
WESTERN INDIAN OCEAN

REGIONAL ACTION PLAN ON MARINE LITTER (WIO-RAPMaLi)



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The Institute of Marine Sciences (IMS) is an academic unit of the University of Dar es Salaam, established in 1978, following a Resolution of the Council of the University of Dar es Salaam. The Institute is located in Zanzibar, residing on the premises of the former East African Marine Fisheries Research Organisation (EAMFRO) of the now defunct East African Community. The main mission of the Institute is to engage in the creation, transmission and evaluation of knowledge in marine sciences through research, training and provision of advisory and public services. The Institute has a long and reputable track record of training, research and providing advisory services in various aspects of coastal and marine sciences. These include coastal zone management, coastal community livelihoods and food security; geophysical sciences and climate change; fisheries and mariculture; marine pollution; biodiversity and conservation; marine based ecotourism; marine technology and innovation.

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Acronyms

ARPEGE	Programme d'Appui à la Promotion d'une Education pour la Gestion de l'Environnement
BI	Birdlife International
BMP	Best Management Practices
CI	Conservation International
CORDIO	Coastal Oceans Research and Development-Indian Ocean
EAWLS	East African Wildlife Society
EPS	Expanded polystyrene
GEF	Global Environment Facility
GESAMP	Group of Experts on the Scientific Aspects of Marine Pollution
GPA	Global Program of Action
IMS	Institute of Marine Sciences
IOC	Indian Ocean Commission
IUCN	International Union for Conservation of Nature
KMFRI	Kenya Marine and Fisheries Research Institute
LBSA	Land Based Sources and Activities
MOI	Mauritius Oceanographic Institute
NC	Nairobi Convention
ORI	Oceanographic Research Institute
SDG	Sustainable Development Goal
SUZA	State University of Zanzibar
SWIOFC	Southwest Indian Ocean Fisheries Commission
TAFIRI	Tanzania Fisheries Research Institute
TNC	The Nature Conservancy
UDSM	University of Dar es Salaam
UEM	University of Eduardo Mondlane
UN	United Nations
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCS	Wildlife Conservation Society
WG40	Working Group 40
WI	Wetlands International
WIO	Western Indian Ocean
WIO-C	Western Indian Ocean Consortium
WIO-RAPMaLI	Western Indian Ocean Regional Action Plan on Marine Litter
WIOLAB	Addressing Land-based Activities in the Western Indian Ocean
WIOMSA	Western Indian Ocean Marine Science Association
WMO	World Meteorological Organization
WWF	World Wide Fund

Definition of Terms

Marine litter	regardless of the size, means any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment.
Litter monitoring	repeated surveys of beaches, sea bed, water column, surface waters and biota to determine litter types and quantities in a representative manner such that information can be compared with baseline data to follow trends.
Nairobi Convention	the Convention for the Protection of the Marine Environment and the Coastal Region of the Western Indian Ocean
LBSA Protocol	the Protocol for the Protection of the Western Indian Ocean against Pollution from Land-Based Sources and Activities of the Nairobi Convention
Western Indian Ocean	the region spans across a large latitudinal range, from the Somalia region, influenced by the strong monsoon regime of the northern Indian Ocean to the southern temperate regime of the tip of South Africa, where the Agulhas current diverges from the northward moving Atlantic Benguela current. It encompasses tropical and subtropical regions of diverse nature, rich stretches of coast along the mainland countries of Somalia, Kenya, Tanzania, Mozambique and South Africa, and vast oceanic areas surrounding the island states of Madagascar, Seychelles, Comoros, Mauritius and French Territories of Reunion and Mayotte.

Summary

Countries in the Western Indian Ocean are endowed with coastal and marine ecosystems rich in biodiversity and luxuriant resources that are important to the well-being of their people. However, these resources are under pressure from a variety of natural and man-made factors, including; resource overexploitation, pollution, unplanned coastal development and climate change. Marine litter is becoming a significant contributor to marine pollution in the World Oceans and Western Indian Ocean (WIO), is not exempt. Over 80% of marine pollution that constitute marine litter and microplastics is from land-based sources, largely associated with the increasing use of synthetic materials, industrialization and urbanization of coastal areas, where disposal and waste management practices are inadequate. Many types of marine litter particularly plastics persist for hundreds of years and are the most damaging to the marine environment. They have a wide range of adverse impacts to the ecological, socio-economic, recreational and aesthetic values of coastal and marine ecosystems. It is a complex, multi-dimensional, multi-sectoral and transnational environmental problem that warrants urgent and effective joint policy and abatement measures to be put in place. In recognition of the problems caused by marine litter, the United Nations General Assembly, in its 60th Session of 2005 called for the national, regional and global actions to address the matter. As a response to the UN call, the UN Environment commissioned the first study on regional overview and assessment of marine litter in WIO region in 2007. According to the report, sparse data exist on the types, quantities, sources, distribution and the magnitude of impacts of marine litter, with the exception of South Africa. The assessment report served as a stepping stone towards development of this WIO Region Marine Litter Action Plan.

This regional action plan is prepared in response to UNEA Resolutions 1/6, 2/11 and 3/20 in an effort to address the problem of marine litter in a coordinated and collaborative manner among the contracting parties to the Nairobi Convention. The plan is aimed at: setting standards for contracting parties on the agreed commitments into action for improvement of the quality of marine and coastal environment; supporting future implementation of the LBSA Protocol; and supporting achievement of Sustainable Development Goal 14, especially target 14.1 that seeks to prevent and significantly reduce marine pollution of all kinds by 2025, in particular from land-based activities, including marine debris and nutrient pollution. The proposed actions focus on five broad areas: Institutions and Stakeholders' Engagement; Policy and Legal Frameworks; Operations for Removal and Prevention of Marine litter; Education and Outreach; and Monitoring, Research and Reporting advocating exchange and sharing of experiences, lessons and best practices in managing marine litter.

1. INTRODUCTION

1.1 Background

The world oceans cover three quarters of the planet surface, containing 97% of the Earth's water, and representing 99% of the living space by volume (UNESCO 2017). The coastal and marine environment is tremendously important to the livelihoods of the human population. For instance, it is estimated that 1.2 billion people (23% of global population) live in the coastal area within 100 m elevation and 100 km of the coast (Nichols and Small 2002), with such population increasing disproportionately to the global population increase (Shi and Singh 2003). Nevertheless, exploitation of this immense resource exposes the coasts, oceans and seas to a number of mixed threats to their sustainability. For example, it is indicated in the Sustainable Development Goal 14 that as much as 40% of the world oceans and seas are heavily affected by human activities, including pollution, depleted fisheries, and loss of coastal habitats.

Marine litter, defined as “any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment” (Coe and Rodgers 1997; UNEP 2005), has recently taken a top slot in the political and public agenda on the health and integrity of the world's oceans and seas. Constituting to marine litter are floating oceanic debris, which tend to accumulate at the center of gyres and along coastlines, frequently washing aground, where they are commonly known as beach litter, tide wrack or ocean trash. One of the more familiar aspects of any visit to the coast in many areas of most of the WIO countries is the sight of plastic debris on the shoreline or floating in the sea. Derived from the marine plastic litter are microplastics. These are small plastic pieces less than five millimeters long, which can be harmful to ocean and aquatic life (Rezania et al. 2018). Microplastics are categorized as primary such as pellets and secondary from the fragmentation of larger plastics. Over 80% of marine pollution that constitute marine litter and microplastics is from land based sources (GESAMP 1991), largely associated with diverse and increasing use of synthetic materials, industrialization and urbanization of coastal areas, where disposal and waste management practices are inadequate (Chen 2015). This warrants urgent and effective joint policy and abatement measures to be put in place for the region.

1.2 Mandate and Rationale

The UNEA Resolution 1/6 of 2014 on Marine Plastic Debris and Microplastics that urged UNEP to provide support to the development of marine litter action plans upon request by countries, recognizing regional and national differences in the levels and sources. Accordingly, measures need to be taken and adapted as appropriate to local, national and regional situations. This was further reiterated in Resolution 2/11 of 2016 that

requested the Executive Director of UN Environment to provide assistance in the development of national and regional measures and action plans to address marine litter, reaffirming the UN General Assembly Resolution 70/1 of 25 September 2015, by which the 2030 Agenda was adopted for Sustainable Development and recalled Sustainable Development Goal 14 and its target 14.1, seeking to prevent and significantly reduce marine pollution of all kinds by 2025, in particular from land-based activities; and to respond to concerns expressed in its Resolution 70/235 of 23 December 2015, on Oceans and the Law of the Sea, regarding the negative effects of marine debris and microplastics and urging States to take action.

A follow-up resolution UNEP/EA.3/L.20 invited relevant international and regional organizations and conventions including inter alia the Convention on Biological Diversity, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Stockholm Convention on Persistent Organic Pollutants, the International Maritime Organization and its conventions, the Food and Agriculture Organization, Regional Fisheries Management Organizations/Arrangements, the Regional Seas Conventions and Programmes, the Organization for Economic Cooperation and Development and the Strategic Approach for International Chemicals Management, as appropriate within their mandates, to support prevention and reduction of marine litter and microplastics and their harmful effects. Specifically, the action plans have to address the need for capacity building, knowledge transfer, awareness-raising and partnerships. Responding to this resolution, UN Environment through its Global Programme of Action (GPA) for the Protection of the Marine Environment from Land Based Activities and the Regional Seas Programme, is taking an active lead by assisting the Regional Seas Programmes around the world in organizing and implementing regional activities on marine litter.

Accordingly, the Contracting Parties to the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean Region (Nairobi Convention) in its Decision CP7/2, made during the Conference of the Parties held in Mahe, Seychelles from 22-24 June 2015, urged the Parties to among other things, implement the GPA within the context of the Amended Nairobi Convention and the Protocol on Land Based Sources and Activities, with the support of UN Environment. This was to follow up to regional assessments on aspects of marine litter. Lane et al. (2007), conducted an overview study and UNEP/Nairobi Convention Secretariat and WIOMSA (2009) specifically reviewed policy, legal, regulatory and institutional frameworks. Some of the main issues raised by these reports include: (i) Countries of the region lack specific policies, laws and regulations to exclusively deal with marine litter and microplastics; (ii) Water runoff from urban areas is the most significant source of marine litter and success in managing the problem varies significantly between countries; (iii) Effective waste management to reduce marine litter is mostly constrained by inadequate awareness about the impacts and shortage of resources; (iv) Land based sources of marine litter are more significant than marine based sources, and that the marine-based sources are more difficult for countries in the region to control; and (v) Countries of the region have varied capacities for preventing solid waste

generated on land, from reaching the sea. Accordingly, effective and continuous research, documentation and monitoring to assess the types and amounts of marine litter are necessary for effective reduction, abatement and alleviation. This warrants an Action Plan to guide the identification of needs and operations of combating marine litter. It is from this background that preparation of this Western Indian Ocean Regional Action Plan on Marine Litter (WIO-RAPMaLi) is founded.

1.3 Objectives and Scope

This action plan is developed with four fold broad objectives.

- (i) To provide guidance and enhance knowledge on the prevention and reduction of marine litter and microplastics including upstream interventions and its impact on marine ecosystems, public health and safety through coordinated regional actions.
- (ii) To monitor the quantities and distribution of marine litter and microplastics for enhancing knowledge and establishing a regional mechanism to deal with the marine litter problem and its impact in the region.
- (iii) To serve as a guide in the management of marine litter and microplastics in accordance with accepted international and regional standards and approaches.
- (iv) To advocate for removal through clean-up campaigns of already existing marine litter to the largest extent possible.

This WIO-RAPMaLi targets litter discharged from both land and sea-based sources as well as litter which is already present in the marine environment and applies to the whole marine area of the WIO region as defined in the Nairobi Convention.

1.4 Outcomes

Expected outcomes that support the preparation of this WIO-RAPMaLi are:

- Identified and recognized specific sources of marine litter and microplastics that are of most concern in the WIO.
- Regionally developed and coordinated measures for reducing and removing litter from the marine environment.
- Contribute to achievement of SDG 14.1 by the WIO region.

1.5 Guiding Principles

Precautionary Principle: where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. As such, preventive measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the marine environment may bring about hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea, even when there is no conclusive

evidence of a causal relationship between the inputs and the effects.

Polluter-pays Principle: adoption of necessary and appropriate legislations and enforcement such that costs of pollution prevention, control and reduction measures are to be borne by the polluter, with due regard to the public interest.

Integration Principle: within and among member countries, where marine litter management shall be an integral part of the solid waste management and other relevant strategies to ensure environmentally sound management of human activities and rational use of resources.

Prevention Principle: that any marine litter management measure should aim at addressing the prevention of marine litter generation at the source and input into the ocean, removal of existing litter and improvement of solid waste management.

Public Participation Principle: enhancement of public participation and stakeholder involvement, by creating awareness about the problem of marine litter and ensuring a sense of public ownership in order to build support for relevant measures.

Sustainable Production and Consumption: transforming unsustainable patterns of production and consumption to sustainable ones that decouple human development from environmental degradation, for example, the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle.

2. MARINE LITTER AND MICROPLASTICS IN WIO

2.1 Sources and Types

Common types of materials that make their way into the oceans include such items as plastic bottles, cans, bags, balloons, rubber, metal, fiberglass, and cigarettes. Others include fishing gear such as line, ropes, hooks, buoys and other discarded materials. These materials are either discarded deliberately or accidentally and emanate from land-based or sea-borne sources. Among these solid wastes, plastics are the most common and persistent in the WIO region (Lane et al. 2007; Duhec et al. 2015).

Although the most obvious types of marine litter are the larger plastic debris, microplastics are also emerging as a global threat in the marine waters, and WIO is not spared. Microbeads are a primary source of microplastics, commonly used in commercial products for cleaning and personal hygiene such as detergents, cosmetics and toothpastes. Secondary microplastics result from fragmentation of larger plastics items in the environment, release of fibres from the washing of textiles and the spillage of pre-production pellets or powders that are in transit or process prior to being made into everyday plastic items. Appendix 2 summarizes common sources of marine litter in the WIO countries.

2.1.1 Land-Based Sources and Types

Marine litter and microplastics are mainly a result of activities occurring on land and with such materials being blown, washed or discharged into the sea. In the WIO, major land-based sources of marine litter are waste from dumpsites; rivers; flood waters; industrial outfalls; discharge from storm water drains, untreated municipal sewage; and littering of beaches (Lane et al., 2007). As elsewhere, coastal populations in the WIO are traditionally concentrated at river mouths and areas suitable for the establishment of ports, and increasingly in areas important for tourism. In addition, industrial development has expanded into such areas to take advantage of opportunities for trade, tourism and other commercial activities. These activities have made coastal population and commercial centres major sources of marine litter and microplastics, with industries, settlements, hospitals and market places being the primary sources (Bello et al. 2016).

2.1.2 Ocean-Based Sources and Types

Apart from land based activities, a significant amount of marine litter and microplastics come from sea-borne sources, with shipping, fishing and offshore resource extraction being major activities discharging litter into the marine environment (Lane et al. 2007). Such marine debris may originate from accidental loss, indiscriminate littering and

illegal disposal directly into the water. To a lesser extent, offshore mining and authorized dumping at sea contribute to marine litter, although the latter activity is found to occur in known locations and appear to be relatively well regulated.

The Indian Ocean offers major shipping routes connecting Africa, Asia, America and Europe. This has inadvertently exposed the WIO waters to overboard littering. For instance, the ecological status of the Somali marine life and of its coastal areas has been significantly affected by shipping. The fisheries sector is another important contributor to marine littering in the Western Indian Ocean, with discarded fishing gear and garbage forming a potential source of litter. Both local and foreign fishing vessels operate in the WIO waters both legally and illegally, with the potential for littering. However, there have been no comprehensive studies in the region to determine the quantities of garbage dumped from shipping liners and fishing boats (Lane et al. 2007).

2.2 Impacts

Marine litter has considerable ecological and economic impact within the marine environment. Impacts of marine litter on species are either directly through entanglement and ingestion or indirectly through chemical contamination. Plastic waste is the most worrying type of marine litter in the WIO region. Microplastics are characteristically more serious as these mingle with phytoplankton and cannot be easily scooped out of the oceans. For instance Hoarau et al. (2014) reported that in the South-West Indian Ocean, more than half of the loggerhead sea turtles (51.4%) recorded to have ingested marine debris (mostly plastics), causing sub-lethal effects or mortality. In addition, marine debris also has financial implications in the tourism industry as they reduce the aesthetic value of beaches resulting into low economic returns from decreased number of visitors (Lamprecht 2013). Appendix 3 provides a summary of release areas of marine litter in the WIO countries and their key impacts. Nonetheless, more needs to be done to verify and update patterns of the impacts as related to the abundance in the region (Lane et al. 2007).

2.3 Management of Marine Litter

There exist a number of mechanisms at national and regional levels relevant for management of marine litter in the WIO region, which can support implementation of the action plans. Networking of institutions or legal mechanisms can facilitate collaboration and mobilization and sharing of resources, expertise and information to achieve the desired action plan outcomes. Through both the GPA and the Regional Seas Programme, UN Environment is already implementing initiatives to raise awareness on marine litter and microplastics as well as spearheading efforts in the monitoring and assessment at the regional level. Such initiatives include the recently launched Massive Open Online Course on Marine Litter, by the Global Partnership on Marine Litter aiming to raise global awareness.

Regionally, initiatives have been implemented to address marine litter within the frameworks of the activities of various regional and international organizations such the World Maritime Organization (WMO), South Western Indian Ocean Fisheries Commission (SWIOFC), FAO and Western Indian Ocean Marine Science Association (WIOMSA). Early regional initiatives include the overview assessment on the marine litter problem and review of the policy, legal, and institutional framework in the region under the auspices of the Nairobi Convention Secretariat and GEF-funded project: Addressing Land-based Activities in the Western Indian Ocean (WIOLAB) (Lane et al. 2007; UNEP/Nairobi Convention Secretariat and WIOMSA 2009).

Among the existing regional platforms with potential to support and facilitate implementation of marine litter management initiatives is the intergovernmental Indian Ocean Commission (IOC), which has a track record of implementing and/or coordinating various coastal and marine resources and habitat conservation and awareness programmes in the region. Among others, IOC has implemented the “Programme d’Appui à la Promotion d’une Education pour la Gestion de l’Environnement” (ARPEGE), which was a regional support programme for the promotion of education for the management of the environment, with the major goal of imparting a sense of awareness among the young generation on the importance of protecting the environment and the natural resources of their countries. IOC also implemented Environmental Components B and C of the “GEF-Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention Project”, with Component B aimed at capacity building for prevention of coastal and marine contamination, while Component C was for building capacity for regional oil and chemical spill response in the region.

A regional institutional networking in the WIO can be exemplified by the Consortium for the Conservation of Coastal and Marine Ecosystems in the Western Indian Ocean (WIO-C). This comprises a group of international and regional NGOs in partnership with intergovernmental organizations that have presence and are active in regional marine and coastal ecosystem management in the WIO. These include the International Union for Conservation of Nature (IUCN), Wildlife Conservation Society (WCS), WIOMSA, WWF, The East African Wildlife Society (EAWLS), Coastal Oceans Research and Development-Indian Ocean (CORDIO), the Nairobi Convention, Birdlife International (BI), Wetlands International (WI), Blue Ventures, Rare, The Nature Conservancy (TNC), Fauna and Flora International and Conservation International (CI). Existing research and academic institutions, with vast human and institutional capacity that can be utilized in the course of implementing the action plan. These include the Institute of Marine Sciences-University of Dar es Salaam (IMS-UDSM); Eduardo Mondlane University (UEM); University of Kwa-Zulu Natal (UKZN); Nelson Mandela Metropolitan University (NMMU); Oceanographic Research Institute (ORI); Kenya Marine and Fisheries Research Institute (KMFRI); Mauritius Oceanographic Institute (MOI); Tanzania Fisheries Research Institute (TAFIRI); University of Reunion Island; and State University of Zanzibar (SUZA). Appendix 1 summarizes national institutional, policy and regulatory arrangements; socio-economic activities; stakeholders and public awareness with relevance to marine litter and microplastics, in the region.

3. ACTIONS ON MANAGEMENT OF MARINE LITTER AND MICROPLASTICS IN WIO

In order to manage marine litter and microplastics in the WIO, the following actions are proposed, grouped in five broad themes: Stakeholder engagement; Policy and legal frameworks; Operations for removal and reduction of marine litter; Education and outreach; and Monitoring, research and reporting.

3.1 Stakeholder Engagement

Action 1: Establish a regional working group to coordinate stakeholder participation in management of marine litter

This should involve the establishment of a WIO Marine Litter Regional Working Group to coordinate and advise on appropriate actions for marine litter management. This should be done by identifying National lead institutions which will act as National Marine Litter Focal Points, tasked with facilitating review of existing government strategies and responsibilities in the management (control and abatement) of marine litter. This should also provide capacity building support to staff from national, provincial, and municipal governments, and port authorities on the prevention and control of marine litter from both land-based and sea-based sources.

Action 2: Develop and implement model national management plan for marine litter

In order to promote effective collaboration between Agencies and other parties, a model for integration of marine litter issues should be developed. This may entail: establishment of country-specific, integrated waste management programmes and projects that are within the context of a National Waste Management Strategy; encouraging development of appropriate industry and/or sector specific guidelines within the framework of National Management Plans; identifying key lead/responsible agency; engaging key stakeholders; conducting research and analyses related to marine litter that will be used to guide future policy decisions; developing and implementing incentives programmes to reduce marine litter; develop economic instruments to provide opportunities for marine litter initiatives such as reduction, recycling, reuse and recovery programmes (Action 8); providing a user-friendly guide of the marine action plan which can easily be used by NGOs, government departments and others; and providing best practice guide for different sectors.

3.2 Policy and Legal Frameworks

Action 3: *Review, evaluate and strengthen legislative measures for effective management of marine litter*

Existing waste management legislation needs to be reviewed, updated or revised to provide support for prevention and monitoring efforts. Effectiveness of the legislative measures needs to be evaluated, and determine whether or not they are being adequately enforced. In most cases, substantial legislation and regulations do exist, but are poorly enforced. The introduction of new legislation, where necessary, dealing specifically with marine litter and microplastics management is proposed and their effectiveness periodically evaluated.

3.3 Operations for Reduction of Marine litter

Action 4: *Improve port reception facilities to effectively manage ship-generated waste*

A survey of the adequacy of existing Port Reception Facilities of all the countries in the WIO is necessary to identify priority areas for improvement and provide recommendations for targeted interventions in respective countries to improve their facilities. Through this, concerns by shipping industry partners on efficiencies of the current operating procedures and reception infrastructure in some ports in the region will be addressed.

Action 5: *Eliminate, change or adapt products for environmental benefits*

It is necessary to evaluate all products and processes that include primary microplastics and act appropriately to reduce their impact on the marine environment. Manufacturing and retail sectors should be engaged to explore the possibility of voluntary agreements to phase out the use of microplastics as a component in personal care and cosmetic products. Where this prove not to be sufficient, a proposal could be prepared to call on the AU to introduce appropriate measures to achieve a 100% phasing out of microplastics in personal care and cosmetic products. It is important to carry out an evaluation of the potential harm caused to the marine environment by items such as cigarette filters/butts, balloons, cotton buds and biofilm support media used in sewage plants, to come up with proposals for elimination, change or adaptation requirements for these potentially problematic items.

Action 6: *Maintain clean environmental compartments*

It is essential to establish an exchange platform on experiences on good cleaning practices in beaches, riverbanks, pelagic and surface sea areas, ports and inland waterways. There is a need for development of best practice on environmental friendly technologies and methods for cleaning. Furthermore, sub regional or regional maps of hotspots of accumulation and floating litter should be developed. Hot spot areas should be identified through mapping of snagging sites or historic dumping grounds. There is a need for development of a risk assessment for identifying where accumulations of ghost nets pose a threat to the environment and should be removed.

3.4 Education and Outreach

Action 7: Promote the 4Rs (Reduce, Reuse, Recycle and Recover)

To manage the generation and input of plastic waste to the oceans, there is a need to promote the reduction, reuse, recycling and recovery of materials. This will be aided by the development of innovative and effective solutions as part of the circular economy. Used plastics should be considered and promoted as useful resource, with commercial value, rather than a waste problem requiring the allocation of scarce public and private sector resources.

Action 8: Encourage product eco-labelling

The labeling of products to show microbead content should be promoted. Additionally a campaign should be used to raise producers and consumers awareness on the harm to the marine environment and on proper disposal of these products.

Action 9: Establish a clearinghouse mechanism on effective strategies and practices for waste management

There is a need to promote knowledge management via database of what is known about marine litter and microplastics, and their effect on the marine environment. The establishment of such database will make information on effective strategies and best options for waste management accessible throughout the region. The database would be used as a repository of the marine debris data collected annually, allowing for direct processing and sharing of information and Best Management Practices (BMPs).

3.5 Monitoring, Research and Reporting

Action 10: Test and validate standard methodologies for studying and reporting on marine litter and microplastics for the WIO region

Common methodologies, guidelines and reporting protocols for assessment and monitoring of marine litter and microplastics, its sources, types and impacts have been developed by WIOMSA^{1,2}. These should be tested and validated for applicability. The recommendations provided by international bodies (such as GESAMP WG40) should be taken into consideration as important mainframe documents.

Action 11: Update baseline data on marine litter and microplastics in the WIO region.

Undertake survey(s) to update baseline data on marine litter at both regional and national level using developed methodologies and assessment criteria.

Action 12: Promote research on alternative biodegradable materials

Promote and conduct research on technologies for production of biodegradable alternatives to plastics. Investigation into alternatives to expanded polystyrene (EPS); and design of stronger, more durable materials to prevent the generation of

¹<https://www.wiomsa.org/wp-content/uploads/2018/09/Manual-on-Marine-Litter-FINAL-LOW-RES-FINAL.pdf>

²<https://www.wiomsa.org/wp-content/uploads/2018/09/Guide-on-Marine-Litter-FINAL.pdf>

microplastics from wear and tear during product use are relevant options to consider.

Action 13: Identify 'hotspots' of land- and sea-based sources for plastic and microplastics

To allow mitigation measures to be better targeted, and used to predict and verify their effectiveness there is a need for identifying 'hotspots' of land- and sea-based sources for plastic and microplastics, using a combination of targeted modelling, knowledge of actual and potential sources (e.g. coastal tourism, aquaculture, fisheries, riverine inputs, urban inputs), environmental and societal data.

3.6 Capacity Development

Action 14: Develop human capacity and infrastructure

Developing scientific and technical capacity in research and practice through education, training and knowledge exchange to enhance capacity for assessment, monitoring and policy making to address marine litter and its impacts. Investing in infrastructure development, acquisition and application to improve waste management systems is equally important.

4. IMPLEMENTATION AND MONITORING PLAN

This action plan is envisaged to be a five-year rolling plan. The implementation and monitoring matrix plan below presents a road map towards realization of the proposed actions, sets targets, to monitor progress, enforcement and effectiveness.

Proposed Action	Output/Target	Objectively Verifiable Indicators	Responsible	Timeframe				
				Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Stakeholder Engagement								
Action 1: Establish a regional working group to coordinate stakeholder participation in management of marine litter	Working group in place	- Activity reports - Established regional forum stakeholder	NC					
Action 2: Develop and implement model national management plan for marine litter	Model marine litter management plan produced	Model management plan in place	NC					
Policy and Legal Frameworks								
Action 3: Review, evaluate and strengthen legislative measures for improved waste management	As applicable, revised legislative measures strengthen	Revised/new legislation	Parties					
Operations for Removal of Marine litter								
Action 4: Improve port reception facilities to effectively manage ship-generated waste	Port reception facilities improved	Survey report on status of reception facilities in major ports	Parties					
Action 5: Eliminate, change or adapt products for environmental benefits	Environmentally friendly products adopted	Framework for regulation of environmentally friendly products	NC					
Action 6:	- Exchange	Exchange	NC					

Proposed Action	Output/Target	Objectively Verifiable Indicators	Responsible	Timeframe				
				Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Maintain clean environmental compartments	platform on experiences on good cleaning practices in beaches, riverbanks, pelagic and surface sea - Sub regional or regional maps of hotspots of litter accumulation and floating litter should developed.	platform						
Education and Outreach								
Action 7: Promote the 4Rs (Reduce, Reuse, Recycle and Recover)	Reduction, reuse, recycling and recovery of waste materials is promoted	Framework documents for promotion of 4Rs	Parties					
Action 8: Encourage product eco-labelling	Framework for eco-labelling developed	Eco-labelling framework document	NC					
Action 9: Establish a clearinghouse mechanism on effective strategies and practices for waste management	Clearing house mechanism established	Database of effective strategies and practices for waste management	NC					
Monitoring, Research and Reporting								
Action 10: Testing and validating standard methodologies for studying and reporting on marine litter and microplastics for the WIO region	Standard methodologies for studying and reporting on marine litter and microplastics for the WIO region tested and validated	Assessment report(s)	Parties					
Action 11: Update baseline data on marine litter and microplastics in the WIO region	Baseline data updated	Baseline assessment report(s)	NC					

Proposed Action	Output/Target	Objectively Verifiable Indicators	Responsible	Timeframe				
				Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Action 12: Promote research on alternative biodegradable materials	Research on biodegradable materials promoted	Research report(s)	NC					
Action 13: Identify 'hotspots' of land- and sea-based sources for plastic and microplastics	Hotspots identified	Hotspots map(s)	NC					
Capacity Development								
Action 14: Develop human capacity and infrastructure	Human and technical capacity enhanced	Framework for knowledge exchange in place	Parties					

5. CONCLUSION

Marine litter in the WIO region is gaining attention as both an environmental and economic problem. Two sources are identified: Land based and sea based, with the former being a major one. Plastics are the most common items found littering the beaches and the ocean, with serious health implications to the marine life and humans. The need for strong policies and laws, and enforcement is key for a successful marine pollution prevention initiative, but lack of proper enforcement of existing legislation by governments and private sector coupled with lack of specific legislation to address marine litter issues, is a common problem in the region. As such, efforts to address the marine litter problem should include encouraging Contracting Parties of the Nairobi Convention to ratify the LBSA Protocol and improve national policies and legislation that will ensure compliance with the Protocol, in particular those policies, legislations, strategies and activities, which address prevention of waste ending up in the marine environment.

To realize this, interventions at national level would include:

- Comprehensive understanding of human behaviour in relation to marine litter.
- Conducting consistent education and outreach (awareness and communication) programmes to the public through for example, establishment of debris abatement programmes, and changes of behaviours that ultimately lead to marine litter impacting ocean.
- Promote cross-country sharing of best practices and lessons learned because from the public point of view, each country is unique in culture, and therefore challenges and priorities. Sharing of information can save resources, otherwise wasted by recreating mistakes or flawed policies.
- Research and monitoring of waste recycling programmes should be encouraged within communities and especially amongst the young citizens as they play a major role in waste management and are more likely to change their behaviour much faster than the adults. To enhance this, development of national marine pollution monitoring programs for contaminants and pollutants through partnerships with research and academic institutions is ideal.
- Countries need to ensure that collaboration occur among the International community with stake on marine litter (e.g. UN agencies and regional bodies), government agencies and departments to secure funding through partnerships to address marine debris and for further implementation of the Regional Action Plan on Marine Litter. Availability of funding would allow creation of national strategies and opportunities that encourage people to reduce and eliminate marine litter through pilot projects of resource recovery especially of plastics at grass root level, where the problem stems from.

References

- Bello, I.A., Ismail, M.N. and Kabbashi, N.A (2016). Solid Waste Management in Africa: A Review. *Int. J Waste Resour* 2016, 6:2. DOI: 10.4172/2252-5211.1000216.
- Chen C.L. (2015). Regulation and Management of Marine Litter. In: Bergmann M., Gutow L., Klages M. (eds) *Marine Anthropogenic Litter*. Springer, Cham.
- Coe J.M. and Rodgers D.B. (eds). 1997. *Marine Debris: Sources, Impacts and Solutions*. Springer-Verlag, New York, 432 pp.
- Duhec, A.V., Jeanne, R.F., Maximenko, N. and Hafner J. (2015). Composition and potential origin of marine debris stranded in the Western Indian Ocean on remote Alphonse Island, Seychelles. *Marine Pollution Bulletin* 96: 76–86.
- GESAMP (1991). *The State of Marine Environment*. Group of Experts on the Scientific Aspects of Marine Pollution. Blackwell Scientific Publications, London.
- Hoarau, L., Ainley, L., Jean, C. and Ciccione, S. (2014). Ingestion and defecation of marine debris by loggerhead sea turtles, *Caretta caretta*, from by-catches in the South-West Indian Ocean. *Marine Pollution Bulletin* 84 (2014) 90–96.
- Lamprecht, A. (2013). The abundance, distribution and accumulation of plastic debris in Table Bay, Cape Town, South Africa. Submitted in partial fulfilment of the requirements for the degree of Master of Science in Applied Marine Science. University of Cape Town, South Africa.
- Lane, SB., Ahamada, S., Gonzalves, C., Lukambuzi, L., Ochiewo, J., Pereira, M., Rasolofojaona, H., Ryan, P., and Seewoobaduth, J. (2007). *Regional Overview and Assessment of Marine Litter Related Activities in the West Indian Ocean Region*. Report to the United Nations Environment Programme. 91 pp.
- Nicholls, R.J. and Small, C. (2002). Improved estimates of coastal population and exposure to hazards released. *EOS Transactions* 83(2), 301-305.
- Rezania, S., Park, J., Din, M.F. Md, Taib, S.M., Talaiekhosani, A., Yadav, K.K., Kamyeb, H. (2018). Microplastics pollution in different aquatic environments and biota: A review of recent studies. *Marine Pollution Bulletin* 133: 191–208.
- Shi, H. and Singh, A. (2003). Status and Interconnections of Selected Environmental Issues in the Global Coastal Zones. *Ambio* 32 (2): pp. 145-152.
- UNEP (2005). *Marine litter: An analytical overview*. Nairobi: UNEP.
- UNEP/Nairobi Convention Secretariat and WIOMSA (2009). Regional synthesis report on the review of the policy, legal and institutional frameworks in the Western Indian Ocean (WIO) region, UNEP, Nairobi. 104 pp.
- UNESCO (2017). *Global Oceans Science Report: The Current Status of Ocean Science Around the World*. Valdés et al (eds.) UNESCO Publishing, Paris.

Appendices

Appendix 1: Institutional, policy and regulatory arrangements; socio-economic activities; stakeholders and public awareness with relevance to marine litter and microplastics management in the WIO countries.

Country	Element	Description
Comoros	Maritime Jurisdiction	The Comoros covers a total area of 2,235 km ² , a coastline of 340 km and territorial sea of 320 km ² .
	Policy and Legal Frameworks	The framework environmental law is Law No. 94-018 of 23 June 1994. The Comoros has ratified (i) the Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, adopted in Basel, March 22, 1989 through Decree No. 94-009/AF of June 6, 1994; ii) Convention for the Protection, Management and Development of Marine and Coastal region of Eastern Africa, adopted in Nairobi in 1985 and ratified by Decree No. 94-012/AF of June 6, 1994.
	Socio-economic Activities	Agriculture, fishing, forestry and hunting account for about 50% of GDP, providing export products and employment to about 80% of the labour force (CIA World Factbook 2017). Shipping and tourism are also important economic activities. The coastal zone is important for cash crops such as vanilla, ylang-ylang and cloves that are associated with processing industries. Other smaller industries being for carpentry, shoes production, plastics, handcrafts, sawmills, printing etc.
	Key Stakeholders	Main stakeholders are the National Directorate of Environment (DNE), the National Institute of Applied Research of Fisheries and Environment and related Ministries. There are regional departments of the environment Ministry and the regional fisheries commission responsible for individual islands. Non-state actors include the NGOs: Action Comores, Association of Intervention for Development and the Environment (AID), Action for sustainable Development and Environment (ADDE), COMOFLORE, and others (ASCLME 2012).
	Awareness Programs	Awareness raising activities on marine litter and microplastics are generally limited.
France (Reunion)	Maritime Jurisdiction	Reunion has a total land area of 2,517 km ² . The coastline is 270 km, with total marine area of 315,058 km ² .
	Legal and Policy Frameworks	Reunion is bound by various policy and legal frameworks operating in France and by extension, the European Union. Among them, the most relevant for marine litter is the 2008 Marine Strategy Framework Directive (MSFD). Other relevant EU-wide frameworks include: EU Directive 2000/59/EC of the European Parliament and of the Council of 27 November 2000 on Port Reception Facilities (PRF) for ship-generated waste and cargo residues; the EU Decision (2010/477/EU on criteria and methodological standards on good environmental status of marine waters; and EU Green Paper on European Strategy on Plastic waste in the environment (2013).
	Socio-economic Activities	Deep-sea fishing, as an activity, can take place throughout the year, as the waters of Reunion are rich. Traditionally, the economy is based on agriculture with coffee, cloves and sugarcane being the major cash crops. Reunion exports sugar, seafood, rum, and vanilla. Tourism especially from Europe is a significant economic contributor.
	Key Stakeholders	Major stakeholders are Ministry of Ecology, Sustainable Development and Energy, Agency for Environment and Energy Management (ADEME) and local Government/Municipal Authorities as well as research and academic institutions.

Country	Element	Description
	Awareness Programs	Existing activities relevant for raising awareness on marine litter include “Programme d’Appui à la Promotion d’une Education pour la Gestion de l’Environnement” (ARPEGE), a support programme for conservation of the Environment; and Voluntary Scheme for Biodiversity and Ecosystem Services in Territories of European Overseas (BEST).
Kenya	Maritime Jurisdiction	Kenya has a total land area of 580,367 km ² ; a coastline of about 536 km long and the territorial sea and adjacent EEZ of some 152,100 km ² . The continental shelf is relatively narrow (less than 10 km) and in some areas the water depth could drop below 200 m within less than 4 km. There are two main rivers (Tana and Sabaki) as well as semi-permanent smaller rivers (Kombeni, Ramisi, Mwache, Rare, Uмба and Mkurumuji).
	Legal and Policy Frameworks	The main policy and legal frameworks include: Environmental Management and Coordination Act (EMCA) 1999; Local Government Act chapter 265; the Wildlife Conservation and Management Act Chapter 376; the Merchant Shipping Act No 4 of 2009; the Lakes and Rivers Act Cap 409 of 1930, revised in 1983. In 2017 a ban on manufacture, importation and use of plastic bags was imposed.
	Socio-economic Activities	Artisanal fishery is the most important livelihood activity, which lands account for about 95% of the total marine catch. Tourism has substantial contribution to the income of the country and the coastal communities, generating about 60% of the total revenue (ASCLME 2012). Other coastal economic activities include shipping and coastal transport, small-scale industries, agriculture, mariculture, and petty trade.
	Key Stakeholders	Main state stakeholders are the National Environment Management Authority (NEMA), the National Environment Council (NEC), the Kenya Wildlife Service (KWS) and Kenya Marine and Fisheries Research Institute (KMFRI). Beach Management Units (BMUs) are community-based stakeholders. Non-state actors include Wildlife Conservation Society (WCS), CORDIO East Africa, Watamu Marine Association (WMA) and beach hotels, spa and resorts.
	Awareness Programs	WMA implements a “Trash to Cash Initiative” which is one of the major awareness program on marine litter. WMA also support a recycling center known as “Eco-World Watamu” where recycled plastics and glass are used to create crafts for tourism. KWS as well as the local hotels support Beach Clean-Ups campaigns in collaboration with NGOs such as the Ocean Sole and The Ocean Conservancy.
Madagascar	Maritime Jurisdiction	Madagascar has a total land area of 587,041 km ² . The country has a coastline of 4,828 km and EEZ of 1.2 million km ² .
	Legal and Policy Frameworks	The environmental legislation framework of 1990, modified in August 2004, emphasizes the importance of environmental protection as a matter and responsibility for all. The main instruments of this framework are the Charter of the Environment and the Decree MECIE. Other laws and statutory include Law No. 97-017 of August 8 1997 on prevention, reduction and the fight against environmental degradation and pollution; No. 63-192 of 1963 on the code of urban planning and housing; No. 92-926 of 1992 on Environmental Impact Assessment regulations; and No. 98-781 of 1998 on exploitation of natural resources.
	Socio-economic Activities	Agriculture, including fishing and forestry, is a mainstay of the economy. These account for 25% of the GDP and employ about 80% of the population. Maritime activities include deep-sea fishing, shipping and tourism.
	Key Stakeholders	Key stakeholders include the Ministry of Environment, Water and Forests, Ministry of Natural Resources and Fisheries, National Council for Environment, Inter Ministerial Committee on Environment and the National Committees on Coastal and Marine Affairs. Others are Marine Ports Agency, National Office for Tourism

Country	Element	Description
		and Fisheries Surveillance Agency.
	Awareness Programs	A well-known awareness program is “ <i>Frontier Madagascar</i> ”, which is promoting community-based beach cleaning. This campaign allows assessment of potential sources of environmental pollution to enable management strategies to be developed and implemented to reduce input of marine litter.
Mauritius	Maritime Jurisdiction	Mauritius has a total area of 2,040 km ² . The coastline is 177 km, with territorial seas and the EEZ, covering about 2.3 million km ² , including approx. 0.4 million km ² jointly managed with the Seychelles.
	Legal and Policy Frameworks	The main legal framework is the Environmental Protection Act (EPA) No. 6 of 2002 (amended in 2008) which has provisions for establishment of Multilateral Environmental Agreements Coordinating Committee; and EIA Monitoring Committee.
	Socio-economic Activities	Sugar industry (sugarcane plantations occupy about 90% of arable land), tourism, textiles and apparel are major economic activities. Other expanding activities include forestry, ports and coastal transport, coastal mining, fisheries and aquaculture, ICT and property development.
	Key Stakeholders	The key stakeholder is the National Development Unit under the Ministry of Environment (MOE), which has overall mandate of the protection of the environment. Others include the Ministry of Agro-Industry and Fisheries; the Mauritius Ports Authority and the Waste Water Management Authority (MWA).
	Awareness Programs	A recent major awareness campaign is known as “ <i>Clean up Mauritius and Embellishment Campaign 2017</i> ”, which promotes public beach cleaning through education and practice.
Mozambique	Maritime Jurisdiction	The total land area is 799,380 km ² . The coastline of the country is 2470 km with EEZ of 784,032 km ² . The country has a very extensive drainage system, having five major rivers namely: Limpopo, Zambezi, Rovuma, Incomati and Save.
	Legal and Policy Frameworks	The environmental laws, though not directly based on marine litter include: the Decree-Law No. 495/73 of 1973 for protection against pollution of waters, beaches and margins; Environment Law No. 20/97 of 1997 and Law of the Sea No. 4/95 of 1996.
	Socio-economic Activities	Fishing is the main livelihood activity along the coast. Other significant activities include aquaculture, shipping, agriculture and tourism. Industrial development is also significant in coastal cities such as Maputo and Beira. The industries are related to fisheries, coastal agriculture, oil and gas production, mariculture and aquaculture, coastal mining, energy, forestry and natural resources. It should be noted however that they lack adequate industrial effluent treatment facilities.
	Key Stakeholders	Key stakeholders include: the Ministry of Land, Environment and Rural Development (MITADER); the National Directorate of Environmental Impact Evaluation – NDEIE; the National Institute of Hydrography and Navigation; the Centre of Sustainable Development for Urban Zones and that for the Coastal Zone.
	Awareness Programs	There is an activist group “ <i>Mozambique: Environmental Activists</i> ”, which promotes beach and mangrove areas cleaning, through awareness raising campaigns. Specific campaigns for special days of cleaning, where activists, students and environmentalists get together to do intensive cleaning of a designated area.
Seychelles	Maritime Jurisdiction	Seychelles has a total land area of 455 km ² . The coastline is 491 km with a total EEZ of 1,374,000 km ² .
	Legal and Policy Frameworks	The main framework is the Environment Protection Act (EPA) of 1994, administered by the Department of Environment (Ministry of Environment, Energy and Climate Change). Other environmental related acts include the Town and Country Planning Act, 1972; the Removal of Sand and Gravel Act, 1982; the Minerals Act 1991; the Maritime Zones Act, 1999; and the Land Reclamation Act 1967.

Country	Element	Description
		Regulations that impose restrictions on manufacturing, importation and distribution of plastic bags, plastic utensils and polystyrene boxes have recently (1 st July 2017) been imposed.
	Socio-economic Activities	Tourism and fisheries are the main economic sectors. Tourism contributes about 26% of the GDP, employing about 30% of the workforce, while the fisheries contributes 8% of the GDP, employing 17% of the population. Other activities include agriculture, forestry, beverage industries, ports and coastal transport as well as small-scale manufacturing.
	Key Stakeholders	Main stakeholders are the Ministry of Environment, Energy and Climate Change; the Ministry of Tourism, Civil Aviation, Ports and Marine; and the Ministry of Local Government. Other relevant stakeholders include: the Solid Waste and Cleaning Agency; the Marine Park Authority; the Seychelles Fishing Authority; the Water and Sewerage Division of the Public Utilities Corporation and the Seychelles Development Corporation. The private sector also participates, having companies that manage the disposal of solid wastes.
	Awareness Programs	Two major awareness programs exist, namely “ <i>Marine Debris Challenge</i> ” meant to educate the public on conservation of beaches as well as the hazards of plastic waste; and the “ <i>Seychelles Turtle with MCSS</i> ” which deals with beach cleaning and clearing of turtle nesting sites.
Somalia	Maritime Jurisdiction	Somalia has a total land area of 637,657 km ² . It has a coastline totaling 3,025 km, with total EEZ of 830,389 km ² .
	Legal and Policy Frameworks	Due to political instability over the past three decades, the environmental policy and regulatory framework is poorly developed, including environmental management plans or strategies.
	Socio-economic Activities	There is an enormous fishery potential, with large pelagics such as tuna, which is heavily exploited by the industrial sector. Artisanal fisheries lightly exploit the resources, but it is the most important activity of the local communities. Somalia maintains an informal economy that is largely based on livestock, remittance/money transfer companies, and telecommunications.
	Key Stakeholders	The main stakeholder is the Ministry of Environment and Disaster Management established in 2005. Local governments are tasked with collection, transportation and disposing of water materials from the city. Foreign partner agencies like Swedish Environmental Protection Agency, Oxfam-Netherlands, United Nations Development Programme (UNDP) and African Development Bank (AfDB) provide assistance in environmental protection and management through support to local NGOs like establishment of the Resource Management Somali Network (RMSN) was established in 1996. One of the NGOs under RMSN is Regional Marine Conservation Organization (RMCO) is specifically engaged with coastal area conservation.
	Awareness Programs	There is low level of public education and awareness that is exacerbated by the absence of regulatory and legislative framework and its enforcement. The “ <i>Mogadishu Clean-up Project</i> ” funded by UNDP is the only reported initiative that aims at cleaning the capital city from garbage, and improving waste management, public health and environmental protection. One of the RMCO activity is public awareness raising and advocacy through training, meeting and public events.
South Africa	Maritime Jurisdiction	South Africa has a total land area of 1,219,090 km ² , with the coastline of 2,798 km and EEZ of 1,535,538 km ² . There are several estuaries along the coast, which are mostly affected by soil erosion, pollution, excessive water abstraction and impoundments.
	Policy and Legal Frameworks	Frameworks relevant to marine litter include: the National Environmental Management Act 107 of 1998 (NEMA), National

Country	Element	Description
		Environmental Management – Waste Act 59 of 2008, Environmental Impact Assessment Management Strategy (EIAMS), the Marine Traffic Act of 1981, the Marine Pollution Act of 1986 and the Merchants Shipping Act of 2014. South Africa had started early (2003) to regulate the use of plastics, in comparison with the other WIO countries.
	Socio-economic Activities	The main economic sectors for South Africa are manufacturing, mining and agriculture. There is also a well-developed financial, communications, energy, shipping, tourism and fisheries sectors.
	Key Stakeholders	Main stakeholders are the Department of Environmental Affairs (DEA), the Department of Transport (DoT). There are several other stakeholders, whose mandate touches on marine pollution and waste management, namely: Ministry of Tourism; Ministry of Human Settlement; Ministry of Water and Sanitation and Ministry of Agriculture, Forestry and Fisheries.
	Awareness Programs	South Africa has numerous initiatives on beach cleaning, with specific regular days, mostly on the first Saturday of each month. Such initiatives include: the “ <i>Beautiful Cleaning</i> ” project, which is under the organization known as “CLEAN C” and Working for the Coast (WftC) under the DEA, contributing to the broader Expanded Public Works Programme (EPWP).
Tanzania	Maritime Jurisdiction	Tanzania has a total land area of 947,300 km ² inclusive of Tanzania mainland and Zanzibar. The total coastline is 1,751 km with a total EEZ of 223,000 km ² . Major river systems draining into the ocean are Rufiji, Pangani, Ruvuma, Wami and Ruvu.
	Policy and Legal Frameworks	Matters related to the management of coastal environment fall under two separate jurisdictions: The United Republic of Tanzania Government and the Revolutionary Government of Zanzibar. For mainland Tanzania, the main policy and legal frameworks are the Environmental Policy of 1997 and Environmental Management Act (EMA) of 2004, while for Zanzibar, there is the Environmental Policy of 2013 and Zanzibar Environmental Management Act of 2015. In Zanzibar a ban on the use of plastic bags was imposed in 2006. Other relevant frameworks (in brackets for Zanzibar) include: National Fisheries Policy, 2013; Human Settlements Development Policy (HSD), 2000; National Tourism Policy, 1999; Fisheries Act No. 7 of 2010 (Zanzibar); National Investment Promotion Policy, 1996; National Energy Policy, 2003; Sustainable Industries Development Policy, 1996; The National Fisheries Act No. 22 of 2003; The Marine Parks and Reserves Act No 29 of 1994; the Tourism Act No. 29 of 2008; and The Urban Planning Act No. 8 of 2007.
	Socio-economic Activities	Agriculture, mining, industry, tourism and trade are the major economic sectors. Other important activities include fishing, shipping and coastal transportation.
	Key Stakeholders	The key stakeholders are the Division of Environment and National Environmental Management Council (NEMC) for mainland Tanzania, and Department of Environment and Zanzibar Environment Management Authority (ZEMA) for Zanzibar. State agencies such as Tanzania Port Authorities; Maritime Transport Regulatory Authorities (Surface and Maritime Transport Regulatory Authority-SUMATRA and Zanzibar Maritime Authority-ZMA) are also important stakeholders. Other relevant governmental stakeholders include sector Ministries for Fisheries, Urban Planning, Transportation; and Local Government Authorities. In the private sector, stakeholders include investors in coastal tourism, and NGOs that promote coastal environmental protection.
	Awareness Programs	While there is not officially state sanctioned campaign on awareness raising on marine litter, public engagement in special environmental days such as World Environmental Day and World Oceans Day. In

Country	Element	Description
		mainland Tanzania, the government has set last Saturday of every month for environmental clean-up. Natural resources and environmental conservation NGOs are taking lead in specific awareness raising and beach cleaning activities.

Appendix 2: Common sources of marine litter in WIO countries. Source: Lane et al. (2007); WHO (2011); Lamprecht (2013); Hoarau et al. (2014).

Country	Source of Marine Litter
Comoros	Due to lack of treatment and storage space on small islands, and the majority of the population being concentrated in the coastal zone, almost all waste ends up in the ocean. Besides garbage, wrecked vehicles, ships, and appliances are also dumped.
France (Reunion)	Major source of marine litter are residential, fishing “ghost net” and shipping especially merchant shipping. Waste from shipping arrives by ocean currents from countries such as Hawaii, Indonesia, Australia and Mauritius. Types of waste include; car shells, fridges, wheels, metallic tubes, pieces of glass, batteries and fishing nets. Plastic bottles and plastic bags dominate the waste, and cause hazards to marine turtles.
Kenya	The major sources of marine litter are estimated as: beach recreation (66%), dumping and water run-off from the land (20%) and shipping (14%).
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 numerous shipwrecks that contribute substantially to marine litter, occurring particularly during the annual cyclone period.
Mauritius	Marine litter arises mainly 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 and fishing, road users and urban storm water runoff are the major sources.
Seychelles	Most litter is from water run-off from rivers and storm drains, port wastes, particularly around eating/picnic areas. Data are not available for fishing activities.
Somalia	The main sources of waste in urban areas are households, commercial centers, communal markets, industries, and waste resulting from demolition and construction work. Residential, commercial and shipping sources are the largest for generating both solid and liquid waste in the area.
South Africa	In South Africa litter mostly consists of single - use items and packaging such as paper and plastic food wrapping, cans, plastic bottles, cigarette packets and cigarette butts. These items accumulate in public places such as public parks and gardens, shopping centres, car parks, railway and bus stations, public bins, landfill sites and recycling depots. Ship generated waste in South Africa is small 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. Despite its small proportion (5.6%) compared to total land area, urban areas in South Africa produce almost all solid debris in rivers.
Tanzania	The major source of marine litter arises from uncontrolled disposal of solid wastes in unplanned settlements where most litter is from urban run-off, illegal dumping into river valleys and drainage from simple open dump sites located near the beach and around rivers. Marine litter also arises from fishing and shipping, especially in Dar es Salaam (Commercial Capital). Fishing contributes a significant quantity of gear, boats, traps, and plastic bottles to the marine litter stream.

Appendix 3: Known and potential release areas of marine litter and key impacts in WIO countries. Source: Lane et al. (2007); WHO (2011); Hoarau et al. (2014).

Country	Release Area	Key Impacts
Comoros	Most litter is concentrated near urban areas and collects on beaches and coral reefs.	Impacts are reported to be evident on coral reefs and associated ecosystems (sea grass, mangroves and beaches), sea turtles and fish.
France (Reunion)	The prevalence of plastics in oceanic loggerheads reflect a predominance of marine debris floating on the sea surface.	Impacts on marine animals, particularly sea turtle.
Kenya	Marine litter is concentrated around urban areas. Oceanic litter occurs in the northern-most coastal areas.	Impacts mainly human health, tourism and marine mammals.
Madagascar	Marine litter is found around urban areas. The prevalence of plastics in oceanic loggerheads reflects a predominance of marine debris floating on the sea surface.	Impacts on human health, particularly, on aesthetics and tourism. Impacts on marine animals, particularly sea turtle.
Mauritius	Most litter is found in the port area and near river mouths. Plastics and other litter are localized on the sea bed.	Solid waste in the port is reported to damage propellers. 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, aesthetically, impacts tourists and the general public, and also a potential threat to public health.
Mozambique	Litter is found mainly on popular beaches, in major towns, at harbours and opposite markets. Areas exposed to oceanic influences (not protected by reefs) receive litter from vessels on the high seas, and from uncontrolled illegal fishing by foreigners.	Impacts human health and tourism.
Seychelles	Marine litter collects at well-defined zones, 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 the destination of the refuse is unknown.	Very little impact is reported to occur because litter levels are kept very low.
Somalia	The accumulation of wastes, open dumping, defecating in open land around human settlements and work areas in urban areas, is very widespread. Dumped wastes flow directly into the rivers or are washed down into the river by floodwaters to the sea and some of them ends up at the beach.	Discarded plastic bottles, bags and other debris (which are being given little attention) from open landfills have significant impact on to the environment and the aquatic ecological systems surrounding big towns and cities across the country especially.
South Africa	Litter is found throughout South African coast and EEZ. However, densities vary greatly, decreasing with distance offshore and with distance long-shore from urban centres. The highest concentrations are found near urban centres.	Impacts on seabirds
Tanzania	Litter is highly abundant near coastal cities, and in fishing areas.	Impacts marine organisms including smothering of coral, and that litter may threaten future tourism and fisheries developments.