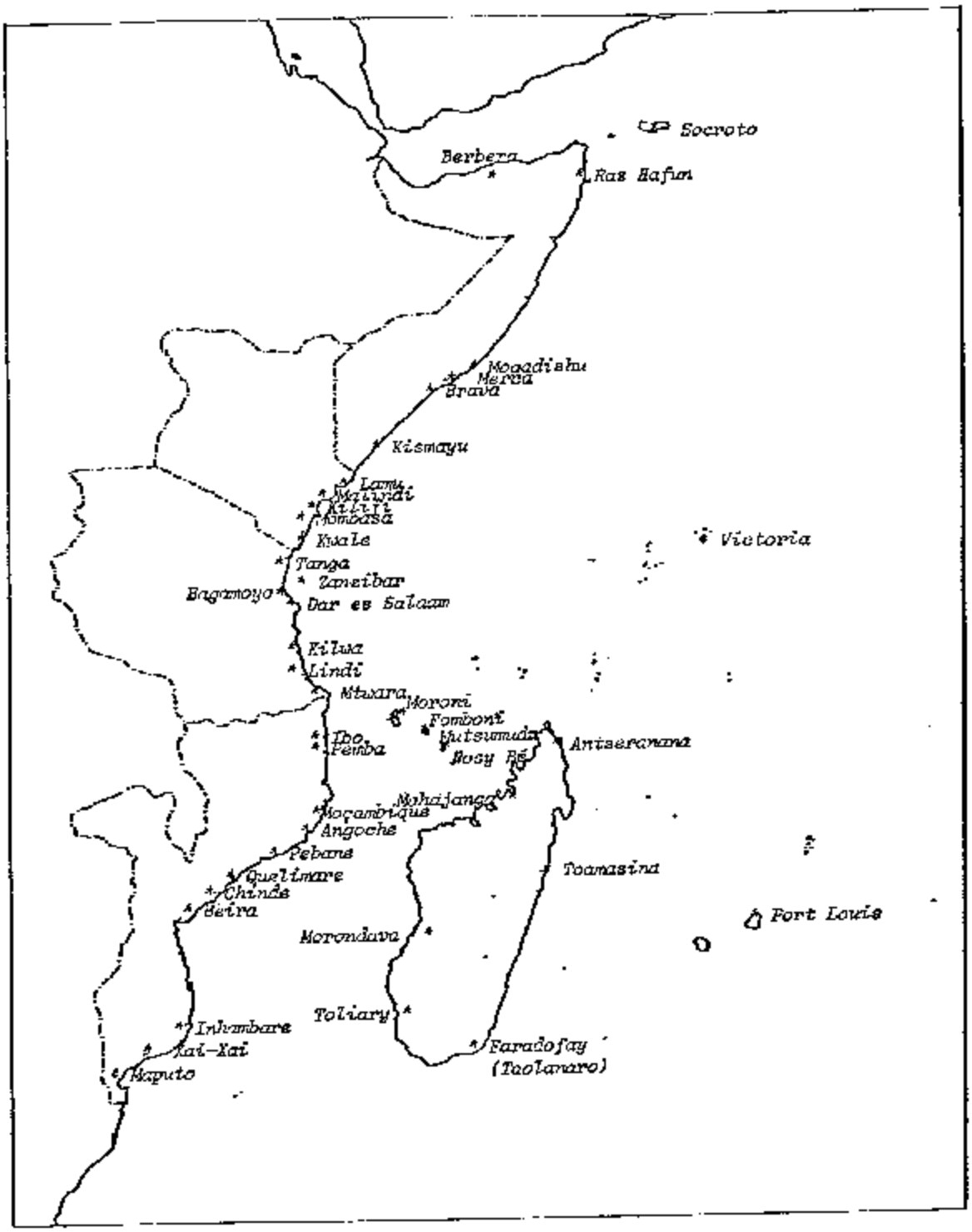

Figure 6 : Coastal cities and towns

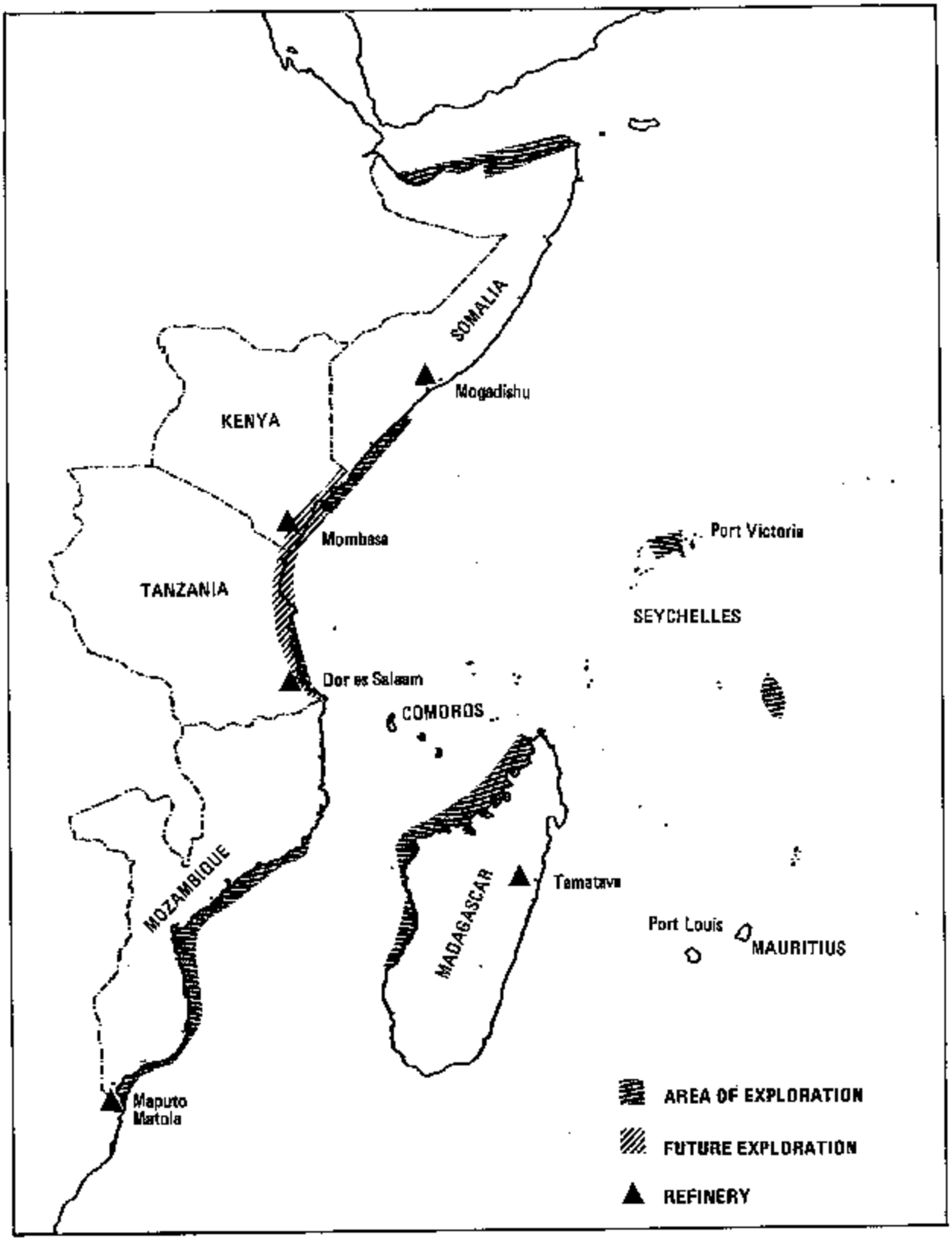

Figure 7 : Oil exploration and refineries

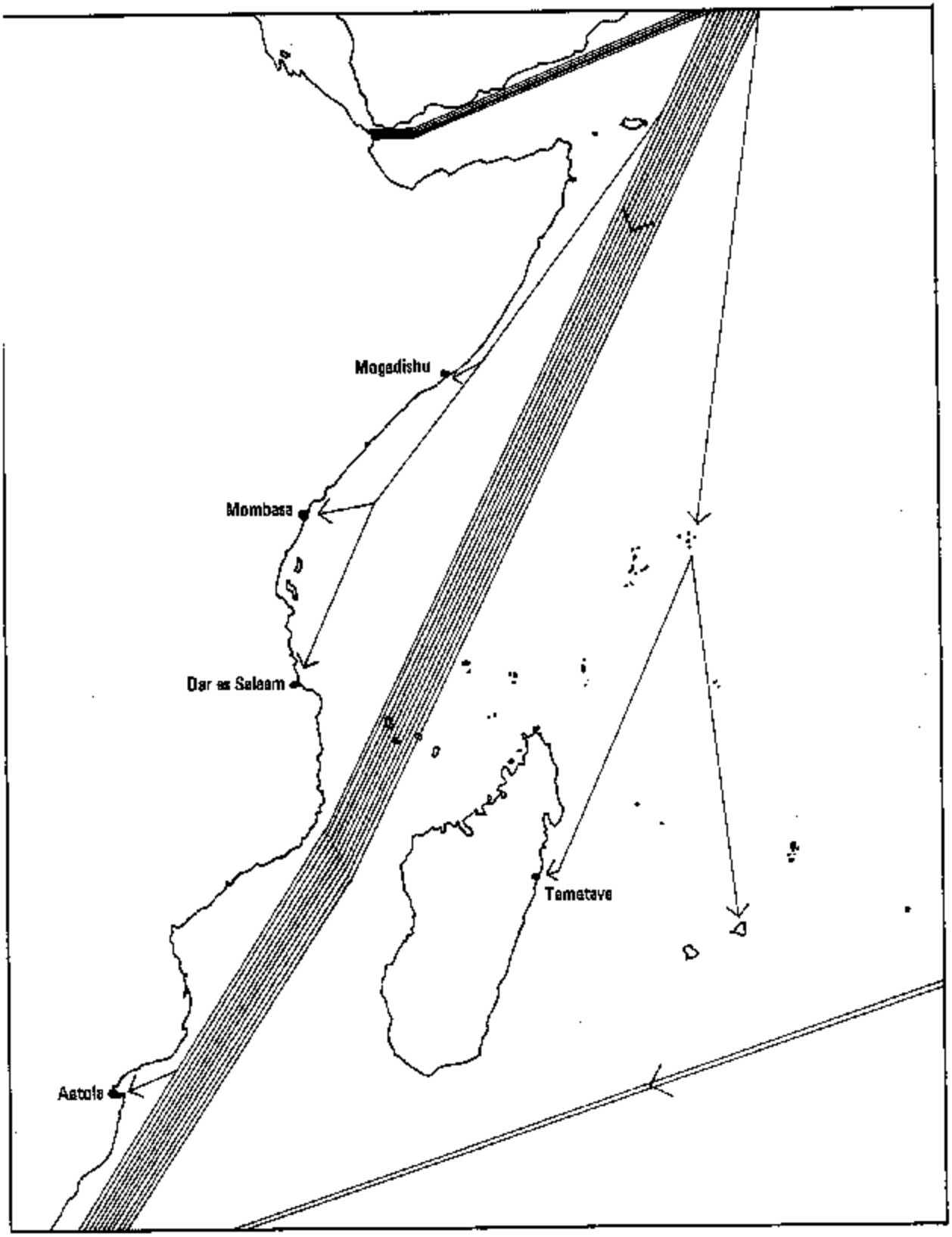

Figure 8 : Tanker routes of the region

industrial pollution, and the necessity for the rational management of all forms of industrial wastes, including their ultimate disposal into the marine environment.

43. Although the industrial sector throughout the States of the region, especially at the coast due to the link with export, is oriented towards the processing of primary commodities, its emphasis varies according to the main local product. In Somalia and west and south Madagascar there is a concentration on livestock products, including meat and leather. In Kenya, Tanzania and Mozambique there is a focus on agricultural and silvicultural commodities, both for export and for internal consumption. These include cashew and copra processing, vegetable oil extraction, coffee bean roasting and grinding, sugar and molasses refining, brewing, and soap production. Rice milling and paper and pulp production, while they produce aquatic discharges, tend to occur upstream near supply sources and primary national markets.

44. The extractive and manufacturing sector tends to be localized in major urban areas including those on the coast - Maputo and Beira (Mozambique); Dar es Salaam; Mombasa; Mogadishu; Toliara, Mahajanga, and Toamasina (Madagascar); Port Louis (Mauritius); and Victoria (Seychelles). The pollution from this sector - especially chemicals and heavy metals - could have severe local effects on marine living resources and on human health.

45. The general regional concentration on agro-industries, however, means that the primary waste management problem is the need to dispose of rather large amounts of organic matter which is generated in the form of suspended solids, larger particles and sludges, and dissolved substances - all of which contribute to total biochemical oxygen demand (BOD). The productive biological characteristics of rivers, bays, wetlands, and other water bodies that received this material can be affected if natural tolerance levels are exceeded.

46. Industrial effluents released into the marine environment are problematic particularly when they exceed the natural carrying capacity of receiving waters or when they contain toxic substances, especially those which are persistent and tend to accumulate in marine habitat or coastal habitation areas. The carrying capacity of marine areas and their tendency to trap pollutants is related to site-specific physical, chemical, and biological factors. For this reason careful assessment of the siting of coastal industrial facilities is critical to the effective managing of their wastes. Similarly, excess turbidity, BOD, or toxicity from industrial sources is a function of waste treatment measures. Improved recovery and treatment of industrial effluents would lessen the impacts on the marine and coastal environment of industries sited on or near the coast. Tables 4(a) and 4(b) give lists of available liquid effluent treatment methodologies, primarily for agro-industrial wastes, and generic waste treatment systems and their use and effectiveness in effluent reduction.

Pollution from domestic sources

47. Direct pollution of the sea by municipal sewage requires prior collection of domestic and other waste waters through a sewerage system which carries them to a coastal discharge point or outfall pipe. This is the case in only a very small number of coastal settlements such as Mombasa (Kenya), Maputo and Beira (Mozambique), and Dar es Salaam and Tanga (Tanzania). These systems cover, however, only about 10 to 25 per cent of the population in the area.

48. Substantive sewerage services combined with ocean outfalls are available, however, in Mauritius and in Seychelles. Two thirds of the coastal urban population

Table 4(b) : Generic waste treatment system: Use and effectiveness

Treatment System	Use	Effluent Reduction
Sedimentation or gravity separation	Primary treatment or by-product recovery	Grease, BOD_5, SS
Dissolved air flotation (DAF)	Primary treatment or by-product recovery	Grease, 60% removal to 100 to 200 mg/l BOD_5, 30% removal SS, 30% removal
DAF with pH control and flocculants added	Primary treatment of by-product recovery	Grease, 95-99% removal, BOD_5, 90% removal SS, 98% removal
Anaerobic + aerobic lagoons	Secondary treatment	BOD_5, 95% removal
Anaerobic + aerated + aerobic lagoons	Secondary treatment	BOD_5, 99% removal
Anaerobic contact process	Secondary treatment	BOD_5, 90-95% removal
Activated sludge	Secondary treatment	BOD_5, 90-95% removal
Extended aeration	Secondary treatment	BOD_5, 95% removal
Anaerobic lagoons + rotating biological contactor	Secondary treatment	BOD_5, 90-95% removal
Chlorination	Finish and disinfection	-
Sand filter	Tertiary treatment and Secondary treatment	BOD_5, to 5-10 mg/l SS, 3-8 mg/l
Microstrainer	Tertiary treatment	BOD_5, to 10-20 mg/l SS, to 10-15 mg/l
Electrodialysis	Tertiary treatment	TDS, 90% removal
Ion exchange	Tertiary treatment	Salt, 90% removal
Ammonia stripping	Tertiary treatment	90-95% removal

discharge their wastes directly to the sea. Treatment is limited to removal of coarse suspended material and leaves all other sewage components to the sea.

49. In terms of marine pollution, domestic sewage mainly contributes organic substances in dissolved and suspended form plus nitrogenous compounds, phosphates and some other inorganic salts. As the organic material is almost entirely biodegradable, it is usually quantified and expressed in terms of biochemical oxygen demand. This may be estimated at 20 kg BOD per capita per year. Total discharges from several cities are summarized in table 5 of this report.

50. The biota present in the coastal waters are usually capable of completing the absorption and biological decomposition of the sewage constituents quite rapidly and without any detrimental effects, particularly as the amounts discharged are minimal for any mass balance. Locally around the discharge site or outfall pipe, however, the intensified biological action and oxygen depletion may cause an unpleasant situation within a limited area. In addition, the mineral salts of the sewage may further promote excessive growth of biomass (eutrophication) in confined or semi-confined coastal discharge areas.

51. The major problem stemming from sewage discharges and excreta disposal along the coastline are the bacteriological constituents. Due to the often very close vicinity of discharge points and coastal recreational or shellfish areas, pathogens are in a short-circuit back to the human target via the coastal environment. Endemic prevalence of infectious diseases with regularly occurring epidemic outbreaks are the result of this situation.

52. In summary, domestic sewage discharges and excreta disposal in coastal settlements are to be considered rather as one of the major public health problems of the region than as a contributor to marine pollution of any significance.

Agrochemical pollution

53. Any chemicals used in large quantities on agricultural fields are partially subject to wash-out and transport with surface run-off during the rainy season. This process is further accelerated by soil erosion. In the region, DDT and related compounds are used heavily for spraying of cotton fields, in sugar-cane plantations, for vector control and for disinfection purposes.

54. Organochlorine compounds reaching the coastal seas are mostly contributed by agriculture. They are to a small extent discharged with direct run-off to the sea as a non-point source along the coast. Most of it, however, is washed into small creeks and rivers which collect all surface run-off and ultimately discharge as point sources into the sea. Thus, the chemical load of rivers constitute the main source of agrochemical pollutants for the marine environment.

55. Quantification of the actual amounts reaching the sea is extremely difficult. A small and undetermined fraction of the chemicals applied are actually following this pathway and only monitoring of rivers at the mouth would provide reliable information. Qualitatively, however, a direct link exists between the chemicals applied within the entire catchment area of the rivers and those found in marine organisms.

56. Fertilizers are in principle following the same pattern. Their chemical nature, however, corresponds to the usual soil constituents. Their wash-out leads, therefore, only to an increase in concentration of certain mineral salts, particularly nitrogenous and phosphorous compounds. Their impact on the coastal

(Table 5 continued...)

Country-City	Population (Estimated) 1980	Length of Coastline Expressed in Km.	Population Sewered	%	BOD_5 ton/yr.	BOD_5 Km coastline ton/yr.
Madagascar	8,500,000	4000				
Tamatave	60,000		9,000	15	180	0.05
Majunga	70,000					
Tulear	40,000					
Diego-Suarez	45,000		4,500	10	90	0.02
Regional/Total	215,000		13,500	6	270	0.07
Mauritius	936,000	200				
Port Louis	250,000		150,000	60	3000	15.00
Plaines Wilhems						
Curepipe	57,000		40,000	70	800	4.00
Beau-Bassin/ Rose-Hill	72,000		50,000	70	1000	5.00
Phoenix	36,000		25,000	70	500	2.50
Regional/Total	415,000		265,000	64	5300	26.50
Seychelles	65,000	600				
Victoria	25,000		6,250	25	125	0.21
Regional/Total	25,000		6,250	25	125	0.21
Somalia	3,850,000	3000				
Mogadishu	400,000					
Merca	55,000					
Kismayo	60,000					
Berbera	50,000					
Regional/Total	565,000					
GRAND TOTAL	3,820,500		650,250	17	13,005	

Table 6 : The biogeographical provinces of the East African region relative to coastal and island ecosysteme (from Upvardy 1975)

Realm	Biogeographic provinces	Country/Islands covered
Afrotropical	Somelian (semi-arid)	Somalia, Kenya, Tanzania south to Rovuma River
	Miombo (Brachystegia) Woodland/Savanna	Rovuma in Tanzania, north Mozambique south to Zambezi River
	South African Woodland/Savanna	Zambezi River to the southern border of Mozambique
	Malagasy Rain Forest	eastern Madagascar
	Malagasy Woodland/Savanna	central and western Madagascar
	Malagasy Thorn Forest	south-western Madagascar
	Comoros Islands and Aldabra	Comoros and Aldabra group of islands (Seychelles)
	Mascarene Islands	Mauritius and Rodriguez group of islands
Indomalayan	Seychelles and Amirantes	Seychelles
	Maldives and Chagos Islands	Mauritius (Chagos islands group)

Table 8 : Available data on mangrove area extent and length of mangrove coastline in the East African region

(Source: MacNae 1974; Saenger et al., 1981)

Country	Mangrove Area km^2	Mangrove Coastline, km	% Total Coastline
Comoros	negligible a/	a/	
Kenya	587	a/	
Madagascar	3207	1150	28.7
Mauritius	negligible a/	a/	
Mozambique	850	1194	48.3
Seychelles	negligible a/	a/	
Somalia	negligible a/	a/	28.7
Tanzania	500 (820)*	a/	

a/ No date available
* FAO/UNDP, 1979

collected as souvenirs, especially near tourist areas. Reefs are also subject to unenlightened and destructive fishing practices, such as dynamiting and poisoning. The balance of life in reef ecosystems can also be affected by overfishing of certain species. Changes in reef ecosystems could lead to depletion of fisheries potential and to loss of aesthetic and recreational values.

61. Other coastal and marine habitat areas such as coastal dry forests, coastal dunes, coastal floodplains, fresh and brackish water marshes, reef-back lagoons, sandy beaches, and sea-bird rookeries - are also threatened by human encroachment, especially for gathering of natural products and conversion to economic uses. Severe loss of such habitats could seriously affect associated populations of coastal and marine animal species and related aesthetic values.

Protection of rare and endangered marine species

62. The coasts and seas of the region provide habitat for several rare or endangered species - such as marine turtles, the dugong, the Nile crocodile, sea-birds and migratory birds, and indigenous coastal birds and mammals - that cannot be effectively protected until: more is known about their location and behaviour; critical habitats are identified and preserved; and human activities adversely affecting them are controlled to the extent possible. Actions on the national, regional, and global level can be helpful in this context. To date, studies of the condition of such species and their habitats in the region have been inadequate; national regulations and protective programmes have not always been effective; concerted regional action (such as on the management of turtles or the identification and protection of populations of dugongs) has not been taken; and the States of the region have not always joined the relevant international conservation conventions. On the national level, the active efforts of Kenyan wildlife officials to protect marine turtles and their young while on beaches deserve mention. Seychelles' efforts to protect wildlife in outlying islands such as Aldabra and Bird Islands should also be mentioned.

Management of fisheries

63. Artisanal and commercial fishery efforts often utilize destructive or wasteful fishing practices such as severe overfishing (especially in nearshore reef areas), use of inappropriate gear (such as fish traps and gill nets on reefs, or nets with small mesh sizes), beach seining or use of weirs in estuaries to harvest juveniles, disposal of edible by-catch from commercial operations, and incidental catch of non-target species such as turtles, dolphins, and even occasionally dugongs. Better regulation and enforcement are needed to combat these practices.

64. Due to a lack of data on fish stocks and catch reports, insufficent analytical and administrative resources, and social and economic difficulties, significant fishery stocks are not always managed for maximum sustained biological or economic yield. There is a need to improve national capabilities to develop and formulate appropriate fishery management objectives and programmes and enforce effective fishery regulations.

65. Absence of equipment, funds, and trained manpower often prevents basic research and surveys, pilot operations, and market development of underutilized species. Of these the regional pelagic fishery resources, constituted mainly of highly migratory tunas, are perhaps the most significant economically but also present the greatest technical, economic and political difficulties. Further significant unrealized opportunities exist. Regional co-operation will be necessary on development and allocation of regional pelagic fishery resources.

70. A number of agricultural projects, involving both large-scale agriculture and integrated agricultural development, are being implemented along the coast in the region. Cotton is being grown in drier areas, and rice cultivation is expanding, often in connection with irrigation schemes in floodplains. There are plans to expand the cultivation of traditional export crops in the coastal zone, as well as to provide new opportunities for diversified farming through integrated development programmes. Although by and large these plans are welcome developments, coastal agriculture can have adverse effects on the marine environment, especially if agro-chemicals such as pesticides are extensively used; if areas contributing to marine productivity such as brackish water wetlands are converted to agriculture; or if irrigation projects and associated works connected to these developments adversely affect the pattern of freshwater flow or sedimentary deposition in areas subject to saline influence. Similarly, such projects can fail if the problem of saline intrusions or build-up is not effectively dealt with or if projects become subject to flooding or sedimentation problems.

71. Urban development wherever located can have a number of adverse environmental effects, including reduction of air and water quality, degradation of surrounding natural resources, deterioration of human health factors, and loss of natural amenities. When urban growth occurs in the coastal zone or on small islands these effects are intensified by resource constraints and the complex and interactive nature of coastal and marine systems.

72. On the continent and in Madagascar the coastal zone (with the exception of Mozambique) is generally not as densely settled as the interior highlands but contains a large number of urban settlements. Some of these are subject to rapid growth and in all of them infrastructure and social services need to be strengthened and expanded to deal with resource constraints or urban expansion.

73. New or rapidly growing coastal zone activities sometimes lead to the creation or rapid expansion of municipal centres on the coast. When such rapid expansion occurs, it is extremely difficult for national or local authorities to respond by planning for and providing infrastructure and social services. In Malindi, Kenya, for example, the growth of a large tourist-related sector has occurred at a traditional small municipal centre with extremely limited services and infrastructure. Population growth rates have reached 20 per cent per annum, and authorities are hard pressed to meet basic needs for sanitation, education, and commercial organization. Similar situations could occur elsewhere, wherever new coastal zone activities stimulate extremely rapid growth in new or small existing municipal centres. Such growth could occur in connection with offshore energy activities - the development of coastal service facilities - or with new port development. The social and environmental effects of such developments must be considered and dealt with in economic planning.

74. A number of secondary urban centres are located in the coastal zone, usually in connection with major ports. These include Beira (Mozambique), Mombasa (Kenya), Berbera (Somalia), and Toamasina, Antsoranana, Mahajanga and Toliara (Madagascar). As port cities, these urban centres are often the location of important industries, such as oil refining, cement production, and a variety of commodity processing operations. The port and industrial character of these cities gives them special problems of oil and industrial pollution. As well-established cities they are usually served by basic infrastructure but it is often very limited and outmoded. Meanwhile population is growing rapidly, although perhaps not as rapidly as at primary national urban centres. The chief needs in this context, therefore, are the upgrading and expansion of infrastructure; physical planning to reduce conflicts between residential construction, recreational activities, and industrial operations; and the prevention of undue strains on coastal and marine resources, environmental health, and loss of amenities.

81. The sound development of marine fisheries depends on more than just biological conservation and stock management actions. Marine fisheries development also depends on positive economic and social measures: the development of infrastructure to support enhanced fishery activities; improved commercial organization to provide fishermen and firms with an outlet for their catch; and market development and promotion activities for existing and new catches and products, both locally and nationally, and even internationally.

82. The shrimp fishery is organized in different ways in the primary regional shrimp grounds. In Madagascar most shrimp are taken by large-scale national ventures operating factory trawlers; in Mozambique by similar vessels operated by foreigners; in Kenya by small-scale national venturers; and in Tanzania almost exclusively by artisanal effort. Ways should be found of realizing the greatest national benefit out of this potentially high-value fishery.

83. Artisanal fisheries are constrained by the lack of infrastructure for storage and inadequate transportation. Equipment and port conditions are poor, calling for commercial reorganization. For a variety of reasons local markets are unresponsive.

84. Commercial fisheries development is impeded by infrastructural constraints such as inadequate port and storage facilities, lack of financing and effective commercial organization and by the absence of systematic market development programmes.

85. The development of deep-water fisheries - for tunas and other pelagic fish, currently unutilized benthic and demersal species, and sharks - is primarily impeded by the absence of commercial structure and financial support. If such fisheries were to develop, additional infrastructure, probably on a significant scale, would also be required. Many deep-water catches, such as tuna, cannot conveniently be processed on board catch vessels.

86. Due to special physical characteristics and dynamics at the coast, special attention should be paid to the natural pattern of geological change and to the effects of human activities.

87. Construction at the shoreline - including seawalls, piers, jetties, breakwaters, and reclamations - can change the patterns of sediment transport at the coast. Formerly stable shorelines can become subject to erosion while other areas experience accretion. Mombasa is now experiencing erosion of the waterfront area of the old town, perhaps caused by modifications of water flow in the interior of the harbour. Beaches have been swept away on Mahé, Seychelles, after construction of protective seawalls.

88. Coastal areas are subject to inundation by seawater during storm periods and also to freshwater flooding from highlands. These problems are most intense in river valleys and the coastal plain.

89. Sea dunes and barrier islands composed of sand and coastal dunes and bluffs of unconsolidated sedimentary material are prone to destabilization due to human activities, especially grazing, establishment of footpaths, and cultivation. In southern Mozambique, gardens and footpaths have destabilized sea dunes; in Somalia grazing during dry periods has destabilized a huge area of coastal dunes. In addition dunes can shift with the wind and be razed by marine forces during storms.

leaching could have immediate health and environmental effects. Few studies have been initiated to determine proper locations for new sites or to improve collection and management practices.

PRIORITIES FOR NATIONAL AND REGIONAL ACTION

94. This section presents possible priority actions, to deal with the concerns summarized in preceding paragraphs that could be adopted by the States of the region both separately and on a regional basis as part of a regional action plan for the protection and development of the marine and coastal environment.

Oil pollution

95. States of the region should review their national regulations on oil discharge into coastal waters and update and expand them as necessary. All important sources of marine oil pollution within national jurisdiction should be brought under effective control. This includes refinery operations, ships bound to or from national ports, and hydrocarbon exploration and development on the continental shelf.

96. States of the region should strive to improve the monitoring of oil pollution levels and contributing practices, the operation of vessels in coastal waters, and the enforcement of anti-pollution regulations concerning oil discharges.

97. States of the region should investigate the feasibility of ratifying international agreements on prevention of pollution of the sea by oil discharged or spilled from ships. Special attention should be given to MARPOL 73/78, which contains a comprehensive system of discharge limitations and restrictions.

98. States of the region should consider co-ordinated regional actions to improve compliance with international and national anti-pollution regulations concerning oil discharges from vessels. Co-operative surveillance programmes could be considered. States could also consider co-ordination of enforcement efforts such as mutual or delegated rights of pursuit, arrest, and detention of offending vessels passing through regional waters.

99. States of the region should consider petitioning IMO under the provisions of MARPOL 73/78 for the creation of a non-discharge zone in all the waters of the region, to prevent any significant discharge of oil by tankers passing through regional waters and to simplify surveillance and enforcement of international standards by the States.

100. States of the region should adopt national contingency plans detailing administrative responsibilities in case of significant oil spills in ports or along the coast and, as far as practicable, provide sufficient contingency equipment to combat foreseeable spills.

101. States of the region should consider adopting a regional contingency plan integrating national plans. They should also consider making equipment available for spills elsewhere in the region and providing for the stockpiling of equipment for the entire region at a single point or several points.

areas, in order both to create a representative regional network of natural areas and to protect migratory species within the region. To this end, national Governments should consider strengthening legislation and regulations to protect marine and coastal habitats and rare or endangered species.

110. States should also consider harmonizing their national legislation and regulations on a regional basis to simplify the surveillance of activities affecting marine and coastal habitats and species and necessary enforcement. This could include regulations on the harvest, sale, and export of corals, mangrove forests and animal products.

111. National Governments should consider the implementation of innovative management approaches for important marine and coastal habitat areas, such as mangroves and coral reefs. These could include special planning exercises, interagency consultations and adoption of special management plans for such areas. Special management approaches could help to integrate the preservation of important habitat into balanced development plans for such areas. For mangrove plantations it is necessary to take measures of adequate protection by advocating the elaboration of legislative texts appropriate at the national level and getting actions of re-wooding under way in order to comply with the needs of the people. An evaluation of the present situation by an appropriate inventory which would take into account the area covered by existing mangrove populations and the rhythm of destruction of these populations should also be considered.

Protection of rare and endangered species

112. National Governments should engage in special programmes, when necessary and practicable, for the affirmative management and protection of rare or endangered species. This would include on-site protection of such species in their habitat areas and artificial enhancement of breeding and the rearing of juveniles.

113. Special attention may be given to certain endangered species, such as the dugong and sea turtles. Intensified surveys and other biological studies of dugong and sea turtle populations and behaviour should be promoted. They should consider regional co-ordination to conserve populations, in the light of their natural and economic values and the possibility of inconsistent national regulations and management programmes. This could include convening a regional conference on conservation and management of endangered species with the aim of drafting a programme or legal agreement on this issue.

Planning and management of coastal and marine-related land use

114. Upland land-use patterns and practices must be controlled in order to reduce soil loss resulting in siltation at the coast and increased fluctuation of fresh-water flow in rivers due to loss of the retentive properties of upland vegetation.

115. Correct soil conservation practices must be adopted, implemented, and enforced and sound range management principles must be followed for the grazing of livestock. Terracing and other necessary erosion control measures should be applied.

116. Large-scale afforestation programmes must be commenced, both on a centralized and popular basis. Loss of forests by commercial lumbering or accelerated cutting for fuelwood or charcoal must be prevented. Increased study must be focused on the fuel cycle and improved means must be found to manage fuelwood resources. This includes improving the efficiency of domestic and charcoal-producing stoves,

125. Positive social and economic measures should be taken for the development of marine fisheries in the region, including the development of infrastructure to support enhanced fishery activities; improved commercial organization to provide fishermen and firms with an outlet for their catch; financial support when warranted; and market development and promotion for existing and new catches and products on a local, national and international level. For example, means should be found to increase national participation in the shrimp industry and to ensure that sound biological management principles are applied.

126. Infrastructure, including improved storage and transportation, should be provided to improve the market potential of artisanal catches. Improved equipment and marketing services should be offered to artisanal fishermen through co-operative organizations. Special efforts should be undertaken to develop local markets for artisanal catches.

127. When economically justified, commercial fisheries development should be assisted through improvement of infrastructure (including port and storage facilities), financial support and organizational measures, and through market development programmes.

128. The national development of deep-water fisheries should be promoted through technical assistance, commercial organization, and financial support when economically exploitable deep-water fisheries are found. These could include tuna and other pelagic species, underutilized benthic and demersal species, and sharks. In the case of highly migratory species such as tuna, national development of such fisheries should be co-ordinated with other States of the region.

Special coastal management issues

129. Due to special physical characteristics and dynamics at the coastline, particular attention should be paid to the effects of human activities on the natural pattern of geological change.

130. The probable effects of construction at the shoreline - including seawalls, piers, jetties, breakwaters, and reclamation - should be considered before projects are undertaken. Non-structural approaches should be adopted whenever possible.

131. Areas of the coast which are hazardous due to the probability of inundation by fresh or salt water during storms should be demarcated and human activities within them carefully limited.

132. Activities on sea and coastal dunes and bluffs and barrier islands should be carefully restricted so that these sensitive features are not destabilized on a chronic or acute basis.

Environmental health factors

133. Every effort should be made to ensure that every resident of the coastal zone is served by convenient, safe, and sufficient supplies of water for drinking and household purposes.

134. Existing sewerage and treatment systems should be carefully maintained and upgraded and new systems or expansions implemented wherever desirable and practical.

143. National policies on the protection and development of marine and coastal resources may usefully be harmonized on a regional basis, and special regional programmes for the protection and development of the marine and coastal environment should be undertaken when desirable.

144. The overall goals and objectives of a regional action plan for the protection and development of the marine and coastal environment should be:

(a) to promote the development and sound management of regional marine resources by:

- enhancing consultations and technical co-operation among the States of the region;
- declaring the economic and social importance of the resources of the marine and coastal environment to the States of the region;
- establishing a regional focus and emphasis for activities and financial support from outside sources of assistance, including international organizations;

(b) to provide for the protection and rational development of the living marine and coastal resources of the region, which are a natural heritage with important economic and social values and potential, through the preservation of habitats, the protection of species, and the careful planning and management of human activities that affect them;

(c) to establish general policies and objectives for the protection and development of the marine and coastal environment on a national and regional level;

(d) to prevent pollution of the marine and coastal environment within the region originating from activities within the States of the region or operations primarily subject to the jurisdiction of extra-regional States;

(e) to strengthen and encourage the activities of institutions within the region involved in the study of marine and coastal resources and systems through increased regional collaboration;

(f) to improve training and assistance at all levels and in all fields relating to the protection and development of the marine and coastal environment;

(g) to stimulate the growth of public awareness of the value, interest, and vulnerability of the region's marine and coastal environment;

(h) to embody the political will of the States participating in the action plan in a regional legal agreement specifying the obligations of the contracting parties to protect and enhance their marine and coastal environment.

Environmental assessment

145. Assessment of the environmental processes of the region is incomplete. Because sound action requires an understanding of the intricate links between development and the environment, there exists a need for continuing systematic assessment of the main factors influencing environmental quality. Among the tasks that should be performed are the following:

(f) Co-operation on the establishment and management of protected coastal and marine habitats, such as wetlands, nurseries and breeding grounds, coral reefs and mangroves, including training of technical personnel and managers in the conservation of wildlife and habitats.

(g) Co-operation on devising alternative land-use practices and development patterns appropriate for conditions in the region, including improvement of national capabilities to assess the environmental impact of development proposals.

(h) Co-operation in the exploration and utilization of fisheries to achieve the most rational utilization on a sustainable basis.

(i) Studies on the environmental, social and cultural effects of tourism and the development of alternative strategies for tourism development.

Environmental legislation

148. National legislation and regulations pertaining to the protection and development of the marine and coastal environment should be reviewed and, when necessary, expanded, updated, or strengthened. The enforcement of national regulations related to marine and coastal resources should be improved, e.g., with respect to prevention of pollution of the marine environment or protection of marine species.

149. National legislation and regulations on the protection and development of marine and coastal resources should be harmonized whenever regional uniformity is required to meet the objectives of such legislation, e.g., on the protection or management of migratory marine species within the region.

150. Consideration should be given to the development of a regional convention and related agreements for the protection and development of the marine and coastal environment. Such a convention should provide a legal framework for co-operative regional activities and create a basis for financing a regional programme.

151. A formal legal agreement, if established for the above purposes, might also help in accomplishing a number of other objectives such as:

(a) providing a framework for harmonizing national legislation and creating, as necessary, new legislation relating to environmental problems;

(b) providing a forum for regular (periodic) high-level consultation among participating Governments on implementation of the regional programme;

(c) establishing guidelines for co-ordinating environmental programmes and institutions at the regional and subregional levels;

(d) stimulating accession by more Governments within the Region to existing global and regional conventions relevant to the environmental issues of the region;

(e) providing a financial framework for continuous co-ordinated action for the protection of the coastal and marine environment of the region.

Overall technical co-ordination

158. The Governments of the region participating in the action plan should identify one organization which would be responsible to the Governments for the overall technical co-ordination and continuous supervision of the implementation of the action plan (the secretariat of the action plan).

159. Some of the options open to Governments in this matter would be: to choose an existing international organization, such as UNEP, UNDP, FAO, UNESCO, WHO or IMO; to choose an existing regional organization, such as ECA or OAU; or to establish a new regional organization to carry out the secretariat responsibilities of the action plan and the convention. It is assumed that the co-ordinating organization would seek the co-operation of the other organizations, in particular the specialized agencies of the United Nations system and the relevent regional organizations, in implementing activities under the action plan.

Regional co-ordinating unit (RCU)

160. The staff of the action plan's secretariat working directly on the implementation of the action plan would comprise a central regional co-ordinating unit (RCU). Such a unit will be necessary to ensure the timely and harmonious implementation of the action plan.

161. The RCU would operate within and under the authority of the organization to which the Governments assign the task of overall management and co-ordination of the action plan.

162. The regional co-ordinating unit should be kept to a minimal size in order to ensure that the maximum amount of available funds may be used to achieve the programme goals set forth in the action plan. To this end, great care must be exercised in determining the terms of reference, the administrative arrangements, the location and the staff structure of the RCU.

163. The secretariat should provide the overall co-ordination for the implementation of the action plan, including the administration and management of the programme and its budget, as adopted and/or modified by the intergovernmental meeting(s).

164. The RCU should not be expected to conduct field research itself, but should serve as a referral centre providing information, identifying experts and institutions to aid participating States in solving specific environmental problems, and facilitating information exchange and co-operation among those experts and institutions.

National focal points (NFP)

165. The active participation and co-operation of the East African States in the programme are basic prerequisites for the success of the action plan. In order to achieve efficient and well co-ordinated co-operation at both the national and the regional levels, a national focal point (NFP) should be established (or an existing structure should be designated) at a high level in each of the participating States to deal with all matters concerning the action plan.

166. The role of the national focal points should be:

International organizations

175. Participation of the international organizations in the programme, in particular those belonging to the United Nations system, can greatly assist the implementation of the action plan, and, therefore, their technical and managerial support for specific projects should be solicited. In general the RCU should assume responsibility for co-ordinating such support. Contacts between the international organizations and national institutions participating in specific projects should be channelled through the appropriate national focal points.

Financial support

176. Official support should be given to the implementation of a regional action plan by national Governments, including financial support for actions related to the action plan, to the greatest possible extent. National Governments should consider providing financial support on a regional basis to facilitate implementation of the action plan. Such support could be provided through the establishment of a regional trust fund for these activities. Such arrangements could facilitate the receipt of financial and other assistance from outside sources on a regional basis.

177. Although one of the ultimate aims of the programme is for the implementation phase of the action plan to be financially self-supporting, it is expected that the United Nations system should initially provide a substantial financial contribution which would progressively decrease as the Governments of the East African region, through a trust fund or some other mechanism, assume financial responsibility.

178. Financial support for the activities of the action plan may come from several sources:

(a) Contributions from East African States participating in the action plan according to a scale to be determined by the Governments concerned.

(b) Contributions made in addition to (a) above from the East African States.

(c) Contributions from States supporting the action plan but not participating in it.

(d) Support from the United Nations organizations (e.g. ECA, UNEP, UNIDO, UNDP, FAO, UNESCO and its IOC, WMO, IMO) on a project-funding basis.

(e) Support from the regional and international organizations which are not part of the United Nations system (e.g. OAU, ADB), in most cases on a project-funding basis.

(f) Any other source of funding agreed to by the East African States.

179. Contributions to the action plan may be both in cash or in kind (staff time, experts, training, facilities, services, etc.). Although contributions in kind may be of great importance, a fixed minimum level of cash contributions is essential for the smooth implementation of the action plan.

Funding mechanisms

180. Two parallel mechanisms may be envisaged as acting together to channel contributions for the support of action plan activities:

186. Pending the formal establishment of a regional co-ordinating unit, possibly in concurrence with the entry into force of the regional convention, States participating in the action plan may wish to invite an international organization, or a regional organization to assume responsibility for interim institutional arrangements that may be required for the achievement of the objectives of the action plan. The executive head of the designated organization would then need to decide how best to fulfil that responsibility and should be entrusted to employ flexible arrangements based on the existing capacities of the organization and the available financial resources.

187. Regular meetings of the States of the region and, as necessary, working groups of experts from the region may be convened by the designated organization to review the progress achieved and to advise the organization on the development of new activities.

188. It is clear that progress in carrying out the action plan will be dependent upon the available financial resources. In the initial stages of implementing the action plan, it may be expected that financial resources will be provided, in part, by the United Nations system. UNEP is committed to assisting the East African States, both financially and technically, primarily on a project-funding basis of programme activities. However, Governments will appreciate that the magnitude of UNEP's assistance will be affected by the global contributions to the Environment Fund, by the annual resources approved by the UNEP Governing Council for the Regional Seas Programme, and by the demands placed upon the Regional Seas Programme by other regions.

189. Governments may also expect contributions from other organizations in services and in kind, and possibly, in cash. In order to generate a financial commitment from other international sources, the Governments of the East African region should make certain that all relevant ministries and departments in the national administration are fully aware of the importance assigned to the action plan. In this way, the East African Governments may concertedly act as a regional grouping in seeking funds for their activities in the appropriate fora of other organizations.

190. Finally, Governments must be fully aware of the need for commitments on their part towards the financing of the programme. Government-financing should be placed at the disposal of the programme from its early stages, through the establishment of a trust fund or through other financial contributions that may be put at the disposal of the programme by Governments. While this financing may be a reduced percentage of the total costs of the programme in its early stage, it is nevertheless important that such contributions should be made as a first step towards starting the operational activities of the programme and, in particular, before any expanded regional institutional arrangements may be implemented. The level of Government contributions should be progressively increased so that the programme will become financially self-contained at the regional level.

Annex I continued...

Species	Status & Habitat	Problem	Conservation measures taken/proposed
7. Mongoose Lemur *L. Mongoz* (L., 1766); *L. m. mongoz* & *L. m coronatus*	MADAGASCAR: north-west forests & scrub to Betsiboka River; *L.m.m.* in forest while *L.m.c.* savannah, dry bush & forest edge	Degradation of habitat; hunting for food	AFRICON A; Ankarafantsika Reserve. WWF/IUCN Proj. improve protection. Intr. Anjouan & Moheli but status unknown
8. Nosy-Bé Sportive Lemur *Lepilemur mustelinus dorsalis* (Gray, 1870)	R MADAGASCAR: humid forest	Forest destruction & degradation	AFRICON A; Lokobe Strict Nature Reserve (SNR)
9. White-footed Sportive Lemur *Lepilemur m. leucopus* (Forsyth-Major, 1894)	CE MADAGASCAR; throughout southern, xerophytic Didiereaceae Bush vegetation but sometimes in gallery forests	Habitat degradation	AFRICON A; Lokobe SNR. Mahafaly Tomb near Fvasy, Ampanihy
10. Grey Gentle Lemur *Hapalemur griseus* Link, 1797, *H. g. olivaceae*	V MADAGASCAR; Hgg shoreline to plateau of north-east & east & bamboo zone; the second form (Hgo) lives in marshes of L. Alaotra	Destruction of primary forest; hunting for food	AFRICON A; Number of reserves & naturally protected areas
11. Fat-tailed Dwarf Lemur *Cheirogaleus medius* (E. Geoffrey, 1812)	E MADAGASCAR; western & southern dry forests; also damp forest of west with *Phaner furcifer* & in southern bush with *Lepilemur m. leucopus*	Habitat destruction through clearing and degradation (needs trees with cavities for semi-hibernation)	AFRICON A; Ankaratantsika Reserve. Andohahela Reserve
12. Coquerel's Mouse Lemur *Microcebus coquerel* (A. Grandidier, 1867)	V MADAGASCAR; humid parts of forests of west Madagascar	Loss of habitat through climatic changes (droughts), destruction and degradation of forests, agricultural developments	AFRICON A; Probably in one of western Nat. Reserves. Private R. (de Beaulieu north of Morondava)

Annex I continued...

Species		Status & Habitat	Problem	Conservation measures taken/proposed
17. Aye-Aye *Daubentonia madagascariensis* (Gmelin, 1778)	E	MADAGASCAR: Lowland humid forest of east & northwest presently only few individuals in northeast. (requires tall trees)	Habitat degradation through exploitation of timber	AFRICON A; Mahambo, Reserve. Nosy Mangabe Sp. R. (Maroantsetra)
MAMMALS: UNGULATES				
18. African Elephant *Loxodonta africana* (Blumenbach, 1797)	V/T	ALL MAINLAND COUNTRIES: wide range of habitats: humid forests to semi-arid, requires large annual range and water	Loss of habitat to cultivation and settlements. Poaching. Reclamation projects, eg., of flood plains	SOM: Sinple G.R. TAN: Selous G.R., Saadani G.R. MOZ: Maputo R., Gorongosa N.P., Marromeo R. CITES II
19. African Black & White Rhino *Diceros bicornis* L. and *Ceratotherium simum* Burchell	CE	ALL MAINLAND COUNTRIES: semi-arid to humid forests; (exhibits territorial behaviour)	Poaching for horn; loss of of habitat to agriculture and settlements	AFRICON A; CITES I. SOM: Bohaeci G.P. TAN: Selous G. Res. MOZ: Maputo & Gorongosa National Parks. CITES I
MAMMALS: CHIROPTERA				
20. Mauritian Flying Fox *Pteropus niger* (Karr, 1972)	R	MAURITIUS: forest habitats with fruit trees; now using cultivated fruit trees	Very high hunting pressure; cyclones	Machabee Forest Reserve
21. Rodriguez flying fox *Pteropus rodricensis* (Dobson, 1878)	CE	MAURITIUS: Rodriguez Island in former mixed forest with fruit trees	Hunting, cyclones and possible starvation.	None, except captive breeding in Mauritius and Jersey Zoo, UK

Annex I continued...

Species	Status & Habitat	Problem	Conservation measures taken/proposed
REPTILES - CROCODILES			
26. Crocodile, Nile Crocodylus niloticus (Lauranti, 1768)	V Rivers, lakes and adjoining swamps and marshes including estuarine & deltaic habitats	Hunting for valuable skin. Habitat destruction/degradation through damming, draining of swamps and lakes, etc. Predation of eggs by monitor lizard	CITES I. SOM: controlled exploit. TAN: Selous G. Reserve. MOZ: Marromeo Reserve. MAD: no information. COM: probably there but no protection. SEY: extinct
REPTILES - TURTLES	All marine turtles use beaches to lay eggs, all suffer from degradation of this habitat, e.g., removal of sand or tourist use, etc.	Trawl nets, exploitation for meat & eggs, souvenir trade. Degradation of sea-grass and potential chemical pollution Oil pollution	AFRICON A; CITES SOM: not protected. KEN: by law and in marine parks. TAN: Mafiwi Island by law but difficult to enforce. MOZ: Bazaruto Reserve, law. MAD: protected by law but no enforcement.
27. Green turtle Chelonia mydas	E Sea-grass meadows in warm waters; carnivorous as juvenile, vegetarian as sub adult and adult on seaweed and sea-grass (Hughes, 1976)		AFRICON A; CITES. COM: no control; locally protected (Mohéli). MAU: only males allowed. SEY: marine parks and coastal reserves, difficult to enforce: Aldabra, Glorieuses; survey under way

Annex I continued...

Species		Status & Habitat	Problem	Conservation measures taken/proposed
31. Loggerhead Turtle *Caretta caretta*	T	Littoral, carnivorous, esp. molluscs, e.g., *Bufonaria sp.*, A temperature nester 25°-28°C	Egg collection. Loss of nesting beaches	MAD: Fort Dauphin, the only nesting area in the region, needs protection
32. Seychelles Pond Turtle		Freshwater marshes on Mahé	Grazing and draining of marshes (Chong Seng 1981)	SEY: N.E. Point, Anse Forban Takamaka, Ponte Police
REPTILES - TORTOISES				
33. Madagascar Spider Tortoise *Pyxis arachnoides* (Bell, 1827)	R	Extreme southern Madagascar In arid to semi-arid thorn/ bush	Habitat degradation Over-collection for pet trade	CITES II Export tax control
34. Madagascar Tortoise *Testudo yniphora* (Vaillant, 1885)	VR	In small bamboo-forested islands, Soala to Cape Sada region (west Majunga)	Bush fires, habitat destruction by pigs. Over collection by inhabitants as garden pets	AFRICON A. CITES JJ. Local taboo in some tribes
35. Giant Land Tortoise *Testudo elephantina (gigantea)*			Potential tourist development	Aldabra Atoll N.P. Transplants on other islands, e.g., Curieuse and Cousine

N.B.: AFRICON - African Convention on Conservation of Nature
CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora
IWC - International Whaling Commission

Annex II continued...

	COMOROS	KENYA	MADAGASCAR	MAURITIUS	MOZAMBIQUE	SEYCHELLES	SOMALIA	TANZANIA
5. S.O.L.A.S. Convention, 1960		R	R			R	R	
5(a) 1974 Amendment								

Note: R - Ratified
S - Signatory-not yet ratified
P - In process of ratification
X - The Seychelles Government to determine if the Devolution Agreement applies.

Annex III continued...

Habitat type	Ecological significance	Threatened/endangered fauna and/or flora	Type/source of threat	Measures taken/proposed
	Protection of water; catchment; only habitat for some endangered forest birds and some palms	MAURITIUS: Pink Pigeon (Nesoenas mayeri; Mauritius Kestrel (Falco punctatus); Mauritius ring-necked parakeet (Psittacula echo); Foudia rubya and F. flavicans); many endemic plants include the Dodo tree Mimusops canari, Tombouriasa, endemic palms and lataniers	Cyclones, privet Ligustrum walkeri and rubus (Rubus mollucanus; guava [Psidium cattleianum)	Machabee FR (Black River Gorge)
		SEYCHELLES: Seychelles black parrot Falco araea, endemic palms & lataniers	Settlements, cultivation, timber, afforestation	Morne Seychelles (Mahé) Vallée de Mai Park Grand Anse
	Catchment area protection	COMOROS	Cultivation of cash crops e.g. ylang-ylang; settlements, timber & firewood	No forest reserve or park
2. Flood plains, coastal marshes and lakes				
	Habitat for fishes; rest & feeding grounds for waterfowl	SOMALIA: No information but may include elephants, rhino etc. waterfowl (migratory); crocodiles and hippopotamus	Conversion to agriculture for rice, bananas, sugar, salt pans	Rubasci GP Sinpe Partial R. Jebel river marshes
	Fertile alluvial soils annual flooding, provision of water supplies esp. in dry season; nursery ground for many fishes	KENYA: No info., probably similar to Somalia, crocodiles, elephants, hippos	Agriculture, hydro dams, sediment	Tana River F. Res. Lamu For. Reserve

Annex III continued...

Habitat type	Ecological significance	Threatened/endangered fauna and/or flora	Type/source of threat	Measures taken/proposed
		KENYA: Mangrove kingfisher mangrove habitat & fisheries	Timber & poles (Rhizophora & Ceriops) for local use & export; reclamation projects in creeks; firewood & charcoal; settlements; oil near ports; industrial pollution	National protection; Lamu-Kipinio FR & NP Malindi-Watamu NP/NR Mida-Gedi FR Kiunga Marine NP Shimoni, Kiigo, Mpukuti, Pipini(prop) Vanga Funzi FR Gazi and Mwache Creeks FRs
		TANZANIA: Fisheries; no other information nor on Zanzibar, Pemba and Mafia Islands	Rufiji River Basin Dev. project; timber & poles for local & export; land reclamation esp. urban centres; oil around ports; industrial pollution	Rufiji Delta FR Saadani GR
		MOZAMBIQUE: fisheries; mangrove kingfisher (Halcyon senegaloides), waterfowl	Ricefields; oil near ports; ind'l pollution; reclamation projects for settlements; poles for local houses; firewood including for sugar factories	Maputo Wild. Res. Inhaca Isl. Marine
		MADAGASCAR: Lemurs; oysters due to silting	Not exploited for timber but locally sedimentation & oil near ports; waste disposal; agricultural expansion	No info. but mangroves do not appear to be in immediate danger; studies of oyster beds undertaken, no follow-up

Annex III continued...

Habitat type	Ecological significance	Threatened/endangered fauna and/or flora	Type/source of threat	Measures taken/proposed
		TANZANIA (cont.)	& Kilwa & turtle shell; tar balls	nesting; controlled exploit. of shells
		MOZAMBIQUE: Molluscs, marine turtles, waders	Reclamation, settlements, development of tourism; sediments: beach erosion, shell collection	Inhaca Island; Maputo Reserve Xai-Xai/Inhabane Coast Primeiras Isl. Bazaruto NP
		MADAGASCAR: Molluscs, marine turtles, waders	Sedimentation, sand collection, shell collection, tar balls	Tourist beaches protected
		MAURITIUS: Molluscs, marine turtles, waders	Reclamation; tourist development, collection of shells; oil	Controlled shell protected on tourist beaches
		SEYCHELLES: Marine turtles, shells, waders	Collection of sand; tourism dev.; tar balls & oil reclamation projects	As for mangroves; controlled collection of sand & shells; protected on tourist beaches
		COMOROS: Marine turtles, molluscs, shore birds	Sand collection; reclamation; oil from ships; tourism	Collection of sand prohibited on some beaches; no reserves/ sanctuaries

Annex III continued...

Habitat type	Ecological significance	Threatened/endangered fauna and/or flora	Type/source of threat	Measures taken/proposed
		MADAGASCAR: As for the other countries	Coral & shell collection; overfishing, coral rock for building; sedimentation of coral flats; over collection of molluscs for food eg. Cassis rufa, echinoderms (sea-urchins) oil prospection	Tuléar Marine Res./park (proposed) 3x24 km; Nosy-Bé Isl.
		MAURITIUS: Porcelain Harts spp.	Sewage outfalls; high tourist use; shell & coral head collection; spear fishing; oil prospection	Flat island Most areas linked with coastal tourism I. Aux Aigrettes
		SEYCHELLES : Octopus, marine turtles	Sedimentation; overfishing by local people; industrial & domestic effluents; oil prospection	St. Anne Marine NP Baie Ternay Marine NP Curieuse Marine NP Aldabra and several marine nature reserves
		COMORES : Coral, molluscs coral fishes shoreline habitats, marine turtles	Sedimentation, collection of coral rock for building & chalk; collection of shells and coral heads; overfishing	No marine reserves and no regulation of coral rock collection

Annex III continued...

Habitat type	Ecological significance	Threatened/endangered fauna and/or flora	Type/source of threat	Measures taken/proposed
		MADAGASCAR : As for Mozambique	Serious sediment encroachment; fishing activities	No information but Govt. very much pre-occupied with soil erosion control
		SEYCHELLES: Molluscs, crustaceans, fishes, marine turtles	Coastal erosion; fishing (local); fishing activities	Naturally protected in many of the unhabited islands; dugong practically extinct; marine turtles protected by law; good enforcement
		MAURITIUS: Marine turtles	Coastal erosion; overfishing (local); fishing activities	Taking of males allowed; females protected
		COMOROS: Dugong, marine turtles, crustaceans	Sedimentation; destabilization of meadows due to strong wave action arising from damage to coral reef front; collection of marine life for food or tourist attractions; fishing activities	Unknown; dugong protected by law & also tradition (Moheli) but no enforcement

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