A Regional Overview & Assessment of Marine Litter Related Activities in the West Indian Ocean Region

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FRONT COVER PHOTOGRAPH: Said Ahamada, Comoros.

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<u>Frontispiece:</u> Geographical coverage of the area of focus of this study in the West Indian Ocean Region (Source: Google Earth). The coastlines extend over a distance of more than 10,000km, excluding the small islands.

EXECUTIVE SUMMARY

Background to this study

Marine litter/ solid waste is becoming a significant contributor to marine pollution in the West Indian Ocean; many types of marine litter persist for hundreds of years, and volumes are accumulating; synthetic/ plastic litter particularly damages ecological, economic, cultural, recreational and aesthetic values of coastal and marine ecosystems and their components.

In recognition of the problems caused by marine litter a United Nations General Assembly resolution in November 2005 has called for national, regional and global actions to address the matter.

The United Nations Environment Programme (both the Global Programme for Action and the Regional Seas Programme) is active in raising awareness about the marine litter problem; one of its activities has been to commission this report on marine litter in the West Indian Ocean Region. The project is being administered by the Western Indian Ocean Marine Science Association (WIOMSA).

Aim of this assessment

The study aims to collate existing information about marine litter in the Region and use it to determine whether or not there is a need to be concerned, and to recommend a way forward.

Approach and participants

This report is a first regional assessment. It gives an integrated synthesis of information and data presented in reports on marine litter from eight of the countries that are signatories to the Nairobi Convention, and supplemented by information from published and unpublished sources.

The countries participating in this study are Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa and Tanzania. Unable to participate were Somalia, which does not have a recognised government, and the French colonies, that are not eligible for funding under Global Environmental Facility arrangements.

A draft regional report was presented for information and comment at the 3rd Joint Meeting of the regional task forces on 'Municipal Wastewater Management' and the 'Physical Alteration and Destruction of Habitats' in Toliara, Madagascar, 3-5th May 2007.

Key findings of the assessment

- Very little data exist on quantities, types, trends, sources and sinks of marine litter, other than in South Africa. Nowhere has the economic impact of litter been adequately quantified. Despite this the national consultants participating in this analysis have provided excellent observations about these topics in their country

reports, and consequently have provided ample evidence for an initial regional analysis to be compiled.

- Marine litter is not dealt with in policy or law as a separate category of waste; it is considered to be part of the general waste stream in the West Indian Ocean region.
- Most countries do have laws and policies that govern solid waste management, to varying degrees, but in many instances they are not effectively implemented.
- The most significant source of marine litter is solid waste in water runoff from urban areas. This is true for all countries in the West Indian Ocean, as is the fact that the degree of successful management of the litter problem varies greatly between countries.
- The major constraints to effective waste management, so to reducing marine litter, are inadequate awareness about impacts and/ or a shortage of funds to deal with it.
- Marine based sources of litter do not appear to be as significant as land based sources and are even more difficult for countries in the region to control; the West Indian Ocean is heavily trafficked by commercial shipping and fishing vessels. Loss of fishing gear and dumping of garbage is prevalent. None of the islands or bordering coastal states can afford to effectively police their territorial waters or exclusive economic zones, where applicable, and they are not legally permitted to police the high seas. Further, because of the nature of the ocean currents, litter dumped almost anywhere in the Indian Ocean can be transported for thousands of kilometres.
- The extent to which solid waste generated on land is prevented from reaching the sea varies greatly between countries, and regions within countries. Participants are found to fall into two distinct groups with respect to their land based solid waste management capacity:
  - On one hand Mauritius, Seychelles and South Africa presently have the motivation and human and material resources to manage waste fairly adequately, and they contribute relatively little to marine littering.
  - On the other hand Comoros, Kenya, Madagascar, Mozambique and Tanzania appear to have very poor waste management capacity. Basic removal, treatment, recycling and disposal services for solid waste do not exist in certain coastal areas of these countries. In many places waste is dumped directly onto the coast either for dispersal via the sea or as a barrier against erosion. These are all amongst the poorest countries in the world with the lowest gross national incomes and human development indices.
- Although the overall levels of marine litter produced by the countries in the West Indian Ocean must be insignificant compared with levels from highly industrialised economies, the situation is considered serious enough to require urgent remedy.

Current status of the report

This report, which includes information from the consultants in eight Nairobi Convention countries, is presently one of the supporting documents to the “Pollution” theme of the West Indian Ocean Trans-boundary Diagnostic Analysis being undertaken by the United Nations Environment Programme.

With the full national reports, this study will also serve as a background document for developing National Programmes of Action in consultation with each country’s stakeholder groups.

Summary of actions required

This Regional Assessment provides an initial and very broad overview; it chiefly concerns the cross-cutting issue of solid waste management on coastal land and at sea. Accordingly, the scope of the study allows recommendations to be made in general terms only, as follows:

a) The need, feasibility and benefits of establishing a "Regional Programme on Marine Litter in the West Indian Ocean Region" should be decided by the Conference of Parties to the Nairobi Convention. The priority would be to decide whether solid waste management should be mainstreamed “into the development agenda of countries through targeted actions that address not only environmental concerns, but also institutional, regulatory, policy and capacity aspects” (the goal of the NEPAD COSMAR programme).

b) It is considered prudent that marine litter arising from sources on land be tackled separately from litter arising at sea because different laws and approaches would apply in many instances (although there is obviously an overlap in the economic incentives required to reduce the production of persistent wastes and improve solid waste management).

c) To control marine based sources of litter all coastal States in the West Indian Ocean Region and all other Flag States should be encouraged to ratify and adhere to existing international instruments, particularly MARPOL Annex V with respect to ship-generated garbage and the London Convention concerning dumping at sea. Ports also need to provide adequate waste reception facilities, which in turn require adequate land-based treatment, recycling and disposal services. It is noted that the International Maritime Organisation is in the process of reviewing Annex V to MARPOL regarding port reception facilities, and the outcome will influence the approach to be taken by participating countries in the West Indian Ocean.

d) Most importantly, the appropriate regional mechanism for implementing recommendations about land-based sources of marine litter is considered to be the Nairobi Convention (Concerning Land-Based Sources and Activities in the Eastern African Region). The convention supplies an appropriate framework law. For land-based sources of marine litter it would be important for “solid waste management” to be listed as an activity requiring attention within an Annex to the new draft Protocol. Any marine litter management programme should not be separated from solid waste management - including where this ties in with municipal wastewater management.

e) Once solid waste management is listed under the protocol, approaches to addressing national legal and administrative instruments and strategies, and cooperation with civil society should be dealt with under the provisions of the Convention.

f) Each nation’s particular priorities for waste management would have to be considered in the context of their other priorities for national development - which may or may not necessitate new or amended domestic laws or regulations, but rather institutional capacity enhancement and methods of better implementation, for example.

g) Methods of funding high cost initiatives, such as port reception facilities and landfills, need to be addressed by each Nairobi Convention country, including their ministries of finance, and should be linked with the use of various economic instruments. The Regional Seas report on financing for the environmental conservation of the Red Sea and Gulf of Aden (UNEP 2006) can be referred to as an example. In addition, UNEP has recently commissioned a study on "Marine Litter and Market Based Instruments" the outcome of which should also be useful to West Indian Ocean countries.

h) Key stakeholders who would need to be involved in developing action plans in each West Indian Ocean country are all those with a vested interest in relevant waste generating, management and disposal activities, and in developing/ marketing alternative (bio-degradable) products.

i) Activities could focus on providing information about reasons for preventing marine litter and, amongst other things, discussing methods of doing so in ways which reduce costs to the fiscus, maximise benefits to the poor, and put the onus of cost of disposal onto producers of plastics, particularly.

j) Solid waste management/ marine litter abatement strategies should also be brought into focus in all foreign funded programmes that governments are allowing in their countries, to assist with development

k) To help with capacity building and awareness raising, West Indian Ocean countries, and regions within countries, could draw on the numerous existing sets of guidelines for marine litter and solid waste management, and adapt them to their own specific circumstances.

l) Finally, the region, and each participating country, needs to consider standardised monitoring methods, but could also contribute to UNEP's global monitoring strategy which the Regional Seas programme anticipates will be developed by mid 2008.

The vision of the African Union is that of an Africa integrated, prosperous and peaceful, **an Africa driven by its own citizens,** a dynamic force in the global arena (Vision and Mission of the African Union, May 2004).

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1. CONTEXT OF THIS PROJECT & SCOPE OF WORK

1.1 BACKGROUND TO UNEP'S MARINE LITTER PROGRAMME[1]

The United Nations Environment Programme describes marine litter/debris as "any persistent manufactured or processed solid material which is discarded, disposed of or abandoned in the marine and coastal environment. Depending upon its composition, marine litter/debris may sink to the seafloor, drift in the water column, or float on the surface of the sea".

Marine litter is a complex and multi-dimensional problem with significant implications for the marine and coastal environment and human activities all around the world. It originates from many sources and has a wide spectrum of negative environmental, economic, safety, health and cultural impacts. Despite efforts made internationally, regionally and nationally, there are indications that the marine litter problem continues to worsen.

The lack of global and regional strategies, deficiencies in the implementation and enforcement of existing international, regional and national programmes and lack of regulations and standards that could improve the situation are the main reasons that the marine litter problem not only persists but appears to be increasing worldwide.

The problem of marine litter was recognised by the United Nations General Assembly, which in its Resolution A/60/L.22 - Oceans and the Law of the Sea - of 29 November 2005 in articles 65-70 calls for national, regional and global actions to address the problem of marine litter. **This resolution notes the lack of information and data on marine debris, encourages States to develop partnerships with industry and civil society, urges States to integrate the issue of marine debris within national strategies dealing with waste management; encourages the development of appropriate economic incentives to address this issue, and encourages States to cooperate regionally and sub-regionally to develop and implement joint prevention and recovery programmes for marine debris.**

A number of regions and countries have taken some initial steps to address the marine litter issue through legislation, enforcement of regional and international agreements, providing reception facilities for ship-generated wastes, improving their domestic waste management practices and supporting extensive beach and underwater cleanup activities, as well as through the initiation of information, education and public awareness programmes. Thus, many activities have already been started but, clearly, not enough of what needs to be done has taken place.

The United Nations Environment Programme (both the Global Programme for Action and the Regional Seas Programme) is active in the development and implementation of activities addressing the marine litter problem and is assisting 11 regional seas of the world in organising regional activities on marine litter (Baltic Sea, Black Sea, Caspian Sea, East Asian Seas, Eastern Africa, Mediterranean Sea, Northwest Pacific, Red Sea and Gulf of Aden, South Asian Seas, South East Pacific, and Wider Caribbean).

[1] This background is extracted from UNEP's "guidelines for the development and implementation of regional strategies for addressing marine litter" DATED 15 November 2006.

For the purposes of this report the "Eastern Africa" region, listed above, is synonymous with the West Indian Ocean Region referred to in this report and depicted in **Figure 1**.

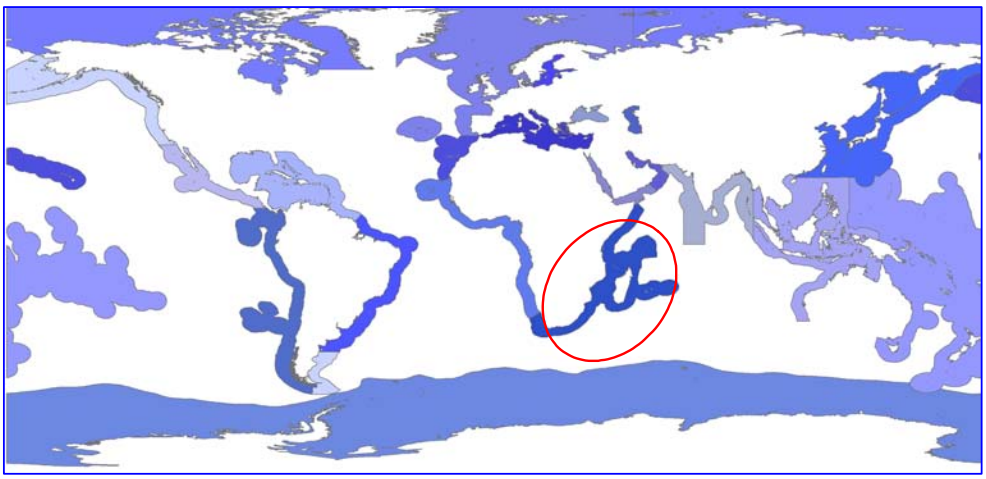

Figure 1.1 : Map illustrating the West Indian Ocean Region within the context of the 11 Regional Seas Programmes of the United Nations Environment Programme.

1.2 TOWARDS A WEST INDIAN OCEAN REGIONAL ACTIVITY

Taking into account the United Nations General Assembly Resolution, the Global Programme for Action framework, ongoing regional activities organised through the Regional Seas Programme of the United Nations Environment Programme and the outcome of the 2nd Intergovernmental Review of the Global Programme for Action, it has been agreed that the strategy to address the problem of marine litter at the regional level be based on the development and implementation of the Regional Action Plans for Marine Litter or Regional Strategies for the Sustainable Management of Marine Litter.

It has also been agreed that the development and implementation of a Regional Strategy should pass through the following three phases:

- Phase I Assessment of the regional situation;
- Phase II Preparation of the Regional Strategy; including a regional meeting of experts and national authorities; and
- Phase III The integration of the Regional Strategy into the Programme of Work of the respective Regional Seas Programmes and the Implementation of the Regional Strategy at the national and regional level.

The activities and collection of information are carried out through regional and national consultants. Within this context, the Western Indian Ocean Marine Science Association (WIOMSA) has been contracted by the Regional Seas Programme to coordinate the assessment of the marine litter problem in the West Indian Ocean Region. The Nairobi Convention Secretariat, and the United Nations Environment Programme's Global Environmental Facility project "Addressing Land-based Activities in the Western Indian Ocean" are also the key partners in this initiative.

This report presents an initial, Phase I, assessment of the West Indian Ocean regional situation.

1.3 TERMS OF REFERENCE FOR THE REGIONAL SYNTHESIS

Terms of Reference for the Regional Consultant were:

1. To develop a national questionnaire on marine litter along the following lines:
   a. Collection of available information on the quantities, type and characteristics of marine litter;
   b. Review of social, economical and environmental impacts of marine litter in the respective countries;
   c. Review of existing institutional arrangements at different levels of governance, ie, municipality, district and national;
   d. Collection, assessment and review of information on existing legal, administrative and institutional instruments and arrangements relevant to the marine litter management,
   e. Collection of information on on-going and completed marine litter management projects, programmes and initiatives, including information on lessons learnt from their implementation; challenges encountered; potential for replicability; and cost-effectiveness;
   f. Identification, assessment and review of gaps and needs in coverage of marine litter management;
   g. Identification of priorities for on-the-ground actions;
   h. Suggestions for changes and recommendations.

2. To communicate with and provide guidance to national consultants regarding completion of national questionnaires and preparation of national reports.

3. Where appropriate, to consult the International Maritime Organisation, the Intergovernmental Oceanographic Commission, Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the Basel Convention, the Global Environmental Facility, the Swedish International Development Cooperation Agency, and the United Nations Environment Programme's Regional Seas Programme on issues related to marine litter.

4. To prepare a Review Document on marine litter in the West Indian Ocean Region covering the points listed in 1 above; by borrowing heavily from national reports (preferably based on the standard questionnaires) and including other available relevant documents such as scientific papers, etc.

5. To prepare a set of recommendations regarding the need, feasibility and benefits of establishing a "Regional Programme on Marine Litter in the West Indian Ocean Region" and its possible institutional, programmatic and legal context. The recommendations were to include, among others, the strategic approach, a feasible costed programme of work, potential regional and international partners, a list of operational activities and recommended sources for funding.

6. To produce as the main output of this assignment a Regional Review document entitled "*Regional Overview and Assessment on Marine Litter Related Activities in the WIO Region – Nairobi Convention and GEF WIO-LaB Project Countries*". The document should include amongst others, and where feasible, the following elements:

- Recommended action points for enhancement of national/regional legal and administrative instruments; national/regional programmes and initiatives; and national/regional institutional arrangements;

- Recommended action points for the development and implementation of regional and national monitoring programmes including suggested methodologies;

- Recommended approach and action points for the development of regional and national strategies on integrated management of marine litter (including regional guidelines for the wise management of municipal solid waste);

- Recommended approach for cooperation with the civil society (private sector, NGOs and the scientific community). Programmes to develop partnerships, voluntary agreements and cooperation with major stakeholders (*e.g.*, shipping industry, tourism industry, fisheries, manufacturers of plastics, waste managers/services, local authorities, municipalities and communities, NGOs and general public);

- Recommended approach and action points for the development of campaigns and /or permanent services for the cleaning and collecting of marine litter that pollute coastal and marine areas; Demonstrations through awareness-raising campaigns in selected destinations and with selected stakeholders;

- Recommended approach for the development of 'responsible citizenship' guidelines for different sectors and target audiences, in particular: children and students, tourists, municipal authorities and local communities, shipping companies, ship and smaller vessels crews; commercial and recreation fishing vessels, and other identified target groups;

- Recommended approach for the development of professional sectorial guidelines for the wise management of marine litter (*e.g.*, tourism, boating, diving, cruise lines, fisheries, coastal construction);

- Recommended approach for the development of Plans for the improvement of port reception facilities and services for garbage collection from the shipping and fishing industries;

- Suggested strategies and approaches for funding high cost initiatives (such as port reception facilities, landfills, fisheries, etc.), These should include approaches to the World Bank, Regional Investment Bank, Global Environment Facility (GEF) and other international financing institutions.

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2. APPROACH TO THE STUDY & STRUCTURE OF THE REPORT

2.1 APPROACH TO THIS REGIONAL STUDY

This Phase I assessment contributes to the foundation for the formulation of strategies for sustainable management of marine litter in the Western Indian Ocean Region, particularly in the participating countries of Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa and Tanzania.

The main objective of this assessment is to understand the current status of the marine litter problem and how it is dealt with by the participating countries in the West Indian Ocean Region, and to make practical recommendations for improvements.

As required by the terms of reference presented above; a questionnaire was designed to guide the national consultants from the participating nations in gathering as much relevant information as possible to allow the objective of this study to be met (the topic headings of the questionnaire are given in the Appendix **in Section 9** to this report).

The national consultants were expected to undertake desk-top studies and hold interviews with key informants to obtain the necessary information and data.

This report gives an integrated synthesis of the relevant information and data presented in the national reports on marine litter in the marine and coastal environments in the West Indian Ocean Region, and is supplemented by additional information obtained. Because the policy, law, institutional arrangements and Non Governmental Organisation programmes are evolving fast in most countries in the West Indian Ocean Region, this report concentrates on looking at the underlying causes of the huge variation in contributions to marine litter. This is done to focus the recommendations provided on aspects useful to the next phase of the United Nations Environment Programme's global initiative to deal appropriately with the growing marine litter problem.

2.2 KEY CONTRIBUTORS TO THE REGIONAL STUDY

The key contributors to the information used in this regional report are the national consultants from the participating Nairobi Convention countries; locations are indicated in the following schematic:

Mr. Jacob Ochiewo of Kenya
Mr. Cliff Gonzalves of Seychelles
Ms. Lilian Lukambuzi of Tanzania
Mr. Said Ahamada of Comoros
Mr. Marcos Pereira of Mozambique
Mr. Jogeeswar Seewoobaduth of Mauritius
Ms. Holy Rasolofojaona of Madagascar
Dr. Peter Ryan of South Africa

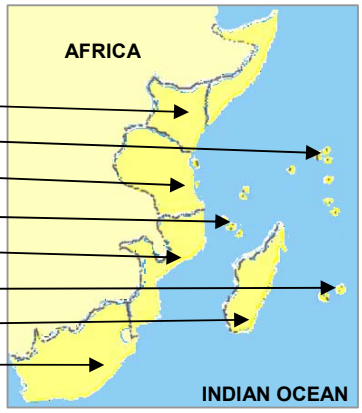

Figure 2.1 : Location of the countries of the contributing marine litter specialists.

The aforementioned consultants in turn drew on information provided by others in their countries. Contact details of contributors are given in the Appendix in **Section 8** to this report.

2.3 REPORT STRUCTURE

This report starts by setting the environmental context of why marine litter occurs in the West Indian Ocean Region and what happens to it. It explains why the land based and marine based sources of marine litter exist, and what the Oceanographic conditions are which disperse the litter (**Section #3**).

The next Section of the report synthesises the key points, from the national consultants reports, which will help answer the question of how well West Indian Ocean countries are currently able to deal with the marine litter problem, and where assistance appears to be needed (**Section #4**).

Information from the national consultants' reports on gaps in marine litter management systems and recommended priorities for action are presented. Socio-economic indicators are also examined to explain some reasons for differences between the West Indian Ocean countries, capacities to manage waste streams. Finally an objective analysis is made of the relative adequacy of waste management systems of each participating country to point out where the need for improvements could be focussed (**Section #5**).

Conclusions, and some thoughts about a recommended approach to addressing the marine litter problem in the West Indian Ocean Region, are presented in **Section #6.**

Appendices are provided with: contact details of the contributors to this report (**#7**); information requested from the national consultants (**#8**); demographic data of West Indian Ocean countries compared with other regions of the world (**#9**); the West Indian Ocean national consultants' recommendations for action (**#10**), and their country maps of the distribution of marine litter (**#11**).

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3. ENVIRONMENTAL SETTING: REGIONAL LITTER SOURCES & SINKS

This Section of the assessment of marine litter in the West Indian Ocean Region briefly sets the environmental context of why marine litter occurs in the region and what happens to it. This integrated regional perspective is drawn from information obtained by the regional consultant and corroborated by points raised by the national consultants.

3.1 LAND BASED SOURCES OF LITTER

The West Indian Ocean Region is not dissimilar from the rest of the world in that, reportedly, most marine litter is derived from land based sources as opposed to marine based sources. It should be noted though that the quantities of litter derived from fishing, mining and dumping at sea, and general shipping, are completely unknown so this statement cannot be verified.

Coastal populations traditionally tend to be concentrated at river mouths and areas suitable for the establishment of ports, and increasingly at other scenically important areas attractive to tourists. Industrial development has expanded into neighbouring areas to take advantage of opportunities for trade, tourism and other commercial activities opened up by ports. Hence coastal areas are relatively heavily populated.

The major land-based sources of marine litter are found to be:

- Waste from legal and illegal dumpsites located on the coast or on rivers;
- Rivers and floodwaters;
- Industrial outfalls;
- Discharge from storm water drains, untreated municipal sewerage, and
- Littering of beaches and coastal picnic/ eating areas.

3.1.1 Population Distributions

The fact that a great number of people live close to the edge of the Western Indian Ocean is illustrated in **Figure 3.1.** Although precise data are lacking best estimates indicate that more than 60 million people reside within 100km of the coast, about one-third of the region's total population (World Resources Institute, 2002).

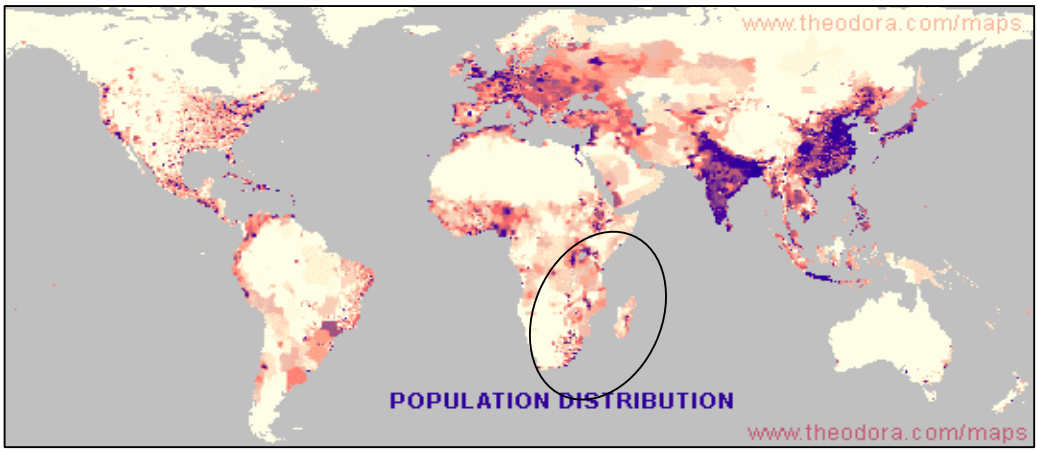

Figure 3.1 : Illustration of the population density within the West Indian Ocean Region, relative to the global population distribution (Source: www.Theodora.com/maps).

In most cases there is great dependence by coastal populations on marine resources for employment and for food security in the West Indian Ocean Region.

The size of the coastal populations of participating countries is broadly estimated as follows:

- Kenya has a population of 29 million people of whom 3 million people, i.e. about 10%, live in the coastal zone;
- Madagascar, a very large island, has an estimated 55% of its 18 million people living in the coastal zone;
- Mozambique has almost 66% of its 20 million people living close to the sea;
- South Africa has almost 33% of its 47 million people living on the east and south coasts.
- Tanzania has 23% of its population of 38 million residing in the coastal zone, mainly in three mainland cities and on the island of Zanzibar, and
- The small island states with their entire populations considered to be living at the coast; Comoros with 0.7 million, Mauritius with 1.3 million and Seychelles with 0.1 million.

3.2 MARINE SOURCES OF LITTER

The West Indian Ocean Region forms part of the greater Indian Ocean (**Figure 3.2**) which is the third-largest of the world's five oceans. As illustrated in the figure, the Indian Ocean is bounded by continents to the north, east and west. In the south its 'boundaries' are designated by cadastral lines vaguely delimiting discontinuities between the Indian Ocean and the Atlantic in the south west, the Pacific in the south east and the Antarctic Ocean at 60°S.

Figure 3.2 : Location of the West Indian Ocean Region (inner circle)

The Western Indian Ocean is a region of great natural diversity with a large variety of habitats and oceanographic conditions. The coastal and marine resources are used in a variety of ways by the populations of coastal states as well as by foreign visitors and vessels. One of the spin-offs of almost all activities in these coastal and marine areas is the production of persistent wastes which cause marine litter.

The major sea-based sources of marine litter are from shipping (merchant, public transport, pleasure, naval, research) and fishing (vessels, angling, fish farming) activities. These are discussed briefly below. To a lesser extent offshore mining (vessels, oil and gas platforms) and authorised dumping at sea also contribute to marine litter. These latter activities are not covered in this survey as they occur in known locations and presently appear to be relatively well regulated.

3.2.1 Shipping

The Indian Ocean provides major sea routes connecting Africa with the Middle East, Australasia, East Asia, the Americas and Europe. The maps in **Figure 3.3** illustrate examples of shipping lanes crossing the Indian Ocean. Owing to the nature of the ocean currents described in Section 3.3 garbage, and particularly plastics, dumped overboard almost anywhere in this ocean could contribute significantly to the marine litter problem in the West Indian Ocean Region.

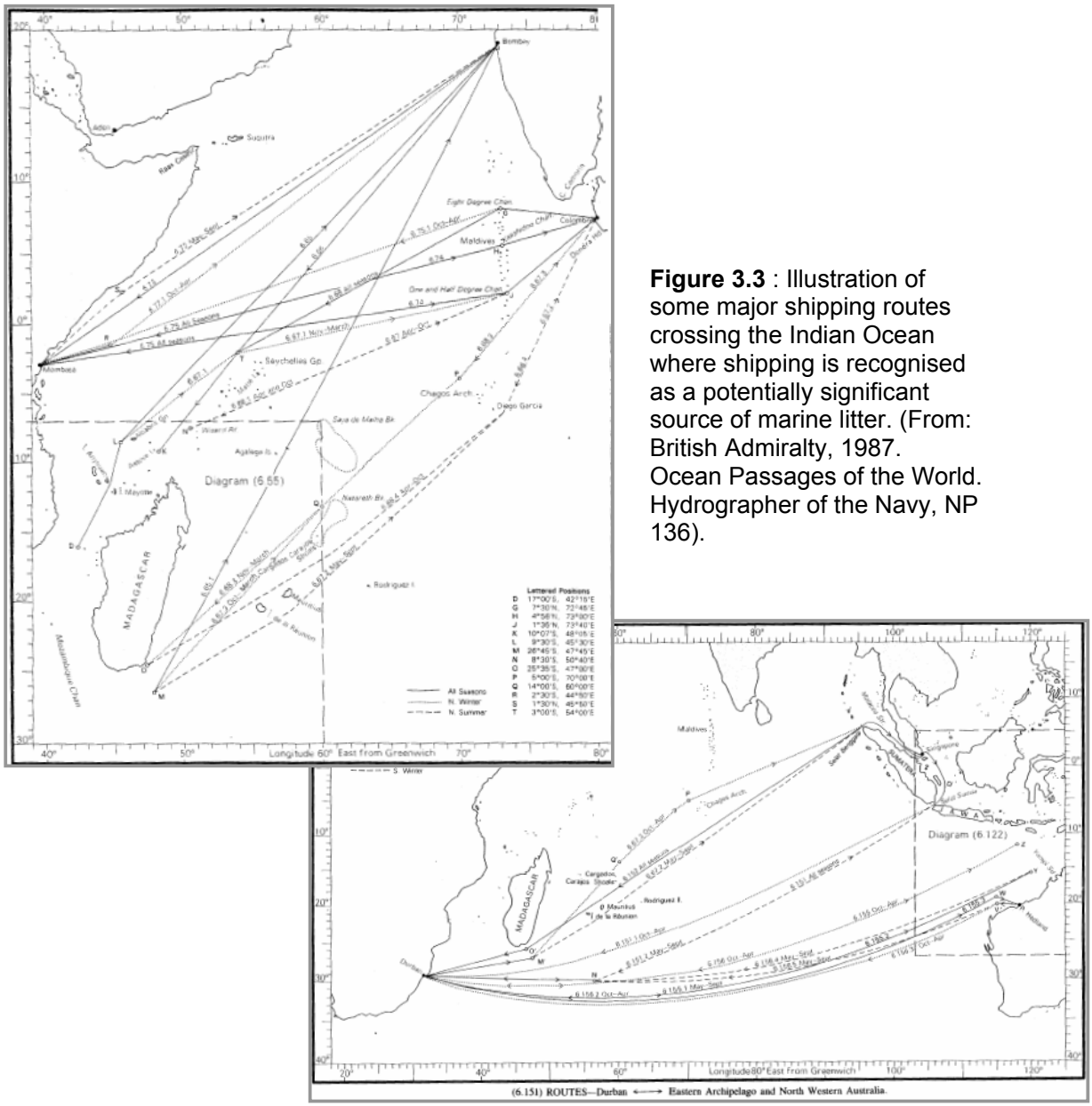

Figure 3.3 : Illustration of some major shipping routes crossing the Indian Ocean where shipping is recognised as a potentially significant source of marine litter. (From: British Admiralty, 1987. Ocean Passages of the World. Hydrographer of the Navy, NP 136).

3.2.2 Fishing

Another major contributor to marine litter in the West Indian Ocean is fishing. The region is intensely fished by local and, increasingly, foreign fleets. Foreign fishing is either conducted under trade agreements with governments or trading blocks such as the European Union or, alarmingly, by illegal fleets. According to Van Der Elst (2004) the West Indian Ocean remains one of few regions in the world where increased fish landings are still reported, and this is probably because of distant nation fishing fleets harvesting a greater proportion of their (high-value) catch in the 200-mile Exclusive Economic Zones of West Indian Ocean nations.

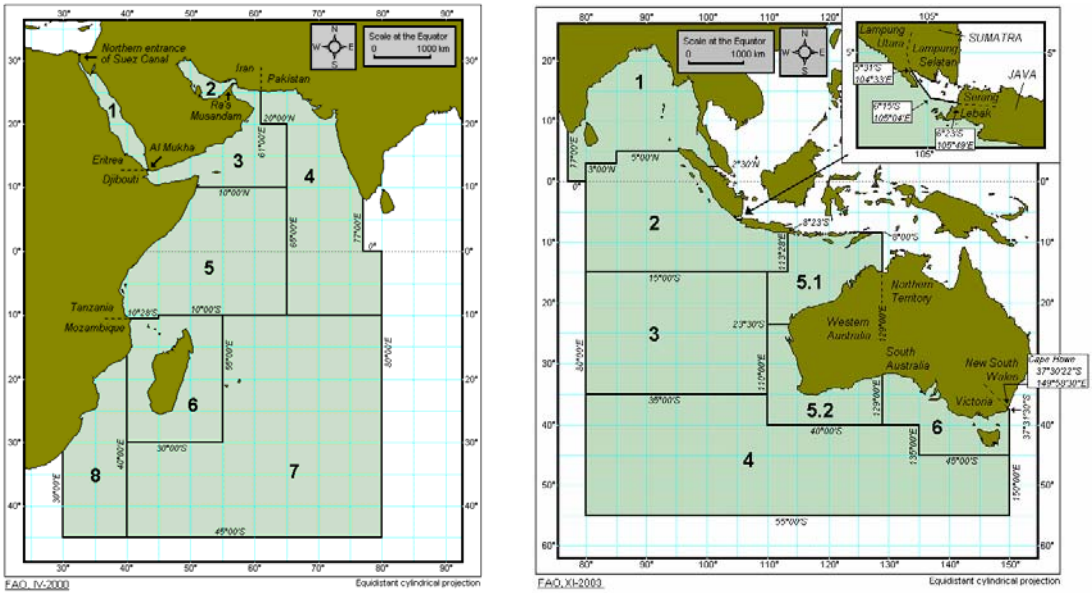

Figure 3.4: United Nations Food and Agriculture Organization maps of fishing regions in the Indian Ocean (time specific data are available on the FAO website). The West Indian Ocean Region is intensively fished, so fishing gear and garbage could be put into the ocean at any point and distributed over great distances by the prevailing ocean currents. (From http://www.fao.org/figis/ - Areas 51 & 57).

The local fisheries sector is an important contributor to the economies of most West Indian Ocean countries, for domestic consumption and export. For example, in Seychelles the fisheries sector generates 35% of foreign earnings, mainly tuna, and tourism generates 60% of earnings - and both potentially contribute to and suffer from the marine litter problem. Further, most coastal populations would depend on marine resources for survival in times of drought and socio-economic instability.

3.3 DISPERSION OF MARINE LITTER

In this section a brief overview of environmental aspects that would influence the dispersion of marine litter in the West Indian Ocean is provided - these are regional scale topography, wind and ocean currents.

The bathymetry or sea bed topography of the Indian Ocean, which influences ocean currents and hence marine litter distribution and deposition areas, is illustrated in **Figure 3.5**.

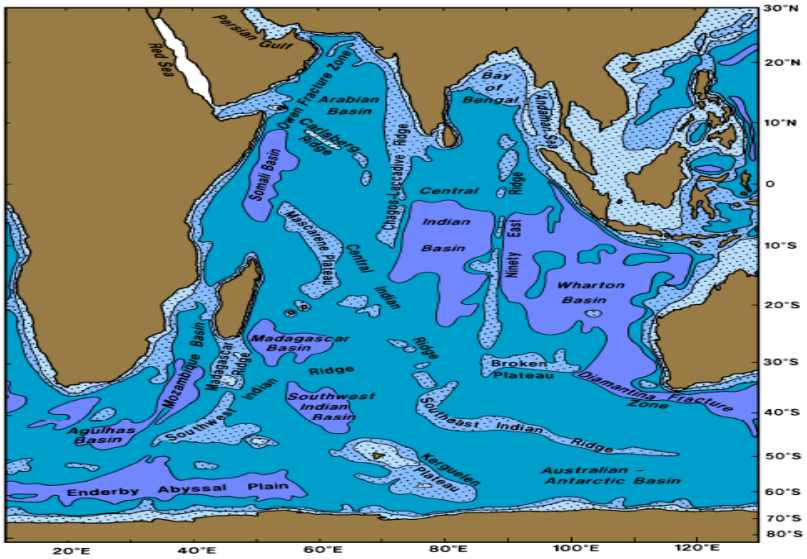

Figure 3.5: Topography of the Indian Ocean. The 1,000, 3,000 and 5,000 meter isobaths are shown, and regions less than 3,000m deep are shaded (From Tomczak and Godfrey, 1994).

Winds and currents: Very broadly, the dominant flow pattern of ocean currents in the south of the West Indian Ocean Region is anti-clockwise, whereas the currents in the northern areas flow clockwise and anti-clockwise (see **Figures 0.1 and 3.10**) depending on the monsoon seasons.

In the northern areas of the West Indian Ocean. the monsoon reverses the currents because of the wind cycles illustrated in **Figure 3.6** below.

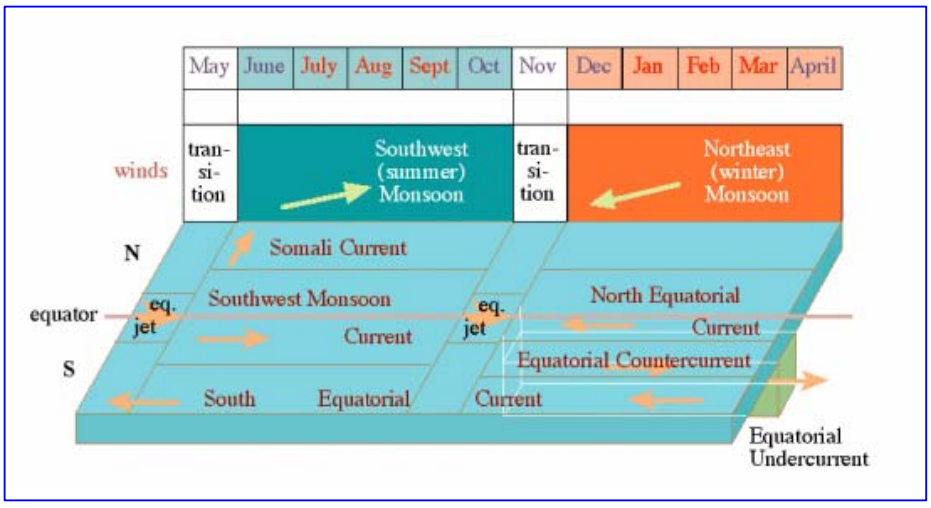

Figure 3.6 The top part of the Figure describes the wind cycle; the lower part shows the major currents that develop in response to the winds (From: Tomczak and Godfrey, 1994)

These latter winds and currents would significantly affect predictions of marine litter distribution in the Seychelles, and to a lesser extent Kenya and northern Tanzania.

(Seychelles reports litter accumulation on the east coast of Mahe during the southeast monsoon, whereas during the northwest monsoon the litter is presumably distributed to sea).

Further, deep water circulation is controlled primarily by inflows from the Atlantic Ocean, the Red Sea, and the Antarctic, and the south western area contains at least 4 layers of water masses with different sources (McCave, 2004).

In fact, as is evident the currents throughout the Indian Ocean are complex. Some change direction with the seasons and many consist of eddies The currents are variable and are not fully understood. This means that nobody can be 100% certain where the litter that is dumped into the Indian Ocean will eventually be deposited, but some trends in deposition of marine debris have been established.

Figures 3.7 A & B below illustrate some of the complexities of water circulation in the southern areas of the Indian Ocean.

3.7A **3.7B**

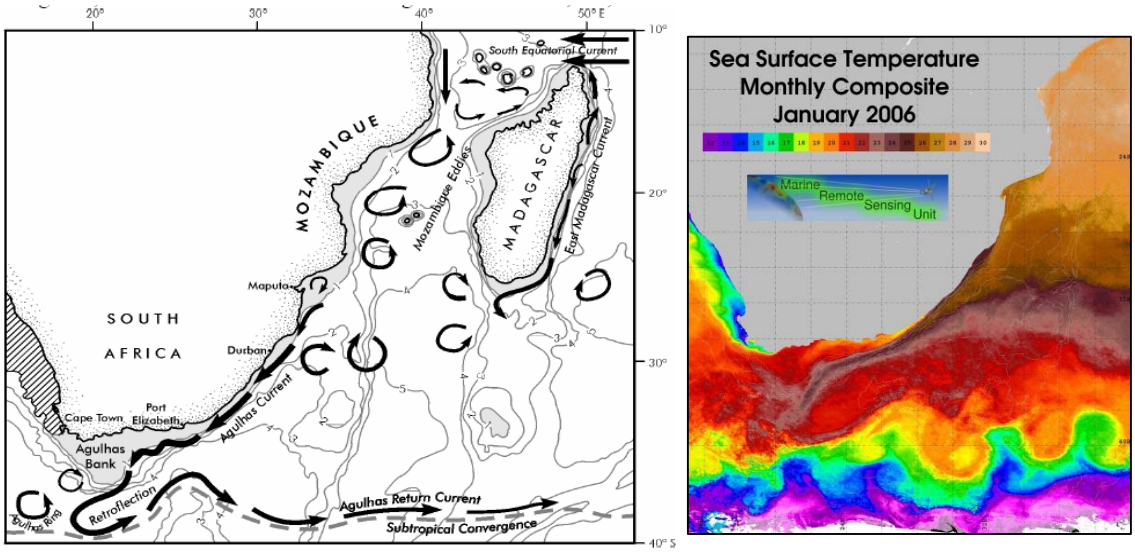

Figure 3.7A : Bathymetry of the south west Indian Ocean (after Dingle et al., 1987a and Simpson, 1974) and the major circulation features, including eddies. Shelf regions shallower than 1 km deep are shaded (hatching on the west coast of South Africa indicates up-welling). **Figure 3.7B :** Surface current movement deduced from satellite images of temperature (SIES, 2006).

Some evidence of the large scale flow pattern in this area has been obtained from the drift of scientific instruments and small polythene drift cards. Items deployed on the east coast of South Africa have been recovered 30 months later on the south coast of Mozambique, presumably having been carried anti-clockwise around the southern Indian Ocean Gyre; items deployed off the west Australian coast have been retrieved on the South African east coast (Gründlingh, 1989). **Figure 3.8** shows the large scale circulation patterns across the southern Indian Ocean between Africa and Australia.

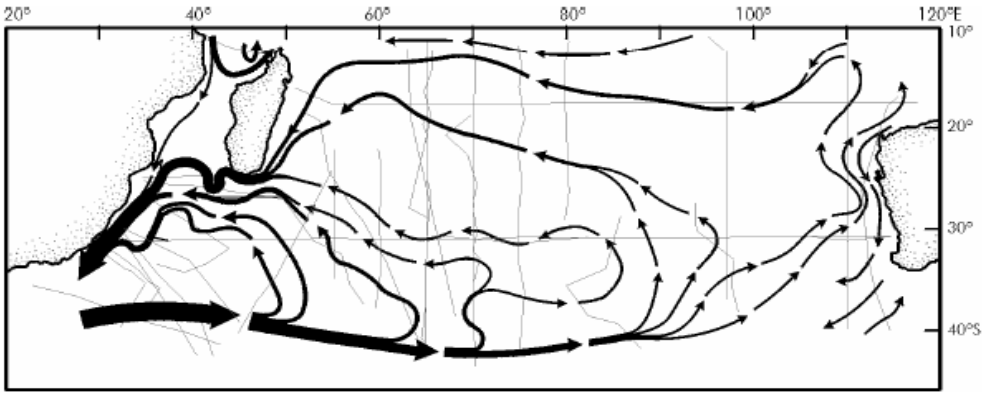

Figure 3.8 : Circulation patterns of the south west Indian Ocean. (After Stramma and Lutjeharms, 1997). The thickness of the lines denotes the volume flux in the upper 1 500m. Thin lines indicate lines of historical hydrographic stations on which the portrayal is based. The Agulhas Current along south-eastern Africa is largely supported by recirculation in a south west Indian Ocean subgyre.

A report by Gründlingh, 1989, on the drift of flotsam from the aircraft "SAA Helderberg" wrecked north-east of Mauritius in November 1987, proposed that objects entering the ocean east of Madagascar and south of about 15°S would initially move westward or southward either inside or adjacent to the East Madagascan Current, and subsequently pass westwards south of the island (**Figure 3.9).** There is however a large variability in the flow south of Madagascar so this is not always the case. Eventually the marine litter would probably be swept southward by the fast-moving flow and carried along by the gyre in the south Indian Ocean as illustrated in **Figure 3.10**.

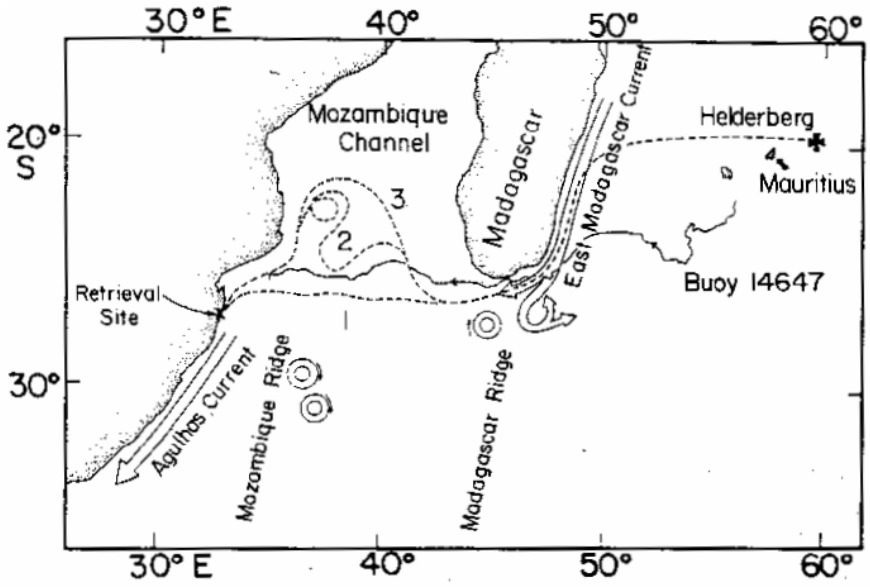

Figure 3.9 : Relevant circulation features in the south-west Indian Ocean, including eddies south of Madagascar and at the Mozambique Ridge. Three postulated courses of wreckage drifting between the aircraft accident site ✤ and the retrieval site are indicated with dashed lines, as well as the observed course of a satellite-tracked buoy no. 14647. (Gründlingh, 1989).

Some other pertinent points about the dispersion of litter by the currents in the West Indian Ocean Region are that:

- Most land based and some marine based litter that enters the ocean ends up back on beaches. This is because the predominantly onshore winds and wave capture zones make beaches a "net capture area" of particulates in the sea.
- Most of the currents in the Indian Ocean are fed by other currents so marine litter 'dumped' offshore could end up being transported from one current to another (See **Figures 3.10** for surface currents **& Figure 3.11** for winds).
- During the Northeast Monsoon season the Somali current is relatively close to the coast and its speed is 0.7 - 1.0m/s. This makes it possible that marine litter dumped off-shore in the north of the West Indian Ocean Region can be deposited particularly on the northern Kenyan coast during this season (see country report).
- It is also possible that litter can be transported to and deposited on the Indian and Australian coasts throughout the year as the currents are situated very close to the coast in these areas.

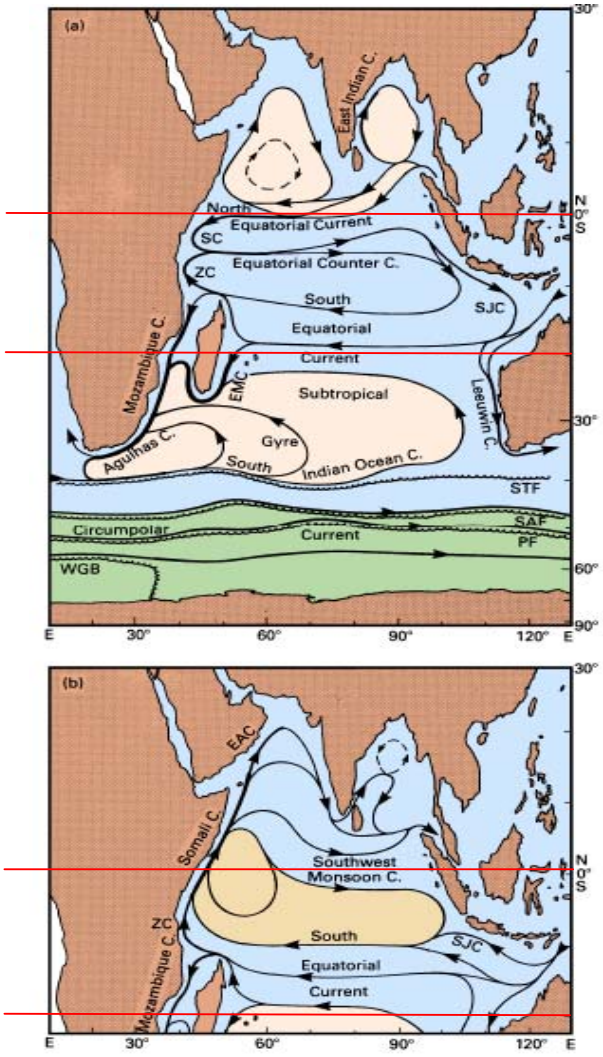

Figure 3.10 : Surface currents in the Indian Ocean.

Top: late Northeast Monsoon season (March-April).

Bottom: late Southwest Monsoon season (September to October);

The circulation south of 20°S remains unchanged.

Abbreviations are used for the East Arabian (EAC), South Java (SJC), Zanzibar (ZC), East Madagascar (EMC), and Somali (SC) Currents.

Other abbreviations denote fronts: Subtropical Front (STF), Subantarctic Front (SAF), Antarctic Polar Front (PF), and Weddell Gyre Boundary (WGB).

(From Tomczak and Godfrey, 1994).

Red lines = equator & 20°S

- It can be inferred from Gründlingh (1989) that if a gyre touches the coast it is possible litter will be deposited along the shore. Deposition will depend on the velocities of the current. Higher current velocities are less likely to deposit litter than lower velocities.
- The oceanic gyre of the south Indian Ocean generally touches Madagascar, the southern Mozambique and northern KwaZulu-Natal coasts, which is where objects floating in the southern ocean areas could be deposited. Most deposits are reported from northern KwaZulu-Natal southwards to the coast of Port Elizabeth. Other litter reaches the Australian coast.
- If marine litter enters the sub tropical gyre, and sinks due to marine organisms growing on it, it should sink near the centre of the gyre where velocities are very low.
- Other weather patterns affecting the distribution of marine litter include:
  -The annual cyclones which cause shipwrecks and wreak havoc on informal constructions and open pit dump sites on the coast in Madagascar, and
  -The severe floods in Kenya, Tanzania and Mozambique which break river banks and carry everything 'moveable' from land into the sea.

Figure 13.11 illustrates wind patterns in the build up to the cyclones which affected Madagascar and Mozambique in mid-March 2007.

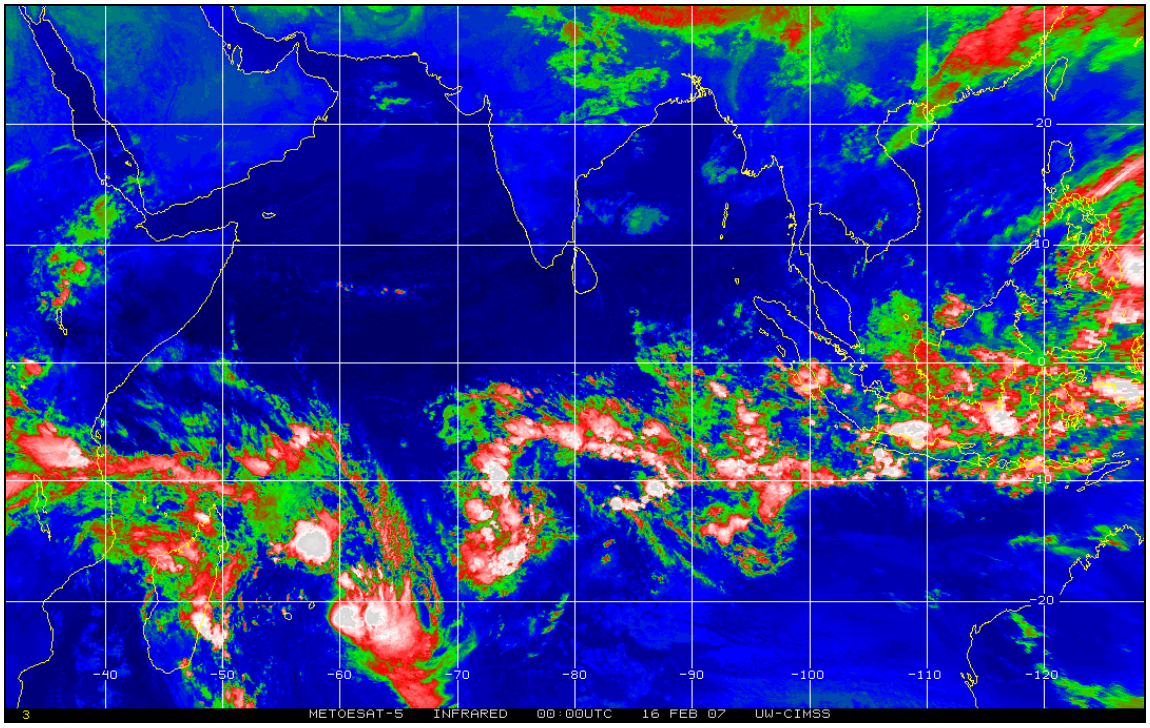

Figure 3.11 : Infra red depiction of winds over the Indian Ocean (Meteosat 5, 16 February 2007).

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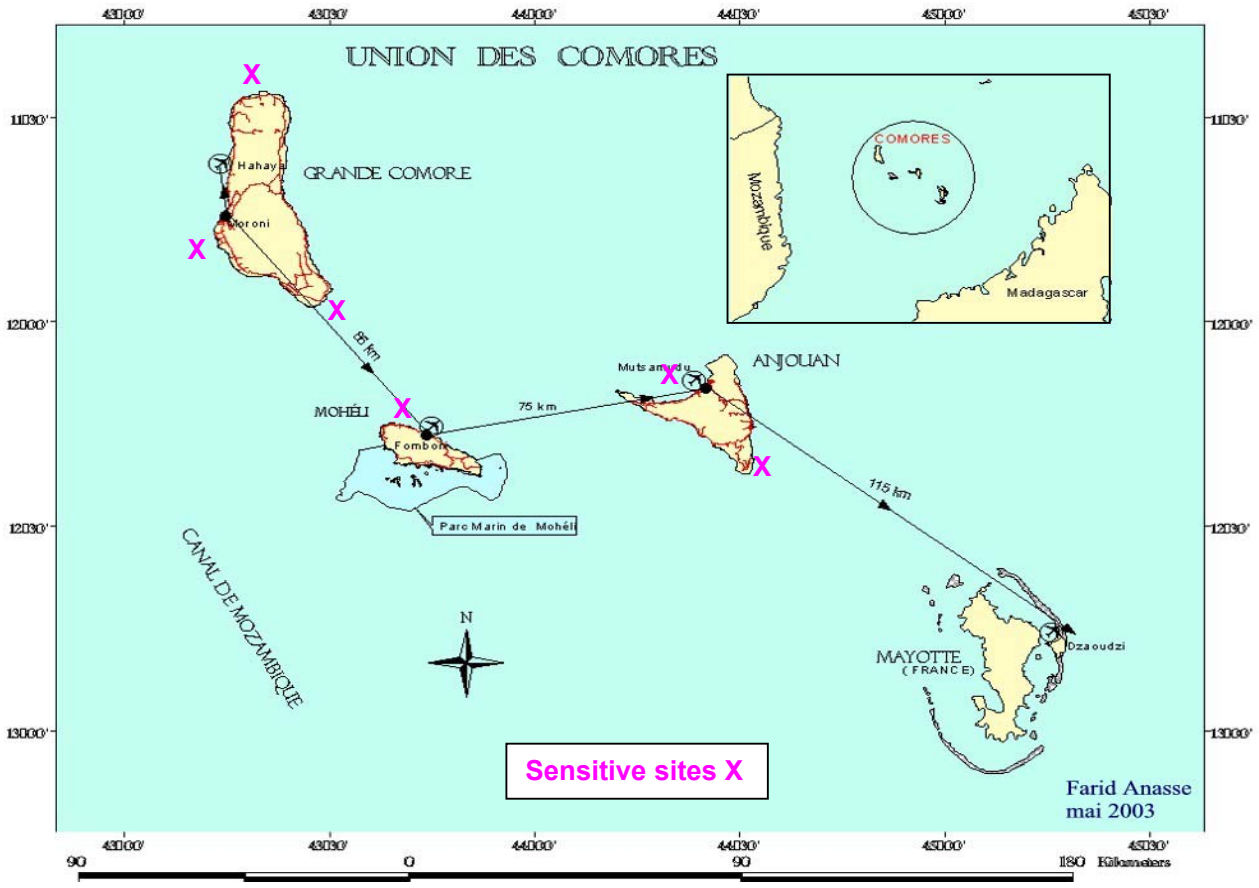
12. APPENDIX: COUNTRY MAPS OF MARINE LITTER DISTRIBUTION

COMOROS



KENYA

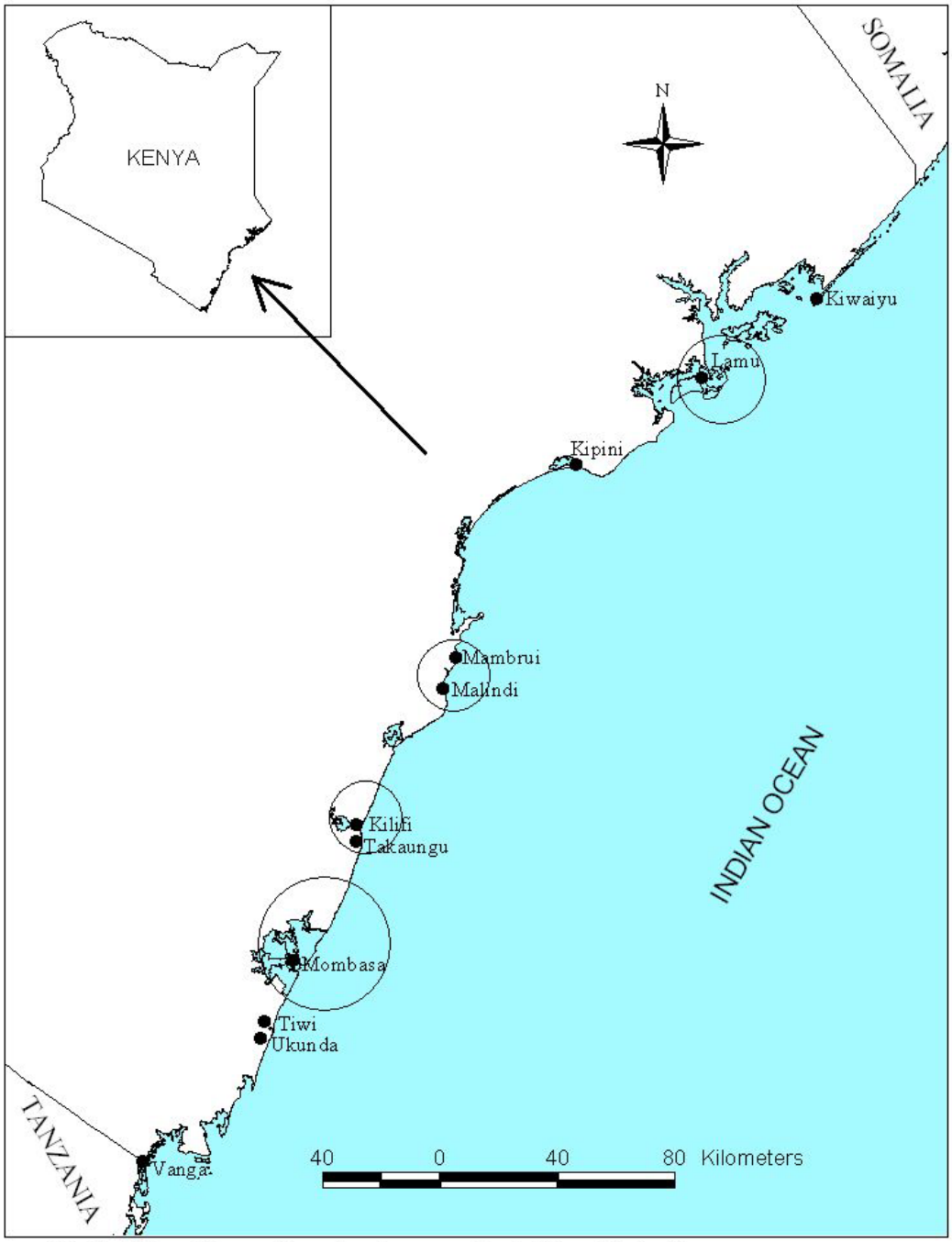
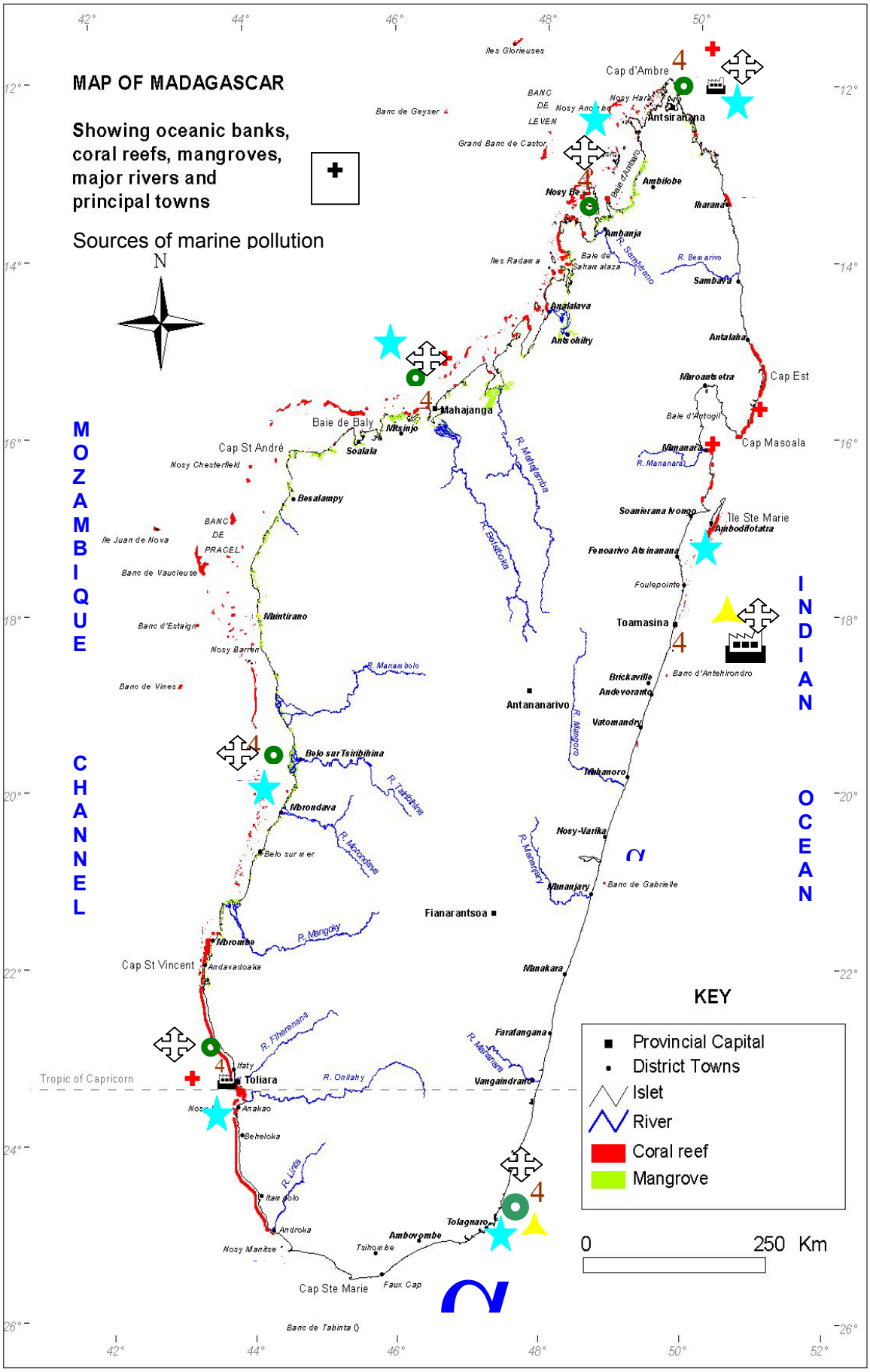


Fig. 1: A Map of Kenyan Coast showing areas with significant Marine Litter.

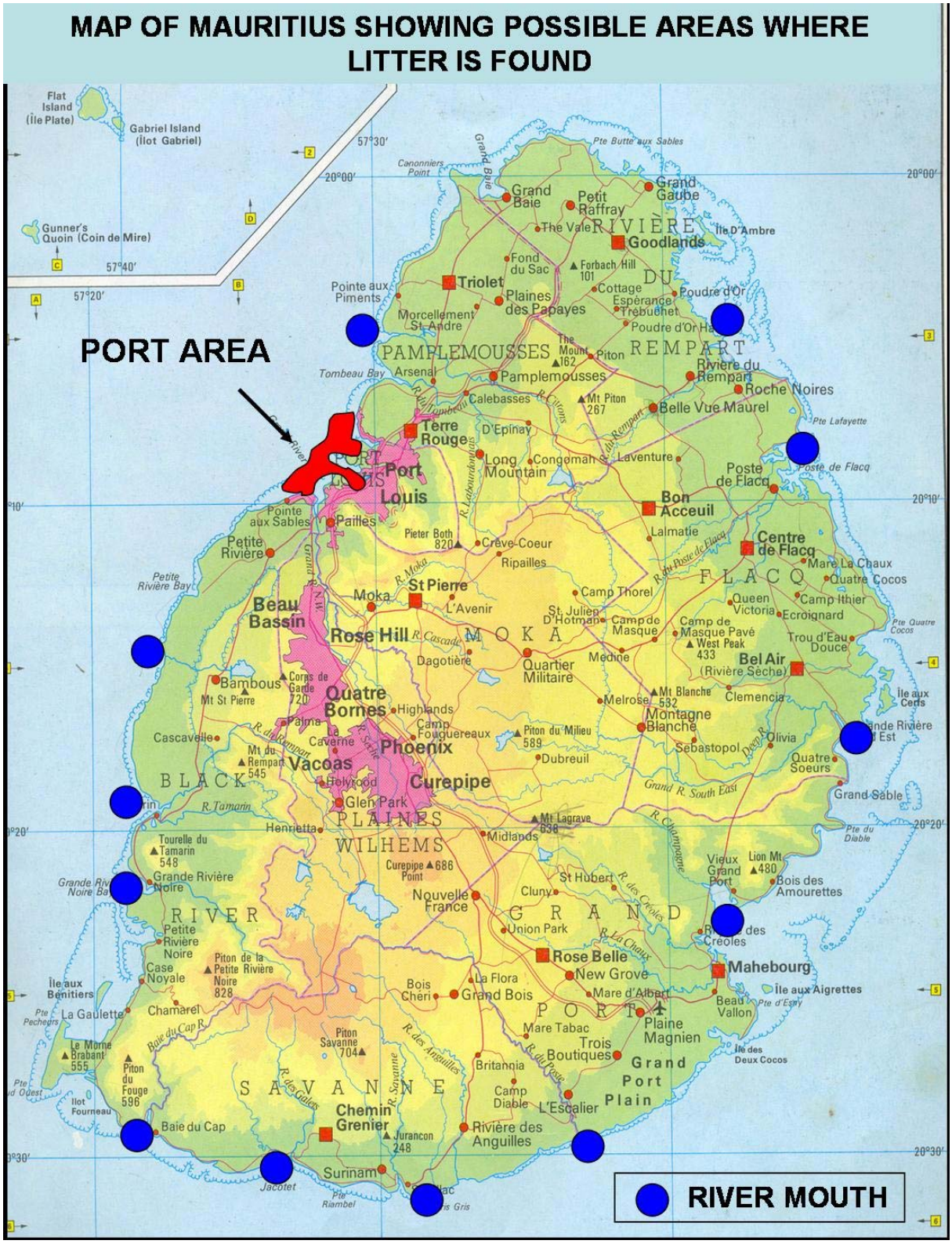
MADAGASCAR-1

Key to map symbols used:

	: Sea oil spill = **Marine-Based Sources** legal & illegal discharge (harbour) Litter?		: Industrial discharge
	: Household waste, market waste		: Hospital waste
4	: Excreta		: **Land-Based Sources** (excreta, household waste, etc.)
	: Wastewater discharge (domestic and others)		: Recreation area (beach)


MAP OF MADAGASCAR
Showing oceanic banks, coral reefs, mangroves, major rivers and principal towns
Sources of marine pollution
N
MOZAMBIQUE CHANNEL
INDIAN OCEAN
Cap d'Ambre
Antsiranana
Nosy Be
Ambilobe
Iharana
Ambanja
Sambava
Antalaha
Cap Est
Maroantsetra
Cap Masoala
Mahajanga
Mitsinjo
Baie de Baly
Soalala
Cap St André
Nosy Chesterfield
Besalampy
Maintirano
Nosy Barren
Belo sur Tsiribihina
Mahajanga
Mitsinjo
Soalala
Besalampy
Maintirano
Mahajanga
Mananara
Soanierana Ivongo
Ile Ste Marie
Ambodifotatra
Fenoarivo Atsinanana
Foulepointe
Toamasina
Brickaville
Andevoranto
Vatomandry
Mahanoro
Antananarivo
Mbrondava
Belo sur mer
Nosy-Varika
Morondava
Manjary
Fianarantsoa
Mbrombe
Andavadoaka
Cap St Vincent
Manakara
Farafangana
Vangaindrano
Toliara
Tropic of Capricorn
Anakao
Beheloka
Itampolo
Androka
Nosy Manitse
Tolagnaro
Ambovombe
Tsihombe
Cap Ste Marie
Faux Cap
Banc de Tabinta
Banc de Geyser
Grand Banc de Castor
BANC DE LEVEN
Nosy Hara
Baie d'Antsiranana
Iles Radama
Baie de Saharnalaza
R. Sambirano
R. Bemarivo
Analalava
Antsohihy
R. Mahajamba
R. Betsiboka
R. Mananara
Baie d'Antogil
Banc de Vaucleuse
Banc d'Estaing
Banc de Vinces
Ile Juan de Nova
BANC DE PRACEL
R. Manambolo
R. Tsiribihina
R. Morondava
R. Mangoky
R. Fiherenana
R. Onilahy
R. Linta
R. Mananjary
R. Matitanana
R. Mangoro
Banc de Gabrielle
KEY
Provincial Capital
District Towns
Islet
River
Coral reef
Mangrove
0
250 Km
42°
44°
46°
48°
50°
52°
12°
14°
16°
18°
20°
22°
24°
26°

MAURITIUS


MAP OF MAURITIUS SHOWING POSSIBLE AREAS WHERE LITTER IS FOUND
PORT AREA
RIVER MOUTH
Flat Island (Île Plate)
Gabriel Island (Ilot Gabriel)
Gunner's Quoin (Coin de Mire)
Port Louis
Grand Baie
Petit Raffray
Grand Gaube
Goodlands
Triolet
Pointe aux Piments
Plaines des Papayes
Pamplemousses
Rivière du Rempart
Roche Noires
Belle Vue Maurel
Terre Rouge
Long Mountain
Poste de Flacq
Bon Acceuil
Centre de Flacq
Pointe aux Sables
Pailles
Petite Rivière
St Pierre
Beau Bassin
Rose Hill
Quatre Bornes
Phoenix
Vacoas
Curepipe
Moka
Camp Thorel
Bel Air (Rivière Sèche)
Montagne Blanche
Mahebourg
Rose Belle
New Grove
Plaine Magnien
Grand Port
Savanne
Chemin Grenier
Rivière des Anguilles
Surinam
Baie du Cap
Black River
Plaines Wilhems
Grand Port
Flacq
Moka
Pamplemousses
Rempart
Port
Savanne

MOZAMBIQUE-1

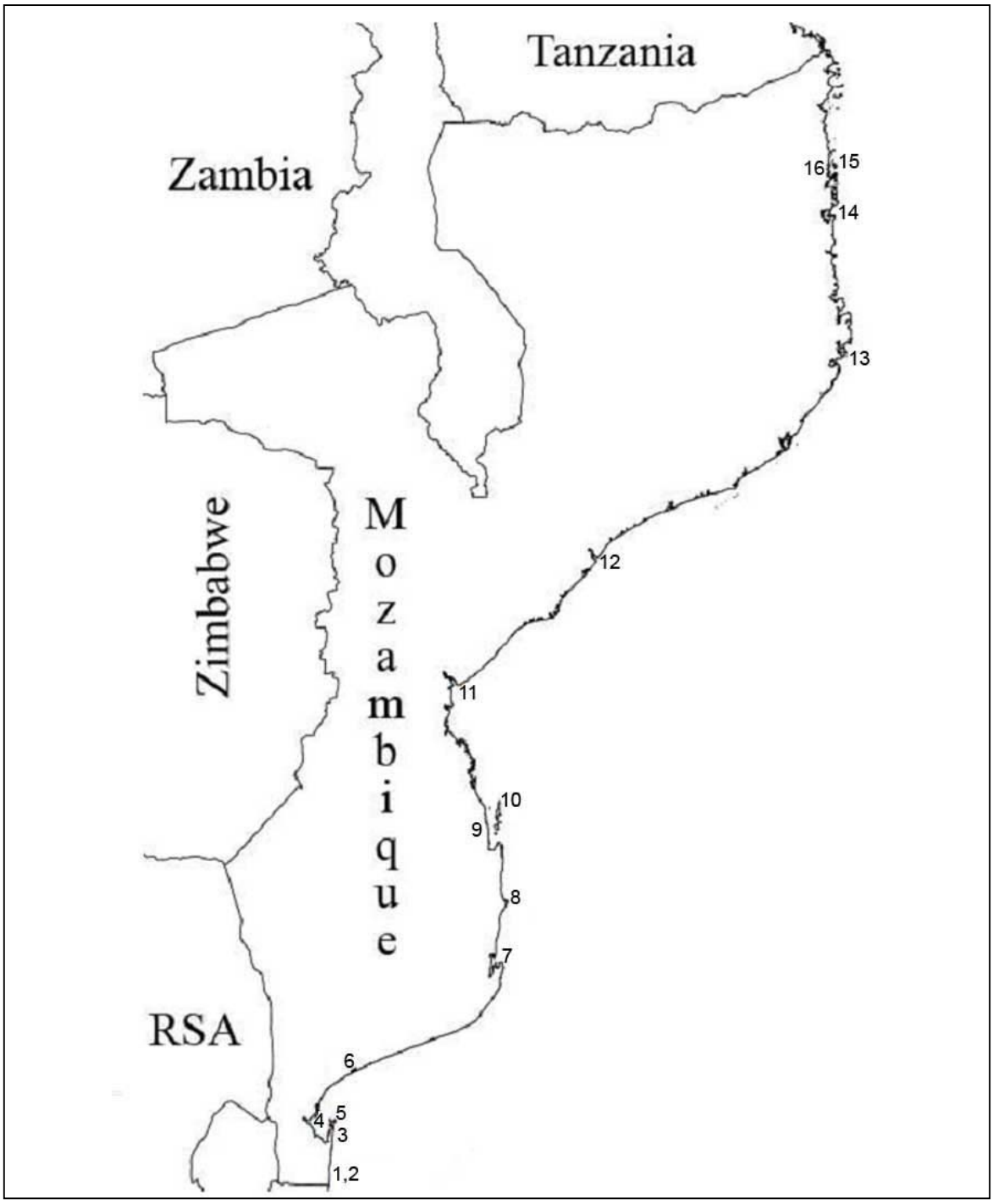


Figure 2. Location of sites, along the Mozambican coast, where information on marine litter is available. 1–Ponta do Ouro; 2–Ponta Malongane; 3–Machangulo peninsula; 4–Maputo; 5–Inhaca Is.; 6–Xai-Xai; 7–Tofo; 8–Pomene; 9–Vilankulo; 10 – Bazaruto Is.; 11–Beira; 12–Zalala; 13–Mozambique Is.; 14–Pemba; 15 – Ibo Is., 16–Quissanga. Data on quantities and impacts are presented in **Table 1**.

MOZAMBIQUE-2

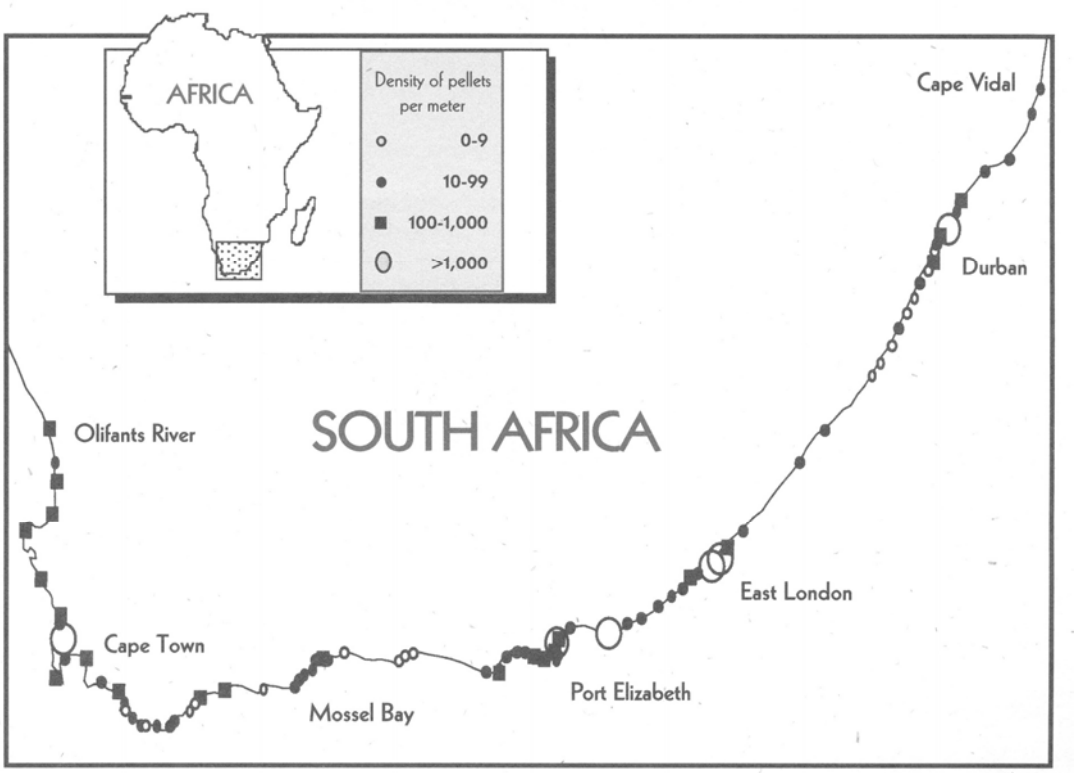
Table 1. Summary of available data on marine litter along the Mozambican coast. The data were compiled from the literature*, personal observations# and also from a questionnaire▽ distributed to tourist operators (Annex 1 in the country report).

Area	Litter types	Litter sources	Impact
1 – Ponta do Ouro▽	Plastics, cans and glass (bottles)	Beach users, garbage from shipping	Aesthetics, but largely negligible
2 – Ponta Malongane *	Litter types: Plastics (368.7 g/100 m^2); glass (786.3 g/100 m^2); cans (732.5 g/100 m^2); others (418.7 g/100 m^2); total (2306.2 g/100 m^2)	Garbage from shipping, beach users	Beach aesthetics, but largely negligible
3 – Machangulo Peninsula▽	Mainly high density plastics and foams	Garbage from shipping	Beach aesthetics
4 – Maputo * #	Plastics (368.7 g/100 m^2); glass (786.3 g/100 m^2); cans (732.5 g/100 m^2); others (418.7 g/100 m^2); total (2306.2 g/100 m^2)	Beach users, garbage from shipping, storm water	Beach aesthetics; public health
5 – Inhaca Is. *▽	Litter types: Mainly plastics (40 large bin bags per 500 m of beach); fishing gear entangled on reefs	Mainly garbage from shipping, lost fishing gear (anchors, lines, ropes)	Beach aesthetics
6 – Xai-Xai beach▽	Cans, glass (bottles) and plastics	Beach users	Beach aesthetics, but negligible
7 – Tofo▽	Cans, glass (bottles)	Beach users	Beach aesthetics, but negligible
8 – Pomene▽	Plastics, human and animal faeces	Garbage from shipping and local settlements	Beach aesthetics and public health
9 - Vilankulos▽	Plastics, cans, cloth, rubble	Beach users, local settlement, road users	Beach aesthetics
10 – Bazaruto Is. ▽	Mainly plastics	Garbage from shipping, local settlement	Beach aesthetics
11 – Beira (mainly Praia Nova) #	Human faeces, wood, plastics	Local market, beach users, local shipyard	Public health (Praia Nova), negligible elsewhere
12 – Zalala #	Cans, glass (bottles) and plastics	Beach users	Beach aesthetics, but largely negligible
13 – Mozambique Is. #	Human faeces, plastics	Local settlement	Beach aesthetics, low tourism and public health
14 – Pemba #	Cans, glass (bottles) and plastics	Beach users	Beach aesthetics, but negligible
15 – Ibo Is. #	Plastics, domestic waste	Local settlement	Beach aesthetics
16 – Quissanga #	Human faeces, cans, broken glass	Local settlement	Beach aesthetics and public health

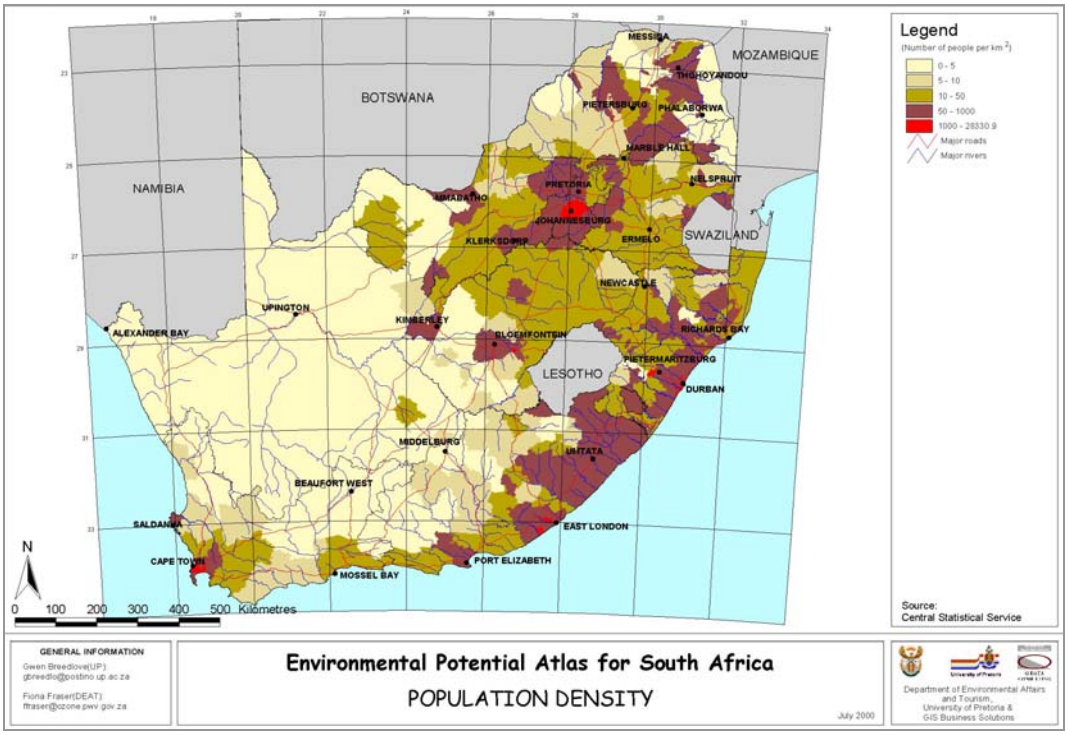
SEYCHELLES

The main island of Mahe. The areas where one encounters marine litter are depicted in red. There is also picknicking on some inner islands such as Cerf Island and it is not uncommon for waste to be left on beaches. The litter is reported to have a relatively low impact.

SOUTH AFRICA-1

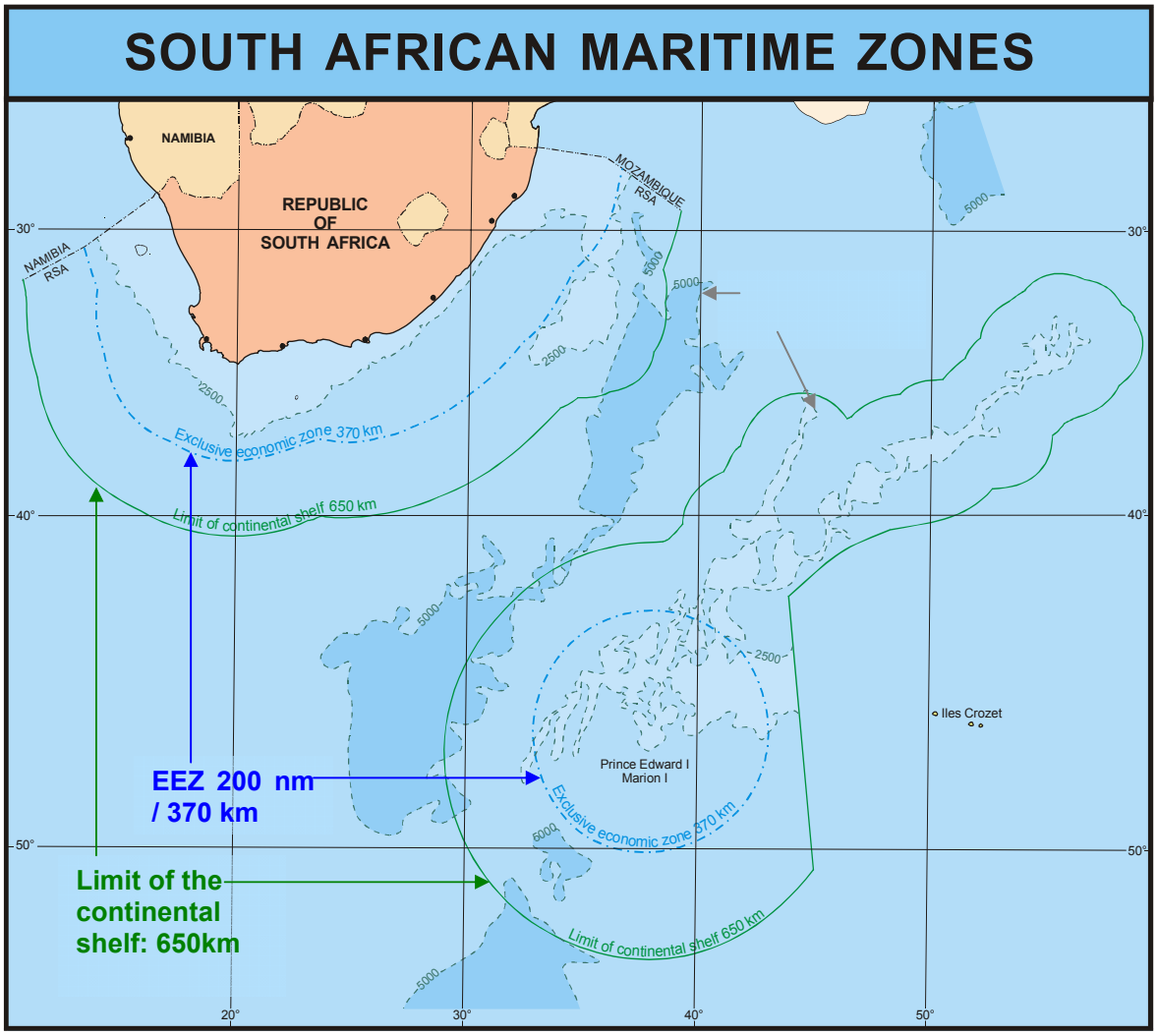


Distribution of **industrial pellets** around the South African coast in 1994, showing concentrations around coastal urban centres (from Ryan & Swanepoel 1995). Maps of other litter types can be generated on request.



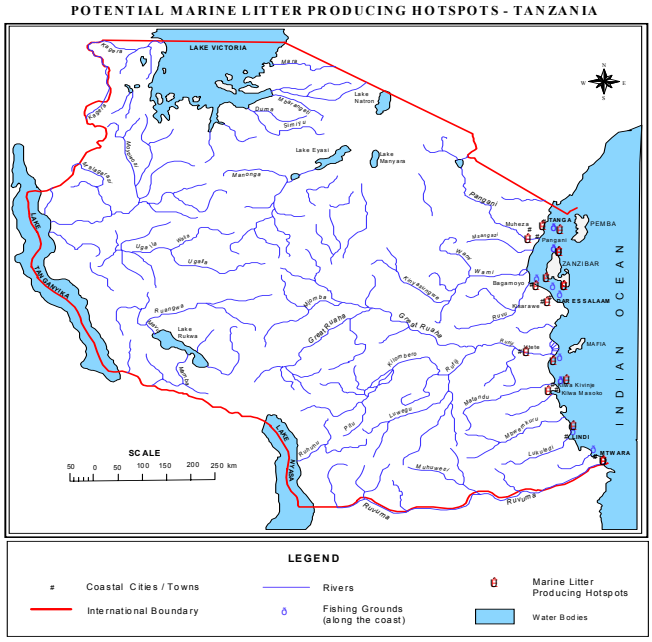
Population distribution relative to the coast in South Africa

SOUTH AFRICA-2

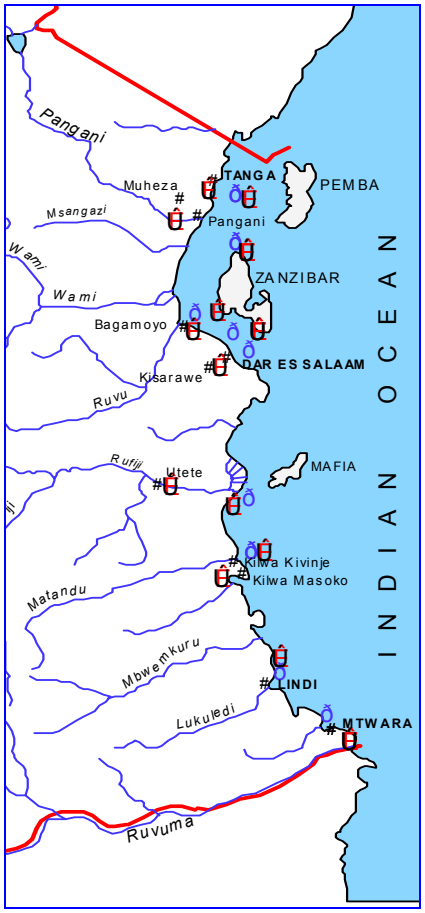


Extent of South Africa's maritime zones which need to be policed to prevent garbage disposal, relative to the land area.

TANZANIA -1

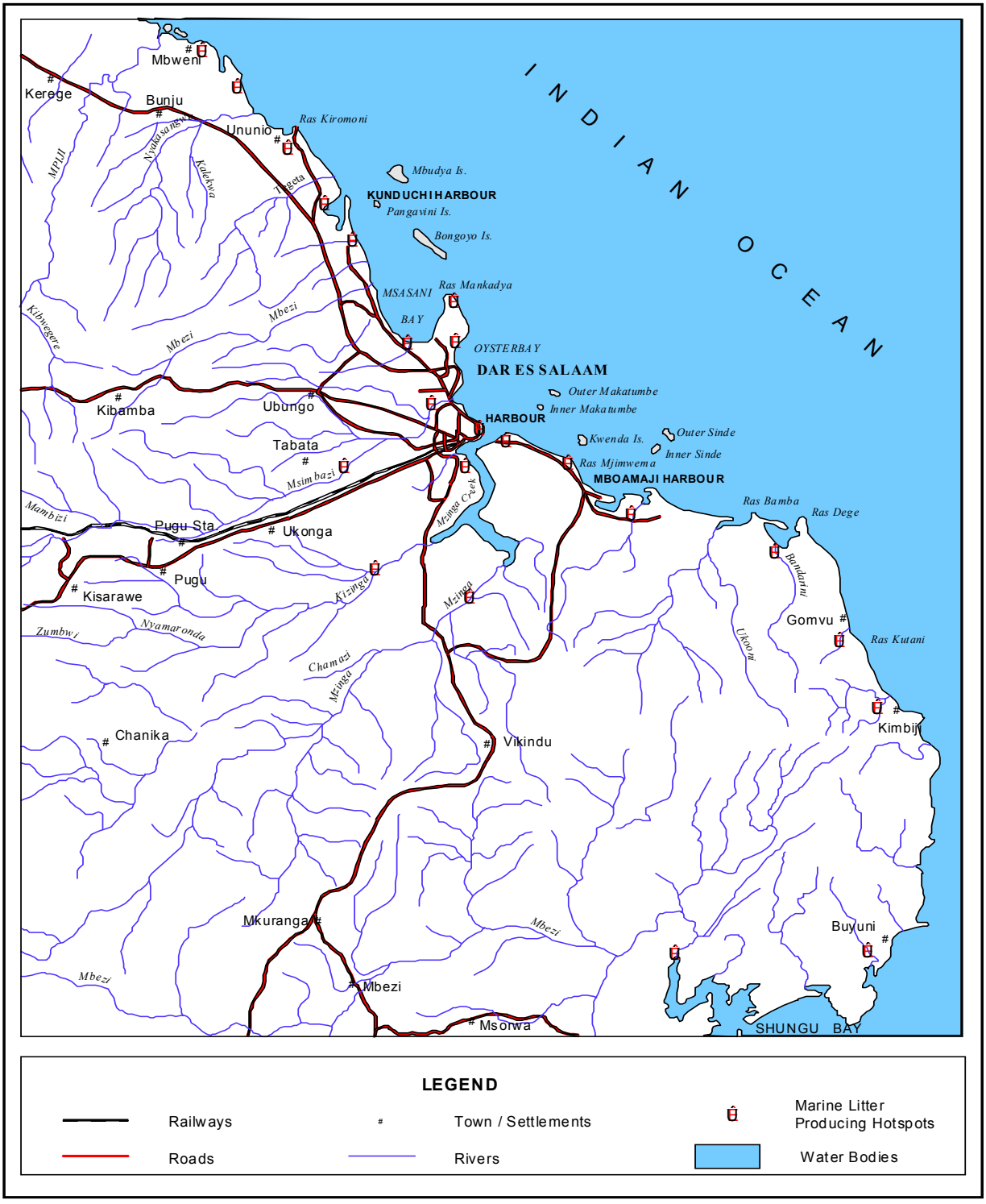


A map showing some of the potential sources of marine litter in Tanzania



TANZANIA-2

POTENTIAL MARINE LITTER PRODUCING HOTSPOTS - DAR ES SALAAM



A map showing some of the potential marine litter sources in Dar es Salaam

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4. SYNTHESIS OF KEY POINTS FROM EACH COUNTRY

This section is drawn from points raised by the national consultants and supplemented by other information obtained by the regional consultant.

It attempts to synthesise the essence of the national consultant's reports[2] and responses to a questionnaire **to answer key points** which are central to determining approaches which could be taken to address the marine litter problem in each country and in the West Indian Ocean Region as a whole.

It is presented to show the similarities and differences between the various countries responses to the specific points in question. More quantitative comparisons between countries would not be useful because of the current inadequacy of available data.

4.1 INFORMATION SOURCES ABOUT MARINE LITTER

As is made evident by the consultants there is a dearth of published quantified information about marine litter in all West Indian Ocean countries except South Africa. None of the participating countries has information about the magnitude of the litter problem in the sea. Accordingly it is not possible to provide accurate information about the true magnitude of the problem in any of the countries or the region as a whole. Despite this the national consultants have managed to provide very useful insights into the main causes and consequences of marine litter and how it could be dealt with in their countries.

Figure 4.1 A coastal clean-up exercise in Mombassa (Reference: WIO-2006 Kenyan national report)

Comoros	No specific studies have been carried out on marine litter. Information is from 6 general reports on pollution supplemented by the author's personal observations on land and while diving.

[2] The detailed country reports are available from UNEP.

Kenya	Information about marine litter was extracted from annual reports for the International Coastal Clean-up 2002-5, popular articles and State of the Environment Reports; this was supplemented by personal observation and key informant interviews.
Madagascar	Information was obtained from government reports on waste management in coastal areas, and key informant interviews. The country report states that surveys are scarce and statistics unreliable.
Mauritius	No specific studies have been conducted into marine litter; information is from government statistics on general waste, and from interviews conducted.
Mozambique	Only two quantitative surveys on marine litter have been done, both in the south of the country. Other information was obtained from the literature and field visits. Anecdotal information was obtained from tourist operators via key informant interviews and a questionnaire.
Seychelles	No references were used. Qualitative judgements are made based on interviews held and experience in the waste sector and cleaning programmes in place.
South Africa	Information is from numerous quantitative surveys, many in scientific journals and some from unpublished data, and key informant interviews. Based mainly on beach litter surveys a substantial amount is known about the abundance, distribution and trends of different types of litter around the coast - probably more than any other country in the West Indian Ocean region and Africa. Sources of litter are inferred rather than demonstrated. The magnitude of impacts of litter on the sea bed is largely unknown, and most impacts on economic resources have not been quantified.
Tanzania	There are no specific studies to assess or quantify marine litter. Some reports on general solid waste management, and key informant interviews, were used as data sources.

4.2 KEY AREAS WHERE MARINE LITTER IS FOUND, & KEY IMPACTS

As requested, the national consultants have supplied maps (attached in the **Appendix in Section 12**) to illustrate either the known or the potential geographic distribution of litter in their country. Quantification of abundance and of the resulting impacts is scarce, although all countries do report that socio-economic and bio-physical harm is done. None of the countries has indicated where litter is or could be distributed at sea within their Exclusive Economic Zones.

Comoros	Most litter is concentrated near urban areas. Litter collects on beaches and coral reefs. Impacts are reported to be evident on coral reefs and associated ecosystems (sea grass, mangroves, beaches) and on sea turtles and fish. Dumped medical wastes could also be hazardous.
Kenya	Marine litter is concentrated around urban areas. Impacts on human health, tourism and marine mammals are the main concerns. Oceanic litter occurs in the northern-most coastal areas (refer to Section 3.3 on ocean winds and currents).
Madagascar	Marine litter is found around urban areas. Other areas have not been investigated. The emphasis is put on negative impacts on human health, particularly, and on aesthetics and tourism.

Mauritius	Most litter is found in the port area and near river mouths. Litter blocks drainage systems and causes back-flooding. Divers report that lost anchors and fishing materials dumped at sea have damaged corals at certain sites. Plastics and other litter are abundant at known sites on the sea bed. Aesthetically these are an acute environmental eyesore to the public and tourists, and also a potential threat to public health. Solid waste in the port is reported to damage propellers.
Mozambique	Litter is found mainly on popular beaches, in major towns, at harbours and opposite markets; concerns expressed are about human health, aesthetics and tourism impacts. Areas exposed to oceanic influences (not protected by reefs) receive litter from vessels on the high seas, and from uncontrolled illegal fishing by foreigners.
Seychelles	There are reported to be well defined zones where litter collects, particularly in and around the capital city and sea port, and immediately to the north due to currents - for 6 months of the year. When currents change direction with the monsoon (see Section on ocean winds and currents) the destination of the flotsam is unknown. Very little impact is reported to occur because litter levels are kept very low on the islands.
South Africa	Litter is ubiquitous around the South African coast and in waters throughout the Exclusive Economic Zone. However, densities vary greatly, decreasing with distance offshore and with distance long shore from urban centres. Accordingly the highest concentrations are near urban centres, except that fishery wastes are only weakly correlated. Levels of ingestion by marine organisms and, perhaps to a lesser extent entanglement, are on a par with the highest recorded elsewhere in the world, with several threatened species affected. Levels of ingestion in some species of birds are among the highest recorded for any birds, and thus cause for concern. Quantities of litter are negatively correlated with the popularity of beaches used for recreation - litter discourages tourism.
Tanzania	Litter is highly abundant near coastal cities, and in fishing areas (see map in Section 12). Impacts are reported to be that marine organisms including coral are smothered, and that litter may jeopardise future tourism and fisheries developments.

4.3 THE PROPORTION OF PLASTIC / SYNTHETIC LITTER

All countries report that plastic, the most persistent and damaging of litter items, make up a significant proportion of the marine litter found. Data are quoted as either volumes or weights or numbers of items collected, and so are not accurately comparable between countries or even between litter collection programmes within the same country. All countries except Seychelles and Mauritius report some positive benefits specifically to poverty alleviation from reuse and recycling of litter. This is particularly so for plastics and particularly in the poorer sectors of society. Seychelles and Mauritius appear to have the most successful formal programmes for the recycling of waste plastics.

Comoros	In 1996 plastics were estimated to be 3% by weight of household refuse. (More than 60,000 tons of garbage was produced by households in 2000, excluding markets and commercial areas).

Kenya	The percentage of plastics in the waste stream is not specified, but it appears that about 40% of items recovered on beaches are synthetics.
Madagascar	No measurements of marine litter have been made but there is evidence that 100m^3 of plastics per day are collected in one coastal city's garbage stream.
Mauritius	About 50 tonnes of wastes are collected from the beach and port areas per day, and the composition is generally about 70% plastics, mainly Polyethylene Terephthalate (PET) bottles.
Mozambique	Although no marine litter measurement is done, plastics are reported to be one of the most common litter items observed on beaches.
Seychelles	Approximately 56% of litter items in a waste analysis done at the Old Port were found to be plastics.
South Africa	Plastics comprise up to 89% of litter items, 60% in mass, found on beaches; 80% of items found on a seabed survey were plastic.
Tanzania	Plastics are quoted to make up 6% by weight of non food wastes in Zanzibar, and 3.4% in Dar es Salaam (3.4 tons/ day).

Figure 4.2 Plastic waste piles in the Mtoni dumpsite in Dar es Salaam. (It is understood that residents requested the City Council to create this dump site to stabilise the land and protect their houses from erosion. Fencing to prevent the waste from being washed into the Indian Ocean was stolen and sold as scrap iron). (Reference: WIO-2006 Tanzanian national report).

4.4 TRENDS IN ABUNDANCE, & EFFICIENCY OF MONITORING

All countries report that littering is increasing with increasing numbers of tourists and disposable plastic products on the market. All except Seychelles and Mauritius report increased uncollected levels of garbage from fast expanding informal settlements of extremely poor people in coastal towns. No countries have reported on the quantities of garbage dumped from ships, or on the quantities of fishing gear lost at sea. All countries point out that monitoring of marine based and land based sources of litter is inadequate at present.

Comoros	There are no baseline data or monitoring of litter but it is observed that litter levels, particularly of manufactured, packaged, products, are increasing.
Kenya	There is no long term monitoring but sporadic measurements are done. The population at the coast is growing fast, as is littering. There is reported to be an increasing awareness amongst the public that marine litter is undesirable.
Madagascar	Surveys are scarce and statistics are reported to be unreliable. No marine litter baseline has been set and no specific assessments done, but it is evident that marine debris is increasing on beaches and in marine environments. Monitoring is inefficient or non-existant
Mauritius	No specific marine litter studies have been conducted, and the monitoring done by government field inspectors is not reported efficiently. Quantities of garbage to be disposed of are increasing.
Mozambique	No assessments or studies on marine litter have been done. There is no monitoring but marine litter is reported to be increasing
Seychelles	No previous research has been done on marine litter. Although litter is at relatively low levels it is evident that the volumes are increasing. Solid waste in the country is increasing at 3% per year. It is realised that more effort is required to reverse the marine litter trend if the country is to keep attracting visitors to its shores.
South Africa	The loads of litter found (particularly small items) increase with each survey, despite an increase in beach cleaning efforts; plastics increased proportionally 52.2% between 1994 and 2005 on the same 83 beaches surveyed; the greatest recorded increases are in sewage/ medical wastes; numbers of plastic bags have decreased since the user pays approach has been enforced. Formal standardised monitoring of marine litter does not take place. Provincial governments are responsible for monitoring the implementation of municipal Integrated Waste Management Plans, but the capacity to do so varies greatly between provinces. South Africa reports to the MEPC of IMO each year on the adequacy of its port reception facilities.
Tanzania	Monitoring is not done and the magnitude of the problem not assessed, but littering is seen to be increasing dramatically with the influx of poor people to coastal cities. Estimates are that about 40% of the more than 3,500 tons per day of general waste generated in the capital city, for e.g., enters the sea via storm water drains, streams and rivers.

4.5 WHERE THE LITTER COMES FROM - MAJOR SOURCES

Although all sources of marine litter are inferred rather than demonstrated the consultants have reached sound conclusions about the major problems. More detailed knowledge about original (production) sources is considered to be central to introducing effective marine litter control measures.

Figure 4.3 Predominantly marine based sources of litter along the beach at Kiunga on the northern Kenya coast (Photo taken by Ms. Gladys Okemwa of KMFRI) Reference: WIO-2006 Kenyan national report.

Comoros	Because of the lack of treatment and storage space on small islands, and the majority of the population being concentrated in the coastal zone, almost all wastes end up in the sea. The major reported source of litter is direct dumping onto the beach, on roadsides, in residential and other areas. Besides garbage, wrecked vehicles, ships, and appliances are also dumped.
Kenya	The major sources of marine litter are estimated as: beach recreation (66%), shipping (14%), and dumping and water run-off from the land (20%).
Madagascar	The major sources are dumping on the beach, and water run-off from urban/ industrial areas (including medical and household wastes) and other areas with crude dumping practices on the land. There are also reported to be numerous shipwrecks that contribute substantially to marine litter, occurring particularly during the annual cyclone period.

Mauritius	Marine litter arises chiefly from beach recreation, runoff from urban areas and from rivers. The volume of ship generated garbage is far smaller than land generated volumes.
Mozambique	Beach users, garbage from shipping, fishing gear, road users and urban storm water runoff are the major sources of litter.
Seychelles	Most litter is from water run-off from rivers and storm drains, despite daily cleaning, and from port wastes, and particularly eatery spots/ picnic areas. Data are not available for fishing.
South Africa	The major source of marine litter is water run off from the land around urban areas (via rivers and storm drains), and is confirmed 1) by litter deposition being greatest in the rainy season and higher closer to urban areas; and 2) by the high proportion of South African-made articles (96%) among stranded litter. Commercial, industrial and low income residential areas produce most litter. Ship generated waste in South Africa is trivial compared to land based litter sources. Some litter comes across the South Atlantic in the West Wind drift from Argentina, Uruguay and Brazil. Marine litter on uninhabited oceanic islands derives from local fisheries, and distant continents and fisheries.
Tanzania	The major source of marine litter arises from uncontrolled disposal of solid wastes in unplanned settlements where, for e.g., about 70% of the capital city's population live. Most litter is from urban run-off, illegal dumping into river valleys and drainage from crude open dump sites located near the beach and in/on rivers. Marine litter also arises from fishing and shipping, as the capital has a large port and fishing is a major activity of the coastal communities. The latter are presumed to contribute a significant quantity of gear, boats, traps, and plastic bottles to the marine litter steam.

Figure 4.4 Photographs of litter dumping practices in the Comoros (Reference: WIO-2006 Comoros national report).

Figure 4.5 Aerial photograph of Victoria, Seychelles. Red lines show major rivers which would convey waste into the sea (Reference: WIO-2006 Seychelles national report).

4.6 ADEQUACY & SOURCES OF FUNDING TO CONTROL LITTER

The inadequacy of funding of each of the components that make up marine litter management is considered to be the crux of the marine litter problem. This is partly because controls over activities causing marine litter are very costly to implement.

Comoros	The lack of funding is quoted as one of the major constrains to solid waste management on the islands. Some community and non-governmental projects have been funded by the European Union and United nations Development Programme (but without due care to appropriateness).
Kenya	Funds come from government, international aid and from private companies. The shortage of government funds makes reliance on donors important.
Madagascar	Government funding is reported to be severely inadequate, and corruption rife. The World Bank and French and Swiss organisations are assisting in dealing with medical waste.
Mauritius	Funds are mainly from central government, from tax payers. More funds are required to improve the system. The main problems that are faced in the development of sustained recycling schemes are: high costs of collection; limited markets; competition with virgin plastics; absence of sound economic instruments to encourage the purchase of recycled goods, and a lack of awareness on the part of customers. Moreover, the companies which are recycling are currently doing so without tax or special financial incentives.

Mozambique	Funding comes from government via municipalities, and a little from international donor – HIVOS. Presently no further funds are needed as the waste industry is self-sustaining, but should funds be required they would be extremely difficult to obtain.
Seychelles	Funding is from government and is currently adequate, but it is difficult to afford the best technologies so government is seeking outside financing for construction of modern landfills and incinerators. Government spends on average US$ 5 million per year on general waste management.
South Africa	Funding has increased while management capacity has recently decreased. Waste management services are delegated to local authorities to run largely on local taxes collected - but solid waste management in South Africa requires financial subsidies to be sustainable. For example, Cape Town spends almost twice the revenue generated from ratepayers, resulting in an annual deficit of more than R350 million/ US$50,000. The demand for other social services before waste removal, and the difficulty of access in informal settlements, are some of the reasons why the poorest municipalities, and poorest areas within municipalities, are under serviced. The ports' waste strategies are also not sustainable - they are aware that imposing an adequate cost recovery, or polluter pays, system may discourage use of port reception facilities. Many larger business enterprises establish their own waste handling strategies, due to shareholder pressure for commitment to best practice and/ or because there is a profit to be made. Non-governmental / community organisations and the general public play a significant role at a local level in promoting recycling, by providing collection facilities, running education programmes and establishing small businesses to make useful items from waste materials. National government helps through grants to non-governmental / community organisations and through poverty alleviation programmes. Industry also supports non-governmental / community organisations. An estimated cost to effectively remove litter from South Africa's waste water streams is about R 2 billion (US$ 286 million) per year.
Tanzania	Inadequate funding is the main constraint to sound solid waste management. Government funds solid waste management activities annually, but insufficiently to execute planned tasks. Most residents are reluctant to pay any refuse collection fees and some do not pay on time hence waste collection contractors cannot earn a living and are demoralized. Many non-governmental / community organisations and small businesses involved in solid waste collection are faced with a lack of working capital and business/administrative skills, and have difficulties borrowing money from funding institutions. Funding is from central government to the Tanzania Ports Authority who claim it is adequate for collection and disposal of waste generated by ships and by the ports activities (although it is reported that there are no formal reception facilities in place in any port – and any collected wastes would end up on the city's open dump sites).

4.7 ADEQUACY OF WASTE MANAGEMENT INFRASTRUCTURES, & USE

Because of inadequate funding in most West Indian Ocean countries the basic infrastructure for effective waste management either does not exist or is becoming overloaded and inefficient or unsustainable. In all countries this is a concern because of increasing waste loads without concomitant increase in revenues for waste management.

Figure 4.6 A reflection of unsatisfactory waste management from storm water runoff into the Port of Durban, South Africa (Source: storm water outfalls study, Lwandle Technologies)

Comoros	The marine litter problem is directly related to the inadequate solid waste management on the islands. It is reported that only one section of the capital city has a garbage collection service, otherwise there are no formal garbage collection services. Treatment and landfill sites are non-existent, and the medical incinerator is not used much. Disposal into the sea and illegal dumping are the only options available at present.
Kenya	There is a lack of garbage treatment plants, incinerators and analytical equipment. Collection services are inadequate – for example it is estimated that only 50% of the solid waste generated is collected from largest city. Dump sites are poorly located; some were in mangrove swamps, but new ones are set back from the beach. Municipalities do not have adequate resources especially in terms of budgets hence the available staff are poorly paid and not motivated to work, and vehicles are not adequate. The private sector operates on a localised scale and focuses on profit (presumably often dumping illegally). Small-scale operators in solid waste management such as youth groups lack transport services and have to use hand-carts to transport wastes to locations where they are then collected by hired transport.

Madagascar	There are reported to be no adequate collection systems, no safe modes of disposal and no litter treatment systems in most Madagascan coastal cities. This is because of poverty and insufficient means. Materials and equipment (incinerators, treatment equipment, etc.) are run down and insufficient. There is a widespread use of traditional techniques/technologies such as garbage embankment fills, burial of hospital litter, open air burning and open dump sites. The coastline is seen as a "free" waste disposal and removal service. It is estimated that only about 10% of household waste is disposed of at authorised sites, about 40% at inadequate sites and 50-70% is illegally dumped.
Mauritius	The infrastructure is adequate; facilities for collection and disposal do exist; wastes collected throughout the island are brought directly or through the four transfer stations to the only, and well managed, landfill disposal site.
Mozambique	The municipalities do some waste removal, but this needs improvement. Tourism operators and environmental non-governmental organisations do almost all of the beach clean-ups themselves in Mozambique, with limited support from the municipalities or governmental institutions. Efforts at central level currently need to be directed towards the creation of and upgrading of waste reception facilities at the main ports.
Seychelles	Over 90% of the solid waste stream is collected, treated and disposed of in an environmentally acceptable manner. The available equipment provides a reasonably satisfactory level of service, but needs upgrading. There are regular and frequent cleaning programmes for all the rivers and beaches of the Seychelles, and also in the sea and yacht basin. It is mentioned that some upgrades are relatively cheap to implement such as fixing waste retaining devices in the mouths of major rivers in Victoria, and that such simple actions can have a significant and noticeable impact in terms of reducing marine litter in Seychelles.
South Africa	Port reception facilities are adequate in the commercial ports, but not in fishing and recreation harbours. Besides catering for rapidly increasing shipping volumes the ports specifically have to cater for the newly designated 'Southern South African waters' as a Special Area under MARPOL Annex I, and for vessels from the Antarctic Sea Special Area where no garbage, inter alia, can be discharged anywhere south of 60°S. On land, solid waste collection services and disposal sites are largely adequate currently - except in informal settlements, the poorest areas, where collection services are not yet adequate. Compacting, landfill and incineration are used, but calculations are that this is not sustainable and pressure is mounting to reduce the waste stream. Effective storm water screening devices have been developed and tested but not yet installed in most places, whether new or older developments.
Tanzania	There is insufficient equipment for the collection of waste, and for covering waste dump sites. All dump sites are open, no treatment is done, hence litter is easily blown by wind and can easily be transported by water to the storm water drains and rivers and into the ocean. Most recyclable items, such as plastics including bottles, containers and bags, are collected by scavengers from the waste collection points and dump sites.

Figure 4.7 A reflection of unsatisfactory waste management at the Old Port in Victoria, Mahe Island (Reference: WIO-2006 Seychelles national report)

4.8 POLITICAL WILL & CAPACITY TO IMPLEMENT GOOD PRACTICE

Capacity is largely tied to 'political will' which reflects the perceived level of importance of litter management (in this instance) to the financial survival of a country (or political party in a democracy). The potential for substantial foreign earnings from tourism is one of the drivers of a successful litter abatement programme. For this reason, although it is reported that financial and human resources are limited throughout the West Indian Ocean Region, Seychelles and Mauritius are relatively well supplied compared with most other West Indian Ocean nations (discussed in Section #5 below).

Comoros	Waste management is evidently a very low priority at present. Close to the existing "waste disposal site" there are conflicts between local communities and the central and regional governments. This is due to the lack of systematic sorting, recycling and treatment which is allowing a proliferation of pathogens and vectors. It is reported that there are some plans to obtain incinerators and devolve waste management powers to 'municipalities'.
Kenya	Public and political awareness is reported to be increasing markedly, but better implementation is needed. There is a bad public culture of littering.
Madagascar	Waste management is a low priority, and marine pollution (except for hydrocarbons) is also a low priority for attention. Accordingly technical and financial resources to deal with waste are inadequate at the national and municipal government levels and the law is not enforced currently. There is an environmental unit within each ministry that has a direct or indirect interest in waste management and marine pollution, but technical training and information are required at all levels to make the units functional.

Mauritius	Political will is "fairly good". Most people are aware that marine litter is not good for the tourist industry and economy. Public beaches are cleaned daily by private contractors, except those beaches which are not proclaimed public and in front of hotels and bungalows. Clean up campaigns are often organised by non-governmental / community organisations in certain regions. The government, community and private sector appear to work well together.
Mozambique	Even though marine litter is a minor problem currently, compared with other issues, should it become a problem government does not currently have the necessary qualified staff, expertise, budget, and equipment to deal with it. So far, governmental institutions (municipalities, fisheries, maritime authorities) have had a minor role in dealing with marine litter issues and should be encouraged to participate, along with local communities and the private sector. It is considered most appropriate to act locally, in a case-by-case fashion, as each location has its own characteristic problems and solutions.
Seychelles	There is a high level of government commitment to waste management so marine littering is adequately managed. Waste management is centralised and is under a single authority. Cleaning programmes are done by various organisations. There is a need for improved coordination between these organisations.
South Africa	Government, industry and civil society have committed to co-operate, but all 3 levels of government and particularly some local authorities have inadequate qualifications and experience to implement waste management strategies effectively. Formal training is required. The ability to enforce existing regulations is difficult because other police priorities make it difficult to catch illegal 'dumpers' on land or at sea, and the existing penalties are an inadequate deterrent. Political will at all levels of government is often lacking because of more pressing priorities - such as providing social services and transport infrastructure, or matters related to poverty relief, job creation and crime prevention. There is evidence of low morale in government departments, due, in part, to poor management. Capacity varies greatly between provinces, depending largely on the ratio of wealth to poverty within that region and the commitment of local governments (this fact probably applies to the entire West Indian Ocean region).
Tanzania	Owing to inadequate funding there is a lack of skilled technical capacity in place to facilitate monitoring and control of solid waste management practices at all levels, so the law is not implemented. Foreign aid agencies have helped set up projects and train waste managers sporadically. There is apparently increasing awareness and action by government BUT no funds for implementation. The Ports Authority appears to function adequately, to an extent. The public are generally not aware that marine litter is a problem.

Figure 4.8 Example of an illegal waste dumping area on the Msimbazi River in Dar es Salaam (Reference: WIO-2006 Tanzanian national report)

4.9 ADEQUACY OF DOMESTIC POLICY, LAW & STANDARDS

In print, policy and laws regulating general waste management appear to be either adequate or partially adequate in all participating West Indian Ocean countries. A significant problem is that they are not applied in many instances.

Marine litter is not recognised as a distinct type of pollution in any of the West Indian Ocean countries' policy and law.

Comoros	The management of marine litter is purported to be a priority in national environmental policy, but no integrated waste management strategy exists. A decree on environmental impact assessment does exist.
Kenya	Laws and waste management plans are in place for land, ports and marine waste management. The laws are, however, not explicit about marine litter issues. Regional co-operation is required (with Tanzania in this instance) by the Treaty for the Establishment of the East African Community Act 2001, but no cooperation was mentioned.
Madagascar	Some basic waste management plans are in place but are not being implemented. The legal texts are outdated, vague and ambiguous; therefore government can not regulate waste management adequately. EIA legislation is in place but the follow-up of its application remains problematic (evidently is not effectively used yet).

Mauritius	The policy and law is up-to date and adequate, but regulations on marine litter specifically are required.
Mozambique	Legal, regulatory and institutional frameworks for solid waste management are inadequate, but these have not been required to date as there has not been a marine litter problem. Legislation needs to be updated to incorporate sustainable waste management strategies including marine litter abatement strategies for the future.
Seychelles	The law is adequate, and is also being updated for both land and ship based sources of solid waste. Additional legislation is needed to target recycling via a deposit and refund system, on beverage bottles particularly.
South Africa	South Africa has a sophisticated body of both international and domestic law pertaining to marine pollution generally, but it lacks the technical and human resources to give these laws optimal effect. Most 'best practice' policies and laws are in place to promote effective solid waste management - but there is no legislation compelling plastics producers to provide effective mechanisms for the recovery of used products, despite the nationally accepted goals of adopting 'cradle-to-grave' and polluter pays strategies.
Tanzania	Laws and waste management plans are in place for land based sources, and to deal with litter from ports, but implementation fails dismally. Regional co-operation with Kenya is required by law.

Figure 4.9 Examples of litter sites, and some control measures used on the coast of Mozambique (Reference: WIO-2006 Mozambique national report).

4.10 COMMITMENT TO INTERNATIONAL POLICY, LAW & AGREEMENTS

The MARPOL [3]Convention of the IMO is the main Convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. Also the London Convention and Protocol govern dumping at sea. Of particular relevance is MARPOL Annex V on prevention of pollution by garbage from ships, which entered into force on 31 December 1998. In terms of Annex V disposal of all plastics, including ropes, fishing nets, bags and incinerator ashes, is prohibited anywhere at sea, and dunnage, lining and packing materials that float can not be discharged within 25 nautical miles from land. West Indian Ocean countries that are signatories to these instruments accept the obligation to ensure that ships flying their flag do not discharge wastes into the sea and, in return, they enjoy the right of not being polluted by ships from other Parties, to the extent that they can prosecute the offenders if the pollution occurs within their territorial waters. Also, the Integrated Technical Co-operation Programme of IMO provides educational, training and technical assistance both to existing Parties and to States wishing to become Parties to MARPOL. Under its Integrated Technical Co-operation Programme, the Organization, recognizing the transboundary nature of marine pollution by garbage, fosters regional agreements which may bring about significant environmental improvements and provide the participating States with a basis for co-operation on enforcement and exchange of technical information (ex Palomares, 2006).

The United Nations GPA (Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities) is *a source of conceptual and practical guidance* for governments to draw on while planning and undertaking activities to prevent damage to the marine environment. Most of the participating countries in the WIO region were represented at an inter-governmental review and update of the programme in Bejing in October 2006.

Noteworthy conventions and maritime claims of each country are listed below.

Comoros	Is a signatory to MARPOL but not LDC[4] Also party to: Biodiversity, Climate Change, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection Maritime claims: territorial sea: 12 nm, exclusive economic zone: 200 nm
Kenya	Is a signatory to UNCLOS[5], LDC & MARPOL, Biological Diversity, Migratory Species and the Nairobi Convention. Also party to: Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Marine Life Conservation, Ozone Layer Protection, Ship Pollution, Whaling. Maritime claims: territorial sea: 12 nm, exclusive economic zone: 200 nm, continental shelf: 200 m depth or to the depth of exploitation.

[3] International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).
[4] Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC), 1972
[5] United Nations Convention on the Law of the Sea of 10 December 1982

Madagascar	International law is mainly oil pollution related. Is a signatory to UNCLOS, MARPOL, Nairobi Convention, Basel Convention but domestic law to incorporate the requirements is inadequate. Also party to: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Marine Life Conservation, Ozone Layer Protection. Maritime claims: territorial sea: 12nm, contiguous zone: 24nm, exclusive economic zone: 200nm, continental shelf: 200-100nm from 2,500m isobath.
Mauritius	Is a signatory to LDC & MARPOL but not Annex V. Also party to: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Life Conservation, Ozone Layer Protection. Maritime claims: territorial sea: 12 nm, exclusive economic zone: 200 nm, continental shelf: 200 nm or to the edge of the continental margin.
Mozambique	**Is not** a signatory to MARPOL, or LDC. Is party to: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection. Maritime claims: territorial sea: 12 nm.
Seychelles	Is a signatory to MARPOL, & LDC. Also party to: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection. Maritime claims: territorial sea: 12 nm, contiguous zone: 24 nm, exclusive economic zone: 200 nm, continental shelf: 200 nm or to the edge of the continental margin.
South Africa	Is a signatory to UNCLOS, MARPOL, LDC and the Nairobi Convention. MARPOL Annex V applies to all vessels operating in South African waters, and to all South African-flagged vessels world wide. Also party to: Antarctic-Environmental Protocol, Antarctic-Marine Living Resources, Antarctic Seals, Antarctic Treaty, Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Life Conservation, Ozone Layer Protection, Whaling. Maritime claims: territorial sea: 12 nm, contiguous zone: 24 nm, exclusive economic zone: 200 nm, continental shelf: 200 nm or to edge of the continental margin.
Tanzania	**Is not** a signatory to MARPOL or LDC. Is party to: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Endangered Species, Hazardous Wastes, Law of the Sea, Ozone Layer Protection. Maritime claims: territorial sea: 12 nm, exclusive economic zone: 200 nm.

In order to rid the seas of ship-generated garbage/litter/debris, as part of the overarching goal of preventing litter from all sources from entering the marine environment, we need to encourage all coastal States in the West Indian Ocean Region and all flag States in the world to ratify and adhere to existing international instruments, particularly MARPOL Annex V with respect to ship-generated garbage and the London Convention concerning dumping at sea.

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5. GAPS AND NEEDS IN MARINE LITTER MANAGEMENT

In this Section information from the national consultants' reports on shortcomings in marine litter management systems and recommended priorities for action are presented. Socio-economic indicators are examined to identify possible underlying causes for differences between the West Indian Ocean countries capacities to manage waste streams and marine litter. Finally an objective analysis is made of the relative adequacy of each country's waste management system to indicate where the need for improvements could be focussed.

5.1 SHORTCOMINGS & PRIORITIES FOR ACTION

Based on the national consultants' data gathering and insights into gaps/ needs/ shortcomings, they have made recommendations about what needs to be done to improve marine litter abatement in their own countries. The activities recommended have been grouped under common topics in **Table 5.1** below for comparative purposes. (The consultants' full recommendations for action are presented in the **Appendix in Section 11**).

In addition all countries reported the need for increased funding, and except for Seychelles for improved enforcement of existing laws. However, it is difficult to evaluate the relative importance of the recommendations made and the underlying causes in differences between countries' needs, particularly the need for funding.

5.2 SOCIO-ECONOMIC INDICATORS OF CAPACITY

To assist in evaluating the relative importance of recommendations and determining the underlying causes, in order to focus on appropriate areas and approaches to addressing the marine litter problem, the socio-economic ratings of the participating countries were looked into.

It is noted that all countries in this region except Seychelles and Mauritius, both of which are small island developing states, are reported to be worse off than the top 100 countries in the United Nations Human Development Index (UNDP, 2005). Accordingly all except Seychelles and Mauritius already face severe socio-economic challenges, with an enormous and growing need for improved infrastructure and employment opportunities.

A closer look at some recent socio-economic performance indicators in **Table 5.2** compares the West Indian Ocean countries with each other and with a selection of other regions. All other things being equal those at the top of the tables, with higher than world average scores, could be more likely to struggle with implementing successful marine litter abatement strategies than those with lower scores and towards the bottom of the tables.

Table 5.1 : Reported areas for priority action to address marine litter (ML) problems

Country	Stakeholder Consultation	Policy, Laws & Regulations	Infrastructure Required	Skills Training	Economic Aspects	Baseline & Ongoing Monitoring	Education Guidelines, Codes of Practice	Other Integrated Planning Aspects
Comoros	NGOs, CBOs & government all need to participate in designing solutions.	Need EIA law enforcement & pollution standards defined.	Yes. Subcontract specialized international well equipped societies	Capacity building in local government, & of specialized waste agencies.	Identify & establishing sustainable participatory funding mechanisms.	Need a marine laboratory & marine pollution monitoring activities.	Establishment of a national "clean up the sea" day.	A national action plan for marine litter management is needed urgently.
Kenya		Need policy and laws to include ML	Need bins on beaches. Increase official disposal sites	Need sanitary dumping practices.	Introduce deposit & refund system	Surveys at index sites. Find origins of litter to target reduction. Need long term monitoring.	Work out how best to educate culturally diverse public about littering & waste handling	Recycling for poverty relief
Madagascar	Hold strategy meetings with key stakeholders to design solutions	Draw up priority legal documents for preventing marine and coastal pollution	Create the transfer & disposal infrastructure for all 12 coastal regions.	Train managers & technical people	Develop incentives & cost recovery mechanisms	Draw up a national inventory of targets for preventing ML	Educate stakeholders. Need incentives for volunteer groups.	Design an integrated plan. Issue directives on collecting, sorting, processing & disposal
Mauritius	Involve all stakeholders to inform & to establish co-ordination	Develop specific ML regulations	Beach facilities are needed, and grids in rivers, canals.		Develop incentives & cost recovery mechanisms	Need monitoring, reporting, communication	Develop codes of ethics & best practice. Raise public awareness	Address waste minimisation. Need a review of the waste management situation
Mozambique	Involve local stakeholders to develop site specific strategies	Penalties for littering are needed in existing laws. National & local laws need updating. Join MARPOL	Need trash bins & local clean-ups at litter 'hot spots'			Find all sources, types, quantities & seasonal variations to focus management	Need guidelines & codes of practice for shipping & fishing, & motivation for volunteers.	Promote recycling to stimulate local economies. Need a review of the situation involving all sectors
Seychelles	Needed to further develop an action plan to keep litter under control	Regulate for deposit- refund systems	Need maintenance of litter barriers on rivers	Need suitably trained personnel.	Need a deposit & refund system for recycling all bottles	Need more litter source analysis, & of marine dispersion		Review to evaluate environmental & economic impacts, & eliminate grey areas in mandates
South Africa		Legislate to promote recycling & reuse through appropriate financial mechanisms	Need waste reception & disposal facilities in fishing harbours. Install litter traps & grids on storm water systems.	Training programmes to build capacity in waste management at local & national government levels	Institute a reward for fishing vessels for returning wastes and gear to shore.	Set up an effective monitoring programme to assess the efficacy of mitigation measures	Educate recreational fishers & small boat users, & the public, about the ML problem & disposal costs	Raise the profile of marine litter as an issue at national government level
Tanzania	Need cross sectoral strategising to collaborate & build on what's available.	Need integrated waste policy. Need enforcement by military!	Need sanitary landfills, (& all other infrastructure). Need removal of dumpsites from coast & rivers.	Further training is required	Develop economic incentives for waste minimisation & recycling	Research to quantify ML abundance & impacts & establish a monitoring baseline	Public have to be made aware of ML & laws. Need standards & guidelines for waste management	Develop integrated waste management plans covering all aspects.

Table 5.2 : A comparison between West Indian Ocean countries and a selection of regions, based on some recent socio-economic indicators.

Country / Region	% pop. below US$ 2 per day
Tanzania	90
Madagascar	85
E. Africa Av	79
Mozambique	78
All Africa	66
Comoros	60
All Asia	59
Kenya	58
World Average	53
South Africa	34
Latin America	24
BlackSea Av	13
Mauritius	_
Seychelles	_
All Europe	_
Oceania	_
N. America	_

Country / Region	GNI ppp per capita US$ (2005)
Tanzania	730
Madagascar	880
E. Africa Av	1,090
Kenya	1,170
Mozambique	1,170
Comoros	2,000
All Africa	2,480
All Asia	5,960
BlackSea Av	7,845
Latin America	7,950
World Average	9,190
South Africa	12,120
Mauritius	12,450
Seychelles	15,940
All Europe	21,120
Oceania	22,180
N. America	40,980

Country / Region	% proj. pop. change 2006-2050
Madagascar	135
E. Africa Av	133
Comoros	118
All Africa	116
Tanzania	92
Mozambique	89
Kenya	87
Oceania	43
Latin America	41
World Average	41
N. America	39
All Asia	33
Mauritius	20
Seychelles	13
South Africa	2
All Europe	**-9**
BlackSea Av	-21

Country / Region	% urban
E. Africa Av	24
Madagascar	26
Tanzania	32
Mozambique	32
Comoros	33
Kenya	36
All Africa	37
All Asia	38
Mauritius	42
World Average	48
Seychelles	50
South Africa	53
BlackSea Av	63
Oceania	73
All Europe	75
Latin America	76
N. America	79

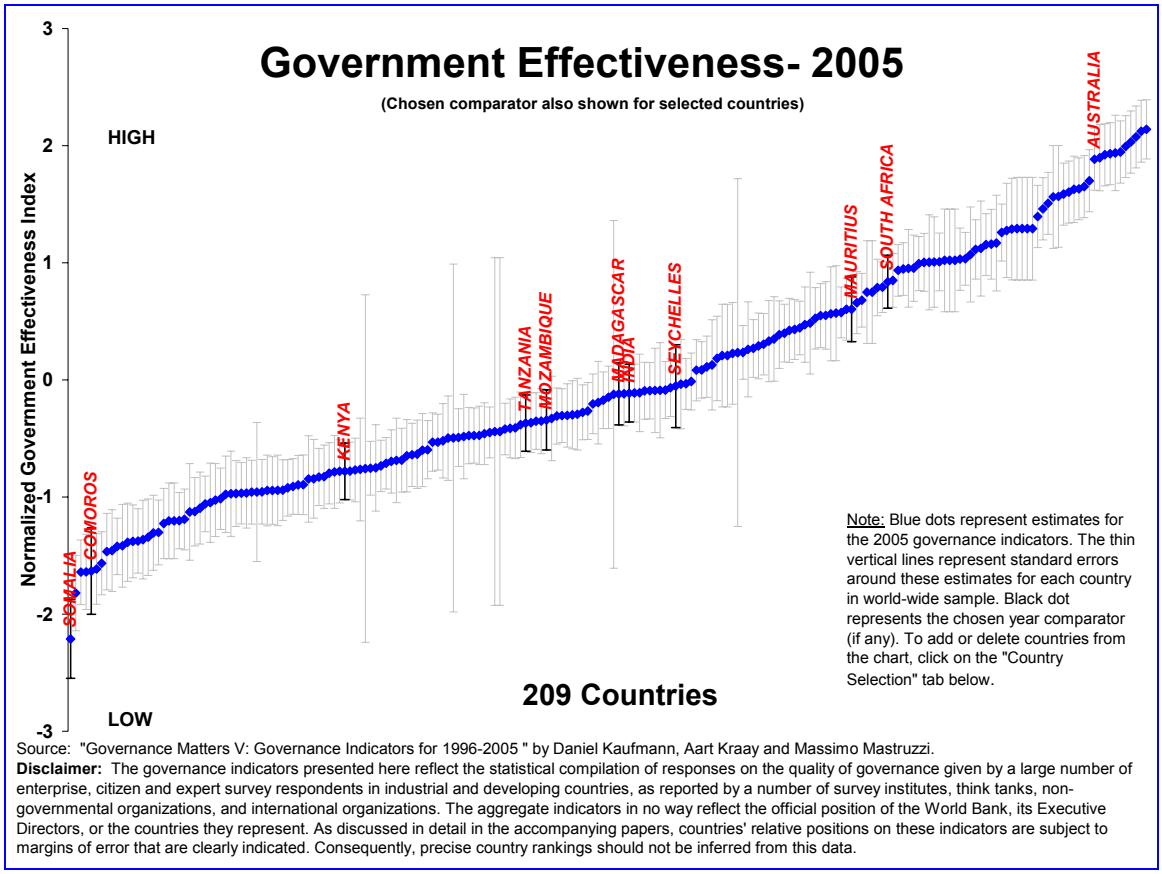
(refer to the **Appendix in Section 10** for more indicators)

In **Table 5.2** Seychelles, Mauritius and South Africa show national earnings above the world average, while Kenya, Comoros, Mozambique, Madagascar and Tanzania fall well below the world average (the figures are in Purchasing Power Parity in US$ in 2005). Gross National Income (GNI) has significant implications for possible approaches to the management of activities causing marine litter in the West Indian Ocean Region. The point is reinforced by the percentage of each country's population shown to be living below 2 US$ per day.

The projected percentage change in population numbers during the lifetime of the next generation, where West Indian Ocean countries are predicted to remain in the same performance groups, increases the challenge significantly.

In addition, style of governance is obviously a critical aspect to take account of in seeking for approaches to the management of activities causing marine litter in the West Indian Ocean Region. Governance is defined here as the traditions and institutions by which authority in a country is exercised for the common good. This includes (i) the process by which those in authority are selected, monitored and replaced, (ii) the capacity of the government to effectively manage its resources and implement sound policies, and (iii) the respect of citizens and the state for the institutions that govern economic and social interactions among them (World Bank, 2006).

In **Figure 5.1** the West Indian Ocean countries are looked at in terms of their calculated "Government Effectiveness Index in 2005", as determined by data obtained from the World Bank website (Kaufmann et. al., 2006).



Source: "Governance Matters V: Governance Indicators for 1996-2005 " by Daniel Kaufmann, Aart Kraay and Massimo Mastruzzi.
Disclaimer: The governance indicators presented here reflect the statistical compilation of responses on the quality of governance given by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries, as reported by a number of survey institutes, think tanks, non-governmental organizations, and international organizations. The aggregate indicators in no way reflect the official position of the World Bank, its Executive Directors, or the countries they represent. As discussed in detail in the accompanying papers, countries' relative positions on these indicators are subject to margins of error that are clearly indicated. Consequently, precise country rankings should not be inferred from this data.

Figure 5.1 : West Indian Ocean countries estimated "Government Effectiveness". Other Indian Ocean countries shown for comparative purposes are Australia, India and Somalia.

The Government Effectiveness survey focuses on measuring government performance in the delivery of public services, which includes measurement of judicial and bureaucratic efficiency and the absence of corruption. Solid waste management, that would prevent marine litter from land based sources partcularly, is one such public service. (Associated aspects looked are the extent of political freedom and political stability; human development and equitable distribution of income; and the climate for stable economic growth including economic management and the debt-to-Gross Domestic Product ratio).

According to the estimates reflected in Figure 5.1 South Africa and Mauritius fall into the 70 percentile bracket, Seychelles and Madagascar into the 50 percentile bracket, Mozambique and Tanzania into the 40 percentile bracket and Kenya into the 20 percentile bracket (Comoros and Somalia fall into the zero percentile bracket). These indices should be very useful in assisting governments to improve the adequacy of their waste management systems and so resolve marine litter problems in the West Indian Ocean Region.

5.3 ADEQUACY OF SOLID WASTE MANAGEMENT SYSTEMS

Waste management comprises many possible different components including some of the more important ones listed in **Table 5.3a**. Not all components may need to be equally

functional at any one stage, although all are required to manage the solid (and liquid) waste stream adequately.

What is deemed essential however is for countries to find ways to raise and spend adequate funding on developing, at least:

- technically adequate disposal sites,
- garbage collection facilities including port reception facilities, and
- on employing skilled, and motivated, waste managers.

(These latter components are in red text in Tables 5.3 a-c).

Additionally, through consultative processes, and in partnership with other programmes aimed at poverty alleviation and improvement of governance, all other components of waste management will need to be put in place to achieve a sustainable system which eliminates marine litter from land based sources; this includes adequate management of port reception facilities.

Analysis

The national consultants' priorities for action, summarised in Table 5.1 above, show that improvements are required in many components of marine litter management in each of their countries. This is to be expected as social and natural environmental conditions continually change and in terms of best practice all components would require constant improvement.

The following analysis is done to help focus on areas where common strategies may be appropriate at the West Indian Ocean regional level.

The exercise started by listing the components of a sound waste management system, and estimating which countries seem to have more and which seem to have less of the components in place at an adequate level. The estimate is based on all information provided by the consultants and supplemented by additional data about socio-economic conditions. The results are presented in **Table 5.3a** where countries are arranged alphabetically.

If the countries are arranged in order of decreasing GNI ppp per capita in US$ in 2005 then areas of focus for action become clearer, as illustrated in the abbreviated **Table 5.3b.**

An arrangement by an estimated Government Effectiveness Index results in a similar pattern, as illustrated in the abbreviated **Table 5.3c.**

This illustrates that the participating countries' levels of wealth and good governance seem to correlate with their ability/ inability to deal with general waste management and the marine litter problem from land based sources. This needs to be taken into account in developing appropriate workable marine litter abatement strategies with key stakeholders in the waste management sector in each country as part of the next phase of UNEP's programme – after the Conference of Parties to the Nairobi Convention.

Table 5.3a : An estimated extent to which West Indian Ocean countries have adequate components of sound waste management in place in the coastal zone. **A**=(adequate), **P**=(partially A&I), **I**=(inadequate). **Countries are arranged alphabetically**.

Components of Marine Litter Management by Governments		Comoros	Kenya	Madagascar	Mauritius	Mozambique	Seychelles	SouthAfrica	Tanzania
INSTITUTIONAL ARRANGEMENTS IN PLACE	Sound general waste policy & domestic law is in place	I	A	P	A	P	A	A	P
	Policy & law specific to marine pollution from solid waste	P	P	P	A	I	A	A	I
	Integrated waste plans with objectives & clear responsibilities	I	P	I	A	I	A	A	I
	Adequate funding for infrastructure & manpower	I	I	I	A	I	A	A	I
	Trained management & technical staff	I	I	I	A	I	A	P	I
	Appropriate economic incentives & sanctions to encourage compliance	I	I	I	I	I	P	I	I
TECHNICAL MEANS FOR COMPLIANCE SUPPLIED	Technically adequate disposal sites.	I	I	I	A	I	A	A	I
	Street / drain sweeping in cities is regular	I	I	I	A	I	A	A	I
	Refuse containers are supplied to all beaches, homes, industries etc.	I	I	I	A	I	A	P	I
	Beach, sea, river, clean-ups occur frequently	I	I	I	A	I	A	P	I
	Garbage collection & transport to disposal / processing facilities.	I	I	I	A	I	A	P	I
	Waste avoidance and minimisation systems are in place & working	I	I	I	P	I	P	P	I
	Sufficient serviced Port Reception Facilities	I	I	I	P	P?	P	P	P?
	Litter barriers are in storm water drains / rivers, & are cleaned.	I	I	I	P	I	P	P	I
WASTE MANAGEMENT SERVICES PROVIDED	ML information dissemination/ education by government occurs	I	I	I	A	I	A	P	I
	Regular monitoring & evaluation is done to focus management.	I	I	I	P	I	P	P	I
	Sufficient inspection/ policing & prosecution is done on land & at sea.	I	I	I	P	I	P	P	I

Table 5.3b : Countries arranged in order of **decreasing GNI PPP per capita, US$ 2005**.

Components	Seych-elles	Mauritius	South Africa	Comoros	Kenya	Mozam-bique	Mada-gascar	Tanzania
General policy law	A	A	A	I	A	P	P	P
Marine policy & law	A	A	A	P	P	I	P	I
Integrated plans	A	A	A	I	P	I	I	I
Adequate funding	A	A	A	I	I	I	I	I
Trained staff	A	A	P	I	I	I	I	I
Economic incentives	P	I	I	I	I	I	I	I
Adequate disposal sites.	A	A	A	I	I	I	I	I
Street / drain sweeping	A	A	A	I	I	I	I	I
Refuse containers supplied	A	A	P	I	I	I	I	I
Beach, sea, river, clean-ups	A	A	P	I	I	I	I	I
Garbage collection	A	A	P	I	I	I	I	I
Waste minimisation	P	P	P	I	I	I	I	I
Port Reception Facilities	P	P	P	I	I	P?	I	P?
Litter barriers.	P	P	P	I	I	I	I	I
Information dissemination	A	A	P	I	I	I	I	I
Monitoring & evaluation	P	P	P	I	I	I	I	I
Inspection & prosecution	P	P	P	I	I	I	I	I

Table 5.3c : Countries arranged in order of **Government Effectiveness Index**.

Components	South Africa	Mauritius	Seych-elles	Mada-gascar	Mozam-bique	Tanzania	Kenya	Comoros
General policy law	A	A	A	P	P	P	A	I
Marine policy & law	A	A	A	P	I	I	P	P
Integrated plans	A	A	A	I	I	I	P	I
Adequate funding	A	A	A	I	I	I	I	I
Trained staff	P	A	A	I	I	I	I	I
Economic incentives	I	I	P	I	I	I	I	I
Adequate disposal sites.	A	A	A	I	I	I	I	I
Street / drain sweeping	A	A	A	I	I	I	I	I
Refuse containers supplied	P	A	A	I	I	I	I	I
Beach, sea, river, clean-ups	P	A	A	I	I	I	I	I
Garbage collection	P	A	A	I	I	I	I	I
Waste minimisation	P	P	P	I	I	I	I	I
Port Reception Facilities	P	P	P	I	P?	P?	I	I
Litter barriers.	P	P	P	I	I	I	I	I
Information dissemination	P	A	A	I	I	I	I	I
Monitoring & evaluation	P	P	P	I	I	I	I	I
Inspection & prosecution	P	P	P	I	I	I	I	I

As for marine based sources, there are no data for West Indian Ocean countries' contributions to marine litter either from vessels registered in or marine activities (including fishing, mining, dumping) permitted by the coastal state. Also, none of the coastal states is able to effectively police garbage disposal and gear loss by foreign fishing and shipping activities in their Territorial Waters or Exclusive Economic Zones.

The areas of focus for action in response to this information are discussed in Section 6.

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6. CONCLUSIONS[6] & RECOMMENDATIONS

This Section presents **concluding remarks assessing the regional situation** and recommendations in general terms for addressing the marine litter problem in the West Indian Ocean Region.

6.1 DATA ON QUANTITIES, TYPES, CHARACTERISTICS OF LITTER

a) **Information and data from marine based sources is effectively non-existent**.

This is largely because there have been no comprehensive audits done locally or internationally on what persistent solids, particularly plastics, vessels dispose of at sea.

All participating countries are aware that shipping and particularly fishing are significant contributors of unknown volumes to the marine litter load, but that they seem to contribute less than land based sources to the quantities of litter washed ashore. Exceptions to this are remote islands and remote coastlines such as in northern Kenya and Mozambique where litter from fishing and shipping appears to dominate the beached litter. One of the contributors here could be illegal foreign fishing vessels, where irresponsible disposal is part of the mind-set.

Because shipping and fishing occur throughout the West Indian Ocean Region, and because of the nature of the ocean currents and winds, it would make predictions of marine distributions very difficult - for clean-up purposes.

b) **Information and data from land based sources varies considerably from country to country.**

At one extreme: South Africa has been publishing the results of research into marine litter for over two decades and knows a substantial amount about the abundance, distribution and trends of different types of litter around the coast. The sources of the litter are inferred rather than demonstrated, but it is obvious that most of it originates from littering and inappropriate waste disposal on land. By Developing Nation standards South Africa is relatively wealthy and 'effectively' governed and currently manages to contain the quantity of litter entering the sea to reasonably low levels. Seychelles reportedly has such a good waste management system in place that it knows it contributes almost nothing to the marine litter load. Mauritius falls into a similar category of wealth and governance and ability to contain wastes. Mozambique on the other hand, despite poverty and inadequate governance capacity, knows it also currently contributes very little to the marine litter load. This is because it has a very poor transport infrastructure and the vast majority (about 70%) of the population live in rural poverty with no access to products with plastic packaging. Additionally, informal 'recycling' of anything salvageable occurs. These factors have kept marine litter under control thus far in most places but this situation may change fast in Mozambique.

[6] Use of the term "wealth" refers to data provided by PRB, 2006.
"Governance" capacity refers to the ratings made by Kaufmann et. al., 2006.

At the other extreme: Tanzania, Madagascar, Kenya and Comoros know relatively little about the absolute quantities, types and characteristics of marine litter that their countries contribute to the marine litter load in the West Indian Ocean; except that massive quantities of litter from urban areas are estimated to find their way to the sea on a daily basis. In certain circumstances, particularly in Comoros and Madagascar, solid wastes are purposefully disposed of into the ocean. The main reason that solid waste finds its way into the sea is that none of these countries has an adequate (solid or liquid) waste management system in place. This is possibly because, like Mozambique, they are amongst the poorest of countries in the world and with governance problems but, unlike Mozambique, they have not been decimated by war or have such a high incidence of HIV related sickness and death. Accordingly the populations' access to packaged and disposable products is much greater in countries other than Mozambique at present.

Aspects in common: All countries report that most land based sources are from urban centres, particularly industrial/ commercial areas and informal settlements (where they exist), and that water run-off is the main distributor; via rivers, streams, storm water drains.

It should be noted that because of the inadequacy of data for the West Indian Ocean Region as a whole, the relative contribution to the global marine litter problem of the quantity and types of litter originating in the region cannot be assessed.

6.2 DATA ON SOCIAL, ECONOMIC & ENVIRONMENTAL IMPACTS

Social, economic and environmental impacts of marine litter are largely inferred and not adequately assessed or quantified, other than in some South African research.

Although the details of the impacts occurring would vary between locations, the description given in the report on South Africa would largely be applicable to the entire West Indian Ocean Region; "Litter has numerous impacts on marine ecosystems, as well as direct and indirect impacts on humans. The main ecological impacts of floating litter are that it is ingested, or entangles, marine organisms. Off South Africa, levels of ingestion and, perhaps to a lesser extent, entanglement, are on a par with the highest recorded elsewhere in the world. There are some encouraging developments (e.g. the reduction in virgin pellets ingested by seabirds), but overall the situation remains unacceptable, with several threatened species affected. Litter at sea may disperse vast distances, crossing ocean basins, and arrive at remote locations such as oceanic islands. It may play a role in rafting organisms to these remote systems, with potentially serious biological and commercial impacts. Litter that sinks to the seabed may impede gas exchange in bottom sediments or become entangled around sessile organisms, increasing their drag and hence the risk of their being washed off when there are large storm swells. The magnitudes of these impacts are largely unknown. Economic and aesthetic impacts include reduced amenity value (e.g. beach use drops as litter levels increase), ever growing investment in formal beach cleaning programmes, risk of flooding due to blocked drains, disabling or damaging vessels and impacting on commercial fisheries. Most of these impacts have not been quantified in economic terms" (P. Ryan, 2006).

Further, the reports from Comoros, Kenya, Madagascar and Tanzania have indicated that medical and sewage wastes can impact human health. This urgent matter appears to be being addressed by the governments in partnership with aid agencies, but not adequately. Medical wastes would obviously be a high priority source of marine litter to eliminate.

6.3 ADEQUACY OF INSTITUTIONAL ARRANGEMENTS,POLICY & LAW

The adequacy of institutional arrangements at different levels of governance, and of domestic policy and law, also varies greatly between participating countries.

None of the countries has marine litter specified as a separate pollution type; it is of necessity dealt with as part of the solid waste stream, which is considered appropriate.

In all participating countries some policy and laws are in place, and institutional mechanisms do exist, but many West Indian Ocean countries are incapable of dealing with waste management - which causes marine litter. This is largely because of a lack of funding, and therefore an inadequate supply of the technical means for compliance and skilled manpower and managers. Sometimes however, assessments that waste management is handicapped by a lack of funding may rather be that the skills or motivation to select adequately qualified people to do the job are what is lacking.

All consultants recognise that it is critically important for national governments to implement legislation that compels producers of plastics (and other synthetics, and tins and glass) to provide effective mechanisms for the recovery of used products.

Seychelles has a centralised and successful waste management regime that operates at the national level. Because of its relatively wealthy and small population, combined with fairly effective governance and an economy largely dependant on coastal tourism, it has adequate institutional arrangements in place as indicated in Table 5.3. The weakest areas appear to be the management of wastes associated with shipping, fishing and port facilities, although these aspects are currently being attended to through improved legislation, budgeting and staffing. Central to the continuing success of the Seychelles system is that top politicians and burocrats know that tourism requires a clean environment.

All the other participating countries have waste management delegated to the local/ municipal level of government, but the adequacy of waste management, that would also prevent marine litter, varies significantly.

At one extreme: Along with Seychelles, Mauritius and South Africa have largely adequate institutional arrangements, technical means and services provided (Table 5.3). Despite this South Africa is reported to face severe problems with marine litter because retail products are heavily packaged, and because a large proportion of the population has limited access to formal waste disposal options. Currently, however, both countries are deemed to have the most effective levels of governance in the West Indian Ocean (along with Reunion) and so should in theory be able to contain and reduce their contributions to marine litter more effectively than the other countries. The consultants have clearly identified areas of focus. These need to be brought to the attention of the respective governments, and addressed by decision makers and other stakeholders through the mechanisms of the Nairobi Convention.

At the other extreme: Other than having some policy and law in place at national and local levels, all other participating countries, namely Comoros, Kenya, Madagascar, Mozambique and Tanzania, are currently deemed to have wholly inadequate levels of the basic institutional arrangements, technical means and services provided (red text in Table 5.3). This means that their contributions to the marine litter load are relatively uncontrollable at present, other than in isolated pockets. The development and operation of basic solid waste management facilities throughout urban areas should be a high priority.

However, these countries face enormous development challenges and the methods of dealing with priorities for action would differ in each country, and even between districts/ regions within a country. Each country and district may require a unique combination of topics to be dealt with. This implies that different approaches would be necessary to solve the marine litter problem in each country.

6.4 MARINE LITTER PROJECTS, PROGRAMMES & INITIATIVES

Marine litter reduction projects, programmes and initiatives of various sorts are taking place in all of the participating countries.

The participants have described numerous successful projects/ programmes/ initiatives that are being undertaken by non-governmental organisations, business and local communities to educate the public and reduce marine litter in their countries. These are either managed or funded to different degrees by business, government and foreign aid - or are the initiatives of local communities themselves.

Some key points emerging, in no particular order of priority, about these projects/ programmes/ initiatives in the West Indian Ocean Region are:

- Most country reports emphasise the importance of small scale, locally driven initiatives focussing on recycling solid wastes for reuse. Such projects can help create jobs and businesses - and reduce levels of marine litter.
- The most successful small scale litter abatement programmes in most places in the West Indian Ocean are those presently that allow people to earn a living through involvement in the programme. This type of initiative needs promotion.
- These initiatives do play an important part in the education that is required at all levels of society to reduce littering and increase recycling and put pressure on governments to take appropriate action.
- It is considered important to enhance existing capabilities and interests in waste disposal and ocean related activities, and collaborate with existing ventures where possible, in order to avoid costly duplication.
- Many activities associated with reducing marine litter loads need to be coordinated, and many need motivation and financial support to continue.
- As fishing is a major economic activity in the West Indian Ocean and shipping is widespread, as outlined in Section 3, methods need to be developed by the international community to ensure flag states are held to count for their contribution to the marine litter problem.
- Also, international intervention is required to help address the contribution to marine litter from illegal fishing vessels operating in the West Indian Ocean. Garbage

management is obviously a very low priority in the mindset of this industry. The extent of illegal fishing, by long-line vessels, is not clear but is evidently a serious problem. Mozambique, for example, reports that increasingly significant quantities of litter (including numerous flares used for illegal night fishing) from these vessels are washing up on the beaches.

Initiatives to deal with lost or abandoned fishing gear and related marine litter from fishing are considered to be particularly important. Some considerations are:

- That marine litter abatement requirements should be tied in with contractual agreements for foreign fishing activities in the West Indian Ocean. The highest standards of environmental pollution control, as applied in the developed country's seas, should be adhered to in the West Indian Ocean too.
- Although law enforcement could be applied to industrial fisheries that are compelled to use port facilities, and are thus more readily checked, it would be difficult to control garbage and fishing gear disposal in the artisanal fisheries which are spread along extensive coastlines and are largely unregulated. [Van Der Else (2005) estimates that almost three million people are directly dependent on artisanal fishing for their livelihood along the shores of East Africa and Madagascar. He reports that most of the West Indian Ocean regions' fisheries go unreported in global statistics, largely due to their unregulated and informal nature].
- Stakeholders who would need to be contacted to help design and agree to marine litter prevention strategies for fishing include different government ministries, cooperatives or trade unions and regional and international development banks. The latter organisations are likely to be involved in programmes to aid and support fishermen as part of poverty relief already.

Finally, it is recognised that there should be cooperation between all the various foreign funded and domestic projects (and programmes and initiatives) that are being undertaken on land and at sea and which can influence solid waste management. This would maximise opportunities for integration of marine litter abatement strategies into all relevant activities.

6.5 REGIONAL PARTNERS & STRATEGIES

Currently there are no regional strategies dealing specifically with solid waste and marine litter management.

One of the major challenges of implementing any strategy at a regional level is to have in place a regional framework law and to strengthen regional government/ administration.

In the West Indian Ocean Region one of the most appropriate mechanisms for implementing marine litter/ solid waste management strategies would be the Nairobi Convention, to which all countries participating in this marine litter survey are signatories.

It was recently proposed[7] that this convention, or framework law, be administered by an existing entity such as the Indian Ocean Commission (IOC), for example. To this end it is noted that the Indian Ocean Commission's mandate has recently been expanded beyond island states to include coastal states. With strengthening, such an administrative body could advise and co-ordinate governments in the region to develop standards for waste management, inter alia.

The third protocol to the Nairobi Convention, which is currently being developed, can supply the basis for national action on land based sources of marine litter by the signatories.

As far as implementation of the law goes, marine litter management strategies in the Western Indian Ocean Region need to be viewed in the context of broader strategies for sustainable development; particularly in view of the levels of poverty and underdevelopment in the region, and in view of the looming critical impacts of climate change. However, despite its problems the Western Indian Ocean presently remains a region of high economic growth potential because of its wealth of natural resources and high biodiversity. Accordingly, with political will and application of sound environmental management strategies, solutions to waste management (including marine litter) problems can be found in consultation with the national governments and regional bodies such as the African Union (AU) and its New Partnership for Africa's Development (NEPAD), the Southern African Development Community (SADC) and the East African Community.

One of the more important structures that need to be consulted and possibly to be worked though or integrated with are the New Partnership for Africa's Development's Sub-Regional Environment Action Plan/s (SREAPs) and particularly but not exclusively the Coastal and Marine Programme (COSMAR). The larger NEPAD Environment Action Plan (NEAP) outlines priority actions that African countries need to implement to maintain the integrity of the environment and ensure the sustainable use of their natural resources through partnerships with the international community. The marine litter abatement programme/s could focus on the NEAP thematic areas of 'marine and coastal resources' and 'crosscutting issues'[8]

It is important that activities affecting solid waste/ marine litter management are explicitly addressed within each priority area of the above mentioned Coastal and Marine Programme, particularly the areas listed in **Table 6.1** below:

[7] Proposed by Professor J. Glazewski, Institute of Marine & Environmental Law at the University of Cape Town, South Africa, at the first regional workshop on the development of a Trans-boundary Diagnostic Analysis and Strategic Action Programme for the Western Indian Ocean, held in Nairobi, Kenya, on 17-19 April 2007.

[8] ***Note***: Although clarity is needed on the outcomes of the 2003 Donors/Partners Conference to mobilize the necessary resources for the implementation of the Action Plan.

Table 6.1 : Current NEPAD[9] COSMAR[10] priority areas where solid waste/ marine litter management matters could be addressed.

Pollution
Municipal Solid Waste Management and Enhancement of Environmental Quality in sub-Saharan Africa.
Prevention of pollution from shipping activities and strengthening of national and regional oil spill management systems in sub –Saharan Africa.
Management of Municipal Sewage in sub-Saharan Africa through Appropriate Technologies.
Sustainable development and use of living resources
Reduction of environment impact from coastal tourism through introduction of policy changes and strengthening public-private partnership.
Promotion of sustainable livelihood strategies in sub-Saharan Africa.
Integrated coastal zone management
Supporting the development and implementation of Integrated Coastal Area Management (ICAM) in Sub-Saharan Africa.
Integrated coastal area management for Small Island Developing states.
Establishment of RAMSAR sites and developing a participatory and integrated approach for river basin management in sub-Saharan Africa.
Conservation of key habitats
Strengthening management, monitoring, control and surveillance capacity in fisheries management organizations in sub-Saharan Africa.
Assessment and mitigation of the ecological and socio-economic impacts of destructive fishing practices in sub-Saharan Africa.

Other structures and programmes operating at a regional level which would need to be consulted and where possible integrated with[11], include:

Key programmes which are-

- The GEF's Agulhas and Somali Current Large Marine Ecosystem (ASCLME)
- The South West Indian Ocean Fisheries Project (SWIOF) of the UNDP/World Bank.
- The European Commission's support for Monitoring, Control and Surveillance of EEZs, and
- The European Commission (EC) bi-lateral fisheries agreements;

Other programmes, including-

- The Food and Agriculture Organisation (FAO) Fisheries Unit's Comprehensive Africa Agriculture Development Programme (CAADP) framework;
- Support programmes to Poverty Reduction Strategies (PRSPs);
- The AU/NEPAD Tourism Action Plan harmonised with the World Trade Organisation's (WTO) Commission for Africa (CAF);
- The SADC Tourism Investment Promotion Initiative, and its funders including the Development Bank of Southern Africa and the Regional Tourism Organisation of Southern Africa;
- The Pan-African Infrastructure Development Fund;

[9] NEPAD: New Partnership for Africa's Development.
[10] COSMAR: Coastal and Marine Programme.
[11] Also note the 34th session of the joint Group of Experts on the Scientific Aspects of Marine environmental Protection involving IMO/FAO/UNESCO-IOC/WMO/IAEA/UN/ UNEP/ UNIDO (GESAMP, 2007).

- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).
- World Bank supported Marine and Coastal Environment Management Plans;
- USAID supported coastal district planning, and National Integrated Coastal Environment Management Strategies (NICEMS);
- Support for marine protected area management (WWF, IUCN, JSDF, Ireland, Norway, Finland, Sweden);
- GEF-supported Global Coral Reef Targeted Research and Capacity Building for Project Management;
- France and UNESCO's assistance with sustainable management and improvement of coastal cultural resources, and
- The German Technical Co-operation (GTZ) projects.

Finally, it has been well documented that any programme is most likely to succeed when all stakeholders are engaged in its design and, where feasible, in its execution. **It is considered crucial that the marine litter abatement / or solid waste management programmes are seen to be driven by the citizens of the region and particularly the participating nation. Ultimately solutions will have to come from the people themselves in each country.**

6.6 SUMMARY OF ACTIONS REQUIRED

This Regional Assessment, which includes the national consultants' findings and recommendations, is presently one of the supporting documents to the "Pollution" theme of the West Indian Ocean Transboundary Diagnostic Analysis being undertaken by UNEP. This report, with the full national reports, will also serve as a background document for developing National Programmes of Action in consultation with each country's stakeholder groups. Potential areas of initial focus are indicated in **Table 5.3** which shows the relative progress of each participating country in implementing the various elements necessary for solid waste management.

It needs to be noted that this is an initial and very broad study that chiefly concerns the cross-cutting issue of solid waste management at the coast (on land) and at sea. Key stakeholders have not been given an opportunity to contribute information. Accordingly, it is impossible and beyond the scope of the study to develop a precise and in-depth set of directions. Recommendations are thus made only in general terms:

m) Firstly, it is considered prudent that marine litter arising from sources on land be tackled separately from litter arising at sea because different laws and approaches would apply in many instances (although there is obviously an overlap in the economic incentives required to reduce the production of persistent wastes and improve solid waste management).

n) It is essential that efforts are not duplicated or resources wasted, and this can only be achieved when all stakeholders consult with each other and agree to collaborate.

o) To control **marine based sources of litter** all coastal States in the West Indian Ocean Region and all flag States in the world should be encouraged to ratify and adhere to existing international instruments, particularly MARPOL Annex V with

respect to ship-generated garbage and the London Convention concerning dumping at sea. Ports also need to provide adequate waste reception facilities, which in turn require adequate land-based treatment, recycling and disposal services. With regard to the recommended approach for the development of Plans for the improvement of port reception facilities and services for garbage collection from the shipping and fishing industries – It is noted that the International Maritime Organisation is in the process of reviewing Annex V to MARPOL regarding port reception facilities, and that this will influence the approach to be taken by participating countries in the West Indian Ocean.

p) Further, it is suggested that audits be done by flag states on fishing (and shipping generally); i.e. a comparison between relevant items purchased by vessels vs. quantities lost or incinerated or dumped at sea or returned to port for disposal. Ships Garbage Record Books required by MARPOL should be linked with goods orders, and amended to help track quantities of plastic/ synthetic gear/items and packaging.

q) Also, because of the nature of the ocean currents that exist, as described in Section 3, marine based litter, particularly, but not exclusively needs to be considered within the trans-boundary diagnostic analysis for the West Indian Ocean.

r) Regarding suggested strategies and approaches for funding high cost initiatives (such as port reception facilities, landfills, fisheries, etc.), including approaches to international financing institutions; this aspect needs to be addressed by the relevant ministries within each participating country, including the ministries of finance, and should be linked with the use of various economic instruments. The Regional Seas report on financing for the environmental conservation of the Red Sea and Gulf of Aden (UNEP 2006) can be referred to as an example. In addition, UNEP has recently commissioned a study on “Marine Litter and Market Based Instruments” the outcome of which should also be useful to West Indian Ocean countries.

s) Most importantly, the appropriate regional mechanism for implementing recommendations about **land-based sources of marine litter** is considered to be the Nairobi Convention (Concerning Land-Based Sources and Activities in the Eastern African Region). The convention supplies an appropriate framework law. For land-based sources of marine litter it would be important for “solid waste management” to be listed as an activity requiring attention within an Annex to the new draft Protocol. Any marine litter management programme should not be separated from solid waste management - including where this ties in with municipal wastewater management.

t) Once solid waste management is listed under the protocol, approaches / action points addressing national legal and administrative instruments and strategies, and cooperation with civil society, etc., should be dealt with under the provisions of the Convention.

u) Each nation’s particular priorities for waste management would have to be considered in the context of their other priorities for national development - which may or may not necessitate new or amended domestic laws or regulations, but rather institutional capacity enhancement and methods of better implementation, for example.

v) Key stakeholders that would need to be involved in each West Indian Ocean country are all those with a vested interest in relevant waste generating, management and disposal activities, and in developing/ marketing alternative (bio-degradable) products. This would include government, port authorities, ship operators and agents, industry, private sector, fishing associations and unions, non-governmental / community organisations and others who may also be key players and who would want the opportunity of expressing their views and stating their interests before any plan/s for action are finalised.

w) Activities could focus on providing insights into reasons for preventing marine litter and, amongst other things, discussing methods of doing so in ways which reduce costs to the fiscus, maximise benefits to the poor, and put the onus of cost of disposal onto producers of plastics, particularly. Amongst others, solid waste management/ marine litter abatement strategies should be brought into focus in all foreign funded programmes that governments are allowing in their countries, to assist with development

x) With regard to the development and implementation of regional and national monitoring programmes: countries need to consider standardised methods, but could also contribute to UNEP's global monitoring strategy which it is hoped will be developed by mid 2008 (*Pers. Com*. E. Adler).

y) For the development of professional sectorial and 'responsible citizenship' guidelines for different target audiences for the wise management of marine litter: it is recommended that West Indian Ocean countries draw on numerous sets of guidelines that already exist, and adapt them to their own specific circumstances.

z) Finally, the need, feasibility and benefits of establishing a "Regional Programme on Marine Litter in the West Indian Ocean Region" should be decided by the Conference of Parties to the Nairobi Convention. The priority would be to mainstream solid waste management "concerns into the development agenda of countries through targeted actions that address not only environmental concerns, but also institutional, regulatory, policy and capacity aspects" (the goal of the NEPAD COSMAR programme).

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Some residents and ward leaders in Temeke area close to the dumpsite, in Dar es Salaam were interviewed.

Some people (scavengers) collecting recyclable materials at the Temeke dumpsite in Dar es Salaam were interviewed.

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9. APPENDIX: INFORMATION REQUESTED FROM NATIONAL CONSULTANTS

The following information was requested of the national consultants in order to assist them in providing the information required by UNEP and WIOMSA:

1. THE CURRENT STATUS OF MARINE LITTER / DEBRIS IN EACH COUNTRY

a. Information available which describes the current situation
b. Gaps in the knowledge available that prevents one from determining whether or not there's a need to be concerned about marine litter
c. Recommendations for filling critical gaps in information

2. CURRENT INITIATIVES TO REDUCE / PREVENT MARINE LITTER IN EACH COUNTRY

b) Existing waste management / litter reduction strategies

- **i)** Legislation on the regulation of environmental pollution in general
- **ii)** Specific provisions for marine litter in legislation and / or waste management strategies
- **iii)** How monitoring and enforcement take place
- **iv)** Involvement in the International Coastal Cleanup (ICC) campaigns in September of each year
- **v)** Government agency/ies assigned with the responsibility to plan and execute a solid waste management policy and strategy.
- **vi)** Municipalities, or authorities, with waste management plans in operation.
- **vii)** Aspects of the waste management hierarchy that are being implemented.
- **viii)** Stakeholders involved in waste collection, treatment, disposal and recycling initiatives
- **ix)** ML contact persons
- **x)** Extent of integration of land-generated and vessel/ship-generated wastes in plans and policies.
- **xi)** Assessment of capacity to execute tasks
- **xii)** The main constraints that prohibit environmentally sound waste handling
- **xiii)** Plans and actions identified to improve the situation in problem areas identified
- **xiv)** Summary of Specific Issues or Case Studies

b) Strengths and weaknesses in current marine litter management practices
c) Actions needed to reduce the impacts of marine litter
d) Suggested approaches for developing solutions

3. SUMMARY ASSESSMENT/ CONCLUSION ABOUT MARINE LITTER IN EACH COUNTRY

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10. APPENDIX: DEMOGRAPHIC DATA

Table of comparison of demographic data per West Indian Ocean country and with other regions of the world.

Table sorted by Gross National Income at Purchasing Power Parity per capita												
WIO	Country	Pop. in mid-2006 (millions	GNI per capita: ppp US$ (2005)	HDI rank of 177 states 2003 ##	% pop. below US$ 2 per day	Projected pop. change 2006-2050 (%)	% urban	Pop. with access to improved sanitation (%) 2002 Urban:Rural		Infant deaths per 1000 live births	Approx. coastline (km)	Area of country (sq km) (thousands
	Tanzania	37.9	730	164th	90	92	32	54	41	68	1,424	945
	Madagascar	17.8	880	146th	85	135	26	49	27	83	4,828	587
	E. Africa Av	284.0	1,090		79	133	24	50	26	81		
	Kenya	34.7	1,170	154th	58	87	36	56	43	77	640	583
	Mozambique	19.9	1,170	168th	78	89	32	51	14	108	2,470	802
	Comoros #	0.7	2,000	132nd	60	118	33	38	15	59	340 (islands)	2
	All Africa	924.0	2,480		66	116	37	62	30	84		
	All Asia	3,968.0	5,960		59	33	38	74	31	49		
	BlackSea Av	94.4	7,845		13	-21	63	95	68	16		
	Latin America	566.0	7,950		24	41	76	84	44	26		
	World Avg.	6,555.0	9,190		53	41	48	81	37	52		
	South Africa	47.3	12,120	120th	34	2	53	86	44	54	3,000	1,220
	Mauritius	1.3	12,450	65th	_	20	42	100	99	14.6	177 (island)	2
	Seychelles	0.1	15,940	51st	_	13	50	_	100	16	491 (islands)	0.5
	All Europe	732.0	21,120		_	-9	75	_	_	7		
	Oceania	34.0	22,180		_	43	73	98	58	27		
	N. America	332.0	40,980		_	39	79	100	100	7		
Source: 2006 Population Reference Bureau (PRB), World Population Data Sheet 2006. www.prb.org												

Notes on the Table:

a. *(—) Indicates data unavailable or inapplicable.*
b. *# Comoros' poverty estimate from http://ec.europa.eu/development/ accessed on 15Jan'07.*
c. ***## HDI - Human development index raking:** from Canadian International Development Agency website: www.acdi-cida.gc.ca accessed on 18Jan'07*
d. *Oceana comprises Australia, New Zealand and Polynesia*

e. ***GNI PPP per Capita, 2005 (US$):*** *GNI PPP per capita is gross national income in purchasing power parity (PPP) divided by midyear population. GNI PPP refers to gross national income converted to "international" dollars using a purchasing power parity conversion factor. International dollars indicate the amount of goods and services one could buy in the United States with a given amount of money. Data are from the World Bank.*

f. ***HDI*** *- The Human Development Index measures the average achievements in a country in three basic dimensions of human development:*
** A long and healthy life, as measured by life expectancy at birth*
** Knowledge, as measured by the adult literacy rate (with two-thirds weight) and the combined primary, secondary and tertiary gross enrolment ratio (with one-third weight)*
** A decent standard of living, as measured by GDP per capita (PPP US$).*
Caution: Calculation of HDI is an evolving methodology, and comparisons should not be made between years (when methods might have varied) but can be made between countries, as issued by the same source (UNDP, 2001)

g. ***Percent of Population Living Below US$2/Day:*** *The proportion of people living below $2 per day is the percentage of the population with average consumption expenditures less than $2.15 per day measured in 1993 prices converted using purchasing power parity (PPP) rates. The World Bank's estimates are drawn from surveys that use common methods for measuring household living standards across countries. When estimating poverty worldwide, the same reference poverty line has to be used, expressed in a common unit across countries. The World Bank uses reference lines set at $1 per day (extreme poverty) and $2 per day (poverty) in 1993 PPP terms, where PPPs measure the relative purchasing power of currencies across countries. For analysis of poverty trends in a particular country, use of the national poverty line is preferable.* ***Most data refer to the late 1990s and early 2000s****.*

h. ***Projected Population 2050:*** *Projected populations based upon reasonable assumptions on the future course of fertility, mortality, and migration. Projections are based upon official country projections, series issued by the UN or the U.S. Census Bureau, or PRB projections.*

i. ***Percent Urban:*** *Percentage of the total population living in areas termed "urban" by that country. Typically, the population living in towns of 2,000 or more or in national and provincial capitals is classified "urban."*

j. ***The percentage of the population using improved sanitation facilities:*** *Improved facilities are those more likely to ensure privacy and hygienic use. Improved facilities include connection to a public sewer, connection to a septic system, pour-flush latrines, simple pit latrines, and/or ventilated improved pit latrines. Unimproved facilities include public or shared latrines, open pit latrines, or bucket latrines- or no facilities at all.*

k. ***Infant Mortality Rate:*** *The annual number of deaths of infants under age 1 per 1,000 live births. Rates shown with decimals indicate national statistics reported as completely registered, while those without are estimates from the sources cited above.*

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11. APPENDIX: WIO COUNTRIES RECOMMENDATIONS FOR ACTION

1. COMOROS

Recommendations

Owing to the lack of waste management on the islands, it is urgent that a national action plan for marine litter management be developed. This should emphasize the need for:

- Subcontracting specialized international well equipped societies such as Actif Dubai and Veolia France
- Capacity building in local government, establishment of specialized waste agencies, training of qualified technicians,
- Identifying and establishing sustainable participatory funding mechanisms.
- EIA law enforcement
- Establishment of a national clean up the sea day
- Defining pollution standards, taking into account international ones
- Setting up a marine laboratory including marine pollution monitoring activities.

The design of foreign funded projects (e.g. European Union and UNDP) should be driven by local and national needs and strategies, to facilitate Comoros "ownership" and be sustainable. This has not occurred thus far. Projects should ensure there are appropriately qualified human resources and equipment in place, and a specialized public monitoring institution established, and that funding mechanisms are sustainable.

A participatory approach / joint action lead by local administrations (as the new established municipality), working with local communities through NGOs and CBOs, seems to be the best way forward.

2. KENYA

Recommendations (abbr.**)**

- Public awareness campaigns on dangers of marine litter and improper dumping, and waste handling problems as a whole should be promoted to sensitize the public. As part of public awareness campaigns television and newspaper documentaries should be produced focusing on the impacts of marine littering.
- The responsible agencies should provide supporting infrastructure facilities. For example, appropriate waste receptacles and signs should be placed on the beaches to facilitate collection of litter. If this is done, it will reduce the cost and even frequency of beach cleaning.
- There is need for further studies on issues of marine litter in the country in order to provide ways and means of influencing public perception and behaviour change.
- Need to put in place a long term programme for gathering monitoring data to address the existing knowledge gaps. The Kenya Marine and Fisheries Research Institute (KMFRI) could be facilitated to work together with the Mombasa Municipal Council (MMC), the National Environment and Management Authority (NEMA), the Kenya Wildlife Services (KWS) and other stakeholders including the private sector to put this programme in place.
- There is need to introduce the deposit refund system in the use of plastic beverage bottles and plastic bags.

- There is need to promote the establishment of waste recycling initiatives (as part of poverty relief).
- There is need to institute regular surveys at index sites to assess site specific variability. If this is implemented, it will tap on the experience of existing community based organizations.
- Strengthen the beach/coastal cleanup activity to involve more participants and increase its frequency so that it is carried out after every six months.
- There is need to increase the number of official dumping sites.
- There is need to institute appropriate sanitary dumping practices.
- Solid waste recycling and composting should be promoted.
- Lobby for formulation of a policy specific to marine litter and coastal management.
- The existing environmental related legislations and guidelines/policies/regulations should be reviewed so that marine litter issues are clearly and strongly captured. In addition, their enforcement should be strengthened by strengthening the existing institutional framework.
- There is need to understand that the communities have varied social/cultural characteristics and these characteristics influence their behaviors. The belief systems, attitudes, values and sociological setup needs to be considered in reducing illegal littering in urban and recreational areas, and from fishing and other vessels (must be consulted in workshops?)
- There is need to better understand origin of marine litter since some litter could be transported by waves from high seas especially in the northern sites such as Kipini, Lamu and Kiunga.

3. MADAGASCAR

Recommendations

Organisational and institutional

- So as to better structure the line of rational management of marine waste, it is important to draw up national technical directives. These directives must specifically concentrate on the system of sorting, processing and disposal of marine waste.
- The code for waste management which is being drawn up must specifically include the management of marine waste
- For this, it is essential to set up a general inventory for marine waste in Madagascar, something which is still non-existent, and to draw up an inventory of existing institutional structures and infrastructures.
- In addition, it is necessary to introduce incentive controlling mechanisms, and to improve the existing legal framework, which will require the drawing up of a legal document on the management of marine waste, as well as the involvement of all those stakeholders, authorities and representatives, NGOs and associations, private operators, civil society etc. The review will also take into account provisions for penalties in the event of failure to comply with or failure to implement, but will also provide incentives for those institutions which respond positively and rapidly.
- Up until now, there are no realistic aims/objectives identified for the reduction of the level of marine waste, backed by appropriate financing, except in the case of spillage of hydrocarbons into the sea with clear incentives and sanctions.
- At the level of MINENVEF, a strategy for the management of marine waste must be drawn up, and a sectoral impact guide for the management of solid and liquid waste, including dangerous waste.
- It is also recommended that the laws and regulations from central level be strengthened by regulatory measures (municipal decrees, etc.), procedures, measures

of implementation at provincial and local level. At this level, municipalities are mainly involved. In other words, it will be necessary to:

- strengthen national regulations regarding the management of marine waste;
- establish specific regulations for each type of marine waste (solid, liquid…);
- set up monitoring procedures ;
- establish the mechanisms and measures for incentives as well as the involvement of the private sector in the management of marine waste.

Information – Education/Awareness – Communication

The awareness, information and education and communication of the masses remain a key factor in the success of the on-site programme. The process must start with small-scale actions which will allow for general involvement, for encouraging communities (implementation of community micro-projects) : cleaning up of beaches, setting up of refuse containers, rehabilitation of urban sanitary equipment, establishment of a system of refuse collection, a factory for the processing of plastic waste and re-use of material) and ensuring the participation and awareness of local officials, building up of the follow-up system and local regulations.

Thereafter, funds will be required to assist those bodies/institutions to develop and run large scale activities like the setting up of infrastructures (facilities, factories and equipment or services?) for example initiatives towards the reduction of waste, the introduction or expansion of separate collections and the processing of waste for re-use (recycling), allocation of equipment, provision of salvage facilities for the re-use of material , the promotion of energy using waste technology and information and educational activities.

Capacity building and public-private partnership

A change of behaviour is called for in terms of knowledge, attitudes and practices. To this end, training and recycling are called for, to a specific timetable, and with objectives and targets

The involvement of the private sector must also be encouraged and facilitated.

Plan of Action

Involvement in terms of the management of marine waste may be summarized into three broad activities according to the following plan of action:

Activity 1 - Implementation of a participative process for the integrated management of marine waste (national integrated management programme for marine waste)

a – to inform and raise the awareness of the officials concerned at national, local and regional levels

b – to create consultation structures, train them, support them in the analysis of problems of management of waste and needs

Activity 2 – Improvement of knowledge on the current state of waste in the marine environment

a – national inventory, assessment and state of affairs
b – analysis of trends
c – development of an Information System / GIS
d – study on the system for waste management (collection, disposal, processing)

Activity 3 – Development and implementation of an integrated management policy/strategy for waste and its means of application (guiding framework and outline)

Activity 4 – Immediate intervention on the ground to resolve urgent problems.

In conclusion, so as to ensure the integrated management of marine waste in Madagascar, it is necessary, in order of priority:

- to set up and implement a strategy for the management of marine waste as well as the relevant legal framework,
- to improve the current system of organisation and incentive as well as the recovery of costs,
- to create the infrastructure for the transfer and disposal of waste in all 12 coastal regions and tourist areas,

- to draw up priority legal documents which are missing, and
- to build the human capacities of the institutions concerned.

4. MAURITIUS

Strengths in Current Marine Litter Management Practices:
In general, people are aware that marine litter is not good for the tourist industry and economy. Public beaches are daily cleaned by private contractors except those beaches that are not proclaimed public and in front of hotels and bungalows. Political will is present and clean up campaigns are often organised by NGOs and CBOs in certain regions. Facilities for collection and disposal are existent.
Weaknesses in Current Marine Litter Management Practices:
- However, institutional framework to deal with marine litter is inadequate. There is absence of specific regulations on marine littering.
- Waste minimisation practices seem not working
- Funding is limited
- Monitoring done by field inspectors not reported efficiently
- No best practices
- Accessibility to certain sites

Actions needed to reduce the impacts of marine litter
- Awareness raising
- Increasing faculties/amenities on beaches
- Regulations/code of ethics/best practices
- Preventive measures upstream such as placing and maintenance of grids in rivers and canals to retain debris

Approaches in developing solutions to the problems
- Involvement of stakeholders-community, private sector, NGOs, CBOs
- Ensure coordination among all stakeholders
- Regulations
- Dissemination of best practices
- Needs for funding

The extent to which the problem is clearly defined is poor, as so far, no specific study has been carried out.
Recommended priorities are for action: Observations made so far are mostly qualitative and to a lesser extent quantitative. Based on the strengths, weaknesses and gaps, the following actions are considered important for the issue of marine litter:
- Legislative –regulations on littering/practices/code of ethics
- Coordination mechanism
- Sensitisation and awareness raising
- Monitoring programme
- Reporting
- Communication

5. MOZAMBIQUE

Conclusion and Recommendations
Traditionally, marine littering in Mozambique has been rather neglected both in terms of research and management. This was manly due to the low incidence of littering and minor severity of impacts. Currently, marine litter is found in small quantities all along the coast with relatively higher quantities being found in selected areas close to large cities or popular beaches (particularly Maputo). Plastics, aluminium cans and glass are the main

items found, while in areas under oceanic influence tar pellets and high-density foams are also found, from high-seas shipping activities. As such, the present measures used to reduce marine litter are reckoned sufficient although there is a definite need to consolidate and adopt a systematic approach. A local initiative called "Eyes on the Horizon" coordinated by ANAII (Inhaca Island Association) (although primarily focused on illegal fishing) could be the depository of reports on marine littering and also coordinate or promote activities to prevent/reduce marine litter. There are other environmental organizations in the country capable of performing this task.

Actions needed

Given the relative low incidence marine litter and severity of impacts, a "National Programme on Marine Litter" is not recommended at this stage. Nevertheless, the following actions are deemed necessary:

i) Research

- There is a need to gather information on composition, amount and sources of litter in other areas along the coast (especially in the north)
- Assess seasonal variation in litter type and quantity in order to focus management measures

ii) Management

- Regular and consistent beach clean-up and awareness campaigns should be undertaken in sensitive or hot spot areas
- Trash bins should be made widely available
- Local communities should be encouraged to take an active role
- Recycling facilities and initiatives should be promoted, which would stimulate the participation of local communities

iii) Legal and Institutional aspects

- The country must join the MARPOL convention
- Littering must be enforced within municipalities
- Penalties for littering should be updated within the existing legislation.

6. SEYCHELLES

Conclusion and Recommendations

It is found in this study that the Seychelles currently has some important litter management initiatives which together is able to maintain a relatively clean environment compared to similar countries in the region. It is thought that this is because there is;

• High level of Government commitment towards environmental preservation and cleanliness which translates into provision of adequate funding for cleaning activities and daily collection of waste.

• High level of Environmental Awareness amongst the Seychelles people who are quick to report abuses such as illegal dumping or whenever the waste truck has missed a particular bin site. This allows for early detection of waste problems.

However, like all SIDS, Seychelles is vulnerable to some inherent weaknesses which also affect its litter management programme. These are;

• Lack of sufficient funds to implement programmes and buy into the latest technology for waste collection and treatment, waste segregation and pre-treatments.

• Lack of suitably trained personnel

• Limited land availability resulting in concentrated coastal pressures. It means that industrial, residential and leisure activities all compete for the same space and waste generating activities are close to the sea.

• Outdated and overlapping legislation.

Although this study has identified litter programmes and has hinted on what needs to be done, it must be noted that the list of hotspots or litter management programmes may not be exhaustive.

There is a need to conduct more detailed studies which unfortunately lies outside the scope of this review. Such studies could quantify the effectiveness and add value to these initiatives. There is also a need to review the roles of all stakeholders involved in marine litter preferably through a workshop followed by a detailed action plan with budget for implementation. This will lead to adoption of the programme and may highlight critical gaps which might not have been picked up in this review.

7. SOUTH AFRICA

Summary Assessment about Marine Litter in South Africa

There is a considerable body of knowledge about marine litter in South Africa, almost certainly more than any other country in Africa. Based mainly on beach litter surveys, we know a substantial amount about the abundance, distribution and trends of different types of litter around the coast. The sources of the litter are inferred rather than demonstrated; there have been no studies tracking the release of marked items in the waste stream to track their dispersal, but it is clear from surveys of waste water litter loads and the differential dispersal of various types of litter around the coast that most litter on beaches and, presumably, in inshore waters, derives from local, land-based sources, with urban centres being the source of most marine litter. South Africa faces especially severe problems with marine litter (and litter in general) because retail products are heavily packaged, yet a large proportion of the population has limited access to formal waste disposal options.

The dynamics of marine litter once in the environment are less well understood. Most marine litter is made from materials that float, especially plastics. Denser materials may be a problem if they are dumped at sea, but such litter does not disperse far from source areas, and thus tends to be a local rather than a widespread problem. Some floating litter is stranded on beaches, where it may remain on the surface, be removed by the wind or waves, or by formal or informal cleanup efforts, or be buried in the beach. On the surface, plastics are subject to UV degradation, and gradually break up into smaller meso- and micro-litter fragments, which are now ubiquitous in the world's oceans. The time taken for UV degradation to take place varies depending on the type of plastic and its additives, as well as its thickness. Some items last at least 20 years even exposed to the high levels of radiation found on South African beaches. Once buried, plastic litter is largely impervious to degradation, and may be released again when the beach is eroded during storms. Litter at sea may disperse vast distances, crossing ocean basins, and arrive at remote locations such as oceanic islands. It may play a role in rafting organisms to these remote systems, with potentially serious biological and commercial impacts. Other litter may become so heavily fouled with encrusting biota that it sinks to the seabed. There is little information on the magnitude of these various pathways, but this is a common lack in all systems.

Litter has numerous impacts on marine ecosystems, as well as direct and indirect impacts on humans. The main ecological impacts of floating litter are that it is ingested, or entangles, marine organisms. Off South Africa, levels of ingestion and, perhaps to a lesser extent, entanglement, are on a par with the highest recorded elsewhere in the world. There are some encouraging developments (e.g. the reduction in virgin pellets ingested by seabirds), but overall the situation remains unacceptable, with several threatened species affected. Litter that sinks to the seabed may impede gas exchange in bottom sediments or become entangled around sessile organisms, increasing their drag and hence the risk of their being washed off when there are large storm swells. The magnitudes of these impacts are largely unknown. Economic and aesthetic impacts include reduced amenity value (e.g. beach use drops as litter levels increase), ever growing investment in formal beach cleaning programmes, risk of flooding due to blocked drains, disabling or damaging vessels and impacting on commercial fisheries. Most of these impacts have not been quantified in economic terms.

Priorities for action

Given the diffuse nature of most litter sources, tackling the problem is not simple. It requires a combination of education at all levels of society with appropriate legislation and incentives to manage wastes effectively and prevent littering. Much of the problem lies with inadequate solid waste facilities at a municipal level, coupled with a lack of willingness to use facilities where they are available. The packaging and retail industry is quick to point out that people litter, not products, but they must bear some responsibility for litter-prone designs, and inappropriate replacement of degradable products. Greater use of reusable packaging should be promoted, and the polluter-pays principle embraced more widely. Unfortunately, it appears that by and large industry is unwilling to take these steps voluntarily, which places the onus on government to impose legislation and regulations. The law requiring retailers to charge for plastic carrier bags met with considerable public support, despite strong opposition from the retail sector, and has been effective in reducing the numbers of carrier bags entering the litter stream. Similar legislations should be considered for other litter-prone articles, should producers fail to act voluntarily.

Key points for action include to:

- improve waste reception and disposal facilities in fishing harbours;
- implement schemes to reward fishing vessels to return wastes to shore;
- educate recreational fishers and small boat users about the problem;
- raise the profile of marine litter as an issue at national government level;
- encourage legislation to promote recycling and reuse through appropriate financial mechanisms;
- develop and support appropriate training programmes to build capacity in waste management at local and national government levels;
- explore alternative packaging options, and make explicit the costs of different packaging to consumers (including disposal costs for single-use packaging);
- require the installation of litter traps and grids on storm water systems to prevent litter entering rivers and the sea;
- set up an effective monitoring programme to assess the efficacy of mitigation measures.

8. TANZANIA

Summary Assessment/Conclusions

The extent to which the problem is clearly defined

The extent of marine litter and associated problems is not known in the country since there is no any assessment or study has been conducted on the subject matter. However the sources/origin of marine litter is clearly known and vividly seen. The origin of the marine litter in the country is mainly from crude open dumps which are located near the ocean, rivers and streams. Other sources includes illegal waste dumping in river valleys and sewerage and storm water drains by people who do not want to pay the refuse collection charges and those who live in unplanned settlements where infrastructure are poor. A recreational activity on the beach is another source of marine litter, without forgetting fishing activities (fishing nets, dynamites, abandoned fishing gears). Waste generated from ships is another big source of marine litter.

Although no assessment have been done on the impact of marine litter in the country problems associated with it are similar everywhere in the world. As it was mentioned earlier in this report, direct consequences of the marine litter include smothering and entanglement of corals and other marine organisms, reduction of the aesthetic value of the water and beaches, making it less attractive for such activities such as tourism and general recreation. Marine litter might therefore pose a significant threat to emerging economic activities such as coastal tourism and fishing which have a great potential in

national development. However, this degradation is also contributed by inadequate law enforcement by relevant authorities.
Therefore, enforcement of available legal framework on waste management and development of a national waste management policy that holistically addresses the waste problem is an essential prerequisite for effective solid waste management and littering control and in the country.

Less has been done to ensure public awareness on the entire solid waste management process including existing laws governing solid waste management hence public support and participation in the process has been insignificant. Public awareness is vital in addressing marine litter problem and ensuring public participation in the battle against marine litter and related activities.

SN	Priority	What to be done	Where	When to be done	Actors	Strategies
1	Research to quantify and assess the magnitude of marine litter and the associated problems in the country	Conduct research to quantify and assess the impact of marine litter in the country	Coastal environment, EEZ and the territorial sea within the jurisdiction of the country	Anytime when funds are available, as part of the academic programme	The local government in collaboration with NEMC, FAST, coastal management programmes such as TCMP, MACEMP	Conducting of small surveys/studies involving undergraduate or graduate students as part of their academic requirement
2	Development and conduction of Solid waste/marine litter public awareness programme	Conduct public awareness programmes on solid waste/marine litter and associated problems and management proposals	Coastal cities and urban centres	As soon as possible	City council with respective municipal councils, NEMC, coastal management programmes (TCMP, MACEMP)	• Conduct seminars, meetings, dramas, media programmes • Production and distribution of awareness materials such as fliers, brochures, posters
3	Public awareness campaign on laws and by-laws governing solid waste management	Translate and distribute soft language booklets on laws and by-laws governing solid waste management to the public	Entire country starting with coastal cities	Immediately	City council and respective municipalities, NEMC	• Selection of a team of experts to do the translation of laws • Print and distribute the booklets to the public • Conduct awareness programmes on TVs and radios
4	Preparation of national solid waste management policy, standards and guidelines for disposal	Prepare solid waste management policy, standards and guidelines for disposal	In the country	Once funds are secured	City & Municipal councils in collaboration with DoE and NEMC	Formulation of a team of experts to prepare the policy, standard and guidelines
5	Promotion of waste minimization and recycling programmes	Promote and encourage waste recycling initiatives	Countrywide but starting with coastal cities	Immediately	City & Municipal councils in collaboration with DoE and NEMC	• Identify and register individuals, groups, NGOs, industries engaged in waste recycling • Identify the kind of materials recycled and the quantity • Find out markets for recyclable materials

SN	Priority	What to be done	Where	When to be done	Actors	Strategies
6	Enforce available regulations governing solid waste management to ensure compliance	Increase strictness against laws violation	Entire country	Immediately	Local government authorities (municipalities, city councils, streets and wards leaders) NEMC, other solid waste management stakeholders)	• Recruit people who have undergone short-term military training and give them policing mandates with provision of incentives through penalties set for violation against the law (Lesson from Moshi municipality). This will supplement the available capacity in municipalities and will enhance enforcement efforts on laws and by-laws on waste management

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