



Overview of Land-based Sources and Activities
Affecting the Marine, Coastal and Associated
Freshwater Environment in the
Eastern African Region

UNEP Regional Seas Reports and Studies No. 167



Note:

This document was prepared by the Institute of Marine Sciences of the University of Dar es Salaam under a consultancy for the Water Branch, United Nations Environment Programme (UNEP) and FAO, as a contribution to implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities in the Eastern African region. This document has been reviewed by government-designated experts and endorsed by the governments of the region.

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Preface

The Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities (UNEP(DCA)/LBA/IG.2/7) was adopted by an intergovernmental conference held in Washington, DC, USA, from 23 October to 3 November 1995. The goal of the Global Programme of Action is to prevent degradation of the marine environment from land-based activities, by facilitating the realization by States of their duty to preserve and protect the marine environment.

The Washington Conference designated the United Nations Environment Programme (UNEP) as secretariat of the Global Programme of Action and requested that, as coordinator and catalyst of environmental activities within the United Nations system and beyond, it should through its programmes and secretariat role:

- (a) Promote and facilitate implementation of the Programme of Action at the national level;
- (b) Promote and facilitate implementation at the regional, including subregional, level through, in particular a revitalization of the UNEP regional seas programme; and
- (c) Play a catalytic role in the implementation at the international level with other organizations and institutions.

The project for the Protection and Management of the Marine and Coastal Areas in the Eastern African Region (EAF/5) of the Food and Agriculture Organization of the United Nations (FAO) was launched in 1993 by the Eastern African Governments in collaboration with UNEP's Regional Seas Programme, with the main objective of developing, in collaboration with FAO and other United Nations agencies and multilateral and bilateral donors, national self-reliance in matters related to the integrated development and management of the environment of the coastal areas. The project is part of the ongoing broader concept within the framework of the Regional Seas Programme's Eastern African Action Plan aimed at enhancing the quality of the marine and coastal environments in partnership with coastal communities and their Governments in the Eastern African region.

To facilitate implementation of the Global Programme of Action around the world, UNEP is organizing, during the period 1996-1998, in cooperation with relevant regional and international organizations, a series of technical workshops of Government-designated experts, as well as representatives of relevant international organizations, the private sector and experts from non-governmental organizations. The purpose is to strengthen national capabilities for protection of the aquatic environment from land-based activities, and to promote regional and subregional cooperation. More specifically, the workshops are being convened with the following aims:

- (a) To review the general objectives of the Global Programme of Action and its implications;
- (b) To identify possible elements of regional framework strategies, with special reference to recommended approaches by source-categories;
- (c) To consider the requirements for development and implementation of national programmes, including the assistance required and available for this purpose through the organizations supporting the Global Programme of Action; and
- (d) To design and agree on general outlines for preparation of regional programmes of action to address land-based activities.

The present overview of land-based sources and activities affecting the marine, coastal and associated freshwater environment in the Eastern African region was prepared as a main background document for the workshop on implementation of the Global Programme of Action in the Eastern African region, held in Zanzibar, United Republic of Tanzania, 6 to 9 October 1997, organized by UNEP, FAO and the Institute of Marine

The objective of the overview is to present information that will assist Governments of the region, both individually and collectively, in their efforts to protect the marine environment and achieve the sustainable development of their coastal and marine areas through integrated coastal-management initiatives. The overview identifies and assesses the problems related to land-based activities for each country and the region as a whole. This information is intended to serve as the basis for establishing the priorities for remedial actions. In addition, management objectives and approaches have been defined, and criteria proposed for the evaluation of their effectiveness.

UNEP and FAO commissioned to the Institute of Marine Sciences of the University of Dar es Salaam to prepare the overview, which is based on national reports from the following countries: Kenya, United Republic of Tanzania, the Zanzibar state of the United Republic of Tanzania, Mozambique, Madagascar, Mauritius, Seychelles and Comoros. The draft document was submitted to the above-mentioned workshop and was reviewed and finalized based on discussions and recommendations provided by the government-designated experts participating, as well as recommendations by the UNEP Global Programme of Action Coordination Office and the Coordinator of the FAO EAF/5 project. The assistance of B. Rawlins and J. Arthurton (British Geological Society) in preparing the document is acknowledged.

The overview has three main objectives, namely:

- (a) To review relevant information and activities of the individual countries comprising the region;
- (b) To identify the priorities and formulate recommendations for the problems arising from land-based activities in each country, and the region as a whole; and
- (c) To provide a basis for the formulation of a regional programme of action to address land-based activities in Eastern Africa.

The overview follows the approach recommended by the Global Programme of Action, as well as the layout prepared by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) for a global review on land-based sources and activities affecting the quality and uses of the marine, coastal and freshwater environment (GESAMP, 1997), and will also be used to provide data and information for the global review, currently being prepared (under the leadership of UNEP) by the GESAMP Working Group on Marine Environmental Assessments, which is expected to be ready by 1999.

Executive Summary

This document provides a regional overview of land-based sources and activities and their impacts on the marine, coastal and associated freshwater environments in the East African region. The overview covers three coastal States [Kenya, United Republic of Tanzania (Tanzania) and Mozambique] and five island States [Madagascar, Mauritius, the Islamic Federal Republic of Comoros (Comoros), the Zanzibar state of the United Republic of Tanzania and the Seychelles]. The rapidly expanding coastal populations of the region exert ever-increasing pressure on coastal habitats and resources. Land-based anthropogenic activities such as agriculture and industry, coastal urbanization, tourism and rock/mineral extraction, disturb natural conditions and processes, degrading coastal resources and habitats. The effects can have serious social and economic implications. The objective of the overview is to present information that will assist Governments of the region in their efforts to protect the marine environment and achieve the sustainable development of their coastal and marine areas through integrated coastal management initiatives.

There is a large degree of uncertainty associated with the source-inventory method for the estimation of pollution loads from industrial and domestic sources, on which all the national assessments were based. Very few scientific studies have been conducted to determine the concentration of specific pollutants in fresh, ground, or coastal waters. Therefore, the interpretations made in this report are tentative.

The lack of infrastructure and treatment facilities for the large quantities of domestic sewage generated by expanding coastal urban populations, and an increasing number of visiting tourists, represents the greatest threat to public health, coastal habitats and economic development in each State of the region. Other priorities requiring action include the effects of siltation related to agricultural activity and the dumping of solid domestic waste leading to the degradation of coastal habitats, with implications for fish stocks and catches. Although eutrophication and algal blooms associated with agricultural, industrial or domestic sewage pollution have been identified as a threat to coastal habitats, further scientific research is required to link the causes and effects.

Strategies and measures are suggested to address the priority issues identified, including the improvement of sewage infrastructures and more

I. Introduction

A. Natural conditions and processes

The East African region comprises 10 States, four coastal States (Kenya, United Republic of Tanzania, Mozambique and Somalia) and six island States (Madagascar, Mauritius, Zanzibar state of the United Republic of Tanzania, Comoros, the Seychelles and Reunion) (Figure 1). They cover a wide range of both political and economical development. The coastal region between Somalia and Mozambique is home to 19 million people with an average population growth rate of 6 per cent in the main urban centres. In the mainland continental States, 20 per cent of the population reside on 12 per cent of the land area, exerting intense pressure on limited coastal resources. All the States of the region are heavily dependent on their coastal environments as sources of food, income and employment. Rapidly expanding coastal populations, as well as increasing industrial and agricultural activities, are potential sources of land-based pollution that threaten the sustainability of coastal and marine ecosystems and their associated non-living resources.

This report considers land-based sources and activities affecting the aquatic environment in Kenya, the United Republic of Tanzania, Mozambique, Madagascar, Mauritius, the Zanzibar state of the United Republic of Tanzania, Comoros, and the Seychelles. Although relevant reports were requested from Somalia and Reunion, they were not submitted for incorporation into this regional assessment. The land areas and the lengths of coastlines of all the countries are shown in table 1.

Table 1. Physical characteristics of the countries considered in the overview

| Country | Area (km ²) | Length of coastline (km) |
|---|----------------------------|--------------------------------|
| Comoros ^a | 1,660 | 350 |
| Kenya ^b | 588,045 | 500 |
| Madagascar ^c | 592,797 | 5,100 |
| Mauritius ^d | 2,040 | 320 |
| Mozambique ^e | 800,000 | 2,770 |
| Seychelles ^f | 445 | 600 |
| Tanzania ^g | 942,654 | 800 |
| Zanzibar | 1,666 | - |
| State of the United Republic of Tanzania ^h | | |

1. Climate and oceanography

The climate of the region is generally tropical humid to sub-humid. The monsoons are the dominant influence on wind direction and strength, temperature and rainfall. They also affect the major coastal currents. There are two monsoon seasons: the north-east monsoon (November to February) is characterized by higher air temperatures and weaker winds compared with the south-west monsoon (April to September) with lower air temperatures and stronger winds. The names of the monsoons may vary according to location within the region. The inter-monsoonal periods, the months of March/April and October/November, are typically calm.

The South Equatorial Current and the East African Coastal Current are strongest during the south-west monsoon; the East Madagascar and the Mozambique current systems are strongest during the north east monsoon (Figure 2). The Somali Current shows reversals in direction reflecting the alternating monsoons. Tidal ranges vary greatly within the region (Alusa and Ogallo 1992). Along the mainland coasts, the average Spring tidal range varies from 2 m to 6 m, with Beira (Mozambique) having one of the largest ranges and the greatest flushing of coastal waters and inlets. Mauritius and Reunion experience negligible tides with minimal flushing.

2. Geology and geomorphology

Many types of geological formation are found in the region, with ages ranging from 200 million years to recent. For instance, the coastal sediments of the United Republic of Tanzania vary in age from Jurassic

limestones form extensive coastal terraces, cliffs and intertidal platforms (Arthurton 1992).

Fringing, largely intertidal platforms, eroded mostly in these Pleistocene limestones, dominate the coastal geomorphology in much of the region. Commonly cliff-bounded to landwards, these platforms extend seawards from a few tens of metres to more than two kilometres from the back shore, their seaward edges forming breaker zones for ocean swell. Terraces and platforms alike are incised by major creeks draining the hinterland, as at Dar es Salaam and Mombasa. Holocene and recent beach-ridge and bar deposits overlie the platform rocks in many places. Mangrove forests are developed in many of the sheltered sedimentary embayments including those in deltaic areas, such as the outflow of the Rufiji River in Tanzania. Coastal sand dunes are associated with river mouths where there is a high discharge of terrigenous sediment, as from the Sabaki River in Kenya (Arthurton 1992). Water resources, including potable water supplies, are dominated by groundwater in coastal areas of highly permeable Pleistocene limestone.

3. Ecosystems

The coastal ecosystems of the region are generally both rich in natural resources and highly productive. Especially important habitats include mangrove forests, coral reefs and seagrass meadows. Of the 38 designated marine and coastal habitats, at least one third are found within each country of the region; the greatest known diversity was reported in Mozambique where 87 per cent of all habitat types are recorded (UNEP 1984). These ecosystems sustain a great diversity of marine life and are an important

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