INDIAN OCEAN COMMISSION

PREVENTION, REDUCTION AND CONTROL OF MARINE PLASTIC POLLUTION IN AFRICAN AND INDIAN OCEAN DEVELOPING ISLAND STATES (AIODIS)

BACKGROUND DOCUMENT

SWIOFISH 2

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Acronyms and Abbreviations

3RI	3R Initiative
$	US dollar
ABNJ/ BBNJ	areas beyond national jurisdiction/ biodiversity beyond national jurisdiction
AC	Abidjan Convention
AIODIS	Africa Indian Ocean Developing Island States
AIR	avoid, intercept, redesign
ALDFG	abandoned lost or discarded fishing gear
AMCEN	African Ministerial Conference on the Environment
APEC	Asia-Pacific Economic Cooperation
AU	African Union
BAU	business-as-usual
BRC	Basil and Rotterdam Conventions
CBD	Convention on Biological Diversity
CE	circular economy
CGF	Consumer Goods Forum
COMESA	Common Market for Eastern and Southern Africa
COP	Conference of the Parties
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EoL	End-of-life
EPR	extended product responsibility
ETS	European Trading System (for carbon credits)
EU	European Union
FAO	Food and Agriculture Organisation
FP	focal point
GEF	Global Environment Facility
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental
GG	Gulf of Guinea
GAIA	Global Alliance for Incinerator Alternatives
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
GPML	Global Partnership on Marine Litter
GRP	glass-reinforced-plastic (fibreglass)
HDPE	high density polyethylene
IEA(s)	international environmental agreement(s)
IMO	International Maritime Organisation
IOC	Indian Ocean Commission
IORA	Indian Ocean Rim Association
IOTC	Indian Ocean Tuna Commission

IPR/IP	intellectual property rights
ISO	International Standardisation Organisation
LBS/LBSA	land-based sources / land-based sources and activities
LBSMP	land-based sources of marine pollution
LCA	life-cycle assessment/ analysis
LDC	Less developed country
LDPE	Low density polyethylene
MARPOL	The International Convention for the Prevention of Pollution from Ships
MoU(s)	Memorandum(a) of understanding
MPP	marine plastic pollution
MR	Mechanical recycling
MSFD	Marine Strategy Framework Directive (EU)
MSW	municipal solid waste
NC	Nairobi Convention
NGO(s)	non-governmental organisation(s)
NIMBY	not in my backyard
NMP	Nano-Microplastics
OECD	Organisation for Economic Co-operation and Development
PA	polyamide
PAH	polycyclic aromatic hydrocarbon
PBTs	bioaccumulative and toxic compounds
PC	polycarbonate
PCB	polychlorinated biphenyl
PE	polyethylene
PENAf	Ports Environmental Network-Africa
PET	polyethylene terephthalate
POPs	persistent organic pollutants
PP	polypropylene
PPHMN	Port Harbour Masters Network
PS	polystyrene
PSMA	Port State Measures Agreement
PBTs	persistent bioaccumulative and toxic compounds
PTER	private transnational environmental regulation
PVC	polyvinyl chloride
REC(s)	regional economic commission(s)
RSC(s)	Regional Seas Convention(s)
SADC	Southern African Development Community
SCM	WTO Subsidies and Countervailing Measures Agreement.
SDGs	Sustainable Development Goals
SIDS	Small Island Developing State(s)
SUP	single use plastic(s)
SWM	solid waste management
TBT	WTO Technical Barriers to Trade Agreement
tons	metric tons
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDOA-LOS	United Nations Department of Ocean Affairs and Law of the Sea
UNEA	United Nations Environment Assembly
UNEP	UN Environment Programme/ UN Environment
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNIDO	UN Industrial Development Organisation
WEEE	Waste electrical and electronic equipment
WEF	World Economic Forum
WFD	Waste Framework Directive (EU)
WHO	World Health Organisation
WIEGO	Women in Informal Employment: Globalizing and Organizing
WIO	Western Indian Ocean
WIOMSA	Western Indian Ocean Marine Science Association
WTO	World Trade Organisation

Foreword

By Dr. Charlotte de Fontaubert, World Bank

We are pleased to be associated with the publication of these reports on the circular economy in the island states of Africa and of the Indian Ocean, which aim at accelerating a development that respects the environment and that is resilient to climate change. These documents, produced by the Indian Ocean Commission (IOC) as part of the implementation of the sub-component AIODIS of the second project on the Governance of fisheries and shared growth in the South-West Indian Ocean (SWIOFish2), deal with three important aspects of circular economy in the AIODIS countries: (i) the state of the circular economy, (ii) the questions of intellectual property with regard to innovative projects and (iii) the prevention, reduction and control measures of marine plastic pollution.

The World Bank has supported, since 2015, the countries of Africa and of the South-West Indian Ocean to meet the Sustainable Development Goals (SDGs) of the United Nations. To this end, we help several countries in their transition to a more sustainable ocean economy (SDG 14). The principle of blue economy is precisely a sustainable use of marine resources to stimulate economic growth, livelihoods and employment, while preserving the health of the ocean ecosystems. In that sense, the World Bank finances regional programmes on fisheries management in the islands of the Pacific, the Caribbean, West Africa and South-West Indian Ocean. It is in this context that lies our SWIOFish2 project in coordination with the IOC.

The first objective of the project is to assist these States to grasp and to increase the economic, social and environmental advantages of blue economy. This can be achieved by improving the management of their marine resources, namely by limiting the depletion of the fish stocks. This is also possible through an increase in alternative livelihood activities for targeted fishermen, and a reinforced regional cooperation in this sector.

With the sustainability of these resources under serious threat, addressing the sources of these multiple and interconnected threats requires us to rethink our entire economy. From the World Bank's perspective, this is why we are committed to supporting these states in their journey towards a circular economy that is best described as a restorative or regenerative industrial system by intent and design.

We are confident that by pooling their experiences and their initiatives through the AIODIS cooperation mechanism, these States will be able to better face their common challenges. Overcoming these challenges will require the use of sufficient technical and financial means coming from institutional frameworks and infrastructure conducive to the development of a circular economy. Thus, it was essential to identify them for each country, so as to set up the foundations of a framework that is adapted to different socio-economic contexts. Endowed with this new knowledge, we can henceforth move forward together towards a circular economy that brings sustainable and inclusive growth opportunities.

Foreword

Plastic: a marker of our times and a responsibility for action

By Prof. Vêlayoudom Marimoutou,
Secretary General of the Indian Ocean Commission

''The obligation to suffer gives us the right to know.''
Jean Rostand

Biologist Commoner draws our attention on one of the characteristics of human action: *"its capacity to produce materials that cannot be found in nature"*, and therefore *"to introduce in the system substances that are utterly unknown to it".* The great circular economy of nature, in which *"nothing is lost, but everything is transformed",* is more and more upset and disturbed by human manoeuvres.

The Modern world is also a world of pollution and, as Barnosky said in 2014, today *"there are few places on earth that are not affected by man-made environmental pollutants. It is common to find traces of pesticides and industrial pollutants in samples of soil and tree bark of any forest in the world, in whales' fat, in the body of polar bears, in fishes of most of the rivers and oceans".* Pollution has become one of the major problems of our times; local or global, of agricultural, industrial or urban origin, it contaminates the lands, the waters and the atmosphere, jeopardising the health of the ecosystems and thereupon that of humans.

Plastic is emblematic of pollution in general

In 2016, J. Zalasiewikz and his colleagues propose to use plastic as an emblematic signature of the general pollution of the Earth's ecosystem characterising the Anthropocene epoch. Plastics are polymers manufactured from petrochemicals, although some are made from cellulose (8% of petrol extracted on the planet, half as raw material). Adapted to multiples uses, plastic impresses with its theoretical capacity to infinite recycling and to the promise of saving natural resources, and because of its hygienic qualities which led to its adoption in pharmacies and hospitals. From the 1950s onwards, it has grown with mass consumption, on the back of synthetic materials and on the rising production of disposable items. It has rapidly become an essential component of electronics and informatics.

Despite its theoretical infinite recycling capacity, we are far from the mark: it is estimated that 50% is recycled or converted into energy (pyrolysis), the proportion recycled being 15% to 25% in Europe and less than 5% in the USA. We therefore have an idea of the amount of plastic debris dispersed each year, in the form of fragments smaller than 5 mm, or even nano plastics, in the environment. Lightweight, easily transported by wind or water, plastic debris has invaded the entire planet, including the oceans, where it is dispersed from the surface to the bottom of ocean basins. The lightest plastics form areas of highest concentration around the 5 major ocean gyres. They represent a total of 25,000 tonnes of floating debris on the sea surface.

Invasion, resistance and toxicity

The problem posed by this pollution is two-fold.

The first is its resistance. Depending on their composition, the degradation of plastics takes between 50 years and 5 centuries, or even millennia for debris to sink to the deep seabed. If we take into account both this resistance to degradation and the 5 to 13 million tonnes of debris that reach the world's oceans each year, we can see the scale of the problem we are building. And according to B. Montsaignon, 'bioplastics' cannot provide a real solution: their manufacture from plant materials does not guarantee the biodegradability of polymers, and moreover it increases industrial pressure on agricultural land; as for those that are claimed to be compostable or fragmentable, they are still derived from petrochemical products.

Second is its toxicity: 50% of the chemical components of plastics are classified as hazardous by the United Nations classification system for chemicals. Studies have also shown the ability of additives used in PVC to pass into the human bloodstream, as well as the carcinogenic risks of certain components of PVC, polystyrene, polyurethane and polycarbonate. Similarly, biologists have warned of the risks that plastic debris poses to fauna, from micro-organisms to whales or seabirds, which are part of the food chain right up to our plate.

Rethinking the models, blue and circular

So, what should we do?

Regeneration, reinvention and restoration form a new framework for action to (re)think our strategies, to innovate and to provide solutions to this global challenge, which raises significant local issues in island territories. It is not a question of going to war against plastic, which has proved to be a useful, practical and inexpensive material. It is a question of analysing our relationship with this material, of defining new ways of consuming and producing it, and of developing innovative ways of disposing of it and reducing the pollution generated on our coasts and at sea.

To address the multifaceted challenge of marine plastic pollution in the islands of Africa and the Indian Ocean, the IOC and the World Bank, through the AIODIS component of the IOC-SWIOFish2 project, are publishing three studies on i) the state of the art of the circular economy, ii) intellectual property issues on innovative projects and iii) measures to prevent, reduce and control marine plastic pollution. We hope that they will prove useful to policy makers, entrepreneurs, and developers in the blue and circular economy sectors.

Introduction

This is a background study for prevention, reduction and control of marine plastic pollution in Africa Indian Ocean Developing Island States (AIODIS). The AIODIS included in the study are: Cape Verde, Comoros, Guinea Bissau, Madagascar, Maldives, Mauritius, São Tomé and Seychelles. La Réunion is a member of the AIODIS group, but is not included in the study. The study has a particular focus on development of sensitisation strategies and the role of the circular economy.

Part I summarises global and regional characteristics of marine plastic pollution (MPP). It describes the complexity of the MPP problem and the challenges facing governments, industries and consumers. It describes the scale of the problem, the nature of plastics, the structure of the plastics economy and global trade in plastics. It quantifies the impacts on economies and on the environment and on biodiversity. Part I sets out the problem of MPP in the context of international law, describes initiatives to build an international convention to prevent, reduce and control plastic waste, and briefly describes actions under two regional seas conventions.

Part II addresses marine plastic pollution in AIODIS and builds on inputs from AIODIS stakeholders through Country Working Papers.

Part III describes the range of approaches and initiatives to prevent, reduce and control marine plastic pollution, with specific reference to the circular economy, to building awareness and to the challenges in AIODIS and small/ island economies.

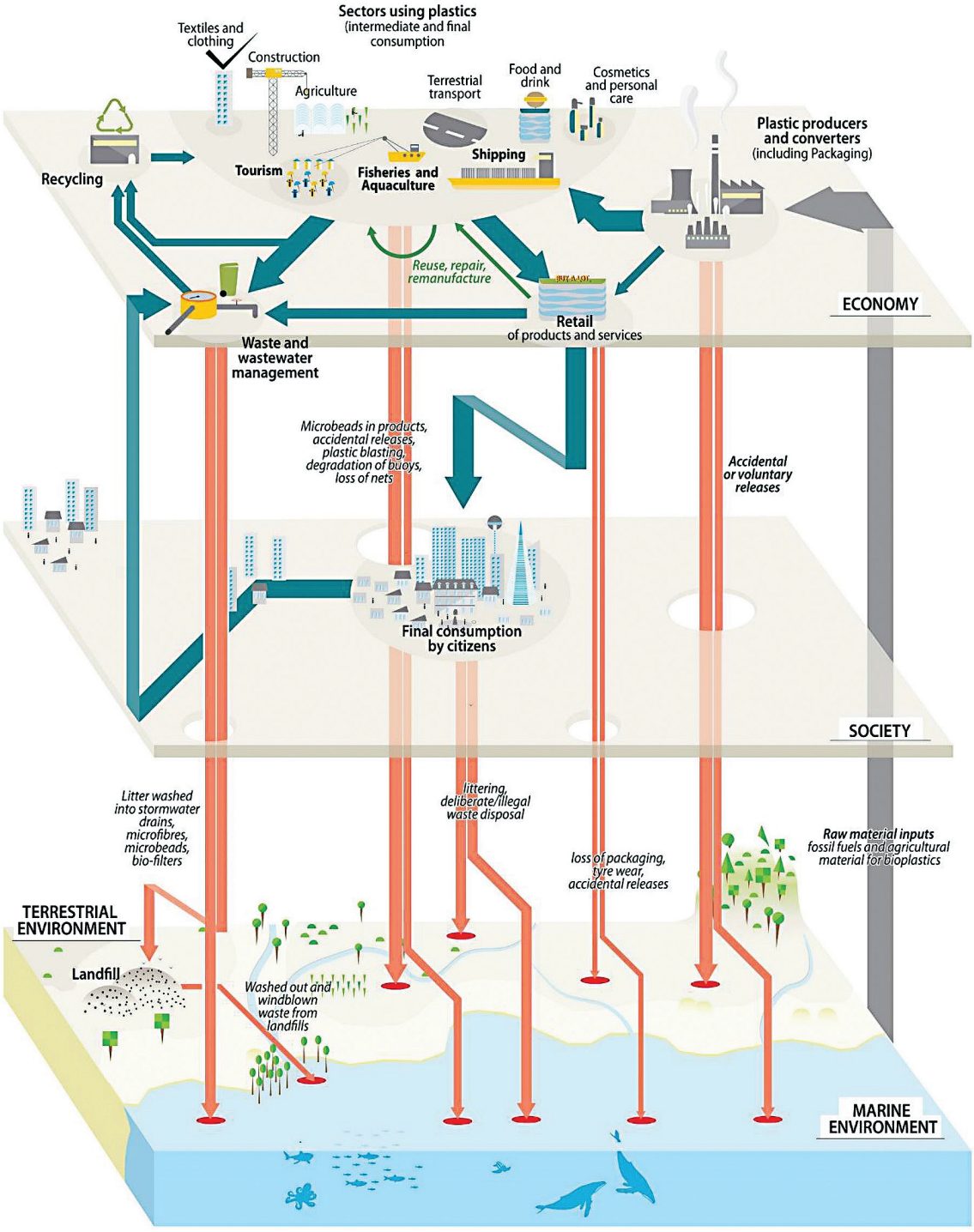
The report sets out and builds on several conclusions:

- a clear understanding of the integrated nature of the problem of MPP is important for development of a national action plan to combat MPP
- public awareness of the problem is fundamental to building the political willingness for actions, as actions can incur costs for consumers, for businesses, for local authorities and to public finance
- consumers and businesses need to be engaged through stakeholder consultation and participation
- MPP is part of a more general waste management problem, in particular, the management of urban solid waste and waste generated by shipping and fisheries activities
- governments will require coherent policies, regulatory measures, public support for waste management, incentives for changes in consumer and business behaviours and support for innovation in and adoption of the circular economy in the business community
- in the AIODIS, national resources and efforts may need to be supplemented by external financial resources, including for private sector investment and technologies
- national actions should ideally be complemented with regional and global actions to be effective, as the problem of MPP is global, requiring actions across sectors and economies
- given the small size of many AIODIS economies, actions to combat MPP can benefit from a regional approach on trade in plastics and plastic waste which may generate the economies of scale and opportunities for a circular economy approach.

This report is a companion report for other reports to be prepared under this project. These other reports will examine the role of the circular economy in addressing plastic waste and plastic pollution in more detail and will also examine intellectual property rights, particularly those associated with circular economy technologies and initiatives.

This work is financed by the World Bank under the 'Promotion of African & Indian Ocean Island Developing States Blue Economy' component of the regional 'South West Indian Ocean Fisheries Governance and Shared Growth Project' (SWIOFish2). The component is managed by the Indian Ocean Commission.

Figure 1. How plastic pollutes the marine environment



Source: Grid Arendal, Riccardo Pavettoni

EXECUTIVE SUMMARY

Key Messages

The **objective** of the study is to compile and present information on key aspects of marine plastic pollution to enable AIODIS to consider national and regional actions to combat marine plastic pollution with particular emphasis on awareness and the circular economy.

A. What is the Marine Plastic Pollution problem?

1. Marine Plastic Pollution (MPP) is growing in AIODIS and worldwide. There are numerous social, economic and environmental impacts. The impacts are complex, cumulative, largely irreversible and difficult to quantify.

2. MPP results in estimated global losses of over $2 billion/year. The losses are disproportionately suffered by island economies. Losses for AIODIS have not been estimated but are considered significant, particularly for tourism, public health and the cumulative loss of ecosystem function.

3. MPP is part of a more general solid waste management (SWM) problem, in particular the management of urban solid waste and waste generated by shipping and fisheries.

4. Global, regional and national actions are not significantly halting or reversing global MPP.

5. Multiple actions across the entire plastics value chain with greater commitments by business stakeholders and concerted international actions are considered fundamental to effectively prevent, reduce and control MPP.

B. How are AIODIS combatting Marine Plastic Pollution?

1. Countries are developing increasing awareness of 'the plastics problem'. All AIODIS have introduced restrictions on single-use-plastic bags. All countries have beach clean-up activities.

2. Only one country has a comprehensive action plan on MPP.

3. Only South Asia has a regional action plan on marine debris.

4. There are no regionally binding measures on MPP and no regional agreements facilitating sustainable trade in plastic waste.

5. The implementation and effectiveness of the two existing regional protocols on land-based sources of marine pollution has not been evaluated in relation to MPP.

6. All countries face technical, resourcing and institutional fragmentation challenges with respect to SWM. Deficient solid waste management (SWM) is the major cause of MPP.

7. There is limited business engagement in combatting MPP. Circular economy initiatives and extended producer responsibility schemes are in their infancy.

C. What more can be done to prevent, reduce and control MPP?

National actions

1. Countries can develop implement comprehensive national MPP action plans.
2. The plan should be an integral part of the national SWM plan, engage stakeholders across the plastics value chain, link to the national vision, the SDGs, and to relevant national environmental, social and economic initiatives.
3. The plan should have a strong regional cooperation component and address trade issues.

Regional actions

1. MPP requires global and regional cooperative efforts, as the problem and the solutions are beyond the capabilities of single countries.
2. Actions at all levels will benefit from enhanced regional cooperation.
3. Ideally, regional action plans should be prepared with effective engagement of the regional economic communities and organisations.
4. A regional action plan should include a trade dimension, help access resources and finance, and help establish a regional position on MPP.
5. Ideally, the action plan should foster development of a binding agreements on measures to combat MPP.

PART I. MARINE PLASTIC POLLUTION: SCALE, IMPACTS, ECONOMICS AND LAW

Part I summarises global and regional characteristics of marine plastic pollution (MPP). It describes the complexity of the MPP problem and the challenges facing governments, industries and consumers. It briefly describes the scale of the problem, the nature of plastics, the structure of the plastics economy and global trade in plastics. It quantifies the impacts on economies, on the environment and on biodiversity. Part I sets out the problem of MPP in the context of international law, describes initiatives to build an international convention to prevent, reduce and control plastic waste, and summarises actions under two regional seas conventions (detailed in Part II).

Fast facts

- MPP is growing rapidly
- The main source is mismanaged solid waste
- Impacts are cumulative and irreversible
- MPP cause global losses of over $2 billion/year
- Plastic is 'inexpensive' partly because the costs of plastic waste management are not included in the market price
- AIODIS imports plastics worth over $400 million each year
- Barriers to trade in plastic waste are likely to increase
- There are no global norms for managing land-based sources of MPP
- Shipping is obliged to manage plastic waste
- Several Regional Seas Conventions have marine litter management plans

Marine plastic pollution (MPP) is growing rapidly as plastic is used in more and more products and generates an increasing quantity of waste. By 2040, without action MPP is projected to reach about 29 million tons/year and contribute to a cumulative total of 450 million tons.

Plastic accounts for an estimated 80% of all marine litter. About 80% of the plastic originates from land-based sources (LBS) and the remaining 20% is from marine sources. Estimates of the quantity of plastics entering the ocean vary but are at least 12.7 million (metric) tons/year, of which microplastics, particles under 5mm (and even smaller nanoplastics), represent an estimated 20%.

Unless collected from beaches or the ocean, plastic remains in the ocean in sediments, floating in the water column, or ingested by animals. Large items may lie on the ocean floor or on beaches for hundreds of years. Many plastics gradually degrade and become microplastics and lie unseen in the environment and our food chains. Many plastic products contain added chemicals to make them harder, fireproof or to give colour. Many of these additives can be toxic and may leach into the environment as plastics degrade.

Sources. The main source of MPP is mismanaged solid waste, particularly in coastal cities. Garbage from shipping and lost or discarded fishing gear are the main marine sources. Rivers draining major urban areas are major global sources. Microplastic pollution is attributable to the breakdown of larger plastics, dust from vehicle tyres, washing of synthetic textiles, paint dust and many other sources. MPP can be transported by ocean currents and is found in even the most remote or deepest oceans.

Impacts. The impacts of MPP and the damage caused are long-term, persistent, cumulative and practically irreversible. MPP impacts negatively on ecosystem function, on biodiversity, on endangered and iconic species, and facilitates transport of invasive species. It impacts on food chains, on public health, on water quality and human wellbeing.

The economic impacts of plastic pollution are estimated to be as high as $2.2 trillion per year including the carbon footprint of plastic and loss of ecosystem services. MPP impacts tourism, fisheries and aquaculture, shipping, offshore industries, taxpayers, and the budgets of municipal and national authorities responsible for waste management. Plastic production, recycling and disposal generate

greenhouse gasses and impact on air quality. The industry is expected to account for 15% of the global carbon budget by 2050. The impact and the cost of microplastic pollution is the subject of ongoing studies and of growing global concern.

The plastics industry. Plastic production is growing at a compound annual rate of 3.2% with a market value of about $1.2 trillion in 2020. Production is projected to double by 2035 and quadruple by 2050. Plastic is an integral part of a growing number of products and value chains and indispensable to many major categories of products ranging from computers to automobiles, from textiles to building construction. The plastics value chain is, by design, essentially linear (produce/use/dispose) as opposed to circular. There are many types of plastics. Only some can be reused or recycled. Recycled plastic accounts for about 9 percent of raw material feedstock. Plastic which is not biodegradable is effectively a pollutant from the instant of its production.

Economics of MPP. The market price of plastic contributes to its increasing use. The market price of plastic products does not reflect the damage caused by plastics during the entire plastic life cycle. The cost of plastic pollution is borne by reduced environmental capital and services, reduced human wellbeing, increased health costs, and by increased service charges or taxation for waste management. There is an ongoing global debate on how the costs of plastic pollution can be equitably shared.

Trade. Trade in plastics falls in three categories: raw material, plastic products and plastic waste. All AIODIS import significant quantities of plastic (at least $300 million/year). Waste exports are negligible (in the order of 2,500 tons, $1.5 million per year). However, trade statistics do not reflect the quantities imported as many plastics are 'hidden' in consumer products (e.g. drinks bottles) and it is often these plastics which contribute most to MPP.

Import restrictions (such as plastic bag bans), import taxes, deposit-return schemes and extended producer responsibility (EPR) schemes can reduce MPP, but may have trade implications. Trade measures may require notification to the World Trade Organisation (WTO). Some measures may conflict with WTO rules. As of 2021, export of plastic waste requires approval of the importing country under revised Basel Convention rules.

International law. The Law of the Sea obliges countries to prevent, reduce and control all marine pollution. However, there is no global consensus on the precise obligations with respect to MPP, either in terms of the national actions required, or acceptable limits to MPP. Under MARPOL Annex V, shipping is prohibited from dumping plastic waste at sea. The London Convention prohibits dumping at sea and the Basel Convention requires 'prior informed consent' from a country importing plastic waste. In contrast to the above conventions, which have binding provisions, few of the regional seas conventions, such as the Abidjan or Nairobi Conventions, have binding provisions, although both of these Conventions have protocols on land-based sources of marine pollution.

There are a large number of 'soft law' instruments, such as resolutions or declarations These include UNGA and UNEA resolutions, action plans by G7/G20 and by regional organisations. Many of these instruments have associated programmes, task forces, action plans or other technical arrangements that support implementation of the resolutions, often executed through UN agencies.

Part II. Marine Plastic Pollution in AIODIS

Scale and sources. MPP generated by AIODIS (excluding La Réunion) is estimated to be in the order of 6,500 tons/year. Information on MPP is poor, so this preliminary estimate requires adjustment as more accurate information becomes available. The main source is mismanaged solid waste from households and businesses. Land-based sources generally account for about 80% of MPP. Fisheries and shipping are the main marine sources. Ocean currents also transport MPP to AIODIS waters, including from South East Asia and Europe.

Microplastic pollution is a separate waste stream and information on the quantities generated in AIODIS are lacking. The estimates provided for selected AIODIS countries are partial and illustrative rather than definitive.

Waste management. Despite ongoing investments, solid waste management (SWM) is generally lagging behind waste generation. The institutional arrangements and financing are often fragmented and an uncertain SWM investment climate often undermines private sector engagement.

Comprehensive action plans. With the exception of Maldives, countries generally lack comprehensive action plans on MPP where such plans are integrated with the overall waste management plans.

Awareness of MPP. Awareness of 'the plastics problem' varies by group: policy makers, consumers, technicians. All countries restrict single-use plastic bags and many have deposit-return schemes for plastic drinks (PET) bottles. There is less awareness of how a circular plastics economy can function effectively. Awareness campaigns are most successful when clearly targeted and accompanied by other measures, such as improved collection of sorted household waste, deposit-return schemes, or support for informal waste collection (waste pickers).

Fast facts

- Mismanaged solid waste is the most important source of MPP in AIODIS
- Solid waste management is generally deficient
- AIODIS generate about 6,500 tons/ year of MPP
- Only two countries have marine litter action plans
- Awareness of MPP varies by country and often lacks a comprehensive plastic life-cycle overview
- The need for a circular economy approach is recognised but implementation faces major challenges in small/ island economies
- Regional cooperation is ongoing, but can be greatly enhanced through development of regional action plans
- Concerted engagement between regional organisations: environmental, economic, fisheries, shipping, tourism and scientific can leverage synergies and resources
- Countries face challenges in institutional capacity and financing

Circular economy. Development of a viable and sustainable circular economy in small/island economies faces significant challenges in terms of economies of scale, limited industrial base and limited market for reused or recycled plastic. Some plastics cannot be recycled. Without a large industrial base, some recyclable plastic waste must be exported to avoid landfill or incineration. Regional cooperation can expand the opportunities for a functional circular economy, for example, in relation to PET bottles, extended producer responsibility (EPR) schemes, shared technologies and capacity development.

Regional cooperation. The Abidjan and Nairobi Conventions and similar cooperative arrangements in South Asia are important instruments for concerted action to combat MPP. However, effective action requires engagement by regional economic commissions or their equivalent. With the exception of South Asia, there are no regional action plans on MPP, or marine litter. The AMCEN supports action on MPP (Durban Declaration), but specific policies, positions, or measures at AU level have not been agreed. There are no regional binding measures (East African Community excepted). Regional fisheries organisations are beginning to address MPP.

Part III. Moving Forward

1. General conclusions

Global problem. MPP requires global and regional cooperative efforts as the problem and solutions are beyond the capabilities of single countries.

State action. Individual countries can combat MPP through a national MPP action plan; improvements in national solid waste management, including use of circular economy approaches; and by engagement in development of regional and international initiatives.

Complexity. There is a growing awareness of the complexity of 'the plastics problem': that it is driven by a growing demand for plastics; that it involves issues of human health and food supply; environment and ecosystems; production and trade; technology and investment; and that it requires changes in human behaviours.

Main points

- Prepare comprehensive national MPP action plans
- Include a trade and regional cooperation dimension and link to the SDGs and the national SWM plan
- Prepare a regional MPP action plan with engagement by the regional economic organisations
- Include trade and resourcing/ funding provisions in the regional plan
- Consider development of regional policy positions in global fora

Holistic approach. There is a broad consensus that no single approach or initiative can effectively prevent, reduce and control MPP. Studies confirm that a coordinated suite of complementary measures are substantially more effective than discrete or isolated measures. For example, a ban on plastic bags can be complemented with an educational campaign and making alternative bags available.

Solid waste management. An effective solid waste management (SWM) system is fundamental to combatting MPP. The system needs to take account of the full life cycle of plastics and products that include plastics. Technically competent and adequately financed local and municipal authorities are key actors in SWM. However, SWM generally only addresses the downstream part of the plastics life cycle and does not extend to the production and design of plastic products, or to the chemical additives involved. Fragmentation of SWM is a significant constraint in terms of financing, jurisdiction and responsibilities of national agencies, municipalities, private contractors and waste producers.

Resources. The financial, human and institutional resources available to combat MPP in AIODIS are generally inadequate, fragmented or lack coordination in relation to the scale and complexity of 'the plastics problem'. Commonly, the major deficit is in relation to capital and recurrent financing of SWM at national and municipal levels. Coordination across the plastic life cycle is generally weak.

Microplastics. There is a relatively low (albeit growing) awareness of microplastic pollution. This may be partly due to the weak understanding of the impact of microplastics on health, on food chains, on biodiversity and on the environment and the lack of 'visibility' of microplastics. Regulatory bans on plastic microbeads in all cosmetic and personal care products are advocated in many global initiatives. Measures to prevent, reduce or control microplastic pollution are rare or non-existent in AIODIS.

Awareness. There is broad consensus that education and awareness is a foundation for acceptance, financing and implementation of plans and policies to combat MPP and plastic pollution in general. Awareness of the technical complexity of 'the plastics problem' is low, but policies and plans need to take account of the technical constraints and opportunities.

Knowledge and science. There are major gaps in scientific knowledge on MPP. These include understanding of the long-term impacts on human health and on ecosystems. Understanding of trade-offs between the economic benefits of plastics and the costs of negative impacts is deficient. Assessment of alternative suites of actions to combat MPP is lacking. Information on MPP in AIODIS ocean areas is fragmentary. There is a need for enhanced arrangements for managing scientific knowledge across the plastic life-cycle at global and regional levels. Such arrangements could include sharing of innovative approaches and evaluation of technical 'solutions'.

Governance. Effective actions to combat MPP rely on the overall quality of governance, including rule of law, transparency in public procurement and public finances, engagement of civil society, security of contracts, and acknowledgement of the value of independent scientific assessment.

Global plastics treaty. There have been numerous calls and proposals for a global plastics treaty that would combat plastic pollution. Given the complexity of the problem and the experiences and delays in negotiating an ABNJ/BBNJ agreement, such a treaty may not have significant direct impact on MPP in the short term. However, an active AIODIS engagement in any such process is of benefit both as a learning process and through contributions to the objectives and design.

National and regional 'solutions'. Given the diversity of members of AIODIS, the suite of actions and their priorities in national MPP action plans is likely to differ widely and needs to be tailored to the needs and capacity of the country. While the AIODIS economies may be relatively small generators of MPP at regional level, they may play an important leadership role in their respective regional economic communities and in regional seas conventions.

Circular economy. The complexity of the evolving EU circular economy regime illustrates the challenges of applying the approach. Guidance on its implementation in small and island economies and at a regional level is deficient.

Small and island economies. These countries are importers of multiple products which generate plastic waste. For technical, economic or other reasons, some of this waste cannot be sustainably or optimally disposed of within the country. The basic options are: (i) to prevent or reduce entry of such products; (ii) require importers (or producers) to arrange for removal or export of the resulting waste; (iii) manage the export of waste without engagement of plastic importers or producers; or (iv) dispose of the waste in-country in a manner which is less than optimal, such as by incineration or landfill.

Common themes. A national action plan to combat MPP is often prepared as a complement to a national solid waste management plan. The plans generally include several key themes: improved awareness, understanding and monitoring of MPP at country level; review and enhancement of SWM actions and plans, including regulatory and economic instruments; stakeholder engagement, including with business, civil society organisations and municipalities; identification of means to secure the financial, institutional and human resources required; and engagement with regional and international initiatives.

2. Action pathways

Marine plastic pollution (MPP) is a growing environmental, social and economic challenge for AIODIS. Combatting MPP requires national actions, regional cooperation and engagement in global initiatives. The complexity of the solutions requires multiple actions by diverse stakeholders across sectors, disciplines and communities. Implementing effective actions to combat MPP requires national and regional action plans, resources, finance, awareness, and political will.

2.1. National MPP action plans

1. AIODIS can consider preparation and/or implementation of national action plans to combat MPP. The action plan can be complementary to a national solid waste management (SWM) plan. If an updated and comprehensive national SWM plan does not exist, then its preparation and resourcing could be considered a priority. The MMP plan can draw on national environmental and economic plans, link to national commitments on the SDGs, interface with the business community and civil society and provide a platform for accessing resources and public engagement. Regional cooperation can be a key component. Core elements of a national action plan are described in Part III. The preparation process can draw on the lessons from other plans in the region and elsewhere.

2.2. Regional MPP action plans

2. Components of regional action plans already exist at various stages of their development. Ideally, the plans can be further developed to include binding measures consistent with UNCLOS Part XII and to provide a platform to secure the political will and resources to address the multiple actions required. Actions are required on trade, solid waste management, development of a circular economy, enhanced human and institutional capacity and mainstreaming regional cooperation. The institutional architecture of the regional plans can be tailored to the requirements of each area and ideally will engage both regional economic communities and organisations and regional seas conventions or their equivalents.

2.3. Engagement by AIODIS in global initiatives and fora

3. AIODIS can benefit from a harmonised position on MPP that articulates the specific challenges of small and island economies and ensures that these are considered in the development of global initiatives and solutions. A harmonised position may be developed as a group, or through international bodies to which AIODIS are party, including through regional economic and political platforms and regional seas conventions, or their equivalents.

4. The harmonised position can draw attention to the information gaps, the capacity and resource deficits, special considerations for trade measures, the issue of MPP carried by ocean currents and generated by non-AIODIS sources, development of measures on fisheries and compliance with relevant norms of shipping.

5. The targeted fora may include UNGA, UNEA, WTO and IMO and the related technical advisory bodies or committees which manage the agendas and prepare information documents or proposals for resolutions, measures, or guidelines. Harmonised positions on two potential or emerging initiatives may be considered:

    a. A possible UNEA resolution to initiate a process leading to the development of an international convention on sustainable management of plastics

    b. A possible process for the development of norms of conduct on marine plastic pollution in accordance with the obligations of the parties to UNCLOS to establish and implement such norms.

2.4. Accessing resources

6. **National resources**. As part of a national plan, AIODIS can review available resources and resource gaps. This could include attention to the funding arrangements for solid waste management at national, municipal and community levels; requirements for institutional and human capacity development and for private sector investment. Clarity on the public and private contributions required may help tune investment guidelines and foster business community innovation.

7. **External resources**. External resources may be required to implement any plan. While countries may have different requirements, they share a number of requirements for external resources. Joint approaches could be considered to relevant UN technical agencies such as: UNEP; FAO and regional fisheries bodies (fishing gear); UNIDO (circular economy); UNESCO (awareness and scientific assessments); oceans agencies; the international conventions on waste; and to the international financial institutions (the GEF, World Bank, regional development banks, and 'green' funds).

8. Consideration can also be given to a harmonised approach to criteria for engagement in industry partnerships.

2.5. AIODIS trade in plastics and plastic waste

AIODIS may wish to consider a number of national and regional actions on trade in plastics.

9. **National**. At national level, ensure coherence between trade policy frameworks and domestic policies to reduce plastic pollution. This may require attention to tariffs, customs codes, import and export standards and procedures, and training of customs officials. The scope could include development of locally-produced alternatives to plastic products; technologies to improve waste management and boost recycling; removal of perverse subsidies; and improved information on plastic trade. Consideration can be given to more comprehensive plastic tariff regimes, 'certification' of 'sustainable' plastic supply chains and more stringent conditions or prohibitions on trade in problematic plastics.

10. **Regional**. Ideally, at regional level, policies, measures, standards and information flows would be harmonised through initiatives facilitated by the regional economic communities (RECs), AU or other competent regional policy agency. Studies would be prepared to define the scope and action required and lead to proposals at the level of the RECs.

11. **Global**. At a global level, AIODIS may wish to establish a common policy platform either through the RECs or by other means and ensure that their common concerns are articulated in the work of the WTO Committee on Trade and the Environment and reflected in any reports to be considered by the WTO ministerial conferences.[1] Given the difficulty of small and island economies to manage certain types of plastic waste, specific attention may be required to issues arising from any application of requirements on exporters to re-import the waste arising from their exports.

[1] Committee on Trade and the Environment https://www.wto.org/english/tratop_e/envir_e/wrk_committee_e.htm. The 12th Ministerial Conference is rescheduled to December, 2021.

PART 1. MARINE PLASTIC POLLUTION. STATUS AND TRENDS

1 The Scale and Nature of Marine Plastic Pollution

This section provides a brief overview of the scale of plastic pollution at global level, the types of plastic and plastic pollutants in the marine environment and the origin and flows of marine plastic pollution (MPP).

Box 1. Interpretation of information presented in this report

The information provided in this report is drawn from a wide range of studies that use several different terms in relation to MPP. These terms include: 'plastic waste', 'marine debris', 'marine litter' and 'marine plastic pollution'. The terms, definitions and timescales, methodologies and assumptions used in various reports mean that there may be differences between quantitative data presented such that the values cannot readily be compared across different studies.

The term 'plastic' is generic and refers to a wide range of products with different chemical characteristics and behaviours in the ocean, for example, some sink, some float and some stay suspended in the water column.

Knowledge on MPP is rapidly evolving and the scientific community readily acknowledges that there are many 'unknowns', in particular with regard to the fate of different plastics in the ocean and the scale of MPP. Because different assumptions and methods are used, the values presented may be inconsistent when derived from different sources.

1.1 The scale of marine plastic pollution

Plastic[2] accounts for an estimated 80 percent of all marine litter and over 70 percent of MPP is from land-based-sources (LBS).[3] The remaining 20-30 percent is from marine sources, but the contribution of different sources differs regionally. Ten major rivers account for a significant proportion of the MPP.[4]

Macroplastics, or large plastics, such as bottles, plastic bags, or lost fishing gear are the most visible components of marine litter and account for about 80 percent of an estimated annual total of 4.8-12.7 million tons of plastic entering the ocean.[5] Microplastics, particles under 5mm (and even smaller nanoplastics), represent an estimated 20 percent of plastic annually entering the ocean (for details, see Table 6).

Global plastic production increased from 2 million tons in 1950 to 381 million tons in 2015 with an estimated value of $569 billion in 2019.[6] Plastic production is projected to double by 2040 and some projections indicate that production could be valued at $1 trillion by 2035 and reach 2,000 million tons by 2050.[7] Other studies suggest an even higher growth rate in production of plastic feedstock – the

[2] The term "plastic" refers to a large number of synthetic products with different characteristics. The main products are: polyethylene (PE), polypropylene (PP), polystyrene (PS), polyvinylchloride (PVC), poly-ethylene terephthalate (PET), PUR resins; polyester, poly-amide, acrylic (PP&A).

[3] See the following for definitions and descriptions: UNEP (2005) Marine Litter: An Analytical Overview; UNEP/GPA (2006). State of the Marine Environment: Trends and Processes, p. 26-28; UNEP (2009). Marine Litter: A Global Challenge.

[4] Schmidt, Christian et al. (2017). Estimation of global plastic loads delivered by rivers into the sea. 19th EGU General Assembly, EGU2017, proceedings from the conference held 23-28 April, 2017 in Vienna, Austria., p.12171.

[5] Jambeck, J. et al. 2015. Marine pollution. Plastic waste inputs from land into the ocean. Science, Vol. 347/6223, pp. 768-71, http://dx.doi.org/10.1126/science.1260352. Jambeck estimates that up to 4.6% of global plastic production ends up in the ocean based on modelling unmanaged waste in the coastal zones of countries (within 50km of the coast). There are several other estimates, all in the 8-12 million tons range (UNEP, 2018; EUNOMIA, 2016; and Boucher and Friot, 2017).

[6] Grand View Research. 2019. Plastics Market Size, Share and Trends Analysis Report by Product (PE, PP, PU, PVC, PET, Polystyrene, ABS, PBT, PPO, Epoxy Polymers, LCP, PC, Polyamide), by Application, and Segment Forecasts, 2019- 2025. https://www.researchandmarkets.com/ reports/4751797/plastics-market-size-share-and-trends-analysis.

[7] World Economic Forum, Ellen MacArthur Foundation, and McKinsey & Co. 2016. The New Plastics Economy.

raw material for plastic products.[8] The low cost of plastic, its high utility and convenience means it is used in most, if not all, industries, either by itself or embedded with other materials. The durability and resistance of plastics to degradation in the environment is a key characteristic that makes plastic a major pollutant both on land and in the oceans. The relatively low cost of the many plastics leads to single use and subsequent disposal as waste. Single use plastics (SUP) are common in packaging; for food distribution; as liquid containers, such as for drinks, cleaning and sanitary products, for chemicals and for many other products. The ability of plastics to combine with metals and other materials means plastics pervade the electronics, the construction and automotive industries. Plastics are found in paints and cosmetics, in furniture and in boatbuilding and pervade the textile, fishing and aquaculture industries.

It is estimated that there are over 190 million tons of marine plastic pollution (MPP) in the world's oceans. An estimated 15 million tons per year of plastic enters the ocean from land-based sources.[9] An additional 2.7 million tons of MPP is attributed to ocean-based sources.[10] In the absence of concerted action, by 2040 the annual flow of plastic into the ocean is projected to be 29 million tons per year. As some plastic may not degrade for hundreds of years, the cumulative total MPP could reach 450 million tons by 2040 if effective measures to combat MPP are not in place. Up to 80 percent of marine litter is plastic[11] and single use plastic packaging comprises about 50 percent of global beach litter.[12]

An estimated 80 percent of marine plastic debris originates from land-based sources and 20 percent from marine sources: from fisheries and aquaculture, from shipping and other maritime activities (for details see section 1.4.3).[13] In 2010, China, North America and Europe accounted for 28 percent, 1 percent and 0.9 percent respectively of the world's MPP and in 2015 five Asian countries (China, Indonesia, the Philippines, Thailand and Viet Nam) are considered to have accounted for 55-60 percent of global MPP.[14] A recent WTO dialogue indicates that plastic waste in Bangladesh increases at a rate of 7.5 percent per year.

In 2018, Asia accounted for more than half of global plastic production, the Middle East and Africa 7 percent. The following table summarises selected indicators for plastic production, waste and marine pollution (Table 1). Table 2 provides an indication of the main sources of plastic pollution showing that plastic packaging is a primary source.

[8] The WEF projects that plastic production and use will grow 3.8 percent per year through 2030. CIEL cites industry reports indicating that production capacity for key plastic feedstocks will grow by 33–36 percent by 2025. CIEL, 2019. Plastic & Climate. The Hidden Costs of a Plastic Planet. https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf.

[9] Forrest, A. et al. 2019. Eliminating Plastic Pollution: How a Voluntary Contribution from Industry will drive the Circular Plastics Economy. Mar. Sci., 25 September 2019. https://doi.org/10.3389/fmars.2019.00627. (see suppl.).

[10] Lebreton, L., Slat, B., Ferrari, F. et al. Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. Sci Rep 8, 4666 (2018). https://doi.org/10.1038/s41598-018-22939-w.

[11] Thevenon, F., Carroll C., Sousa J. (editors), 2014. Plastic Debris in the Ocean: The Characterization of Marine Plastics and their Environmental Impacts, Situation Analysis Report. Gland, Switzerland: IUCN. https://portals.iucn.org/library/sites/library/files/documents/2014-067.pdf. Note that the terms 'marine debris' and 'marine litter' are not equivalent as marine debris could include items such as tree trunks or coconuts.

[12] Ocean Conservancy, Together for our Ocean - International Coastal Cleanup 2017 Report, I.C. Cleanup, Editor. 2017, Ocean Conservancy: Washington, DC.

[13] Geyer, R., J. Jambeck and K. Law (2017), "Production, use, and fate of all plastics ever made", Science Advances, Vol. 3/7, p. e1700782, http://dx.doi.org/10.1126/sciadv.1700782.

[14] Jambeck, J. et al. 2015; Ocean Conservancy. (2015). Stemming the tide: Land-based strategies for a plastic-free ocean. McKinsey Center.

Table 1. Indicators of global plastic production, waste and marine plastic pollution

Indicator	Value
Global plastic production *(Plastics Europe)*	357 million tons (2018)
Cumulative global plastic production 1950-2015 (incl. recycled)	6,300 million tons
Amount of plastic in the oceans	190 million tons; 150 million tons (2015)
Amount of plastic entering the ocean/ year (Jambeck, 2015)	4.8-12.7 million tons (2010)
Amount of marine plastic pollution from land-based sources in 2016	11 million tons
Marine plastic pollution from marine sources	≈20% of MPP
Projected MPP per year by 2040 *(Pew/ BAU scenario)*	29 million tons (range 23-37 m. tons)
Projected cumulative amount of plastic in the ocean in 2040 in a 'business as usual scenario'	450 million tons
Projected MPP reduction from existing commitments (BAU)	7% (Pew)
Plastic as a percentage of marine litter	80% (up to 95% in some areas)
Fate of plastic waste (*Geyer et al. 2015*)	6,300 million tons of waste plastic
Landfills or environmental pollution	79%
Incineration	12%
Recycled	9% (some countries up to 30%)
Plastic as share of global carbon budget	1% (2014); 15% (2050 – projection)
Plastics as share of global hydrocarbon production	6% (2014); 20% (2050 – projection)

Table 2. Indicative principal sources global plastic waste, European waste and demand

Category	Global Waste 2015	Europe Waste 2018	Europe Demand 2018
Packaging	36%	61%	39.9%
Building and construction	16%	6%	19.8%
Textiles*	14%	na	na
Other	12%	18%	16.7%
Consumer and institutional products	10%	4%	4.1%
Transportation	7%	5%	9.9%
Electrical/electronic	4%	6%	6.2%
Industrial machinery	1%		

Source: Plastics Europe, 2019. A circular economy for plastics – A European Overview; Plastics Europe. The Facts.
** textiles imported to Europe are not captured in these values*

In summary, there is a considerable range of estimates of global MPP with order of magnitude differences. The differences are due to different approaches and assumptions. For example, estimates generated by models do not necessarily align with estimates made from sampling of beach litter or ocean sampling. Recent studies suggest that annual MPP may be below the lower (4 million tons) level suggested in 2015 (Jambeck, et al.). Whatever the global quantities, plastic pollution is present in all oceans and seas, in sediments in the deep ocean, throughout the ocean water column, in sea-ice, in all organisms which ingest particles and throughout the food chain.

1.2 Drivers of marine plastic pollution

A key driver of MPP is the 'linear economy' which is practiced globally and in most of Africa. It means that many manufactured products are essentially designed to become a low or no-value waste at the end of their initial use, rather than being designed with a view to reuse, recycling or retaining value as a waste product. This is illustrated by the higher per capita waste generation in Maldives and Seychelles: both have a large tourist industry, both are heavily dependent on imports and both have a low capacity for local production.

Inadequate solid waste management is a primary and direct cause of most plastic pollution.[15] Excess use or avoidable use of plastics and a low or no after-use value of many plastic products all contribute to plastic waste. Globally, about two billion people do not have access to basic waste collection services. This is a key driver of marine plastics pollution and also deprives the recycled plastics industry of raw material and the economies of scale to make recycling viable.[16] It is projected that, without action, up to 4 billion people could be living with inadequate waste management systems by 2040.[17] Population growth, particularly in coastal areas and major river basins, is a key factor in increasing waste and MPP. At both global and African levels, population growth tends to be greater in coastal areas and in major river basins.[18] Income is a second important factor driving waste and the proportion of plastic in municipal solid waste. Developing economies currently use about 20 times less plastic per capita than advanced economies. Consumption is projected to grow as these economies develop. Plastic averages 6.4 percent of waste in low income countries; 11 percent in middle-income countries and 13 percent in high-income countries. In 2016, over 2 billion tons of urban solid waste was generated, equivalent to 0.74 kilograms per person per day. This is projected to increase by about 70 percent to about 3.4 billion tons in 2050.[19] Urbanisation is also an important driver of plastic consumption and waste generation. In many countries, or municipalities, the waste management services cannot keep pace with rapid urbanisation or increasing population density.

The problem of scale and waste management in an island economy is illustrated in the EU. In Malta and Cyprus, both small island economies, about 75 percent of waste plastic is sent to landfill compared to an EU average of about 25 percent.[20] Both countries have difficulties in complying with the mandatory waste management targets set by the EU. Countries having low levels of mismanaged waste does not necessarily mean that best practices are being applied, as many developed countries have a history of simply exporting plastic waste. A recent study on the USA significantly raised the country's estimated contribution to global MPP by the inclusion of its plastic waste exports to countries with a weak capacity for management of plastic waste.[21] Landfill disposal is not considered best practice and conflicts with a circular economy approach. An unstable market for plastic waste also contributes to MPP. Domestic and import regulations on waste can vary significantly. Waste buyers have diverse standards for the separation of different types of plastics and with regard to the level of additives or contaminants in the plastic waste. Recent changes to the Basel Convention also requires prior informed consent from the importing country for imports of plastic waste.

[15] Kaza et al. 2018. (What a Waste 2.0).

[16] OECD, 2018. Improving Plastics Management: Trends, policy responses, and the role of international co-operation and trade. OECD Environment Policy Paper No. 12.

[17] Pew, SYSTEMIQ, 2020. Breaking the Plastic Wave. A comprehensive assessment of pathways towards stopping ocean plastic pollution.

[18] Neumann, B. et al. Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. PLoS ONE 10(3): e0118571. doi:10.1371/journal.pone.0118571. See Supplementary Materials for country-level details.

[19] Kaza et al. The report stresses that country-level data on waste generation in Sub-Saharan Africa is deficient and available for only 25% of countries (see Box 1.1).

[20] PlasticsEurope and EPRO. 2019. Plastics – the Facts 2019. An analysis of European plastics production, demand and waste data. https://www.plasticseurope.org/application/files/9715/7129/9584/FINAL_web_version_Plastics_the_facts2019_14102019.pdf

[21] Lavender Law, K. et al. 2020. The United States' contribution of plastic waste to land and ocean. Science Advances. Environmental Studies. December 16, 2020.

The direct challenges to improved solid waste management include a lack of finance to provide waste management services, weak capacity to manage existing services and waste sites, overuse of landfills, burning on waste landfills, lack of sites for new waste dumps and inability to collect charges for waste services. Waste management responsibility and financing is fragmented across multiple agencies from national level to provincial, municipal and village levels. This limits economies of scale and private investment in 'valuing' waste. Weak technical capacity and an uncertain regulatory climate constrains effective governance, accountability and investment.

The political economy of waste shares common to environmental economics issues: free riders (e.g., individuals or enterprises that benefit from dumping waste without paying for the damage caused); externalities (the failure to reflect the damage caused by plastic in the price of the product); and NIMBYism (not in my backyard), for example when local residents block the establishment of a waste dump or incinerator in their locality, often reflecting land scarcity in small islands. The relationship between increased growth in an economy and environmental pollution over time is described by the Kuznets curve which is shaped by per capita income and by policy responses to declining environmental quality. The 'optimum' is where economic benefit per unit of environmental damage is maximised, as this allows a portion of the net benefits to be directed to remedial investments.[22]

Solutions, including through circular economy initiatives, face a complex of challenges. These include:

- poor awareness of the impacts of deficient waste management
- poor awareness of solutions to urban solid waste management and the costs involved
- lack of political support for investment in waste management
- overlapping responsibilities among agencies, such as municipal authorities, health authorities and environment protection agencies
- weak regulations or enforcement of regulations, including an absence of regulations on extended producer responsibility (EPR)
- weak investment climate for recycling, for approved incineration or other value-added use
- low waste separation at household and business levels
- lack of affordable alternatives to plastics
- lack of markets for recovered or recycled plastics and the low value of many plastic waste products, resulting in poor economic returns from collection and recycling.

Shipping, tourism and fisheries are also drivers of MPP. in the, There may a lack of port reception facilities, an absence of responsible hotel operators and difficulties in collection of waste nets and gear at fishing village level.

In addition to the drivers outlined above, the contribution of a country to MPP depends on numerous factors:[23]

[22] Panayotou, T., 2003. Economic Growth and the Environment. Paper prepared for and presented at the Spring Seminar of the United Nations Economic Commission for Europe, Geneva, March, p. 49.

[23] ORA, 2016. Plastic Marine Pollution and Land-Based Mechanisms, Ocean Recovery Alliance. Draft; McIlgorm, A., K. Raubenheimer and D.E. McIlgorm, 2020. Update of 2009 APEC report on Economic Costs of Marine Debris to APEC Economies. A report to the APEC Ocean and Fisheries Working Group by the Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Australia, December.

- geography: coastal cities, rivers draining urban watersheds, hydrology, or patterns of river water flow, rainfall patterns and coastal wetlands which may trap plastics
- infrastructure: dams, reservoirs, storm-water collection systems, waste treatment and disposal facilities
- institutional effectiveness: efficiency of waste collection, regulations and their enforcement
- technology: poor access to technology for the formal waste system
- behaviour: demographics, culture and degree of environmental concern, population density
- economy: income level and waste composition and presence of certain types of industry.

1.3 Types of plastics and plastic pollution

There are thousands of different plastics, many designed for specific uses: all contribute to plastic waste and MPP. Plastics continue to substitute natural materials – plastic chairs are a good example – because of lower cost, durability and convenience.

Box 2. Plastics are everywhere – the diversity of plastics

In terms of manufacturing, plastics are often classed as either thermoplastics or thermosets.

Thermoplastics can be re-melted and returned to their original state. They are usually made as small pellets (also called 'nurdles') which are heated and moulded to make products. Thermoplastics include polyethylene, polypropylene, polyvinyl chloride, polystyrene, nylon, polycarbonate, and others.

Thermoset plastics are usually produced and formed into products at the same time and cannot be melted down to their original state. They include car tyres (blended with rubber), polyurethanes, melamine, epoxies, and others.

There is a wide range of '**engineered plastics**' designed for specific properties such as resistance to abrasion (polyamides), or impact (polycarbonate, e.g., motorcycle helmet), hardness (ABS, e.g., Lego toys, 3D printers)

Plastic **fibers** are extensively used for clothing (polyester, nylon, rayon, acrylic, spandex), for ropes, body armour (Kevlar®) and numerous other products. PET is often recycled for clothing such as fleece jackets.

There are **many more categories** of plastics, such as coatings (paints), adhesives, elastomers and rubbers that are used in everything from motor vehicles and shipping to computers and medical health (such as face masks and PPE to combat the Covid 19 pandemic).

All plastics are found as pollutants in the marine environment. Table 3 lists the most common macro, or large, plastic items found in marine debris either in the ocean or washed up on beaches.

Table 3. Most common types of plastics in the marine environment

Type of plastic	Short form	Products	Percentage of plastic production	Floats (Yes/No)
Polypropylene	PP	Rope, bottle caps, netting, hot food containers, vehicle parts	24%	Yes
Low-density polyethylene	LDPE	Plastic bags, six-pack rings, bottles, netting, drinking straws	21%	Yes
Polyvinyl chloride	PVC	Plastic film, bottles, cups, tubing	19%	No
High-density polyethylene	HDPE	Milk, juice, shampoo containers, buckets	17%	Yes
Polyethylene terephthalate	PET	Plastic drinks bottles	7%	No
Polystyrene	PS	Plastic utensils, food containers	6%	varies
Foamed Polystyrene		Floats, foam cups (styrofoam)		Yes
Nylon	PA	Netting, fishing lines and traps	<3%	-
Cellulose Acetate	CA	Cigarette filters		No

All plastics are considered to incur some level of risk to human health, often indirectly by absorbing toxins and subsequently releasing them in the body or in the food chain. Impacts on health are discussed in section 2.2 and illustrated by type of plastic in Table 4.

Table 4. Indicative characteristics of main types of plastics

Plastic	Code	Health risk	Recycling potential	Demand % (EU, 2018)	Notes
PET	1 PET	low	high	7.7	Includes carcinogenic chemical. Intended for single use. Extended use can lead to leaching of chemicals.
HDPE	2 HDPE	low	high	12.2	Possible hormone disruption. Bisphenol A (additive)
PVC	3 V	highest		10	Can leach numerous toxic chemicals, numerous health risks. Additives: phthalate, bisphenol A
LDPE	4 LDPE			17.5	Possible hormonal disruption. Additives: flame retardants, other
PP	5 PP	low		19.3	Possible hormonal disruption/ asthma. Additives: phthalate, bisphenol A
PS	6 PS		low	6.4	Can leach styrene - a nervous system toxant, possible carcinogen
	7 OTHER			19	Often mixed plastics. Class 7 materials are generally not recyclable. Polycarbonate (PC) is associated with chromosome damage.

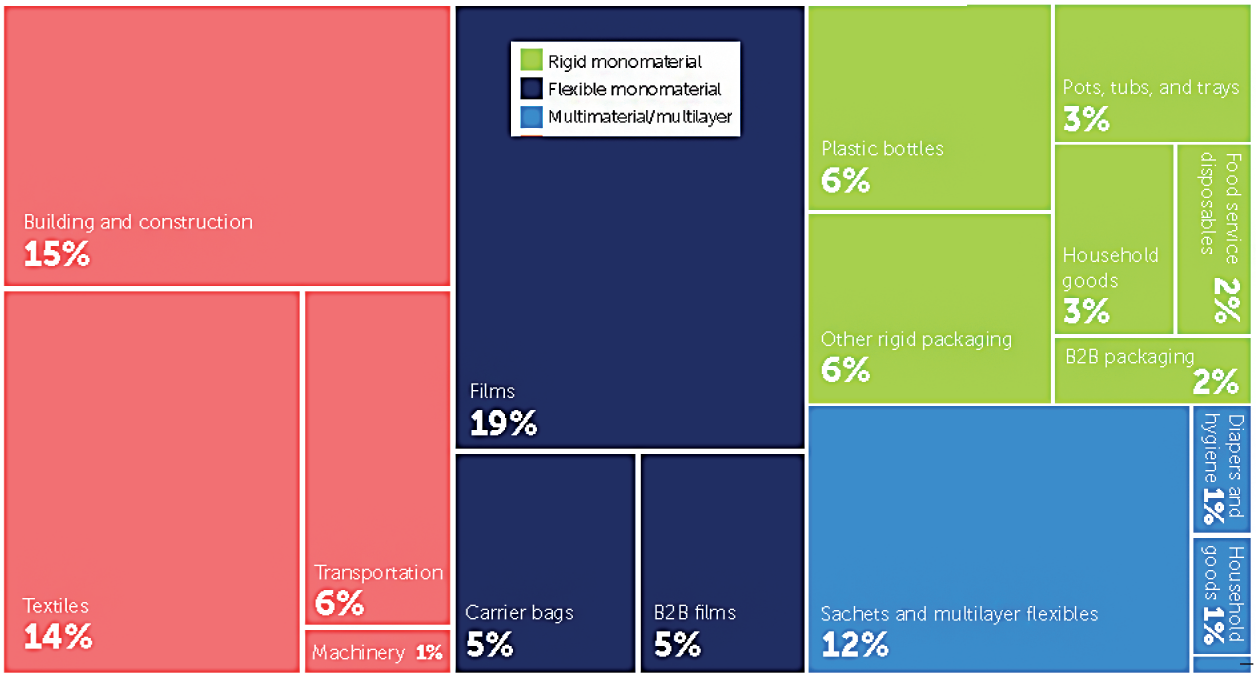
The Resin Identification Coding System for plastics (numbers 1 to 7 in the above table) is an industry designation that has been adopted by most countries. There is no standard code or logo for composite plastic materials. The abbreviations can vary, e.g., PET and PETE are equivalent. The triangular 'recycle' logo does **not** mean that a product is recycled, or recyclable, for example, compostable plastic (code #7) is not recyclable. The capability to recycle differs from place to place and between recycling facilities.

1.3.1 Different plastic products

Of the wide diversity of plastic products, several groups of products contribute a disproportionately high proportion of MPP relative to the quantities produced, indicating a high level of leakage into the environment. These include flexible packaging (e.g., bags, films, pouches), multilayer and multimaterial plastics (sachets, diapers, drinks cartons), and microplastics.[24] Between 35-45 percent of plastic production is used for packaging. The multilayer and multimaterial plastic products present a challenge to recycling as the components must be separated for recycling. Separation may involve costs which exceed the value of the materials and also require substantial investment in separation technology. Less than 10 percent of the over 8.3 billion tons of plastic produced has been recycled and about 60 percent has been discarded.[25]

Global plastic production was 348 million tons in 2017. About 64 percent is used in consumer products and because of consumer disposal habits these products are very likely to become a component of solid waste. The remaining 46 percent is 'locked' into building materials and other products with a relatively longer life cycle (Figure 2). Of the 64 percent (222 million tons), an estimated 41 percent (91 million tons) is estimated to become mismanaged plastic waste, of which up to 12 percent (range 5-15 percent) may enter the ocean.[26]

Figure 2. Global plastic production by end use



Source: Pew/SYSTEMIQ. 2020. Breaking the Plastic Wave.

[24] Pew/SYSTEMIQ.

[25] Geyer et al 2017.

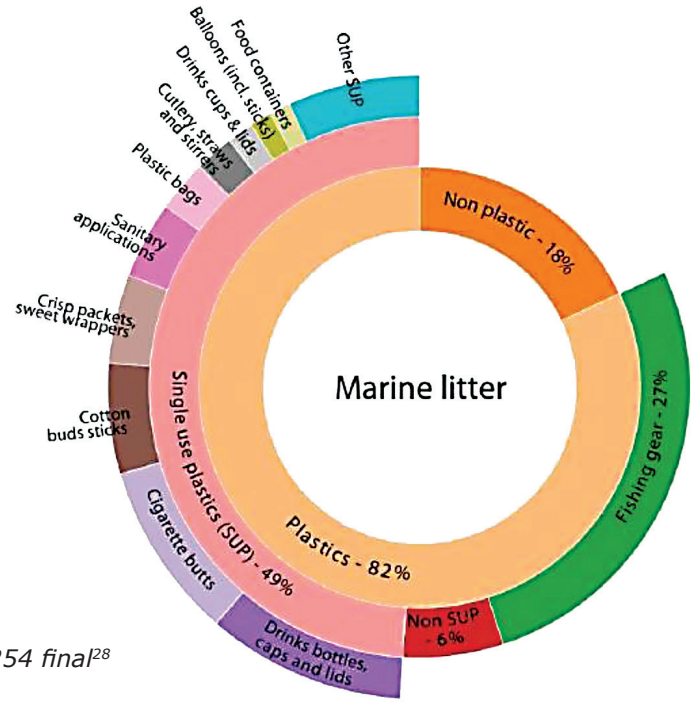
[26] The percentage of mismanaged plastic waste entering the ocean is a subject of considerable debate. The range which appears to be currently most accepted is 5 – 15 percent. Note that 15 percent was the lower bound of the Jambeck (2015) study.

For the purposes of waste management, plastics can be more conveniently classified into three broad categories which align with the different disposal options for urban solid waste:

- rigid products made of a single plastic (e.g., water bottles; other food-grade bottles; non-food-grade bottles; food service disposables; pots, tubs and trays; business-to-business (B2B) packaging; household goods; other rigid monomaterials)
- flexible products made of a single plastic (e.g., bags; monomaterial films; and B2B films)
- multimaterial and multilayer products (e.g., sachets and other flexible multilayers; many types of multilayer food packaging; household goods; sanitary items and diapers).

Plastics that are marketed as 'biodegradable' may only be biodegradable in industrial facilities and may not be readily biodegradable in the natural environment. Standards (if any) for plastics marketed as 'compostable', 'bioplastic', 'biodegradable', 'organic' or similar designations are not widely available and are often confusing.[27] Most (but not all) thermoplastics and can be melted and reused. PET is currently the only plastic type which can (theoretically) be recycled almost endlessly without significantly decreasing quality.

Figure 3. Composition of marine litter on EU beaches



Source: EC, 2018. SWD(2018) 254 final[28]

1.3.2 Macroplastics

'Macroplastics' simply refers to large waste plastic items to distinguish them from 'microplastics'. Macroplastics form the bulk of marine litter and of floating plastic and are considered to comprise 80 percent of total MPP. The composition of macroplastic MPP varies widely with the region and method of assessment. For example, analysis of beach litter from Aldabra and other isolated ocean islands indicates that fishing gear can contribute up to 90 percent of the MPP (by weight), whereas assessment of litter from urban beaches indicates high proportions of plastic bottles, cigarette filters, and wrappers (by number). Figure 3 illustrates the composition of marine litter on EU beaches.

[27] For analysis (USA 'standards') see: 5 Gyres. Better Alternatives Now B.A.N.List 2.0.

[28] EC. 2018. Commission Staff Working Document. Impact Assessment. Reducing Marine Litter: action on single use plastics and fishing gear SWD(2018) 254 final.

As most plastic is less dense than seawater, it is considered that about half of marine plastic will float.[29] The composition of garbage patches in the open ocean reflects floating items or plastics suspended in the water column. However, estimates of the amount of floating plastic (less than 0.3 million tons) are orders of magnitude less than estimates of the MPP from land-based sources. This indicates that understanding of the pollution pathways and flows and the ultimate fate of marine plastic pollutants is far from complete (so-called 'missing plastics').[30]

1.3.3 Microplastics

Microplastics are plastic fragments or particles generally considered to be less than 5mm (between 0.05-5mm) in size, although different studies may use slightly different criteria.[31] Nanoplastic particles are smaller than 0.05mm (50 µm) but are grouped with microplastics for the purposes of this report. Annually, microplastics are estimated to represent 20 percent of all MPP and originate primarily from (Figure 4):

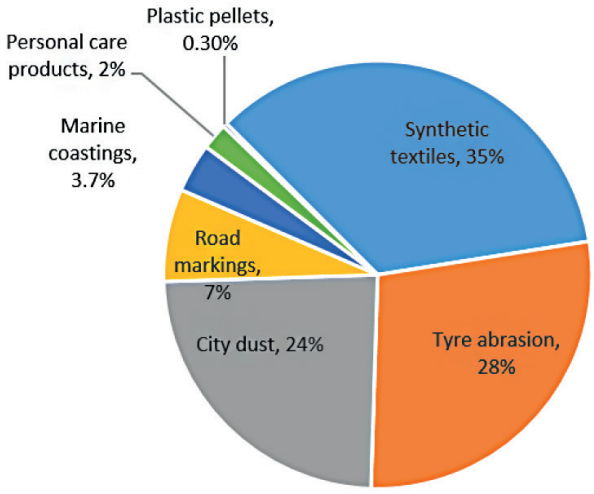
i. the breakdown of macroplastics in the ocean;

ii. additives to consumer products (e.g. microbeads in cosmetics) and

iii. the degradation of products, in particular motor vehicle tyres and synthetic clothing.

Primary microplastics are particles that are included in products by design. These include cleaning abrasives in toothpastes and in cosmetics (microbeads) or the microplastic scrubber particles used in 'sandblasting' of boat hulls. These particles are mostly designed to be 'washed down the drain' and are not trapped by conventional wastewater treatment plants. A number of countries have legislated to ban or limit the use of primary microplastics in certain products.

Figure 4. Origin of marine microplastics



Source: Boucher and Friot, 20.

Secondary microplastics arise from degradation of larger plastic fragments. This is caused by UV light, by abrasion from wave action on beaches and by a range of chemical, biological, physical, and mechanical processes in the environment that change the structure, integrity and size of plastics. Major sources of secondary microplastic pollution include wear of motor vehicle tyres and washing of synthetic textiles/clothing (42 percent and 29 percent respectively of microplastics in European

[29] Geyer R., Jambeck J. R. and Law K.L. 2017 Production, use, and fate of all plastics ever made Sci. Adv. https://doi.org/10.1126/sciadv.1700782

[30] van Sebille E, et al. 2015. A global inventory of small floating plastic debris. Environ. Res. Lett. 10 124006.

[31] Andrady A.L. 2011. Microplastics in the marine environment. Mar. Pollut. Bull. 201; 62:1596–1605.

river catchments).[32] Other important sources are plastic coatings such as paints and degradation of lost fishing gear. The growth of 3D printing of a wide range of products illustrates the likely growth of further sources over time. Unless recovered, or buried in sediments, all plastic that enters the ocean is likely to end up as microplastic as it degrades in the water column or in sediment.[33] The total estimated transport of microplastics to the ocean is estimated at 1.5 million tons per year.[34]

Many of the sources of secondary microplastics, such as synthetic fibres (polyester, nylon, or polyamide) which are imported as clothing, carpets or other textiles, are not categorised as plastics in import statistics, For example, Africa had a consumer demand of 5 kg synthetic fibres per person in 2014, over 6 million tons of synthetic clothing or other textiles.[35]

Table 5. Microplastic pollution levels in selected AIODIS ocean areas

Ocean area	Plastic contamination level	Data source[36]
SW Indian Ocean (seamounts)	1.4 to 4 pieces/50 ml (fibers)	Woodall (2014)
West Coast-off Colombo, Sri Lanka	0.67 ± 0.14 mg/m^3 and 140.34 ± 13.99 items/m^3	Athawuda (2018)
Beach, Chagos Archipelago	4.5 pieces per 50ml	Readman et al. (2013)
Naifaru, Maldives	241-333 pieces per kg	Patti et al. (2020)
Atlantic sub-tropical gyre (e.g. Cape Verde)	<0.1 particles/m^2	Law et al. (2010)

Microplastic particles in marine ecosystems range from 0.001 to 140 particles/m^3 in seawater and 0.2 to 8,766 particles/m^3 in sediments.[37] There is evidence that microplastics can be transported from the Northern Hemisphere as sampling suggests that microplastic concentration in the Southern Ocean are similar to those in Northern Hemisphere oceans.[38] The deep ocean appears to be a significant sink for microplastics:[39] a recent study conservatively estimates that 14 million tons of microplastic are on the ocean floor.[40] Naifaru Island (Maldives) has one of the highest recorded densities of microplastic pollution in the world.[41]

[32] Microbeads from personal care products were 10%.

[33] Auta, H.S., Emenike, C. U. and Fauziah, S. H. 2017. Distribution and importance of microplastics in the marine environment: A review of the sources, fate, effects, and potential solutions. Environ. Int. 102, 165–176. doi:10.1016/j.envint.2017.02.013.

[34] Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN; Eriksen M et al. 2014. Plastic pollution in the world's oceans: more than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. PLoS One 9:e111913; Cózar A et al. 2014. Plastic debris in the open ocean. Proc Natl Acad Sci USA 111:10239–10244.

[35] Henry B, Laitala K, Klepp I.G. 2019. Microfibres from apparel and home textiles: prospects for including microplastics in environmental sustainability assessment. Sci Total Environ 652:483–494. https://doi.org/10.1016/j.scitotenv.2018.10.166; Carmichael, A. 2015. Man-made fibers continue to grow. Textile World Innovation Forum. https://www.textileworld.com/textile-world/fiber-world/2015/02/man-made-fibers-continue-to-grow/.

[36] Athawuda A.M.G.A.D., et al. 2018. National Aquatic Resources Research and Development Agency (NARA) International Scientific Sessions. Vol. 65. 2018. Plastic litter enumeration and characterization in coastal water, off Colombo, Sri Lanka; p. 35. http://www.erepository.nara.ac.lk/handle/1/837; Readman, J.W. et al. 2013 Contaminants, pollution and potential anthropogenic impacts in Chagos/British Indian Ocean Territories. In Coral reefs of the United Kingdom overseas territories, coral reefs of the world (ed. CRC Sheppard). Amsterdam, The Netherlands: Springer; Law K., et al. 2010. Plastic accumulation in the North Atlantic subtropical gyre. Science. 2010;329:1185. https://www.ncbi.nlm.nih.gov/pubmed/20724586

[37] G.G.N. Thushari and J.D.M. Senevirathna. 2020. Plastic pollution in the marine environment. Heliyon. 2020 Aug; 6(8): e04709; GESAMP, 2015. Sources, Fate and Effects of Microplastics in the Marine Environment: A Global Assessment. UNEP.

[38] Isobe A, Uchiyama-Matsumoto K, Uchida K, Tokai T (2016) Microplastics in the Southern Ocean. Mar Pollut Bull. doi:10.1016/j.marpolbul.2016.09.037

[39] Woodall L.C., et al. 2014. The deep sea is a major sink for microplastic debris. R. Soc. Open Sci. 2014;1:140317.

[40] Barrett, J. et al. 2020. Microplastic Pollution in Deep-Sea Sediments from the Great Australian Bight. Front. Mar. Sci., 05 October 2020. https://doi.org/10.3389/fmars.2020.576170.

[41] Patti, T.B. et al. 2020. Spatial distribution of microplastics around an inhabited coral island in the Maldives, Indian Ocean. Science of The Total Environment. Volume 748, 15 December 2020, 141263.

Over 80 percent of tap water samples across the world have been found contaminated by microplastics, indicating that it is not solely a marine pollution problem. Concentrations range from 10^{-3} to 10^{3} particles per litre: polyethylene terephthalate and polypropylene particles are those most frequently detected in drinking water. There is currently no evidence of significant risks to human health, but there are major gaps in understanding of the fate, effects and risks of microplastics and a growing number of studies indicate adverse effects on marine organisms, including from chemicals transported by microplastic.[42] There does not currently appear to be a viable means of removing microplastics from the marine environment at scale, although there are emerging technologies for microbial breakdown of plastics.[43]

It is projected that marine microplastic pollution from both primary and secondary sources will increase and that many marine macroplastics will progressively degrade to microplastics and accumulate in the water column or in coastal or deep ocean sediments. Given that there are known risks associated with microplastics and that the pollution load will increase over time, the precautionary approach suggests and scientific consensus support measures to limit the leakage of microplastics to the environment, possibly starting with their elimination from products such as cosmetics and toothpastes.

1.4 Plastic pollution pathways

The relative contributions of the main plastic pollution pathways are set out in Table 6. Land-based sources of mismanaged solid waste are the primary contributors to MPP. The contributions of each vary in terms of the quality of solid waste management in a country, national control over marine pollution and various physical and demographic features (such as coastal current systems and the proportion of urban coastal dwellers).

Table 6. Estimated contributions of pollution pathways to global marine plastic pollution

Source	Value/ Range (million tons/year)
Coastal Mismanaged Plastic Waste (MPW)	3.37 – 12.7
Inland MPW	0.4 – 4.0
Lost fishing gear (incl. 0.6 million tons microplastics)	1.15
Shipping	0.6
Primary microplastics	0.95 - 3.01
Atmospheric transfer of microplastics (fibres)	unknown
Global marine plastic pollution	4.8 – 12.7

Source: Boucher and Billard, 2019.[44]

[42] World Health Organization. 2019. Microplastics in drinking-water. Geneva; SAPEA, (2019). A Scientific Perspective on Microplastics in Nature and Society. Berlin: SAPEA. https://doi.org/10.26356/microplastics; Mason, S.A. et al. 2018. Synthetic polymer contamination in bottled water. State University of New York at Fredonia, Department of Geology & Environmental Sciences.

[43] Caruso, G., 2015. Plastic degrading microorganisms as a tool for bioremediation of plastic contamination in aquatic environments. Pollution Effects and Control 3, e112. http://dx.doi.org/10.4172/2375-4397.1000e112; Ru J, Huo Y and Yang Y. 2020. Microbial Degradation and Valorization of Plastic Wastes. Front. Microbiol. 11:442. doi: 10.3389/fmicb.2020.00442.

[44] Boucher, Julien and Guillaume Billard. 2019. The challenges of measuring plastic pollution. Field Actions Science Reports. Special Issue 19, 2019. Reinventing Plastics.

1.4.1 Land-based sources

Land-based sources are estimated to account for 80-90 percent of global MPP.[45] The primary cause of land-based plastic pollution is inadequate waste management both in urban and rural settings.[46] At a global level, Nigeria was ranked ninth for per capita inadequately managed plastic waste and South Africa eleventh (0.85 million tons and 0.63 million tons respectively, 2010 data).[47] The problem of waste management is discussed in more detail in other sections.

1.4.2 Rivers

Studies suggest that about 91 percent of marine plastic waste is transported via watersheds larger than 100 km^2 indicating that rivers are major pathways for MPP;[48] an estimated 0.8-2.7 million tons per year.[49]

Rivers with a high population in their catchment basins are major sources of MPP, in particular several Asian rivers.[50] In the Indian Ocean, Pakistan generates about 3 million tons of plastic waste each year and the Indus River contributes 164,332 tons of plastic waste (to the sea) annually.[51]Significant amount of plastic flow from several African river basins, in particular the Niger and associated Nigerian rivers, the Nile and the Congo. Nigeria is reported as releasing up to 0.34 million tons of plastic debris into the ocean in 2010 and was the country ranked the ninth in the world for pollution of the marine environment.[52] Recognizing the contribution of rivers, a number of initiatives are in place or technologies are being deployed to capture plastic from rivers.

1.4.3 Marine sources

Marine sources are estimated to account for about 20 percent (range 10-30 percent) of MPP, or 1.75 million tons per year (range 0.3 – 5.91 million tons per year. However, estimates vary with the approach used. If the global estimate is an extrapolation from EU studies, then 1.75 million tons (range1.3 – 1.8 million tons) of MPP are generated annually by marine sources.[53]

The main sources are:

- shipping by dumping wastes at sea
- fishing though lost or abandoned fishing gear
- abandoned fiberglass (GRP) boats
- coastal and marine tourism, including cruise ships in some regions.

[45] Brooks, A. L., Wang, S., & Jambeck, J. R. (2018). The Chinese import ban and its impact on global plastic waste trade. Science advances, 4(6), eaat0131.

[46] Hoornweg, D., and Bhada-Tata, P. (2012). What a Waste: A Global Review of Solid Waste Management. Washington, DC: World Bank.

[47] Jambeck et al., 2015.

[48] Lebreton, L. and A. Andrady. 2019. Future scenarios of global plastic waste generation and disposal. Palgrave Communications (2019) 5:6 https://doi.org/10.1057/s41599-018-0212-7 www.nature.com/palcomms.

[49] The Ocean Cleanup; Schmidt 2017 estimate 0.43-2.75; Li et al 2016 - 80% from land.

[50] Lebreton, L. C. M., et al. 2017. River plastic emissions to the world's oceans. Nat. Commun. 8:15611. doi: 10.1038/ncomms15611.

[51] Muhammad Mukheed, Alisha Khan. 2020. Plastic Pollution in Pakistan: Environmental and Health Implications. Journal of Pollution Effects & Control Vol. 8 Iss. 4. No: 251; https://www.dawn.com/news/1512547.

[52] Dumbili, E. and L. Henderson. 2020. The challenge of plastic pollution in Nigeria. Chapter 22 – Environmental Impact, Societal Issues, Prevention, and Solutions. Plastic Waste and Recycling 2020, Pages 569-583. https://doi.org/10.1016/B978-0-12-817880-5.00022-0. The Kwa Ibo river has an estimated plastic pollution load of about 12,000 tons per year.

[53] Sherrington, C. 2016. Plastics in the Marine Environment. Eunomia, 2016. https://www.eunomia.co.uk/reports-tools/plastics-in-the-marine-environment\.

Despite international rules (see section 4.1.2 (MARPOL Annex V)), commercial fishers accidentally lose or deliberately dump damaged fishing gear at sea: nets, lines and ropes, strapping bands, bait boxes and bags, gillnet or trawl floats. Yachts and other recreational craft can lose or dispose of sails, cordage, floats or galley waste. Merchant shipping, ferries, naval vessels may also release plastic waste at sea. Offshore oil and gas platforms may lose or dispose of lines, plastic piping, insulating materials, plastic containers and other plastics at sea. An increasing number of fiberglass, or glass reinforced plastic (GRP) vessels are reaching the end of their useful life of 30-50 years and present particularly difficult problems of disposal. Marine tourism can result in direct MPP by tourists, hotels, cruise ships or recreational boats.

Table 7. Estimated marine sources of marine plastic pollution

Source of MPP	Million tons per year (estimate)	Contribution %
Fishing gear	1.13	65%
Shipping	0.61	35%
GRP vessels/ other marine GRP	≈ 0.07	unknown
Marine tourism	unknown/ included with land-based sources	na

Sources: Pew 2020; EUNOMIA, 2016.

Fishing. Sampling of the Pacific garbage patch indicates that of the 28.1 percent of the MPP of marine origin, 17.9 percent is associated with fishing, 1.3 percent with aquaculture and 8.9 percent with shipping, which is broadly consistent with the values presented in Table 7.[54] An estimated 29 per cent of lines, 8.6 per cent of fish traps, and 5.7 per cent of nets are lost each year. Gillnets (particularly bottom-set gillnets) have the highest risk of loss, while the risk of loss of trawls and purse seines is relatively low.[55] Plastic from fisheries sources comprised 83 percent of beached litter on Aldabra atoll, the centre of a major tuna fishery.

Shipping is estimated to generate about 35 percent of marine sourced MPP. Waters around the Cape of Good Hope, a major shipping lane, have experienced a significant increase in the amount of 'non-African' marine litter attributed to non-compliance with MARPOL Annex V by shipping, primarily Asian shipping judging from the composition of the marine litter.[56] Ports are required to provide facilities for disposal of ship's garbage, and despite internationally recognised disposal standards, ships may simply dump garbage outside of territorial waters.[57]

GRP boats began to be mass produced from the 1950s and surged in the 1970s. The vessels have a life expectancy of 20-50 years and range from recreational boats and yachts to trawlers and ferries. All pose significant difficulties in disposal: burning releases toxic compounds; the space required for landfill can be a problem in SIDS; breaking-up is costly. Partly due to the costs associated with disposal, old GRP vessels are often left on moorings, or on beaches, or scuttled, either without authorisation, or as part of 'artificial reefs'.

[54] Lebreton, L. et al 2018. Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. Sci. Rep. 8:4666. doi:10.1038/s41598-018-22939-w.

[55] K. Richardson, B.D. Hardesty, and C. Wilcox, "Estimates of Fishing Gear Loss Rates at a Global Scale: A Literature Review and Meta-Analysis," Fish & Fisheries 20, no. 6 (2019): 1218-31, https://onlinelibrary.wiley.com/doi/abs/10.1111/faf.12407.

[56] Ryan, Peter G. et al. 2019. Rapid increase in Asian bottles in the South Atlantic Ocean indicates major debris inputs from ships. PNAS, October 15, 2019 vol. 116 no. 42 p.20892–20897. For details see: https://www.youtube.com/watch?v=ZWC_SZdrZeY.

[57] International Maritime Organization (IMO), 2016. Review of the Current State of Knowledge Regarding Marine Litter in Wastes Dumped at Sea under the London Convention and Protocol - Final Report (LC 38/16); ISO, 2011. Management and handling of shipboard garbage (ISO 21070:2011); ISO, 2013. Arrangement and management of port waste reception facilities (ISO 16304:2013).

MARPOL (Annex V) does not apply to GRP hulls and the London Convention and Protocol make no specific reference to dumping of GRP vessels.[58] The liability of vessel owners, manufacturers or suppliers for disposal is generally unclear in national legislation and EPR schemes are practically non-existent. Some countries prohibit disposal in landfills. Cost of disposal can be high, partly because recycling of GRP presents significant technical problems and costs.[59] The estimated costs of dismantling and disposal in the EU are as follows: €800 for a 7-meter boat; €1,500 for 10-12m vessels; and up to €15,000 for a 15m vessel. The marine element of composite waste streams is forecast to be around 10% of the total by 2025 (or about 70,000 tons/year).

1.4.4 Ocean transport of plastics

Once leaked into rivers and oceans, the plastics can be moved by currents, winds and waves, often polluting other nations' shorelines or exclusive economic zones (EEZs).[60] Efforts have been made to track the sources of marine debris based on their labelling or other characteristics, but these studies face several problems: some plastics sink, others degrade to smaller fragments, or microplastics; large quantities are beached without significant ocean transport. Some studies have used ocean current information to model ocean transport and many studies have focused on 'ocean garbage patches'.[61]

The 'garbage patches' have been likened to a very thin soup, or bouillon, as most patches contain perhaps 1 piece of plastic per m^2. The main garbage patches of relevance to AIODIS are the Central and South Atlantic gyres and the Southern Indian Ocean gyre, where ocean currents tend to concentrate ocean plastics (Figure 5). However, there has been a very low level of sampling of ocean plastic in the AIODIS regions.

Small quantities of MPP from Maldives, Tanzania, Comoro Islands, Mauritius and Madagascar have been recorded in Australia's EEZ indicating transport of MPP across the Indian Ocean.[62] Several South Asian countries are ranked among the 'top 20' for inadequate waste management: Sri Lanka (5), Bangladesh (10), India (12), Pakistan (15) and substantial quantities of MPP enter the Northern Indian Ocean. Most of the floating plastic debris originating from South Asian countries remains north of the equator with a concentration in the Bay of Bengal as a result of current patterns.[63] However, some floating plastic escapes south of the equator and can pollute beaches in east African countries or may enter a southern Indian Ocean garbage patch. The existence of a southern Indian Ocean garbage patch is the subject of discussion, as the plastic appears to be highly dispersed and the strong winds in the southern Indian Ocean move floating plastic into the South Atlantic Ocean.[64]

[58] IMO and LC&P. 2019. End-of-life management of fibre reinforced plastic vessels: Alternatives to at sea disposal. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fibre%20Reinforced%20Plastics%20final%20report.pdf. See case study for Fiji.

[59] European Boating Association. 2020. EBA Position Statement. End of Life Boats. https://eba.eu.com/wp-content/uploads/site-documents/eba-position-statements/eba-position-elb.pdf.

[60] Lavers and Bond, 2017; Lebreton et al., 2017.

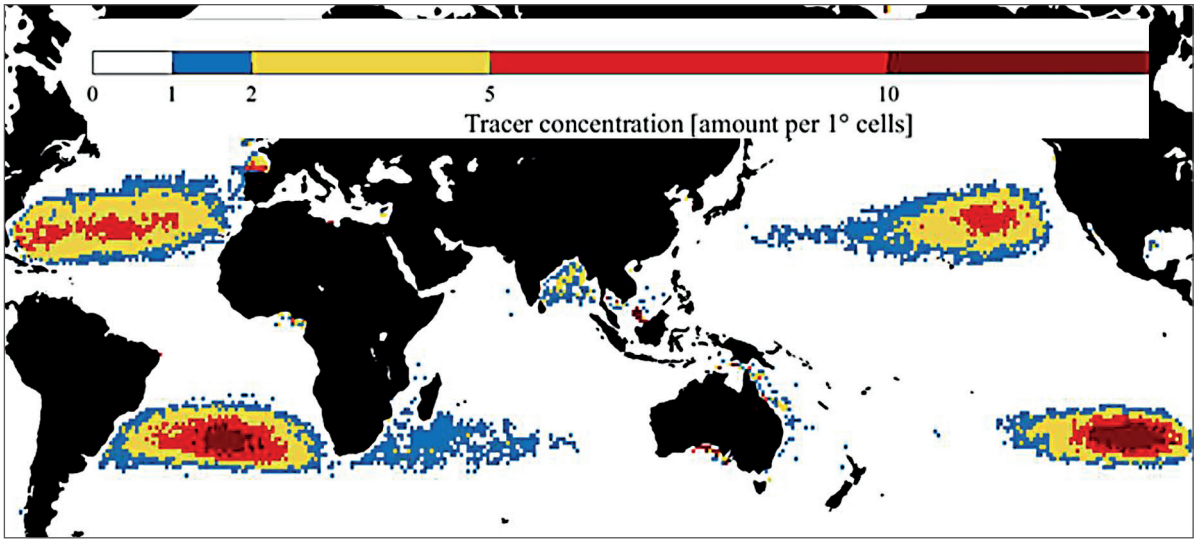
[61] Lebreton et al., 2012; Eriksen et al., 2014; Critchell and Lambrechts, 2016.

[62] Galaiduk, R. et al. Transnational Plastics: An Australian Case for Global Action. Policy Brief Article. Front. Environ. Sci., 22 July https://www.frontiersin.org/articles/10.3389/fenvs.2020.00115/full.

[63] van der Mheen, M., van Sebille, E., and Pattiaratchi, C. 2020. Beaching patterns of plastic debris along the Indian Ocean rim, Ocean Sci. Discuss., https://doi.org/10.5194/os-2020-50, in review, 2020; van der Mheen, M., C. Pattiaratch and van Sebille, E., 2019. Role of Indian Ocean Dynamics on Accumulation of Buoyant Debris. JGR: Oceans:28 March 2019. p. 2571-2590.

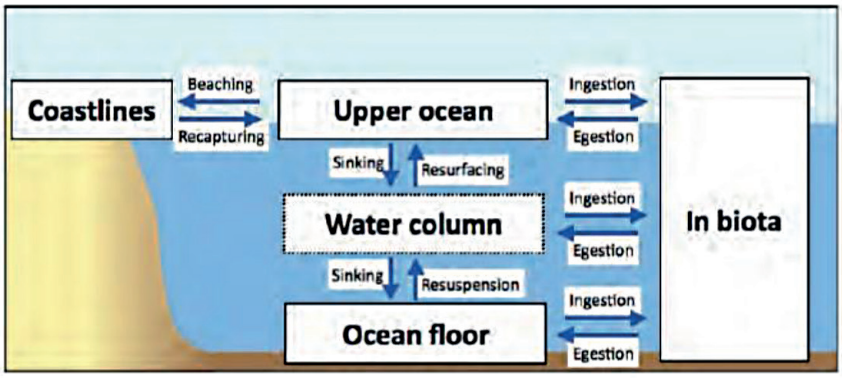
[64] See: https://vimeo.com/327706415.

Figure 5. Ocean garbage patches (simulation) showing Atlantic and Indian Ocean gyres



Source: van der Mheen, 2019.

Figure 6. Fluxes of marine microplastics



Source: GESAMP/ van Sibele 2017

There is poor understanding of how and which plastic accumulates in the garbage patches. Studies suggest that about 50 percent of the plastic remains suspended in the water column below 2km depth and only about 1 percent is floating on the surface.[65] Understanding of the fluxes of marine microplastics is also poor (Figure 6).

1.5 Marine plastic pollution in Africa

Estimated per capita plastic consumption in Africa in 2015 was 16 kg[66] giving an estimated plastic consumption of 19.5 million tons for the continent (excluding secondary plastics, such as components of motor vehicles or electronic goods).[67] Six countries (Egypt, Nigeria, South Africa, Algeria, Morocco,

[65] Egger, Sulu-Gambari.. 2020 Sci Reps.

[66] Statista, 2018. Per capita consumption of plastic materials worldwide in 2015 by region. https://www.statista.com/statistics/270312/consumption-of-plastic-materials-per-capita-since-1980/.

[67] Babayemi, Joshua O. et al. 2019. Ensuring sustainability in plastics use in Africa: consumption, waste generation, and

and Tunisia) account for just over 50 percent of total African plastics consumption, some of which is exported as manufactured plastic products. Imports of plastics, including raw feedstock, are estimated to double by 2030.[68] Sub-Saharan Africa generated 174 million tons of waste in 2016, or 0.46 kg/person/day.[69] Waste is projected to quadruple by 2050. An estimated 8.6 percent of municipal solid waste is plastic. About 44 percent of waste is collected – a higher proportion in many urban areas and a lower proportion in most rural areas and informal settlements. An estimated 69 percent of waste is openly dumped.

Africa's total mismanaged plastic waste is estimated at 4.4 million tons (2010), potentially rising to 10.5 million tons by 2025 without investment in solid waste management. Egypt, Nigeria, South Africa, Algeria and Morocco are considered to be among the top 20 countries contributing to global marine debris.[70] The proportion of mismanaged plastic waste entering the ocean is unclear. A 2015 study assumed 15-40 percent of mismanaged plastic waste in the coastal regions became MPP.[71] More recently, Africa is estimated to produce some 19 million tons of plastic waste and, with an average of 88.5 percent of mismanaged solid waste, annually generates some 17 million tons (range 10–20) of mismanaged plastic waste.[72] Africa and the Middle East generate an estimated total of 1.53 million tons of marine plastic waste and 0.13 million tons of primary marine microplastic waste.[73]

In Africa, an estimated 44 percent of waste is collected formally (i.e., by municipal services or private contractors). Collection coverage is more comprehensive in urban areas (43 percent on average) than in rural areas (9 percent on average), where collection is often non-existent.[74] The remaining waste may be dumped without controls, burned or collected by informal labourers (waste pickers). The waste pickers are important stakeholders in collection, sorting and recycling of plastic, aluminium cans, cardboard and other waste materials. Waste collection 'dumpsters' are often placed in unplanned settlements but littering remains a major problem in many areas which do not have a formal waste collection scheme. In most countries, waste separation and recycling is at a low level and separation and recycling may rely heavily on the private sector. About 7 percent of waste is recycled (Table 8).[75]

Table 8. Waste disposal and treatment in Sub-Saharan Africa

Type of waste disposal	Percent of waste
Open dump	69%
Landfill (unspecified)	12%
Controlled landfill	11%
Recycling	6.6%
Composting	1%
Other (sanitary landfill, incineration, anaerobic digestion)	≈1%

Source: Kaza et al. 2018

projections. Environ Sci Eur (2019) 31:60.

[68] Babayemi et al. 2019.

[69] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-1329-0.

[70] Jambeck, J. et al, (2017). Challenges and emerging solutions to the land-based plastic waste issue in Africa. Marine Policy. 10.1016/j.marpol.2017.10.041.

[71] Jambeck et al. 2015.

[72] Kaza et al. 2018.

[73] Julien Boucher and Guillaume Billard. 2019. The challenges of measuring plastic pollution. Field Actions Science Reports, Special Issue 19, 2019. http://journals.openedition.org/factsreports/5319; Lebreton, L., Andrady, A. Future scenarios of global plastic waste generation and disposal. Palgrave Commun 5, 6 (2019). https://doi.org/10.1057/s41599-018-0212-7.

[74] E.g. Antananarivo 89% of waste is collected; Moroni 60% (data from Kaza et al. 2018).

[75] Kaza et al. 2018; R Mohee, T Simelane. 2015. Future directions of municipal solid waste management in Africa. africabib.org.

More recent and detailed modelling has assumed lower transfers of mismanaged waste from land to the ocean: 8-10 percent for direct dumping by households; 5 percent for dumping of collected waste. Provisions have also been made for recovery of plastic waste from beaches or dump sites and to account for microplastics, including from abrasion of motor vehicle tyres and textiles.[76]

Some estimates of plastic waste may not include estimates of secondary sources of plastic waste arising from plastics used in motor vehicles, kitchen equipment, electronic goods and other products. In the case of Nigeria, plastic used in these products was estimated at about 25% of total plastic imports.[77] This suggests that while plastic waste may be significantly underestimated, many of these plastic waste products may not be leaked to the ocean.

Mismanaged waste, in particular mismanaged municipal solid waste, is the single greatest source of MPP in Sub-Saharan Africa. MPP also arises from fisheries and maritime activities and from microplastics. There are no estimates of MPP generated by marine sources, although some surveys of beach litter indicate high levels of MPP attributable to fisheries. There are no specific estimates of African marine microplastic pollution, although models have used assumptions in order to develop global estimates.

While Sub-Saharan MPP can largely be attributed to weak waste management at national levels. significant, but largely unquantified, amounts of MPP may originate from outside each country. Upstream or landlocked countries may generate plastic waste that escapes into rivers. Ocean currents may deposit plastic on beaches and in sediments or contribute to the mass of plastic floating on the surface or suspended in the water column. The contribution of major river basins to MPP in AIODIS and ocean transport of plastic pollution is addressed in section 1.4.4. The Nile is the world's fifth most plastic-polluted river. The Niger ranks in the world's 'top ten' while the Indus (which flows into the northern part of the WIO) is the world's second most plastic-polluted river.

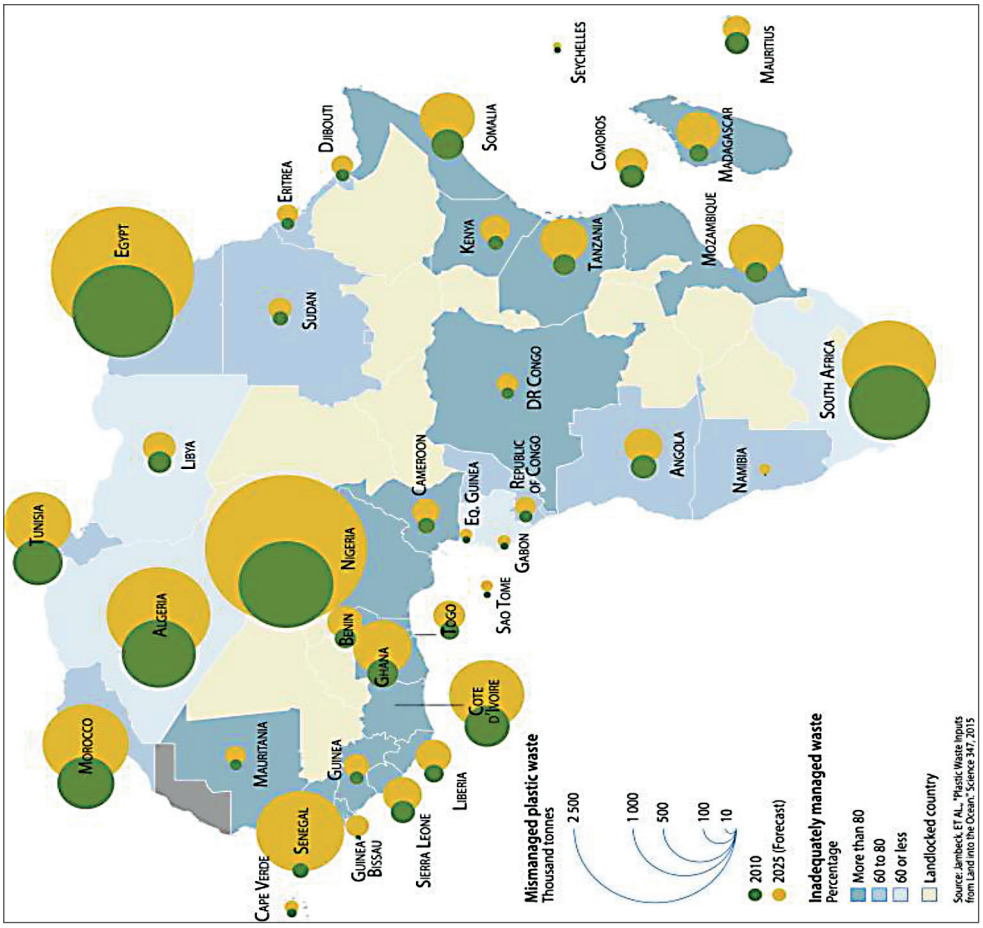
In summary, there are no reliable estimates for MPP in Sub-Saharan Africa. Collaboration with the authors of global and African country-level MPP estimates could potentially generate a robust consensus estimate.[78]

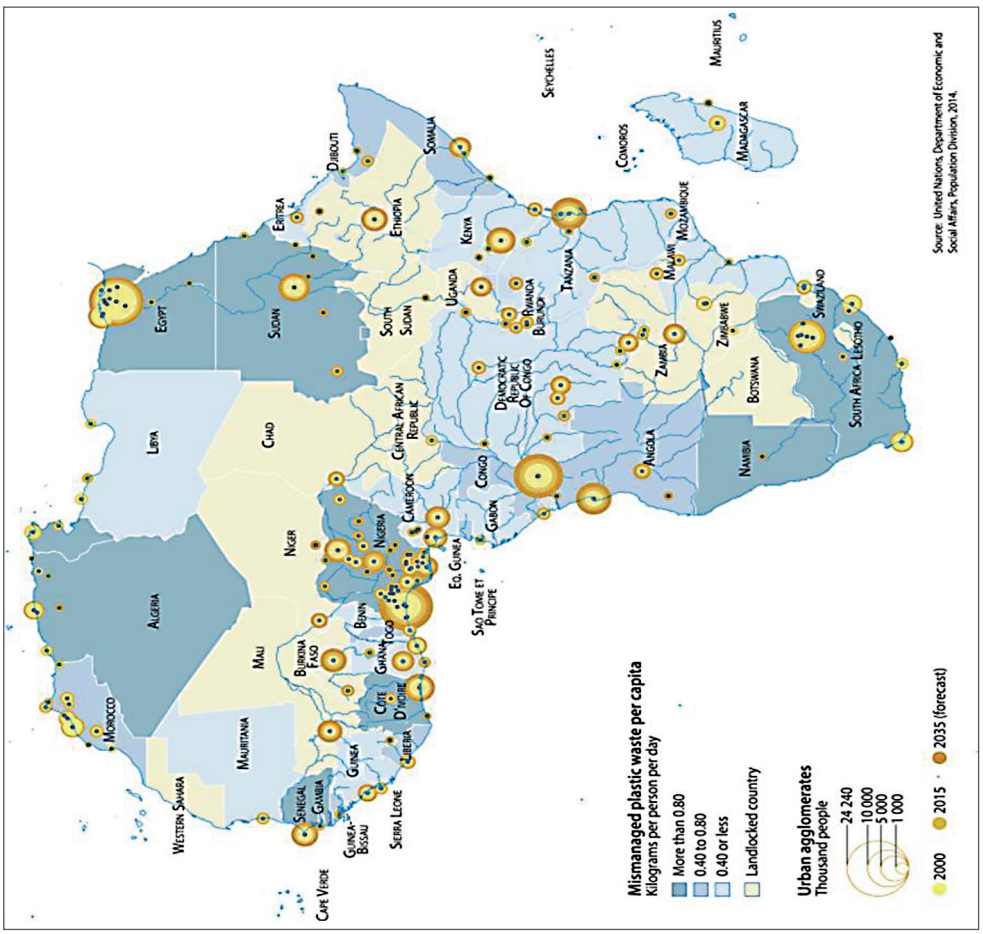
[76] Lau et al. 2020. See Supplementary Materials. Country-level data is not currently available.

[77] Babayemi J.O., Ogundiran M.B., Weber R., Osibanjo O. 2018. Initial inventory of plastics imports in Nigeria as a basis for more sustainable management policies. J Health Pollut. 8(18):6–20.

[78] E.g. Jambeck, et al.; Lau et al.; Ryan, P.G.

Figure 7. Mismanaged plastic waste in Africa (Left: kg/capita; Right: tons/annum and %)





Source: Jambeck et al. 2018

2. The Impact of Marine Plastic Pollution

Production of plastic is essentially the production of a pollutant. Pollution, by definition, generates negative impacts, harm or damage to society, or to natural capital and ecosystem function. Plastic pollution impacts negatively not only on coasts and oceans, but also impacts negatively on land, rivers, lakes and , drinking water supplies. The manufacture of plastics impacts on the atmosphere through generation of greenhouse gases, as dust particles and through waste disposal processes (greenhouse gas and toxic chemical release). The attributes that make plastic so useful (malleable, durable, lightweight, inexpensive) also makes plastic waste a highly dispersed, pervasive, low-value waste and a persistent threat to human health, to ecosystems and to economic activities.

However, the plastic waste stream can generate benefits, for example, for recycling enterprises, by creating employment for 'waste-pickers' who sort plastic waste, or (arguably) in terms of energy production if waste plastic is incinerated using appropriate technology. If, however, plastic waste is burned on landfills, it merely converts waste into atmospheric and land pollution; if the health of waste-pickers is compromised, those employed may not have a net benefit. This section deals largely with the negative impacts of MPP.

The harm from MPP occurs directly through degradation of tourist beaches, blockages of pipes and machinery, entanglements of vessels and mortality of wildlife. Marine mammals, turtles and seabirds are among the most vulnerable, but ingestion of plastic particles has effects along the entire food chain. Fish expend energy consuming indigestible plastic; seabirds feed plastic to their young; plastics accumulate toxins which can work their way up the food chain. The impacts on human health are becoming more evident. Once plastic is manufactured it is already a waste disposal problem. Plastic that is neither incinerated nor recycled persists: in landfills, on beaches, at the bottom of the sea, floating or in suspension in the ocean.

The negative impacts of MPP occur across coastal and marine areas and species:

- on public health through direct exposure to some plastics, through contamination of food products and release of toxins absorbed by plastics when plastic particles are ingested (see section 2.3)[79]
- on marine ecosystems – almost all marine organisms examined, including corals, have been shown to be harmed by ingestion of plastics. Entanglement with plastic nets, lines or ropes increases mortality in larger marine animals, notably in birds, turtles, marine mammals and fish[80]
- both marine ecosystems and industries are impacted by invasive species transported by floating plastic
- many plastics are produced with additives which may not only pose a risk to the environment and to human health, but may be problematic in recycling and a potential barrier to a plastics circular economy.[81]

[79] For example, in the construction or repair of GRP fishing vessels, workers are exposed to styrene which causes a range of health problems. See: U.S. Department of Health and Human Services. 2007. In-depth survey report: Styrene exposures during fiber reinforced plastic boat manufacturing. Report No: EPHB 306-17a. June 2007.

[80] Thevenon, F., Carroll C., Sousa J. (editors), 2014. Plastic Debris in the Ocean: The Characterization of Marine Plastics and their Environmental Impacts, Situation Analysis Report. Gland, Switzerland: IUCN. 52 pp. The authors reported entanglement by over 300 species.

[81] SCP/RAC, UNEP, BRS, IPEN. 2020. Plastic's toxic additives and the circular economy. September 2020. https://ipen.org/sites/default/files/documents/plastics_and_additives_final-low-o-en.pdf; Hermabessiere, Ludovic, et al. 2017. Occurrence and effects of plastic additives on marine environments and organisms: A review. Elsevier, May 2017, Chemosphere. The most common plastic additives found in marine environments are phthalates and bisphenol A (BPA), both potent endocrine disruptors; polybrominated diphenyl ethers (PBDE) (flame retardant) and nonylphenols (NP).

Negative impacts occur across sectors:

- real estate values decline through contamination of beaches and wetlands
- tourism revenues can decline through contamination of beaches, dive sites, mangrove tour routes or through the decline in use of marinas and leisure craft (sailing, kayaking)
- fisheries and aquaculture enterprises lose revenue through contamination of seafood, either by ingestion of plastic particles or leaching of toxins from plastics
- shipping incurs costs from fouling of pumps and pipes by plastics and carriage of invasive species which can cause fouling of structures causing delay in shipping schedules
- the offshore oil and gas industries encounter similar problems to shipping
- governments, local authorities, port authorities and industries all incur the costs of clean-up for coastlines, waterways, marinas and ports.

The impact of marine microplastic pollution is the subject of ongoing study.[82] The known impacts are essentially negative.[83] Quantification of the impacts is challenging due to the complexity of analyses, a lack of transparency on the composition of plastic products and additives and poor understanding of the cumulative effects, poor understanding of the transport of plastics in the environment and of the effects of plastics on ecosystem processes.

Toxins associated with plastics in the marine environment arise in several ways: through leaching of toxic additives; from the chemical breakdown of plastics; from absorption of other toxins from seawater and from recycling processes. The toxic chemicals include pesticides, industrial chemicals (e.g. POPs) and heavy metals used as plastic colorants.[84]

2.1 Economic impacts

The economic impacts of plastic pollution are estimated to be as high as $2.2 trillion per year including the carbon footprint of plastic and loss of ecosystem services.[85] However, estimates vary widely and are not necessarily comparable as they refer to different sets of information, are based on different approaches and refer to different time periods or country coverage. The estimates warrant further description and clarification (see: Figure 8, Table 9, and Box 3). The estimates of economic damage often refer to 'marine debris', rather than 'marine plastic'. While plastic is generally understood to be about 80 percent of marine debris, no attempt is made to adjust estimates of damage from marine debris.

Estimates of economic and social impacts of MPP need to be treated with due caution because of the weaknesses in the quantification of MPP, the delays in detecting impacts and the often weak causal relationships between MPP and apparent impacts. Differences between estimates are also due to the different time periods assessed, the inclusion or exclusion of categories of damage, and the assumptions used in accounting for damage where there is a lack of empirical assessment. Some estimates also include the costs of remediation while others do not.

[82] See, for example: Avio, C.G., et al., 2016. Plastics and microplastics in the oceans: From emerging pollutants to emerged threat. Marine Environmental Research; Guzzetti E, Sureda A, Tejada S, Faggio C. 2018. Microplastic in marine organism: Environmental and toxicological effects. Environ Toxicol Pharmacol. 2018 Dec;64:164-171; Engler, RE. 2012. The complex interaction between marine debris and toxic chemicals in the ocean. Nov 2012, Environ Sci Technol. 2012 Nov 20;46(22).

[83] CIEL et al. 2019. Plastic & Health. The Hidden Costs of a Plastic Planet. www.ciel.org/plasticandhealth.

[84] NTN, IPEN. 2018. Ocean pollutants guide. Toxic threats to human health and marine life. October 2018. https://ipen.org/sites/default/files/documents/ipen-ocean-pollutants-v2_1-en-web.pdf.

[85] Forrest A, et al. 2019. Eliminating Plastic Pollution: How a Voluntary Contribution From Industry Will Drive the Circular Plastics Economy. Front. Mar. Sci. 6:627. doi: 10.3389/fmars.2019.00627.

Many assessments of economic impacts are qualitative and lack information on the value of losses, or remediation costs. Estimates often illustrate specific fragments of global costs and cannot be summed or extrapolated across countries, regions, or globally. While the estimates are likely to become more refined as assessments improve, several conclusions emerge:

- global and national economic impacts are significant
- economic losses will increase as the MPP load accumulates and disrupts marine ecosystems and food chains
- some of the economic damage is irreversible
- the environmental costs are not reflected in the price of plastic products and are not borne by producers of plastic products
- the harm may be disproportionately borne by the poor
- many economic costs are hidden or will only become apparent as MPP reaches 'tipping points' such as unacceptable levels of bio-accumulated toxins in seafood, or the collapse of a keystone species
- the costs of inaction are generally greater than the costs of remedial action.[86]

Figure 8. The $8 billion costs of plastic pollution on natural capital by product

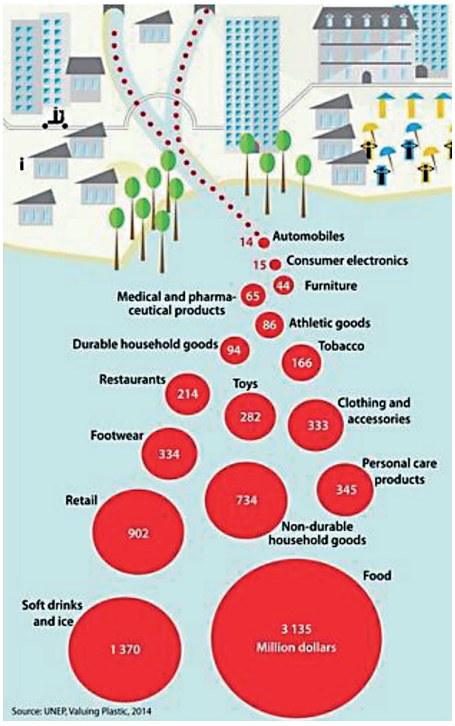


Table 9. Selected estimates of economic loss and/ or costs from marine plastic pollution

Global estimates	Economic loss	Data source
Environmental and social damage of plastic	$2.2 trillion/ year	Forrest 2019
Loss of ecosystem services (global decline 1-5%)	$0.5-2.5 trillion/ year	Beaumont, 2019
Marine plastic pollution from rivers	$19 billion/ year	Deloitte 2019
Marine litter Asia-Pacific region	$1 billion/year	McIlgorm, 2011
Lost economic value of single use of plastic packaging materials	$80-$120 billion/year	Ellen MacArthur Foundation, 2016
Environmental cost of plastic	$75 billion/ year	UNEP, 2015
Global coastal clean-up (all marine debris)	$50 billion/year	IMES, 2011
Fisheries and aquaculture loss from plastic marine debris	$2.2 billion/ year	Thompson et al, 2009; Trucost 2016*
Global plastic environmental cost of consumer plastic products and packaging (2015)	$139 billion	Trucost, 2016
Marine debris from consumer goods industry only	$4.7 billion/ year, ($56/ton)	Trucost 2016
Losses to tourism (3% of revenues, incl. freshwater)	$4.6	Trucost 2016*
Beach clean-up costs	$7.8 million*	Trucost 2016*
Impact on fish and birds	tbd	Trucost 2016*
Marine plastic pollution, direct costs to tourism, fisheries, government in Africa (2018)	97.8 million	Deloitte, 2019

*Sources: see Box 3. Note: * appears to be an order of magnitude under-estimate.*

[86] Lee, J. 2015. Economic valuation of marine litter and microplastic pollution in the marine environment: An initial assessment of the case of the United Kingdom. Cefas, Lowestoft laboratory. (cost-benefit of remediation).

Box 3. Estimates of damage attributable to marine plastic pollution and marine debris

Forrest (2019) compiled from Beaumont and other sources and includes the carbon cost of plastic and impacts on oceans, land, air and water as follows (in $billion): oceans, 1,500; GHG, 695; land pollution, 25; freshwater, 4.8; air, 1.3; and land value, 0.9. Impacts on human health are not directly included.

Beaumont (2019)[87]is based on a 1–5% decline in marine ecosystem services and uses the global baseline $49.7 trillion per year proposed by Constanza et al., 2014.

Deloitte (2019)[88] refers only to the direct costs to tourism, to fisheries and to government. It ignores direct or indirect costs to health or to ecosystems. Potential clean-up costs for remote areas are ignored on the assumption that no clean-up will take place. The estimate for Africa is $97 million/year or less than 1 percent of the $12.6 billion global total.

McIlgorm (2011)[89] indicated the costs of marine litter for 21 countries in the Asia Pacific region in the order of $1 billion per year for marine-based industries, equivalent to 0.3 percent of the blue economy GDP.

McIllgorm (2020)[90] The damage from marine debris to fisheries and aquaculture, marine transport, shipbuilding and marine tourism industries in APEC is estimated at S$11.2 (2015), a nine-fold increase from the $1.26 billion estimate for 2009.

Trucost (2016)[91] focuses on consumer products with an objective of demonstrating that plastics have a significantly lower environmental footprint than alternatives and that effective measures to reduce waste can significantly reduce environmental harm. The study ignores some costs, such as the costs of beach clean-up and the estimates need to be treated with caution. Plastic waste is estimated to cost up to $33,000 per ton in reduced environmental value. The study sets out the 'environmental argument' of the plastics industry.

UNEP (2014) has been updated by many of the other studies.[92]

In general, the cost estimates do not capture the potential harm to human health, largely because the relationship between plastics and human health is complex, long-term and unclear.

The estimates are generally given for a point in time (e.g. a base year) and do not necessarily capture the cumulative impact of plastics on sectors, on ecosystems, or on human health.

The increased estimate of damage in the APEC region (for 2015, compared to 2009) is of particular interest. APEC's blue economy was estimated to be US$2.13 trillion dollars, 4.8% of total APEC GDP in 2015. The 2020 report estimates $10.8 billion in damage for 2015, of which fisheries accounts for approximately 59 percent; shipping 27 percent and fishing and aquaculture 14 percent. The estimates are for losses and do not include the costs of clean-up. The estimate for 2015 is over eight times that for 2009 ($1.26 billion). This is due to an increase in the blue economy, an increase in MPP, improved

[87] Beaumont, N.J. et al. 2019. Global ecological, social and economic impacts of marine plastic. Marine Pollution Bulletin 142 (2019) 189–195.

[88] Deloitte, 2019. The price tag of plastic pollution. An economic assessment of river plastic. Deloitte, Netherlands.

[89] McIlgorm, A., Campbell, H. F., & Rule, M. J., 2011. The economic cost and control of marine debris damage in the Asia-Pacific region. Ocean and Coastal Management, 54, 643–651

[90] McIlgorm, A., K. Raubenheimer and D.E. McIlgorm, 2020. Update of 2009 APEC report on Economic Costs of Marine Debris to APEC Economies. A report to the APEC Ocean and Fisheries Working Group by ANCORS

[91] Trucost, 2016. Plastics and Sustainability: A Valuation of Environmental Benefits, Costs and Opportunities for Continuous Improvement. American Chemistry Council

[92] UNEP. 2014. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry

information and a more comprehensive approach to the estimate. Prior analysis indicates that there is a breakeven point for remedial action – the more MPP, the more economically feasible the remedial actions (prevention, reduction, clean-up).

If the estimated damage to the APEC economy in 2015 is extrapolated to the global economy, the damage to the global economy from marine debris in 2015 was about $18 billion and over 21 billion in 2019 (Table 10). While the values estimated are broadly similar to some estimates presented previously, these estimates do not include explicit provisions for loss of ecosystem function, remedial expenditures and impacts on health or biodiversity.

Table 10. Extrapolation of APEC damage from marine debris to the global blue economy

	$ billion 2015	$ billion 2020
APEC economy (GDP)	44,439	53,299
APEC marine economy	2,065	
APEC marine economy % total APEC economy	4.6%	4.6%
APEC Damage	10,08	
APEC % damage to APEC marine economy	0.52%	0.52%
Global economy (GDP) 2015	75,199	87,698
APEC economy as % global economy (GDP)	59.10%	59.10%
Marine economy 4.6% of global economy (GDP)	3,494	4,075
Damage as 0.52% of value of the marine economy (GDP)	18.28	21.31

Note: The values presented are simple extrapolations and rely on the assumptions that: (i) damage from marine debris in the APEC region is representative of the damage incurred globally; and (ii) that the blue economy proportion of the global economy is similar to the proportion in APEC. Both assumptions could be revised downwards to reflect the high contributions of some Asian rivers and countries to MPP and to adjust for non-coastal states.[93]

Tourism, fisheries and shipping all contribute to MPP, but also incur significant economic losses either through direct harm, or through the costs of remedial or clean-up actions. The latter may accrue through port charges, municipal taxes, or direct payments such as beach cleaning by hotels.[94]

2.1.1 Economic impact on tourism

In the Asia-Pacific Economic Cooperation (APEC) region's tourism sector, marine litter is estimated to result in a decrease in revenue of about $622 million per year.[95] A beach user survey in Brazil indicated that beach litter could reduce revenues by about 39 percent and that users would avoid a beach with >15 items /$m^{2.}$ However, willingness to pay for clean-up was linked to perceptions with regard to the origin of the litter: from local beach users, or from marine (non-local) sources.

In Sweden, a 1-5 percent loss of tourist revenues (€23 million) was attributed to marine litter. Beach cleaning costs in the EU vary between €214 and €38,000 per km per year, largely depending on the intensity of tourist use and the beach's importance to the local economy. The estimated annual cost of beach cleaning in the EU is estimated at €413 million (range €194 – 630 million). Coastal communities on the US west coast pay about $13 per resident for beach clean-up. Including provision of devices to capture debris from storm-water drains, these costs extrapolate to about $0.5 billion/year for the US

[93] E.g., a 2015 study estimated the blue economy (GDP) as 32% of global GDP. See: Hoegh-Guldberg, O. et al. 2015. Reviving the Ocean Economy: the case for action. Methodology (BCG). 2015. WWF International. The OECD estimated the ocean economy to be 2.5% of global GVA in 2010.

[94] Newman, S. et al. 2015. The Economics of Marine Litter. Marine Anthropogenic Litter. 367-394. 10.1007/978-3-319-16510-3_14.

[95] McIllgorm, 2011.

west coast. Costs for the North Sea region have been estimated at €100 million/year and the costs for a global beach cleanup (34 million km) have been estimated at $50 billion/year.[96]

AIODIS tourism could suffer a direct loss of over $70 million/year if MPP accounts for a 1 percent reduction in tourism (Table 11).[97] Assuming that 10 percent of AIODIS' coastlines warrants regular cleaning for tourism, annual costs would be in the order of $0.9 million at $500 per km.[98] However, actual long-term losses could be far higher if MPP harms coral reef ecosystem integrity or beach remediation.[99] For example, the behaviour of plastic 'sand' differs substantially from mineral sand and depends on the density, shape and shearing properties of plastic and microplastic particles.[100] Impacts on biota are discussed in section 2.4.1.

Table 11. Potential economic loss to AIODIS tourism from marine plastic pollution

	Tourism receipts (2018) $ million	Assuming 1% loss ($ million)
Cape Verde	524	5.2
Comoros	77	0.8
Guinea Bissau	20	0.2
Madagascar	879	8.8
Maldives	3,054	30.5
Mauritius	2,161	21.6
Sao Tome	72	0.7
Seychelles	611	6.1
Total	7,397.6	74.0

Sources: WTO, World Bank.[101]

2.1.2 Economic impact on fisheries

Negative impacts accrue from lost fishing time, fouled propellers, blocked pumps, fouled nets, separation of plastic from nets and catches, contamination through ingestion and disposal of GRP vessels, waste fishing gear and plastic caught in nets. There is substantial indirect loss of earnings due continued fish mortality by lost or abandoned gear. Costs of recovery or clearance of lost/ abandoned gear are considerable. Global losses are estimated at $2.2 billion/ year.[102]

On the east coast of the USA, over 45 percent of fishers experienced fouled propellers, about 40 percent experienced blocked pumps or engine cooling systems clogged by plastic, over 30 percent had their gear fouled.[103] The annual costs of marine litter to UK fisheries have been estimated at €36 million. Costs of removing marine litter from gear are estimated at €11,47 million /year for the EU – a total of over €40 million/ year, or over €3,300 per vessel. Total costs associated with marine debris

[96] Papers from the Sixth International Marine Debris Conference, San Diego, 2018; IMSA Amsterdam, 2011.

[97] In the case of a Korean island, tourism revenues declined by over 60 percent due to marine debris pollution: Jang Y.C. 2014. Estimation of lost tourism revenue in Geoje Island from the 2011 marine debris pollution event in South Korea. Marine Pollution Bulletin, 11 Mar 2014, 81(1):49-54. Studies in the USA and elsewhere also show significant economic gains from beach clean-ups.

[98] Arcadis, 2014. Final report Marine Litter study to support the establishment of an initial quantitative headline reduction target. SFRA0025 European Commission DG Environment Project number BE0113.000668.

[99] Lamb J.B., et al. 2018. Plastic waste associated with disease on coral reefs. Science 359, 460-462 (2018).

[100] Waldschläger, K. and H. Schüttrumpf, 2019. Erosion Behavior of Different Microplastic Particles in Comparison to Natural Sediments. Environ. Sci. Technol. 2019, 53, 22, 13219–13227.

[101] World Tourism Organization, Yearbook of Tourism Statistics, Compendium of Tourism Statistics and data files; World Bank, 2018. Travel and Tourism direct contribution to GDP. https://data.worldbank.org/indicator/.

[102] Trucost, 2016.

[103] Wallace, 1990.

(not just plastic), including reduced fishing revenues and costs of remediation are estimated at €61.7 million/ year, or about 0.9 percent of EU fisheries revenues (landed value).[104] Average costs attributable to marine litter for Scottish fishing vessels (excluding the costs of ghost fishing) were estimated at between €17,000 and €19,000 per year, of which 66 percent was attributed to lost fishing time or clearing nets.[105] The estimates from Japan and Scotland suggest losses of 3-5 percent of fisheries revenues and even in very remote areas marine plastic debris negatively affects fishers.[106] In the APEC region, costs to fishing and aquaculture are estimated at $2.13 billion (2015), or 14 percent of total economic cost of marine debris. For 2002, the costs to aquaculture in the UK were estimated at €489,050 for cage clearance and €916,970 for fouled propellers and pump intakes.[107]

Costs of removal of lost or abandoned gear can be considerable, and although generally not paid by the fishing industry, expenditures may draw on financial support available to the sector. Fishers may be contracted to remove lost gear, so the activity could be a source of revenue. The costs of removal depend on the depth, the type of gear, the density of lost gear, the bottom topography and numerous other site, or case-specific factors. Indicative costs of removal range from $65 per ton to $25,000 per ton. In the Puget Sound (USA) removal of nets cost $12,000 per hectare of net; in Sweden costs were $800 per km of net; in Hawaii costs were $2,467 per ton; in Korea, from $1,685 to $3,075 per ton.[108] .

Although there is no definitive evidence of impacts on human health, there are increasing risks that consumer demand for seafood may decline, or prices may fall due to growing health concerns regarding microplastic contamination of seafood, or from accumulation of toxins via plastics ingested by fish and shellfish (see section 2.3).

2.1.3 Economic impact on shipping, ports and services

Shipping suffers fouling of propellers by ropes and nets, blocked cooling water intakes and resulting engine damage.[109] In Korea, 9 percent of shipping accidents involved marine debris (1996-98). There are numerous records of propeller or rudder entanglement leading to serious accidents when ships lose control over navigation, in some cases leading to loss of life. This impacts on shipping insurance costs and costs are also incurred from provision of marine safety and rescue services for both commercial shipping and small boats. The cleanup costs incurred by marinas and small landing sites are generally not captured in these estimates.

Damage to APEC's shipping sector from marine debris was estimated at $2.9 billion/ year, or 27 percent of all damage caused. Cost of repairs, lost sales and downtime for US commercial vessels has been estimated at $792 million/ year.[110] In the UK, 286 rescue operations to vessels with tangled propellers cost between €830,000 and €2,189,000 (although not all incidents can be attributed to marine debris). UK ports and harbours incur an estimated at €9.28 million/year (about €73,000 per year per harbour) for such rescue services and the recovery and disposal of marine debris.[111]

[104] Arcadis, 2014; Werner, S., et al. 2016. Harm caused by Marine Litter. MSFD GES TG Marine Litter - Thematic Report; JRC Technical report; EUR 28317 EN; doi:10.2788/19937. http://publications.europa.eu/resource/cellar/2f418eca-0303-11e7-8a35-01aa75ed71a1.0001.03/DOC_1.

[105] Mouat, J., R. Lopez Lozano and H. Bateson. 2010. Economic Impacts of Marine Litter. KIMO.

[106] Nash, A.D. 1992. Impacts of marine debris on subsistence fishermen An exploratory study. Marine Pollution Bulletin. Volume 24, Issue 3, March 1992, 150-156. (Study on Irian Jaya).

[107] Fanshawe T. and M. Everard, 2002. The Impacts of Marine Litter. Report of the Marine Litter Task Team (MaLiTT) May 2002 Marine Pollution Monitoring Management Group.

[108] Macfadyen, G.; Huntington, T.; Cappell, R. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.

[109] Johnson, L.D. (2000). Navigational hazards and related public safety concerns associated with derelict fishing gear and marine debris. In Eds. McIntosh, N., K. Simonds, M. Donohue, C. Brammer, S. Manson, and S. Carbajal. Proceedings of the International Marine Debris Conference - Derelict Fishing Gear and the Ocean Environment, 6-11 August 2000, Honolulu, Hawaii.

[110] Ofiara, D.D. and J.J. Seneca, 2006. Biological Effects and Subsequent Economic Effects and Losses from Marine Pollution and Degradations in Marine Environments: Implications from the Literature. Marine Pollution Bulletin 52(8): 844-864.

[111] Mouat et al. 2010.

Estimates of damage from MPP in several other sectors is fragmentary. These include: oil and gas platforms and services; wind, wave and tidal power installations; water intake systems for coastal power stations, for desalinisation plants, and for marine scientific monitoring devices. Plastic flotsam is also linked to the increased incidence of invasive species, some of which block pipes and water intakes. Flooding caused by plastic blocking storm drains has resulted in significant damage to both inland and coastal communities and has been a contributory factor to the introduction of bans on plastic bags.

2.2 Social impacts

Negative social impacts include degrading of heritage or sacred sites, beaches, dive sites, waterfronts, estuaries and marinas and increased social concerns over loss of biodiversity and iconic species. There may also be indirect social impacts on wellbeing if communities reduce their use of beaches or other polluted marine or coastal public spaces.

On the positive side, waste plastic provides employment opportunities for workers in the plastic recycling industry, including some 11 million waste pickers, or '*catadores*', who are among the most marginalised groups in society and who provide up to 60 percent of the waste plastic raw material for recycling.[112] Employment and incomes are generated from investments in clean-ups of plastic, disposal systems for ports and investment and innovation to combat MPP. Arguably, mitigating marine litter can potentially benefit coastal communities by acting as a catalyst for environmental awareness and behavioural change, creating employment clean-ups and increasing social cohesion through the sense of belonging to a clean environment. There is a lack of recognition of the important role of waste-pickers and their low social status which can prevent interaction with other segments of society, or access to schooling and education.

A study of waste pickers (*catadores*) in Bissau uncovered a complex web of relationships, middlemen, specialists in different waste components (cans, glass, cardboard, plastic), a high child labour component, poor health and poor access to health and welfare support. Most of the *catadores* were women and there are distinct age differences between genders. Only 9 percent of women were literate. Many have a second job as cleaners, street vendors or as security guards. Only 60 percent had ID cards and only 2 percent had registered with social security.[113] In Maputo (Mozambique) *catadores* are mainly women and children. Men are often considered criminals or drug addicts and in general *catadores* are a marginalised group (outcasts in local language 'molwenes'). The municipal authorities have slowly recognised their role but attitudes vary between providing support or regarding *catadores* as a nuisance.[114] The Global Alliance of Waste Pickers advocates for social inclusion of waste pickers and integration of their activities into the formal waste management system which has proven of mutual benefit to municipalities and waste pickers.[115] In Africa, there are waste-pickers organisations in Ghana, Kenya, Uganda, South Africa, DRC, and Cameroon.[116]

In some countries, bans on plastic bags have met social opposition, particularly if alternatives were lacking. In turn, this has led to undermining of the rule of law if the ban is unenforced.

[112] GAIA, 2019. Discarded: Communities on the Frontlines of the Global Plastic Crisis. Berkeley, CA: Global Alliance for Incinerator Alternatives.

[113] LVIA, 2016. Os apanhadores de lixo. Quem são e como trabalham? LVIA, Câmara Municipal de Bissau, União Europeia.

[114] Charlotte Allen et al. 2011. Mapping of the Policy Context and Catadores Organizations in Maputo, Mozambique. WIEGO Organizing Briefs.

[115] https://globalrec.org/mission/; see also: http://www.wiego.org/sites/default/files/publications/files/IEMS-Pune-Waste-Picker-Policy-Recommendations-WIEGO.pdf

[116] https://globalrec.org/waw/list/.

2.3 Impacts on human health

At every stage of their lifecycle, plastics pose a wide range of risks to human health. The risks arise from exposure to plastic particles, from toxic chemicals associated with plastics either as ingredients or leached from plastics. Exposure occurs through inhalation of plastic dust, ingestion from contamination of food or from contact of foods with their plastic wrapping, from contamination of water supplies with microplastics, or from skin contact in its manufacture, disposal or use. With respect to MPP, the main concern is with regard to contamination of seafood by plastics.

Box 4. Plastics and health

Extraction and transportation of fossil feedstocks for plastic releases an array of toxic substances into the air and water, including those with known health impacts, including cancer, neurotoxicity, reproductive and developmental toxicity, and impairment of the immune system

Refining and production of plastic resins and additives releases carcinogenic and other highly toxic substances into the air, with effects including impairment of the nervous system, reproductive and developmental problems, cancer, leukaemia, and genetic impacts like low birth weight

Consumer products and packaging can lead to ingestion and/or inhalation of microplastic particles and hundreds of toxic substances

Plastic waste management, especially landfill burning of plastic and other forms of incineration, releases toxic substances, acid gases and particulate matter, which pollute enter air, water, and soil causing both direct and indirect health risks for workers and nearby communities

Fragmented plastic and microplastics can enter the human body directly and lead to an array of health impacts, (including inflammation, genotoxicity, oxidative stress, apoptosis, and necrosis) that are linked to health conditions ranging from cardiovascular disease to cancer, autoimmune conditions and endocrine system disorders

Cascading exposure as plastic degrades, which further leaches toxic chemicals concentrated in plastic into the environment and human bodies

Ongoing environmental exposures as plastic contaminates and accumulates in food chains through agricultural soils, terrestrial and aquatic food chains and the water supply, creating new opportunities for human exposure. There are also risks of bioaccumulation of plastic-associated toxins up food webs

Source: CIEL et al. 2019. Plastic & Health: The Hidden Costs of a Plastic Planet. February 2019.

The effects of unmanaged plastics and microplastics on human and animal health are not yet fully understood. Respiratory issues are increasing due to air pollution from burning plastic. In a waste management BAU scenario, a three-fold growth in open burning of plastics is projected with an increasing release of persistent toxic chemicals. Chemicals used in the production of plastic materials are known to be carcinogenic.[117] There is growing evidence that many single-use food contact materials, including plastics, may pose health risks to consumers due to chemical migration of toxins. Harmful chemicals such as endocrine disruptors have been shown to migrate from plastic food wrapping or food containers.

Some plastics are considered to be 'toxin sponges' absorbing toxins from the ocean. This could be of benefit if the particles are buried in sediment, but alternatively, pose a risk if passed up the seafood chain. However current levels of such toxins in plastic particles are orders of magnitude below the levels considered to cause serious harm or death in marine organisms.[118]

[117] Sustainable Manufacturing and Environmental Pollution (SMEP). 2020. Manufacturing Pollution in sub-Saharan Africa and South Asia: Implications for the environment, health and future work. Main Report.

118 Burns, Emily E. and Alistair B.A. Boxall, 2018. Microplastics in the aquatic environment: Evidence for or against adverse impacts and major knowledge gaps. Environmental Toxicology and Chemistry. Volume37, Issue11 November 2018. p. 2776-2796.

2.3.1 Micro and nanoplastics

In the USA, consumption of microplastic particles is about 74,000 particles per person per year.[119] Consumption of nanoplastic particles is unknown.

There are multiple health risks from exposure to microplastics. These risks are generally from high levels of exposure, e.g., by workers in the plastic industry. Most exposure to microplastics occurs through to those working with plastics, from drinking water and from atmospheric dust rather than from MPP, where the main risk to human health is from consumption of seafood contaminated by microplastics.

The risks to human health from microplastic contamination of seafood are largely unknown due to the numerous uncertainties: not all microplastics are (chemically) the same; the concentration by different marine food chains and organisms is unclear; absorption and release of toxins varies by plastic and toxin and the levels of toxins in the area; the level of microplastics in the environment varies by area; and the thresholds for health effects are unclear (but generally require high levels of microplastics). A recent review concluded that microplastic ingestion by marine organisms is unlikely to increase exposure to persistent bioaccumulative and toxic compounds (PBTs) in these organisms. Improved understanding of human/microplastic/ocean interactions are required at several levels: sub-cellular, cellular, organ, individual, population and ecosystem.

Nanoplastics are potentially more harmful to human health than microplastics as, due to their small size, ingested nanoplastics can pass biological barriers such as the gut-blood and blood-brain barriers and be transported throughout the body. Knowledge of the effects on human health is lacking, but nanoplastic contamination of seafood is a growing concern.[120]

2.4 Impacts on the environment, on ecosystems and on biodiversity

The impact of plastics on the environment is largely irreversible and cumulative. In the marine environment plastics will degrade to microplastics, adding further layers of complexity in terms of dispersion, mixing with other materials, absorption of toxins, accumulation in biota, or impact on keystone species. The processes of production, manufacture and disposal of plastics contributes to global GHG emissions and climate change.

With the exception of bacteria and algae[121] almost all classes of marine organisms examined suffer harm from MPP. Marine ecosystem services have been valued at approximating $49.7 trillion per year.[122] If the harm suffered by organisms is assumed to be, in aggregate, 1 percent of their contribution to marine ecosystem services, then the damage to ecosystem services would be equivalent to $0.5 trillion/year, or about $3,300 per ton of MPP.[123] However, as much of the MPP is cumulative with little or no prospects of reversal, the damage could also be considered to be cumulative and possibly compounding rather than presenting a 'linear' annual cost profile. It is likely that damage to one trophic level or keystone species will cascade to other processes. Without attempting to address the complexities of cumulative impact analysis, it is likely that the impacts involve synergistic and iterative

[119] Cox, K. D., et al. 2019. Human consumption of microplastics. Environ. Sci. Technol. 53, 7068–7074. doi: 10.1021/acs.est.9b01517.

[120] Lusher, A. L., Hollman, P. C. H., & Mendoza-Hill, J. J. (2017). Microplastics in fisheries and aquaculture: Status of knowledge on their occurrence and implications for aquatic organisms and food safety. FAO Fisheries and Aquaculture Technical Paper. No.615.

[121] The term 'plastisphere' has been used to describe bacterial communities on the surface of marine plastic. Zettler, E. R. et al. 2013. Life in the 'Plastisphere': Microbial communities on plastic marine debris. Environmental Science & Technology 47, 7137-7146 (2013).

[122] Constanza, R., et al., 2014. Changes in the global value of ecosystem services. Glob.Environ. Chang. 26, 152–158.

[123] Beaumont, 2019. Beaumont uses a range of 1-5%.

processes, rather than a linear (additive, or incremental) progression. Assessment of the cumulative impacts are severely hampered by the diversity of plastics and their respective impacts, by long latency periods between exposure or ingestion and harm, and by weak understanding of the effect that the harm on one organism or species has on ecosystem dynamics (such as the effectiveness of predator/ prey relationships).

If the area of EEZs are taken as a proxy for the contributions of countries to global marine ecosystem services and assuming that MPP reduces marine ecosystem services by 0.5 percent, then the damage to the services provided by AIODIS is in the order of $10 billion/ year (Table 12).

Table 12. Assumed loss of AIODIS ecosystem services attributable to marine plastic pollution

	EEZs (km2)	Value of ecosystem services ($billion)
Global	137,926,515	49700.0
AIODIS	6,047,291	2179.1
AIODIS as % of Global	4.38%	4.38%
Loss of 0.5% AIODIS marine ecosystem services		10.9

Note: It is assumed that ecosystem services are homogenously distributed throughout the global ocean and that EEZ area can be used as a proxy for these services – both assumptions are a gross simplification.

Life cycle assessment (LCA) can be used to assess the environmental impact of plastics.[124] However, the tool needs to be used with caution as the knowledge gaps require numerous assumptions which have limited scaling-up applicability with respect to the range of plastic products, leakage of plastic to the environment, waste management regimes, ecosystem effects of MPP, economic valuations of harm and non-linear impacts along the life cycle.[125]

2.4.1 Impact on ecosystems

The impact of MPP on ecosystems is largely unquantified. The impact of macroplastics on turtles, seabirds, fish and marine mammals has been well documented (see section 2.4.3). GESAMP has summarised the impacts of microplastics by type of plastic and species group[126]. Microplastics have penetrated all habitats and most (if not all) taxa examined. With the exception of bacteria and algae, the impacts are negative and range from the physical blockage of gills or other organ function to cellular and sub-cellular changes in functionality, including cancers and reduced immune responses. Nanoplastics are probably more common and widespread than microplastics, yet its hazards may be more complex but are less understood. Microplastics can transport invasive species, including harmful algal blooms and pathogens. GESAMP advocated adoption of a risk-based approach to 'managing' microplastics. Risks from different plastics could be placed in categories, from negligible to high/ catastrophic, with appropriate responses established for each category.

A recent study scored impacts on lifespan and/or reproductive potential of various marine taxa on the basis of extent, reversibility and frequency of the impacts. Categories were added to score

[124] E.g. Parker, G., and Edwards, Chris (2012) A Life Cycle Assessment of Oxo biodegradable, Compostable and Conventional Bags. Intertek Expert Services.

[125] Eunomia 2020. Plastics: Can Life Cycle Assessment Rise to the Challenge? How to critically assess LCA for policy making. Report Commissioned by Break Free From Plastic. https://www.breakfreefromplastic.org/library/#reports

[126] GESAMP, 2016. Sources, fate and effects of microplastics in the marine environment: part two of a global Assessment. (Kershaw, P.J., and Rochman, C.M., eds). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/ UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 93, 220 p.

ingestion, entanglement, absorption of toxins and physical changes such as interference with feeding or predation. The scores were than applied to global marine ecosystem service data to gauge the impacts on these services.[127] Using a different approach, a prior study estimated the environmental damage to marine ecosystems caused by MPP at $13 billion per year.[128]

Studies demonstrate and growing scientific evidence corroborates that microplastics:[129]

- are not biologically inert materials
- mechanical or physical damage can be caused or induced
- induce complex eco-toxicological hazards and bioaccumulation of toxins
- can shorten animal lifespans because of plastic consumption
- can compromise reproduction and growth
- can adversely affect cellular biochemical pathways
- can interfere with chemical communication among aquatic organisms when plastics absorb these chemicals
- can cause loss of nutritional value of diet
- allow increased exposure to pathogens and
- enable transport of alien and invasive species which can disrupt ecosystems, including coral reefs.[130]

Given the state of knowledge, it not possible to form definitive conclusions as to whether microplastics harm or do not cause harm to the environment. The scientific consensus is that, given the current state of knowledge and the levels of exposure, the ecological risks appear low, but that nevertheless a wide range of impacts and risks are apparent.[131] As the microplastic load in the marine environment increases, ecological risks are likely to increase. Microplastics add to other environmental stressors – ocean acidification and warming, noise and other types of pollution. Understanding of cumulative effects or 'tipping points' is lacking.[132] The impacts of microplastics need to be closely monitored and a precautionary approach adopted.

2.4.2 Impact on climate

In 2015, plastics produced from oil and gas emitted 1.8 $GtCO_2e$ over their life cycle, or about 3.8 percent of the 47 $GtCO_2$ emitted globally (production 61 percent; manufacture 30 percent; end of life including incineration 9 percent).[133] In a BAU scenario, this would increase to 6.5 $GtCO_2e$ in 2050 (3.6 times the 2015 emissions and up to 15 percent of global emission), indicating the need for radical change in plastic use and disposal. Other studies estimate the production and incineration

[127] Beaumont, et al. 2019. The results are provided in section 2.1.

[128] Raynaud, Julie. Valuing Plastic: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry. Nairobi: United Nations Environment Programme (UNEP), 2014. https://wedocs.unep.org/handle/20.500.11822/9238.

[129] Avio, C.G., et al., Plastics and microplastics in the oceans: From emerging pollutants to emerged threat, Marine Environmental Research (2016), http://dx.doi.org/10.1016/j.marenvres.2016.05.012; Lindeque, P. et al. Plymouth Marine Laboratory, Plastics and Plankton: What do we know?, at 21, http://www.ices.dk/news-andevents/symposia/zp6/Documents/Presentations/W4/w4_wednesd_0900_lindeque_plastics.pdf; Burns et al, 2018.

[130] Lamb, J. B., Willis, B. L., Fiorenza, E. A., Couch, C. S., Howard, R., Rader, D. N., et al. (2018). Plastic waste associated with disease on coral reefs. Science 359, 460–462. doi:10.1126/science.aar3320.

[131] Science Advice for Policy by European Academies (SAPEA). 2019. A Scientific Perspective on Microplastics in Nature and Society. www.sapea.info/microplastics.

[132] Everaert, G. et al. 2020. Risks of floating microplastic in the global ocean. Environmental Pollution. Volume 267, December 2020, 115499.

[133] Zheng, J., and Suh, S. 2019. Strategies to reduce the global carbon footprint of plastics. Nat. Clim. Change 9, 374–378. doi:10.1038/s41558-019-0459-z.

of plastic generated more than 850 million tons of greenhouse gases (GHGs) in 2019 (about 0.2 percent of industrial emissions);[134] and estimate the annual cost of plastic waste externalities at $40 billion annually, including the cost associated with GHG emissions from plastic production and waste incineration at $700 billion per year.[135]

There is growing evidence that ocean plastic emits GHGs as it degrades (particularly methane and ethylene). The emission rate increases as a function of the surface area of the plastic particle. This means that as the plastics break down to smaller particles, emissions will increase as the increasing global stock of waste plastic degrades over time and is exposed to sunlight and weathering.[136] The cumulative impact of MPP on climate over time remains unclear.

A second concern is that the ingestion of plastic particles or of leached toxins will reduce photosynthesis, growth and/ or reproduction of ocean plankton responsible for carbon capture with negative impact on the ocean carbon sink.[137] A third source of concern is that microplastic ingestion alters the sinking rate of planktonic waste – an important component of marine snow. While the scale of this effect and its impact on the ocean carbon pump remains unclear,[138] ingestion of microplastic by many zooplankton taxa has been recorded for Kenyan waters.[139] The CO_2 emissions attributable to the plastics life cycle have an additional indirect effect on ocean ecosystems by contributing to ocean acidification.

Many countries have committed to the Paris Climate Agreement and to reducing consumption of fossil fuels for energy production. In contrast, production of plastics based on fossil fuels is continuing on a rapidly increasing trajectory, driven partly by low oil and gas prices and diversification of investments by the 'oil giants'. Bio-based, including sugarcane-based plastics have potential to reduce global lifecycle GHG emissions of plastics. However, to meet global demand (250 million tons) would require about 5 percent of all arable land.

2.4.3 Impact on biodiversity

The Convention on Biological Diversity (CBD) Aichi Biodiversity Targets explicitly recognised the threat of marine debris to wildlife and have expressed "continuing or growing concern [regarding] plastics, in particular their impacts on marine ecosystems" (Global Biodiversity. Strategic Goal B Target 8). Studies indicate that in the 2012 to 2016 period, the number of species recorded as affected by ingestion, entanglement, and habitat damage or destruction by marine debris, mainly plastic, is over 800. Of these, at least 17 percent are species on the IUCN Red List (status threatened or near threatened).[140] Although direct mortality rates for species may be relatively low (i.e., from entanglement or ingestion), the impacts on growth, reproduction, longevity or from accumulation of toxins are difficult to establish. Turtle mortality is estimated at about 5.5 percent; marine mammals 2 percent; seabird mortality <1 percent. About 8 percent of marine mammals are found to have ingested plastic.[141]

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[134] CIEL et al. 2019. Plastic & Climate. The Hidden Costs of a Plastic Planet. www.ciel.org/plasticandclimate. Methane emissions from degrading ocean plastic are estimated at 2,129 Mt CO_2e per year.

[135] UNEP (2014). Valuing Plastic: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry.

[136] Royer, Sarah-Jeanne et al.,2018. Production of Methane and Ethylene from Plastic in the Environment.13(8) PloS ONE (2018), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200574.

[137] Sjollema, Sascha et al., Do Plastic Particles Affect Microalgal Photosynthesis and Growth? 170 Aquatic Toxicology 259 (2016), https://www.sciencedirect.com/science/article/pii/S0166445X15301168.

[138] Cole, M. et al., Microplastics Alter the Properties and Sinking Rates of Zooplankton Faecal Pellets, 50(6) Envtl Sci. Tech. 3,239 (2016). https://pubs.acs.org/doi/10.1021/acs.est.5b05905.

[139] Kosore, C. et al. 2018. Occurrence and Ingestion of Microplastics by Zooplankton in Kenya's Marine Environment: First Documented Evidence, 40 African J. of Marine Sci. 225 (2018). https://www.tandfonline.com/doi/abs/10.2989/1814232X.2018.1492969.

[140] S.C. Gall, R.C. Thompson, 2015. The impact of debris on marine life, Mar. Pollut. Bull. 92(1) (2015) 170–179, http://dx.doi.org/10.1016/j.marpolbul.2014.12.041.

[141] See Beaumont et al. 2019 for an assessment of impacts by taxonomic group.

MPP is an important stressor on biodiversity. Studies show that all known species of sea turtles, about half of all species of marine mammals, and one-fifth of all species of sea birds were affected by entanglement or ingestion of marine debris, while the number of fish species affected has significantly increased over time. Over 80 percent of marine debris impacts on these taxa were associated with plastic debris About 15 percent of the species affected through entanglement and ingestion are on the IUCN Red List.[142]

[142] Secretariat of the Convention on Biological Diversity and the GEF STAP, 2012. Impacts of Marine Debris on Biodiversity: Current Status and Potential Solutions, Montreal, Technical Series No. 67, 61 pages.

3. The Plastic Economy

3.1 Scale and players

Plastic production in 2018 (359 million tons) was over twenty times the production in 1964 and is expected to double by 2035 and quadruple by 2050. The global market for plastic (raw material) was $569 billion in 2019 and the market for products is projected to be $1.2 trillion in 2020.[143] The market for raw plastic is expected to grow at a compound rate of 3.2 percent to 2027. Asian countries produce over half the world's plastic. China accounted for 30 percent in 2018. North America and Europe account for 18 percent and 17 percent respectively, while Africa and the Middle East jointly account for 7 percent. Over 5 million people are employed in the plastic production industry.

Plastic is an integral part of innumerable products and value chains and is indispensable to many major categories of products ranging from computers to automobiles, from textiles to buildings. Africa is responsible for about 5 percent of global production and consumes about 4 percent of global production.

Conventional plastic production is about 90 percent dependent on natural gas and oil and many of the major plastic producers are major integrated 'oil' and industrial chemical producers.[144] Production of plastic may use more than 180 litres of water per kilogram. Recycled plastic accounts for about 9 percent of raw material feedstock. Plastics use about 6 percent of global oil production (2018) and in a BAU scenario would account for 15 percent of the global carbon budget by 2050.[145]

With the exception of the recycled component, the plastics value chain is, by design, essentially linear (produce/use/dispose) as opposed to circular. The plastics life cycle can be categorised into five components: production and consumption, collection and sorting, recycling, disposal and mismanaged waste. Waste generation and collection rates are correlated with per capita gross national income, while waste collection and disposal correlates with income category and population density.[146]

There are a number of major multinational producers of plastic resins, the raw material for the manufacture of plastic products (Box 5). Several are major oil and gas producers. Some use the plastic resins to produce a range of secondary products to supply manufacturers. The plastics industry has several industry associations and promotes its industry codes for sustainability. In general, the producers of primary plastic raw materials (resins) do not accept responsibility for MPP, claiming that extended producer responsibility does not extend to the primary producers.

The industry argues with some conviction that plastics have a lower environmental footprint than alternatives: for example, if the impact analysis includes the consumption of energy, water, fertilisers and pesticides for substitution of synthetic textiles with cotton or other organic raw materials.[147] While the various industry analyses may be challenged, cost-effective substitution of plastics with environmentally friendly alternatives is a major challenge.

The companies producing consumer products considered to be the 'top' SUP polluters are listed below. The ranking is based on statistics from volunteer cleanup operation in about 50 countries, and while the sampling is not restricted to beaches, the ranking provides a reasonable indication of the corporate

[143] Business Research Company. 2017. Plastics Product Manufacturing Global Market 2017.

[144] These include: DowDuPont, ExxonMobil, Shell, Chevron, BP, and Sinopec.

[145] Barra et al. 2018. Plastics and the circular economy. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC.

[146] See Lau et al. 2020 for an in-depth analysis of the archetypes.

[147] Trucost, op. cit.

composition of beach plastic waste. While these brands dominate globally, local or national brands may dominate litter in many countries. The main 'conclusion' is that that these major food and drinks and cosmetics multinationals with annual revenues of hundreds of billions produce a high proportion of MPP by number of items (not necessarily by weight).[148]

Box 5. The major global producers of plastic resins

Exxon Mobil, USA. Global sales: $290 billion. It is among the world's largest public companies by revenue. ExxonMobil produces plastics, petrochemicals, and many other products, operates worldwide and employs about 75,600 people.

BASF, Germany. Global sales: $65.4 billion. The company is one of the world's largest plastics and resin supplier and has one of the most comprehensive plastics portfolios. It employs more than 117,000 people in over 200 countries with about 34,000 in the plastic and resin industry.

Dow Chemical, USA. Global sales: $49 billion. Dow is the leading global supplier of every major polyethylene (PE) resin worldwide (2016) and the world's largest producer of chlorine and polyalkylene glycols. It ranked as the world's largest plastics manufacturer in 2008. The company operates in about 35 countries and employs approximately 49,500 people worldwide.

SABIC, Saudi Arabia. Global sales: $35.4 billion. SABIC is the world's third-largest producer of polyethylene and the fourth-largest producer of polypropylene and polyolefins in general. The company operates in more than 40 countries across the world and employs over 40,000 people.

Lyondell Basell, Netherlands. Global sales: $34.7 billion. Lyondell Basell is the world's largest producer of polypropylene resins and polypropylene compounds, one of the top worldwide producers of polyethylene and a major producer of high-value specialty polymers and resins. The company operates in 17 countries and employs approximately 19,400 people worldwide.

INEOS, Switzerland. Global sales: $60 billion. INspecEthyleneOxideSpecialities produces plastics, resins and intermediates for all major markets including packaging, pharmaceuticals, agrochemicals, textiles, consumer goods, building & construction, and automotive & transportation. The company operates in 24 countries across the world, has 171 sites and employs over 19,000 people.

LG Chem, Korea. Global sales: $25.5 billion. Korea's largest chemical company is a major manufacturer of petrochemicals, polyolefins, polyvinyl chloride, polystyrene, synthetic rubbers, specialty polymers, IT & electronic materials, and batteries. LG employs about 15,000 people worldwide.

ENI, Italy. Global sales: $89.4 billion. ENI is active in exploration, production, and refining of gas and oil, and is one of the major manufacturers of plastics and rubbers. The company operates in 73 countries across the world and employs over 31,000 people.

Chevron Phillips, USA, Global sales: $158.9 billion. The company has has approximately 5,000 employees working in 31 production and research facilities located in the United States, Singapore, South Korea, Saudi Arabia, Qatar and Belgium.

Lanxess, Germany. Global sales: $7.9 billion. Lanxess has a joint venture with Saudi Aramco and is a leading supplier of synthetic rubber. The company has about 16,700 employees and 54 production sites worldwide in 29 countries.

DuPont, USA. Revenues 21.5 billion. DuPont is a global multi-industry company that manufactures for the safety, healthcare, nutrition, electronics, mobility, and construction industries. Dupont's resin products include solid resins, thermoplastic polyimide resins and nylon resin materials.

[148] Break Free From Plastic, 2020. Branded, Vol. II Identifying the World's Top Corporate Plastic Polluters. Greenpeace Philippines.

Box 6. Ranking of global corporate plastic litter producers

Coca-Cola, USA. Revenues $37 billion (2019), 86,000 employees. Africa HQ in Port Elisabeth.

Nestlé, Switzerland. Revenues $102 billion (2017), 352,000 employees. World's largest food company with sales in 189 countries. Brands: Nestle, Nespresso, Nescafé, Kit Kat, Smarties, Nesquik, Vittel, and Maggi.

PepsiCo, USA. Revenue $67 billion (2019), 267,000 employees. Brands: Pepsi, Tropica, KFC, Pizza Hut.

Mondelez International, USA. Revenue $25.87 billion (2019), 80,000 employees. Produces sweets, chocolate, gum, crackers, coffee, water, ice cream – Toblerone, Chicklets, Cadbury and many other brands.

Unilever, UK. Revenue €52 billion (2019), 155,000 employees. Products: personal care, cleaning agents, drinks, food, toothpaste, chewing gum, many others. World's largest ice cream manufacturer. Brands: Dove, Persil, Vaseline, Flora, Magnum.

Mars Incorporated, USA. Revenue $35 billion (2017),130,00 employees. Brands: Milky Way, M&M's, Skittles, Snickers, Twix, Dolmio and pet foods.

Procter & Gamble, USA. Revenue $70.95 billion (2020), 90,000 employees. Leading producer of detergents and household cleaning products.

Colgate-Palmolive, USA. Revenue 15.5 billion, 34,500 employees. Makes household, health care, personal care (e.g., toothpaste, toothbrushes) and veterinary products.

Phillip Morris Int., Switzerland. Revenue $78.9 billion (2018). Cigarettes.

Perfetti van Melle, Italy. Revenue $2.65 billion (2019), 17,900 employees. Produces sweets, chewing gum, other confectionary and sells in over 150 countries.

Industry-led initiatives with respect to MPP, plastic pollution in general and the circular economy are briefly discussed in section 3.4.3.

China contributes the highest share of mismanaged plastic waste with around 28 percent of the global total, followed by 10 percent in Indonesia, and 6 percent each in the Philippines and Vietnam. Total waste and the proportion of plastic waste is projected to grow exponentially with increasing incomes and urbanisation, thus creating opportunities for a waste-based circular economy.

In sub-Saharan Africa, about 44 percent of all waste is collected. Urban waste collection is higher. Most waste is openly dumped, although there has been a growth in both formal and informal waste collection. Plastic made up an estimated 9 percent of all Sub-Saharan waste in 2016.

3.2 Recycling

Globally, about 14-18 percent of plastic waste is recycled.[149] India is recorded as having the highest rate (47–60 percent); the EU about 30 percent (2014) and in China 22 percent (2013). In the USA, about 9.5 percent of municipal plastic waste was recycled in 2014.[150] The plastic recycling industry is dynamic with recycled plastic feedstock competing directly with virgin plastic in some markets, while other markets are seeing the introduction of legislation requiring recycled content in plastic products. Traceability and certification for recycled feedstock is challenging. Investment in modern and efficient plastic recycling plants is costly, requires substantial technical expertise, and may also

[149] WEF, 2020. Plastics, the Circular Economy and Global Trade. White Paper. World Economic Forum.

[150] Geyer, op.cit.; Barra, R. and Sunday, L., 2018. Plastics and the circular economy. STAP, GEF and UNEP. https://www.thegef.org/sites/default/files/publications/PLASTICS%20for%20posting.pdf.

generate environmental impacts (e.g., from disposal of contaminants or chemical waste). Competition between biodegradable, recycled and 'organic' plastics cloud consumer choice and legislative options. Legislation, innovation and structural adaptation of waste management are seen as key drivers of recycling.[151]

There are several distinctly different types of recycling. Mechanical recycling, the most common, does not alter the chemical structure of the plastic but sorts, washes and melts the plastic into chips, or feedstock for reuse. Dissolution is similar to mechanical recycling but uses a chemical process to separate plastic without altering the chemical structure of the plastics. Chemical recycling changes the molecular structure of the plastic to a simpler or 'common denominator' chemical by 'cracking', or by a similar relatively energy-intensive process. Biological or organic recycling, which is the least common, involves composting (aerobic) or digestion (anaerobic) by micro-organisms with a breakdown of plastics to organic residues, methane, carbon dioxide and water, and possibly leaving some microplastics. Biological recycling is not the same as 'biodegradable'. Other processes are used (e.g. for mixed plastics) for conversion into fuel or energy (incineration). It is arguable if these processes constitute 'recycling'.

At the level of the consumer, recycling claims and labelling and are confusing.[152] This is partly attributable to the fact that the definitions that underpin standards, labels, and claims lack cohesion, international consistency and real-world applicability. The logos and terms used in labels and claims are not consistently defined or verified, even at a country-level, and there is a range of ecolabels with quite different 'messages'. These messages include: 'made from recycled plastic', 'ocean plastic', 'bio-based', '100% compostable', 'biodegradable', 'recycle me', 'please recycle'. The 'compostable'/'biodegradable' labels are effectively meaningless at the consumer level as the technology required is essentially industrial.

3.3 The economics of plastic pollution

Who bears the costs of marine plastic pollution and costs of remedial actions?

In most cases, the costs of MPP, and plastic pollution in general, are 'externalities' and the costs are not borne by the primary producers of plastics, by the manufacturers of plastic products, or directly by the polluters, or consumers. The market price of plastic products does not reflect the damage caused by plastics during the entire plastic life cycle. The cost of plastic pollution is generally borne by reduced environmental capital and services, reduced human wellbeing, increased health costs, and by increased service charges or taxation for waste management.

If the 'true cost' of plastics was reflected in the price to consumers, the value of plastic waste would increase, the demand for plastic would decline and opportunities to develop more sustainable alternatives for some products could be created. This thinking underpins market measures to combat plastic pollution - to raise import duties, or taxes on plastics, in particular on 'un-necessary' or single-use plastic products.[153] A number of cost/benefit studies confirm that the benefits from actions to reduce marine plastic pollution substantially outweigh the costs involved.[154]

[151] Locock, KES. 2017. The Recycled Plastics Market: Global Analysis and Trends. CSIRO, Australia.

[152] UNEP, 2020. Can I Recycle This? A Global Mapping and Assessment of Standards, Labels and Claims on Plastic Packaging.

[153] ten Brink P., Lutchman I., Bassi S., Speck S., Sheavly S., Register K., C.Woolaway. 2009. Guidelines on the Use of Market-based Instruments to Address the Problem of Marine Litter. Institute for European Environmental Policy.

[154] Jeo Lee. 2015. Economic valuation of marine litter and microplastic pollution in the marine environment: An initial assessment of the case of the United Kingdom. Cefas. July 2015.

A second approach looks towards extended producer responsibility (EPR). However, given the economic power of the corporate giants involved (Box 5, Box 6) building comprehensive and effective schemes may be challenging. A third approach highlights the economic losses of $80-120 billion/year worth of material value due to low recycling rates. This approach argues for legislation, or other measures, to require a greater recycled content in plastic products. In addition to the challenging 'mechanics' of such an approach, the price of recycled plastic is closely related to oil and gas prices which determine prices of virgin plastic. With depressed demand for oil, recycled plastic may not be competitive unless backed by an international mechanism, for example, modelled on that used for 'carbon' in the Kyoto Protocol arrangements. It should be noted that the cost per ton of municipal plastic waste collection is as much as four times the cost of unsorted municipal waste.[155]

New and planned capital investment in plastic production presents a further consideration. As demand for oil and gas for energy has declined and is likely to continue to decline with the growth of renewable energy sources, the oil and gas investors have looked to plastics as an alternative market and a hedge against falling prices. As a result, increased investments in plastic production plants, or 'crackers' are already under way, particularly in the US (Appalachia and the Gulf). In the words of an industry operator:

> "Where we are coming from is that plastic, in most of its forms, is good and it serves to be good for humanity. Creating more plastic, helps to reduce carbon emissions by creating lighter and more efficient cars and airplanes. You have plastic in wind turbines. You have plastic in solar panels. I don't see a contradiction."[156]

The plastics industry argues with some justification, that substituting plastics with alternatives will have a higher environmental cost due to greater use of resources and the lower functionality of substitutes.[157] However, this is hardly a justification for continued MPP and to offset plastic pollution the industry supports a range of initiatives to combat plastic pollution, including MPP.

Nevertheless, with public support, governments can change the plastic economy through a range of measures – with or without the consent of industry. Measures include taxes on plastic products, import tariffs, requirements to meet standards including on EPR, mandatory recycling or waste recovery. Recycled content labels can be required and recycled content in selected plastic products can be mandatory (examples include plastic pipes, garden furniture). Recycled content standards can be established and public procurement rules can include requirements for recycled content. This can foster demand and increase incentives for separate collection and recycling of plastic waste and reduce leakage. Many countries tax virgin plastics to reflects the environmental costs of the material. The EU Waste Framework Directive established recycling targets for Member States which significantly increased recycling.

Some so-called 'shift' countries have historically simply moved the waste problem by exporting waste products. However recent trade bans on waste plastic and other materials have forced countries to examine product life cycles and develop solutions at national and regional levels.

There is a limited demand for waste plastics in Africa for several reasons: limited capacity for recycling, relatively high cost of transport of low-value products, lack of stable markets, contamination by other wastes, and lack of economies of scale and integration in the waste management systems – all elements of a vicious cycle.[158] There are no regional arrangements for trade in waste plastics which

[155] E.g., in the Netherlands, plastic waste collection is €470-580 per tonne and municipal solid waste €104 per ton (DRIFT, 2012; Agentschap NL, 2012).

[156] https://insideclimatenews.org/news/04062020/shell-plastics-plant-pittsburgh-coronavirus/.

[157] Trucost, 2016.

[158] Bayemi op. cit.

undermines potential economies of scale. New requirements under the Basel Convention may create additional bureaucratic constraints.

3.4 Trade in plastics

There are three distinct plastic trade flows. Plastic raw material (also known as 'primary plastics') is produced from oil and gas, mainly by global chemical giants or enterprises linked to the oil giants. The second is plastic waste, mainly generated and exported by developed countries. However, growing restrictions, including by China (a major recycler) have radically altered the trade in waste plastic: plastic waste exports from G7 countries fell by 20 percent following the 'China ban'. From 2021, the waste plastic trade will be further influenced by new requirements under the Basel Convention. The third trade flow of value added plastics has three components: 'secondary' plastic inputs to manufacturing and building (pipes, sheets, fibres); packaging (bottles, boxes, films); and thirdly, finished plastic products (toys, clothes), many of which are not classified as 'plastic' in customs documents and are not captured in trade statistics on plastics. Plastic packaging used for finished products (detergent, or cosmetics containers, food wrappers) also remains 'hidden' from trade statistics as does plastic used in a wide range of consumer products, such as vehicles, computers and synthetic clothing.

AIODIS import over $400 million worth of plastics each year.[159] With the exception of Mauritius, exports of plastics and plastic goods from AIODIS are low or negligible.[160] Plastic trade statistics must be treated with caution as customs officials tend to focus on the monetary value of trade and not the physical weight – the latter being of fundamental importance for estimates of material flows.[161]

Table 13. Trade in plastic and plastic goods: AIODIS 2015-2019 ($ million)

Imports	2015	2016	2017	2018	2019
Cabo Verde	19.3	26.4	24.0	29.9	na
Comoros	2.9	2.7	2.7	3.5	3.0
Madagascar	100.5	115.6	122.1	131.6	124.3
Maldives	56.5	65.6	76.0	96.5	na-
Mauritius	120.3	125.7	140.1	164.0	156.7
Sao Tome and Principe	3.0	3.5	2.7	3.2	3.0
Seychelles	18.0	82.9	19.1	28.4	28.0

**Values are for Customs Code 39. No data for Guinea Bissau. Source: Comtrade https://comtrade.un.org/data*

South Africa and Nigeria are the 'giants' of Sub-Saharan plastic trade. South Africa's import of plastics is about six times the combined imports of the AIODIS. Effective management of plastic waste in these two countries is clearly critical to any regional efforts to combat MPP.

[159] Comtrade https://comtrade.un.org/data (Customs Code 39). Comtrade provide value, but not quantity. Note that some plastic products are not included under HS Code 39, e.g., plastic sandals fall under Code 64.

[160] In 2019 Mauritius exported US$45 million under Code 39. Madagascar exported US$4.8 million.

[161] Babayemi, op.cit.

Table 14. Trade in plastic and plastic goods: Nigeria and South Africa. 2015-2019 (US$ million)

Year	2015	2016	2017	2018	2019
Nigeria imports	na	1,516	1,454	1,633	na
South Africa imports	2,397	2,265	2,478	2,819	2,491
Nigeria exports	na	39	85	84	na
South Africa exports*	1,224	1,202	1,305	1,439	1,433

**Values are for Customs Code 39, excluding re-exports. Source: Comtrade https://comtrade.un.org/data*

The total volume of trade in plastic waste is unclear, but it appears to have reached a peak of 17.89 million tons in 2014 and was valued at $4.3 billion in 2017.[162] Exports were valued at over $3 billion in 2019.[163] Asian countries imported 1.5 million tons from G7 countries alone in 2018. It is estimated that 5-20 percent of imported plastic waste has little or no value and becomes a secondary waste stream.[164] The USA has historically been the largest exporter of plastic waste – 15.3 percent of global exports in 2018. China's permanent ban on non-industrial plastic waste (National Sword, active 2018) disrupted trade patterns and plastic waste was diverted elsewhere, mainly to SE Asian countries and to some Latin American countries. Lack of recycling capacity in Africa has meant that African countries are not significant importers.

While the plastic trade network is a complex web, three regional 'hubs' are evident: Asia, Europe and North/Latin America and several major players stand out. China remains a major player although Malaysia and Vietnam are showing an increasing role. India has had a relatively stable import trade volume, while the USA has had a relatively stable export volume. Africa's export trade has been almost entirely of waste plastic to Asia. Belgium, Germany and the Netherlands are key European actors in the plastic waste industry. European exports have declined since 2015, partly due to EU legislation on waste management. The patterns of trade in plastic waste in AIODIS is not immediately apparent from Comtrade statistics (Table 15).

Table 15. Reported plastic waste trade flows in AIODIS

Country	Trade Flow	tons	Trade Value (US$)
Cabo Verde	Import	1	2,992
Comoros	Import	29	29,563
Madagascar	Import	57	50,304
Madagascar	Export	50	17,074
Mauritius	Import	19	10,485
Mauritius	Export	1795	937,439
Sao Tome and Principe	Import	15	4,387
Seychelles	Import	1	9,134

Source: Comtrade HS 3915, 2019.

About twenty multilateral environmental agreements (MEAs) include provisions to control trade in order to prevent damage to the environment. These include the Basel and Rotterdam conventions and the Convention on Biological Diversity (CBD). However, the WTO agreements are crucial (see below). Several international initiatives on trade in plastics are facilitated by WTO Environment and Trade

[162] Wang, C. et al. 2019. Structure of the global plastic waste trade network and the impact of China's import Ban. Resources, Conservation & Recycling 153 (2020) 104591.

[163] Comtrade HS 3915.

[164] GRID-Arendal (2019). Controlling Transboundary Trade in Plastic Waste (GRID-Arendal Policy Brief). http://www.grida.no/activities/311.

Committee, the G7, the World Economic Forum and the OECD. Trade is also an important element of efforts to formulate an international treaty on plastic pollution.

3.4.1 The role of the World Trade Organisation

The WTO is a key forum for addressing responsible trade in plastics and measures to combat the negative impacts of the global plastics industry. Under WTO rules, members can adopt trade-related measures aimed at protecting the environment provided the measures are not protectionist. WTO members recognise that trade arrangements play a key role in managing plastic pollution. Most AIODIS are WTO members and Comoros plans to accede to the WTO in the near future. São Tomé is not a WTO member.

The WTO TBT and SCM Agreements are of particular relevance to MPP.[165] Measures to subsidise recycling of plastics could be subject to the provisions of the SCM. Bans, or tariffs on SUP or other plastic products could be subject to the TBT. Between 2009 and 2018, LDC members of the WTO notified over 100 environment-related measures with regard to trade in plastics, mostly pursuant to the TBT Agreement, including on requirements related to waste management, import licensing, and bans on SUP products.[166] Between 2016 and 2018, eight Sub-Saharan countries have notified WTO 29 times under the TBT in relation to plastic products. Of these, 18 notifications (Mauritius (6) and Seychelles (4)) related to rules on the import of plastic packaging, notably plastic bags.[167]

WTO members recognise the need for coherence in policies and rules on plastics, to avoid a patchwork of trade measures and regulations. The WTO Committee on Trade and Environment (CTE) is the primary platform used to develop trade measures to reduce plastic pollution and provides bridges with the other multi-lateral environmental agreements (MEAs). WTO recognises that to address plastic pollution, coherence and transparency is required along the entire supply chain from producers to policymakers and consumers.[168]

The links between the WTO TRIPS Agreement (on intellectual property) and the environment are complex and the impact of many of the issues involved are contentious. The discussions on "outstanding implementation issues", i.e., concerns about the implementation of the present WTO agreements, take place mainly through the TRIPS Council under the 2001 Doha ministerial mandate as the Doha Ministerial Declaration mandated the Trade and Environment Committee to examine the relevant provisions of the TRIPS Agreement.[169]

Discussions on plastics pollution and environmentally sustainable plastics trade have continued in the WTO, but with little concrete progress.[170] Plans to launch a WTO plastics initiative, including promotion of the circular economy, stalled as 12th Ministerial Conference was postponed due to the Covid 19 pandemic. Seven WTO members have launched an open-ended informal dialogue on plastics in an effort to build consensus on trade-related actions to combat the environmental, health and economic costs of plastics pollution.[171] There have been suggestions to build capacity for plastic trade management

[165] See also: GATT Article 20, pursuant to which several environmental disputes on fisheries have taken place.

[166] WTO, 29 November 2019.

[167] Other plastic packaging notifications were from included Burundi, Congo, Togo and Uganda. (https://edb.wto.org/notifications).

[168] WTO Committee on Trade and Environment, 2020. Communication on Trade in Plastics, Sustainability and Development by the United Nations Conference on Trade and Development (UNCTAD). JOB/TE/63 10 June 2020.

[169] See: https://www.wto.org/english/tratop_e/envir_e/cte_doha_e.htm; and https://www.wto.org/english/tratop_e/envir_e/trips_e.htm.

[170] IISD, 2020.WTO Committee on Trade and Environment Continues Efforts on Plastics Pollution, Circular Economy. 23 July 2020. See also: https://unctad.org/en/PublicationsLibrary/wto_unctad_CTE2020_en.pdf

[171] They are: Australia, Barbados, Canada, China, Fiji, Jamaica and Morocco.

through Aid for Trade (A4T) and the Enhanced Integrated Framework (EIF) and to support a plastics circular economy, possibly by drawing on work done on the proposed Environmental Goods Agreement (EGA). A range of activities have been discussed, or proposed by WTO. These include:

- defining principles for effective and coherent, WTO compliant trade-related measures and setting targets for reducing trade in single-use, non-sustainable plastics in a WTO compatible manner.
- ensuring that existing measures are WTO compliant (e.g. plastic bag, microbead bans)
- the removal of subsidies that promote plastic production and trade (and reduce associated emissions)
- developing harmonised environmental standards and labelling requirements for plastics (the existing labelling is an industry initiative)
- WTO-compliant government procurement policies to reduce use of single-use plastics
- mandated extended producer responsibility schemes for certain categories of plastic goods
- circular economy initiatives which are compliant with SCM[172] requirements, such as subsidies and tax incentives to spur recycling, innovation, technology transfer to substitute plastic products, develop more biodegradable plastics, and effective waste management technologies
- monitoring mechanisms to track and evaluate the effectiveness of measures and to track the trade life cycle of plastics
- Basel-compatible rules on trade in waste plastic
- information-sharing and dialogue on sustainability standards and development considerations
- improved capacity building and cooperation related to trade and plastic pollution.

AIODIS, African, and SIDS countries have only a minor presence in many of these dialogues although concerns about plastic pollution transcend the North-South divides that have long thwarted cooperation on trade and environment issues at the WTO. As many AIODIS do not have the economies of scale necessary for recycling of plastics and that even the sorting of plastic waste for export may not be economical for island economies, raising the particular issues facing small and island economies in these discussions may be of value.

3.4.2 Initiatives by global economic organisations and industry

International dialogues recognise that basic structural factors influence recycling. Recyclers are hesitant to invest or not invest in recycling capacity because profitability is low and markets subject to oil price fluctuations and changing importer rules. Users or manufacturers face uncertainties regarding quality and availability of raw materials. Incentives for production of virgin plastic feedstock are ongoing with little movement to account for externalities in plastic pricing. Few countries aim to create a level playing field between virgin and recycled plastics or intervene to develop the market for recycled plastics, for example through levies on virgin plastic, requirements for inclusion of recycled content in selected products, or fostering the international standards and trade arrangements required.[173]

[172] Agreement on Subsidies and Countervailing Measures.

[173] OECD, 2018. Improving Plastics Management: Trends, policy responses, and the role of international co-operation and trade Background Report Prepared by the OECD for the G7 Environment, Energy and Oceans Ministers September 2018. http://www.oecd.org/environment/waste/policy-highlights-improving-plastics-management.pdf. See also: https://www.weforum.org/agenda/2020/01/wto-address-plastic-pollution/ .

In 2020, the G20 "reaffirm[ed its] commitment to reduce additional pollution by marine plastic litter, as articulated by the Osaka Blue Ocean Vision".[174] In line with circular economy initiatives, at a technical level, the G7 and World Economic Forum (WEF) have considered OECD and other suggestions to:

- create certification standards for recycled plastics
- mandate requirements to progressively collect separate and recycle all types of plastics
- facilitate coordination and communication across the plastics value chain, including on additives and their handling in recycling
- develop rules and restrictions on the use of hazardous additives in plastics manufacturing
- provide incentives for better product and plastics design and innovation for reuse and recycling
- develop schemes for extended producer responsibility, product stewardship and deposit-refund systems
- support R&D for improved plastics management systems and the sustainable design of plastics (more easily recyclable or more easily biodegradable for example)
- explore partnerships with industry, industry codes of sustainable practice and the role of industry in addressing plastic pollution legacy issues
- introduce and enforce national recycling targets and transparency on the methods used to calculate these rates
- increase levies for landfill disposal of waste plastics.

3.4.3 WEF and industry initiatives

The WEF serves as an industry forum and has moderated a dialogue between the New Plastics Economy (NPE) (2016) initiative led by the Ellen MacArthur Foundation and the Consumer Goods Forum, an association of global corporate leaders in the consumer goods industry, which is the principal generator of plastic packaging waste.[175] Based on analysis that estimated that 95 percent of plastic packaging was short/single use, that 32 percent escapes collection, and that global material losses were estimated at $80–120 billion annually, the NPE advocated a circular economy vision with an action focus on plastic packaging. A number of major consumer goods corporations and members of the Consumer Goods Forum were engaged with the NPE.[176]

While there are a number of regional and product-specific industry MPP initiatives and partnerships, the CGF's Coalition of Action on Plastic Waste is probably the most influential in terms of the interface with consumers, as its members include many of the 'top 10' corporate polluters (Box 6), although Coalition members do not include the producers of primary plastics. The members' shared vision is to move towards a plastic packaging circular economy. Actions focus on (i) packaging design; (ii) EPR; (iii) recycling; and (iv) key markets.[177] Many of the Coalition members, companies with an aggregate revenue of over $1.1 trillion, have agreed to adopt new plastic packaging rules by 2025 and work to improve waste management systems worldwide.[178] The CGF has also set out EPR generic principles

[174] https://www.g20riyadhsummit.org/pressroom/g20-riyadh-summit-release-of-leaders-declaration/; https://g20mpl.org/wp-content/uploads/2020/11/G20mpl_20201214_IGES_second-edition.pdf.

[175] https://www.theconsumergoodsforum.com/who-we-are/overview/

[176] See: http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf. Coca-Cola, Unilever, Nestle and other companies were involved.

[177] https://www.theconsumergoodsforum.com/environmental-sustainability/plastic-waste/commitments-and-achievements/

[178] Coalition members selling plastic packed products in AIODIS include: Carrefour, Coca-Cola, Colgate-Palmolive, Danone, Johnson & Johnson, L'Oréal, Mars, Mondelēz, Nestlé, PepsiCo, Procter & Gamble, Tetra Pak, Unilever and others. For packaging design guidance see: https://www.theconsumergoodsforum.com/wp-content/uploads/2020-Plastics-Golden-Design-Rules-1-2-One-Pager.pdf; https://www.theconsumergoodsforum.com/wp-content/uploads/2019-CGF-McKinsey-Summary.pdf.

which have wide applicability. The principles avoid specific commitments and the actions appear to be guided as much by economic as by environmental tenets.[179]

The WEF, the CGF and the Plastic Waste Coalition could potentially provide a platform for AIODIS dialogue on MPP through regional trade organisations or through the regional seas conventions (see section 4.1.5).

[179] CFG, 2020. Building a Circular Economy for Packaging: A View from the Consumer Goods Industry on Optimal Extended Producer Responsibility. https://www.theconsumergoodsforum.com/wp-content/uploads/EPR-Building-a-Circular-Economy-for-Plastic-Packaging-cgf-plastic-waste.pdf.

4. International and Regional Legal frameworks

This section reviews the international and regional legal instruments. National legislation is considered under the profile of each country (see companion report in preparation). The status of AIODIS with respect to the relevant international conventions is set out in Part II.

The international legal framework relevant to MPP fall into several categories:

- international law relating to marine pollution (UNCLOS, IMO/MARPOL)
- regional conventions and treaties (Nairobi and Abidjan conventions)
- international law on hazardous materials (Basel and Stockholm conventions)
- international law related to impacts on natural resources (CBD)
- WTO agreements in relation to trade in plastics, the environment and human health
- regional economic community agreements
- soft law instruments (UNGA resolutions, codes of conduct, ecolabels, international guidelines and regional resolutions and commitments).

In general, regulatory frameworks are fragmented and do not address plastic raw material creation, product design, manufacture, use, reuse and recycling within the framework of a circular economy or the plastics lifecycle. The frameworks do not create an operational basis for allocation of responsibility for MPP, for sharing the costs of plastic pollution, or a robust mechanism to establish norms to prevent, reduce and control MPP. The predominantly fossil fuel basis of plastic production and disposal and its growing contribution to GHG emissions also generate material linkages to the legal instruments and commitments established under the UNFCCC.

4.1 International legal framework relating to marine plastic pollution

4.1.1 UNCLOS

Marine plastic pollution falls within the scope of the United Nations Convention on the Law of the Sea (UNCLOS)[180] definition of "pollution of the marine environment". The relevant obligations of states are set out in Part XII, and in particular Article 207 on land-based sources of marine pollution (LBSMP).[181] There is an international consensus that MPP directly causes transboundary, permanent, and cumulative harm through complex negative impacts on marine ecosystems and human wellbeing, even if this harm is poorly quantified and even if allocation of responsibility for the harm is problematic.

States have obligations under UNCLOS to "prevent, reduce and control" MPP[182], specifically States are obliged to:

180 Legal scholars use the term "the Convention" and reserves the acronym UNCLOS for the Conference(s). UNGA reports however use 'UNCLOS' to refer to the Convention. See: Edeson, William R. 2000. United Nations Convention on the Law of the Sea Confusion over the Use of "UNCLOS", and References to other Recent Agreements. International Journal of Marine & Coastal Law. Aug 2000, Vol. 15 Issue 3, p413.

181 Article 1.1(4) *"pollution of the marine environment" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities"*

182 As a general obligation under Article 191, with regard to transboundary damage (Art. 194.2), in relation to persistent pollutants and land-based sources (Art. 194.3 (b)) and from vessels (Art 194.3 (b)).

- adopt[183] and enforce[184] national laws that take account of international efforts to *"establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution of the marine environment from land-based source".*
- use *"the best practicable means at their disposal and in accordance with their capabilities"*
- to cooperate to establish science-based rules on marine pollution[185] and
- assess and report on activities that cause significant pollution or harm.[186]

State compliance with Part XII obligations largely depends on their compliance with other conventions that set the norms for pollution and due diligence.[187] These include MARPOL in the case of emissions and waste disposal by shipping, and the Regional Seas Conventions (RSCs) with respect to land-based sources of MPP.[188] However, with regard to MPP, 'competent international organisations' have not developed the required norms or specified the due diligence requirements. For example, national or regional measures on plastic bags and SUPs are a patchwork of rules that are far from being a form of customary international law. Even if appropriate norms were to be agreed, UNCLOS does not have a mechanism to monitor state compliance, or impose sanctions. Because of a lack of internationally agreed norms, the international community is unable to determine if states are exercising due diligence with respect to their commitments under Part XII.

4.1.2 MARPOL Annex V

The International Convention for the Prevention of Pollution from Ships (MARPOL)[189] gives effect to numerous UNCLOS provisions on pollution by ships.[190] MARPOL demonstrates that, internationally, norms can be adopted.[191] Disposal of plastic garbage by ships is prohibited,[192] however, compliance is deficient and application to vessels under 400GT is not required, thus exempting most of the world's fishing fleet – a significant source of MPP.[193]

[183] UNCLOS Art. 207.

[184] UNCOLS Art. 213 (land-based sources).

[185] UNCLOS Art. 201.

[186] UNCLOS Art 198, 205, 206. More recently, the ITLOS reconfirmed state responsibility and due diligence. See: Request for an advisory opinion submitted by the Sub-Regional
Fisheries Commission (SRFC), ITLOS Case No. 21, Advisory Opinion of April 2, 2015.

[187] States are obliged to cooperate to establish competent international regimes (e.g. Art. 212.3).

[188] Art 207 requires only that states only *"[take] into account internationally agreed rules, standards and recommended practices and procedures"*.

[189] International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997 (MARPOL) in force 2 October 1983. 12 ILM 1319. The Kyoto Protocol also obliged parties to limit or reduce shipping emissions.

[190] IMO considers itself the appropriate international organisation for establishing the 'due diligence norms' for implementing the shipping provisions of UNCLOS Part XII. See: Implications of the United Nations Convention on the Law of the Sea for the International Maritime Organization, Document LEG/MISC/8, January 30, 2014, p. 80. The MARPOL definition of 'pollution' (Art. 2.2.) is consistent with the UNCLOS definition (Art. 1.1.(4)).

[191] Transport accounts for about 23% of emissions of which about 95% is CO_2. Shipping accounts for about 3% of global CO_2 emissions. (World Development Report 2010). Aviation accounts for about 2% of global emissions but has no equivalent to MARPOL. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a scheme to stabilise and offset rather than reduce emissions.

[192] Annex V of MARPOL 73/78 Regulations for the Prevention of Pollution by Garbage from Ships (in force 31 December 1988), Regulation 3.1(a) *"the disposal into the sea of all plastics, including but not limited to synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products which may contain toxic or heavy metal residues, is prohibited."* Annex V contains numerous provisions for compliance including shore-side garbage disposal facilities, vessel garbage plans, vessel inspections and record keeping. The legally binding ban on disposal of plastics at sea entered into force in 1988. Adopted by some 140 states, it covers almost 100% of global shipping. Annex V essentially prohibits all waste disposal at sea, unless specifically provided for (e.g. treated food waste).

[193] Fishing gear accounts for about 8% of 'large' MPP. See: UNEP, FAO (2009). Abandoned, lost or otherwise discarded fishing gear. Available at: http://www.unep.org/regionalseas/marinelitter/publications/docs/Marine_Litter_Abandoned_Lost_Fishing_Gear.pdf.

Annex V 'Prevention of Pollution by Garbage from Ships' (in force 31 December 1988), deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of. The Annex imposes a complete ban on the disposal into the sea of all forms of plastics.

Ports are required to have adequate facilities for ships garbage disposal and ships are required to keep records of garbage generation and disposal. Specifically, MARPOL Annex V, Regulation 7 requires that port States shall ensure the provision of reception facilities for garbage disposal which must be adequate to meet the needs of ships, without causing undue delay.[194] IMO has an action plan to ensure adequate port reception facilities.

4.1.3 Dumping and Hazardous Waste

The London Convention regulates dumping into the marine environment.[195] The Protocol prohibits all dumping, except for eight specified categories of wastes. The export of waste was also prohibited but this restriction has been removed.[196] The Protocol provides a globally-agreed and evolving framework to regulate ocean dumping and a robust frame of reference for UNCLOS Part XII obligations.[197]

The Basel Convention's[198] objective is *"to protect human health and the environment against the adverse effects of hazardous wastes and other wastes".* Plastics are included in 'other wastes' and are subject to non-binding technical guidelines.[199] Basel requires adoption of domestic legislation and other measures to implement its provisions, but does not specify targets for reduction or trade in plastic waste, and does not have mandatory reporting on plastic waste generation or trade.[200]

Despite considerable pressure from the plastics industry, concern over the negative social, environmental and economic impacts arising from weak regulation of trade in plastic waste, resulted in adoption of the 2019 "Plastic Amendments" to the Basel Convention. The 'Plastic Amendments' are seen by some as first step in more comprehensive international regulation of the plastics industry.[201] The new rules governing international shipments of waste plastics among signatories of the Basel Convention entered into force on 1 January 2021.[202]

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[194] For 'adequate' see: MEPC 44, 2000 resolution MEPC.83(44) and circular MEPC/Circ.469/Rev.1.

[195] The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention) and its 1996 Protocol (the London Protocol). http://www.imo.org/en/OurWork/Environment/LCLP/Pages/default.aspx. Dumping is defined as: *"any deliberate disposal into the sea of wastes or other matter"* (LP Art. 1.1.4.1).

[196] The restriction was made to avoid circumvention of the dumping prohibition. It was removed (resolution LP.3(4)) for carbon storage in recognition that not all countries have suitable storage sites in the deepsea.

[197] The Protocol 1996 covers 97% of global shipping tonnage.

[198] Basel Convention on the Transboundary Movements of Hazardous Wastes and Their Disposal. For and overview on MPP see: http://www.basel.int/Implementation/MarinePlasticLitterandMicroplastics/Overview/tabid/6068/Default.aspx.

[199] COP-6 (2002) adopted the Technical guidelines for the identification and environmentally sound management (ESM) of plastic wastes and for their disposal". A working group is focused on further action on MPP and microplastics including on relations with MARPOL (decisions BC-13/11 and SC-8/15).

[200] For a discussion see: Karen Raubenheimer, Alistair McIlgorm. 2018. Can the Basel and Stockholm Conventions provide a global framework to reduce the impact of marine plastic litter? Marine Policy, Available at: https://doi.org/10.1016/j.marpol.2018.01.013.

[201] http://www.brsmeas.org/?tabid=8005.

[202] See also: Jonathan Krueger. 1998. Prior Informed Consent and the Basel Convention: The Hazards of What Isn't Known. The Journal of Environment & Development. Vol. 7, No. 2 (June 1998), pp. 115-137.

Box 7. Basel Convention Plastic Waste Amendment (Decision BC-14/12)
Annex II: Y48, plastic waste, including mixtures of such wastes, subject to the prior informed consent (PIC) procedure (excluding those that would fall under A3210 or B3011)
Annex VIII: A3210, clarifies the scope of plastic waste presumed to be hazardous and therefore subject to the PIC procedure
Annex IX: B3011, plastic waste destined for recycling and almost free from contamination and other types of waste that remain excluded from the PIC procedure (certain single polymers or mixture of PE, PP and/or PET)
Effective as of 1 January 2021.

International legal approaches to MPP can also draw on the models provided by other international environmental agreements. The Stockholm Convention[203] has no specific mandate on MPP, but is a potential model to address aspects of LBSMP. Its scope is limited to those products containing or contaminated with listed POPs. The parties are aware of the threats posed by transport of POPs through MPP.[204] Although a climate agreement, the Montreal Protocol could also serve as a model to regulate the production and life cycle of plastics.[205] In 2002, the WSSD established the Strategic Approach to International Chemicals Management (SAICM), a multi-stakeholder, multi-sectorial process committed to ensure "chemicals are produced and used in ways that minimize harm". SAICM is voluntary and life-cycle focused, which has relevance for plastic waste.[206] The Espoo Convention provides guidance on environmental assessment; the Aarhus Convention provides norms for public participation.[207] The Partial Test Ban Treaty (PTBT) also provides insights into pollution of the marine environment by nuclear materials.[208]

4.14 The Washington Declaration, the GPA and the Regional Seas Conventions

As indicated above, there is a deficit in development of internationally accepted norms related to MPP and land-based sources of pollution in general, other than in the case of hazardous chemicals and mercury. Those norms that exist relate to conduct rather than to results.

This deficit was recognised and, in 1985, the Montreal Guidelines on LBSMP were prepared. This led to the 1995 Washington Declaration and the creation of the non-binding GPA.[209] 'Montreal' not only consolidated UNCLOS, Stockholm and the RSCs commitments at the time, but emphasised the need for norms and technical standards (see Montreal annex). 'Montreal' also saw the guidelines as a basis for a possible global convention on LBSMP. However, rather than pursuing a process to create such norms under UNCLOS, the decisions were made to build the GPA and the regional seas programme.

As a result, marine pollution became largely 'regionalised' and 'technical' and 'managed' under a UNEP/UNEA mandate, rather than being the subject of a global subsidiary instrument under UNCLOS.

[203] Stockholm Convention on Persistent Organic Pollutants (Stockholm, 22 May 2001, in force 17 May 2004).

[204] Some plastic absorbs POPs and through ingestion by marine organisms, POPs may make their way up the food chain. See papers at the Sixth International Marine Debris Conference. The Chemistry of Plastic Marine Debris. Available at: http://internationalmarinedebrisconference.org/index.php/the-chemistry-of-plastic-marine-debris/.

[205] Karen Raubenheimer, Alistair McIlgorm. Is the Montreal Protocol a model that can help solve the global marine plastic debris problem? Marine Policy. Volume 81, July 2017, Pages 322-329.

[206] Strategic Approach to International Chemicals Management (SAICM), adopted in 2006; the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) is of relevance to application of UNCLOS Art. 206.

[207] Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, done at Aarhus, Denmark, on 25 June 1998 (entered into force on 30 October 2001).

[208] 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water.

[209] UNEP, 1985. Montreal Guidelines for the Protection of the Marine Environment against Pollution from Land-based Sources. UNEP(092)/E5. [1985] UNEP, Nairobi; Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), UNEP(OCA)/LBA/IG.2/7, (GPA) (3 November 1995).

The Honolulu Strategy (2011) provided a framework for combatting marine litter, including awareness building and education, but did not specify targets to prevent, reduce or eliminate marine plastic litter or microplastics.[210] The Manila Declaration (2012) supported creation of the Global Partnership on Marine Litter (GPML).[211] UNEP/GPA and partners undertook a range of studies on the scale and impact of MPP, on marine litter legislation and on relevant best environmental/ available practices.[212] In this regard, the United Nations Environment Programme (UNEP) has an important role in:

- coordinating efforts to develop scientific consensus on the status and impact of MPP by supporting the work of the GPA and GESAMP;[213]
- promoting actions to mitigate MPP;
- supporting the coordination of RSC actions; and
- fostering consensus on marine environmental protection, including through UNEA resolutions and contributions to UNGA resolutions.[214]

Between 2014 and 2019, there have been four UNEA resolutions on MPP. A United Nations Environment Assembly (UNEA)-mandated study reviewed the international legal framework for combatting MPP and explored three options: (i) maintaining the status quo; (ii) strengthening existing instruments; and (iii) preparation of a new international instrument.[215]

The subsequent UNEA resolution highlighted the growing threat and its complexity, re-emphasised the urgent need for greater national and regional actions and opted for further study on the options – perhaps a reflection of the lack of appetite for a new convention.[216] UNEA failed to grasp the opportunity to develop draft articles on a LBSMP convention, as originally envisaged by 'Montreal', although the background study had already reviewed the legal approaches and identified the need for a bridging architecture to render the existing disparate instruments more cohesive. The resolution perhaps reflects a recognition of the costs associated with waste management obligations, particularly for developing countries, and the interests of regional participants in leading through the RSCs.[217] The Abidjan and Nairobi Conventions are discussed in Part II.

Progress towards any global convention on marine plastic pollution, on land-based sources of marine pollution, or on plastic pollution in general remains slow.[218] This may be due to several factors. The

[210] A Global Framework for Prevention and Management of Marine Debris, 25 March 2011, (Honolulu Strategy) http://www.unep.org/gpa/documents/publications/honolulustrategy.pdf.

[211] Manila Declaration on Furthering the Implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, UNEP/GPA/IGR.3/CRP.1/Rev.1, (Manila Declaration) (27 January 2012). http://www.unep.org/regionalseas/globalmeetings/15/ManillaDeclarationnew.pdf. 'Manila' also established other GPA partnerships on nutrients and on wastewater (Article 5).

[212] E.g., guidelines on national policy and legislation. See: UNEP, 2016. Marine Litter Legislation: A Toolkit for Policymakers. Environmental Law Institute (ELI)/United Nations Environment Programme (UNEP). UNEP, Nairobi.

[213] The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) (http://www.gesamp.org/) generates scientific advice on preservation of the health of the quality the marine environment for UN agencies, e.g. through targeted research: GESAMP (2016). "Sources, fate and effects of microplastics in the marine environment: part two of a global assessment" (Kershaw, P.J., and Rochman, C.M., eds). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 93, 220 p.

[214] UN, 2019. Compilation of United Nations Environment Assembly resolutions on marine litter and microplastics. UNEP/AHEG/2019/3/INF/2. Ad hoc open-ended expert group on marine litter and microplastics. Third meeting Bangkok, 18–22 November 2019. https://papersmart.unon.org/resolution/uploads/unep.aheg_.2019.3.inf_.2_compilation_of_resolutions.pdf.

[215] UN Environment, 2017. Combating marine plastic litter and microplastics: An assessment of the effectiveness of relevant international, regional and subregional governance strategies and approaches. UNEP/EA.3/INF/5. UNEA 5 October 2017.

[216] United Nations Environment Assembly of the United Nations Environment Programme, Resolution on Marine Litter and Microplastics, UNEP/EA.3/L.20, Third Session, 4-6 December 2017 "to further examine [...] the range of national, regional and international response options, including actions and innovative approaches, and voluntary and legally binding governance strategies and approaches" (paragraph 10(d)(i)).

[217] For a discussion see: Linda Finska (2018). Did the latest Resolution on Marine Plastic Litter and Microplastics take us any closer to pollution-free oceans? http://site.uit.no/jclos/files/2018/01/JCLOS-Blog-100118_Marine-Litter_Finska.pdf; Tanaka, Yoshifumi. 2006. Regulation of Land-Based Marine Pollution in International Law: A Comparative Analysis between Global and Regional Frameworks. 66 Zeitschrift für ausländisches öffentliches Recht und Völkerrecht 535 (2006).

[218] CIEL, 2020. Convention on Plastic Pollution. Toward a new global agreement to address plastic pollution. https://www.ciel.

institutional 'home' for such an agreement is unclear, e.g., an implementing arrangement under the existing UNCLOS Part XII mandate can be considered, or a stand-alone instrument with a broader industry, life cycle and trade scope. The scope of a stand-alone agreement remains the subject of debate. The broader the scope, the weaker the instrument is likely to be and the more difficult to negotiate. Clarity on relationships with other agreements, such as with WTO instruments, pose major challenges. There is also a lack of 'appetite' for new marine environmental agreements given the experience of the effectively stalled ABNJ/BBNJ negotiations. The current forum for such discussion, UNEA, itself lacks a robust legal instrument (such as UNCLOS) upon which it can build an agreement, while its experience in managing such negotiations is limited (e.g., Minamata Convention, UNEAs efforts on geo-engineering).

UNEA Resolution 4.9 'Addressing Single-Use Plastic Products Pollution' may be of particular interest to AIODIS. It requests UNEP to support governments upon demand in "the development and implementation of national or regional action plans to address the environmental impact of single-use plastic products", and to facilitate and coordinate technical and policy support to governments on this topic. The USA 'disassociated' itself from the 'prescriptive language' regarding SUPs. The topic remains on the agenda for UNEA5 (February 2021 (technical) and 2022). The item is strongly supported by the Nordic Council, the EU, Pacific Islands and CARICOM and could potentially be a focus for AIODIS action, possibly through the Nairobi and Abidjan conventions.[219]

The plastics industry nominally supports development of an agreement, possibly to reduce business uncertainties and risks, to harmonise the diversity of national rules, to avoid liability for MPP and to be seen to be actively supporting the combat against MPP and other forms of plastic pollution.[220] However, the expressed UNEA positions of some countries, which have strong interests in production of primary plastics, suggest a nuanced industry approach.

The International Law Commission (ILC) draft articles on state responsibility and the draft articles on transboundary harm systematise relevant international legal issues. Existing instruments, such as the Montreal and Kyoto protocols, have elements that might be adapted for a 'plastics convention'. Undertakings by the G7, G20 and national 'global ocean commitments' do not generally incur international legal obligations.

4.1.5 Other conventions

The Port State Measures Agreement (PSMA) is directed at illegal fisheries activities and depending on national law and the resolutions of regional fisheries management organisations, the PSMA could potentially be applied to control marine debris from fishing vessels. Resolutions of the Convention on Migratory Species have encouraged parties to address marine debris and lost fishing gear and advocated development of standard methodologies to assess impacts. The Convention on Biological Diversity has also endorsed international resolutions and declarations on MPP.

org/reports/convention-on-plastic-pollution-toward-a-new-global-agreement-to-address-plastic-pollution/.

[219] Chair´s Summary for the Ad Hoc Open-Ended Expert Group on Marine Litter and Microplastics. AHEG Report of Nov 2020 (par. 22g, 23, 24.). https://papersmart.unon.org/resolution/uploads/chair_summary_final.pdf#overlay-context=Fourth-adhoc-oeeg; Raubenheimer, K., Urho, N., 2020. Possible elements of a new global agreement to prevent plastic pollution. Nordic Council of Ministers, Denmark, Copenhagen. https://pub.norden.org/temanord2020-535/temanord2020-535.pdf.

[220] WWF, the Ellen MacArthur Foundation and BCG, 2020. The business case for a UN treaty on plastic pollution. https://www.plasticpollutiontreaty.org/UN_treaty_plastic_poll_report.pdf.

4.2 Regional legal frameworks

4.2.1 The EU: lessons for a regional approach

The EU has formulated the most comprehensive suite of regional actions on MPP. Its approach provides guidance and lessons for the AIODIS, particularly in relation to any potential joint actions by AIODIS or under the aegis of the different regional economic communities. However, it should clearly be understood that EU legislative instruments must be applied at national level. The unifying framework for EU initiatives on MPP and more broadly on the CE and waste management are set out in the Plastics Strategy which builds on and is supported by a number of other legislative instruments:

- European Commission, 2018. Plastics Strategy and Staff Working Document[221]
- Packaging & Packaging Waste Directive (PPWD) 2018 sets new packaging recycling targets for all materials
- Waste Framework Directive 2018/851, which will introduce 'eco-modulated' EPR fees, e.g., recyclable packaging will incur lower fees in future, and non-recyclable packaging will be heavily penalised
- Marine Strategy Framework Directive requires that the marine environment meets environmental quality standards, including for MPP
- Waste Water Directive which also addresses microplastic pollution (rivers, lakes, estuaries)
- Landfill Directive
- Waste Incineration Directive
- EU Action Plan for a circular economy.

On average, 32 kg of plastic packaging waste is produced per person per year in the EU, compared to 45 kg per person per year in the USA and 5 kg in India. Some of the key legal instruments are directed at waste management and plastic packaging.[222] In the 2018 update of the Packaging and Packaging Waste Directive, new plastic packaging recycling targets for 2025 (50 percent) and 2030 (55 percent) have been adopted. The 2019 EU Single Use Plastic (SUP) Directive implements part of the plastics policy, by banning a range of products, requiring separate collection of bottles and an increasing recycled content in PET bottles (30% by 2030).[223] Legislation restricting lightweight plastics bags has already been in force since 2015. More recent initiatives have also focused on extended producer liability (EPR) and a new consumer agenda, including the 'right to repair'.[224]

In relation to the packaging targets, recent EU reports indicate that: (i) the amounts of plastic packaging used may be significantly underreported; (ii) the legal obligations are subject to differing national interpretation; and (iii) for technical and other reasons, there is a lack of accurate reporting.[225]

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[221] European Commission.: Staff Working Document accompanying 'A European Strategy for Plastics in a Circular Economy'. SWD(2018) 16 final. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018SC0016&qid=1606408023854&from=EN

[222] European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste (OJ No L 365/10 of 31.12.94); European Commission (2008) Directive 2008/98/EC on Waste (Waste Framework Directive) 5 Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ L 182/1 of 16.7.1999).

[223] Directive (EU) 2019/904 – 'the SUP Directive'. https://eur-lex.europa.eu/legal-content/EN/TXT PDF/?uri=CELEX:32019L0904&from=EN

[224] EC, 2020. Communication from the Commission to the European. Parliament and the Council. New Consumer Agenda Strengthening consumer resilience for sustainable recovery. Brussels, 13.11.2020. COM(2020) 696 final. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0696&qid=1606408023854&from=EN

[225] European Commission. 2018. Report on the implementation of EU waste legislation, including the early warning report for Member States at risk of missing the 2020 preparation for reuse/recycling target on municipal waste. COM(2018) 656 final, September 2018; Eunomia, 2017. Study on Waste Statistics – A comprehensive review of gaps and weaknesses and key priority areas for improvement in the EU waste statistics Final Report for DG Environment. https://ec.europa.eu/environment/waste/pdf/Eunomia_study_on_waste_statistics.pdf.

The target for recycling is ambitious (55 percent) as the maximum theoretically feasible recycling rate for plastic packaging is estimated to be 60 percent, given that not all waste is collected.[226] EU legislation is generally 'made effective' though national laws. At national level the EU has encountered problems with effective harmonised legal definition(s) of 'municipal waste' and 'recycling' and harmonised reporting.[227] The EU is also working through the RSCs (OSPAR, Helsinki, Barcelona and Odessa Conventions) to coordinate MPP action plans with neighbouring non-EU countries and implement the LBSA protocols of these conventions.

Numerous national schemes have been established by EC businesses to meet their legal obligations with respect to plastic recycling. For example, some businesses pay fees to their associations to finance household recycling bins, bottle banks, civic amenities and business back-door waste nationwide. Similar arrangements are evolving in other developed countries.[228]

4.2.2 Other regional frameworks

In general, these frameworks take the form of declarations, international 'commitments' and regional action plans. In most cases the instruments do not have the force of law, and many lack a robust mechanism for monitoring, reporting and adjustment of targets. However, they are of considerable value to help underpin regional collaboration, secure support for investments, or respond to regional peer pressure. There are examples of such initiatives in South East Asia, the Caribbean and the Pacific Islands mostly accompanied by action plans. The ASEAN framework identifies four categories of action: (i) policy support and planning; (ii) research, innovation, and capacity building; (iii) public awareness, education, and outreach; and (iv) private sector engagement. Under the framework, ASEAN will consider a regional agreement on MPP and integrate awareness activities with other ASEAN initiatives.[229]

[226] EXPRA. 2015. Analysis of Eurostat packaging recycling data - a study of the years 2006-2012. http://www.expra.eu/uploads/downloads/20151015%20Analysis%20of%20Eurostat%20packaging%20recycling%20data%201%200%20with%20cover26.10.pdf.

[227] European Court of Auditors, 2020. EU action to tackle the issue of plastic waste. Review No.04. https://www.eca.europa.eu/lists/ecadocuments/rw20_04/rw_plastic_waste_en.pdf.

[228] See: OECD (2018), Improving Markets for Recycled Plastics: Trends, Prospects and Policy Responses, OECD Publishing, Paris, https://doi.org/10.1787/9789264301016-en

[229] [ASEAN Framework of Action on Marine Debris. https://asean.org/storage/2019/06/3.-ASEAN-Framework-of-Action-on-Marine-Debris-FINAL.pdf; https://live.worldbank.org/marine-plastics-east-asia-pacific.

PART II. THE STATE OF MARINE PLASTIC POLLUTION IN AIODIS

5 Scale of marine plastic pollution in AIODIS

5.1 Estimating marine plastic pollution in AIODIS

There are three main sources of marine plastic pollution (MPP) in AIODIS:

- mismanaged or unmanaged solid waste (SW), the main source of MPP
- marine sources, mainly from fishing activities and shipping with a minor contribution from marine leisure (e.g., yachts, cruise ships)
- ocean transport from non-AIODIS, such as from the outflows of major rivers draining large urban areas.

Estimates of MPP are generally lacking, outdated, or incomplete for AIODIS countries.[230] The estimates[231] of MPP generated by the AIODIS that are provided in this report are indicative and preliminary. The estimates are based on available information and assumptions regarding solid waste management (or mismanagement), on the scale and nature of the fisheries, on the shipping activities an, for some countries, on an estimate of MPP from microplastics (Table 19 and Table 17 below).

Where a value is provided for MPP from shipping and from 'non-AIODIS ocean sources' of MPP, the value should be regarded as a placeholder for the amounts generated on an annual basis, as robust quantitative information on MPP from these sources is lacking. No attempts have been made to assess the cumulative quantities of MPP such as the quantity of floating or suspended marine plastic, or the quantity of microplastics in the EEZ, or in sediments, as this would be a complex exercise beyond the scope of the current study. In other words, the estimates are largely limited to an assessment of the quantities generated by national activities on an annual basis and notional values for the quantities of MPP transported from non-AIODIS sources.

The estimates are provided to indicate an order of magnitude of the MPP, to identify sources of MPP, to illustrate the knowledge gaps in quantification and monitoring of MPP, and to provide a basis for discussion of national plans or strategies to combat MPP.

Table 16 provides a simple baseline extrapolation of MPP from mismanaged plastic solid waste alone based on World Bank data on solid waste (see Table 19). Table 16 presents two estimates for MPP in AIODIS, assuming leakages of mismanaged plastic waste to the ocean of 1 percent and 5 percent respectively. The country working papers (Appendix 1) suggest that several AIODIS have higher levels of leakage of mismanaged plastic waste to the ocean. This is attributable to several factors, notably the direct dumping of household waste on the beach, into the sea or into rivers and streams.

[230] Lwandle Technologies Pty Ltd, WIOMSA. 2007. Marine litter in the West Indian Ocean region: First regional assessment Technical Report · January 2007. UNEP, WIOMSA, GPA.

[231] Although part of the AIODIS group, La Réunion is not included in the country working papers.

Table 16. Baseline estimates of marine plastic pollution from mismanaged solid waste in AIODIS

Country	municipal/ total waste (tons/yr)	plastic (%)	plastic waste (tons/yr)	Waste collection (%)	Not collected (tons/yr)	plastic leakage to ocean (scenarios)	
						1%	5%
Cape Verde	173,569	0.099	17,183	0.76	4,124	41	206
Comoros	148,941	0.05	7,447	0.48	3,872	39	194
Guinea Bissau	420,682	0.05	21,034	0.77	4,838	48	242
Maldives	211,505	0.05	10,575.25	0.382	6,536	65	327
Madagascar	689,850	0.1	68,985	0.48	35,872	359	1,794
Mauritius	480,000	12.4	59,520	0.084	54,520	545	2,726
Sao Tome & Principe	25,587	0.075	1,919	0.484	990	10	50
Seychelles	86,250	0.075	5,516	0.9	562	6	28
Réunion	514470	0.149	76656	1	0	-	-

Source: Author, compiled from different sources.

Note: The values provided may be inconsistent between tables as they may be derived from different sources, or refer to different years. See Appendix 1 for details of country estimates.

Table 17 provides a second estimate based on the country studies. This latter estimate (6,879 tons/year) is higher by just over 1,300 tons and is considered to be more realistic, as it is based on more detailed country-level information, including on the economic, geographical and governance constraints to solid waste management (SWM).

Table 17. Estimates of MPP based on Country Working Papers

Country	MPP (ton/year)
Cabo Verde	300
Comoros	1,814
Guinea-Bissau	409
Madagascar	3,478
Maldives	256
Mauritius	158
São Tomé and Príncipe	61
Seychelles	403

Sources: From Country Working Papers except Seychelles which is from Table 16.

While it is not particularly useful to make comparisons between countries, for illustrative purposes, Table 18 provides an indication of the level of MPP in relation to country income levels and the area of the EEZ.

Table 18. MPP in relation to population, GNI and EEZ

Country	MPP/ population (kg/capita/yr)	MPP/ per capita GNI (tons/$)	MMP/EEZ (kg/km²)
Cabo Verde	0.55	0.21	0.41
Comoros	2.13	0.50	11.34
Guinea-Bissau	0.21	0.50	3.87
Madagascar	0.13	6.69	2.30
Maldives	0.47	0.03	0.28
Mauritius	0.12	0.01	0.08
São Tomé and Príncipe	0.28	0.03	0.37
Seychelles	4.13	0.024	0.29

The following sections briefly review the sources of MPP in AIODIS. Further country-level details are provided in Appendix 1.

5.1.1 Mismanaged solid waste

Solid waste (SW) can be disaggregated in several ways: urban/rural; household/commercial. A breakdown by type of waste is of particular importance to MPP: organic (or compostable waste); versus recyclable and reusable waste (e.g., glass bottles, cans and some plastics). Additional disaggregation into other types of waste is also of relevance, as plastics often form part of other wastes, such as construction waste, e-waste (computers, cell-phones), fishing gear, GRP boats, or car tyres. Table 19 provides preliminary estimates of unmanaged plastic waste in the developing AIODIS countries.[232] The values are extracted from available World Bank data and adjusted to reflect population increase. Table 20 provides summary information on SWM in AIODIS based on this (adjusted) data.

Table 19. Baseline estimate of solid waste generation in AIODIS

Country	Municipal solid waste tons/year	Population	Waste: kg per capita per day	Waste: tons per capita/ yr	Year	Data source
Cabo Verde	132,555	513,979	0.71	0.26	2012	de Carvalho 2013
Comoros	93,134	796,000	0.32	0.12	2015	World Bank 2015
Guinea-Bissau	289,514	1,770,526	0.45	0.16	2015	Ferrari et al. 2016
Madagascar	3,768,759	24,894,551	0.41	0.15	2016	World Bank 2016
Maldives	211,506	409,163	1.44	0.52	2015	Maldives, WMPDC and MEE 2017
Mauritius	438,000	1,263,473	0.95	0.35	2016	Min. SS,NS,E&SD 2017
São Tomé and Príncipe	25,587	191,266	0.37	0.13	2014	Dias, Vaz, and Carvalho 2014
Seychelles	48,000	88,303	1.57	0.54	2012	Talma and Martin 2013

Source: World Bank, 2018. What a Waste.

[232] The values are taken from the World Bank study 'What a Waste 2.0' and adjusted for population change.

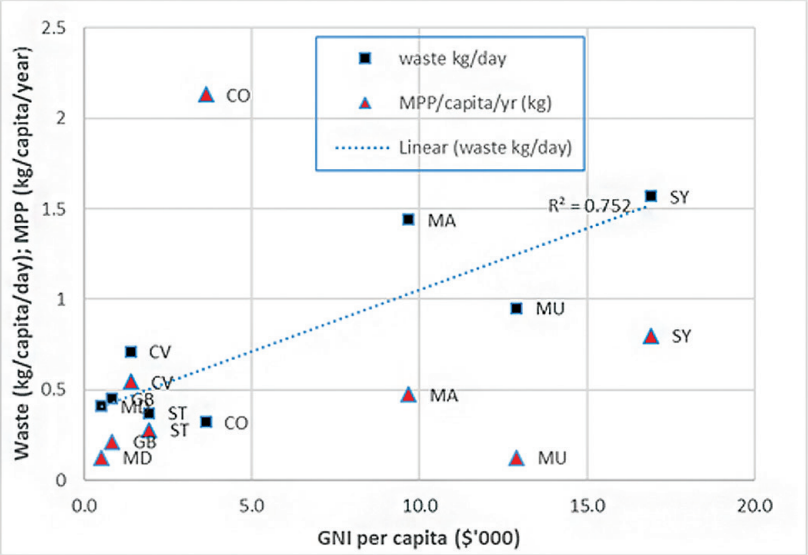
Table 20. Selected characteristics of solid waste management (SWM) in AIODIS

Country	Characteristics of solid waste management	Source
Cape Verde	76% of population served by formal waste collection. Poor waste segregation. Island-level 'solutions'.	Based on ANAS, 2016
Comoros	Collection limited, varies by community; not sorted; major issues with informal dumping and burning. Numerous technical, economic and governance. Split responsibilities (national/ island/ municipalities). Relatively low awareness of MPP.	Charbuillet 2018; Cap Business
Guinea Bissau	Maximum of 10% collected; 5% plastic. Low waste segregation except where there are income opportunities (glass, cans, PET bottles) Numerous SWM issues: rural SWM unclear; relatively low level of awareness of MPP.	Djonu et al.; Ferrari et al.; LVIA; author
Madagascar	Collection limited (17%), no formal sorting; some plastic product manufacture, 3.7 million tons MSW/yr Major differences between municipalities.	World Bank
Maldives	>90% collected ('urban' areas), formal inter-island waste transport, 'landfill' island constructed, regional and island waste collection centres; PET exported. Landfill capacity extremely limited. Very high level of awareness of MPP and high-level political engagement.	World Bank
Mauritius	40% recycled; some product manufacture. Good level of awareness, but some poor consumer practices.	Cap Business
Sao Tome	48% waste collection, 25,000 tons municipal solid waste/yr. Some direct dumping on beaches and into waterways. Technical and economic issues. Relatively low awareness of MPP.	World Bank
Seychelles	Up to 95% waste collected. Approx. 240 tons/yr PET chips exported. Landfill capacity limited. High level of awareness of MPP and high-level political engagement.	Cap Buisness, ETH
All	All countries have some form of ban on plastic bags. In some countries these are ignored or not enforced.	

Note: For additional details see Appendix 1, Country Reports.

In AIODIS, as a group, while there is a strong relationship between per capita income and waste generation ($r^2 > 0.75$), there is no statistically significant relationship between per capita income and MPP for the group ($r^2 < 0.01$) (Figure 9).

Figure 9. Income, waste generation and MPP in AIODIS



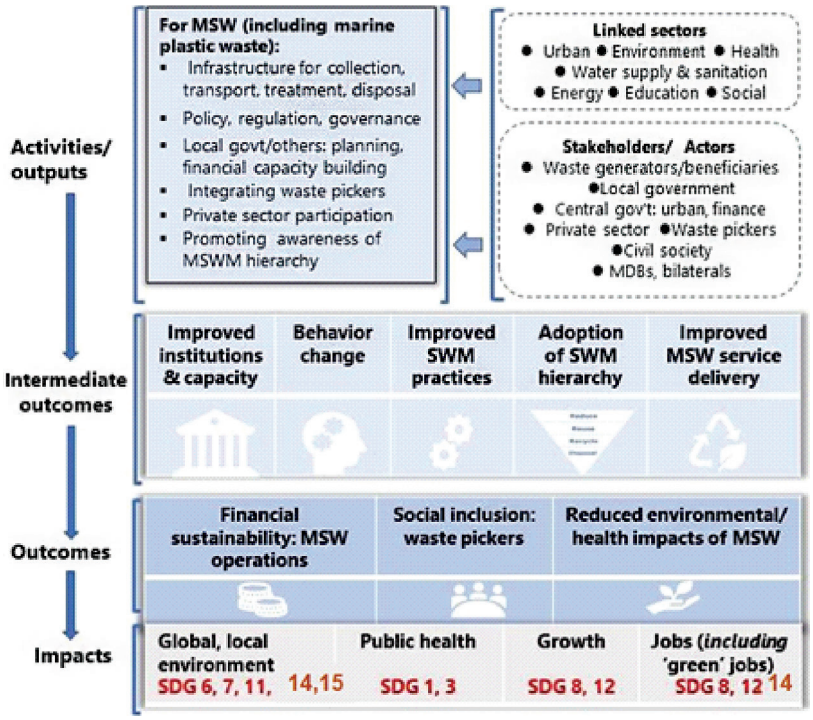
It is suggested that while income is an underlying factor in waste generation and waste collection, a number of other factors are also of importance. The physical and human geography determines options and costs of waste management. Atolls have little or no available land for waste disposal. Selection of landfill sites on rocky volcanic islands presents technical difficulties and shortage of drinking water on atolls and small volcanic islands leads to extensive use of plastic water bottles. Transport of waste on relatively remote islands (or between islands) incurs high costs which are rarely, if ever, accounted in the sales value of products. Road transport links may be poor or non-existent for some communities, while transport of waste by sea is unlikely to be compatible with transport of agricultural or fisheries products from small communities. The technical capacity to segregate and manage an ever-growing diversity of waste streams (medical, e-waste, metals, glass, plastics, agricultural chemicals) is generally lacking in small island or rural communities and opportunities to 'value' waste are few because of the lack of market opportunities, high energy costs for transformation and a weak technological base.

In general, reliable data on SWM is deficient in many AIODIS. Information on quantities, composition and collection often shows inconsistency between different reports which is partly attributable to the different means of monitoring by municipalities, a selective focus on particular waste streams (e.g., 'green waste' for composting or 'waste to energy'). There is also a major knowledge gap with respect to the leakage of mismanaged plastic waste to the marine environment. Information on the likely differences in leakage from urban and rural communities, leakage from coastal compared to inland communities and from agriculture is lacking. The assumptions made in the Country Working Papers with respect to leakage rely on fragmented empirical data.

The policy linkages between SWM and the SDGs, particularly to SDG 14 generally lack assertion, so that SWM may not garner the necessary support. For example, SWM indicators may not be included in state of the environment reports.[233]

[233] Ferronato, N. and V. Torretta, 2019. Waste Mismanagement in Developing Countries: A Review of Global Issues. Int. J. Environ. Res. Public Health 2019, 16, 1060; doi:10.3390/ijerph16061060; International Solid Waste Association, 2017. Prevent Marine Plastic Litter - Now! ISWA Marine Task Force Report 2017. https://marinelitter.iswa.org/fileadmin/user_upload/Marine_Task_Force_Report_2017/ISWA_report_interactive.pdf.

Figure 10. Links between solid waste management and the SDGs



Source: World Bank

Fragmentation in SWM institutional mandates is evident at national, island or municipality levels. This impacts on coordination, on alignment of public finance and budget support; on contracts with private SWM operators and on economies of scale and financing of waste collection, in waste separation, reuse/recycling and final disposal. There are numerous instances of infrastructure (collection trucks, compacters), often financed by development partners, which cannot be maintained either because of lack of recurrent budgets, or technical challenges. Project design may not reflect the realities of financing SWM recurrent costs given the competing demands on public funds at the local level (e.g., road maintenance, water supply), low household willingness to pay, or inability to collect waste disposal charges. The structure, governance and performance of dedicated waste management funds, such as those financed by waste collection charges or EPR contributions in AIODIS and similar island economies has not been examined.

It may be useful to group the SWM issues. Madagascar and Mauritius have existing plastic manufacture and recycling enterprises, while the other smaller island economies generally need to either export plastic waste or dispose by incineration or landfill (both of which are the least preferred options in a waste hierarchy). Scale, population density, rural/urban divide, education, income and inequality have all been found to influence SWM and the design of SWM schemes.[234] For example, organisation of informal waste collectors can be particularly important in disadvantaged communities. A number of key questions that bridge between SWM and a plastic circular economy (CE) are scale, economics and coordination among key stakeholders.

Scale. Given the small size of the national economies, discrete island and remote communities, what is the smallest scale on which different (plastic) waste streams can be 'valued'? For example, in the case of PET bottles, can a basic PET flake manufacturing unit be made viable on an island in Comoros,

[234] Vieira, V.H.A., et al., 2017. The impact of socioeconomic factors on municipal solid waste generation in São Paulo, Brazil. Waste Management & Research: The Journal for a Sustainable Circular Economy. Vol 36, Issue 1, 2018.

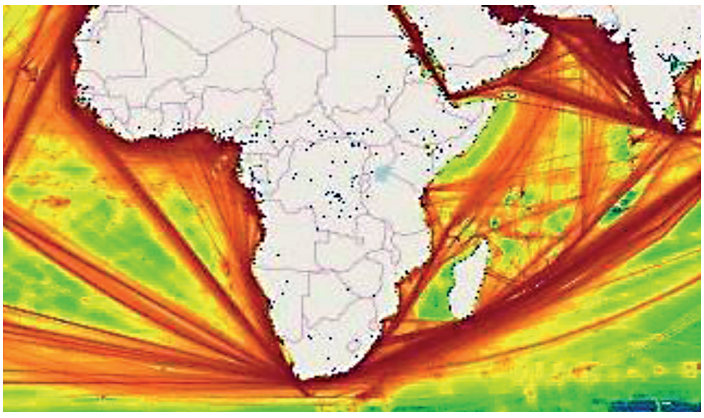
on an island in Cape Verde, an atoll in Maldives, or a coastal community in Madagascar? What is the minimum population, plastic consumption, or waste volume required for effective circular economy initiatives? Can such a unit function on renewable energy and what are the requirements for water or other scarce or costly inputs at island level?[235] Similar questions can be posed in relation to other technologies: compacting; separating different plastics; use for production of tiles, bricks or other products with a local market; or waste to energy conversion.

Economics. As the costs associated with plastic waste are generally not included in the price of plastic products, the costs must be borne indirectly by consumers (e.g., through waste collection charges), by society (government allocations to municipalities, public health), or by the environment (contamination, pollution). Public awareness of these costs and their distribution underpins design, implementation and effectiveness of SWM schemes and policies to combat MPP through changed consumer behaviour, prohibitions or taxes on some plastics, EPR schemes, or support for innovation in SWM, waste reuse and recycling.

Coordination. Efficient, cost-effective and sustainable SWM and schemes to combat MPP rely on coordinated activities by all major stakeholders. These include households and enterprises that generate waste, municipal and national authorities, and civil society organisations. The relationships between key actors, understanding of their respective responsibilities, of their contractual and financial arrangements and means of monitoring and adjustment require clarity, transparency and equity. The key actors include: community and business organisations, waste management enterprises or parastatals, municipal, island and national authorities, NGOs and consumers. National planners have a particular role in setting out national SWM plans and creating a firm foundation for the required public and private investment, to avoid fragmentation, to provide leadership, and to set out a vision for an equitable distribution of the costs of SWM.[236]

5.1.2 Shipping and fisheries

Figure 11. Shipping traffic density in AIODIS



Marine sources contribute an estimated 20 percent of MPP. In the absence of reliable information, the values used for MPP from shipping in the Country Working Papers are 'placeholders'. Analyses of beach litter shows that the plastic originates from both domestic and foreign commercial shipping and fisheries. Given that a significant proportion of the shipping and large-scale fishing in AIODIS is foreign owned, it is likely that much of the MPP from marine sources is of foreign origin. No estimates of MPP from shipping or from foreign fishing are available by country or EEZ and there is poor understanding of the distribution of marine debris caused by shipping. A useful starting point would be a compilation of reports from AIODIS ports with regard to the monitoring of the ships' garbage logbooks as required under MARPOL Annex V complemented by a compilation of information on the use and adequacy of ships' garbage reception facilities, and a calibration of related shipping

[235] See the following for an example of how a large-scale PET bottle pelleting plant operates. https://www.youtube.com/watch?v=vAr4BZM_Tzk. For a small-scale solar-powered initiative (Timor L'este), see: https://renew.org.au/renew-magazine/reuse-recycling/small-scale-plastic-recycling/; and for other small-scale plastic recycling resources see: https://www.plasticasaresource.com/user-guides.html; https://www.fastcompany.com/40486883/these-diy-machines-let-anyone-recycle-plastic-into-new-products; https://preciousplastic.com/. For indicative prices of some small-scale recycling equipment see: https://bazar.preciousplastic.com/.

[236] For a detailed discussion of these issues, see What a Waste 2.0, chapters 4 and 5.

traffic by EEZ (Figure 11). Consideration could also be given to the designation of selected AIODIS areas (e.g., the Northern Mozambique Channel) as 'special areas' under MARPOL Annex V.[237]

For domestic fisheries, the MPP values are based on the import of fishing nets or gear with an assumption that a proportion of the imports can be attributed to replacement of nets and gear lost at sea. Additional information on the imports, on fisher behaviour, on facilities for collection of waste fishing gear, or on schemes to recover lost gear and FADs could improve these estimates. Part III provides links to guidelines on implementation of MARPOL Annex V provisions with regard to plastic waste and on approaches to reduce MPP from fisheries activities.[238]

Glass-reinforced-plastic (GRP or fiberglass) vessels are likely to constitute a growing threat of MPP as many end-of-life boats are left to deteriorate on beaches or sunk at moorings. Disposal of GRP boats presents considerable challenges as, in island economies, there are few, if any, cost-effective means of effective disposal.

5.1.3 Tourism and beach-clean-ups

An indication of the variability in quantities of beached MPP is provided in Table 21. River mouths tend to have high levels of marine debris as they funnel litter from storm drains and roads and waste may be dumped directly into rivers and streams. The composition of beached MPP varies with the collection site, tides, waste management practices, and consumer and vessel behaviour. In general, the level and the composition of MPP, as assessed from beach litter surveys, is related to the proximity of the beach to urban centres and for remote islands the proximity to shipping lanes and the intensity of fishing activities in the area. The contribution of MPP from more distant sources by ocean transport is related to the floating characteristics of the plastics, the ocean current system, the influence of winds and other oceanographic factors. As some plastics sink, the overall composition of MPP cannot be inferred from beached marine litter. However, the composition illustrates the waste management challenges and opportunities to change behaviours (Table 22). PET bottles and plastic bags and wrappers are a dominant component in all AIODIS.[239] However, the high proportion of cigarette butts in Mauritius (Table 22) may illustrate an opportunity to change habits of beach users in relation to cigarette disposal.

Table 21. Results of beach collection of marine debris

Site	tons	km	tons per km
Seychelles - Isle du Nord collection	2.43	1,128	0.002
Seychelles – Aldabra (estimated tons)	513.0	85	6.035
Mauritius - Grande Riviere Noire collection	8.66	19	0.464

Source: https://www.coastalcleanupdata.org/; Burt, et al. 2020.

A clean-up on Aldabra atoll (Seychelles), an isolated World Heritage Site and one of the world's largest atolls, recorded 26.4 tons of waste, including 6 tons of plastic shoes (60,000 flip-flops) and estimated that over 500 tons remained on the 85 km shore.[240] Analysis showed that different types of plastic waste lodge in different beach habitats. Aldabra is at the nexus of a major tuna fishery and has a

[237] Guidelines for the Designation of Special Areas and the Identification of Particularly Sensitive Sea Areas. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/A24-Res.982.pdf.

[238] For an example of an integrated approach to MPP from fisheries see: Stulgis, M. 2019. Marine litter in a European context. Presentation, DG for Maritime Affairs and Fisheries, EC. https://static1.squarespace.com/static/58525fe86a4963931b99a5d1/t/5ce4f4554d7c5c000119c9ee/1558508634370/Day2_05.pdf. See also: https://www.marelittbaltic.eu/documentation.

[239] A 2014 beach litter collection in Guinea Bissau's Parque Nacional Marinho João Vieira - Poilão found 7.5 kg of litter in 100m consisting mainly of plastic bags and wrappers (by number).

[240] Burt, A.J., et al. 2020. The costs of removing the unsanctioned import of marine plastic litter to small island states. Nature Scientific Reports (2020) 10:14458. https://doi.org/10.1038/s41598-020-71444-6.

particularly high level of fisheries debris (because of its flotation characteristics, fishing gear may beach more readily than other plastics). Fishing gear comprised 83 percent of the debris by weight, followed by plastic shoes (7 percent). The clean-up cost for the litter removed from this remote location was over $220,000, or $8,900 per ton of litter – an estimated $4.68 million for removal of the remaining 513 tons polluting the entire atoll, a UNESCO World Heritage Site. The responsibility of the fishing industry remains unclear despite resolutions in the region's tuna management organisation.

Table 22. Composition of beach litter Seychelles and Mauritius by number of items (%)

Category/ item	Seychelles, Isle du Nord	Mauritius, Gr. Riviere Noire
Consumables of which:	51.27	78.99
- Plastic bottles	26.26	18.42
- Plastic bottle caps	9.78	3.66
- Cigarette butts	2.1	16.73
- Food wrappers	1.63	7.86
Fishing gear	2.81	0.76
Packing materials of which:	42.03	14.84
- Foam packing	38.42	12.43
Other	3.74	5.03

Source: https://www.coastalcleanupdata.org / Burt, et al. 2020.

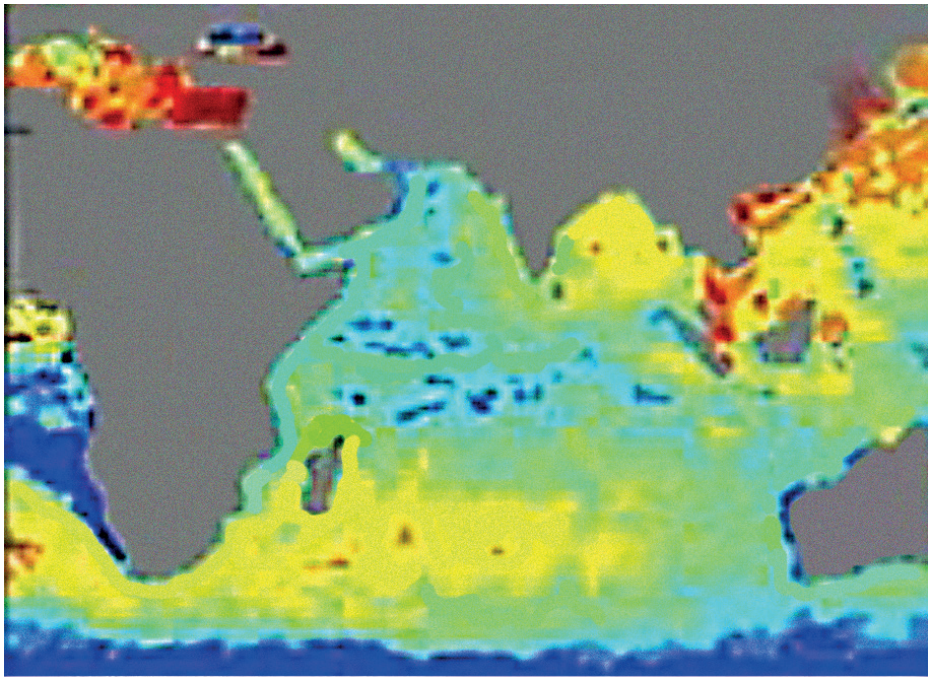
Although any extrapolation from beach surveys is questionable, if a mean of 100 kg of plastic per km for the 18,215 km combined coastlines of the AIODIS developing countries is assumed, the total MPP on AIODIS beaches would be in the order of 2,000 tons. In the absence of repeated same-site surveys using a standard collection and sorting protocol, it is difficult to establish the rate at which plastic accumulates on different beaches and to draw conclusions as to the origin of the plastic.

Studies in South Africa indicate that urban concentrations contribute orders of magnitude more marine debris (20 percent plastic) than isolated (rural) areas; and that there is a higher proportion of plastic in oceanic marine debris (≈75 percent, with significantly more 'fisheries' debris) than in coastal or beach marine debris.[241] There is also evidence that coastal wetlands and mangrove areas can 'trap' plastics before they enter the open ocean, suggesting that the global estimates of the proportion of solid waste becoming MPP may be overestimates for some countries, for example where extensive river deltas exist.[242]

[241] Ryan PG. 2019. The transport and fate of marine plastics in South Africa and adjacent oceans. S Afr J Sci. 2020;116(5/6), Art. #7677, 9 pages. https://doi.org/10.17159/ sajs.2020/7677.

[242] Appadoo, C. et al. 2020. Macro-litter Monitoring in Mangroves, in Barnardo & Ribbink (Eds). African Marine Litter Monitoring Manual, pp. 43-56, Chapter 5. July 2020.

Figure 12. Graphical representation of relative microplastic density



Source: after van Sibele, 2015 (model)

5.1.4 Transport by ocean currents

The transport of MPP by ocean currents varies widely among AIODIS and is dependent on the quantities and type of marine plastic debris generated in the particular ocean regions and the current systems. Some plastic sinks, some is suspended in the water column and a proportion of the floating plastic may be washed up on shores. Much of the larger plastic particles degrade to microplastics. Studies confirm the transport of MPP to AIODIS marine spaces by current systems, but estimates of the quantities of MPP carried by ocean currents and entering the AIODIS EEZs are not currently available.[243] The direct observation studies are generally of MPP in discrete coastal areas or enclosed seas. Larger-scale studies tend to focus on ocean basins or global distribution of either floating plastic debris, or microplastics. These studies generally use models to map flows and distribution, such as those suggesting a highly dispersed 'garbage patch' south of Madagascar and in the Southern Atlantic (e.g., Figure 12).[244]

Atlantic and Gulf of Guinea. Plastics from over 25 countries are found on Cape Verde beaches with over 16 tons removed from the western beaches of Sal Island.[245] Cape Verde is seasonally important for tuna fishing and is located at the nexus of several different North Atlantic currents and at the eastern end of the North Atlantic Subtropical Gyre which is a 'marker' for the North Atlantic 'garbage patch' (Figure 13).[246]

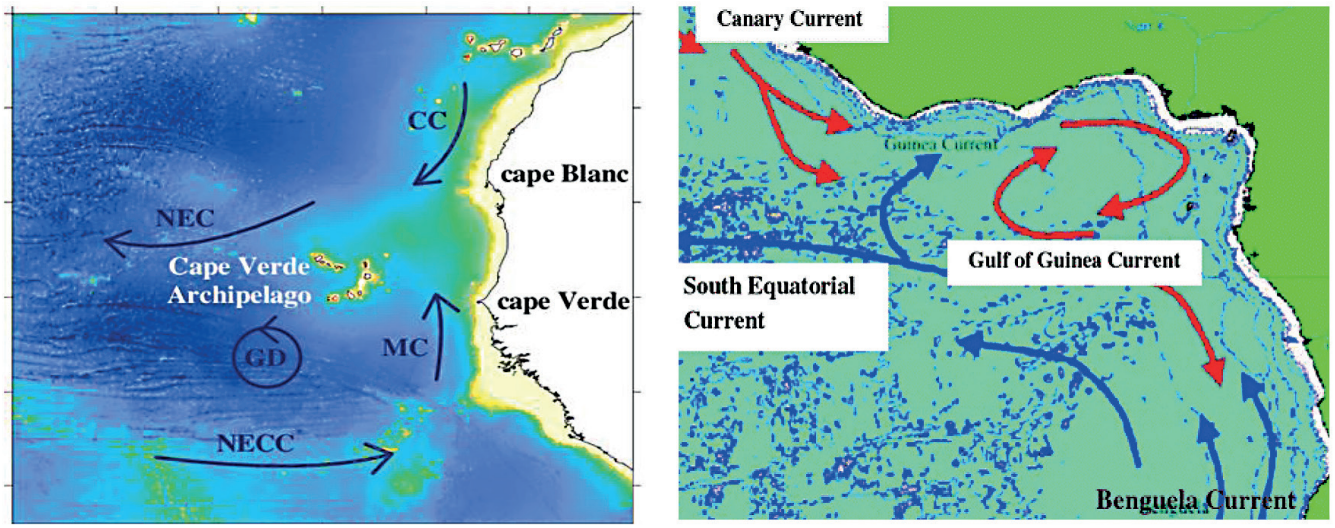
[243] The lack of coverage is well recognised: Maximenko, N. et al. 2019. Toward the Integrated Marine Debris Observing System. Front. Mar. Sci., 28 August 2019. https://doi.org/10.3389/fmars.2019.00447.

[244] Many studies are at the level of current systems or ocean basins. For example: 'The combined mass of just the three most-littered plastics (polyethylene, polypropylene, and polystyrene) of 32–651 μm size-class suspended in the top 200m of the Atlantic Ocean is [estimated at] 11.6–21.1 million tons.' Pabortsava, K. and R.S. Lampitt, 2020. High concentrations of plastic hidden beneath the surface of the Atlantic Ocean. Nature Communications (2020) 11:4073.

[245] https://beachcam.meo.pt/newsroom/2018/12/cabo-verde-invadido-de-plastico-oriundos-de-mais-de-20-paises/. Schmidt, N. et al.. The Amazon River -a major source of organic plastic additives to the tropical North Atlantic?. Environmental Science and Technology, American Chemical Society, 2019, 53 (13), pp.7513-7521.

[246] Law. K.L. et al. 2010. Plastic Accumulation in the North Atlantic Subtropical Gyre. Science 329, 1185 (2010); Raqueline C P. et al. 2018. Plastic pollution in islands of the Atlantic Ocean. Environ Pollut . 2018 Jul. 238:103-110.

Figure 13. Currents in the Eastern Central Atlantic and Gulf of Guinea



Source: Fernandes et al. 2005[247]

Microplastic concentrations greater than 100g per litre have been found in Canary Island beach sediment.[248] At an ocean scale, a cumulative total of 11.6–21.1 million tons of polyethylene, polypropylene, and polystyrene microplastics is estimated to be in the top 200m of the Atlantic Ocean. Important turtle nesting beaches in Cape Verde and Guinea Bissau are polluted by large quantities of plastic. While Sao Tome and Principe may not generate significant MPP, it may be subject to pollution carried from the outflows of the Niger, Kwa Ibo and Congo rivers.

Western Indian Ocean (WIO). Analysis of marine debris beached on the remote Alphonse Is. (Seychelles) illustrates the external origin of some of the region's MPP. The survey found a total of 142 kg per kilometer, or 4.7 items per meter of coastline. An estimated 96 percent of the marine debris items collected were made of plastic. Beach sandals made the largest contribution (33 kg). More than 75 percent of labelled items originated from Asian countries (mainly Indonesia, Thailand and China), while only 4 percent originated in WIO island countries.[249] Beach clean-ups on Diego Garcia collect about 2 tons per year of which 80 percent is plastic. As the local generation of plastic waste is negligible, the plastic in the beached marine debris has been transported by ocean currents.[250]

South Asian coastal countries rank among the global 'top twenty' in terms of quantity of mismanaged plastic waste. The complex ocean currents and a modelling of ocean drift from SE Asia are illustrated in Figure 14. Studies indicate that the plastic also tends to transport toxins from land-based activities to the marine environment where they can impact on marine life (Figure 15).[251]

[247] Fernandes, M.J. et al. 2005. Oceanographic Characterization of the Cape Verde Region Using Multisensor Data. Proc. of the 2004 Envisat & ERS Symposium, Salzburg, Austria 6-10 September 2004.

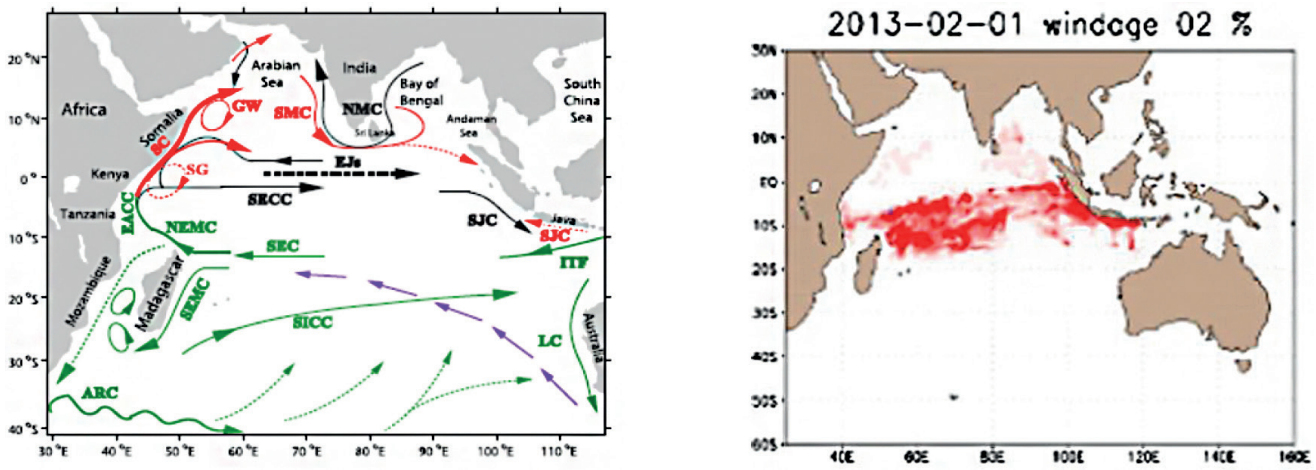
[248] Baztan, J. et al. 2014. Protected areas in the Atlantic facing the hazards of micro-plastic pollution: First diagnosis of three islands in the Canary Current. Marine Pollution Bulletin, Elsevier, 2014, 80 (1-2), pp.302-311.

[249] Duhec, A.V. et al. 2015. Composition and potential origin of marine debris stranded in the Western Indian Ocean on remote Alphonse Island, Seychelles. Marine Pollution Bulletin 96 (2015) 76–86.

[250] https://biot.gov.io/wp-content/uploads/2018-Annual-Report-BIOT-Final.pdf; https://www.darwininitiative.org.uk/documents/DPLUS090/24980/DPLUS090%20AR1%20-%20edited.pdf.

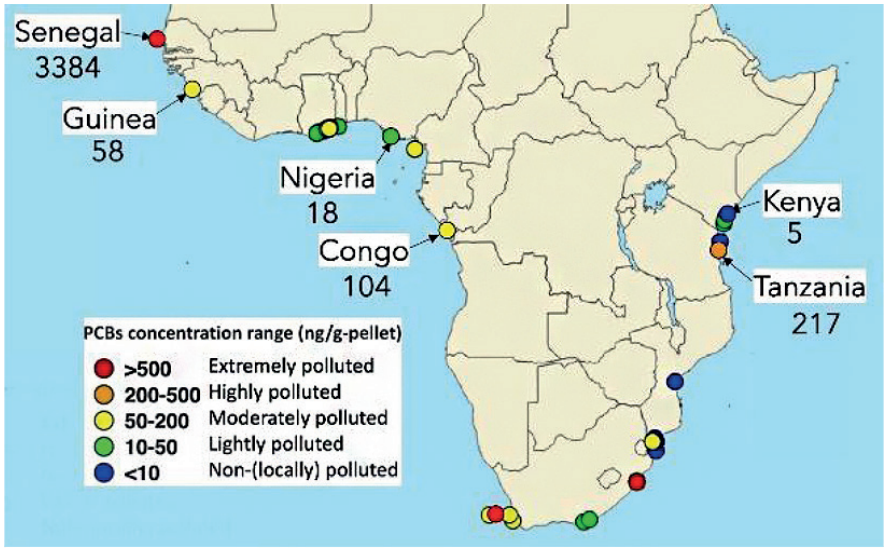
[251] Cartraud, A.E. et al. 2019. Plastic ingestion in seabirds of the western Indian Ocean. Marine Pollution Bulletin, Elsevier, 2019, 140, pp.308-314. See also: Lachmann F., et al. 2017. Marine plastic litter on Small Island Developing States (SIDS): Impacts and measures. Report No. 2017:3. Swedish Institute for the Marine Environment.

Figure 14. WIO surface currents and plastic carried by ocean currents (model)



Images : Surface currents, model of plastic transport[252]

Figure 15. PCBs in plastics in the environment



Recent analyses of leakage of plastics from the East Africa mainland (South Africa, Mozambique, Tanzania and Kenya) suggest that these countries contribute 190,000 tons of MPP/ year, or about 33 times that of the five island countries combined (<6,000 tons/year).[253] The leakage is mainly from urban areas and river outflows. A number of important studies are currently under way under the umbrella of WIOMSA/ Nairobi Convention and the results of these studies should be taken into account when they become available.[254]

[252] South Equatorial Current (SEC), South Equatorial Countercurrent (SECC), South Indian Ocean Countercurrent (SICC), Northeast and Southeast Madagascar Current (NEMC and SEMC), East African Coastal Current (EACC), Somalia Current (SC), Equatorial Jets (EJs), Southwest and Northeast Monsoon Currents (SMC and NMC), Northeast and Southeast Madagascar Currents (NEMC and SEMC), Great Whirl (GW), and South Gyre (SG). Summer (winter) red (black), all seasons green. Line thickness here represents the strength of current. For the ocean drift model see: Peng, S. et al. op. cit.

[253] Manyara, P. 2021. Shaping action and measures to effectively address marine plastic pollution in the Western Indian Ocean Region. IUCN. Nairobi Convention, WIO Regional Science to Policy Meeting

[254] Manyara, ibid.; Olivier, F. et al. A review of marine plastic litter in the WIO region: Effectiveness of measures undertaken, and opportunities. ECOGEOS; Thiel, M. et al. A review of the current status of marine litter and microplastics knowledge in the Western Indian Ocean region: amounts, sources, fate and resultant ecological and human health impacts on the coastal and marine environment; Ribbink, A. et al. Economic consequences of unmanaged plastics and the economic opportunities in the WIO region. Sustainable Seas Trust.

On average, plastic comprises 13 percent of solid waste in Sub-Saharan Africa (SSA). The average collection rate in SSA in 2015 was estimated at 44 percent and 39 percent for the East Africa mainland states in 2020 (excluding Somalia).[255] However, average waste collection rates are often meaningless as there can be considerable variation between countries and municipalities. Information on urban/rural differences in SWM is sparse: in Ghana open dumping was about 30 percent in urban areas, while 80 percent in rural areas, suggesting that coastal rural areas may generate a relatively higher per capita leakage of plastics to the marine environment.

5.1.5 Microplastic pollution

Information on microplastic pollution in AIODIS is extremely limited. However very high levels have been recorded in Maldives, thought to be associated with leakage from landfills. Most of the studies assess microplastics in sediments, in beach sand or in corals or other organisms. Representative information on microplastics in AIODIS sediments, ocean waters or biota is effectively non-existent.[256] Estimates of the quantity of microplastics in the ocean water body are closely related to the mesh size used in the sampling. In many instances the quantity of smaller particles (nanoplastics) may not be adequately represented and as a result, estimates of microplastics in ocean waters or sediments tends to be underestimated.[257]

For three countries, estimates of the level of microplastic marine pollution generated annually from car tyre abrasion have been included in the Country Working Papers as part of the country MPP estimate (Table 23). The values presented are rudimentary and partial and based on estimates of car tyre abrasion, which is considered to be a major source of microplastic pollution. As such, these values are a simplistic proxy for microplastic marine pollution, should be treated with caution, and should not be regarded as definitive, but as a basis for further work. Although tyre abrasion is considered a major source of environmental microplastics, estimation of its contribution to MPP is technically challenging.[258] If car tyre abrasion accounts for 28 percent of microplastic marine pollution,[259] and the combined estimates from the Country Working Papers are raised to 100 percent (population is used as the raising factor for countries where no estimate was made), then AIODIS as a group may generate in the order of 2,470 tons per year of microplastic pollution.

Table 23. Estimates of microplastic pollution from tyre abrasion (tons/year)

Country	tyres	vehicles
Madagascar	51	22
Maldives	5	17
Mauritius	17	102

Source: Country Working Papers (two methods: based on A. tyre imports and B. numbers of vehicles)

An assessment of microplastics pollution associated with waste water treatment may be of particular interest. Where microplastics are retained in waste water sludge, then the use of sludge as fertiliser is likely to result in microplastic pollution of agriculture and possible rainwater runoff or leaching of microplastics into the ocean. In Europe and North America, approximately 50 percent of waste water

[255] UNEP. 2018. Africa Waste Management Outlook. Nairobi, Kenya: UNEP. http://hdl.handle.net/20.500.11822/25514

[256] Alimi, O.S, et al. Microplastics in African ecosystems: Current knowledge, abundance, associated contaminants, techniques, and research needs. Science of the Total Environment. Volume 755, Part 1, 10 February 2021, 142422.

[257] Lindeque, P.L. et al. 2020. Are we underestimating microplastic abundance in the marine environment? A comparison of microplastic capture with nets of different mesh-size* Environmental Pollution 265 (2020) 114721.

[258] For a discussion of the technical issues involved, see: Parker-Jurd, F. et al. 2020. Investigating the sources and pathways of synthetic fibre and vehicle tyre wear contamination into the marine environment. Report prepared for the Department for Environment Food and Rural Affairs (UK).

[259] Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN. 43pp.

sludge is reused as fertilizer and in Norway, about two thirds. South Africa is also known to use high proportions of sludge as fertiliser. The fate of sludge in AIODIS is unclear. Microplastics in waste water tend to have a high fibre content, largely as a result of washing textiles.[260]

In the absence of robust information on the scale and sources of microplastics, AIODIS could consider, at minimum, measures to ban products containing plastic microbeads, ideally through regional measures negotiated through the RECs.

6. National policies, plans and institutions

National policies, plans, institutional arrangements and legal and fiscal measures are described in detail in the Country Working Papers. This section provides an overview of selected features.

6.1 Policies and plans

Arguably, only Maldives has a comprehensive suite of policies, plans and measures to address plastic pollution in general. Combatting MPP is an integral part of those activities. In other countries, MPP is addressed in a somewhat fragmented manner: as a marginal part of solid waste management (SWM) (all countries), through awareness campaigns and beach clean-ups (all countries); through bans on plastic bags (all countries) and through bottle deposit and return schemes (e.g., Seychelles); or through circular economy initiatives to reuse of waste plastic (most countries). There is generally a coordination gap across policies, institutions and business, with regard to planning and financing, and with regard to knowledge management, human capacity and support for innovation.

There are several reasons why Maldives has a well-developed suite of policy measures and SWM plans. It has an acute solid waste disposal problem, given the shortage of land, the low-lying atoll ecosystem, the reliance on an image of clean waters and beaches for tourism and the technical, logistic and economic challenge of collection and effective disposal of multiple waste streams from hundreds of small and isolated island communities.[261] Maldives has a shortage of drinking water and relies heavily on bottled water and most products are imported, while the weak manufacturing base offers little opportunity for a circular economy. Elements of the tourist industry have been particularly supportive, not only in relation to reducing plastic use, but on circular economy activities at resort or atoll level.

6.1.1 Solid waste management.

Implementation of an effective SWM plan is fundamental to combatting MPP. To a greater or lesser extent improved waste management can help deliver all 17 SDGs (Figure 10).[262] Most AIODIS have SWM plans. However, the associated institutional arrangements, financing arrangements and sustainability vary widely:

- there are generally split responsibilities for SWM: between national authorities responsible for the environment, for infrastructure development (e.g., waste dumps/ landfills), for urban or district management (municipalities, island councils). In the absence of clear institutional and financial arrangements, the split responsibilities constrain implementation of plans and the financing and sustainability of SWM systems

[260] About 85% of human-made debris on shorelines around the world are estimated to be microfibers.M. A. Browne, M.A. et al. 2011. Accumulations of microplastic on shorelines worldwide: sources and sinks. Environmental Science & Technology, pp. 9175–9179, 2011. See also: Auta, C. U. et al. 2017. Distribution and importance of microplastics in the marine environment. A review of the sources, fate, effects, and potential solutions. Environment International, vol. 102, pp. 165–176, 2017.

[261] Over 180 inhabited islands and over 150 resort islands.

[262] Lenkiewicz, Z. and M. Webster, 2017. Making Waste Work: A Toolkit Community Waste Management in Low and Middle Income Countries. WasteAid UK and CIWM.

- the plans often underestimate the rate of growth in waste. Information on waste generation, composition, collection and disposal is often dispersed among municipalities or competing private waste management operators. With a focus on urban areas, there is often a lack of information on rural SWM and waste generation by informal settlements
- siting and management of landfills presents numerous technical, social and financing issues. Costs associated with sanitary landfills are high and require economies of scale not available on many islands. Safeguards against leaching and contamination of water tables are required while objections from local residents may result in protracted delays in construction. Poorly managed coastal landfills may result in spillage to the ocean and scattering of wastes by seabirds. The private sector may be reluctant to manage landfills because of perceived liability for unforeseen future damages, or unknown legacy from previous managers
- financing of waste collection and disposal may require significant public investment (e.g., landfill sites) and long-term arrangements with private contractors (to enable investment in waste management equipment). Low public willingness to pay for waste services means that recurrent public support may be required, particularly for SWM in informal settlements
- because of costs, fragmented responsibilities, or political pressures, SWM plans are often implemented incrementally as municipalities secure planning, finance or approval. Within cities significant disparities may exist between areas.

SWM plans encounter a similar set of challenges:

- there is a low rate of formal collection and waste segregation at source
- the importance of informal waste collection (by wastepickers/ catadores) may not be fully appreciated and support for their organisation and wellbeing may be deficient[263]
- there is low uptake of many deposit/ return schemes
- the cost of transport of waste from islands or remote communities generally outweighs its value
- compliance with SWM rules and regulations is often weak and many regulations are unenforceable
- repair and maintenance of equipment may be problematic (e.g., finance, spare parts, technical capacity for compacters, incinerators, collection trucks)
- investment in recycling or reuse often requires stable supplies of sorted wastes and markets for products. Extended support for innovation, SME development and development of technologies may be required. Comparing the relative costs of poorly managed waste and extended support for circular economy initiatives is complicated
- some plastics cannot be recycled (or readily recycled), or have unwanted chemical contaminants which result in market rejection or require high-tech investment
- manufacturing costs associated with a CE may be high, often require economies of scale which may not exist in-country, and may also generate wastes.

The African Union's target is that by 2023 African cities will recycle at least 50 per cent of the waste they generate, an ambitious target given that only 4 percent of MSW was recycled in 2012,[264] although the recycling rate is considerably higher for plastics. In South Africa up to 40 percent of waste is recycled (plastics, glass, metals, paper), mainly through waste segregation at dump sites (i.e., there

[263] Ntuli, Z. 2019. Local realities and political histories: The waste pickers in Sasolburg and their struggle for transformation in the waste management system of South Africa. Masters dissertation. Johannesburg: University of the Witwatersrand; Samson, M. 2020. Lessons from Waste Picker Integration Initiatives. Technical Report: Integrating reclaimers into our understanding of the recycling economy. Johannesburg: University of the Witwatersrand.

[264] UNEP, 2018. Africa Waste Management Outlook. UNEP, Nairobi, Kenya.

is low household level waste separation).[265] South Africa has taken a balanced approach combining developing world solutions with developed world approaches.[266] It recognises that:

- capacity-building, awareness-raising and informed decision-making needs to precede investments
- partnerships and collaboration with civil society and informal sector integration is required to actively participate in all aspects of waste management in their communities
- coherent policies, monitoring and enforcement capacity is required
- as the waste sector is perceived as a high-risk investment, public-private partnerships are key to unlocking opportunities
- combination of small-scale, low-cost, decentralized, community-driven initiatives and larger-scale, higher-cost, centralized initiatives is needed
- applied research, innovation and investment with links to the energy sector are an important part of a more effective SWM life-cycle
- there can be a progressive adoption of more institutionally demanding SWM as knowledge, awareness and capacity develops as a foundation for an integrated waste management system.[267]

6.1.2 Shipping and fisheries waste

Shipping. All AIODIS are parties to MARPOL Annex V (on disposal of ships garbage), but there is little detailed information on the implementation of its provisions either by AIODIS flag vessels or in AIODIS ports.[268] In the absence of any irregularities reported by IMO, it is assumed that there is a good level of compliance. However, Annex V only applies to larger vessels, so that application of its provisions by smaller costal vessels and fishing vessels is lacking. Areas of high biodiversity, such as the Northern Mozambique Channel could potentially be designated a 'special area' under Annex V, such that no garbage can legally be jettisoned in the area. Reports of inspection of ships garbage logbooks could potentially be consolidated regionally to enhance compliance, while Annex V requirements could be extended to fishing vessels through inclusion in licensing conditions.

In Port Louis (Mauritius) a harbour clean-up contract is in place. Male (Maldives) has had port and waterfront clean-ups by volunteers. In South Africa, the Blue Port Project focuses on applied research and strategic interventions to reduce plastic waste.[269] Contractors handling ships garbage generally dispose unsorted garbage in landfills. Some cruise lines sort garbage segregating the plastic for recycling.

AIODIS are party to either the West Africa or Indian Ocean memoranda of understanding (MOU) on port state control (PSC) through which compliance with MAROPL Annex V requirements could be further asserted.[270] Both the West African and East African port networks are engaged with the Ports Environmental Network-Africa (PENAf), and the Port Harbour Masters Network (PPHMN) and could catalyse actions on MPP from shipping.[271]

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[265] Steyn, D. 2021. The Role of the Private Sector in the Management of Plastics as an Environmental Challenge. Nairobi Convention/ WIOMSA Science to Policy Meeting. Some 19 of the world's 50 biggest dumpsites are in Africa. UNEP, 2015. Global Waste Management Outlook.

[266] Department of Science and Technology, 2014. A Waste Research, Development and Innovation Roadmap for South Africa (2015-2025). Summary report. Department of Science and Technology: Pretoria.

[267] Godfrey, L. and A. Nahman 2007. Are developing countries ready for first world waste policy instruments? CSIR Natural Resources and the Environment, South Africa.

[268] IMO 2018. Action plan to address marine plastic litter from ships. MEPC 73, Resolution MEPC.310(73); Dae-Jung Hwang, (2020) The IMO Action Plan to Address Marine Plastic Litter from Ships and Its Follow-Up Timeline, Journal of International Maritime Safety, Environmental Affairs, and Shipping, 4:2, 32-39. https://doi.org/10.1080/25725084.2020.1779428.

[269] See Youth Employment Services/ Blue Port Team project supported by WILDTRUST. https://page.impacttrack.org/blue-port-project.

[270] https://www.iomou.org/.

[271] Port Management Association of Eastern and Southern Africa (PMAESA) (https://www.pmaesa.org/) and the Port Management Association for West and Central Africa, PMAWCA.

Fisheries. The AIODIS country losses of fishing gear by local fleets have been estimated largely as a function of fishing nets and/ or fishing gear imports (see Country Working Papers). There is little or no direct and comprehensive information on collection or disposal of waste gear, on reported losses by fishers, on campaigns to recover lost gear, or on facilities to dispose of waste gear in AIODIS.[272] These are subjects that could be addressed in annual reports of fisheries authorities and by fisher organisations (such as the FPAOI).

The number of drifting FADs in the IOTC area is estimated to be 10,000-14,500 with slightly less in the ICCAT area. An estimated 10 percent of the drifting FADs are reported to be beached in the WIO area each year (1,000-1,400 by EU and Seychelles-flag vessels alone).[273] Loss of anchored FADs can be as much as 80 percent annually. IOTC has agreed to the mandatory use of biodegradable FADs from 1 January 2022, to prevent both entanglement and MPP. The RFMOs require FADs to carry identification. At a global level less than 7 percent of purse seine net fragments are recorded lost. Up to 30 percent of longline gear is lost annually. Loss of entangling nets varies widely with fishing ground.[274] Overall, about 6 percent of fishing gear (nets and lines) are lost annually, although the production and sale of fishing nets indicates that total fishing net waste is considerably higher.[275]

The need to disassemble gear into its different plastic components prior to recycling makes recycling costly. Some components cannot be recycled and non-plastic materials (shells, seaweed) may contaminate the waste. Fishing gear could be a target for 'design for recycling', EPR and focused recovery of wastes.[276] Ideally, waste fishing gear requires facilities for collection at ports and landing sites, arrangements with net importers and manufacturers for recovery and recycling, and information on quantities lost and/ or considered as waste.

None of the AIODIS have comprehensive schemes for disposal of end-of-life glass-reinforced-plastic (GRP, or fiberglass) boats, which are often abandoned on beaches or in fishing ports. Because of its composite nature, GRP is particularly difficult to recycle, or to reuse (because of health issues in cutting GRP boats into pieces). Institutionally, the burden of disposal may fall between the marine, environmental and local authorities as the vessel owner retains ownership rights but may bear little of no legal responsibility for disposal of the vessel.[277] Provisions for the costs associated with end-of-life disposal may need to be set aside at the time of vessel commissioning.

6.2 Legal and market instruments

6.2.1 Regulatory measures

A wide range of legislation has a direct or indirect bearing on MPP (Box 8).[278] As of 2018, some 127 countries had legislation to regulate plastic bags, mostly in the form of restrictions on manufacturing,

[272] The Oceanic Society has provided small grants for removal of lost gear in areas adjacent to turtle nesting beaches, including in Maldives and Sao Tome.

[273] Balderson, S.D. and L. E. C. Martin, 2015. Environmental impacts and causation of 'beached' Drifting Fish Aggregating Devices around Seychelles Islands: a preliminary report on data collected by Island Conservation Society. IOTC–2015–WPEB11–39 (2015); Maufroy, A., et al. 2015. Large-Scale Examination of Spatio-Temporal Patterns of Drifting Fish Aggregating Devices (dFADs) from Tropical Tuna Fisheries of the Indian and Atlantic Oceans. PLOS one, 10(5).

[274] Richardson, K. et al. 2019. Estimates of fishing gear loss rates at a global scale: A literature review and meta-analysis. Fish and Fisheries. 2019;20:1218–1231.

[275] Greenpeace. 2019. Ghost gear: the abandoned fishing nets haunting our oceans. Greenpeace, Germany.

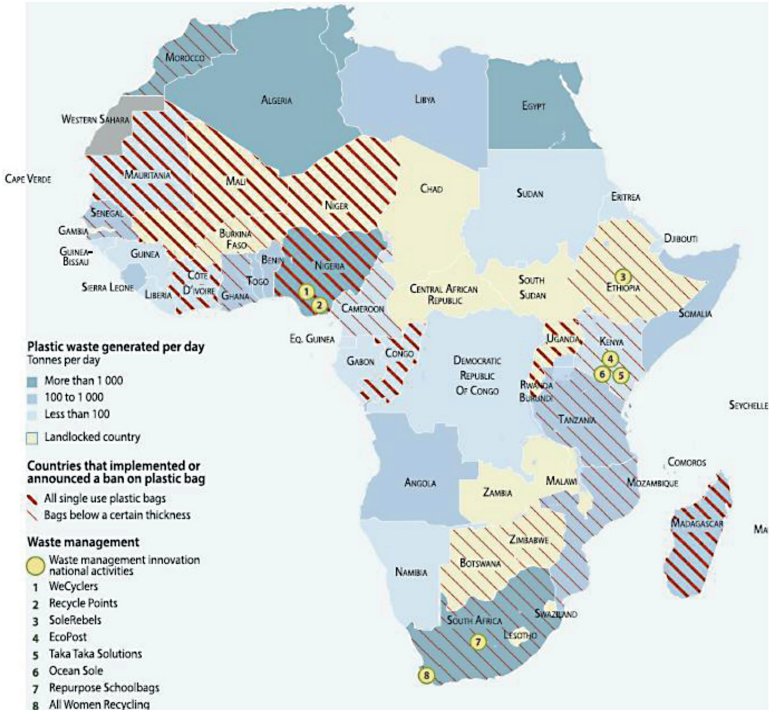
[276] Nordic Council of Ministers, Nordic Council of Ministers Secretariat. 2020. Policy Brief: Clean Nordic Oceans - a network to reduce marine litter and ghost fishing.

[277] Nordic Council of Ministers 2013. Disposal of plastic end-of-life-boats. http://norden.diva-portal.org/smash/get/diva2:741961/FULLTEXT01.pdf.

[278] For discusion see: Pinto da Costa, J. et al. 2020. The Role of Legislation, Regulatory Initiatives and Guidelines on the Control of Plastic Pollution. Front. Environ. Sci., 24 July 2020. https://www.frontiersin.org/articles/10.3389/fenvs.2020.00104/full; Crawford, C. B., and Quinn, B. 2017. Plastic production, waste and legislation. Microplast. Pollut. 2017, 39–56.

distribution, on use and imports, and to a lesser extent, in the form of fees and recycling targets. Fifty-four African countries have legislated to restrict use of plastic bags (Figure 16). Sixteen have banned use of plastic bags, in some cases without introducing regulations to enforce the bans.

Figure 16. Plastic waste and plastic bag bans in Africa, 2015



Source: Jambeck et al 2015

Box 8. Types of legislation of relevance to MPP	
General	**Specific legislation on plastics**
Environmental management and conservation legislation	Bans and / or import restrictions
Solid waste legislation	Fiscal measures (import/use taxes)
Legislation establishing waste management authorities	Specific legislation on microplastics
Legislation on private waste management	Packaging and labelling regulation
Legislation on municipal or local authority responsibilities	Recycled content regulations
Local authority regulations including beach management	**Other**
EPR legislation	Contaminants regulations
Standards legislation	Medical waste disposal
Monitoring and reporting requirements	Port regulations
EIA requirements	Public procurement rules
Budgetary instruments	
Harbour and foreshore regulation	

Measures to restrict trade in plastic bags fall within the scope of several GATT rules (Article III (discrimination) and Article XI:1 (protection)) and can be justified under Article XX(b) and (g) (environment). The measures also fall under the TBT Agreement which requires notification (Articles 2.9 and 2.10). Not all African countries have notified WTO of the measures which they have introduced.[279]

All AIODIS have regulations that prohibit or restrict use or import of plastic bags (Table 24). Most regulations exempt certain types of bags, based on type of plastic, thickness or use (e.g. reusable shopping bags, re-sealable/ ziplock-type bags, large garbage bags). It should be noted that the bans on plastic bags are not well enforced in some AIODIS countries, that the regulations may differ substantially between countries, that customs codes and product classifications may also differ. Box 9 lists plastic bag bans in non-AIODIS African countries.

Table 24. AIODIS' regulation of plastic bags

Country	Regulation of plastic bags
Cape Verde	Prohibited the production, import into the market, and use of conventional plastic bags for packaging
Comoros	Prohibited the production, import, sale and distribution of non-biodegradable low density plastic bags in 2017
Guinea Bissau	In 2013, the government announced a ban on plastic bags that came into effect in 2014.
Maldives	Comprehensive bans on bags and a progressive extension to all single-use plastics (2020)
Madagascar	Plastic bags less than 0.05 millimetres thick have been banned in Madagascar since 2015, and have forced local businesses to find alternative packaging solutions.
Mauritius	The law, promulgated in August 2015, prohibits import, manufacturing, sale or supply of plastic bags. In 2016, the government exempted a list of plastic bags from the ban.
Reunion/Mayotte	EU rules apply
São Tomé	Law No. 8/2020 bans certain plastic bags.
Seychelles	Only the manufacturing, importation, distribution of plastic bags which do not fall into the list of exempted plastic is permitted. This ban focuses mainly on thin plastics. There is a ban on plastic utensils including cups, forks, Styrofoam takeaway boxes and plates since 2017 and more recently a ban on single-use plastic straws. A ban on balloons comes into effect in 2021.

Sources: See Country Working Papers; Greenpeace Africa, 2020 34 Plastic Bans in Africa. A Reality Check. May 2020; The Ocean Project Seychelles and Sustainability for Seychelles;

[279] Regis Y, Simo. 2019. Of Sustainable Development in Africa: Addressing the (In)Congruence of Plastic Bag Regulations with International Trade Rules. Brooklyn Journal of International Law. Volume 45 Issue 1 Article 5. 12-27-2019.

Box 9. Bans on plastic bags in non-AIODIS coastal African countries	
Tunisia	supermarkets banned from using plastic bags (2017)
Morocco	plastic bag ban (2015)
Mauritania	ban (2013) – ingestion is a major cause of cattle and sheep death
Senegal	ban on several SUP products, including coffee cups from 2020
Gambia	manufacture, import, use. or sale of plastic bags is a criminal offence
Cote d'Ivoire	ban legislation has been difficult to put into effect
Togo	ban on manufacture, import, distribution and marketing of non-biodegradable bags and packaging
Benin	ban on the production, import, sale and possession of non-biodegradable plastic bags (2017)
Nigeria	ban on plastic bags in effect 2014
Cameroon	ban on import, production and sale of SUP products – implementation difficulties
Gabon	ban on import and use of non-recyclable bags
Congo	ban includes plastic sachets and films
DRC	ban on manufacture and sale of plastic bags and bottles - implementation a challenge
Namibia	environmental levy on plastic bags (2019)
South Africa	ban on thin bags (2003), revenue from levy on other bags supports environmental projects
Mozambique	ban on some bags, charges on others (2016)
Tanzania	ban on selected products
Kenya	ban on single-use plastic, heavy penalties
Somalia	Somaliland ban on bags in 2005, but weak enforcement
Eritrea	ban on plastic bags since 2005, prohibits import, production, sale ban on import and sale of non-biodegradable plastic bags and packaging unless biodegradable and of local manufacture (2015).
Egypt	ban - selective plastics ban for Red Sea province 2019

Sources: Greenpeace Africa, 2020. https://www.greenpeace.org/africa/en/blogs/11156/34-plastic-bans-in-africa/

Box 10 provides examples of national legislative instruments relating to plastic bags in non-AIODIS. In 2020, Kenya barred all single-use plastics such as water bottles and straws from its national parks, beaches, forests and other protected areas. Recycling of PET bottles is a common target for regulations in AIODIS and other countries, for example:

- Mauritius: Environment Protection (Polyethylene Terephthalate (PET) bottle Permit) Regulations 2001
- Seychelles: Environment Protection (Beverage Containers and Labels) Rgulations (2013); Environment Protection (Restriction on manufacturing, importation, distribution and sale of Plastic Bags) Regulations 2017 (S.I. No. 37 of 2017)
- Madagascar: Décret n° 2017-010 du 03 Janvier 2017 portant Interdiction de la Production, de l'Importation, de la Commercialisation, de la Constitution de Stock et de l'Utilisation des Sachets et des Sacs en Plastique sur le Territoire National.

Box 10. Examples of regulations on plastic bags in non-AIODIS coastal African countries

Waste separation

Tanzania: The Environmental Management Act 2004

Plastic packaging

Benin: Inter-Ministerial Decree setting the Methods of Recovery and Repayment for Products with Ecotaxes and Fines (2004)

Benin: Inter-Ministerial Decree determining Ecotaxes and Fines for Pollution of the Environment (2004)

Import/ manufacture bans

Zimbabwe: Plastic Packaging and Plastic Bottles Regulation 2010

Cameroon: Joint Ministerial Order Relating to the Manufacture, Import, and Sale of Non-Biodegradable Packages (2012)

Rwanda: Law Relating to the Prohibition of Manufacturing, Importation, Use and Sale of Polyethylene Bags and Single-Use Plastic Items (2019)

Plastic bags (for details see Box 9)

Togo: Décret n° 2011-003-PR du 05 Janvier 2011 Fixant les Modalités de Gestion des Sachets et Emballages au Togo

Mauritania: Decree No. 2012-157 of 21 June 2012 Prohibiting the Manufacture, Importation, Marketing and Use of Flexible Plastic Bags and Bags

South Africa: Plastic Bags - Regulations under Section 24 (D) of the Environmental Conservation Act (No. R. 543 of 2002)

South Africa: Plastic Carrier Bags and Plastic Flat Bags (No. R. 625 of 2003)

Kenya: Kenya Gazette Supplement – The Finance Act, 2008 (ban)

Cote d'Ivoire: Decret n°2013-327 Portant Interdiction de la Production, de l'Importation, de la Commercialisation, de la Détention et de l'Utilisation des Sachets Plastiques

Nigeria: Plastic Bags (Prohibition) Bill (2019)

6.2.2 Fiscal measures

Fiscal measures can help combat MPP (Box 11).[280] Taxation of primary plastics and plastic products may not be appropriate for many AIODIS, as many are importers of manufactured products. However, selected tariffs could potentially foster local manufacture and recycling of selected products. Taxes on plastic bags result in cost-effective use reduction. Deposit-refund schemes are effective and while they can be costly, they also provide income opportunities for informal waste collectors. Garbage collection charges can be a disincentive but may be required to support operating costs. When fiscal measures are complemented by awareness campaigns and improved waste disposal schemes, they are often found to be most effective. Incentives to fishers to return waste to shore is effective in reducing marine litter, may complement incomes, and provide inputs for recycling. Where 'plastic taxes' are paid to 'environmental funds' there is a risk that these funds may be used for other purposes other than combating plastic pollution. Some examples of the results of taxes on single-use plastics are as follows:

- Wales introduced a mandatory charge on all SUP carrier bags, regardless of their material. The charge is estimated to have contributed to a decrease of 71 percent in consumption
- Scotland set a mandatory charge of £0.05 on SUP bags and some other non-plastic SU bags. The scheme is estimated to have contributed to a decrease of about 80 percent in use of SU bags in the first year

[280] Oosterhuis. F. et al, 2014. Economic instruments and marine litter control. Ocean & Coastal Management Volume 102, Part A, December 2014, Pages 47-54.

- Ireland introduced a €0.15 plastic bag levy setting the tax at 6 times the estimated average willingness to pay. Combined with an awareness campaign, this led to a 90 percent reduction in the use of plastic bags.

In summary, the effectiveness of economic instruments depends on response of consumers and businesses to price signals. The choice and design of the interventions are case specific, depending on the target products, the desired responses, consumer preferences, awareness and behaviour. The country's institutional and physical infrastructure must also be in a position to support the schemes (e.g., the ability to collect taxes, a commitment by suppliers to support deposit return schemes).

Tax incentives (e.g. tax holidays) for plastic recyclers will encourage their activities and the acquisition of needed machinery. Targeted grants of tax incentives for innovation, applied R&D and awareness campaigns (e.g., by supermarkets) can also have value.

Box 11. Considerations regarding economic instruments

- taxes on beverage packaging outside deposit-refund systems.
- deposit-refund systems which include beverage packaging such as plastic bottles.
- EPR scheme. All producers and importers of plastic packaging (over a threshold) are legally responsible for organizing a collection and recycling system for the plastic packaging waste entering the markets. However, the municipality may be responsible for collection schemes for plastic packaging from households; and possibly for the recycling of the collected waste back into plastic material.
- landfill taxes (or bans); incineration tax
- municipalities use marginal-price instruments for garbage collection such as volume- or weight-based fees while other use flat free-pricing. Weight-based waste fees generally result in higher collection rates than flat fees and/or volume-based fees
- bans on landfill may lead to higher incineration
- trade-off between achieving the optimal environmental effect and limiting the administrative burdens of the instrument
- cost of recycled versus virgin plastic vary by type of plastic and market demand
- incineration is often a lower-cost solution than recycling
- there is large difference in composition of plastic packaging (e.g., bottles) v plastic products (toys, shoes)
- small amounts of recycled plastic are difficult to sell – large stable supplies preferred
- economics may not be the key factor for recycling. There are numerous technical issues, e.g., contamination of/ mixed/quality of plastic waste, market access, high waste transport costs. Need to sort at source so waste can be compacted by type of plastic
- different instruments are directed at different groups: consumers, importers, recyclers, businesses, households

Source: Nordic Council of Ministers 2014. Economic Policy Instruments for Plastic Waste – A review with Nordic perspectives. www.norden.org/en/publications.

7 Awareness challenges

Approximately 172 million tons of plastics valued at $285 billion were imported into Africa between 1990 and 2017 and an additional 15 million tons were produced using African raw materials.[281] The growth in demand suggests that plastic use may double in Africa by 2030, generally tracking growth in per capita GDP. Globally an estimated 30 percent of the plastics historically produced remain in use; 12 percent of wastes have been incinerated, 9 percent recycled, and 79 percent have accumulated in landfills or in the natural environment. Assuming the same proportions for Africa, just under 150 million tons remains in Africa's environment (2017), or about 2.2 million tons in the environment of AIODIS.[282]

Awareness can be divided into at least four streams and target groups:

A. Decision makers who approve policies and plans and regulatory measures, and endorse allocation of financial and institutional resources

B. Consumers and voters whose behaviour and opinions may either support or undermine policies and measures and whose opinions are particularly important with regard to product prices, convenience and the links between plastics, health and environment

C. The business community which must balance productivity and profits with sustainability, corporate image, regulatory compliance and possible liabilities related to plastics (particularly in waste management)

D. 'Technicians' who advise on policies, plans and their implementation.

Decision-makers. Given the existence of plastic bag regulations, adhesion to MARPOL and Regional Seas protocols in all AIODIS, decision-makers usually have an awareness of the threats posed by MPP. As environmental impacts may accrue beyond an election horizon, the arguments of importers and retailers, or the potential for rising consumer prices may curtail initiatives that incur price rises for consumers, or losses for business. Because of the capital and recurrent costs, split responsibilities, technical issues, and the need to prioritise by area, decisions on investment in SWM are challenging. In this regard, awareness takes the form of clear policy guidelines, costed options, financing opportunities and institutional cohesion, preferably based on national SWM plans.

Consumers. Consumers, voters and taxpayers are a key group of influencers. Support for action on MPP is not only contingent on the perceived costs involved, but also on competing priorities and perceptions of the impact of plastic pollution on health, on the environment, on the economy and wellbeing. Effective awareness campaigns generally focus on the environment, biodiversity, national and local pride in a clean environment, the perceptions of tourists and the need for citizen action. The economic impact of MPP may be difficult to estimate and communicate effectively in relation to specific actions.

Business. The business community must strike a balance between profits, the image of corporate responsibility and consumer preferences. Plastic packaging of food in supermarkets illustrates some of the issues. Plastic packaging significantly extends the shelf life of products, reduces food waste and increases business returns. In today's 'Covid 19 world', minimising handling of food items through packaging has had increased importance (whether real or perceived). However, plastic packaging is a

[281] Babayemi, J.O. et al 2019. Ensuring sustainability in plastics use in Africa: consumption, waste generation, and projections. Environ Sci Eur (2019) 31:60. The value for AIODIS was extrapolated from Babayemi using population as a raising factor where country information was not provided. Estimates exclude textiles.

[282] Geyer, R., Jambeck, J.R., Law, K.L.2017. Production, use, and fate of all plastics ever made. Sci Adv 3(7):1–5. https://doi.org/10.1126/sciadv.1700782.

major contributor to MPP and much of the packaging cannot readily be recycled due to contamination by food. Sectors such as tourism can often play a leadership role in change in business behaviour, innovative business solutions and awareness campaigns. Waste management enterprises, local plastic manufacturers, and recyclers can all play a valuable role in raising awareness. Work with drinks manufacturers for recycling of PET bottles to manufacture football shirts has proved an effective awareness initiative.

'Technicians' have a particularly important role in contributing to a balanced discussion on measures to combat plastic pollution. A wide range of 'technical' issues, all with significant policy implications may need to be mastered by 'technicians' who need to select and mould the policies and instruments to the local needs and political support base.

Growing demand and reduction in use. There is a need to recognised the growing importance of plastics and that they pervade and are essential to growing range of products. Demand and use of plastics will continue to rise - fed by GDP growth, by its use in ever more products and by the efforts of the oil giants to diversify their products.[283] On the other hand, at the moment of its production, most plastic becomes a long-term pollutant. Despite numerous studies, arguments to reduce plastics strain to provide economic justification, as the negative impact of plastics and plastic pollution are dispersed in space and time, are difficult to estimate, and often lack a sufficiently robust scientific basis (e.g. the impact of microplastics on human health has proved difficult to evaluate).[284] On the other hand, the benefits of plastics are 'immediate' and the value is captured in low prices which generally excludes the 'intangible' cost of pollution. Alternatives to plastics often have higher purchase costs for consumers and struggle to compete, particularly in low income countries.

Environmental footprint of alternatives. On the other hand, the plastics industry argues (with some justification) that the alternatives to plastic have a larger environmental footprint.[285] Several often cited examples illustrate the point. For example, if plastic bags were to be substituted by cotton bags, the environmental footprint of cotton would be greater than that of plastics (use of water, pesticides, energy). Plastic is needed for alternative energy, e.g. windmill blades, solar panels. Plastic motor vehicle components makes cars lighter and more fuel efficient, thus saving fuel and reducing GHG emissions. While some of these arguments may be challenged, 'technicians' need to be able to advise on policy makers and navigate between these competing positions. For example, it should not be assumed that glass or other alternative drinks containers are inherently more environmentally friendly than plastic (Table 25). Because cartons are composed of multiple materials they are particularly difficult to recycle. Bottles are heavy to transport and cannot be reused if chipped. One study shows that glass has a lower environmental impact than plastic only if 40 percent of the bottles are recycled.[286]

[283] See Jevon's paradox, e.g.: https://www.frontiersin.org/articles/10.3389/fenrg.2018.00026/full.

[284] Pew, SYSTEMIQ, 2020. Breaking the Plastic Wave. A comprehensive assessment of pathways towards stopping ocean plastic pollution. https://www.pewtrusts.org/-/media/assets/2020/07/breakingtheplasticwave_report.pdf.

[285] However, the long-term cumulative environmental footprint of plastics is largely unknown and many of the environmental footprint estimates are met with 'counterfactuals', e.g., a cotton t-shirt (weight 0.4kg) requires 4.3kg CO_2-eq per t-shirt while manufacture of a similar polyester t-shirt requires 3.8 kg CO2e, or 7.1 kg CO_2e if the fabric is woven. See: Kirchain, R.,et al. 2015. Sustainable Apparel Materials. Cambridge, MA: Materials Systems Laboratory, Massachusetts Institute of Technology. https://matteroftrust.org/wp-content/uploads/2015/10/SustainableApparelMaterials.pdf

[286] Accorsi R, Versari L, Manzini R. Glass vs. Plastic: Life Cycle Assessment of Extra-Virgin Olive Oil Bottles across Global Supply Chains. Sustainability. 2015; 7(3):2818-2840. https://doi.org/10.3390/su7032818.

Table 25. Indicative comparison of the environmental impact of drinks containers in USA

Indicator	Glass bottle	Single use plastic (PET bottles)	Carton (Tetrapak)	Aluminium can
Drinks market share (indicative)	15%	70%	5%	10%
Carbon footprint (medium) (gm)	323	250	32	488
Recycling carbon footprint reduction	24% (refill x30)	30%	No data available	96%
Recycle number of times	Infinite for brown colour	PET is infinitely recyclable (in principle)	Paper can be reused 4-5 times	Infinite
% recovered for recycling	up to 80%	9.5% (60% in EU)	No data available	45%
Years to 'decompose'	1 million	400	unknown*	100-400
Other environmental impacts	difficult to compare			

Source: https://tappwater.co/us/footprint-of-glass-vs-plastic-vs-aluminium-best-choice/

PET bottles may also make up only a small fraction of the total plastic packaging waste. For example, in the UK,while 37 percent of all plastic is used for packaging, less than 2 percent is used for PET drinks bottles.

Allocation of 'responsibility'. Awareness of responsibility for addressing MPP can be the subject of debate. Producers of 'raw' plastic maintain they respond to manufacturers demand and have no 'control' over the fate of the plastic, while environmentalists may argue that they are the 'prime culprits'. There is a growing call for EPR and placing responsibility on manufacturers. However, for products such as textiles (carpets, clothing), construction materials (insulating panels), electronics (computers, cell phones), implementing EPR is challenging.

Awareness and the circular economy. The circular economy struggles to establish viable plastic waste reuse products and business models at different scales, particularly in the small economies of many AIODIS. Reuse of waste plastics in bricks, tiles, road surfaces often rely on support from 'projects' and arguably simply give environmental plastic a more permanent home. For example, plastics incorporated into road surfaces are likely to degrade or abrade to microplastic dust over time. Recycling in smaller AIODIS economies may rely on exports as domestic technologies and local markets do not provide the required scale and suffer from higher energy costs and technology gaps in reuse, or recycling. In addition, recycling is far from a panacea for plastic waste, as many plastics cannot readily be recycled for technical, scale or for economic reasons (Table 26). The ubiquitous 'chasing arrows' logo on plastics infers that it is recyclable; awareness that it is little more than a marketing device is low.

Table 26. Illustrative recycling rates of different plastics

Type of plastic	USA recycle rate % (2015)	recycling
1 PET(E)	18.4	common
2 HDPE	6.2	common
3 PVC	0	cannot/ rarely
4 LDPE	6.2	difficult if contaminated
5 PP	0.9	not usually
6 PS	1.3	very little
7 Other	22.6	sometimes
All	9.1	

While the prospects for smart 'life cycle' design of plastic product holds promise, the sheer volume of new plastic products entering markets may constrain widespread application. This is perhaps where the combined market power of trade blocks can force or encourage industry to adopt such practices, initially in selected categories of products, as is occurring in the EU. Similarly, regulations and standards struggle to keep pace with innovation in plastics, the advent of new compound plastic products (which are likely to be difficult to recycle), moulding of composite plastics, and replacement of 'traditional' manufacturing with 3D printing.

These issues all present knowledge and awareness challenges. AIODIS can look to the policies, practices, discussions and lessons in developed regimes for guidance and clarity on policies while adopting tried and tested approaches. Among the current 'leaders' the following stand out:

- The EU which has a complex of policies and rules (Directives and Regulations) accompanied by monitoring and evaluation of progress. This is the only comprehensive international regional regime
- Recent US legislation and attendant discussions[287]
- California State legislation
- Maldives SUP policy rollout.

Campaigns. A wide range of national campaigns to combat MPP are described in the Country Working Papers. Many campaigns are intermittent and rely on the support of NGOs, the tourist industry, volunteers for beach cleanups, or collaboration with local authorities and waste management enterprises. In São Tomé, awareness is raised through incentives - the Príncipe Biosphere Reserve offers steel water bottles in exchange for a quantity of PET bottles. The Maldives Authentic Craft Cooperative Society and other artists and craft-workers use art to make statements on MPP and have a scheme to convert waste plastic into swimsuits, bags and tourist souvenirs.[288] Only three AIODIS countries (Madagascar, Maldives, and Seychelles) collaborate in the Cleans Sea campaign which offers a range of awareness building resources.[289]

[287] https://www.plasticpollutioncoalition.org/break-free-from-plastic-pollution-act-summary
[288] United Nations Development Programme. 2019. Plastics and Circular Economy: Community Solutions.
[289] https://www.cleanseas.org/resources.

Guidelines on targeting, organising and financing awareness campaigns are described in more detail in Part III. Various materials which can be used in raising awareness include:

- Ocean literacy portal: http://stag-oceanliteracy.ioc-unesco.org/principles/
- AXA Ocean Education for schools: https://encounteredu.com/partners/axa-ocean-education; https://encounteredu.com/partners/axa-ocean-education/francais; https://encounteredu.com/partners/axa-ocean-education/portugues
- Global Sustainable Tourism Council (GSTC) standards
- International Solid Waste Association : https://www.iswa.org/media/publications/knowledge-base/.

The politics of the 'the plastics problem' is trending beyond a focus on the more readily managed products (e.g., plastic bags, PET bottles, microbeads in cosmetics) to address more complex plastic products (e.g., food packaging, textiles, tyres); to life cycles; complex waste streams; circular economy issues; and the elements of a possible global plastics treaty.

8 Circular Economy for plastics in AIODIS

8.1 Moving from a linear to circular economy

In 2020, the global economy was primarily linear. Only about 8.6 percent is 'circular' – a decline in circularity since 2018.[290] The linear economy follows a 'take, make, use and dispose (waste)' model, relying on large quantities of cheap, easily accessible materials and energy. The model relies on a market economy, growing consumer demand and capital flows that pursue economic returns.

The ambition of the circular economy (CE) is to be restorative and regenerative by design (Figure 17). It aims to keep products, components and materials at their highest utility and value at all times while assuring environmental and socioeconomic sustainability. The challenges are not only technical but necessitate an appreciation of the possible adaptive change in the underlying economic model which may be required.

A distinction must be made between 'circular' and 'sustainable', as there is often an assumption that more circularity means more sustainability.[291] However, this is not necessarily true (e.g., biofuels and biopolymers). Each material or product cycle may need separate consideration in terms of its social, economic and environmental footprint. The Product Environmental Footprint (PEF) approach is advocated by industry for this purpose, and while it responds to product-specific issues, it may undermine more forceful generic rules on classes of materials or products. While there are undoubted benefits from CE, the relationships between materials, energy, circularity, economic growth and the environment are not always apparent. This is even more evident in the weak economies of scale in AIODIS.

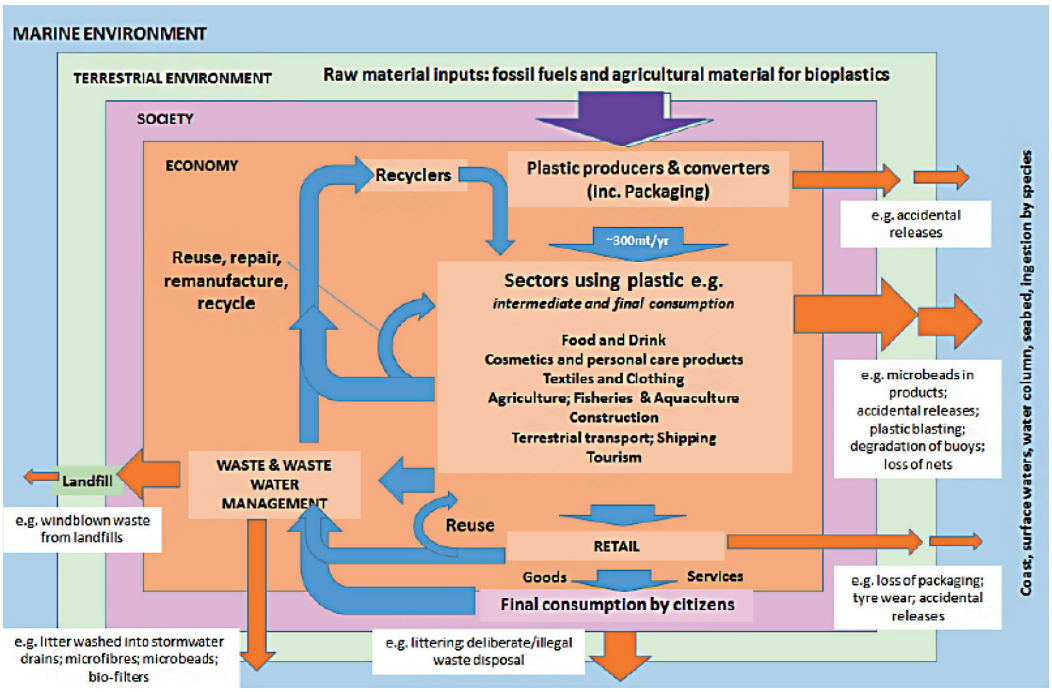
There are several different visions of the CE, each aligned with a somewhat different political economy models and beliefs.[292] The 'tweaking' school of thought builds on a model of the economy that is market and consumer-driven and where capital seeks financial returns. It believes that by tweaking the economy and targeted reforms, technology combined with social and economic innovations can develop a successful CE. It envisages an interpretation of the 'market/ laissez-faire' approach that would reinforce reforms with additional controls such as allocation of critical supplies, or economic measures that address externalities.

[290] Circle Economy, 2020. The Circularity Gap Report 2020. https://www.circularity-gap.world/global.

[291] Blum, N.U. et al. 2020. Why "Circular" doesn't always mean "Sustainable". Resources, Conservation & Recycling 162 (2020); Kirchherr, J., et al. 2017. Conceptualizing the circular economy: An analysis of 114 definitions. Resources, Conservation and Recycling, 127, 221–232.

[292] Friant, M.C. et al. 2020. A Typology of Circular Economy Discourses: Navigating the Diverse Visions of a Contested Paradigm. Resources Conservation and Recycling 161 May 2020. https://www.sciencedirect.com/science/article/pii/S0921344920302354?via%3Dihub

Figure 17. Material flows: plastic pollution, the circular economy and the marine environment



Source: P. ten Brink

A more radical school of thought believes that the market economy/ capitalism/ consumerism model is incompatible with CE and that a CE cannot be achieved without major transformation of the economy, and without a move to a more frugal world with more equitable distribution (e.g., restrictions on production of non-essential 'luxury goods').[293]

In general, there is a poor understanding on how a CE can develop in a world dominated by a linear economy while maintaining economic growth. The CE discussion has been largely dominated by industrial value chains, material life cycles (e.g., material flow analysis) and technological innovations. This has led to a useful but fragmented development of the CE in response to physical challenges (e-waste, plastic bags, PET bottles, white goods). The focus on materials (e.g., plastics) means that there has been less attention to the drivers of consumerism, the social implications of a CE and the political economy pathway(s) to a viable CE.

To some extent, this 'AIODIS project' reflects such a fragmented approach by recognising the challenge of developing solutions which can be effective in an island economy. Several underlying CE questions may need attention: (i) to what extent can the CE be feasible in small and island economies and which sectors (e.g., energy, industry, agriculture, or tourism) offer the most potential and how can they interact; (ii) to what extent is the island CE dictated by external factors, such as the need to import (or restrict import of) non-recyclable products, or to export wastes (e.g. e-waste, plastic) that cannot be effectively managed within the island ecosystem? These questions imply that in an open island economy, a CE may only be partial, or selective, and may be heavily constrained by economies of scale, geography, market and trade opportunities.

[293] See e.g., Thomas Piketty: https://www.lemonde.fr/blog/piketty/2019/10/15/towards-a-circular-economy/.

Box 12. Elements of a CE initiative

A wide range of analyses conclude that the following actions are important elements in moving towards a CE for materials:

- product design: use of appropriate materials for the product lifetime, to facilitate extended use and facilitate optimal recovery and reuse of components
- maintain and preserve existing products by repair or upgrading to maximise the lifetime or extend product life through take-back strategies, if applicable.
- rethink the business model to create greater long-term value through business models that build on the interaction between products and services (e.g. leasing rather than purchase of vehicles).
- consider waste as a resource. Utilise waste streams as a source of secondary resources and recover waste for reuse and recycling
- prioritise use of renewable, reusable non-toxic resources, materials and energy in an efficient way
- engage key stakeholders along supply or product chains including manufacturers, distributors, service businesses, public sector, and consumers in a transparent manner to create shared value
- use technology and information to track and optimise resource use and strengthen connections between supply-chain actors

Box 13. Leading global plastics circular economy initiatives

Initiative	Goals, activities
European Commission EU Plastics Strategy (2018)[294]	Goals for recycling, packaging design, and innovation; reduction targets for marine litter and single-use items; global partnerships between the EU and other countries and international organizations; voluntary pledges by companies to meet reduction and recycling targets; fostering collaboration among industry members in pursuit of circular systems.
Circular Plastics Alliance (2019)	Gathers almost 300 stakeholder organizations along the plastics value chain to promote voluntary action on the circular economy; aims to provide 10 million tons of recycled plastics to the EU by 2025.
Global Plastics Platform (UNEP, 2018)	Supports countries and cities in setting plastic reduction targets; explores ways to change the design, production, consumption, and disposal of plastics in line with a transition to a more circular economy.
Ellen MacArthur Foundation New Plastics Economy Global Commitment (2018).	Some 450+ signatories including global leaders in packaged goods, raw material producers and governments committed to 2025 targets to: eliminate all problematic and unnecessary plastic items; innovate to ensure that the plastics we do need are reusable, recyclable, or compostable; and circulate plastic items to keep them in the economy and out of the environment.
World Economic Forum Global Plastic Action Partnership. Platform for Accelerating the Circular Economy	Supports countries and cities in setting plastic reduction targets; explores ways to change the design, production, consumption, and disposal of plastics in line with a transition to a more circular economy. Develops public-private partnerships in support of CE; lends policy advice and support to address barriers; scales up and accelerates CE projects by partners (over 50 members from the public and private sectors).
Quantis International & Shaping Environmental Action (2019) Plastic Leak Project	A commitment signed by more than 350 organizations (as of March 2019), representing more than 20% of all plastic packaging produced globally, to eliminate plastic waste and pollution at the source.

Source: Nielsen, T.D. et al. 2019. op.cit.; author.

[294] EC, 2017. A European Strategy for Plastics in a Circular Economy. http://ec.europa.eu/environment/circular-economy/index_en.htm

8.1.1 Recycling as a key element of a plastics circular economy

Recycling is a key pathway in a plastic's circular economy. However, the diversity of plastic waste in terms of chemical composition, the high investment costs required to sort, clean and convert the waste into a recycled raw material, and low, or no, plastics manufacture in small economies, means recycling may not be a viable option. Sorted plastic waste may have to be exported to be recycled, so key elements of a CE may be 'offshore' and this supports the idea of a regional framework for CE in the case of small, or island economies. If a plastic's CE is not feasible within a small economy, a significant proportion of waste plastic may be streamed into 'waste to energy', or incineration. This is the option of last resort when recycling and other reuse options are not feasible, but is still considered preferable to landfill in the waste hierarchy. For countries with a cement industry, co-incineration in cement kilns is a possibility; the ash from incineration can potentially be used for building materials.

Although recycling is vital, it is not a panacea. Recycling involves costs and energy use. Many recycled plastics loose quality and may be downgraded, e.g., from 'food grade' to non-food grade because of colour changes or the presence of additives which cannot readily be removed. However, the market for recycled plastics is projected to grow by $14.74 billion in the 2020-2024 period. [295] The key economic determinant is the price of recycled raw material compared to the price of virgin plastic feedstock, the price of which is strongly correlated with the price of oil.[296] The capacity of even fully deployed current technology would provide for recycling a maximum of 53 percent of the current mix of plastics.[297]

Public interest in reducing the negative environmental footprint of plastic products is a key driver of recycling. In order to retain market share, many global brands have set targets to reduce, eliminate or recycle their plastic products. Examples include drinks companies and producers of cosmetics and household cleaning agents. The trend has been reinforced by policy and regulatory actions by governments, municipalities and regional economic blocks (such as the EU).

Technology gaps include establishing cost-effective practices and technologies for the collection, sorting and recycling of wastes that maximise their volume, usability, purity, quality and also add value from the redirection of material to other streams (such as waste to energy). There are particular technical challenges associates with composite products such as multilayer packaging.

8.1.2 Plastics in a circular economy in Africa

A companion study provides details of the CE in AIODIS.[298] This section provides additional detail on plastics in the circular economy and on recycling of plastics in particular.

In 2019, the African Ministerial Conference on the Environment (AMCEN) committed to replicate, scale up and use circular economy approaches and Ministers committed to supporting global action to address plastic pollution (Box 14).[299]

Plastic is among the 'easier' entry points to the circular economy as the approach can enable plastic reuse, recycling and waste-to-energy, rather than landfill or pollution.[300] Because there are numerous plastics and multiple waste streams, investments in recycling of many plastics require economies of

[295] Technavio. 2020. Recycled Plastics Market by End-user, Type, and Geography - Forecast and Analysis 2020-2024. Feb 2020.

[296] Locock, KES (2017) The Recycled Plastics Market: Global Analysis and Trends. CSIRO, Australia.

[297] Barra et al. 2018. Plastics and the circular economy. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC, and information from GAIA and Zero Waste Europe.

[298] Failler, P. 2020. Circular economy in African and Indian Ocean Island Developing States. Existing strategies and state of play. Indian Ocean Commission, Draft Report, October 2020.

[299] For an overview and suggested roadmap see: Wang, F., et al. (eds.). Addressing Marine Plastics: A Roadmap to a Circular Economy. UN Environment Programme, 2019.

[300] UNIDO. 2019. Addressing the challenge of Marine Plastic Litter using Circular Economy methods. Relevant considerations. Department for Environment, Vienna, Austria;

scale which are not readily available in small economies. As such, there are benefits from cohesive regional or multilateral trade arrangements on plastic and plastic waste that can generate economies of scale through common industry standards, common tariff regimes, harmonised measures and arrangements to ensure compliance. Ideally, trade in plastics and plastic waste could be the subject of a Pan-African trade initiative, which could progressively target product categories, e.g., starting with microbeads in cosmetics, plastic bags and other SUPs.

Box 14. Extracts from the AMCEN Durban Declaration, 2019

On the circular economy, the ministers:

- recognized the value of the circular economy and its potential to improve the way in which we produce and consume goods and services, reduce waste, create jobs and contribute to sustainable development.
- agreed to raise the political visibility and awareness of the circular economy in Africa through the development of policies, regulatory frameworks and institutional arrangements.
- committed to replicating, scaling up and using circular economy approaches as part of our region's transformation efforts as contained in Agenda 2063 of the African Union.
- encouraged the private sector and other non-state actors to promote and invest in the circular economy to create employment and sustainable trade in and markets for green products and services.
- committed to the implementation of a circular economy approach in Africa to assist with reducing the dependence on natural resources and reducing pollution in Africa.
- resolved to implement a circular economy in order to contribute to economic growth and job creation and divert waste away from landfills through capacity development programmes

And on plastic pollution, the ministers committed to:

- supporting global action to address plastic pollution, which will require further work in order to engage more effectively on global governance issues relating to plastic pollution, including
- reinforcing existing agreements or the option of a new global agreement on plastic pollution that takes a comprehensive approach to addressing the full life cycle of plastics, from production and design to waste prevention and management, while
- ensuring coherence among and coordination of activities undertaken by existing regional and international instruments while highlighting the importance of technology transfer, research on alternatives to plastic, and adequate financing to enable African countries to deal with plastic pollution.

Source: AMCEN.[301]

Cap Business (the IOC network of chambers of commerce) has recognised the opportunities for regional cooperation to build a plastics circular economy which meets regional requirements while also contributing to global initiatives.[302] AIODIS could consider several transformative activities:[303]

- building awareness of the unsustainable nature of the linear economy and setting out a policy and planning roadmap for building a circular economy, including a specific module on plastic waste

[301] African Ministerial Conference on the Environment. 2019. Draft Durban Declaration on taking action for environmental sustainability and prosperity in Africa AMCEN/17/L.2 Seventeenth session. Durban, South Africa, 11–13 November 2019

[302] For case studies see: Footprints Africa and African Circular Economy Network (ACEN). The Circular Economy: Our Journey in Africa So Far. https://www.acen.africa/case-studies.

[303] PA Consulting. 2019. The Sustainable Manufacturing Revolution Why the circular economy has the potential to transform manufacturing in low-income countries. UKAid.

- identifying and addressing institutional barriers and building human capacity
- assessing the respective roles of government and private sector in relation to innovation, investment, development of enabling policies and legislation and influencing corporate and consumer behaviours
- exploring regional partnerships and financing
- identifying CE models for recycling of plastics at regional level.

8.2 Recycling plastics

Recycling is a key component of a plastics circular economy and relies on stakeholders across the plastics lifecycle from product designers to distributors and consumers (Box 15). Recycling rates vary widely. Globally, less than 20 percent of plastic is recycled. South Africa recycles over 40 percent.

Box 15. Household behaviour and recycling

The following are among the positive (+) and negative (-) factors which influence recycling at the household level.

- household size (-) negative effect
- convenience – e.g., acceptance of mixed recyclables in a bin (+)
- degree of separation required – more separation (-)
- collection system
- frequency of collection (+), households don't like to store recyclables
- proximity of deposit/ collection points (+), 'bring system' reduces household storage
- educational level (+)
- women households (+)
- age of household: (+) recycling increases with age
- awareness (+)
- structure of fees (+/-), depends on fee and structure (flat, by weight, by volume)
- ownership of scheme and belief in its importance/valuation of the environment (+)
- income (+)
- perception of a rule being imposed (-)

Source: Nordic Council of Ministers 2014. Economic Policy Instruments for Plastic Waste – A review with Nordic perspectives. www.norden.org/en/publications

Recycling and labelling a product as 'recyclable' goes well beyond the chemical nature of the plastic and technology. The consumer or waste manager must have access to a recycling scheme, a recycler must be able to process the waste material, and there must be a market for the recycled product at prices, terms and conditions which are competitive.[304] The Association of Plastic Recyclers (APR) and Plastics Recycling Europe (PRE) set out conditions for a plastic product to be considered 'recyclable':

- the product must be made of a plastic that is collected for recycling, has market value and/or is supported by a legislatively mandated program. It also must be sorted and aggregated into defined recycling streams

[304] For discussion see: https://wastemanagementreview.com.au/global-definition-recyclable/.

- it must also be able to be processed and reclaimed or recycled with a commercial recycling process and it must become a raw material that is used in the production of a new product.
- materials must demonstrate that they can be collected and sorted in sufficient quantities, must be compatible with the existing industrial recycling processes or will be available in sufficient quantities to justify new recycling processes.

In EU legislation, recycling requires that the base material remains intact (i.e., its chemical composition), so alteration of the polymers through chemical or thermal processes may not meet the recycling criteria.[305] With the lowest recycling rate in the EU, Malta has introduced specific CE legislation and illustrates the challenges faced and approaches taken by a small island.[306]

8.2.1 Recycling waste fishing gear

In the EU, only 1.5 percent of gear gets effectively recycled.[307] Waste fishing gear must be dismantled prior to recycling (e.g., separation of cables, chains, buoys, lead lines, nylon, polypropylene and other materials). Some materials are often too contaminated (by seaweeds, shells, fouling organisms) for recycling and are streamed to thermal processing. Even in developed economies recycling of fishing gear suffers from lack of economies of scale and irregular supply (e.g., seasonal renewal of gear) and, technical issues in processing.[308] Under the EU Waste Framework Directive and SUP Directive, additional measures are being introduced to prevent, reduce and control waste fishing gear becoming MPP, including developing legal requirements for collection at fishing ports and EPR schemes.[309] The EU revised Port Reception Facilities Directive (2018) covers fishing vessels and fishing gear and requires countries to provide adequate reception facilities. In practice this is often done in close cooperation with fisher organisations.

Waste to energy. Incineration is generally not considered 'recycling', but serves a function in reducing landfill. There are growing concerns that plastic waste to energy is less efficient and contributes more GHG per unit of energy than LGN plants.[310]

[305] E.g. it is possible that conversion of waste fishing nets, or PET into polyester fibres for carpet manufacture may not qualify for fiscal incentives available for recycling.

[306] EC 2019. The EU Environmental Implementation Review 2019 Country Report – Malta. SWD(2019) 127 final. https://ec.europa.eu/environment/eir/pdf/report_mt_en.pdf. See also: Ministry for the Environment, Sustainable Development and Climate Change. Single-use Plastic Products Strategy for Malta. Rethink plastic. Public Consultation Document. 2020-2030.

[307] https://ec.europa.eu/fisheries/new-proposal-will-tackle-marine-litter-and-%E2%80%9Cghost-fishing%E2%80%9D_en

[308] Stolte, A. and F. Schneider, 2018. Recycling options for Derelict Fishing Gear. MARLITT/ INTERREG. https://static1.squarespace.com/static/58525fe86a4963931b99a5d1/t/5bed7be54fa51a83926caa21/1542290449080/Recycling_Report_MARELITT_Baltic.pdf. Also see other MARLITT reports: https://www.marelittbaltic.eu/.

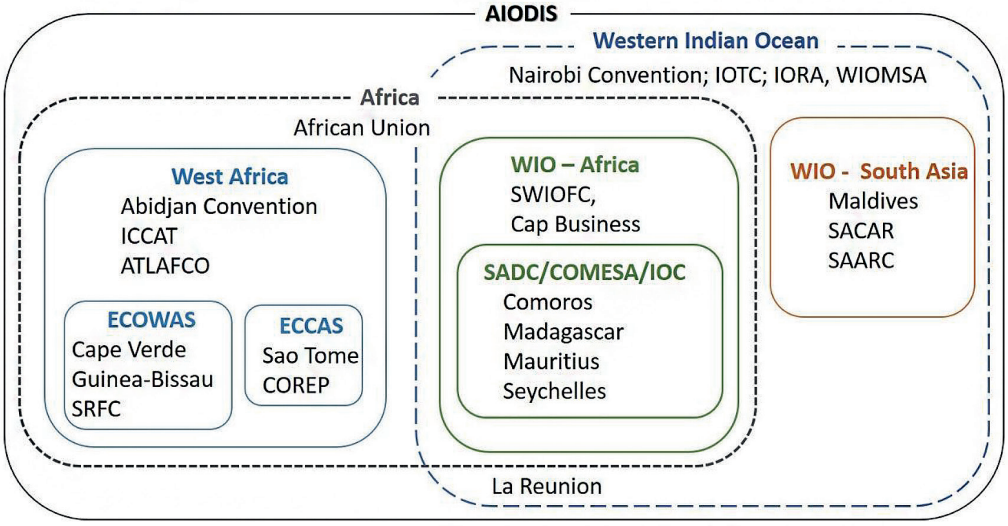
[309] Fishers have the obligation to retrieve or report lost gear under Council Regulation (EC) No 1224/2009.

[310] Eunomia/ Client Earth. 2020. Greenhouse Gas and Air Quality Impacts of Incineration and Landfill. Dec 2020.

9 Current and potential AIODIS cooperative initiatives

AIODIS do not collectively correspond to a single region: at least three regions are involved in terms of potential to combat MPP including through related economic or institutional initiatives (Figure 18).

Figure 18. Institutional potential for AIODIS regional cooperation



AIODIS can cooperate at several levels in relation to different objectives:

A. as a single group AIODIS can draw attention to the particular challenges in combatting MPP in small economics and island countries and propose or support measures or initiatives that will contribute to their efforts, including through raising awareness on the need for regional and global cooperation; or

B. as several regional groups working with regional or sub-regional institutions on policy measures, on advocacy, on cooperation and coordination, or on joint programmes.

Before discussing these complementary approaches, it is of value to examine the engagement of AIODIS in various international environmental agreements relevant to MPP and adhesion to related fora.

Table 27. Adhesion to relevant international instruments by AIODIS

International convention	CPV	GNB	STP	COM	MDG	MDV	MUS	SYC
GLOBAL	Atlantic			Indian Ocean				
UNCLOS (Convention)	r	r	r	r	r	r	r	r
London (Dumping) 72	a	x	x	x	x	x	x	a
Basel 1989 (hazardous waste)	r	r	r	r	r	r	r	r
Basel - plastics amendment	a	a	a	a	a	a	a	a
Bamako 1991 (hazardous waste, Africa)	x	s	s	r	s	x	r	s
UNFCCC	r	r	r	r	r	r	r	r
Paris Agreement 2015	r	r	r	r	r	r	r	r
MARPOL Annex V (ship's garbage)	r	r	r	r	r	r	r	r
WTO (trade)	r	r	x	x	r	r	r	r
CBD (biodiversity)	r	r	r	r	r	r	r	r
'SOFT LAW'								
Washington Declaration GPA 1995								
REGIONAL								
AFRICA/ WIO								
SADC (member)				y	y		y	y
COMESA (member)				y	y		y	y
IOC/COI				y	y		y	y
IORA				y	y	y	y	y
Nairobi Convention (parties)				r	r	x	r	r
Nairobi Convention LBSA protocol 2010				r	r	x	r	r
Indian Ocean MOU on PSC (shipping)				y	y	y	y	y
SWIOFC (fisheries)				y	y	y	y	y
IOTC (tuna)				y	y	y	y	y
AFRICA/ ATLANTIC								
ECOWAS	y	y						
ECCAS			y					
Abidjan Convention	y	y	y					
Abidjan Convention Grand Bassau LBSA Protocol 2012								
Mindelo Declaration (marine litter) (CPLP)	y	y	y					
Gulf of Guinea Commission (interim)	y	y	y					
ATLAFCO (fisheries)	y	y	y					
ICCAT (tuna)	y	y	y					
SRFC (fisheries)	y	y						
COREP (fisheries)			y					
Abuja MOU on PSC (shipping)	y	y	y					
SOUTH ASIA/ LAKSHADWEEP SEA								
SASEC						y		
South Asia Co-op. Environment Programme						y		
Bay of Bengal Programme-IGO						y		
Regional 3R Forum in Asia						y		

r = ratified, x = not party, s = signature, a = acceptance, y = yes

9.1.1 AIODIS' adhesion to international instruments relevant to MPP

With some exceptions, all AIODIS are party to the main international agreements relevant to MPP (Table 27). These include UNCLOS, the regional seas agreements and MARPOL. With the exception of Cape Verde and Maldives, AIODIS are party to Bamako. The Bamako Convention defines hazardous waste and includes substances which may present "diverse impacts to the environment by means of bioaccumulation and/ or toxic effect upon biotic systems" which potentially covers many plastic waste products (see Annex 2. H11 & 12).[311] Comoros and São Tomé are the only WTO non-members.

At a policy level, the African AIODIS are all members of the AU and engaged in AMCEN. The African countries are members of various Regional Economic Commissions (RECs). As Maldives is not an AU member, it is not engaged in AMCEN deliberations, but is actively engaged in similar initiatives with Asia and South Asia.[312] Adhesion to key conventions and economic and environmental policy platforms is set out in Table 27.

9.2 Opportunities for AIODIS working as a single group

9.2.1 Global agendas

AIODIS could contribute to a common AU and SIDS position and action proposals on MPP for presentation at global fora and to inform the discussions of policy and technical institutions.[313] These could include the following:

- UNGA oceans deliberations
- UNEA discussions on a possible plastics treaty[314]
- UNCLOS dialogues on development of norms for implementation of state responsibilities with respect to Part XII with specific reference to measures to prevent, reduce and control MPP, including requirements for regional cooperation under Articles 197, 200 and 2001
- IMO MARPOL Annex V committees
- Inputs to the SIDS Samoa Pathway and related initiatives[315]
- WTO Committee on Trade and the Environment[316]
- WEF Global Plastic Action Partnership and other partnerships[317]

Harmonised technical approaches. A consolidated approach may yield more benefits than initiatives at country, or regional levels on some technical issues, e.g., on science, trade in plastic waste, shipping and fisheries.

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[311] Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa

[312] The South Asia Subregional Economic Cooperation Program is 'project-based'. https://www.sasec.asia/.

[313] Wienrich, N., Weiand, L., & Unger, S. (2021). Stronger together: The role of regional instruments in strengthening global governance of marine plastic pollution. IASS Study, February 2021

[314] Carlini, G., & Kleine, K. (2018). Advancing the international regulation of plastic pollution beyond the UNEA resolution on marine litter and microplastics. Review of European, Comparative and International Environmental Law, 27(3), 234 – 244. https://doi.org/10.1111/reel.12258.

[315] The SAMOA Pathway (2014) for measures to manage waste, including marine plastic litter. See: UNGA, 2019. Sustainable development: follow-up to and implementation of the SIDS Accelerated Modalities of Action (SAMOA) Pathway and the Mauritius Strategy. A/74/L.3; and progress report: https://sustainabledevelopment.un.org/content/documents/221852019_SG_Report_SAMOA_Pathway_Advance_unedited_copy.pdf.

[316] E.g., WTO informal dialogue on plastics pollution and environmentally sustainable plastics trade. https://www.wto.org/english/tratop_e/envir_e/wrk_committee_e.htm.

[317] https://www.weforum.org/projects/global-plastic-action-partnership. E.g., Maldives is a partner in Parley for the Oceans (https://www.parley.tv/#fortheoceans).

- **Monitoring** MPP and its impacts. The relative lack of studies on MPP in AIODIS can be highlighted in scientific fora with a view to offering opportunities to fill knowledge and technical gaps through 'north-south' cooperation and greater inclusion in global assessments. While no single AIODIS may have the range of scientific and technical expertise required, structured engagement in networked specialisation and cooperation could bridge some deficits.[318]
- **Trade** in plastic waste. The new Basel Convention provisions on trade in plastic waste strongly suggest that regional agreements are necessary to underpin effective trade in plastic waste and supply of plastic for recycling. Ideally, to benefit from economies of scale in regional markets and regional recycling capacity, common standards for waste plastic separation, composition, levels of additives or contaminants, customs procedures and tariffs will be required. Even with favourable trade arrangements, partly because of transport costs for low value/ high volume plastic waste, recycling may not be economically attractive for some plastics.[319]
- **Shipping**. Regional consolidation of work done through IMO, the maritime MOUs (Abuja and IO), and African and Indian Ocean ports organisation(s) can offer opportunities to reduce MPP generated by shipping.
- **Fisheries**. The various regional fisheries bodies have a role in control of fisheries debris. Although concerns have been expressed in various bodies (e.g. IOTC) and resolutions on marking of fishing gear considered, mandatory measures are often weak or lacking and initiatives to prevent, reduce and control lost or abandoned gear are few (e.g. on 'biodegradable FADs). The RFMOs concerns over the legal status of 'lost' FADs and over reduced fishing opportunities, as a result of measures to reduce mortality of endangered species from entanglement often dominate fishing gear deliberations. FAO/COFI may have a role in fostering EPR for fishing gear and in relation to disposal of GPR fishing vessels.
- **Biodiversity**. Consideration of added protection for areas of special biodiversity or ecological value, e.g., Bijagos Archipelago, Northern Mozambique Channel, Aldabra.
- **Resourcing**. Common positions and prioritisation could facilitate access to resources, including from global partnerships on plastic waste, e.g., it is evident that some AIODIS require substantial investment in SWM.

While such common positions or initiatives could be fostered by the AIODIS, an AIODIS' MPP action plan may be a useful guiding document, but may not be an effective delivery mechanism. Effective pathways are likely to require the engagement of regional or sub-regional institutions and specific proposals from countries following internal dialogues. Part III suggests specific actions that could be undertaken at different levels by the international and regional organisations to which AIODIS are party.

9.2.2 Africa

The 2019 AMCEN Durban Declaration (Box 14) committed countries to address plastic pollution, including through supporting global action to address plastic pollution, reinforcing existing agreements or by considering the option of a new global agreement on plastic pollution which takes a comprehensive approach to addressing the full life cycle of plastics.[320] It committed to ensuring coherence and coordination of activities undertaken by existing regional and international instruments and highlighted the importance of technology transfer, research on alternatives to plastic, and adequate financing.

[318] E.g.: https://www.gpmarinelitter.org/; https://internationalmarinedebrisconference.org/index.php/marine-debris-networks-reasons-impacts-and-challenges/.

[319] For an analysis of PET recycling for IOC region, see : UCCIOI, 2020. Approche régionale de la gestion des déchets dans l'océan Indien. Rapport final consolidé. Mars 2020. Verso, GIRUS, Dynamia.

[320] AMCEN, Durban Declaration, November 2019. AMCEN/17/L.2. https://wedocs.unep.org/bitstream/handle/20.500.11822/30732/AMCEN_17Declaration.pdf?sequence=7

The Declaration also recognised the CE as a framework for sustainable economic development, for job creation, for the sustainable production and consumption of goods and services and for reducing waste and pollution. Ministers agreed to raise the political visibility and awareness of the circular economy, including through development of policies, regulatory frameworks and institutional arrangements (e.g., Agenda 2063). AMCEN recognised the important role of the private sector and non-state actors and made specific reference to sustainable trade and diversion of waste away from landfills. While the AU's Africa Integrated Maritime Strategy (AIMS) makes reference to marine pollution, it does not specifically refer to MPP or the CE. The AU has already set a target of 50 percent for urban waste recycling (2023).

Shipping. With respect to MPP from shipping, the Ports Environmental Network-Africa (PENAf) may be a useful conduit. PENAf hosts conferences on environmental management of ports and links directly to African ports associations: the Port Management Association for West and Central Africa, PMAWCA, established in 1972 under the auspices of the Economic Commission for Africa (UNECA); and the Port Management Association for Eastern and Southern Africa whose members are directly engaged with shipping lines and largely responsible for MARPOL Annex V compliance control.[321] At a recent conference, members emphasised the need for engagement between port authorities and environmental protection ministries; with the Abidjan and Nairobi Conventions and the need for improved waste reception facilities.[322] The Poseidon Principles focus on the climate footprint of shipping, but, in principle, it is open to progressive inclusion of additional initiatives – MPP could be a potential focus.[323]

Solid waste management. The African Marine Waste Network is committed to assisting the coastal and island states of Africa to reverse the growth of litter and its transport to the seas and is currently providing online educational materials to the Abidjan Convention.[324]

West Africa. The Abidjan Convention can be considered the key institution in the combat against MPP. It offers the means through which West African AIODIS can prepare a regional action plan which can engage the RECs (ECOWAS and ECCAS) on trade issues; the fisheries bodies (ATLAFCO, ICCAT, SRFC, FCWC and COGECA); the port authorities (PENAf and PMAWCA). A cohesive regional plan could support awareness, MPP monitoring and national decision-making, help increase access to resources for waste management, advance industry engagement and development of a circular economy.

In 2012, the Abidjan Convention adopted a protocol on land-based sources and activities causing marine pollution (LBSA protocol). It requires parties to develop national action plans, cooperate in harmonising legislation, policies, guidelines and standards, including comparable monitoring and evaluation programmes.[325] Implementation is national and compliance relies essentially on national reporting. There is provision for cooperating with third parties, such as ECOWAS and ECCAS. The Abidjan Convention COP decision CP.12/16 on the issue of marine waste advises establishing an information system on the extent of pollution by marine debris and the effectiveness of measures to address the threat with a view to developing regional, national and municipal strategies to combat marine debris, including a programme to build awareness of the problem.[326] The 2020 progress report

[321] Ports Environmental Network-Africa (PENAf). https://www.penaf.org/.

[322] https://www.penaf.org/african-ports-commit-to-collaborative-partnerships-on-their-environmental-sustainability-development/

[323] https://www.poseidonprinciples.org/#home

[324] Developing best practice action plans for management of plastic waste in Africa. http://www.abidjanconvention.org/

[325] Protocol to the Abidjan Convention Concerning Cooperation in the Protection and Development of Marine and Coastal Environment from Land-Based Sources and Activities in the Western, Central and Southern African Region. Grand-Bassam, 2012.

[326] UNEP, 2017. Projet de rapport de la douzième Conférence des Parties contractantes à la Convention relative à la coopération en matière de protection, de gestion et de mise en valeur du milieu marin et des zones côtières de la côte atlantique de la région de l'Afrique occidentale, centrale et australe. UNEP/ABC-WACAF/COP.12/7. See also: Adam, I., et al. 2020. Policies to reduce single-use plastic marine pollution in West Africa. Mar. Policy 116:103928. doi: 10.1016/j.marpol.2020.103928.

indicates that these measures are being implemented and the 2020-2021 work programme lists a programme for the management of plastic waste and marine debris.

Indian Ocean. In the Indian Ocean, the Indian Ocean Rim Association (IORA) is a high-level economic cooperation body which may have a role in regional trade in plastics and plastic waste, in technology transfer and in development of a common position on MPP. As MPP could be considered within its priority areas (blue economy, trade, technology) IORA could consider establishing an ad-hoc working group to address economic and trade issues relevant to MPP.

Western Indian Ocean. In the WIO, the Nairobi Convention is a catalytic institution with similar possibilities to that of the Abidjan Convention (see above). The IOC has a major complementary role at the political level in catalysing actions and in harnessing resources for regional endeavours. A joint action plan could engage the RECs (SADC, ECA, COMESA and IGAD) on trade issues, the fisheries bodies (IOTC, SWIOFC, SIOFA and possibly the Indian Ocean Federation of Artisanal Fishers (Fédération des Pêcheurs Artisans de l'Océan Indien, FPAOI) on fisheries, and the port authorities (PENAf and PMAESA and IOC MOU) on shipping. The region also benefits from a broad-based scientific network (WIOMSA), a marine litter task force/network, existing regional projects (e.g., SAPPHIRE, SWIOFish and others) and a network of marine environmental NGOs.

South Asia. Although Maldives is not a party to the Nairobi Convention, regional actions to combat MPP are well advanced in South Asia. IORA, the South Asia Cooperative Environment Programme (SACEP), the Bay of Bengal IGO and the South Asian Association for Regional Cooperation (SAARC) provide a foundation for existing regional plans and projects (see below).

9.3 Cooperation at a regional level

9.3.1 West Africa

Abidjan Convention. The Abidjan Convention can be considered as the principal pathway for regional cooperation on MPP in West Africa. Ideally, the Abidjan Convention could prepare a specific action plan on MPP which could serve as a basis for generating resources and partnerships, including with the RECs, fisheries bodies, shipping lines and port authorities, the business community and development partners. These could include the Guinea Current Commission (when functional), the Network of Institutes of Fisheries Research and Marine Sciences (RAFISMER) and other 'blue economy' networks.[327] As part of the implementing arrangements for the Abidjan LBSA Protocol, West African AIODIS could consider proposing a COP resolution on MPP that includes preparation of a regional action plan on MPP and an associated funding proposal for the preparation process.[328]

RECs. The West African AIODIS could consider initiating a dialogue in ECOWAS and ECCAS on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic (and other) waste would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate unnecessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of substitutes and collection and recycling schemes. Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO. Of 16 West African countries 11 have plastic bag bans, one has an economic measure on SUPs and four have no measures.[329]

[327] Abea, J. and B.E. Brown. 2020. Towards a Guinea Current Large Marine Ecosystem Commission. Environmental Development, Volume 36, December 2020, 100590.

[328] Further discussion is provided by: Olusola Olaitan Ayeleru, et al. Challenges of plastic waste generation and management in sub-Saharan Africa: A review. June 2020. Waste Management 110:24-42. The status and application of the LBSA Protocol is unclear. The existing Abidjan Convention action plan is well out of date and efforts are under way to prepare an update.

[329] Adam, I., et al. 2020. Policies to reduce single-use plastic marine pollution in West Africa Marine Policy 116(6):103928 March 2020.

ECOWAS developed a draft strategy on plastic waste management in 2016 and in 2020 ECOWAS environment ministers initiated measures to ban the import, production and marketing of plastic packaging in the region by 2025, including the installation of new plastic packaging production units in the ECOWAS countries. The three AIODIS Lusophone countries are members of the Comunidade dos Países de Língua Portuguesa and party to the Mindelo Declaration (2018) on 'Mar sem Lixo/ Seas without Waste'. The Declaration takes the Honolulu Strategy (2011) as its framework and signatories commit to implement its proposed activities, including building awareness on marine litter.[330] The West African AIODIS could take steps to follow up to the Mindelo Declaration (2018).

While solid waste management (SWM) is essentially a national function, the Abidjan Convention, the Bamako Convention and the RECs could play an important role in identifying regional SWM synergies and the resources required for investment in SWM, including in human and institutional capacity, for financing investments and for cooperation on recycling.

Fisheries. Actions on fisheries at regional level can consider several pathways: (i) resolutions generating management measures in the two RFMOs (ICCAT and SEAFO) to ensure appropriate practices with regard to lost gear and disposal of waste gear; (ii) resolutions and cooperative programmes by the regional fisheries bodies (SRFC, FCWF, COREP); (iii) engagement with the EU and other distant water fishing partners to include appropriate gear management measures in access agreements; (iv) engagement with FAO and with net and GRP boat manufactures on disposal and recycling of gear and vessels.

Shipping. A regional review of the implementation of MARPOL Annex V, including information on port reception facilities, their use (or non-use) and cross-checking of garbage logs could provide a basis for further actions. The Council of the Port Management Association for West and Central Africa indicates a trend towards regionalisation of port environmental governance in addition to the state-led mechanisms for WCA (SAPEIPP declaration).[331] All three AIODIS are parties to the Memorandum of Understanding on Port State Control for West & Central African Region (Abuja MOU). However none of the countries reported either inspections or deficiencies in 2019, suggesting that increased application could be useful in relation to MARPOL requirements.[332]

9.3.2 Western Indian Ocean

Nairobi Convention. The Nairobi Convention can be considered as the principal pathway for regional cooperation on MPP in the WIO. All WIO island countries, except Maldives, are contracting parties and all have adopted the LBSA Protocol.[333] The LBSA largely reflects national obligations under UNCLOS Part XII and commits parties to cooperate, apply the precautionary and polluter pays principles and best available techniques and practices to:

> "prevent, reduce, mitigate, combat and, to the extent possible, eliminate the pollution or degradation of the Protocol area from land based sources and activities, using for this purpose the best practicable means at their disposal and in accordance with their respective capabilities."

[330] Honolulu Strategy. https://wedocs.unep.org/bitstream/handle/20.500.11822/10670/Honolulu%20strategy.pdf?sequence=1&isAllowed=y

[331] Barnes-Dabban, H. et al, 2018. Regional convergence in environmental policy arrangements: A transformation towards regional environmental governance for West and Central African ports? Ocean & Coastal Management Volume 163, 1 September 2018, p. 151-161. https://www.sciencedirect.com/science/article/abs/pii/S0964569117305963?via%3Dihub; Barnes-Dabban, H, and S. Karlsson-Vinkhuyzen, 2018. The influence of the Regional Coordinating Unit of the Abidjan Convention: implementing multilateral environmental agreements to prevent shipping pollution in West and Central Africa. Int Environ Agreements (2018) 18:469–489.

[332] Last available report, http://www.abujamou.org/index.php.

[333] Protocol for the Protection of the Marine and Coastal Environment of the Western Indian Ocean from Land-Based Sources and Activities 2010 (LBSA Protocol). https://www.unenvironment.org/nairobiconvention/resources/policy-and-strategy/final-act-conference-plenipotentiaries-adoption-protocol-protection

The Protocol makes specific reference to ensuring public participation, educational and awareness programmes (Art. 15) and essentially sets out a range of due diligence requirements, including for monitoring and reporting on land-based sources of marine pollution. Waste management and plastics (manufacture) are listed among the priority activities to be controlled.

Following a COP (2018) decision, a marine litter regional technical working group was established. The WIO Marine Litter Working Group targets research, capacity building, science to policy, awareness (focused on decision makers), and coordinates and advises on appropriate actions for marine litter management. The group is hosted by WIOMSA and composed of designated national lead institutions which serve as National Marine Litter Focal Points.[334] The Group has prepared guidelines and an action plan for the Convention.[335] Consideration could be given to broadening and updating the actions plan with a view to resourcing key actions.

Solid waste management. In 2014, an IOC regional workshop on waste management reached the following conclusions, which remain largely valid in 2020:[336]

- the information required for decision-making is insufficient
- the regulatory frameworks are diverse and do not actively support regional cooperation
- human resources lack the necessary professional skills
- maritime transport is too costly for optimal regional waste management.

Several opportunities were flagged, including the harmonisation of information systems on waste, establishment of a joint platform for information exchange, training in key technical areas and establishment of a regional 'lobby' to pursue actions to improve regional waste management. The underutilisation of some waste management facilities (e.g., recycling) and the high potential for waste to energy were noted (e.g., biowaste and controlled incineration of plastic waste). The background study projected a total of 57,000 tons of plastic waste in 2025 (including Reunion).[337]

A second regional review focused on plastic waste and estimated recovery rates for PET waste (Comoros 0%; Madagascar 1%; Mauritius 6%; Reunion 15 % and Seychelles 34%).[338] This would provide an estimated regional annual total of over 5,000 tons of waste PET (see Table 28). The private sector in the IOC countries has also engaged in regional CE initiatives through Cap Business, the regional association of chambers of commerce.[339] A recent analysis focuses on PET.

[334] Decision CP.9/3. Management of marine litter and municipal wastewater in the Western Indian Ocean.

[335] UNEP, 2018. Western Indian Ocean Regional Action Plan on Marine Litter (WIO-RAPMaLi). https:/ nairobiconvention.org/Meeting%20Documents/December%202018/WIO-RAPMaLi_Full%20Revised%20Draft_29102018_Final pdf; IMS. no date. Development of the Western Indian Ocean Action Plan on Marine Litter and Microplastics Institute of Marine Sciences U. of Dar es Salaam; WIOMSA, 2018. Marine Litter Monitoring Manual. Sustainable Seas and African Marine Waste Network. See also: Lane, S.B., et al. 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.

[336] https://www.commissionoceanindien.org/wp-content/uploads/2020/01/Conclusionsetrecommandations_Dechets_Dec2014final.pdf

[337] COI/ AFD. 2014. Etude de diagnostic pour une gestion optimisee des dechets dans L'Ocean Indien EP3013. Version : 02 - 09/12/2014. COI/AO/2013/007.

[338] Charbuillet, C. et Meurville, J-M. 2018. Etude de la gestion des déchets de la zone COI. AM, Inst. Carnot.

[339] https://www.capbusiness.io/project/filieres-regionales-de-gestion-des-dechets/

Table 28. Estimated household plastic waste in selected WIO AIODIS in 2018 (tons)

Country	Potential waste	Available waste	PET	PEHD	PEBD	PP	PS	PVC	Other
Comoros*	7,447	3,575	930	644	429	375	89	304	804
Madagascar*	68,985	33,113	8,609	5,960	3,974	3,477	828	2,815	7,450
Mauritius	59,520	59,520	18,451	7,142	9,523	8,333	4,166	2,381	9,523
Réunion	76,656	76,656	23,763	9,199	12,265	10,732	5,366	3,066	12,265
Total	212,608	172,864	51,753	22,945	26,191	22,917	10,449	8,566	30,042
%			31%	12%	16%	14%	7%	4%	16%

*Source: Charbuillet, 2018.; * unsorted waste.*

Based on the recommendations of the 2018 review, in 2019, COI published a regional action plan on waste management.[340] The plan has three main activities: (i) establishment of a regional 'observatoire' to collect and analyse information on waste generation and flows with a view to planning further actions; (ii) provide support for national policies and regulation of waste, including circular economy initiatives and professional training; and (iii) to build a regional capacity for research, innovation and education in relation to the plastics value chain. Several regional projects, including SWIOFish2, the Blue Champion Award l'Expédition Plastique Océan Indien support the implementation of the plan.[341]

RECs. As noted in relation to West Africa, the RECs can play a key role with regard to trade in plastics and plastic waste, in harmonising regulatory and fiscal measures, fostering EPR, recycling and innovation. In 2017, the East African Community (EAC) passed the Polythene Materials Control Bill a regional legislative initiative distinctly different from the EU plastics and waste directives, as it is directly applicable in EAC countries rather than being transposed, or 'given effect' in national law as are the EU instruments. The Bill controls manufacture, distribution and retail use of polythene within the Community and is intended to: brand the EAC as green and clean; prevent pollution caused by polythene; promote recycling, environmentally friendly packaging materials and a clean and healthy environment. The Bill and plastic bag bans have met with resistance from manufacturers and consumers, but support from environmental NGOs and tourism interests.[342] The approach established that a harmonised plastic management regime, however limited could serve as a model for AIODIS countries, or to extend certain trade provisions though SADC and/or COMESA.

COMESA has recognised that diversity of plastic and plastic waste regulations constrains trade and that a harmonised regime would benefit recycling and a circular economy. The COMESA Business Council is engaging with industry players to develop a business position for the harmonisation of regulations related to plastics control.[343]

Most of the above initiatives rarely, if ever, mention microplastics, or despite important marine and fishing industries, refer to plastic pollution from marine sources.

Fisheries. Similar approaches as described above for West Africa can be considered, in particular through the IOTC and SWIOFC, possibly with a particular emphasis on the recovery of FADs and implementation of provisions on 'recyclable' FADs; EPR arrangements with respect to nets; and facilities

[340] UCCIOI, 2020. Approche régionale de la gestion des déchets dans l'Océan Indien – Rapport de Final – Décembre 2019. Verso, Girus, Dynamia; COI, 2019. Plan d'action de reduction et de gestion des dechets dans les pays de la Commission de L'ocean Indien. Jamvier 2019. https://www.commissionoceanindien.org/wp-content/uploads/2020/01/Plan-daction-d%C3%A9chets-COI-FINAL.pdf

[341] ExPLOI supported by (AFD and others, €6.2m, planned for 2021-2025.

[342] Pritish Behuria. 2019. The comparative political economy of plastic bag bans in East Africa: why implementation has varied in Rwanda, Kenya and Uganda. Global Development Institute, Working Paper Series. 2019-037. February 2019.

[343] BIZnet, 2020. Towards a harmonized regional framework on plastics waste management in COMESA. Industry Perspectives and Experiences. Policy Brief 3/2020.

for collection and disposal of waste nets from small-scale fisheries, including through engagement with fisher associations (e.g., FPAOI) and net importers.

Shipping. Initiatives could parallel those suggested for West Africa, such as enforcement of MARPOL Annex V requirements and possibly including use of the Indian Ocean Memorandum of Understanding (IOMOU) on port state control (PSC).[344] Engagement with the Ports Environmental Network-Africa (PENAf), the Port Management Association of Eastern and Southern Africa (PMAESA) and the Port Harbour Masters Network (PPHMN) could catalyse actions on MPP from shipping.[345]

9.3.3 Lakshadweep Sea: Maldives, India and Sri Lanka

Maldives and the South Asian countries offer a largely project-driven model for regional cooperation on MPP. Several studies and the SACEP country reports have reviewed the status of MPP and marine litter in South Asia, including Maldives.[346] The Regional Marine Litter Action Plan for South Asian Seas Region provides a comprehensive framework for action.[347] This is supplemented by a 'roadmap' that sets targets for 2030. The targets are linked to SDGs and specify a phase-out of single-use plastics; all plastic packaging to be either recyclable, reusable or compostable; and a reduction in MPP of all kinds.[348] The high level of plastic pollution attributable to the region's rivers is addressed through a regional project which is partly based on the Regional Marine Litter Action Plan.[349] These initiatives are complemented by ongoing work by the BOBP-IGO, IORA and others (see Maldives Country Working Paper).[350]

With regard to the economic and trade dimensions of MPP, Maldives is a member of the South Asian Association for Regional Cooperation (SAARC) and the Indian Ocean Rim Association (IORA). In relation to the circular economy, Maldives is party to the Regional 3R Forum in Asia and the Pacific which promotes a range of policy and technical approaches to address plastics in the circular economy.

In summary, the regional cooperation through SACEP, SAARC and other means not only provides for national measures, but also addressed the transboundary MPP from South Asian rivers. Maldives benefits from a series of investment projects on SWM which also offer lessons in dealing with waste in small and isolated communities, including the technical and financing challenges involved. The region, through a common plan, has secured regional funding to address a key source of MPP – rivers.[351]

[344] https://www.iomou.org/.

[345] PMAESA is a non-profit, inter-governmental organization made up of port operators, government line ministries, logistics and maritime service providers. https://www.pmaesa.org/.

[346] EPA, 2018. Maldives Marine Litter Acton Plan, Maldives. Environmental Protection Agency.

[347] SACEP, 2018. Regulating Marine Litter and Plastic Wastes in the South Asian Seas Region; SACEP, 2019. Regional Marine Litter Action Plan for South Asian Seas Region. South Asia Co-operative Environment Programme, Colombo. The plan is based on a review of marine litter challenges in five coastal states (Bangladesh, India, Maldives, Pakistan, and Sri Lanka) and in the region. See also: Kapinga, C.P and S.H. Chung, 2020. Marine Plastic Pollution in South Asia. UNESCAP.

[348] SACEP, 2019. A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030. The Roadmap was developed with the support of the Ministry of Environment, Japan through UNEP IETC.

[349] South Asia – World Bank. 2020. Plastic Free Rivers and Seas for South Asia Project (P171269). Washington, D.C. World Bank Group. http://documents.worldbank.org/curated/en/891301591063382724/South-Asia-Plastic-Free-Rivers-and-Seas-for-South-Asia-Project; http://www.sacep.org/programmes/plastic-free-rivers-and-seas-for-south-asia.

[350] See: https://www.bobpigo.org/; IORA, 2017. Declaration of the Indian Ocean Rim Association on the Blue Economy in the Indian Ocean Region. Ebene: IORA.

[351] Wienrich, N., Weiand, L., & Unger, S. (2021). Stronger together: The role of regional instruments in strengthening global governance of marine plastic pollution. IASS Study, February 2021; Carlini, G., & Kleine, K. (2018). Advancing the international regulation of plastic pollution beyond the UNEA resolution on marine litter and microplastics. Review of European, Comparative and International Environmental Law, 27(3), 234 – 244. https://doi.org/10.1111/reel.12258.

Part III. COMBATTING MARINE PLASTIC POLLUTION: APPROACHES AND INITIATIVES

10 National strategic plans to combat marine plastic pollution

Strategic national and regional action plans can provide a foundation for efforts to combat marine plastic pollution. Several AIODIS already have such frameworks and regional initiatives are in various stages of development or implementation. The following sections seek to inform these processes by:

- illustrating existing AIODIS initiatives (detailed in Part II)
- drawing on experiences from other regions and countries
- referencing guidelines and best practices
- indicating sources of potential technical or financial resources or partnerships.

10.1 Key considerations

The development of AIODIS' plans or strategies to combat marine plastic pollution (MPP) can be framed by a number of key considerations.

Global problem. MPP requires global and regional cooperative efforts as the problem and solutions are beyond the capabilities of single countries.

State action. Individual countries can combat MPP through a national MPP action plan, improvements in national solid waste management, including use of circular economy approaches, and by engagement in development of regional and international initiatives.

Complexity. There is a growing awareness of the complexity of 'the plastics problem': that it is driven by a growing demand for plastics and that it involves issues of human health and food supply, environment and ecosystems, production and trade, technology and investment and change in human behaviours.

Holistic approach. There is a broad consensus that no single approach or initiative can effectively prevent, reduce and control MPP. Studies confirm that a coordinated suite of complementary measures are substantially more effective than discrete or isolated measures. For example, a ban on plastic bags can be complemented with an educational campaign and making alternatives bags available.

Solid waste management. An effective solid waste management (SWM) system is fundamental to combatting MPP. The system needs to take account of the full life cycle of plastics and products that include plastics. Technically competent and adequately financed local and municipal authorities are key actors in SWM. However, SWM generally only addresses the downstream part of the plastics life cycle and does not extend to the production and design of plastic products, or the chemical additives involved.

Resources. The financial, human and institutional resources available to combat MPP in AIODIS are generally inadequate, fragmented or lack coordination in relation to the scale and complexity of 'the plastics problem'. Commonly, the major deficit is in relation to capital and recurrent financing of SWM at national and municipal levels. Coordination across the plastic life cycle is generally weak.

Microplastics. There is a relatively low awareness of microplastic pollution. This may be partly due to the weak but growing understanding of the impact of microplastics on health, on food chains, on

biodiversity and on the environment and the lack of 'visibility' of microplastics. Regulatory bans on plastic microbeads in all cosmetic and personal care products are advocated in many global initiatives. Measures to prevent, reduce or control microplastic pollution are rare or non-existent in AIODIS.

Awareness. There is broad consensus that education and awareness is a foundation for acceptance, financing and implementation of plans and policies to combat MPP and plastic pollution in general. Awareness of the technical complexity of 'the plastics problem' is low, but policies and plans need to take account of the technical constraints and opportunities.

Knowledge and science. There are major gaps in scientific knowledge on MPP. These include understanding of the long-term impacts on human health and on ecosystems. Understanding of trade-offs between the economic benefits of plastics and the costs of negative impacts is deficient. Assessment of alternative suites of actions to combat MPP is rudimentary or fragmented. Information on MPP in AIODIS' ocean areas is fragmentary. There is a need for enhanced arrangements for managing scientific knowledge across the plastic life-cycle at global and regional levels. Such arrangements could include sharing of innovative approaches and evaluation of technical 'solutions'.

Governance. Effective actions to combat MPP rely on the overall quality of governance, including rule of law, transparency in public procurement and public finances, engagement of civil society and security of contracts, and acknowledgement of the value of independent scientific assessment.

Global plastics treaty. There have been numerous calls and proposals for a global plastics treaty that would combat plastic pollution. Given the complexity of the problem and the experiences and delays in negotiating an ABNJ/BBNJ agreement, such a treaty is unlikely to have a significant direct impact on MPP in the short term. However, an active AIODIS engagement in any such process is of benefit both as a learning process and through contributions to its objectives and design.

National and regional 'solutions'. Given the diversity of members of AIODIS, the suite of actions and their priorities in national MPP action plans is likely to differ widely and needs to be tailored to the needs and capacity of the country. While the AIODIS economies may be relatively small generators of MPP at regional level, they may play an important leadership role in their respective RECs and regional seas conventions.

Circular economy. The complexity of the evolving EU circular economy regime illustrates the challenges of applying the approach. Guidance on its implementation in small and island economies and at a regional level is deficient.

Small and island economies. These countries are importers of products which generate plastic waste. For technical, economic or other reasons, some of this waste cannot be sustainably or optimally disposed of within the country. The basic options are: (i) to prevent or reduce entry of such products; (ii) require importers (or producers) to arrange for removal/ export of the resulting waste; (iii) organise export of waste which does not engage the importers/ producers; or (iv) dispose of the waste in-country in a manner which is less than optimal, such as by incineration or landfill.

Common themes. A national action plan to combat MPP is often prepared as a complement to a national solid waste management plan. The plans generally include several key themes: improved awareness, understanding and monitoring of MPP at country level; review and enhancement of SWM actions and plans, including regulatory and economic instruments; stakeholder engagement, including with business, civil society organisations and municipalities; identification of means to secure the financial, institutional and human resources required; and engagement with regional and international initiatives.

10.2 Key components of a national policy and strategic action plan to combat MPP

Some of the key processes and components of a national strategic plan to combat MPP are illustrated below and would need to be tailored to the specific requirements of each country:

Foundational actions to be considered

- analyses and monitoring of solid waste streams, including the origins, volumes, composition, trends and household and business behaviours associated with waste generation and management. An understanding of costs of waste management; assessment of the social, economic and environmental impact of mismanaged waste; information on reuse and recycling, on imports of plastics and exports of plastic waste are all important for design of the action plan
- monitoring of MPP and waste streams to provide baselines and enable evaluation or adjustment of the plan
- understanding of the human and institutional capacity for SWM and the capacity for innovation and private investment in a circular economy
- knowledge of stakeholder concerns and the level of awareness of MPP can inform the preparation process
- assessment of the enabling environment to identify bureaucratic constraints, institutional overlaps, the state of policy coherence and stakeholder coordination.

Preparation of the action plan

- ideally any foundational studies prepared are made publically available both in the interests of transparency and engagement and to identify gaps, public priorities, or objections
- a process for public engagement is established, preferably with high-level agreement across the political spectrum in order to maintain continuity in the event of political change. This could involve one, or more stakeholder 'task forces', inter-ministerial committees, scientific advisory panels or specific sector groups (e.g. for fisheries, recyclers, consumers, or tourism)
- a white paper of draft action plan is prepared for public dissemination, public comment and presented at public meetings as required. Comments and responses would be publicly available
- at least two rounds of consultation would take place, informed by revised drafts which take account of the comments and concerns and specify any trade-offs required
- a clear process of approval would be established and the nature of the outcomes specified: e.g., policy framework, legislation, institutional change, budget allocation(s).

Components

- the action plan will ideally be based on a suite of nationally accepted principles, e.g., precautionary principle, ecosystem approach, sustainable use, polluter pays, inter-generational equity or other broad-based drivers
- linkages to existing national policies and plans are specified (e.g., sustainable development plans, environment policy, tourism, or SME plans)
- the scientific basis for the proposed actions is described and justified

- national and international legal foundations are identified and compliance with international conventions demonstrated
- clear objectives and generic targets proposed together with indicators and means of monitoring and evaluation
- specific sector or product targets identified (e.g., SUPs, shipping, recycling)
- implementation modalities specified together with proposed budgets and means of cooperation between implementing agencies (e.g., national and municipal authorities, waste management enterprises, households)
- the roles of business and civil society organisations set out
- investment priorities, in particular with regard to capital and recurrent financing of SWM, specified. Where 'contentious' investments are contemplated (e.g., landfills, incinerators) appropriate provision is made for EIAs and review processes
- sources of finance indicated
- major instruments are detailed and justified, e.g. regulations, taxes, EPR
- a comprehensive awareness and education component is included
- regional cooperation is described, including consistency or synergy with existing regional initiatives
- a mechanism for review, revision and stakeholder engagement in implementation included.

10.3 Examples of national policies and action plans

In AIODIS, excluding La Réunion, only Maldives has a comprehensive set of initiatives that addresses MPP both as an integral part of their national SWM plan and through regional projects. Seychelles benefits from a comprehensive SWM plan and policy upon which a MPP action plan can be readily prepared. The economic geography and waste management challenges of both these countries are substantially different from other AIODIS, such that the transfer of lessons and experiences must be treated with caution.[352]

10.3.1 Island economies

Maldives. While there is no specific action plan to combat MPP, the components for such an action plan exist in current policies, plans and projects. In 2019, the Clean Blue Maldives Charter, endorsed by the office of the President, committed parties to a range of specific actions to prevent, reduce and manage plastic waste.[353] In 2019, the parliament passed a resolution to ban single use plastics in Maldives from 2025. A national Plastic Committee comprising government and civil society representatives was established by the Ministry of Environment and developed a Single Use Plastic (SUP) phase-out policy with the following elements:[354]

- bans on the import, production and sale of specific SUP products
- market based instruments (import tariffs and consumer levies, support for local SUP substitutes)
- strengthened national waste data and setting reduction targets for plastic packaging

[352] A structured approach to development of MPP plans is provided by Alpizar, F. et al. 2020. A framework for selecting and designing policies to reduce marine plastic pollution in developing countries Environmental Science and Policy 109 (2020) 25-35. https://edepot.wur.nl/521439.

[353] See also: Maldives Parliament Resolution of 2019 and the Presidential declaration at the 74th session of the UNGA in 2019. https://presidency.gov.mv/Press/Article/22264

[354] Nashfa, H. 2019. Single Use Plastic Phase-out policy for Maldives 2020-2023 (draft). Ministry of Environment. Republic of Maldives. See also: Duvat, V.K.E., Magnan, A.K. Rapid human-driven undermining of atoll island capacity to adjust to ocean climate-related pressures. Sci Rep 9, 15129 (2019). https://doi.org/10.1038/s41598-019-51468-3.

- extended producer responsibility (EPR) including deposit refund system (DRS) environmental product design, separate collection, and end-of life management of single use plastic
- strategies for sustainable provision of alternatives
- education and awareness.

In December 2020, Law No:31/79 (Export-Import Act of Maldives) was amended to enable listing of SUP products to be phased out. These measures come into effect in mid-2021. The plans are implemented with the assistance of a suite of projects financed by the government, World Bank, ADB/ Japan Fund, EU and others with contributions from island and atoll councils and others.[355]

In addition to the national actions, Maldives is actively engaged in implementing the Regional Marine Litter Action Plan for South Asian Seas Region which provides a comprehensive framework for action through a 'roadmap' that sets targets for 2030,[356] and regional projects that address MPP from South Asian rivers and MPP in the Lakshadweep Sea.[357]

Seychelles. The National Waste Policy 2018-2023, adopted in 2018, outlines the priority objectives and provides direction as to how these objectives should be met. The policy is orientated by a number of principles, including: regarding waste as a resource, cost recovery and polluter pays, a multi-stakeholder approach, sustainable development, the waste hierarchy and a recognition of the need for increased awareness and education. The goals include minimising landfilled waste, transitioning to a more circular economy, and development of waste management capacity of state and non-state institutions. However, although the policy includes measures on SUPs and to promote recycling, it does not distinguish plastics as a particular category of waste. The policy is essentially aspirational, providing guidance on key initiatives, including regulatory and economic instruments, infrastructure investment, financing and awareness building.

The Seychelles Solid Waste Masterplan sets out a comprehensive vision and is a basis for combatting MPP.[358] Key challenges are typical of many AIODIS. These include: inadequate waste infrastructure; a 'trade imbalance' with high imports but low export of the resulting waste; poor or contradictory information on waste streams; fragmented or unaligned institutional arrangements; poor financing; and despite considerable efforts to raise awareness, continued unsustainable behaviours by households and business. The proposed improvements in targeting waste reduction, landfills, priority waste streams and technologies are estimated to cost about $40 person/year. However, the plan is focused essentially on land-based sources of waste. Plastic is not considered a 'priority waste stream'. It does not make reference to marine sources of waste from fisheries or from shipping, to marine debris, to microplastics, or to issues with regard to disposal of sludge from waste water or sewage treatment.

Seychelles can readily build on the existing policies, plans, commitments and initiatives to develop an action plan to combat MPP as a complement, extension, or tuning of the existing framework.

Palau. The Palau National Solid Waste Management Strategy (2017-2026) sets out six strategic goals and 14 guiding principles.[359] Palau's vision is for a clean and safe Palau through effective waste management consistent with traditional values. The goals include: improved waste data and strengthened institutional capacity; stakeholder understanding and sharing of responsibilities; use of best practices; transparent and effective reporting of outcomes. In addition to a number of principles

[355] For details see Part II, Maldives Country Working Document.

[356] SACEP, 2019. Regional Marine Litter Action Plan for South Asian Seas Region. South Asia Co-operative Environment Programme, Colombo.

[357] South Asia – World Bank. 2020. Plastic Free Rivers and Seas for South Asia Project (P171269). Washington, D.C. World Bank Group. http://documents.worldbank.org/curated/en/891301591063382724/South-Asia-Plastic-Free-Rivers-and-Seas-for-South-Asia-Project.

[358] COWI, 2020. Solid Waste Masterplan for Seychelles (2020-2035). Final.

[359] Government of Palau. National Solid Waste Management Strategy: The Roadmap towards a Clean and Safe Palau.

found in several action plans, Palau lists several of particular relevance to small island economies:

- product stewardship interprets EPR as 'those involved in producing, importing, selling, using and disposing of products have a shared responsibility to ensure that those products or materials are managed throughout their lifecycle in a way that reduces their impact on the environment and on human health and safety'
- proximity - treatment and disposal of waste takes place as close as possible to source
- transparency in all waste management activities
- regional cooperation and collaboration through genuine partnerships to overcome common constraints, share resources and harness shared strengths
- a proactive approach, such that SWM is undertaken in a planned rather than reactive manner to ensure limited resource allocations are optimized.

Pacific Island Countries (PICs). A review of existing MPP measures in the PICs highlighted several issues to be addressed, including: effective application of existing international measures; a focus on waste management rather than waste prevention; measures to ensure 'repatriation' of imported plastics and restrictions on 'problematic' plastics that could be considered; inter-ministerial cooperation to be enhanced; harmonised monitoring and reporting; harmonised standards and customs codes needed.[360]

10.3.2 Southeast Asia

Vietnam's national action plan (NAP) on MPP recognises the lack of information on MPP and the weak human and financial capacity. It sets out a phased approach to improve understanding of the problem (e.g., by river basin) and aims to establish local action plans linked to the National Strategy for Management of Solid Wastes (2025-2050). Actions will include raising awareness, improvement of waste management, disposal of waste fishing gear, protection of MPAs, reduction of SUPs, international collaboration and regulatory reform.[361]

Cambodia experiences the same difficulties as several AIODIS: weak regulations, shortage of human and financial resources and limited citizen participation. It plans to respond through improved cooperation across government on legislation, investment in waste management, raised awareness and cooperation with international partners.

Indonesia launched its National Plastic Action Partnership (NPAP) in 2019 in collaboration with the WEF Global Plastic Action Partnership and closely aligned with the National Waste Management Policy and Strategy and the National Action Plan on Marine Debris.[362] The NPAP sets out a fully costed change across the plastics ecosystem: reduction in avoidable plastic use, materials innovation, waste recovery, recycling and disposal. It distinguishes between geographies with different waste management challenges (e.g., megacities, rural communities, remote islands) and between types of plastic. It aims to invest over $5 billion in waste management and recycling in the near term: a total capital investment of $13.3 billion (2025- 2040) complemented with recurrent financing reaching $1.8 billion/year in 2040.[363] The 'plastics plan' involves critical change through policy, investment, leadership and public engagement with the following core components: reduce and substitute; redesign for reuse;

[360] EIA. 2020. Plastic Pollution Prevention in Pacific Island Countries: Gap analysis of current legislation, policies and plans. Environmental Investigation Agency.

[361] https://fr2.slideshare.net/OECD_ENV/c-session-1-ta-dinh-thi-viet-nam

[362] Indonesia. National Policy and Strategy on Solid Waste Management 2018-2025; National Plan of Action for Combating Marine Litter 2018-2025 (Presidential Regulation No. 83/2018). See also: Presidential Regulation 16/2017 on the Indonesian Ocean Policy.

[363] WEF, 2020. Radically Reducing Plastic Pollution in Indonesia: A Multistakeholder Action Plan National Plastic Action Partnership. WEF Insight Report

double waste collection and recycling rates; invest in waste management and disposal; and gradually build a circular economy.[364]

G20 countries. As of 2019, most G20 countries (19 out of 25 countries) have already formulated a strategy and action plan relevant to marine plastic litter at the national level.[365] The strategic actions in G20 countries fall into four categories: prevention and reduction with rules on EPR, plastic bags and microbeads; SWM with actions on river and coastal clean-up and fishing gear; promotion of innovation; and multi-stakeholder involvement and awareness raising.[366]

Brazil has an action plan with three pillars: improved SWM at watershed level, including floating barriers in rivers; cleaning of mangroves, beaches and rivers; monitoring and awareness. The plan has six axes of action: immediate responses, improved SWM, studies and innovation, sectoral agreements, norms and directives; awareness and education. The plan includes indicators, baselines and targets, allocates responsibilities among stakeholders and was prepared through a public consultation process.[367]

Other examples of interest to AIODIS include: Philippines, National Action Plan on Marine Litter; Sri Lanka, National Action Plan on Plastic Waste; France, National Roadmap against Marine Litter 2019–2025.[368]

In many countries action plans on MPP or marine litter are an integral part of the national waste management plan. Strategies emphasise that there is no one action which can 'solve' MPP. Integrated actions on multiple levels are required with a shared vision and coordination among key stakeholders. Actions can be directed at a particular group of products (such as plastic packaging); upstream, downstream, or across product life cycles; at marine or at land-based sources. The plan may involve different combinations of regulatory, economic and public engagement instruments tuned to the national requirements. Ideally the action plan will be based on sound analyses of SWM, stakeholder engagement and national dialogue on the merits of different options. Analyses will not only establish baselines and help determine realistic targets, but provide an understanding of the drivers and flow of MPP, review the effectiveness of regulations, and help clarify responsibility and accountability among consumers, businesses, and public authorities.

The importance of awareness and a public education and outreach component is evident from its inclusion in most, if not all, national action plans on MPP, on plastic waste or in related circular economy schemes.[369] It can explain the costs to human health or to the economy. It can explain the environmental benefits, influence consumer behaviour and generate political support for recycling and investment in waste management. Compliance with littering regulations and implementation of household waste separation is improved though information campaigns. Where a plastic tax is charged, transparency on the use of the revenues (e.g., to support an environmental fund) generates support.

[364] Up to 72% of plastic pollution is in rural areas. Some of the targets are drawn from the Pew/SYSTEMIQ analysis.

[365] Ministry of the Environment, Japan, 2019. G20 Report on Actions against Marine Plastic Litter
First Information Sharing based on the G20 Implementation Framework.

[366] Hotta, Y. et al. Designing policies towards Osaka Blue Ocean vision. Institute for Global Environmental Strategies; G20 Report on Actions against Marine Plastic Litter: First Information Sharing based on the G20 Implementation Framework. Examples include: Canada-wide Strategy on Zero Plastic Waste and Action Plan. https://www.ccme.ca/en/resources/waste/waste/plastic-waste.html; Finland's Plastics Roadmap https://muovitiekartta.fi/in-brief/.

[367] Ministério do Meio Ambiente, 2019. Plano Nacional de Combate ao Lixo no Mar. http://www.mma.gov.br/agenda-ambiental-urbana/lixo-no-mar.htm

[368] Ministry of the Environment, 2020. G20 Report on Actions against Marine Plastic Litter 2020 Ministry of the Environment, Japan. https://g20mpl.org/wp-content/uploads/2020/11/G20mpl_20201214_IGES_second-edition.pdf

[369] Karasik, R. et al. 2020. 20 Years of Government Responses to the Global Plastic Pollution Problem: The Plastics Policy Inventory. NI X 20-05. Durham, NC: Duke University.

11 Regional action plans

This section provides a brief overview of selected regional actions plans that address MPP, marine litter, or plastic pollution in general.[370] Depending on the ownership, political cohesion of the region and the perceived benefits from cooperation, the action plans have varied levels of aspiration or ambition. In some regions, the plans are largely aligned with RECs and the commitments or resolutions have an added political or regulatory impetus, e.g., in the EU.

In general, the plans are initiated by environmental concerns and the social and economic justification built over time. There are few binding measures. The EU directives and Mediterranean Action Plan are exceptions.[371] This is indicative of the nature of the Regional Seas Conventions and the lack of relevant global norms for establishment of obligations of conduct under UNCLOS Part IV. In most cases, the plans identify essentially voluntary actions and have no, or weak, compliance mechanisms. Compliance usually takes the form of reporting on the progress of voluntary, or regionally agreed actions. Compliance relies on peer pressure. A key (sometimes unstated) rationale of the plans is to provide a platform for development of projects, for knowledge exchange, to build capacity and cooperation, and to access resources and partnerships.

11.1 Core elements of a regional action plan to combat MPP

Enabling factors

- shared geographies, e.g., LMEs, current systems, semi-enclosed seas, river basins leaking plastic pollution (upstream countries may also need to be engaged)
- shared vision and principles
- common environmental, social and economic interests in combatting MPP
- ideally, alignment of the initiative with economic blocks and political commitments
- resilience to industry positions opposed to the plan
- broad consensus on sources and impacts of MPP, possibly as a result of a common scientific network.

Preparation processes

- political leadership
- selection of appropriate forum: international environmental convention, regional economic organisation, or other mechanism
- preparation and approval of primary action statement or mandate at political level: 'the region will prepare an MPP action plan'
- securing initial catalytic resources for preparation through national commitments, external support, or partnerships
- assignment of executive and secretarial responsibilities, e.g., a ministerial task force, or regional coordinating institution, such as the Abidjan or Nairobi convention

[370] Most plans are referred to as 'regional marine litter plans' rather than plans to combat MPP. Plastic may comprise over 90% of marine litter and is arguably the most problematic component. See: Galgani F., Hanke G., Maes T. (2015) Global Distribution, Composition and Abundance of Marine Litter. In: Bergmann M., Gutow L., Klages M. (eds) Marine Anthropogenic Litter. Springer, Cham. https://doi.org/10.1007/978-3-319-16510-3_2.

[371] Regional EAC legislation on polypropylene is also an example.

- preparation and approval of process: studies, consultations, drafting of action plan, resources and responsibilities
- linkage to other initiatives, SDGs, regional economic/ environmental plans.

Institutional components of the action plan

- institutional foundations – execution and coordination: national and regional roles (who, how)
- foundations in international law (e.g., UNCLOS Part XII) and linkages to regional policies or soft law (e.g., protocols on land-based sources)
- proposed resourcing and finance
- review and adjustment mechanisms
- definition of the role of the private sector and institutional partnerships
- possible explicit exclusion of questions of liability arising from MPP.

Technical components (which may be progressively included/gradually developed)

- knowledge management: monitoring, reporting, impact assessment, facility for provision of scientific advice, studies to fill key knowledge gaps
- building human and institutional capacity, raising awareness, education, transparency
- stakeholder engagement mechanisms
- improving solid waste management
- engagement in global and international initiatives
- promotion of innovation in SWM
- schemes for prevention or removal of MPP
- establishing principles and terms and conditions for regional trade in plastics and plastic waste
- establishing guidelines for harmonised monitoring and reporting on MPP and microplastic pollution, including from distant sources and collating information on beach clean-ups
- partnerships and their financing and resourcing
- shared technical resources, standards, labelling, customs codes, EPR, additive restrictions, certification schemes, use of logos, ecolabelling
- setting out agreed definitions of key terms[372]
- targeting of products/campaigns, e.g., products with intentionally added microplastics, polystyrene, expanded polystyrene/Styrofoam, SUPs, single-use food ware, bags, sachets, cigarette butts, sanitary products (wet wipes, disposable diapers), inclusion of flame retardants, toxins
- selecting sector targets: retail, shipping, fisheries, aquaculture, textiles, or tourism.

[372] E.g., 'waste', 'plastic', 'refuse', 'garbage', 'litter', 'pollution', 'microplastic', 'marine debris', 'hazardous waste', 'emissions' and 'contaminant', 'lost fishing gear', 'port reception facilities', 'plastic (GRP) vessels', 'end-of-life', 'biodegradable', 'recyclable'.

11.2 Examples of regional action plans

11.2.1 South Asia and Maldives.

The Regional Marine Litter Action Plan for South Asian Seas Region provides a comprehensive framework for action through a 'roadmap' that sets targets for 2030.[373] It was backed by a range of South Asia Cooperative Environment Programme (SACEP) country reports that reviewed the status of MPP and marine litter in South Asia.[374] The targets are linked to SDGs and specify: a phase-out of single-use plastics; all plastic packaging to be either recyclable, reusable or compostable; and a reduction in MPP of all kinds.[375] At a political economy level, the South Asian Association for Regional Cooperation (SAARC), the Indian Ocean Rim Association (IORA), and the Regional 3R Forum in Asia and the Pacific promote a range of policy and technical approaches to address plastics in the circular economy, while the regional Bay of Bengal Programme is focused on related fisheries aspects.

Two regional projects support implementation of the Plan. The objective of the Prevention of Marine Litter in the Lakshadweep Sea (PROMISE) project is to promote source-to-sea solutions to reduce marine littering in tourism clusters along the Lakshadweep shorelines of the Maldives, Sri Lanka and India with a particular focus on waste minimisation in small and medium tourism enterprises (MSMEs).[376] The objective of the Plastic Free Rivers and Seas for South Asia Project is to strengthen innovation and coordination of circular economy solutions to plastic pollution flowing into South Asian Seas.[377] Further details of the projects are provided in the Maldives Country Working Paper (see appendix to Part II).

11.2.2 Pacific Islands

Few PICs have a dedicated MPP action plan. Measures on MPP are generally embedded in national waste management strategies. The Pacific Marine Litter Action Plan (MLAP) is nested within the Pacific Regional Waste and Pollution Management Strategy 2016-2025 (Cleaner Pacific).[378] The MLAP selects four specific targets: (i) model legislations for plastics and take-away food; (ii) implementation of the regional 2017-04 Conservation and Management Measure for fishing vessels (in force 2019); (iii) cross-compliance protocols to strengthen existing MARPOL formal arrangements for cruise and other shipping; and (iv) a cross-compliance code for tourist resorts to foster a stronger waste management component in Ecotourism Certification. The MLAP also suggests that the conventional 3Rs be expanded to 5Rs: **R**efuse - legislation to ban imports of certain products; **R**educe waste; **R**euse; **R**ecycle; and **R**eturn - which recognises that return of recyclable commodities to facilities located overseas is necessary, given that establishing such facilities may not be technically or economically feasible for many small island countries and territories. The additional '**R**s' – **R**efuse and **R**eturn are of particular interest to the AIODIS. Study of the possible back-loading of clean sorted recyclable waste via

[373] SACEP, 2019. Regional Marine Litter Action Plan for South Asian Seas Region. South Asia Co-operative Environment Programme, Colombo.

[374] SACEP, 2018. Regulating Marine Litter and Plastic Wastes in the South Asian Seas Region; Kapinga, C.P and S.H. Chung, 2020. Marine Plastic Pollution in South Asia. UNESCAP.

[375] SACEP, 2019. A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030. The Roadmap was developed with the support of the Ministry of Environment, Japan through UNEP IETC.

[376] https://www.switch-asia.eu/project/promise/ ; https://projectpromise.eu/; https://www.adelphi.de/en/project/prevention-marine-litter-lakshadweep-sea-promise.

[377] South Asia – World Bank. 2020. Plastic Free Rivers and Seas for South Asia Project (P171269). Washington, D.C. World Bank Group. http://documents.worldbank.org/curated/en/891301591063382724/South-Asia-Plastic-Free-Rivers-and-Seas-for-South-Asia-Project.

[378] SPREP, 2016. Pacific Regional Waste and Pollution Management Strategy 2016-2025. Cleaner Pacific 2025; SPREP, 2018Pacific Marine Litter Action Plan 2018 – 2025 (MLAP). Apia, Samoa. https://www.sprep.org/publications/pacific-regional-action-plan-marine-litter.

shipping freight has been considered as a potential cost-effective means of **R**eturn.[379] The Moana Taka Partnership, facilitated by SPREP and UNEP, is a mechanism intended to remove recyclable waste including plastic bottles out of some PICs.

The plan has links to the SAMOA Pathway and Noumea Convention and identifies potential resources which may be accessed in the context of the Pacific Regional Waste and Pollution Management Strategy, e.g., through a Pacific Regional Reception Facilities Plan.[380] The Pacific Regional Environment Programme (SPREP) has assisted in implementing a Pacific Ocean Litter Project focused on reducing use of single use plastics, particularly take away food and drink containers, plastic bags and plastic straws. Targeted regional and national activities are divided into four strategic components, linked to Cleaner Pacific 2025 strategic approaches, the CleanSeas Campaign and the GPA/GPML. These are: (i) improved data collection and information sharing; (ii) policies and regulatory frameworks; (iii) best practices, including enhanced private sector engagement; and (iv) enhanced human capacity.

11.2.3 Caribbean

The Regional Action Plan on Marine Litter Management (RAPMaLi) for the Wider Caribbean Region (2014) updates a prior (2008) plan and has five components: legislation, policies and enforcement; institutional frameworks and stakeholder involvement; monitoring programmes and research; education and outreach; and solid waste management strategies. The rationale of the plan appears to be to enable project-driven actions at regional and national level. A number of partnerships have been established (e.g., with NOAA and with OSPAR) and a Caribbean node of the Global Partnership on Marine Litter (GPML) is hosted by the Secretariat for the Cartagena Convention and the Gulf and Caribbean Fisheries Institute (GCFI). It is unclear to what extent the Plan has been formally adopted by countries or as an instrument of the Cartagena Convention.[381]

In 2019, CARICOM adopted a relatively generic declaration on combatting plastic pollution.[382] One third of Caribbean SIDS (14) have banned single-use plastics and/or Styrofoam. Single-use plastic items comprise 35 percent of all plastic waste and Caribbean beach clean-ups indicate that plastic bottles comprise 21 percent of the items collected.[383] The Caribbean has a significantly higher level of marine litter on its beaches than the global average and lost or abandoned fishing gear is a substantial proportion of floating marine debris (see following tables).[384]

Table 29. Average composition of plastic items in beach clean-ups (number/km)

	All items/ km	bottles	bottle caps	bags	lids	straws/ stirrers	foam food containers
Caribbean	2014	431	148	54	34	61	39
Global	573	65	34	22	17	17	15

Source: Ocean Conservancy 2017.[385]

[379] Raubenheimer, K., 2019. Desktop studies on principles of waste management and funding mechanisms in relation to the Commonwealth Litter Programme (CLiP). Commonwealth Litter Programme; Lachmann, F., et al. 2017. Marine plastic litter on small island developing states (SIDS): impacts and measures. Swed. Instit. Mar. Environ, 4, 1-76.

[380] In relation to fiscal incentives for waste management, see: AFD, FFEM, IEEP. 2018. Greener taxes and subsidies in PICTs.

[381] Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention); Protocol Concerning Pollution from Land-Based Sources and Activities (LBS) 1999/ 2010.

[382] St. John's Declaration. https://www.marketscreener.com/news/latest/CARICOM-Caribbean-Community-COMMUNIQUE-ISSUED-AT-THE-CONCLUSION-OF-THE-FORTIETH-REGULAR-MEETING-OF--28862544/. Corbin, C., et al. 2014. Regional Action Plan on Marine Litter Management (RAPMaLi) for the Wider Caribbean Region. Nairobi: UNEP.

[383] Diez, S.M., Patil, P.G., Morton, J., Rodriguez, D.J., Vanzella, A., Robin, D.V., Maes, T., Corbin, C. (2019). Marine Pollution in the Caribbean: Not a Minute to Waste. Washington, D.C.: World Bank Group.

[384] Diez, S.M., et al. 2019. Marine Pollution in the Caribbean: Not a Minute to Waste. Washington, D.C.: World Bank Group.

[385] Ocean Conservancy. 2017. "Together for Our Ocean: International Coastal Cleanup 2017 Report." https://oceanconservancy.org/wp-content/uploads/2017/04/2017-ICC_Report_RM.pdf.

Table 30. Relative Contribution of Fishing Gear Reported as ALDFG in the Caribbean

Gear	%	Gear	%	Gear	%
Traps	41.0	Casitas	5.5	Surround nets	0.9
Other nets	14.9	Other gear	3.8	Lift nets	0.8
Recreational	14.0	Surface longlines	3.2	Dredges	0.2
Hook and line	7.0	Seines	1.4	Bottom longline	0.2
Gillnets	6.3	Trawls	1.0		

Source: Mathews, 2009.[386]

As part of LBS Protocol activities, the Cartagena Convention has published a "State of the Convention Area Report" (SOCAR) that will be the first baseline compilation of information regarding coastal water quality that reflects national data rather than extrapolations from global assessments.[387]

11.2.4 ASEAN

Bangkok Declaration on Combating Marine Debris in ASEAN Region (2019) sets out a range of actions and endorsed the ASEAN Framework of Action on Marine Debris. The Framework was developed through an East Asia Summit Conference on Combating Marine Plastic Debris and an ASEAN Conference on Reducing Marine Debris in the ASEAN Region (both 2017). The Framework lists largely generic actions in four areas: (i) policy support and planning; (ii) research, innovation, and capacity building; (iii) public awareness, education, and outreach; and (iv) private sector engagement. The actions include the development of EPR but no specific trade measures. The ASEAN Working Group on Coastal and Marine Environment (AWGCME) and several regional projects address MPP through capacity building and development of national action plans, regional cooperation and promotion of the circular economy.[388] The Plan has produced a range of outputs, including on SWM and the CE, and a suggestion for an ASEAN framework agreement on plastic pollution.[389]

11.2.5 European Union

EU. The EU has a complex, well-developed and evolving action plan on plastics, MPP and the CE. A detailed description is beyond the scope of this study. Key policies and directives include:

- A European Strategy for Plastics in a Circular Economy https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN
- Directive on the reduction of the impact of certain plastic products on the environment (SUP
- Directive): https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0904&from=EN
- International Ocean Governance: an agenda for the future of our oceans https://ec.europa.eu/maritimeaffairs/policy/ocean-governance_en

[386] Matthews, T.R. 2009. "Assessing Opinions on Abandoned, Lost, or Discarded Fishing Gear in the Caribbean." Final Report to U.S. Department of State.

[387] UNEP, 2019. State of the Cartagena Convention Area Report An Assessment of Marine Pollution from Land-based Sources and Activities in the Wider Caribbean Region. May 2019

[388] ASEAN-Norwegian Cooperation Project on Local Capacity Building for Reducing Plastic Pollution in the ASEAN Region (ASEANO); Strengthening Capacity for Marine Debris Reduction in ASEAN Region through Formulation of National Action Plans for AMS and Integrated Land-To-Sea Policy Approach; ASEAN PROBLUE Activities on Marine Plastic Debris; ASEAN-EU Project on Circular Economy.

[389] https://environment.asean.org/wp-content/uploads/2020/03/Summary-Report-Waste-Management-in-ASEAN-Countries-UNEP.pdf; https://environment.asean.org/wp-content/uploads/2020/02/Circular-Economy-gap-analysis-final.pdf,

- Directive on port reception facilities: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1570190453030&uri=CELEX:32019L0883
- Marine Strategy Framework Directive: https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategyframework-directive/index_en.htm
- Good Environmental Status – Marine Litter: https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm
- Revision of the Waste Legislation: https://ec.europa.eu/environment/waste/target_review.htm.

Other complementary directives and frameworks include those on waste and waste water, on product labelling/descriptions and on disposal of hazardous materials. Discussions on regulation of microplastics in the EU are ongoing with calls for simplicity, minimal exemptions and anticipation of future microplastic pollution.[390]

11.2.6 OSPAR, the North-East Atlantic

The objectives of the Regional Action Plan for Prevention and Management of Marine Litter in the North-East Atlantic are to:[391] (i) prevent and reduce marine litter pollution and its impact; (ii) remove litter from the marine environment where practical and feasible; (iii) enhance knowledge and awareness on marine litter; (iv) support contracting parties in the development, implementation and coordination of their programmes for litter reduction, including those for the implementation of the EU Marine Strategy Framework Directive; and (v) to develop management approaches to marine litter that are consistent with accepted international approaches. OSPAR adopts several principles, including: the precautionary and polluter pays principles; the ecosystem approach; and sustainable consumption and production. It advocates integration with solid waste management, public participation and stakeholder involvement and cooperation with other organisations and competent authorities.

Substantive action areas are championed by different countries or groups of countries and include: marine sources (fisheries and shipping); land-based waste management; removal of existing litter; and education and outreach, with smarter production as an integral theme. There are ongoing dialogues on fisheries, ship generated waste, land-based waste management, product packaging and design, clean-ups and removal, and discussions with industry on major pollutants.

Nordic countries. A Nordic ministerial declaration commits Nordic countries to reducing the environmental impact of plastic, including through:

- prevention of plastic waste and support for product design for reuse, longer life and recycling
- effective waste-management systems and increased recycling of plastic waste
- co-operation on measures to stop plastic waste in the seas for cost-effective clean-up solutions
- advancing knowledge of microplastics and measures to reduce environmental leakage of microplastics
- advancing knowledge of the environmental impacts of bio-based alternatives to plastic and biodegradable plastics
- advancing knowledge of problematic substances in recycling of plastic.

[390] EEB, Client Earth 2021. Phasing out the use of microplastics The road to an effective EU restriction of intentionally-added microplastics. Position Paper Version 2, March 2021.

[391] https://www.ospar.org/documents?v=34422

11.2.7 Mediterranean Plan Bleu

The Regional Plan on Marine Litter Management in the Mediterranean is a legally binding agreement under the Barcelona Convention. [392] The Plan came into force in 2014, obliging parties to undertake 19 concrete actions in keeping with the waste management hierarchy. These included: closure of illegal dumping/dumpsites, shift to sustainable consumption and production patterns, removal of existing marine litter e.g., through fishing for litter, clean up campaigns and improved port reception facilities. It specifies monitoring, assessment and reporting on implementation of measures and enforcement of national legislation with a time horizon established as 2020. The plan has made substantial progress and has enabled effective engagement with a range of initiatives and programmes (EU, G7, G20, GPA and others).[393]

Parties to the Barcelona Convention have national action plans for environmental protection of the Mediterranean and the Convention has identified urban waste as a priority. The Mediterranean Strategy for Sustainable Development 2016-2025 promotes national measures for implementing innovative waste management solutions, in line with the waste hierarchy. Urban waste is also a key target of the Horizon 2020 initiative (H2020) for a Cleaner Mediterranean and in various initiatives within the Euro-Mediterranean Partnership and the Union for the Mediterranean.[394]

11.2.8 HELCOM and the Baltic Sea

The process for development of the Baltic Marine Litter Action Plan started in 2013 with an existing Baltic Sea Action Plan as foundation.[395] The Plan makes specific reference to UNCLOS Part XII, the London Convention, the GPA and UNGA resolutions and engages with relevant regulatory instruments (EU directives, Russian laws). It cites the principles of participatory processes, sustainability, best available practices, cooperation, the waste hierarchy and the ecosystem approach.

The Plan sets out about 30 actions with corresponding targets and timescales and distinguishes regional actions from voluntary national actions. The targets include: SWM, microplastics, sewage-related litter, and specific plastics (polystyrene, bags and bottles). Its actions target shipping, fishing and aquaculture, port and marine reception facilities and education and outreach. The plan defines key terms and makes provisions for standardised reporting.

[392] Decision IG.21/7, 2013.

[393] UNEP, 2019. Regional Plan on Marine Litter Management in the Mediterranean: Progress in Implementation and Main Elements for its Evaluation. UNEP/MED WG.466/3. For technical details see: Plan Bleu, Acteon, Arcadis, 2019. Analyse socio-economique des meilleures pratiques cles en matiere de dechets marins pour prevenir/reduire les sacs et les bouteilles en plastique a usage unique; EEA-UNEP/MAP, 2020. Technical assessment of progress towards a cleaner Mediterranean Monitoring and reporting results for Horizon 2020 regional initiative Joint EEA-UNEP/MAP Report. EEA Report No 08/2020; UNEP/MAP-Plan Bleu, 2009. State of the Environment and Development in the Mediterranean, UNEP/MAP-Plan Bleu, Athens, 2009.

[394] See recent COP 2019 decisions 10, 11, 13: https://www.unep.org/unepmap/meetings/cop-decisions/cop21-outcome-documents.

[395] HELCOM, 2015. Regional Action Plan for Marine Litter in the Baltic Sea. Adopted in 2015. www.helcom.fi; http://www.helcom.fi/Lists/Publications/Marine%20Litter%20Action%20Plan%20for%20the%20Baltic%20Sea.pdf#search=marine%20litter%20action%20Plan

12 Global initiatives

The 'plastics problem' shares several common features with the 'climate problem' and the 'ocean acidification problem'. All have: dispersed and often indirect causality; high complexity; 'solutions' require multiple and costly actions; international cooperation is required to share the burden of remediation; responsibly and accountability is clouded; and the consensus on metrics for monitoring the state of MPP and for assessment of the responses is lacking. The arguments over responsibility for MPP and the obligations to 'resolve the plastics problem' are many. Some argue that the responsibility lies with the producers of plastics, or with the manufacturers of plastic products, others with consumers, or with governments, or failed international environmental governance regimes.

There is no one 'plastics problem', but a complex of inter-related problems. There is no single authority to take responsibility for global governance of plastics, to establish norms and prevent, reduce and control plastic pollution. There are few binding international instruments and these apply only to specific products or actions (dumping, trade in waste, hazardous waste, shipping). Consequently, there is a patchwork of global, regional and national initiatives spawned by international organisations, by environmental conventions, by regional economic groups, by industry and by civil society.[396] There are alliances, foundations, community action groups, programmes and projects all armed with policies, strategies and cooperative arrangements. Most of these initiatives share several key components:

- building awareness among policy makers, among consumers and among local authorities
- a recognition that the business community has a key role in terms of product life cycles and in the management of wastes, including through CE programmes
- a requirement for more effective regulatory measures, including economic and trade measures
- enhanced human and institutional capacity and
- increased investment, including in waste management, in science, in innovation and in technology.

Technical organisations tend to focus on the science, understanding of scale, impacts and dynamics of the plastics problem. Industry tends to promote 'solutions' that avoid reduction in the utility and profits from plastics and favours technological solutions (recycling, biodegradable plastics, an innovative circular economy). Some partnerships are an uncomfortable marriage of environmental and industry interests where both recognise the benefits of a mutual engagement that refrains from undermining their different core values. Few approaches undertake a cost-benefit analysis of a comprehensive suite of global actions, set out targets, identify the sources of finance, the responsibilities for implementation, the reporting mechanisms and possible compliance measures.[397]

This section provides a brief overview of selected global initiatives by UN organisations, by economic cooperation organisations, by industry and by civil society. Additional information on these and other initiatives are provided in the appendices.

12.1 Initiatives by UN organisations

It is necessary to clearly distinguish between plastic pollution in general and marine plastic pollution, the focus of this report. A description of the international legal framework related to MPP is provided

[396] Karasik, R., et al. 2020. 20 Years of Government Responses to the Global Plastic Pollution Problem: The Plastics Policy Inventory. NI X 20-05. Durham, NC: Duke University.

[397] Pew and SYSTEMIQ, 2020. Breaking the Plastic Wave: A Comprehensive Assessment of Pathways Towards Stopping Ocean Plastic Pollution. https://www.systemiq.earth/wp-content/uploads/2020/07/BreakingThePlasticWave_MainReport.pdf. See also: Newman, S. et al. 2015. The Economics of Marine Litter. Chapter 14 in Bergmann, M. et al. (Eds.) 2015. Marine Anthropogenic Litter. Springer, 2015.

in Part I and includes an overview of relevant conventions, such as the London Dumping and Basel convention. This section focuses on four key regimes: UNGA, UNEA, UNCLOS and IMO.

UNGA and UNEA resolutions have no binding nature, but guide and orient policies and the work programmes of UN agencies and cooperating partners. In contrast, the provisions of UNCLOS and IMO resolutions incur legal obligations for parties and are cornerstones for combatting MPP.

UNGA resolutions provide a policy foundation for international actions on MPP. The relevant resolutions are listed in Appendix 2 and reflect international commitments and guide cooperative actions and the work of UN agencies. The related technical reports and working documents are reflected in the reports of the Regular Process prepared by UN Oceans and summarised in the reports on oceans to the Secretary General of the UN.[398]

UNEA has a similar policy role in relation to the environment and has approved a number of resolutions on plastic pollution and marine litter. UNEP has undertaken a wide range of activities in relation to MPP at global level and in association with, or as a secretariat to the Regional Seas Conventions.[399] The relevant UNEA resolutions are listed in Appendix 2. Progress with UNEA Resolution 4/6 has been substantial.[400] In addition to a call for national and civil society actions, Resolution 4/6 calls for a wide range of scientific, monitoring, coordination, capacity and awareness building and collaboration with the private sector. Other than asking for a stocktaking of existing measures and their effectiveness, UNEA has not called for a 'new global instrument' on plastic pollution. As parties to UNEA have not reached consensus, no formal process has been initiated with respect to a 'global plastics agreement', or 'new global instrument'.[401] Given that there is no assurance that such a 'new global instrument' will eventuate and that the process could take a decade or more, and that binding measures may be difficult to negotiate, the importance of pursuing effective implementation of UNCLOS Part XII provisions and MARPOL Annex V resolutions should arguably take centre stage in the short and medium term.

12.1.1 IMO MARPOL Annex V

The revised International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V imposes a complete ban on the at-sea disposal of plastics together with a range of measures to ensure compliance.[402] The provisions include requirements for garbage management plans and record books (logs), ship-board signage and port inspection. Parties must provide adequate port reception facilities for the discharge of garbage and waste without undue delay to ships. MARPOL has provisions to designate special areas which have ecological vulnerabilities. Potentially, these could include the Bijagos Archipelago and the Northern Mozambique Channel. In 2018, IMO adopted an Action Plan to Address Marine Plastic Litter from Ships, which also applies to fishing vessels.[403] Implementation issues include high port fees for garbage disposal, lack of reception facilities for some forms of wastes (e.g.,

[398] http://www.unoceans.org/; https://www.un.org/regularprocess/; www.un.org/depts/los/general_assembly/general_assembly_reports.htm; The Second World Ocean Assessment (WOA II).

[399] https://www.un.org/Depts/los/general_assembly/contributions_2020/UNEP.pdf

[400] UNEA Resolution 4/6 Marine plastic litter and microplastics. https://wedocs.unep.org/bitstream/handle/20.500.11822/28471/English.pdf?sequence=3&isAllowed=y; UNEP, 2020. Progress in the implementation of resolution 4/6 on marine plastic litter and microplastics. Report of the Executive Director. UNEP/EA.5/8. https://wedocs.unep.org/bitstream/handle/20.500.11822/34734/K2002794-E.pdf?sequence=1&isAllowed=y. See also: Chair's summary1 of the work of the ad hoc open-ended expert group on marine litter and microplastics for consideration by the United Nations Environment Assembly at its fifth session.

[401] CIEL, 2018. Toward a New Global Convention with a Multi-Layered Governance Approach to Address Plastic Pollution. https://www.ciel.org/wp-content/uploads/2018/11/Thought-starter-for-a-new-global-convention-with-a-multi-layered-governance-approach-to-address-plastic-pollution-Nov-2018.pdf. Also see the Ministerial Conference statement (Sept. 2021) https://ministerialconferenceonmarinelitter.com/documents/.

[402] See: 2017 Guidelines for the implementation of MARPOL Annex V.

[403] Marine Environment Protection Committee, document MEPC 73/19/Add.1, annex 10, resolution MEPC.310(73). The plans was prepared in consultation with the London Convention, FAO, GESAMP, the GPML and others. See: https://www.imo.org/en/MediaCentre/PressBriefings/Pages/20-marinelitteractionmecp73.aspx.

fishing gear) and non-application to some vessel classes under previous guidelines.[404] Despite these issues MARPOL Annex V demonstrates that negotiation of international binding measures to address MPP is possible and that such measures can be made enforceable.

12.1.2 UNCLOS Part XII

The MARPOL Annex V binding measures applicable to marine sources of MPP is in stark contrast to the lack of effective binding measures for land-based sources of MPP. UNCLOS Part XII provides a foundation for such measures (Art. 192 and 207.4), and requires that parties make efforts to establish and apply the relevant norms (Art. 197). While there are acknowledged technical difficulties in setting, applying and monitoring physical limits for MPP, there are numerous international guidelines and international plans of action on MPP, or on marine litter, which provide guidance on national and regional actions to combat MPP.

It may be possible to progressively elevate such guidelines to the status of global norms under UNCLOS Part XII, either through formal UNCLOS processes or by other means. While this may not establish obligations of performance for parties, it would establish obligations of conduct, for example, requiring parties to have appropriate MPP action plans and report on the status of MPP and the actions taken under the national plans. The regional seas conventions are, to a limited extent, pursuing this approach, but on a regional rather than global level, and the norms established do not have the force of obligations of conduct under UNCLOS Part XII.

12.2 Initiatives by economic organisations

12.2.1 G20 and G7

Under the G20 Implementation Framework for Actions on Marine Plastic Litter, the G20 members agreed to facilitate effective implementation of the Action Plan by encouraging voluntary actions by G20 members, engaging in collaborative actions and in outreach activities.[405] The G20 also linked actions to the G20 Resource Efficiency Dialogue and the Osaka Blue Vision, Japan's initiative on management of wastes, recovery of marine litter, innovation, and empowerment.[406] In 2019 and again in 2020, G20 countries have reported their actions in implementing the plan.[407]

In 2015, G7 Leaders approved an Action Plan to Combat Marine Litter and in 2017, five G7 countries and the EU endorsed the Oceans Plastic Charter and committed to a resource-efficient lifecycle approach to plastics in the economy including through sustainable design, recycling, awareness, innovation and technology and through cooperation with the regional seas programmes. The Plan makes reference to generic overarching principles and identifies priority actions on land-based SWM, removal of litter, addressing marine sources, education, awareness and science.[408]

[404] EIA 2020. Nothing Fishy About It - IMO Briefing. https://eia-international.org/report/nothing-fishy-about-it-meaningful-measures-on-fishing-gear-at-imo/

[405] Framework 2019. https://www.mofa.go.jp/policy/economy/g20_summit/osaka19/pdf/documents/en/annex_14.pdf

[406] G20, 2017. G20 Action Plan on Marine Litter. Hamburg: G20 Foundation. See also: https://g20mpl.org/

[407] G20, 2019. G20 Report on Actions against Marine Plastic Litter: First Information Sharing based on the G20 Implementation Framework; G20, 2020. https://g20mpl.org/reports; G20 Report on Actions against Marine Plastic Litter: Second Information Sharing based on the G20 Implementation Framework. November 2020. https://g20mpl.org/wp-content/uploads/2020/11/G20mpl_20201130_IGES_second-edition.pdf.

[408] G7 Germany, 2015. G7 Action Plan to Combat Marine Litter. Annex to the Leaders- Declaration G7 Summit 7-8 June 2015.

The OECD has worked with G7 and G20 in a technical capacity by preparing briefs, analyses and reviews.[409] In general, the analyses highlight economic policy and technical solutions – efficiency in product life cycles, investment in SWM and recycling, innovation, smart design or the circular economy, and illustrate the nature and dimensions of trade-offs between different policies and technological pathways.

12.2.2 World Trade Organisation (WTO)

Global trade in plastics continues to grow. Recent revised estimates consider the trade to be in excess of $1 trillion in 2018, including primary, intermediate, manufactured and waste plastics – about 5 percent of global trade.[410] Waste is about 3 percent of the trade by value (about 8 million tons in 2018). Between 36 percent and 54 percent of plastic produced is traded depending on how the estimate is made. About 45 percent of primary plastic production (worth $348 billion in 2018) is traded and about 60 percent of textile is traded.

Table 31. Global trade in plastic by major product form, 2018

Plastic products	$ billion
Primary forms of plastics	348
Intermediate forms of plastics	158
Manufactured plastic goods - intermediate	83
Manufactured plastic goods - final	416
Plastic waste	3
Total	1,008

Source: Barrowclough et al. 2020.

AIODIS, or the RECs to which they are party, may need to consider two types of actions in relation to trade in plastic and combatting MPP: on the streamlining of procedures for trade in waste plastics and alignment of measures on trade in of plastic goods, including 'hidden plastics' – plastics that are used in products which are not classified as plastics in trade statistics (e.g., vehicles, electronics, toys and others).[411]

Trade in waste will benefit from common procedures to implement the Basel Plastic Waste Amendment on Prior Informed Consent (PIC).[412] This will involve capacity building, possible changes to customs codes and waste product or contaminant definitions in national legislation and dialogues with the SWM business community, exporters, importers and recyclers on actions to minimise costs, to avoid technical issues and to facilitate regional economies of scale in handling plastic waste.

[409] OECD, 2018. Improving Plastics Management: Trends, policy responses, and the role of international co-operation and trade. Background Report. Prepared by the OECD for the G7 Environment, Energy and Oceans Ministers. September 2018; OECD, 2019. Improving Resource Efficency to Combat Marine Plastic Litter. Issue Brief. Prepared by the OECD as input for the 2019 G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth January 2019. See also: Ministero della Transizione Ecologica. Mainstreaming the work of the Regional Sea Programmes towards the better implementation of the G7 Action Plan and the achievement of the global commitments on marine litter. Rome, Italy - 20-21 April 2017. https://www.minambiente.it/pagina/g7-workshop-marine-litter.

[410] Barrowclough, D. et al. 2020. Global trade in plastics: insights from the first life-cycle trade database. UNCTAD Research Paper No. 53, UNCTAD/SER.RP/2020/12.

[411] WTO, 2019. What role for the WTO in addressing plastics pollution? Workshop co-organized by China, Sri Lanka and Morocco, 25 November 2019. WTO, Geneva.. https://www.wto.org/english/tratop_e/envir_e/cte_week_251119_e/china_251119.pdf; Birkbeck. C.D., 2020. Strengthening international cooperation to tackle plastic pollution: Options for the WTO. Global Governance Brief No. 01 January 2020. https://static1.squarespace.com/static/5b0520e5d274cbfd845e8c55/t/5e25683a556e15498ad1e73f/1579509842688/Plastic_Trade_WTO_Final.pdf

[412] Annex II: Y48 plastic subject to PIC; Annex VIII: A3210 hazardous waste; and Annex IX: B3011 (e.g. clean PET) excluded from the PIC.

AIODIS can also benefit from alignment of measures on trade in plastic products to facilitate trade, reduce unnecessary or unwanted plastics, and avoid potential conflicts with WTO rules. The measures fall into several categories which may come under scrutiny for compliance with WTO rules: government procurement; import licensing; quantitative restrictions (e.g., bans); SPS and TBT measures. Other approaches could include harmonised regional rules that foster inclusion of environmental costs in product prices; removal of inappropriate subsidies; incentives for innovation, development of local plastic substitutes and investment in a circular economy; 'sunset' periods for elimination of products such as SUPs; harmonised trade descriptions and standards on SUPs; requirements for labelling and product information; and common EPR provisions. In most, if not all cases, alignment on a regional or global basis will be of benefit.[413]

12.2.3 World Economic Forum (WEF)

The WEF builds bridges between intergovernmental organisations, governments, civil society organisation, and the private sector, including the plastics industry and investment banks. Since 2018, the WEF has created space for a rich dialogue which seeks to link the actions of environmental, social and economic stakeholders in efforts to 'solve the plastics problem' through synergies, value addition, innovation and finance. The Global Plastic Action Partnership (2018) was established by the WEF as a global platform for plastic action that enables public, private and civil society leaders and their initiatives to interact and drive the transition towards a circular plastics economy, while helping to restore natural systems and creating growth opportunities. It involves contributors to MPP, such as PepsiCo, Nestlé, the Dow Chemical and Coca-Cola and has ties with the OECD and with the World Resources Institute, which provides technical backstopping, and with the GEF. The Partnership has focused actions on Indonesia, Ghana and Vietnam, partly through development of national action plans and opening opportunities for partnerships and resourcing for implementation of the plans.[414]

12.3 Industry and civil society initiatives

12.3.1 Initiatives, partnerships and their objectives

While industry initiatives are viewed differently depending on perspective, the plastics industry, including users of plastic packaging, such as plastic bottles, clearly has a major role in both causing and combatting MPP. The more sceptical consider industry initiatives as a means of 'greenwashing', or improving their image of corporate responsibility, as a means of satisfying environmentally-motivated shareholders, as an opportunity to keep abreast of an evolving plastics paradigm, or simply as a means of assuaging liability for legacy issues.[415] The sceptical perspective is supported by the often duplicitous industry support for 'green' activities, while litigating to prevent complementary regulatory controls.[416]

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[413] Barrowclough, D. and D. Vivas Eugui, 2021. Plastic Production and Trade in Small States and SIDS: The Shift Towards a Circular Economy. International Trade Working Paper 2021/01. Commonwealth Secretariat, London. See also: Liuab, Z. et al. 2018. Are exports of recyclables from developed to developing countries waste pollution transfer or part of the global circular economy? Resources, Conservation and Recycling. Volume 136, September 2018, Pages 22-23; Communication on trade in plastics, sustainability and development by the United Nations Conference on Trade and Development (UNCTAD). https://unctad.org/en/PublicationsLibrary/wto_unctad_CTE2020_en.pdf; GRID-Arendal, 2019. Controlling Transboundary Trade in Plastic Waste (GRID-Arendal Policy Brief). http://www.grida.no/activities/311; Deere Birkbeck, C. 2019. Tackling Plastics Pollution: What Role for the WTO? Global Governance Center; Barrowclough, D. and C. Deere Birkbeck, 2019. The Political Economy of the Global Plastics Economy: Production, Trade and Governance. Economic Governance Programme Working Paper, Global Economic Governance Programme, University of Oxford.

[414] https://www.weforum.org/agenda/2020/01/wto-address-plastic-pollution/; https://globalplasticaction.org ; WEF, 2020. Radically Reducing Plastic Pollution in Indonesia: A Multistakeholder Action Plan National Plastic Action Partnership. April 2020. https://globalplasticaction.org/wp-content/uploads/NPAP-Indonesia-Multistakeholder-Action-Plan_April-2020.pdf.

[415] E.g. https://www.earthisland.org/images/uploads/suits/2020-02-26_Earth_Island_Complaint_FILED.PDF

[416] See US litigation against plastic bag restrictions. https://www.plasticbaglaws.org/litigation.

The plastics industry became aware of the MPP problem no later than the 1970s and was actively involved scientific meetings on the issue. Historically, the plastics industry ignored MPP and downplayed the threats. More recently the industry has acknowledged the problem and promotes reuse and recycling while regularly opposing measures that ban plastics or regulate plastic products.[417] In 1984, USA held the first workshop on marine debris.[418] Conservation NGOs, UN agencies and governments have entered partnerships with industry, or partnerships supported by industry, in either conscious or unconscious recognition of the power of industry to either stymie 'green' initiatives or lend its knowledge, resources and support and cooperation to initiatives.

Industry and civil society initiatives can be classified in three groups: (i) those which are industry driven and promote economic, technical solutions and may favour 'softer' regulation; (ii) those independent of industry, pursuing agendas supported by governments, consumer organisations, conservation and philanthropic organisations, or scientific networks; and (iii) blended initiatives combining the interests and agendas of both (i) and (ii) above, through partnerships, alliances, campaigns, or a narrow focus on areas of common concern (e.g., beach clean-ups).

The plethora of industry lobbies and civil society actors has spawned a multiplicity of messages in an effort to distinguish and gain support for their efforts. The messaging ranges from saving endangered turtles and seabirds to campaigns against incinerators or plastic straws. Analyses suggest that many initiatives are often narrowly focused on post-consumption actions (such as SUPs, plastic bags) rather than on systemic actions along the entire plastic value chain. Many industry commitments also tend to focus on downstream actions rather than on reduction, reuse, and redesign of the products and remain as 'add-ons' to remedial treatment of a linear economy approach, rather than fully embracing a circular economy approach to the problem.[419]

An analysis of the complexity, scope, partnerships and influence of the numerous initiatives is beyond the scope of this report. Selected initiatives are listed in Appendix 2, several of which are active in AIODIS. Some of the more well-known are briefly described below.

When engaging in such initiatives AIODIS' stakeholders need to be aware of the underlying philosophy, the possible vested interests, the implications of the messaging and the trade-offs involved. For example, despite their potential to generate much-needed financing, emerging paradigms involving plastic footprints, plastic credits or offsets may need to be treated with due caution.[420]

12.3.2 Overview of selected industry and civil society initiatives

The **Honolulu Strategy** prepared as an outcome of the Fifth International Marine Debris Conference is a framework for global effort to reduce the ecological, human health and economic impacts of marine debris. It orientates three actions: prevention of MPP from marine sources, from land-based sources and removal of existing debris.

The **Ellen MacArthur Foundation** develops and promotes the idea of a circular economy. It works with business, academia, policymakers, and institutions to mobilise 'systems solutions' at scale and globally.[421] It has a number of major strategic industry partners (Unilever, IKEA, Danone and others).[422]

[417] Center for International Environmental Law. Plastic Industry Awareness of the Ocean Plastics Problem. https://www.ciel.org/wp-content/uploads/2017/09/Fueling-Plastics-Plastic-Industry-Awareness-of-the-Ocean-Plastics-Problem.pdf

[418] NOAA. 1984. Workshop on the Fate and Impact of Marine Debris.

[419] Changing Markets Foundation, 2020. Talking thrash. The corporate playbook of false solutions to the plastic crisis. https://talking-trash.com/wp-content/uploads/2020/08/TalkingTrash_ExecutiveSummary.pdf.

[420] See various assessments of the Kyoto Protocol; WWF, 2021. WWF Position: Plastic crediting and plastic neutrality.

[421] https://www.ellenmacarthurfoundation.org/our-story/mission

[422] See also: New Plastics Economy Global Commitment https://www.ellenmacarthurfoundation.org/our-work/activities/new-plastics-economy/global-commitment.

3R Initiative (3RI) is developing a market-based approach focused on collection and recycling activities and increased accountability for plastic waste reduction efforts around the world.[423] It is active in India and Ghana. Its founding members include Nestle, TetraPak and Danone. 3RI supports a market for plastic credits which will transparently and sustainably increase the value of plastic and beverage carton waste, and incentivise new activities that support the circular economy.[424]

The **Global Alliance of Waste Pickers** is a networking process supported by Women in Informal Employment: Globalizing and Organizing (WIEGO) and engages with thousands of waste picker organizations in more than 28 countries covering mainly Latin America, Asia and Africa.[425] National organisations in Kenya, Senegal and South Africa are involved.

GAIA is a worldwide alliance of more than 800 grassroots groups, non-governmental organisations, and individuals in over 90 countries. Initially with an anti-incinerator focus, GAIA aims to catalyse a global shift towards environmental justice by strengthening grassroots social movements that advance solutions to waste and pollution.[426]

Parley for the Oceans focuses on consumer choice using art and creative industries deploying an Avoid, Intercept and Redesign (AIR) strategy and upcycling waste plastic into consumer products. The waste is derived from clean-ups or waste fishing nets. Some products are sold on-line and some are brand-name products, such as Adidas runners.[427] Both Maldives and Seychelles have engagement with Parley.

The Pew Charitable Trusts Preventing Ocean Plastics project supports a wide range of activities. Arguably, the most important has been the preparation and dissemination of the 'Breaking the Plastic Wave' report, which presents the first costed global model for reduction in plastic pollution.[428] The model proposes an 82 percent reduction to 2040 based on a suite of actions across five action categories: reduce, substitute, recycle, improved disposal, and apply known microplastics solutions. The model proposes specific actions and quantitative targets:

- reduce growth in plastic production and consumption to avoid nearly one-third of projected plastic waste generation through elimination, reuse, and new delivery models
- substitute plastic with paper and compostable materials, switching one-sixth of projected plastic waste generation
- design products and packaging for recycling to expand the share of economically recyclable plastic from an estimated 21 per cent to 54 per cent
- expand waste collection rates in the middle/low-income countries to 90 per cent in all urban areas and 50 per cent in rural areas and support the informal collection sector
- double mechanical recycling capacity globally to 86 million metric tons per year
- develop plastic-to-plastic conversion, potentially to a global capacity of up to 13 million metric tons per year
- build facilities to dispose of the 23 per cent of plastic that cannot be recycled economically, as a transitional measure
- reduce plastic waste exports by 90 per cent to countries with low collection and high leakage rates.

[423] https://www.3rinitiative.org/;
[424] https://verra.org/new-plastic-stewardship-initiative/.
[425] https://globalrec.org/.
[426] https://www.no-burn.org/about-gaia/.
[427] https://www.parley.tv/#fortheoceans.
[428] Pew and SYSTEMIQ, 2020. op. cit. https://www.systemiq.earth/wp-content/uploads/2020/07/BreakingThePlasticWave_MainReport.pdf.

Plastic (offset) credits and certification schemes. A number of these schemes have emerged to generate value from commitments to reduce plastic pollution. These include schemes to certify the plastic has been recycled, is compostable, or has been collected from the ocean. Plastic credits are similar to carbon credits which arose as part of the efforts to comply with the UNFCCC Kyoto Protocol. Definitions, standards, verification schemes, and markets are created by the owners, or promoters of the schemes. The certificates, or credits are issued by the schemes and purchased by brands to demonstrate corporate responsibility and sustainable practices.[429] The schemes are businesses rather than altruistic endeavours, and while they may help expand markets for recycled plastic, their overall impact remains unclear. They may also generate perverse incentives or skew market for recycled plastics if not appropriately designed or implemented. In general, these schemes should apply ISEAL's Codes of Good Practice.

The **African Plastics Recycling Alliance** was formed in 2019 by a group of international consumer goods companies operating across Africa aims to transform plastics recycling infrastructure across sub-Saharan Africa. The **South African Plastics Recycling Organisation** (SAPRO) has operated since 2010. **UPSTREAM** sparks innovative solutions to plastic pollution and brings people together to transform our throw-away society to a culture of stewardship. **IPEN** brings together leading public interest groups working on environmental and public health issues in over 100 countries to take action internationally to minimize and, whenever possible, eliminate hazardous, toxic chemicals. The Break Free From Plastic Movement (**BFFP**) is a network of over 10,000 organisations tackling plastic pollution across the whole plastics value chain with a focus on prevention.[430]

13 Building awareness

13.1 An integral part of an action plan

An awareness campaign on MPP will generally need to be anchored in a broader environmental or sustainability framework and in policies. The campaign will backstop the desired changes to consumer behaviour, foster sustainable business practices, and provide for the engagement of other stakeholders, such as local authorities. The awareness campaign could be part of a national environment education programme, linked to a sustainable development vision, a blue economy programme, or the development of the circular economy. It may well be anchored in several of these frameworks.

Awareness activities can therefore generally be embedded as an integral part of national policy and strategic action plan and designed to support its preparation, to support the public dialogue involved, or the implementation of the plan. Design of the awareness activities will need to address a number of questions.[431] These include:

- why undertake the awareness – to change behaviours, influence decisions, gain political support, justify new regulations, explain the science?
- awareness for whom - policy makers, consumers, the business community, youth and schoolchildren, local authorities or 'all of the above'?
- what are the messages – human health, economic loss, environmental damage, compliance, business responsibility, national 'clean' image, future generations, explain how plastic taxes are used?

[429] Schemes include: Circular Action Hub, plasticbank, rePurpose, Plastic Credit Exchange, and others.

[430] https://www.breakfreefromplastic.org/.

[431] UNEP, 2017. Consuming Differently, Consuming Sustainably: Behavioural Insights for Policymaking. Ideas42. https://sustainabledevelopment.un.org/content/documents/2404Behavioral%20Insights.pdf.

13.2 Designing awareness campaigns

The fundamental objective of an awareness campaign is to change human behaviour. The 'plastics problem' is as much about people and their behaviour as it is about plastics. Approaches to inducing behavioural change can be broadly categorised into three groups: (i) command and control – rules and regulations; (ii) market-based (e.g., taxes on plastic products, 'free' collection of plastic waste); and (iii) information strategy, including consumer advocacy, industry codes of practice, product labelling and public pressure. An awareness initiative is grounded in an information strategy but may be directed at, or act in support of, the other two approaches in terms of rationale and incentives.

The assumption is that raised awareness will change behaviours and affect environmental change. However, the impact of an awareness initiative is not always clear and the value of efforts to increase awareness depends on how the campaign is designed: its objective, target, timetable, and participation. There is a strong case for inclusion of behavioural sciences in the design of an awareness campaign: to determine strategies; to refine messaging; to identify target groups and stakeholder priorities attitudes, beliefs and possible cultural constraints; to assess reactions to measures (e.g., a SUP ban); or to design the rollout of regulations.[432]

Segmentation is a common tool in advertising and simply helps target different groups with messages designed to change the behaviour of that group. For example, in an anti-litter campaign in the UK, the research segmented the public into four groups on the basis of attitudes and beliefs and held focus groups to identify how behaviours might be changed. The groups were:

- converts - aware that their behaviour can have a negative effect on the environment and taking appropriate steps as a responsible individual
- sympathisers - aware that their behaviour has an effect on the environment and taking some steps towards leading a more sustainable lifestyle
- unawares - unaware their behaviour has an effect on the environment - taking no steps
- sceptics - may or may not be aware that their behaviour has a negative effect on the environment and resist making any changes to their lifestyle.[433]

Surveys were able to categorise littering 'beliefs' and link them with character traits, for example:

- duty – 'it's my civic duty not to litter'
- justifiers - 'others are worse than I am'
- can't be bothered – 'what difference is it going to make?'
- guilty – 'its ok as long as no one sees I am littering'
- blamers – 'local authority should clean up/provide more waste bins'.

Some of the conclusions were that public areas should be kept clean as an example, youth education influences behaviour, using celebrities works, enforcement has a role (e.g., as in Singapore).

[432] K. Akerlof, C. Kennedy, 2017. Nudging toward a healthy environment: How behavioral change research can inform conservation. Moore Foundation. George Mason University; Economic Commission for Latin America and the Caribbean. 2000. Role of environmental awareness in achieving sustainable development. LC/R.1961.

[433] Campbell, F. 2007. People Who Litter. www.encams.org.

13.2.1 Awareness on plastic pollution

The 'plastics problem' is complex. However, awareness messages need to be simple without being over-simplistic. Accurately reflecting the science and public trust in science is important. Knowledge is not sufficient: intentions do not always align with the desired actions due to costs or convenience. Consumer choices are often a result of habits.

The desired changes in behaviour may not appear relevant to an individual or the rationale for change may not be clear. Behaviour is strongly influenced by peers and social groups and it can be hard to implement sustainable choice. Surveys or research to understand the drivers and change agents can be a useful investment: 'Facebook' could be more relevant than a classical public information campaign through television or radio. The choice of media and messaging (posters, television screens, flyers, websites, public exhibitions, stakeholder meetings) depends on the target group and the desired behavioural change.

Studies highlight that simplicity of messaging enables informed consumer choice, e.g., clarity with regard to product recycling labels is important; complexity in messaging or labelling (e.g. multiple different green labels or ecolabelling schemes) causes confusion. Convenience, clarity, or emphasis on a default choice – 'if in doubt, choose green' - promotes its selection. Ideally, regulations should prevent companies using price discounts to undermine warnings or efforts to promote sustainable choice. Transparency and trust in information, fairness in regulations, and attention to ethical issues promotes uptake, as stakeholders may have a negative view of government regulations. Cultural or religious attitudes may also be important. Acceptance by the public is greater when messages are linked to relevant values and perceptions and backed with transparent communication and implementation

Behavioural economics indicates that the combined impact of a suite of policy measures (such as regulations, consumer information and environmental taxes) is complex and may not deliver the desired behavioural change (e.g., separating household waste). Consequently, actions to monitor and assess the of impacts are necessary and mechanisms to adjust the measures are required. These efforts could include surveys and focus groups.[434] For example, a survey of 700 stakeholders in SE Asia (2020) asked: "what is the most important thing to do to beat plastic pollution?" The outcomes were: (i) stronger regulations on SUPs (38%); (ii) redesign plastic products to be easier to reuse and recycle (23%); promote reduction, reuse and recycling (21%); and (iv) make better choices as consumers and use less single-use plastics (18%).[435]

13.3 Selected examples of plastic campaigns and associated actions

The following are some examples of national awareness campaigns and related actions:

Australia. Investments in awareness led to larger reductions of plastic waste on Australian beaches than did policy investments, such as plastic bag bans and support for recycling, particularly when combined with policy measures.[436]

France. The 'Triman' label in France is a mandatory waste label that marks all household waste that is recyclable. The label was established by regulation to provide a unified information and signage for all recyclable products that are placed on the French market under Extended Producer Responsibility

[434] Lunn, P., 2014. Regulatory Policy and Behavioural Economics. OECD; OECD, 2019. Delivering Better Policies Through Behavioural Insights. OECD.

[435] OECD, 2017. Behavioural Insights and Public Policy: Lessons from Around the World. Life Cycle Initiative https://www.lifecycleinitiative.org/resources/reports/.

[436] Kathryn Willis et al. 2018. How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment? Marine Policy Volume 96, October 2018, Pages 243-249.

(EPR) schemes. France carried out campaigns on plastic pollution in the fishing and aquaculture sector, established a citizen science marine litter platform and engaged with NGOs (www.remed-zero-plastique.org)

USA has specific legislation on marine litter (Marine Debris Act). New England has a scheme for recycling GRP vessels (mainly yachts and pleasure boats). Competitive small grants are awarded through the Urban Waters and Environmental Justice schemes. The Green Blue Institute, developed the How2Recycle Label program to optimise waste sorting. Firms may choose to put this label on their products to provide consumers with sorting and recycling guidance.

Evidence from divers. In 2011, through the Dive Against Debris campaign more than 25,000 divers conducted about 4,000 surveys, removing and reporting over 800,000 debris items from coastal seas, of which 63 percent was plastic. The scientifically managed campaign provide an evidence basis for action on MPP.

Canada undertook national outreach campaigns (10,000 Changes and Be Plastic Wise), developed an Oceans Plastics Education Kit, and funded the Great Canadian Shoreline Clean-up programme.

Germany's Ocean Plastics Lab is a travelling exhibition targeting policy-makers and set up at major events (e.g., G7 meeting) (https://oceanplasticslab.net/).

Indonesia raises awareness using multiple channels: social media, radio and television, newspapers, clean-up campaigns, exhibitions and through school programmes (green school). Behavioural change is a key component of the Plan of Action on Marine Plastic Debris which aims to reduce the debris by 70 percent by 2025. The behaviour change 'playbooks' aim to empower local community and youth initiatives and campaigns.[437] Indonesia's National Plastic Action Partnership includes public awareness and behaviour change as one of four pillars. The other three pillars are: investments and sustainable finance; innovation (research, technology/development, business models, markets); and metrics (transparency and accountability), including the Indonesian Marine Pollution Database.[438]

Japan has used a Marine Litter Zero Award and model projects for local governments.

Korea has a monthly beach clean-up day, numerous media campaigns and runs a contest for innovations to combat marine litter and improve recycling.

South Africa has a Source to Sea initiative and has held national policy workshops.

Russia has banned the use of SUP goods during holidays and in Moscow households can exchange separated plastic waste for tickets to cinemas. A similar exchange scheme operates in Reunion (http://www.fourmize.com/).

Singapore has voluntary agreement (industry, NGOs and government) to reduce packaging waste.

Netherlands. In order to reduce microplastics from tyre wear, the Netherlands has a campaign on tyre pressure and type.

Brazil has established a database to track marine litter.

UK has developed a partnership with Commonwealth countries.

Portugal has an 'app' that enables the public to count marine litter on beaches. https://www.lixomarinho.app/

[437] The activities are supported by the World Bank ISOP project.

[438] https://globalplasticaction.org/wp-content/uploads/NPAP-Indonesia-Multistakeholder-Action-Plan_April-2020.pdf

Appendix 2 provides a selection of guidelines and media resources developed for awareness campaigns.

14 Towards a Plastics Circular Economy in AIODIS

A companion study examines the AIODIS circular economy (CE) in general. Issues specific to a circular economy for plastics in AIODIS are described in more detail in Part II of this report and outlined in Box 16.

Box 16. Challenges to an AIODIS plastics circular economy

Despite a high level of diversity among AIODIS, a number of vulnerabilities are common to many states and constrain capacity to manage plastic waste and engage in a viable circular economy:

- small population means limited markets and market power and scarcity of human resources and institutional capacity as smaller institutions must manage a complex national agenda.
- small economy often means a dependence on few industries, such as tourism and fisheries, both of which are contributors to MPP. In addition to relatively high debt levels, the Covid-driven decline in tourist revenues has had a major impact on many AIODIS economies and is likely to constrain investment in tourism, in waste management and projection of future government revenues.
- geographies that disperse population among numerous islands (e.g., Maldives) or challenging terrain (e.g., Cape Verde) means fragmentation of economic activities, high waste transport costs
- isolation of island economies constrains access to markets for waste and supply of factors of production for waste management and recycling
- limited area puts pressure on land available for waste disposal (Seychelles, Maldives) and may drive unplanned settlements which are not serviced by waste management schemes
- awareness of sustainable consumption and good waste management may be limited, partly due to poor educational levels in some segments of the population
- natural disasters are a significant threat, e.g., tsunami and sea-level rise (Maldives), volcanic activity (four AIODIS), seasonal cyclones and flooding. Climate change is an overarching threat.

** some generalities may not be applicable to Madagascar or Maldives (for different reasons).*

In a plastic circular economy, reuse and recycling should be prioritised in accordance with the waste hierarchy. However, the diversity of plastic waste in terms of chemical composition, the high costs required to sort, wash and convert the waste into a recycled raw material, and low or no plastics manufacture in small economies, means recycling may not be a viable option.[439] Sorted plastic waste may have to be exported to be recycled. In the absence of an export market, a significant proportion of waste plastic is likely to be streamed into 'waste to energy', or incineration. This is the option of last resort when recycling and reuse are not feasible, but is considered preferable to landfill. Assuming that a national CE plan includes provisions for plastics, AIODIS countries could focus on several questions:[440]

- which plastics are essential, which are unwanted, problematic or un-necessary?
- which plastics/plastic waste cannot be reused or recycled?

[439] Wang, F., L. Talaue McManus, R. Xie (eds.). Addressing Marine Plastics: A Roadmap to a Circular Economy. UN Environment Programme, 2019; Barra et al. 2018. Plastics and the circular economy. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC.

[440] PA Consulting. 2019. The Sustainable Manufacturing Revolution Why the circular economy has the potential to transform manufacturing in low-income countries. UKAid.

- which plastic waste cannot be exported (for whatever reason)? Can the export constraints be overcome?
- how can residual waste plastics be disposed of? What are the costs and impacts and who should pay these costs?
- how can **R**efuse (to import) measures be applied without undue economic costs?
- how can **R**eturn measures be applied in the context of EPR, Basel and other rules?

The answers are country, product and industry specific, but illustrate that when certain 'undesirable' plastics are allowed to enter a small island economy, the resulting waste may have little prospect of becoming part of a domestic circular economy. If the waste cannot be exported, disposal becomes problematic and costly.

14.1 Plastic recycling

The size of the market for recycled plastics is projected to grow by $14.74 billion in the 2020-2024 period. [441] The key economic determinant is the price of recycled raw material compared to virgin plastic feedstock, the price of which is strongly correlated with the price of oil.[442] It is estimated that the best available recycling technology, fully deployed, could process a maximum of 53 percent of the current plastic mix. To date, only 9 percent of plastic produced has ever been recycled.[443]

Public interest in reducing the negative environmental footprint of plastic products is a key driver of recycling. In order to retain market share, many global brands have set targets to reduce, eliminate or recycle their plastic products. Examples include drinks companies and producers of cosmetics and household cleaning agents. The trend has been reinforced by policy and regulatory actions by governments, municipalities and regional economic blocks (particularly, the EU).

The largest technological gaps include the cost-effective practices and technologies for collection, sorting and recycling of wastes that maximise the volume, usability, purity, quality of the waste and also add value from redirection of material to other streams such as energy from waste. There are particular technical challenges associates with composite products such as multilayer packaging.

Extended Producer Responsibility (EPR) policies and regulations can help improve recycling, reduce waste and landfilling and may (directly or indirectly) save costs to consumers. Plastics are an important target for EPR schemes in developed countries and, increasingly, in emerging economies. While EPR schemes present opportunities, they also face policy, trade, design and implementation challenges, including the assessment of the costs, the environmental effectiveness and market impacts.[444]

14.2 Recycling plastic boats and fishing gear

The EU commissioned two projects on boat recycling: Boatcycle (2010-12) produced guidelines for building boats in a more sustainable way and instructions for dismantling and recycling end-of-life boats; Boat DIGEST (2013-15) provided training and accreditation for boat dismantling.[445] The Fishing for Litter HUB is a portal which provides unified information about Fishing for Litter initiatives

[441] Technavio. 2020. Recycled Plastics Market by End-user, Type, and Geography - Forecast and Analysis 2020-2024. Feb 2020.

[442] Locock, KES (2017) The Recycled Plastics Market: Global Analysis and Trends. CSIRO, Australia.

[443] GAIA, Zero Waste Europe, and CIEL reports. For Africa see: Sadan, Z. and De Kock, L. Plastics: Facts and Futures: Moving beyond pollution management towards a circular plastics economy in South Africa. WWF South Africa, Cape Town, South Africa.

[444] For guidance see: OECD, 2016. Extended Producer Responsibility. Updated Guidance for Efficient Waste Management. https://www.oecd.org/environment/extended-producer-responsibility-9789264256385-en.htm.

[445] See also: EC/ Farnet, 2019. Circular economy in fisheries and aquaculture areas. Farnet GUIDE #17; OSPAR, 2019. Scoping study to identify key waste items from the fishing industry and aquaculture. Marine Litter Regional Action Plan Action 35.

throughout Europe and will be used to implement various aspects of the Port Reception Facilities Directive and Single Use Plastics Directive. France requires boat owners to pay an 'eco tax' when they register their boats and the funds generated are used to scrap old boats. The owners must transport the boats to an approved recycling centre. The challenges of implementing EPR are noted in Box 17.

Examples of commercial services include the following. Roth International provides a global service for disposal of boats.[446] In the USA, Eco-wolf uses scrap fibreglass to make bathtubs and railways sleepers and filler for boat repairs. A Norwegian company turns fiberglass into flowerpots and benches. Ryds Båtindustri AB, Sweden's largest GRP boatbuilder, in association with the Swedish Institute of Composites, began manufacturing boats with recycled scrap, which accounted for about 10% of its production. The Rhode Island Fiberglass Vessel Recycling (RIFVR) Pilot Project aims to address the disposal issue for the high number of recreational fiberglass boats reaching the end of life. Between 2003 and 2012, about 1.5 million recreational boats in the U.S. were "retired."[447] Odyssey Innovation (UK) uses waste fishing gear to manufacture kayaks.[448] R.J. Marshall (USA) recycles fiberglass (mainly SMC).[449]

Box 17. EPR and recycling of fishing gear

Challenges:

- use of mixed materials during manufacture, only some of which have value for recycling, or pose difficulties in separation
- an effective EPR scheme must accept both valuable and non-valuable materials
- colour separation is important for recycling and how and where (at port, by recycler?) to effectively separate different coloured fishing gear (e.g. netting, ropes) is problematic
- recycling is a challenge for the producers of fishing gear, not the fishing industry.

Opportunities:

- leasing rather than buying gear may facilitate effective EPR schemes
- 'discounts' on new gear if old gear is streamed to recycling
- the fishing industry/ associations can help in separation schemes, but recycling is up to the producers
- policy and awareness focus on 'gear management' or cost savings rather than 'ghost gear'
- 'ecological' fishing gear design should be a consideration from the outset. This might require that the number/type of polymers is simplified and possible loss of gear efficiency
- focus on standards rather than throughputs: ensure that separation and sorting takes place rather than monitoring volume
- share good practice and recruit fishermen ambassadors in each port to accelerate the transition to a circular economy for fishing gear
- policy recommendations to maintain a clear distinction between aquaculture and fisheries
- rather than financial incentives, create incentives for fishermen that benefit the fishing community as a whole, for example, public infrastructure made from recycled fishing gear (park benches, litter bins).

Source: https://www.kimointernational.org/news/exploring-extended-producer-responsibility-schemes-for-fishing-gear/

[446] https://www.roth-international.de/en/disposal/disposal-of-vessels-boats/.

[447] The Rhode Island Marine Trades Association (RIMTA) is the project's sponsor.

[448] https://www.odysseyinnovation.com/about.

[449] https://www.proboat.com/2016/09/recycling-dead-boats/. Sheet Molding Composite (SMC) is extensively use and without economies of scale, SMC may cost more to recycle than it does to dump. It is generally composed of randomly oriented, short-chopped fiberglass in a thick resin (usually polyester, but also epoxy, Kevlar, or carbon fibre) and filler paste.

15 Moving forward

1. Marine plastic pollution (MPP) is a growing environmental, social and economic challenge for AIODIS. Combatting MPP requires national actions, regional cooperation and engagement in global initiatives. The complexity of the solutions requires multiple actions by diverse stakeholders across sectors, disciplines and communities. Implementing effective actions to combat MPP requires national and regional action plans, resources, finance, awareness, and political will.

15.1 National MPP action plans

2. AIODIS can consider preparation and/or implementation of national action plans to combat MPP. The action plan can be complementary to a national solid waste management (SWM) plan. If an updated and comprehensive national SWM plan does not exist, then its preparation and resourcing could be considered a priority. The MMP plan can draw on national environmental and economic plans, link to national commitments on the SDGs, interface with the business community and civil society and provide a platform for accessing resources and public engagement. Regional cooperation can be a key component. Core elements of a national action plan are described in Part III, section 10.2. The preparation process can draw on the lessons from other plans in the region and elsewhere.

15.2 Regional MPP action plans

3. Components of regional action plans already exist at various stages of their development. Ideally, the plans can be further developed to include binding measures consistent with UNCLOS Part XII and provide a platform to secure the political will and resources to address the multiple actions required, including on trade, solid waste management, development of a circular economy, enhanced human and institutional capacity and mainstream regional cooperation. The institutional architecture of the regional plans can be tailored to the requirements of each area and ideally will engage both regional economic organisations and regional seas conventions or their equivalents.

15.3 Engagement by AIODIS in global initiatives and fora

4. AIODIS can benefit from a harmonised position on MPP that articulates the specific challenges of small and island economies and ensures that these are considered in the development of global initiatives and solutions. A harmonised position may be developed as a group or through international bodies to which AIODIS are party, including regional economic and political platforms and regional seas conventions, or their equivalents.

5. The harmonised position can draw attention to the information gaps, the capacity and resource deficits, special considerations for trade measures, the issue of MPP carried by ocean currents and generated by non-AIODIS sources, development of measures on fisheries and compliance with relevant norms of shipping.

6. The targeted fora may include UNGA, UNEA, WTO and IMO and the related technical advisory bodies or committees which manage the agendas and prepare information documents or proposals for resolutions, measures or guidelines. Harmonised positions on two potential or emerging initiatives may be considered:

    a. A possible UNEA resolution to initiate a process leading to the development of an international convention on sustainable management of plastics

b. A possible process for the development of norms of conduct on marine plastic pollution in accordance with the obligations of the parties to UNCLOS to establish and implement such norms.

15.4 Accessing resources

7. **National resources**. As part of a national plan, AIODIS can review available resources and resource gaps. This could include attention to the funding arrangements for solid waste management at national, municipal and community levels; and requirements for institutional and human capacity development and for private sector investment. Clarity on the public and private contributions required may help tune investment guidelines and engage business community innovation.

8. **External resources**. External resources may be required to implement the plan. While countries may have different requirements, they share a number of shared requirements for external resources. Joint approaches could be considered to relevant UN technical agencies such as: UNEP; FAO and regional fisheries bodies (fishing gear); UNIDO (circular economy); UNESCO (awareness and scientific assessments); oceans agencies; the international conventions on waste; and to the international financial institutions (the GEF, World Bank, regional development banks, and 'green' funds).

9. Consideration can also be given to a harmonised approach to criteria for engagement in industry partnerships.

15.5 AIODIS trade in plastics and plastic waste

AIODIS may wish to consider a number of actions.

10. **National**. At national level, ensure coherence between trade policy frameworks and domestic policies to reduce plastic pollution. This may require attention to tariffs, customs codes, import and export standards and procedures, and training of customs officials. The scope could include alternatives to plastic products and technologies to improve waste management and boost recycling; removal of perverse subsidies and improved information on plastic trade. Consideration can be given to more comprehensive plastic tariff regimes, 'certification' of 'sustainable' plastic supply chains and more stringent conditions or prohibitions on trade in problematic plastics.

11. **Regional**. Ideally, at regional level, policies, measures, standards and information flows would be harmonised through initiatives facilitated by the RECs, AU or other competent policy agency. Studies would be prepared to define the scope and action required and lead to proposals at the level of the RECs.

12. **Global**. At a global level, AIODIS may wish to establish a common policy platform either through the RECs or by other means and ensure that their common concerns are articulated in the work of the WTO Committee on Trade and the Environment and reflected in any reports to be considered by the WTO ministerial conferences.[450] Given the difficulty of small and island economies to manage certain types of plastic waste, specific attention may be required to issues arising from any application of requirements on exporters to re-import the waste arising from their exports.

[450] Committee on Trade and the Environment https://www.wto.org/english/tratop_e/envir_e/wrk_committee_e.htm. The 12th Ministerial Conference is rescheduled to December, 2021.

APPENDIX 1. Country Working Papers

This Appendix is a compilation of the Country Working Papers prepared for stakeholder information and review. Because of project time constraints the Working Papers have not been significantly edited following initial distribution.

The Working Papers show a progression in the level of detail from the first prepared (Seychelles) through the three West Africa papers to Maldives, the last paper prepared.

There is some repetition in the Working Papers, in particular with respect to the description of the methodology used to estimate MPP, the treatment of regional cooperation and MPP from fisheries, shipping and tourism. The repetition is necessary so that they can be used as 'stand-alone' documents.

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Selected Abbreviations and Acronyms

(see main report for full list of acronyms / abbreviations)

GRP glass-reinforced plastic

MPP marine plastic pollution

MSW municipal solid waste

PET polyethylene terephthalate

SW solid waste

SWM solid waste management

WEST AFRICA

1 Cape Verde

1.1 Marine plastic pollution in Cape Verde

1.1.1 Sources of marine plastic pollution

This report provides the first estimate of marine plastic pollution (MPP) in Cape Verde. The estimate is preliminary and relies on several assumptions (see Table 1). There are three main sources of MPP in Cape Verde:

- mismanaged, or unmanaged solid waste which is by far the most important
- marine sources, mainly fishing activities and shipping with a minor contribution from marine leisure (yachts, cruise ships)
- plastics transported by ocean currents from non-AIODIS countries.

Table 1. Estimate of marine plastic pollution in Cape Verde

Item		Source/ Assumption
Population	549,935	World Bank 2019
Waste (kg/person/day)	0.874	PENGeR 2016
Waste (tons/year)	175,435	calculation
Plastic (%)	10.2%	PENGeR 2018
Plastic waste (tons/year)	17,859	calculation
Mismanaged plastic waste (tons/year)	5,358	30% (assumption)
Marine plastic pollution(tons/year)	268	5% of mismanaged waste (assumption)
Fisheries and shipping (tons/year)	30	assumed*
Microplastics	2	assumed
Non-Cape Verde sources	-	no information

** mainly attributable to regional tuna fishing*

The impacts of MPP are addressed in the main report.[1]

Solid waste. Although a relatively high proportion of urban waste collection is reported (about 85 percent of residences serviced), progress on implementation of national waste management plans has been slow.[2] Implementation faces a number of problems, including the island geography of Cape Verde and the mountainous terrain which results in relatively high costs of waste transport, lack of economies of scale for the municipal authorities responsible for about 17 municipal dumps and

[1] Specifically for the Eastern Central Atlantic islands, see e.g.: Rodríguez, Y. et al. 2020. Socio-economic impacts of marine litter for remote oceanic islands: The case of the Azores Marine Pollution Bulletin Volume 160, November 2020, 111631. https://www.sciencedirect.com/science/article/abs/pii/S0025326X20307499.

[2] Plano Nacional de Gestão de Resíduos (PNGR) 2004-2014; Plano Estratégico Nacional de Gestão dos Resíduos Sólidos (PENGeR) 2015-2030; Ecovisão. 2017. Roadmap dos Resíduos em Cabo Verde.

various collection systems.[3] In addition, high seasonal winds in Cape Verde carry plastic waste from mismanaged dumps where burning also contributes to dispersion of plastic waste particles. In 2017, over 8 percent of households disposed of waste directly into the environment (i.e., in gardens or local public spaces), while over 10 percent burned waste locally. Occasional flash floods may also transport waste plastic and litter to the ocean, including from about 150 'uncontrolled' waste dumps.

Progress on national waste management plans and 'roadmap' remains constrained by resources, lack of opportunities for recycling and means of generating value from wastes. Attempts have been made to organise waste-pickers, known as 'catadores' and there is ongoing concern for the health and well-being of these disadvantaged workers.[4]

Fisheries. Both local fisheries and international tuna fishing is a source of MPP through lost gear, including fish aggregating devices. Losses are generally related to the type of gear and location where the fishing takes place. Over 200 small-scale fishing boats operate in Cape Verde and about 50 larger 'industrial' (mainly tuna) vessels are based in Cape Verde. Global estimates of MPP from these sources are preliminary.[5] Gillnets have a high level of loss while fishing on rocky bottoms also increases losses

Since 2015, the NGO 'Calao' has collected over 16 tons of marine debris on Sal islands western beaches (about 90 percent plastic), a constant leakage of debris, mainly produced by the international fishing industry, some carried from mainland West African coastal fisheries. While there are a range of guidelines available, and various workshops have been held, it is unclear to what extent best practices are implemented in Cape Verde and regionally.[6] A 2019 regional workshop indicated a low level of awareness on the scale of and nature of appropriate solutions. Although most small fishing vessels are wooden, fibreglass (GRP) fishing vessels and pleasure boats are progressively reaching the end of their useful life, will accumulate as plastic waste and may degrade to marine microplastics if abandoned on beaches. Most countries have no provision for appropriate disposal of GRP vessels.

Shipping. Galley waste from shipping, including from cruise ships, can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. Arrangements for disposal of ships garbage in smaller ports in Cape Verde needs assessment. Inter-island cargo shipment of is about 1 million tons per year, an increase of over 12 percent per year in recent years.

[3] Ventura J.E., Santos E.D.O.S., Cabral A., 2013. A Problemática dos Resíduos Sólidos na Cidade da Praia. Atas do Colóquio Internacional Cabo Verde Guiné-Bissau: Percursos do saber e da ciência.

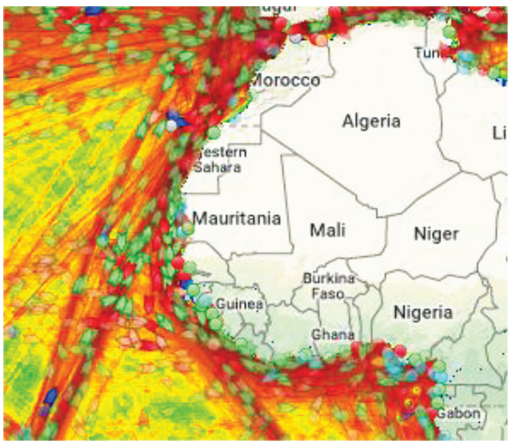
[4] About 80 catadores worked in Praia in 2015 (UNISOL study). See: http://www.southsouthworld.org/pt/component/k2/97-solution-pt-br/2109/apoio-a-promocao-do-artesanato-e-a-reciclagem-de-lixo-na-cidade-da-praia-cabo-verde-pt-br.

[5] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

[6] Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

Foreign sources. MPP in Cape Verde results from MPP in other countries including mainland Africa and South America. Beach litter surveys show marine litter originating in 25 countries. Circulation models for the Canary Current, the North Equatorial Counter-current and the Amazon plume suggest that plastic marine debris, including microplastics can be transported to Cape Verde waters. In addition, it is possible that some microplastics are carried in atmospheric dust on the NE trade winds from the West Africa mainland.[7] Although there are no specific reports of marine plastic debris originating from non-Cape Verde flag vessels, it is likely that industrial longline gear, FADs and other lost or abandoned gear contributes to MPP (see main report also).

Figure 1. Shipping traffic density West Africa



Microplastics. The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important factors. Where there are slow-moving rivers and extensive estuaries microplastics may become trapped before entering the sea. However, this is not the case in Cape Verde and the main sources are likely to be waste water (cosmetics, cleaning agents, laundry), road runoff of rainwater containing microplastics from car tyre abrasion, and air-borne microplastics resulting from burning and breakdown of macroplastics by wind and sun. There are no requirements to exclude microplastics from cosmetics and cleaning agents imported into or sold in Cape Verde. It is unclear if the various waste water treatment plants trap and effectively dispose of microplastics. The Ministry of Agriculture and Environment is understood to have initiated a study on microplastics.

1.1.2 Existing and potential measures to combat MPP

The priority is to implement the PENGeR, which provides a comprehensive check-list of policy, legislative, infrastructure and behavioural actions required by government, by the private sector and by consumers. Financing for implementation of the PENGeR appears to be a significant constraint and is not prioritised in any of the plans of the major development partners.[8] Parliamentarians have referred the Canaries ('zero plasticos no mar') and the Azores as providing examples of good practices adapted to Macaronesian region. Solid waste management is linked to numerous SDGs. The inclusion and tracking of indicators on urban waste management (SDG 11), plastic consumption (SDG 12) and marine pollution (SDG 14) in the INE reports on sustainability could be considered.[9]

A review of policy gaps and PENGeR implementation could uncover some cost-effective measures to reduce waste in general and MPP in particular. These may include measures to reduce or phase-out SUPs, codes of industry conduct for tourism to reduce SUPs and plastic waste, EPR schemes and a ban on the import of cosmetic and other household products which contain microbeads. Measures with respect to fisheries, shipping and development of awareness are briefly described below. Reference should be made to the main project reports for greater detail and discussion of recycling of plastic waste.

Solid waste management. A number of the activities set out in the PENGeR are under way or have been completed, such as the establishment of an information system (Sistema de Informação de Resíduos (Sires)) and the development of the Ilha Santiago sanitary landfill. National regulations on

[7] Zhang, Y. et al. 2020. Atmospheric microplastics: A review on current status and perspectives. Earth-Science Reviews, Volume 203, April 2020, 103118.

[8] E.g., WB, AfDB, EU, Luxembourg, Portugal.

[9] INE, 2019. Relatório Estatístico. Indiadores dos Objectivos de Desenvolvimento Sustentável, Cabo Verde. Agenda 2030.

municipal waste management were approved in 2020;[10] the prohibition on plastic shopping bags was introduced in 2015.[11] A range of studies may also provide insights for solid waste management.[12] Work by NGOs, by partnerships and others may also provide a basis for actions to combat MPP and address some the social issues involved.[13]

Tourism, including cruises, contributes about 25 percent of Cape Verde's GDP but drives about 40 percent of the economy. The number of tourists has quadrupled in the 2001-2017 period placing significant strain on waste management. A projected decline of about 70 percent in tourism in 2020 may offer the opportunity to introduce measures on plastic pollution and waste management, such as in tourist codes of conduct and reduction of SUPs by hotels. About 70 percent of cruise passengers disembark and spend an average of $45 per day.

Fisheries. In Cape Verde, marking of fishing gear, requirements for reporting loss and location of loss (i.e. with GIS reference), 'fishing' to recover lost gear, port reception facilities for waste gear and arrangements for recycling are all measures which can help reduce MPP from fishing.[14] Measures based on MARPOL Annex V can be applied to fishing vessels. The arrangements for collection and recycling of fishing gear collection and gear recycling programme require practical local solutions. Recycling of nets and ropes may require the economies of scale which are only feasible through regional schemes, through close engagement with businesses and possibly with economic support from EPR arrangements with importers. Studies suggest that the direct economic costs and benefits of fishing gear EPR schemes, such as deposit-return arrangements, or 'environmental taxes' on fishing gear imports are considered to be about equal (excluding indirect environmental benefits). However, the distribution of costs can be skewed, e.g., if manufacturers simply increase the cost of gear to fishers to cover EPR.[15] Fishers could introduce local rules to curtail gillnets in rocky areas where nets are frequently lost, as ghost fishing impacts on all fishers.

Abandoned GRP vessels present a growing plastic waste problem. Rules for disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

Reduction of MPP from international fisheries (e.g., tuna) requires a regional approach. This could start with resolutions by ICCAT, SRFC, and COMAFAT phasing in MARPOL Annex V requirements for vessels and with respect to FADs and specifying responsibility for recovery of FADs. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and be an approved ICCAT management measure. Fisheries support vessels could be included. FAO might be requested to provide support for design of a phased approach.

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[10] DL 26/2020.

[11] Lei nº 99/VIII/2015.

[12] Moreira, A.J.G. et al., 2020. Application of a decision support tool for municipal solid waste open dumps remediation in Cape Verde. African Journal of Environmental Science and Technology, January 2020; Silva, M.A,R., 2018. Plano De Negócios –Criação de uma Empresa de Reciclagem em Cabo Verde. Projeto de Mestrado, Instituto Politécnico de Lisboa; Mendes de Castro, M.E., 2017. Avaliação Ambiental Estratégica (AAE) de um Plano Operacional de Gestão de Resíduos na ilha do Sal - Cabo Verde. Universidade do Minho.

[13] WWF/ FIBA, 2010. Proposta do Plano de Gestão da Reserva Natural Marinha de Santa Luzia, Ilhéus Branco e Raso; and work by Sociedade Portuguesa para o Estudo das Aves (SPEA); GCV, ANMCV & PNUD. 2017. Catalog of Good Practices of Development in Cape Verde; Dias, S., 2018. Three ways waste pickers can be included in the new circular economy. Equal Times, 23 March 2018. www.equaltimes.org/three-ways-waste-pickers-can-be#.

[14] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear – Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

[15] EC, 2018. Study to support impact assessment for options to reduce the level of ALDFG Final Report 22-02-2018. https://webgate.ec.europa.eu/maritimeforum/en/system/files/Final%20Report%20Plastics%20from%20Fishing%20Gear%20Delivered.pdf.

Shipping. Ensuring that Cape Verde meets its obligations under MARPOL Annex V is the key action. Engagement between vessels operators and agents, port officials and waste disposal enterprises can help to ensure compliance on ships garbage disposal. Clarity on responsibilities for control, for inspection of ship's waste management logbooks and monitoring of practices at smaller ports may require agreements between Enapor, responsible ministries and municipal authorities. Dialogues could also help in separation of recyclables in ship's garbage. Possible dialogue IMO and regional port authorities could ensure coordinated measures to prevent dumping of waste by other shipping and foster codes of conduct by cruise lines.[16]

Possible regional initiatives. Prevention, reduction, or control of MPP from foreign sources requires regional (or global) action. Cape Verde could consider several cooperative initiatives:

- preparation of joint strategic plan on MPP under the Abidjan Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Abidjan LBSA Protocol
- preparation by the Abidjan Convention of programme and associated funding submission for a regional MPP monitoring. including from distant sources and collating information on beach clean-up through existing initiatives, and preparation of a strategic plan on MPP
- Further use of Comunidade dos Países de Língua Portuguesa in the context of a follow up to the Mindelo Declaration (2018).

Cape Verde could also consider initiating a dialogue in ECOWAS on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic (and other) waste would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of substitutes and collection and recycling schemes. Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO.

At the level of AIODIS and Africa, Cape Verde could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA. A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

Awareness of MPP. A range of approaches to raising awareness is detailed in the main AIODIS report. In the case of Cape Verde, the existing awareness may need to be channelled into practical actions, such as the separation of plastic waste, access to sources of funding for recycling, possibilities with regard to EPR schemes and development of a business case for 'valorização' of waste streams. Specific attention may need to be directed to preparing consumers for possible measures on SUPs and raising awareness on microplastic pollution as this is less visible. In addition to possible public awareness campaigns, awareness activities can build on the work of environmental NGOs and the development of materials for school curricula. Campaigns can also focus on voluntary actions and procurement policies, e.g., elimination of SUPs from public procurement. Given the relatively low level of manufacturing in Cape Verde engagement with existing manufacturers (e.g., CERIS(Estrela) and AguaBrava (water)) could foster innovation, initiatives and awareness.

[16] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report (see commitment on phasing out of SUPs).

Resources. As already noted, solid waste management does not appear to have a high priority in any of agendas of the development partners. This implies increased attention to the cost-effectiveness of waste management, means to reduce wastes (e.g., import of packaging), application of 'polluter pays' charges on items such as plastic bottles and plastic packaging, recovery of waste collection costs and possible cross-subsidy for collection from remote communities. A small task force could review the PENGeR with an emphasis on availability investment and recurrent finance and (in the absence of investment funds) the prioritisation of low-cost actions, including awareness raising and change in consumer and household behaviour on waste management. Island-level, or sector-specific plans to combat MPP, or to manage waste could be considered with a view to improved synergies between existing public and private efforts. The proposed 'blue bond' concept note flags the challenge posed by MPP and solid waste management and could potentially provide catalytic resources.[17]

[17] World Bank. 2020. Cabo Verde: Blue Bond Note. Report No: AUS0001012. See also: World Bank, 2016. World Bank Group Engagement in Small States: The Cases of the OECS, PICs, Cabo Verde, Djibouti, Mauritius, and the Seychelles Clustered Country Program Evaluation.

2 Guinea-Bissau

2.1 Marine plastic pollution in Guinea-Bissau

Although Guinea-Bissau regulates plastic bags, the country does not currently have a comprehensive national strategy or plan to address marine plastic pollution (MPP).[18] This report is a first step to develop a dialogue and action plan on MPP with a particular emphasis on developing awareness among key stakeholders and identifying practical steps.

2.1.1 Sources of marine plastic pollution

This note provides a preliminary estimate of marine plastic pollution (MPP) in Guinea-Bissau, provides a synthesis of available information on MPP. There are three main sources of MPP in Guinea-Bissau:

- mismanaged, or unmanaged solid waste, which is by far the most important. This can be subdivided into two main categories: (i) urban waste from Bissau; and (ii) waste from rural coastal areas and coastal or riverine municipalities, or districts
- marine sources are mainly fishing activities and shipping with a minor contribution from marine tourism
- some plastics may also be transported by ocean currents from other countries.

Plastic waste is just one part of a much broader waste management problem, one of a range of sustainable development challenges faced by Guinea-Bissau. Guinea-Bissau's population of almost 2 million is 45 percent urban, of which over 40 percent lives in the capital Bissau. Mismanaged urban solid waste in Bissau and suburbs is considered to be the single greatest source of MPP, as Bissau and its catchment area are coastal. All coastal and estuarine settlements with mismanaged waste are potential sources of MPP, particularly as Guinea-Bissau has a tidal range of over 5 meters. Flooding mainly affects inland area (to a lesser extent the coastal south-east) and may not play a major part in flushing plastic waste into the ocean, except in urban areas.

The estimate relies on several assumptions (see). MPP in Guinea-Bissau is estimated primarily as a function of mismanaged solid waste.[19] Guinea-Bissau has a total population of almost 2 million. The coastal population (population within 50km of the coast) was estimated at 1.2 million in 2010. The urban population in 2018 was over 800,00. The population of Bissau is about 380,000 and the population of the main coastal towns is about 50,000 (Bolama, Cacheu, Catio, Bubaque and Buba). If an additional 70,000 people are considered to live in close proximity to the coast, or the extensive estuaries, the coastal population which is likely to generate plastic waste and which may leak into the ocean would be about 0.5 million. This is the coastal population value used to estimate the potential MPP generated from solid waste.

Studies indicate a range of estimates for the amount of solid waste generated per person. This ranges from 0.6 kg per person per day to 0.45 kg/person/day.[20] A rate of 0.5 kg per day is used for the MPP estimate, partly because urban areas tend to generate more solid waste. Waste plastic has been estimated to comprise as much as 15 percent of waste in urban communal collector bins. For the estimate, a value of 10 percent is used, as a significant part of the plastic waste, and PET bottles

[18] The terminology used in Lusophone countries generally refers to marine litter or debris ('lixo marinho'). rather than to marine plastic pollution. MPP is generally considered to account for about 80 percent of marine litter or debris. Because of the extensive estuarine and mangrove system in the case of Guinea-Bissau, there may be a high natural (rather than anthropogenic) content in marine debris (e.g., mangrove leaves, tree branches, tree trunks).

[19] See Jambeck et al., 2014 and the main report for details of this methodology.

[20] World Bank. What a Waste 2.0. Some earlier estimates have a value as low as 0.2 kg/day.

in particular, are collected either for reuse or recycling before entering the 'mixed' waste stream. Information on plastic waste exports is not available.[21]

The collection of urban waste in Bissau does not appear to be consistent, particularly in areas served exclusively by the municipality. This is due to breakdown of waste collection trucks and other resource and logistics constraints. In some districts (bairros) waste collection may be non-existent. As a result, wastes are dumped in the streets or any adjacent unused ground and in some cases may be burned by the roadside or in gardens. Even when waste is dumped at the municipal landfills, it may lie unburied for some time. For the purposes of the estimate, 85 percent of the solid waste generated by the 'coastal population' is considered 'mismanaged.

The mismanagement of solid waste means that the waste plastic can be leaked into the ocean by rainfall and flooding, by dumping directly into rivers or the sea, by dumping on the shore, or by wind which carries plastic from dumps, or plastic particles from burning plastic. The estimate assumes that 5 percent of mismanaged plastic waste is leaked into the marine environment. While this value is substantially below that used for preparing the 2014 global estimate[22] it appears consistent with direct observations in several African countries. The impacts of MPP are addressed in the main report.

Guinea-Bissau's contribution to MPP is estimated at 409 tons per year (). For comparative purposes, information extracted from the 2014 global estimate is provided in Table 3.

Table 2. Estimated plastic waste generation in Guinea-Bissau

Item		Source/ Assumption
Population total (million)	2	World Bank 2019
Waste (kg/person/day)	0.5	World Bank/ other
Solid waste total (tons/year)	365,000	calculation
Coastal' population	500,000	estimate
Coastal' waste (tons/year)	91,250	calculation
Plastic (%) of waste	10%	assumption
Plastic waste (tons/year)	9,125	calculation
Mismanaged plastic waste (tons/year)	7,756	85% (assumption)
Marine plastic pollution(tons/year)	388	5% of mismanaged waste (assumption)
Fisheries and shipping (tons/year)	20	assumed (see below)
Microplastics	1	assumed (see below)
Non-Guinea-Bissau sources	-	no information
Estimated MPP (tons/year)	409	

[21] While plastic represents less than 5% of waste collected by the Bissau municipality, much of the plastic waste of value has already been separated by catadores and others (see LVIA, 2015).

[22] Jambeck et al., 2014 consider that 10-20% of mismanaged waste in the coastal area leaks into the marine environment. The 5% value used here appears consistent with direct observations made in some African countries.

Table 3. Mismanaged plastic waste in 2010

Coastal population (<50 km) (2010)	1,208,106	
Waste generation rate (kg/person/day}	0.6	
Plastic in waste stream (%)	9.0	
Inadequately managed waste (%)	83.5	
Littered waste (%)	2.0	
Waste generation (kg/day)	724,864	
Plastic waste generation (kg/day)	64,875	
Inadequately managed plastic waste (kg/day)	54,155	
Plastic waste littered (kg/day)	1,298	
Mismanaged plastic waste (kg/person/day)	0.05	
Mismanaged plastic waste in 2010 (tons)	20,240	
Mismanaged plastic waste in 2025 (tons)	51,947	

Source: Information extracted/ extrapolated from Jambeck et al., 2014.

2.1.2 Management of solid waste

Estimates of the amount and composition of solid waste which are derived from analysis of waste collected by the municipalities are not necessarily representative, as households carry out considerable sorting for reuse or resale. In particular, glass, cans, plastic bottle and cardboard may be separated. Food waste is also extensively used to feed chicken, pigs or other animals, while any excess food is frequently shared in the community. As cooking may be done with charcoal, ash may form a significant portion of waste. Similarly, yard sweepings mixed with soil and sand may also be a significant component by weight. As a result, the waste profile is not directly comparable to the profile of many other AIODIS municipalities or urban areas.[23]

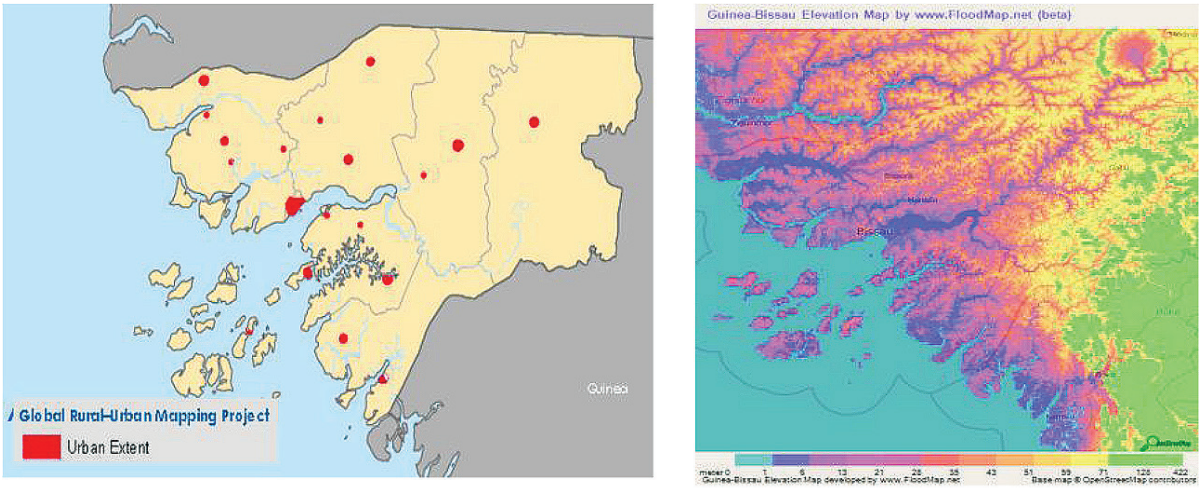
Municipal solid waste in Guinea-Bissau has been estimated at 290,000 tons per year.[24] In 2015, the Bissau municipal authority (Câmara Municipal de Bissau) estimated that the capital produced 250,000 tons of waste per year and more recently estimated waste production at 300,000 tons. Surveys done in parts of Bissau city indicate that collection was 'practically non-existent' and that rubbish accumulated in the streets for lengthy periods.[25] The municipal authorities are responsible for waste management but generally lack the resources to operate or maintain the solid waste management services (collection, maintenance of dump sites, pubic waste bins, vehicles).

[23] Ferrari, K., S. Cerise, R. Gamberini, B. Rimini, and F. Lolli. 2016. An International Partnership for the Sustainable Development of Municipal Solid Waste Management in Guinea-Bissau, West Africa. Paper presented at the Twenty-First Summer School "Francesco Turco"—Industrial Systems Engineering. Naples, Italy, September 13–15.

[24] World Bank, What a Waste global database.
https://datacatalog.worldbank.org/dataset/what-waste-global-database/resource/

[25] Djonú, P. et al. 2018. Objetivos do desenvolvimento sustentável e condições de saúde em áreas de risco. Ambiente & Sociedade São Paulo. Vol. 21, 2018.

Figure 2 The extent of urban settlements; flood vulnerability map



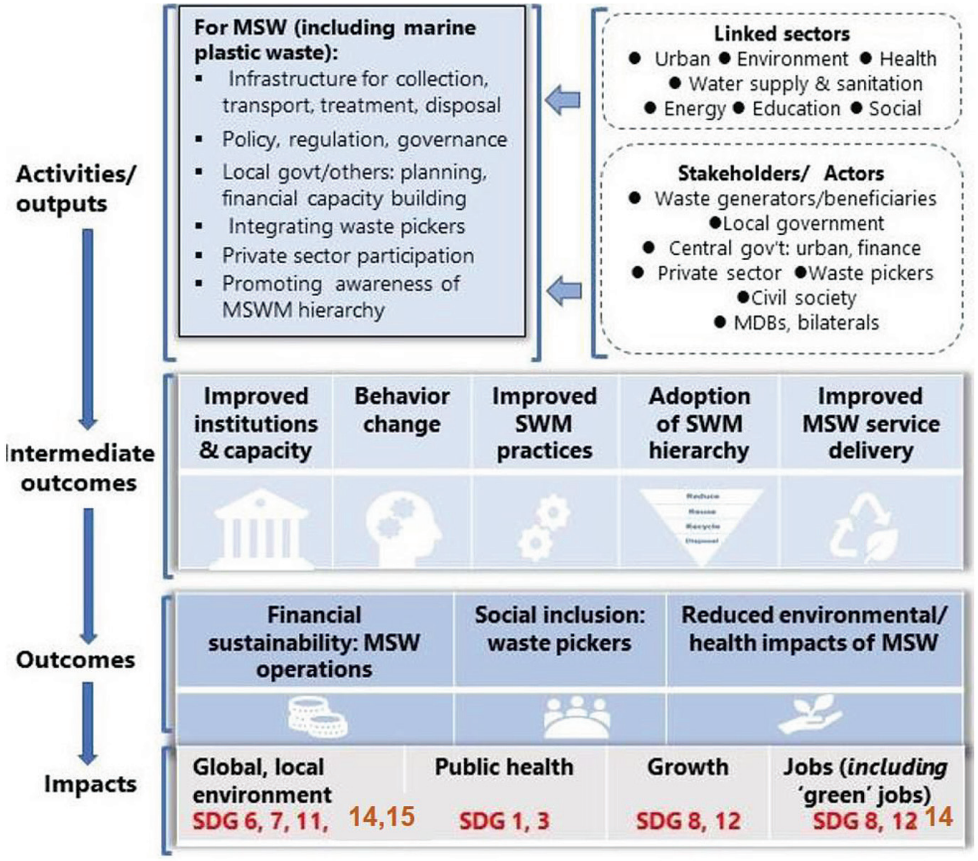
The disposal of solid waste in rural areas is unclear. However, based on reports of practices in many sub-Saharan rural communities, much of the waste is burned, placed in household waste pits, or in unmanaged communal dump sites. There is also likely to be a higher proportion of organic or compostable waste in solid waste generated by rural households and enterprises. Additional information would be required for a more accurate accounting of the scale and disposal of plastic waste from rural households, such as the reuse or disposal of plastics in agriculture (e.g. fertiliser bags or rice sacks). The extensive estuarine system and substantial tidal suggest that some more inland areas may be sources of MPP. However, the extensive mangrove cover also suggests that may macroplastics may be trapped in the mangroves of in the sediments and remain a 'hidden' fraction of MPP.

Plastics comprise 0.76 percent of imports by value (about $316,000).[26] However, this excludes the import of drinks and liquids which account for 27 percent of imports by quantity; excludes the import of some 127 tons of synthetic clothing; and excludes plastics used for construction (e.g. pipes, panels) and other purposes.

In conclusion, the main driver of MPP in Guinea-Bissau is deficient solid waste management, particularly in coastal urban areas. MPP and plastic waste in general is just one part of a much broader waste management problem resulting from underlying governance issues which result in lack of investment in infrastructure, weak financial and human resources and erratic waste management services. The relationship of MPP and solid waste management in general to the SDGs is shown in the following figure.

[26] https://tradingeconomics.com/guinea-bissau/imports

Figure 3. Links between management of municipal solid waste and the SDGs



Source: World Bank, Independent Evaluation Group.
Note: MSW = municipal solid waste; MDB = multilateral development bank; MSWM = municipal solid waste management; SWM = solid waste management.

Fisheries. Both local small-scale and large-scale fisheries and foreign fishing are sources of MPP through lost gear.[27] Losses are generally related to the type of gear and location where the fishing takes place. In 2017, small-scale and industrial catches were estimated at over 300,000 tons/year of which 8 percent was contributed by local small-scale fisheries. About 160 industrial vessels from 17 countries (including Comoros) are licensed annually (2017 data), of which many only fish on a seasonal basis.[28] The tuna fishing fleet (40-50 vessels) are mainly EU-flagged and may also fish in the waters of the other AIODIS countries (tuna catches in Guinea-Bissau waters are relatively low). FADs are likely to be the main source of marine debris from this fleet.

A large licensed or chartered fleet of mainly Asian trawlers operates in Guinea-Bissau. Because of the predominantly 'soft' nature of the bottom (mud and sand), trawl gear is unlikely to be lost, although some losses may occur from entanglement in sunken tree trunks. Analyses of beach litter from the Western Indian Ocean suggest that garbage from Asian fishing vessels can contribute significantly to MPP. As few of the industrial vessels operating in Guinea-Bissau visit port, there is a lack of information on vessel garbage disposal, or disposal of waste fishing gear by industrial vessels.

[27] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

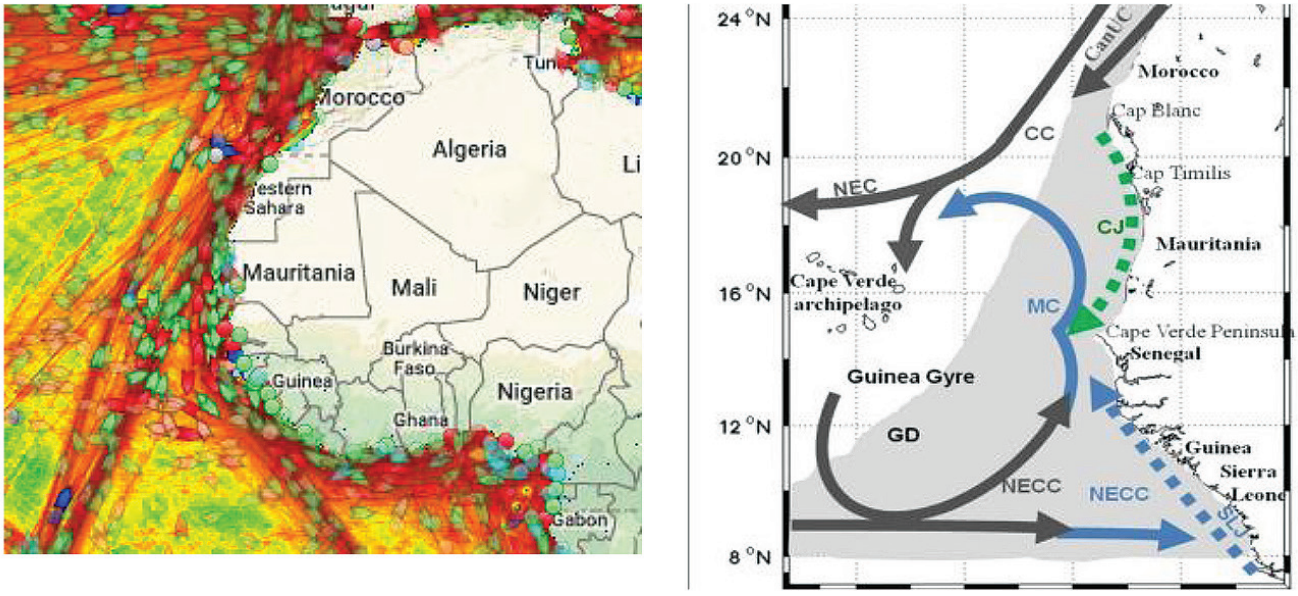
[28] Unreported and illegal fishing activities are considered to be high so that catch information may be unreliable. See: Intchama, J.F. et al., 2018. Assessing Guinea Bissau's Legal and Illegal Unreported and Unregulated Fisheries and the Surveillance Efforts to Tackle Them. Front. Mar. Sci., 04 April 2018. https://doi.org/10.3389/fmars.2018.00079.

There are over 1,500 small-scale vessels operating.[29] Some pirogues can be over 15 meters. Loss of nets by local small scale fishers is likely to be low unless fishing in reef areas, as the nets used can be retrieved in the relatively shallow estuarine and island archipelagic waters, while many fishers target pelagic species where no entanglement is likely. Losses of gear from large Senegalese pirogues fishing for higher value demersal species (e.g., snappers) may be significant. As there is no direct information on MPP from fisheries in Guinea-Bissau, the estimate given in should be considered as a 'place-holder' until such time as further information is available.

While there are a range of guidelines available to prevent marine debris from fishing vessels, and various workshops have been held, it is unclear to what extent best practices are implemented in Guinea-Bissau and regionally. A 2019 regional workshop indicated a low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.[30] Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. These will accumulate as plastic waste and may degrade to marine microplastics if abandoned on beaches. Most countries have no provision for appropriate disposal of GRP vessels.

Shipping. Galley waste from shipping, including from cruise ships, can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. However, the Bissau commercial port is known to have maintenance and service challenges and has (understandably) prioritised investments in key areas, such as dredging. Arrangements for disposal of ships garbage in smaller ports or landing sites in Guinea-Bissau would need attention as marine transport to the islands and along the estuaries is an important component of the transport network.

Figure 4. Shipping traffic density and ocean currents in West Africa



29 http://spcsrp.org/en/guinea-bissau

30 Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

Foreign sources of MPP. Some MPP may occur through the transport of marine debris and MPP from other countries by ocean currents. However, information on these sources is not available. Plastic pollution may also originate in adjacent where countries as some river basins are shared. However, the upper catchments of Guinea-Bissau (Geba and Corubal rivers) have a low population density and are unlikely to be significant sources of water pollution.[31]

Microplastics. The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important factors. Where there are slow-moving rivers and extensive estuaries microplastics may become trapped before entering the sea, as is the case in Guinea-Bissau. The main sources are likely to be waste water (cosmetics, cleaning agents, laundry), road runoff of rainwater containing microplastics from car tyre abrasion, and air-borne microplastics resulting from burning and breakdown of macroplastics by wind and sun. As the area of tarmac road is relatively small, most tyre microplastics are probably trapped in the soil before reaching the sea.

2.2 Existing and potential measures to combat MPP

MPP needs to be seen in the context of overall waste management in Guinea-Bissau, the level of poverty, governance challenges, the competing national development priorities, and the scarcity of human and financial resources. In 2018, Guinea-Bissau was ranked 178 out of 189 countries with respect to the Human Development Index (HDI). Despite an improvement of over 17 percent in the HDI between 2005 and 2018, per capita GNI only increased by 1.8 percent.[32] To put this in context Guinea-Bissau (GB) compares as follows to the rest of Sub-Saharan Africa (SSA) in 2018:

Table 4. Development indices for Guinea-Bissau (2018)

Indicator	Guinea-Bissau	Sub-Saharan Africa
Per capita GNI ($)	1,993	3,443
Mean years schooling	3.3	5.7
Population below poverty line (%)	67	41 (Liberia)
HDI	0.46	0,54

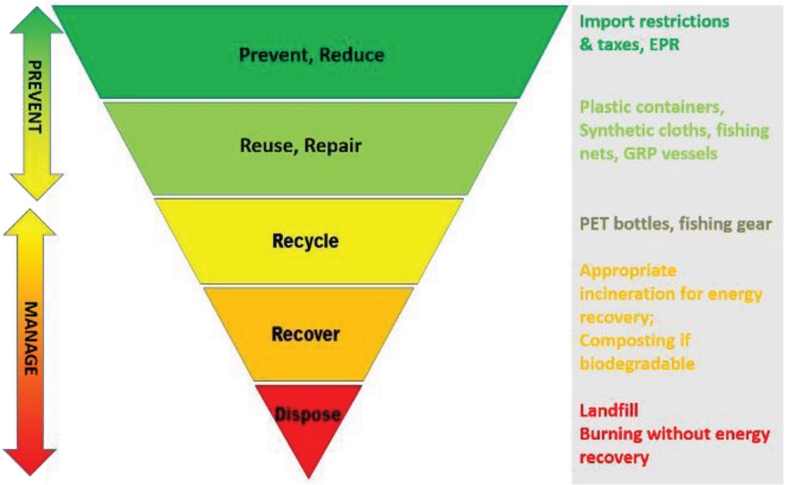
[31] Robalo, H., no date. Programme D'action Mondial pour la Protection du Milieu Marin contre la Pollution due aux Activites Terrestres. Elaboration des rapports nationaux des pays du Courant des Canaries. Guinée-Bissau.

[32] UNDP. 2019. Human Development Report 2019. Briefing note for countries on the 2019 Human Development Report. Guinea-Bissau.

2.2.1 Policy and planning

Despite a recent EU-financed project, policies and plans for municipal solid waste management remain vague.[33] The national development plan mentions the establishment of a solid waste handling centre, but comprehensive plans to address the management of waste do not feature.[34] This lack of a 'plano director' is well recognised.[35] Any initiative to combat MPP will need to take a realistic and strategic approach taking account of the limited resources available and the relatively low priority of MPP in the overall development agenda. If it is assumed that, in the medium term, waste management will have to rely largely on existing resources, several of the actions described below could be envisaged.

Figure 5. The waste hierarchy



A draft, or outline national plan to combat MPP could be prepared with a particular focus on municipal waste management. The plan could affirm widely accepted principles for managing waste efficiently and sustainably and preventing, reducing and controlling plastic pollution, such as the waste hierarchy, cost recovery and the circular economy (Figure 5).

A task force, or working group could be established to share information and improve cooperation between key institutions. These could include representatives of the environment ministry,[36] municipal authorities, fisheries administration, port authority, and ministry, chamber of commerce, the media and concerned NGOs (Box 1). The NGOs could include resident's associations and representatives of the 'catadores'. Devolution of some responsibilities or contracts with resident's associations and well-organised catadores' associations could gradually develop locally adapted and effective waste management practices, including greater separation of wastes and improved opportunities for reuse and recycling.

[33] Sá Pereira, Luís Filipe. 2020. Opinião: gerenciamento sustentável dos resíduo ssólidos urbanos na Guiné-Bissau. Jornal Odemocrata 28/06/2020; Notícias, DW. 2020. Bissau está "cansada" do problema do lixo. 20.08.2020. https://www.dw.com/pt-002/bissau-está-cansada-do-problema-do-lixo/a-54636646; Sanhá Na Maba, Ramalho. 2010. Gestão de resíduos sólidos em Guiné-Bissau, 1975 – 2010: Gerenciamento e manejo de resíduos sólidos em Bissau "uma co-administração das ocorrências". Universidade Federal da Bahia.

[34] República da Guiné-Bissau, 2015. Plano Estratégico e operacional Terra Ranka-2015-2020. Março de 2015. "Criação dum centro de tratamento de resíduos sólidos".

[35] Diretor Geral da Cooperação Internacional, 2020. Relatório final. Implementação do programa de acção de istambul na Guiné-Bissau 2011-2020. Bissau, 9 Março de 2020. https://www.un.org/ldc5/sites/www.un.org.ldc5/files/guine_bissau_ipoa_national_report.pdf.

[36] Direcção de Ambiente Urbano e Controle das Poluições, or equivalent.

Box 1. State actors will need to coordinate and cooperate to combat plastic pollution

The authorities responsible for the environment (Lei no. 1/2011, Lei de Bases do Ambiente) include the Secretaria de Estado do Ambiente e Biodiversidade. The Conferência Nacional de Ambiente (Decreto-Lei no. 11/96) is a high level consultation mechanism and could establish an MPP working group. The Conselho Consultivo (environment ministry) helps coordinate inter-ministerial actions and resource mobilisation, including with development partners. The Instituto Nacional do Ambiente (under environment ministry) fosters environmental protection and can have a role in awareness raising.

Municipal authorities (Decreto Lei no. 7/96) have financial autonomy and are directly responsible for waste management

The health ministry (Ministério da Saúde Pública) has a role in monitoring and advising on health measures related to waste management.

The education ministry (Ministerio de Educação e Ensino Superior) has a key role in environmental education and raising awareness on waste management and MPP as does the environment authoritiy's Direcção de Informação, Formação, Documentação e Educação Ambiental.

The ministries responsible for tourism and for fisheries have the competence to regulate and promote sustainable and environmentally-responsible practices

The Ministério das Infraestruturas, Habitação e Desenvolvimento Humano has a role in the investment in waste management infrastructure

Other stakeholders include the business community, the actors engaged in waste management and consumers and users of plastic products.

Further reduction in import of non-essential plastics, selected SUPs using economic instruments and prohibition of selected products containing microbeads could be envisaged. Guinea-Bissau already has a ban on plastic bags.[37] However, it is reported that this ban is not widely respected or enforced. Introducing import taxes on selected non-essential plastics could potentially reduce consumption and provide revenue while possibly creating a market for local production (e.g. products from used rice bags.

If solid waste management is included in the 'list' of development priorities, opportunities are likely to arise to insert small but catalytic actions to combat MPP and plastic pollution into projects and initiatives that target the related SDGs (Figure 3).

Ideally, plans for solid waste management would involve both investment and recurrent financing components.[38] The government has already closed the unsanitary Antula waste dump and opened a new landfill at Safim, some 16km from Bissau. Investments in sanitary landfills will need to ensure that the landfills can be maintained and, if possible, that facilities for catadores (storage of sorted wastes, sanitation) are included.[39] Investments could possibly prioritise the various forms of community actions, including voluntary local clean-ups, deployment of youth groups, innovation in reuse and recycling and partnerships with business with a view to the use of unskilled labour to add value to waste.[40] Greater community engagement could potentially secure the resources which are not available to municipal authorities through voluntary efforts or labour paid through adding value to waste.

[37] Decreto no. 16/2013 prohibits the manufacture, import, sale and distribution of several types of plastic bags including those made from polyethylene and polypropylene.

[38] EC, União Europeia e Câmara Municipal de Bissau lançam o projeto "Gestão dos Resíduos Sólidos Urbanos em Bissau"

[39] Global Alliance of Waste Pickers. 2012. First Global Strategic Workshop of Waste Pickers: Inclusive Solid Waste Management Pune, India 2012 (globalrec.org). See models for Dakar and Bamako.

[40] Duarte, E.A.H.J.D., 2012. Contribuição para a organização e planejamento do sistema de gestão dos resíduos sólidos no município de Bissau, Guiné-Bissau. Universidade Federal de Santa Catarina.

The catalytic actions could include raising awareness of the health benefits of waste management, raising community pride in cleanliness, organisation of traders and catadores, supporting SMEs which can innovate and add value to waste.

The catadores have an important role in adding value to waste and plastic represents about 17 percent of the materials collected. Study suggests that basic organisation of these marginalised workers could improve market opportunities for recycled/ reused materials, reduce plastic pollution and contribute to management of municipal solid waste at least in Bissau.[41]

Figure 6. Waste items collected by catadores

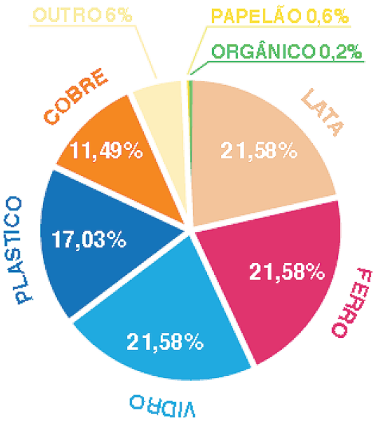
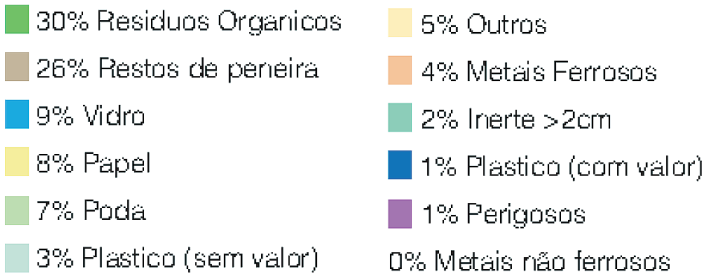


Figure 7. Composition of waste at Bissau city waste collection points



Source: LVIA, 2015

The national environmental management plan recognises the problem of pollution and waste management, but does not prioritise it.[42] Desertification and land degradation, which have strong links to rural poverty, are seen as the priorities. A wide range of environmental studies and plans exist, often prepared in response to commitments under international initiatives such as those on climate change or biodiversity. As monitoring and evaluation of these activities is deficient, the level of execution of these plans remains unclear, but appears weak. This a partly attributable to a lack of human capacity, particularly at medium and lower levels and the permanent shortage of financial resources. National 'state of the environment' reports could include indicators on urban waste management (SDG 11), plastic consumption (SDG 12) and marine pollution (SDG 14).[43] Reference should be made to the main project reports for greater detail and discussion of recycling of plastic waste.

2.2.2 Fisheries

In Guinea-Bissau, marking of fishing gear, requirements for reporting loss and location of loss (i.e. with GIS reference), 'fishing' to recover lost gear, port reception facilities for waste gear and arrangements for recycling are all measures which can help reduce MPP from fishing.[44] Measures based on MARPOL Annex V can be applied to fishing vessels. The arrangements for collection and recycling of fishing gear collection and gear recycling programme require practical local solutions. Recycling of nets and ropes may require the economies of scale which are only feasible through regional schemes, through

[41] LVIA, 2016. Os apanhadores de lixo de Bissau. Quem são e como trabalham? LVIA, CMB, EU.

[42] Plano Nacional de Gestão Ambiental.

[43] PNUD, GEF. 2011. République de Guinée-Bissau. Autoévaluation des besoins en Renforcement des Capacités de Gestion de l'Environnement National et Mondial.

[44] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear – Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

close engagement with businesses and possibly with economic support from EPR arrangements with importers. Studies suggest that the direct economic costs and benefits of fishing gear EPR schemes, such as deposit-return arrangements, or 'environmental taxes' on fishing gear imports are considered to be about equal (excluding indirect environmental benefits). However, the distribution of costs can be skewed, e.g., if manufacturers simply increase the cost of gear to fishers to cover EPR.[45] Fishers could introduce local rules to curtail gillnets in rocky areas where nets are frequently lost, as ghost fishing impacts on all fishers.

Abandoned GRP vessels present a growing plastic waste problem. Rules for disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly if vessels fishing in Guinea-Bissau land catches in Dakar, Conakry or Las Palmas and do not make port calls to Bissau. This could start with resolutions by ICCAT, SRFC, and COMAFAT phasing in MARPOL Annex V requirements for vessels and measures with respect to marking gear and FADs and to specify responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and be an approved regional management measure. Fisheries support vessels could be included. FAO might be requested to provide support for design of a phased approach.

2.2.3 Shipping

Ensuring that Guinea-Bissau meets its obligations under MARPOL Annex V is the key action. Engagement between vessels operators and agents, port officials and waste disposal enterprises can help to ensure compliance on ships garbage disposal. Clarity on responsibilities for control, for inspection of ship's waste management logbooks and monitoring of practices at smaller ports may require agreements between Enapor, responsible ministries and municipal authorities. Dialogues could also help in separation of recyclables in ship's garbage. Possible dialogues with IMO and regional port authorities could ensure coordinated measures to prevent dumping of waste by other shipping and foster codes of conduct by cruise lines.[46]

2.2.4 Awareness of MPP

There is an awareness of MPP in Guinea-Bissau. This is evidenced by the Guinea-Bissau's endorsement of the Mindelo Declaration on marine litter; ratification of the Abidjan Convention's LBSA Protocol; ratification of MARPOL Annex V; and national legislation prohibiting plastic bags. The awareness exists at the level of decision-makers. However, a similar level of awareness may not exist among consumers and businesses as evidenced by the reported lack of compliance with the plastic bag regulations.

A range of approaches to raising awareness is detailed in the main AIODIS report. In the case of Guinea-Bissau, the existing awareness may need to be channelled into practical actions, such as the separation of plastic waste, access to sources of funding for recycling, possibilities with regard to EPR schemes and development of a business case for 'valorização' of waste streams. In 2020, the Câmara

[45] EC, 2018. Study to support impact assessment for options to reduce the level of ALDFG Final Report 22-02-2018. https://webgate.ec.europa.eu/maritimeforum/en/system/files/Final%20Report%20Plastics%20from%20Fishing%20Gear%20Delivered.pdf.

[46] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report (see commitment on phasing out of SUPs).

Municipal de Bissau indicated that an awareness campaign on urban 'cleanliness' would be launched.[47] In addition to possible public awareness campaigns, awareness activities can build on the work of environmental NGOs and the development of materials for school curricula. Campaigns can also focus on voluntary actions and procurement policies, e.g., elimination of SUPs from public procurement, beach cleaning in the Bijagos and tourist areas, codes of industry conduct to reduce SUPs and plastic waste and EPR schemes to improve markets for waste products.

Specific attention may need to be directed to preparing consumers for possible measures on SUPs and raising awareness on microplastic pollution as this is less visible. Dialogue on a possible ban on the import of cosmetic and other household products which contain microbeads could also be envisaged.

2.2.5 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (or global) action. In cooperation with other countries, Guinea-Bissau could consider several initiatives:

- preparation of joint strategic plan on MPP under the Abidjan Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Abidjan LBSA Protocol
- preparation by the Abidjan Convention of a funding submission for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-up through existing initiatives, and preparation of a strategic plan on MPP
- further use of Comunidade dos Países de Língua Portuguesa in the context of a follow up to the Mindelo Declaration (2018).

In conjunction with other countries, Guinea-Bissau could also consider initiating a dialogue in ECOWAS on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic (and other) waste would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of substitutes and collection and recycling schemes and underpin a dialogue with regional suppliers, such as agents for soft drinks. Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO.

At the level of AIODIS and Africa, Guinea-Bissau could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA. A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

2.2.6 Resources

As already noted, solid waste management does not appear to have a high priority in the agendas of the development partners, or the problem has been 'dissipated' among other challenges, such

[47] Câmara Municipal de Bissau, 2020. «uma campanha que vai ser realizada na televisão e nas rádios de Bissau, destinada aos munícipes». QW Noticias 20 August 2020. https://www.dw.com/pt-002/bissau-est%C3%A1-cansada-do-problema-do-lixo/a-54636646.

as health, infrastructure, public finance or education.[48] This implies increased attention to the cost-effectiveness of waste management, means to reduce wastes (e.g., import of packaging), application of 'polluter pays' charges on items such as plastic bottles and plastic packaging, recovery of waste collection costs and possible cross-subsidy for collection from remote communities. In the absence of major investment funds, low-cost actions, including awareness raising and change in consumer and household behaviour on waste management could be targeted. As suggested above, small interventions could be identified as part of projects that address the relevant SDGs. In particular, community initiatives to manage waste and improved synergies between any existing public and private efforts could be considered. Lessons could possibly be learned from the Dakar catadores (Association des Recuperateurs et Recycleurs de Mbeubeuss (BOKK DIOM)) which services households, commercial establishments, hospitals, markets and other producers of wastes. Further studies could be prepared as part of university theses, but organised in a way to fill gaps in understanding of waste management and to identify options for waste valuation or for local products to substitute plastics.

[48] Although the Istanbul IPOA calls for improved waste management. See: Fourth United Nations Conference on the Least Developed Countries, 2011. Programme of Action for the Least Developed Countries for the Decade 2011-2020. Istanbul, Turkey, 9-13 May 2011. http://unohrlls.org/UserFiles/File/IPoA.pdf. The national review of the Istanbul programme reviews the mobilisation of internal and external resources Director Geral da Cooperação Internacional, 2020. Relatório final. Implementação do programa de acção de istambul na Guiné-Bissau 2011-2020. Bissau, 9 Março de 2020. https://www.un.org/ldc5/sites/www.un.org.ldc5/files/guine_bissau_ipoa_national_report.pdf.

3 São Tomé e Príncipe

3.1 Marine plastic pollution in São Tomé e Príncipe

São Tomé e Príncipe (STP) has a comprehensive solid waste management plan but does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).[49] This report is a first step to estimate the scale of MPP and to develop a dialogue and action plan on MPP with particular emphasis on use of the existing solid waste plans, developing awareness among key stakeholders and identifying practical steps.

3.1.1 Sources of marine plastic pollution

This note provides a preliminary estimate of marine plastic pollution (MPP) in STP and provides a synthesis of available information on MPP. There are three main sources of MPP in STP:

- mismanaged, or unmanaged solid waste, which is by far the most important. This can be subdivided into two main categories: urban and rural waste.
- marine sources are mainly fishing activities and shipping with a minor contribution from marine tourism
- plastics are also transported by ocean currents from other countries, notably from Nigeria's river outflows and the Congo outflow.

Plastic waste is part of a much broader waste management problem, one of a range of sustainable development challenges faced by STP's population of almost 0.22 million. About 74 percent of the population is urban and the entire population is considered 'coastal', as due to the steep topography and seasonally high rainfall, any mismanaged plastic waste could potentially enter the marine environment. The tidal range (up to 1.8m) suggests that waste dumped on the shoreline could also result in MPP.

The estimate relies on several assumptions (see). MPP in STP is estimated primarily as a function of mismanaged solid waste.[50] Studies indicate the amount of solid waste generated per person is 0.4 kg/person/day.[51] In 2020, an estimated total of approximately 32,000 tons of waste was generated by a population of almost 220,000. In 2017, an estimated 38 percent of municipal solid waste was collected and the balance is considered to be mismanaged waste.[52] In 2017, plastic was estimated to comprise 5 percent of the solid waste stream.[53]

The mismanagement of solid waste means that the waste plastic can be leaked or transported into the ocean by rainfall and flooding, by dumping directly into rivers or the sea, by dumping on the shore, or by wind which carries plastic from dumps, or plastic particles from burning plastic. The estimate assumes that 5 percent of mismanaged plastic waste is leaked into the marine environment. While this value is substantially below that used for preparing the 2014 global estimate[54] it appears consistent

[49] The terminology used in Lusophone countries generally refers to marine litter or debris ('lixo marinho'). rather than to marine plastic pollution. MPP is generally considered to account for about 80 percent of marine litter or debris.

50 See Jambeck et al., 2014 and the main report for details of this methodology.

[51] TESE, EcoGestus, 2010. Plano de Acção para a Gestão Integrada de Residuos Sólidos Urbanos (PA-GIRSU) - São Tomé e Principe, 2011-2016. The PA-GIRSU scenario (2010) has uses a rate of 0.35 kg. The assessment prepared for the 2018 Plan estimates 0.3875 kg/person/day. See also: World Bank. What a Waste 2.0.

[52] World Bank. What a Waste 2.0; review of PA-GIRSU (2017); INE data (2012) indicated that only 19.3% of the population was served by solid waste collection.

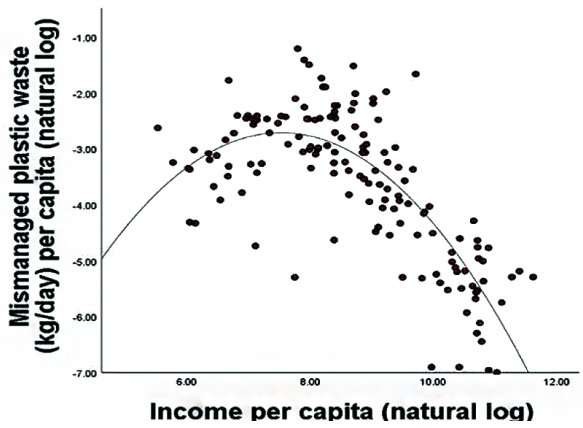
[53] PA-GIRSU studies indicated that about 4 percent of the waste in 2010 was 'identifiable' plastics and additional plastics, such as food wrappers, were in mixed waste; PA-GIRSU (2018) gives a value of 4.85%.

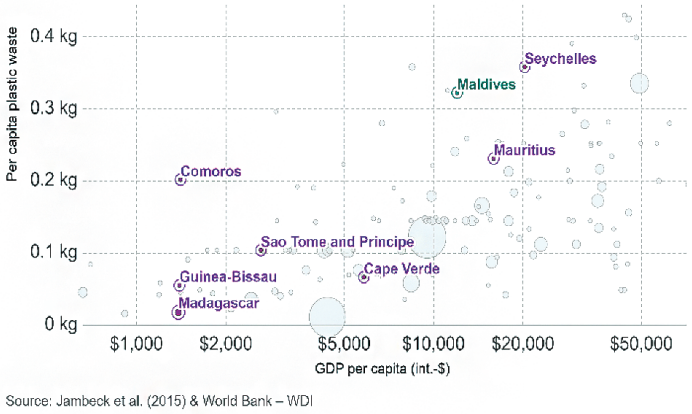
[54] Jambeck et al., 2014 consider that 10-20% of mismanaged waste in the coastal area leaks into the marine environment. The 5% value used here appears consistent with direct observations made in some African countries.

with direct observations in several African countries. In 2019, STP imported $2.97 million of plastics. However, imports under the 'plastics' custom code do not include drinks bottles and other plastic containers, or plastics used in packaging which is the type of plastic most likely to become MPP.[55] Information on plastic waste exports is not available.[56]

There is a relationship between plastic waste and income levels (Figure 8).[57] In 2019, the GNI per capita in STP was $1,960, but is expected to decline as a result of a projected GDP contraction of 9.5 percent in 2020. While consumption of plastics may decrease as a result, the increase in the use of plastics to combat the pandemic is likely to compensate for any such temporary decline. Tourist arrivals (almost 30,000 per year pre-pandemic) have declined and consumption by tourists (about 10.8 percent of GDP) is also likely to temporarily reduce MPP.[58] MPP in STP is estimated at 61 tons per year (Table 5).

Figure 8. Relationship between income and mismanaged plastic waste





Sources: Barnes, 2019; Jambeck, et al. 2015.

Table 5. Estimated marine plastic waste in STP

Item	Value	Source/ Assumption
Population total (million)	0.22	World Bank 2019
Waste (kg/person/day)	0.4	PA-GIRSU; World Bank
Solid waste total (tons/year)	32,120	calculation
Plastic (%) of waste	5%	assumption
Plastic waste (tons/year)	1,606	Calculation (all recyclables 3,272 tons)
Mismanaged plastic waste (tons/year)	996	51.6% (= uncollected waste, World Bank)
Marine plastic pollution(tons/year)	50	5% of mismanaged waste (assumption)
Fisheries and shipping (tons/year)	5	assumed (see below)
Microplastics	1	assumed (see below)
Non-STP sources	5	assumption (from Niger, Congo, other rivers)
Estimated MPP (tons/year)	61	

[55] HS Code 39.

[56] While plastic represents about 4% of waste collected by the municipalities, some plastic waste of value has already been collected separated by catadores and others.

[57] Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505

[58] Montes-Rojas, G. and R. Barroso, 2020. What Are the Empirical Determinants of International Tourist Arrivals and Expenditures? An Empirical Application to the Case of São Tomé and Príncipe. World Bank Policy Research Working Paper 9189.

3.1.2 Management of solid waste

Because of the relatively small size of the island ecosystems, unmanaged plastic waste can have a long-term impact on soils, water supplies, the air quality (through open burning) and the marine environment and cause a wide range of negative effects on health, tourism, food supply and the quality of life. The impacts of MPP are addressed in detail in the main report.

Two districts in particular, Água-Grande and Mé-Zochi, account for more than half the population and the preponderance of solid waste. There has been a trend in increased import of plastic products, or products in plastic containers or wrapping. As in other small island economies, STP lacks the economies of scale for investment in recycling. In common with Cape Verde, the mountainous terrain and difficulties in accessing residences, or villages, raises the costs of household waste collection. High humidity and high seasonal rainfall means that waste may be wet, or heavy and difficult to handle and chemicals may leach from plastics into the water supply. Imported trucks and other waste management equipment may rust or incur high maintenance costs in the tropical climate. Retaining qualified personnel, such as waste managers or engineers, is also a challenge, particularly for local councils. The cost of transporting waste from Principe, or from more remote parts of São Tomé is also likely to outweigh its value for reuse or recycling.

The collection of urban waste has been in decline due to resource and logistics constraints. In some areas waste collection is non-existent. As a result, wastes may be dumped on unused ground, or may be burned by the roadside or in gardens. Even when waste is dumped at the municipal landfills, it may be burned or become a health hazard by lying unburied.

The 2010 solid waste management plan. The solid waste management action plan (PA-GIRSU, 2010) set out a comprehensive and balanced approach to waste management. It was revised and updated in 2018 and the changes in the period to 2017 was reviewed:[59]

- training and community assistance occurred (2011)
- composting of bio-waste and construction of Agua Grande composting facility (2012-13) took place
- an environmental impact tax on plastics was introduced (2013)
- improved waste separation and commercial sale of compost ensued (2014)
- a biogas pilot project was completed and composting was extended to other districts (2015)
- a central waste sorting/ processing station was established (2016)
- the main landfill (Penha) expanded from 0.75 to 2.25 hectares
- overall costs attributable to waste increased significantly (x 3.4 in the 2011-2017 period)
- collection declined to 38 percent and collection and handling equipment degraded and became dysfunctional in some districts.

The 2010 plan was comprehensive, but components were implemented selectively, probably as a function of the targets and policies of the cooperation programmes backed by the development partners. The major infrastructure, items, notably the construction of sanitary or managed landfills was not undertaken and remains largely unfinanced, largely because of the high cost and technical issues (siting, drainage, transport logistics to a central landfill).[60] The waste management responsibilities given to the district authorities were not matched by either public support or by revenues from

[59] Actualização do Plano Nacional de Gestao Integrada dos Residuos (2018-2030). https://issuu.com/joaovaz71/docs/stp_res_duos_waste_management__pngir__2018_00.

[60] TRAGSA study 2008-2009.

user charges for waste collection. Waste collection declined and waste handling equipment was not replaced in a timely manner. A number of legislative instruments were approved, but their application and effectiveness is unclear (Box 2). The awareness and environmental education efforts which were undertaken do not appear to have been matched with effective and timely community actions and support, although the composting activities appear to be sustainable in some districts. The planned national waste management authority (Autoridade Nacional de Resíduos) was not established so that STP remains without an institution which has a mandate to coordinate the activities of the various stakeholders (e.g., environment, health, local authorities, business and civil society organisations); to take responsibility for preparation of targeted investments; to secure finance for implementing the waste management plans; and to develop a scheme for financing the recurrent costs of waste management.

The district councils (Câmaras Distritais) which have primary responsibility waste management are constrained by weak financial and human resources (with the exception of the Água Grande and Mé-Zóchi district councils which are more well-equipped). Despite a general awareness of environmental sustainability and a recognition of the waste problem, there is an apparent lack of well-structured community engagement backed by catalytic investments. Nevertheless, a number of NGOs have engaged with development partners to raise awareness and contribute to waste management efforts. A single private waste disposal company is complemented with numerous informal waste transporters.

The composting and glass recycling (tile making) initiatives have had a measure of success. Plastic containers are reused numerous times and some waste plastic is made into artisanal items, e.g., for the tourist trade. On Principe, there has been a scheme to exchange 50 plastic (PET) bottles for one aluminium bottle in order to protect the Biosphere reserve.

Waste collection has taken various approaches, such as: partnerships with associations, private companies and NGOs (e.g. TESE); using door-to-door collection for households and businesses; and establishing communal waste sites. Some of these sites are located on the coast which can contribute to MPP (Figure 9). In several cases, efforts to 'create value' have experienced challenges in implementing business plans which ensure their sustainability.

Figure 9. Placement of waste and waste collection on the coast

Source: 2018 Plan

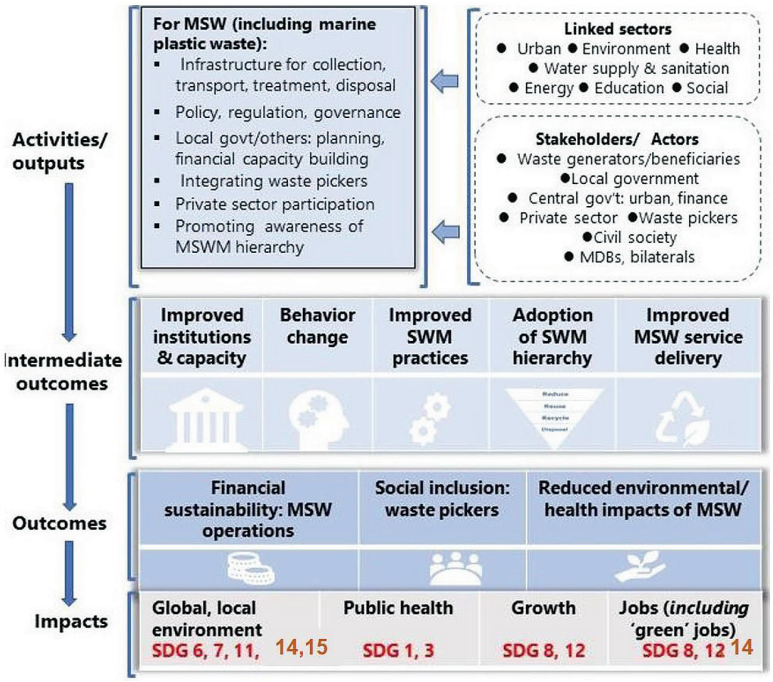
Estimates of the amount and composition of solid waste which are derived from analysis of waste collected by the municipalities are not necessarily representative, as households carry out considerable sorting for reuse or resale. Composition also varies by island and district. In particular, glass, cans, plastic bottle and cardboard may be separated. Food waste is also extensively used to feed animals, while excess food may be shared in the community. Cooking may be done with charcoal, so ash may form a significant portion of waste. Similarly, yard sweepings mixed with soil and sand may also be a significant waste component by weight. As a result, the waste profile may not be directly comparable

to the profile of some other AIODIS municipalities. The disposal of solid waste in rural areas is unclear. However, based on reports of practices in many sub-Saharan rural communities, much of the waste is burned, placed in household waste pits, or in unmanaged communal dump sites.

An estimated $3 million worth of plastics were imported in 2019.[61] However, this excludes the import of drinks and liquids which account for 6.6 percent of imports by value; excludes the import of synthetic clothing; and excludes plastics used for construction (e.g. pipes, panels) and other purposes.

In conclusion, the main driver of MPP in STP is deficient solid waste management, but MPP and plastic waste in general is just one part of a much broader waste management problem. The relationship of MPP and solid waste management in general to the SDGs is shown in the following figure.

Figure 10. Links between management of municipal solid waste and the SDGs



Source: World Bank, Independent Evaluation Group.

Note: MSW = municipal solid waste; MDB = multilateral development bank; MSWM = municipal solid waste management; SWM = solid waste management.

Fisheries. Both local small-scale and large-scale fisheries and foreign fishing are sources of MPP through lost gear.[62] Losses are generally related to the type of gear and location where the fishing takes place. There are over 2,000 active fishers in STP with catches in the order of 10,000 tons/year. There are about 2,000 small unpowered wooden canoes and over 500 small powered vessels. Access agreements with the EU and private operators for tuna fishing are an important source of revenue.[63] The 2019-2024 agreement provides for 28 tuna seiners and 6 longliners and reference catch of 8,000 tons/ year.

There no information on losses of fishing gear or MPP from fisheries. However, STP imports about 1.6 tons of netting per year, so that an equivalent amount is assumed to be lost or become waste. Designation of sites for collection of waste fishing gear, possibly through fishing organisations and

[61] COMTRADE code HS39.

[62] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

[63] €0.84 million/ year.

arrangements with importers for responsible disposal could be of practise value in addressing fisheries MPP. Given the nature of the canoe fisheries marking of fishing gear and 'fishing' for lost gear may not be practical. However, 'fishing' for lost gear and other MPP by volunteer divers at prime tourist dive sites or beaches may be of value.

FADs are likely to be the main source of marine debris from the tuna fleet which also fishes in other West African countries. Analyses of beach litter from the Western Indian Ocean suggest that garbage from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the STP EEZ. As few of the industrial vessels operating in STP visit port, there is a lack of information on vessel garbage disposal, or disposal of waste fishing gear by industrial vessels. As there is no direct information on MPP from fisheries in STP, the estimate given in should be considered as a 'place-holder' until such time as further information is available.

While there are a range of guidelines available to prevent marine debris from fishing vessels, and various workshops have been held, it is unclear to what extent best practices are implemented in STP and regionally. A 2019 regional workshop indicated a low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.[64] Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. These will accumulate as plastic waste and may degrade to marine microplastics if abandoned on beaches. Most countries have no provision for appropriate disposal of GRP vessels.

Shipping. Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. Arrangements for disposal of ships garbage in smaller ports or landing sites in STP may need attention as marine transport between islands is a key component of the transport network.

Figure 11. Shipping traffic density and ocean currents in the Gulf of Guinea/ STP area

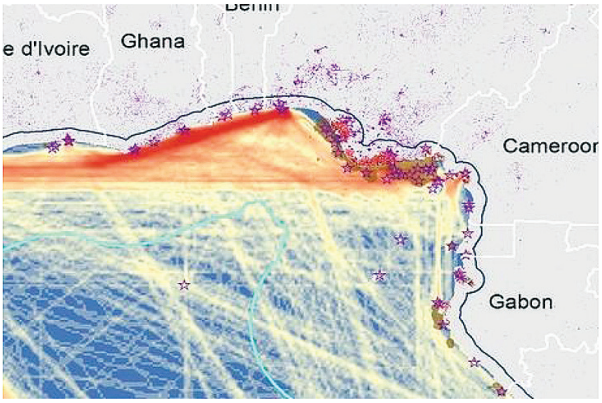
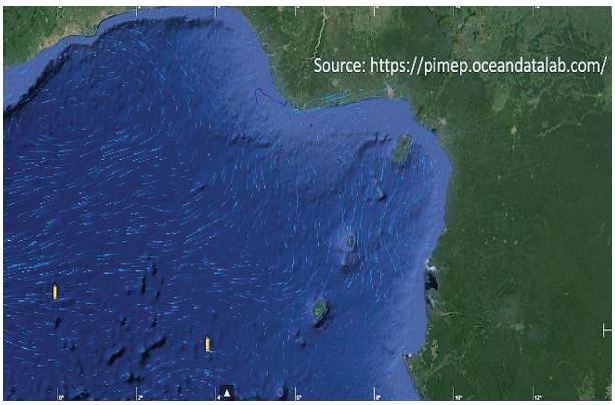


Figure 12. Surface currents in the Gulf of Guinea/ STP area



[64] Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

Foreign sources of MPP. It is highly likely that MPP originating from the Africa mainland is transported to STP by ocean currents from shipping and from rivers. However, specific information on the quantities arriving in STP is not available. In 2015, three rivers entering the Gulf of Guinea were ranked among the top 20 plastic polluting rivers at a global level. The estimated MPP loads were: Cross (Nigeria/ Cameroon) 40,300 tons; Imo (Nigeria) 21,500 tons; and Kwa Ibo (Nigeria) 11,900 tons.[65] No estimate is available for the Congo, which is the world's second largest river in terms of water discharge (1,308 km^3/year).[66] The absence of dams downstream of the major population areas in these river basins suggests that plastic waste in these catchment areas can be transported to the sea. A 2017 model, estimated that the Niger discharged 38,700 - 6,650 tons/year of plastic waste.[67] More recently, using a model based on HDI, population and population density, plastic waste discharge by all African rivers was estimated at 6,730 tons (range 3,730 – 11,100 tons). The wide range of the estimates strongly suggests that further study is required.[68] There is a strong correlation between the amount of mismanaged plastic waste in the catchment and the amount of plastic entering the sea: an average of 0.3 percent. This correlation is strongest for microplastics.[69] However, this relationship describes large 'inland' catchments of Asian or European rivers and does not necessarily apply to the 'short' coastal catchments of STP and other AIODIS.

Microplastics. The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In STP, the absence of slow-moving rivers or extensive estuaries means that microplastics are likely to get flushed into the ocean. The main sources are likely to be waste water (cosmetics, cleaning agents, laundry); road runoff of rainwater containing microplastics from car tyre abrasion; and air-borne microplastics resulting from burning and breakdown of macroplastics by wind and sun. As the area of tarmac road is relatively small, microplastics from tyre abrasion may be trapped in the soil before reaching the sea.

3.2 Existing and potential measures to combat MPP

3.2.1 Policy and planning

The 2018 national integrated waste management plan (2018 Plan)[70] provides an in-depth assessment of the challenges and sets out a robust and comprehensive approach. It identifies a lack of finance as the primary reason for lack of effective implementation of the 2011 Plan and builds on the lessons learned from the efforts to implement the 2011 Plan.

The 2018 Plan recognises that investment in hard infrastructure will remain a challenge and focuses on a range of partnerships backed by targeted regulations and their enforcement. It emphasises catalytic investments to foster a circular economy for wastes, by 'valuing waste', including through measures to reinforce existing activities, such as composting, reuse and recycling. It favour technologically simple, labour-intensive solutions, rather than a reliance on imported mechanical equipment, which may be difficult to maintain and costly to operate effectively. It recognises the seasonal changes in the composition of wastes, the need to reduce wastes and to progressively eliminate the open unsanitary landfills and unhealthy practices such as burning of plastics and other waste. The plan recognises

[65] Lebreton, L., et al. 2017. River plastic emissions to the world's oceans. Nat Commun 8, 15611 (2017). https://doi.org/10.1038/ncomms15611.

[66] Kinshasa plastic waste. https://www.youtube.com/watch?v=gNtIv-TrlBE.

[67] Schmidt C, Krauth T, Wagner S. Export of Plastic Debris by Rivers into the Sea. Environ Sci Technol. 2017 Nov 7;51(21):12246-12253. doi: 10.1021/acs.est.7b02368.

[68] Mai L., et al. 2020. Global Riverine Plastic Outflows. Environmental Science & Technology. 2020 Aug. 54(16):10049-10056. DOI:10.1021/acs.est.0c02273.

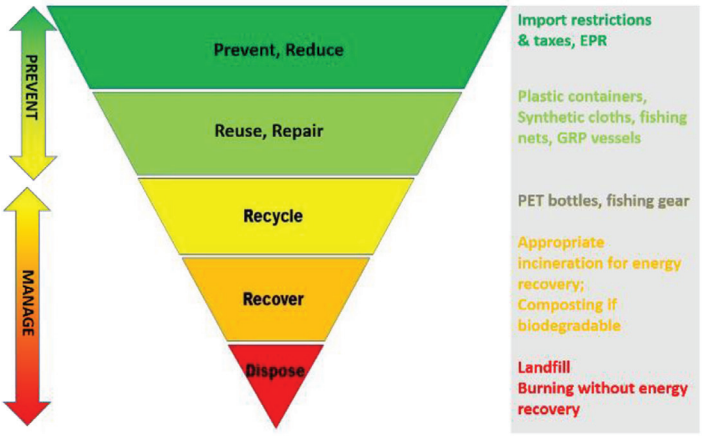
[69] Schmidt, op. cit.

[70] Ministério das Infraestruturas, Recursos Naturais e Ambiente, 2018. Plano Nacional de Gestão Integrada de Resíduos Sólidos Urbanos (PNGIRSU) 2018-2023. https://issuu.com/joaovaz71/docs/stp_res_duos_waste_management_pngir_2018_00

the need for an effective means of ensuring stakeholder cooperation and alignment of projects and initiatives; and for undertaking critical institutional and legislative reforms which can create incentives for sustainable practices, enforce rules and ring-fence revenues for waste management.

MPP needs to be seen in the context of overall waste management in STP, the level of poverty, governance challenges, the competing national development priorities, and the scarcity of human and financial resources. In 2018, STP was ranked 137 out of 189 countries with respect to the Human Development Index (HDI), a score of 0.69 compared to the Sub-Saharan Africa mean of 0.54. In 2018, per capita GNI was $1,870 compared to a Sun-Saharan Africa mean of 3,443. Population growth is 1.9 percent/year.

Figure 13. The waste hierarchy



While the 2018 Plan provides a useful roadmap for development of solid waste management and recognises that there have been many difficulties in implementation, there is little in the way of concrete investment proposals in the national budgets, nor does solid waste management figure prominently in any programmes agreed with development partners. If solid waste management is included in the 'list' of development priorities, opportunities are likely to arise to insert small but catalytic actions to combat MPP and plastic pollution into projects and any initiatives that target the related SDGs (Figure 3). National 'state of the environment' reports could include indicators on urban waste management (SDG 11), plastic consumption (SDG 12) and marine pollution (SDG 14). The main project report provides greater detail and discussion of option for recycling of plastic waste.

A draft, or outline national plan to combat MPP could be prepared as an add-on to the 2018 Plan. The MPP plan could affirm widely accepted principles for preventing, reducing and controlling plastic pollution, such as the waste hierarchy, cost recovery and the circular economy (Figure 5). The 2018 Plan already prioritises the establishment of an effective institutional arrangement for coordination of solid waste management and the sustainable financing and development of the system. While the establishment of an 'Autoridade' could take time, a ministerial-level task force, or working group could be established to improve cooperation between key institutions, including through memoranda of understanding, budget alignment and sharing of information. A task force could include representatives of the environment ministry,[71] municipal authorities, finance ministry, chamber of commerce, the media and concerned NGOs; and in the case of MPP, the fisheries administration, port authority and tourism stakeholders. The NGOs could include resident's associations and representatives of the 'catadores'. Devolution of some responsibilities or contracts with resident's associations and more organised 'catadores' associations could gradually develop locally adapted and effective waste management practices, including greater separation of wastes and improved opportunities for reuse and recycling.

STP already has a ban on plastic bags.[72] However, it is reported that this ban is not widely respected or enforced. Further reduction in import of non-essential plastics using bans or import taxes could be envisaged, i.e., for selected SUPs and a ban on the import of cosmetics containing microbeads. This

[71] Direcção de Ambiente Urbano e Controle das Poluições, or equivalent.

[72] Decreto no. 16/2013 prohibits the manufacture, import, sale and distribution of several types of plastic bags including those made from polyethylene and polypropylene.

could both potentially reduce consumption and provide revenue while possibly creating a market for local products (e.g. schoolbags made from local, or reused materials).

Even if investment in sanitary landfills is not considered feasible, alternative investments in 'controlled' landfills will need to be accompanied by arrangements for maintenance and, if possible, facilities for catadores (storage of sorted wastes, sanitation).[73] Investments could possibly prioritise the various forms of community actions, including voluntary local clean-ups, deployment of youth groups, innovation in reuse and recycling and partnerships with business with a view to the use of unskilled labour to add value to waste. Greater community engagement could potentially secure the resources which are not available to municipal authorities through voluntary efforts or through labour paid by adding value to waste.

3.2.2 Regulation

Despite the existence of laws on plastic bags, the 2018 Plan points out that there is no national policy on reduction of plastic bag consumption and sets out a number of measures to reduce consumption of plastic bags by 75 percent through:

- creation of legal norms for reduction of plastic bags in commerce
- raising awareness of alternatives among commercial establishment (shops, supermarkets) and among consumers
- taxes on plastic bags paid by consumers and collected by shops
- prohibition of advertising on plastic bags
- joint industry/ public campaigns on awareness of the environmental impact of plastic bags and plastic pollution.

STP has a range of legislative instruments of relevance to MPP (Box 2). However, while setting out useful measures (such as an environmental tax), they have not been considered entirely complementary in terms of their application or effectiveness.

[73] Global Alliance of Waste Pickers. 2012. First Global Strategic Workshop of Waste Pickers: Inclusive Solid Waste Management Pune, India 2012 (globalrec.org). See models for Dakar and Bamako.

Box 2.Selected legislation of relevance to marine plastic pollution
Law 10/1992 set out the responsibilities and competences of the district authorities in relation to waste. Law 10/1999 Towards adequate waste management (policy/ principles). Law 36/1999, Waste law. Law 14/2003 (DR nº.16, 5º.Suplemento) creates and applies the 'Sanitary tax' (TS) and the Environmental Impact tax (TIA); Law No. 13/2007 establishing the Basic Law on Maritime Safety and Prevention of Marine Pollution. Decree-Law No. 32/2007 creating the Maritime and Harbour Institute of Sao Tomé e Príncipe (IMAP-STP) November 2007. Regional Legislative Decree No 3/ALRAP December 2009 on the protection of marine turtles. Order No. 12/2012 approving the Participatory Strategy for Water and Sanitation of Sao Tomé e Príncipe until 2030 and makes provision for monitoring of water quality. Decree-Law No. 64/2013 creating the Environmental Impact Tax (TIA) introduces the principle of the extended responsibility of the producer of goods to the production of waste. An Environmental Impact Fee (called TIA) is to be collected by customs on imports of plastic packaging. Decreto n. 27/2018 – adops the clean environment policy (Política Nacional do Saneamento Ambiental (PNSA)). Law No. 8/2019 approving the Major Options Plan for the Economic Year of 2019 includes provisions for educational and awareness campaigns for environmental preservation. The Major Options Plan for 2020 provides for improvement of solid waste management. Law No. 8/2020 approving Measures to Reduce the Use of Plastic Bags in São Tomé and Príncipe. The Law prohibits the production, import, commercialization and distribution of non-biodegradable plastic bags.

3.2.3 Fisheries

For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements can be applied to fishing vessels.[74] Recycling of nets and ropes may require the economies of scale which may only be feasible through regional schemes (e.g. COREP), through close engagement with businesses and possibly with economic support from EPR arrangements with importers. Studies suggest that the direct economic costs and benefits of fishing gear EPR schemes, such as deposit-return arrangements, or 'environmental taxes' on fishing gear imports are considered to be about equal (excluding indirect environmental benefits). However, the distribution of costs can be skewed, e.g., if manufacturers simply increase the cost of gear to fishers to cover EPR.[75] Fishers could introduce local rules to curtail gillnets in rocky areas where nets are frequently lost, as ghost fishing impacts on all fishers.

Abandoned GRP vessels present a growing plastic waste problem. Rules for disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats. In the case of STP, most small-scale vessels are made of timber and GRP vessels may not present a major disposal problem.

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly as foreign

[74] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear – Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

[75] EC, 2018. Study to support impact assessment for options to reduce the level of ALDFG Final Report 22-02-2018. https://webgate.ec.europa.eu/maritimeforum/en/system/files/Final%20Report%20Plastics%20from%20Fishing%20Gear%20Delivered.pdf.

vessels fishing in STP land catches elsewhere (e.g., Abidjan is a regional tuna hub) and do not make port calls to STP. This could start with resolutions by ICCAT, the Regional Commission of Fisheries of Gulf of Guinea (COREP), and COMAFAT, possibly phasing in MARPOL Annex V requirements for vessels; introducing measures with respect to marking gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and could be an approved regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of the EU fisheries access agreement.

3.2.4 Shipping and tourism

Ensuring that STP meets its obligations under MARPOL Annex V is the key action. Engagement between vessels operators and agents, port officials and waste disposal enterprises can help to ensure compliance on ships garbage disposal. Clarity on responsibilities for control, for inspection of ship's waste management logbooks and monitoring of practices at smaller ports may require agreements between port authorities, responsible ministries and municipal waste management authorities. Dialogues could also help in separation of recyclables in ship's garbage. Possible dialogues with IMO and regional port authorities could ensure coordinated measures to prevent dumping of waste by other shipping and to foster codes of conduct for regional shipping lines.[76]

Tourism. Although tourist arrivals increased by 263 percent in the 2010-2016 period with 29,000 arrivals for about a 1,500 bed capacity, tourism is considered to still be in an embryonic state. The vision is for STP to be the 'the most conserved island destination in equatorial Africa'. Tourism is not perceived as causing public cleanliness problems. Public cleanliness is seen as detracting from the quality of tourist experiences, and tourists give STP sanitary conditions a relatively low score. Both traders and stakeholders in the tourism sector consider public cleanliness as one of the two most important areas for improvement and also rank environmental awareness as a major issue.[77]

3.2.5 Awareness of MPP

There is an awareness of MPP in STP. This is evidenced by the STP's endorsement of the Mindelo Declaration on marine litter; ratification of the Abidjan Convention's LBSA Protocol; ratification of MARPOL Annex V; and national legislation on plastic bags. The awareness exists at the level of decision-makers. However, a similar level of awareness may not exist among consumers and businesses as evidenced by the reported weak compliance with the plastic bag regulations.

A range of approaches to raising awareness is detailed in the main AIODIS report. A recent public opinion survey ranked 'health' as the number one development priority in STP, so that emphasising the health benefits of improved solid waste management could raise its profile in the development project portfolio.[78] In the case of STP, the existing awareness may need to be channelled into practical actions, such as the separation of plastic waste, access to sources of funding for recycling, possibilities with regard to EPR schemes and development of a business case for 'valorização' of waste streams.[79] In 2020, it was indicated that an awareness campaign on urban 'cleanliness' would be launched.[80] In

[76] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report (although STP does not receive cruise ships, the commitment on phasing out of SUPs is of interest).

[77] Governo de São Tomé e Príncipe, 2018. Plano Estratégico e de Marketing para o Turismo de São Tomé e Príncipe.

[78] World Bank, 2019. World Bank Group Country Opinion Survey 2019: Sao Tome and Principe.

[79] World Bank, 2019. Country Economic Memorandum: Background Note 6. Stock take on business environment reform in São Tomé and Príncipe.

[80] "uma campanha que vai ser realizada na televisão e nas rádios [...] destinada aos munícipes". QW Noticias 20 August 2020. https://www.dw.com/pt-002/###-est%C3%A1-cansada-do-problema-do-lixo/a-54636646.

addition to public awareness campaigns, awareness activities can build on the work of environmental NGOs, focus on: raising community pride in cleanliness; establishing more formal relationships between waste buyers and catadores; supporting SMEs that can foster innovation that adds value to waste; and on the development of materials for school curricula.[81] Campaigns can also focus on voluntary actions and procurement policies, e.g.: elimination of SUPs from and reduction of plastics in public procurement, beach cleaning in tourist areas, codes of industry conduct to reduce SUPs and plastic waste, and EPR schemes to improve markets for waste products.[82]

Catadores can have an important role in adding value to waste. Plastic represents about 17 percent of the materials they collect and plastic comprises 15 percent of the items collected at the Penha landfill.[83] Studies suggests that basic organisation of these marginalised workers could improve supply and market opportunities for recycled/ reused materials, reduce plastic pollution and contribute to management of municipal solid waste.[84]

3.2.6 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (or global) action. In cooperation with other countries, STP could consider several initiatives:

- preparation of a joint strategic plan on MPP under the Abidjan Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Abidjan LBSA Protocol
- preparation by the Abidjan Convention secretariat of a funding submission for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-up through existing initiatives, and preparation of a strategic plan on MPP
- further use of Comunidade dos Países de Língua Portuguesa to follow on the Mindelo Declaration (2018).

In conjunction with other countries, STP could also consider initiating a dialogue in ECCAS on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic (and other) waste would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO.

At the level of AIODIS and Africa, STP could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA. A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

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[81] E.g., educational videos produced by TESE, Projeto +ValoRES - Sustentabilidade e Economia Verde na Gestão de Resíduos (EU & Instituto Camões). https://www.facebook.com/pg/LIXO-ZERO-EM-STP-1409225786038334/posts/.

[82] Téla Nón, 2019. STP começa a envolver-se na limpeza do mar para Turismo ser futuro seguro. 25 de Setembro de 2019. See also: TESE - Associação para o Desenvolvimento - https://www.linkedin.com/in/teseongd/.

[83] Cruz, V.G., et al. 2018. Gestão sustentável dos Resíduos Sólidos Urbanos em São Tomé e Príncipe: Contributos da Educação Ambiental. AmbientalMente sustentable, xaneiro-decembro 2017, ano XII, vol. I, núm. 23-24, páxinas 47-62.

[84] See: Machado, G.B. Os Catadores e a Politica Nacional de Resíduos Sólidos. Resíduos Sólidos (Brazil). https://portalresiduossolidos.com/os-catadores-e-a-politica-nacional-de-residuos-solidos/.

3.2.7 Resources

As already noted, solid waste management does not appear to have a high priority in the agendas of the development partners, or the problem has been 'dissipated' among other challenges, such as health, infrastructure, public finance or education. This implies increased attention to the cost-effectiveness of waste management, means to reduce wastes (e.g., import of packaging), application of 'polluter pays' charges on items such as plastic bottles and plastic packaging, recovery of waste collection costs and possible cross-subsidy for collection from remote communities.

In the absence of major investment funds, low-cost actions, including awareness raising and change in consumer and household behaviour on waste management could be targeted. As suggested above, small interventions could be identified as part of projects that address the relevant SDGs. In particular, community initiatives to manage waste and improved synergies between any existing public and private efforts could be considered. Lessons could possibly be learned from the Dakar catadores (Association des Recuperateurs et Recycleurs de Mbeubeuss (BOKK DIOM)) which services households, commercial establishments, hospitals, markets and other producers of wastes. Further studies could be prepared possibly as part of university theses, but organised in such a way as to fill gaps in understanding of waste management and to identify options for waste valuation or for local products to substitute plastics.[85]

[85] Accelerating the Circular Economy in Africa – Lessons from Algeria, Ethiopia, and Rwanda. https://vimeo.com/484171717; Angola. Desburocratização do mercado do lixo. https://www.angop.ao/noticias/ambiente/jomo-fortunato-quer-desburocratizacao-do-mercado-do-lixo/

WESTERN INDIAN OCEAN

4 Union of the Comoros

4.1 Marine plastic pollution in Comoros

The Union of the Comoros (Comoros) does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).[86] Comoros, however, has proposed an investment project to address solid waste management as and when resources become available. This report is a first step to estimate the scale of MPP, to describe the sources of MPP and to develop a national dialogue and action plan on MPP with particular emphasis on use of the existing solid waste management initiatives, developing awareness among key stakeholders and identifying practical steps.

4.1.1 Sources of marine plastic pollution

This note provides a preliminary estimate of marine plastic pollution (MPP) in Comoros and provides a synthesis of available information on MPP. There are three main sources of MPP in Comoros:

- mismanaged, or unmanaged solid waste, which is by far the most important
- marine sources are mainly fishing activities, shipping, offshore oil and gas platforms and a minor contribution from marine tourism
- plastics may also be transported by ocean currents from other countries.

Plastic waste is part of a much broader waste management problem, one of a range of sustainable development challenges faced by Comoros. The country has a population of about 0.85 million. About 74 percent of the population is 'urban' and the entire population is considered 'coastal' for the purposes of estimating MPP. By this is meant that plastic dumped in any part of the country can potentially become MPP. This is due to the relatively small size of the islands, the steep topography and seasonally high rainfall so that any mismanaged plastic waste could potentially be washed into the marine environment. The tidal range (up to 1.8m) suggests that waste dumped on the shoreline could also result in MPP, particularly when storm surges occur.[87]

The estimate relies on several assumptions. MPP is estimated primarily as a function of mismanaged solid waste in Comoros.[88] Studies indicate the amount of solid waste generated per person is 0.4 kg/person/day.[89] A 2013 survey suggested that the amount of waste could be higher, as only 7 percent of the sample of Mutsamudu (Anjouan) residents surveyed indicated that they produced less than 1 kg/day.[90] The same survey recorded that plastic comprised 14 percent of the waste.[91] A 2016 study noted that wealthier households generated more in Moroni and estimated an average of 1.7kg/day per household (0.36 kg/person).[92]

[86] MPP is generally considered to account for about 80 percent of marine litter or debris.

[87] Risk of cyclones and coastal flooding in Comoros is considered 'high'. https://thinkhazard.org/en/report/58-comoros/CY

[88] See Jambeck et al., 2014 and the main report for details of this methodology.

[89] Issihaka Ali, A. 2015. Contribution à l'amélioration de la gestion des déchets ménagers aux Comores. International Journal of Innovation and Applied Studies. Vol. 12 No. 4 Sep. 2015, pp. 786-800. See also: World Bank. What a Waste 2.0. (database).

[90] Sinane, K.M. 2013. Les littoraux des Comores, dynamique d'un système anthropisé : le cas de l'île d'Anjouan. Géographie. Université de la Réunion, 2013. Français. https://tel.archives-ouvertes.fr/tel-01237270.

[91] The study acknowledges that the high estimates probably reflect estimates of volume rather than mass by those interviewed.

[92] Mousfou, I.H.Y., 2017. Gestion et traitement des déchets ménagers à Moroni. Memoire Master, Universite d'Antananarivo;

In 2020, an estimated total of approximately 124,000 tons of solid waste was generated by a population of almost 851,000. Plastic is estimated to comprise 5.4 percent of the solid waste stream.[93] In Comoros little of the solid waste is effectively managed and the waste that is collected (up to 40 percent in Moroni) appears to be dumped in uncontrolled landfills where plastic may be burned, carried by the wind, or washed into streams. For the purposes of the estimate, it is considered that 90 percent of the waste is mismanaged, although in recent years some communes, NGOs and communities have invested in waste management (Table 6).[94]

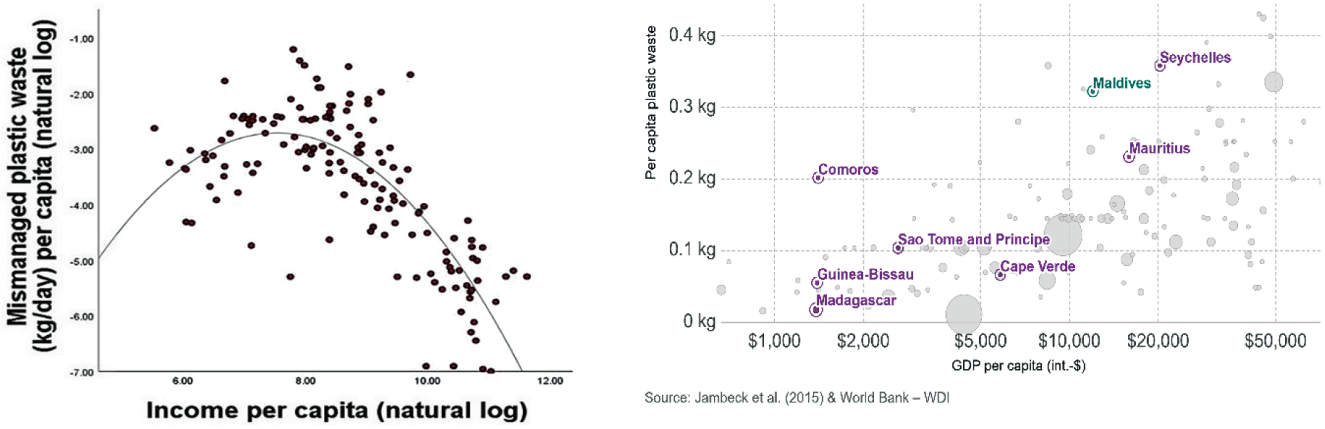
Table 6. Survey of waste disposal in Anjouan, 2013

Site of waste disposal	% of survey respondents
Beach	86%
Rivers	5%
Drains	2%
Potential to become MPP	93%
Other, around house	7%
Total	100%

Source: Sinane, 2013.

There is a relationship between plastic waste and income levels (Figure 14).[95] In 2019, the GNI per capita in Comoros was $1,400, and while consumption of plastic products can be expected to decline during 2020, the increase in the use of plastics to combat the pandemic may offset some of the decrease. Reduced tourist arrivals (about 10.8 percent of GDP) is also likely to temporarily reduce MPP.

Figure 14. Relationship between income and mismanaged plastic waste



Sources: Barnes, 2019; Jambeck, et al. 2015.

The mismanagement of solid waste means that the waste plastic can be leaked or transported into the ocean by rainfall and flooding, by dumping directly into rivers or the sea, by dumping on the shore, or by wind which carries plastic from dumps, or plastic particles from burning plastic. The 2013 study also showed that waste dumped in or near waterways by inland villages accumulate near the estuaries

Africa Clean Cities Brief 2018.

[93] Hydroplan, 2003. Expertise pour la gestion des déchets solides. Rapport final. Ministère des finances, du budget et de la privatisation des Comores. This study has been repeatedly cited. No more recent study appears available. About 4% of market waste is plastic, see: La direction générale de l'environnement et des forets. 2019. Rapport sur la caractérisation des déchets solides du marché de volo-volo. Préparer par Service déchets.

[94] Studies in 2003 (Hydroplan) and 2014 (Fouque) also indicate high levels of waste dumping on beaches.

[95] Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505

of these streams. The estimate conservatively assumes that 30 percent of mismanaged plastic waste is leaked into the marine environment. While this value is higher than that used in preparation of the 2014 global estimate, it reflects the practice of dumping waste directly into the sea, or on the shore and that a high proportion of the population live in close proximity to the coast .[96] In 2019, Comoros imported $2.97 million worth of plastics. However, imports under the 'plastics' custom code do not include drinks bottles and other plastic containers, or plastics used in packaging which is the type of plastic most likely to become MPP.[97] Information on plastic waste exports is not available.

MPP in Comoros is estimated at over 1,800 tons per year (Table 7).

Table 7. Estimated marine plastic pollution in Comoros

Item	Value	Source/ Assumption
Population total (million)	850,886	World Bank 2019
Waste (kg/person/day)	0.40	Issihaka Ali, et al. 2015
Solid waste total (tons/year)	124,229	calculation
Plastic (%) of waste	5.4%	Hydroplan, 2003
Plastic waste (tons/year)	6,708	calculation
Mismanaged plastic waste (tons/year)	6,038	90% (see text)
Marine plastic pollution(tons/year)	1,811	30% of mismanaged waste based on Sinane, 2013
Fisheries and shipping (tons/year)	1	assumed (see below)
Microplastics	1	assumed (see below)
Non-Comoros sources	1	assumption (from Madagascar, Mozambique, other)
Estimated MPP (tons/year)	1,814	

4.1.2 Management of solid waste

Because of the relatively small size of the island ecosystems, unmanaged plastic waste can have a long-term impact on soils, water supplies, the air quality (through open burning) and the marine environment and cause a wide range of negative effects on health, tourism, food supply and the quality of life. The impacts of MPP are addressed in detail in the main report. The causes of mismanaged solid waste are attributed to a combination of factors:

- lack of financial resources either from the government budget or local taxes or service charges
- lack of a comprehensive waste management policy, plan, or strategy
- lack of coordination, divided responsibilities and other institutional obstacles
- weak human resources and technical knowledge
- lack of infrastructure
- difficulties in translating awareness among consumers and households into sustainable practices and little or no sorting of waste.

However, the population is aware of the problem of waste and the impacts on wellbeing. The problem is a lack of commitment to finding and implementing solutions due to the combined effects of institutional inertia, lack of resources and support for a plan to address the problem (see below 4.2.1 on the subject of plans).

[96] Jambeck et al., 2014 consider that 10-20% of mismanaged waste in the coastal area leaks into the marine environment. The 5% value used here appears consistent with direct observations made in some African countries.

[97] HS Code 39.

Although legislation is in place to establish a national waste management authority, Comoros currently lacks an institution which coordinates the activities of the various stakeholders (e.g., environment, health, local authorities, business and civil society organisations); takes responsibility for preparation of targeted investments; secures finance for implementing the waste management plans; develops a scheme for financing the recurrent costs of waste management; and provides incentives for waste use and recycling. The waste management responsibilities given to the district authorities are not matched by either public support or by revenues from user charges for waste collection.

Some waste collection takes place. This appears to vary by district and the availability of collection resources (e.g., trucks, fuel), appears erratic and little, if any, separation of waste takes place. Collected waste also appears to be dumped in uncontrolled sites where plastics may be burned or washed into streams of the sea. A number of NGOs, youth groups, environment protection groups, community association and communes are actively engaged in addressing waste management.[98] In some cases they are supported by religious leaders and quartier chiefs, resources from development partners and waste collection services provided by the local authorities. Investment in major infrastructure, notably the construction of sanitary or managed landfills has not been undertaken and remains largely unfinanced (see below 4.2.1 on proposed plans). Comoros has a unique problem in that the selection of inland waste landfill sites must be at elevation and limited by the geomorphology, as leachate from upland landfill can readily contaminate a fragile water-table.

Figure 15. Placement of waste and waste collection sites on the coast

Source: Hydromet, Comoros Actualites[99]

As in other AIODIS economies, Comoros has a trend in increased import of plastic products, or products in plastic containers or wrapping, but lacks the economies of scale for investment in recycling. The cost of transporting waste between islands is likely to outweigh its value for reuse or recycling. Island geography and mountainous terrain raises the costs of household waste collection and disposal. High humidity and high seasonal rainfall means that waste may be wet, or heavy and difficult to handle. Imported trucks and other waste management equipment may incur high maintenance costs in

[98] E.g., AIDE, ULANGA, 2 Mains.

[99] http://www.comores-actualites.net/2019/09/18/les-cotes-de-la-ville-diconi-croule-sous-les-dechets-plastique/

the tropical climate. Retaining qualified personnel, such as waste managers or engineers, is also a challenge, given the diaspora enjoyed by Comoros. It is unclear if chemicals from plastics are leaching into the water supply, but due to its complex hydrogeology, Comoros already faces major challenges in assuring a sustainable supply of drinking water and effective waste management is part of the solution.

In conclusion, the main driver of MPP in Comoros is a weak solid waste management. MPP and plastic waste is just one part of a much broader waste management problem.

Fisheries. As there is no direct information on MPP from fisheries in Comoros, the estimate given in should be considered as a 'place-holder' until such time as further information is available. Both local small-scale and large-scale fisheries and foreign fishing are potential sources of MPP through lost gear and garbage disposal.[100] Losses are generally related to the type of gear and location where the fishing takes place. There are over 8,000 active fishers in Comoros operating about 1,500 GRP vessels and 3,500 wooden canoes with catches in the order of 16,000 tons (Figure 16).[101] Access agreements with the EU for tuna fishing were an important source of revenue before the agreement was denounced in 2016 with a major impact on total annual fisheries access revenues of about $1.3 million.

Figure 16 GRP vessels in Comoros

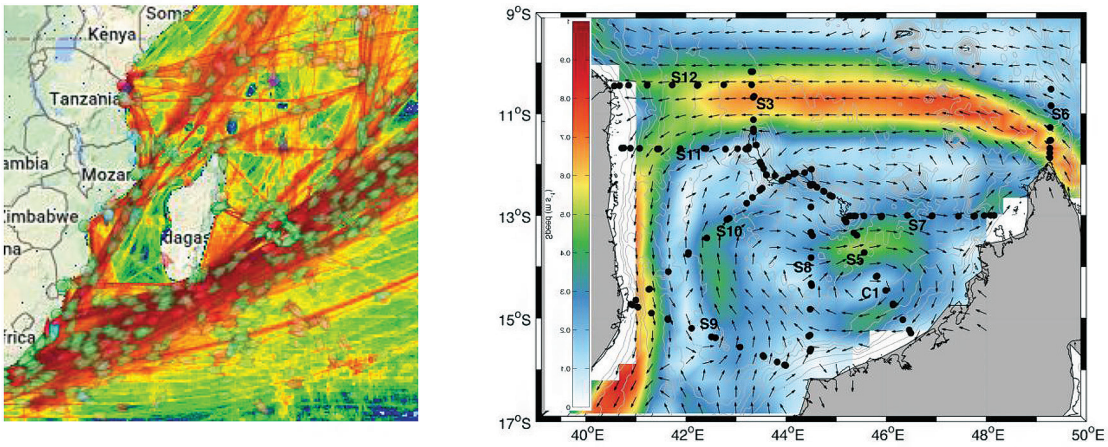
There is no information on losses of fishing gear or MPP from fisheries. Available import information indicates that Comoros imports less than 1 ton of fishing nets per year which appears to be a substantial underestimate, but it is assumed that at least 1 ton/ year is lost or becomes MPP.

Shipping. Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. Arrangements for disposal of ships garbage in smaller ports or landing sites in Comoros may need attention, as marine transport between islands is a key component of the transport network. In addition, growing offshore oil/gas exploration activities can be a source of MPP and effective waste management may require to be specified or included in any revisions of the legislation on marine pollution or in the terms and conditions of concessions.

[100] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

[101] In 2012, FAO reported a total of 10,000 fishers and 5 800 vessels of which nearly 70% were unpowered.

Figure 17. Shipping traffic density and ocean surface currents in the Comoros area



Foreign sources of MPP. It is likely that MPP originating from the African mainland and possibly from Madagascar is transported to Comoros by ocean currents from shipping and from rivers. However, shipping traffic is relatively light in the Northern Mozambique Channel and the surface current systems appear to have a tendency to form eddies rather than act as a major carrier of marine debris.[102] However, specific information on the quantities arriving in Comoros is not available and beach clean-up activities do not sort debris by possible origin.

Microplastics. The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In Comoros, the absence of slow-moving rivers or extensive estuaries means that microplastics are likely to get flushed into the ocean. The main sources are likely to be untreated waste water (cosmetics, cleaning agents, laundry); road runoff of rainwater containing microplastics from car tyre abrasion; and air-borne microplastics resulting from burning and breakdown of macroplastics by wind and sun. As the area of surfaced/tarmac road is relatively small, microplastics from tyre abrasion may be trapped in the soil before reaching the sea.

4.2 Existing and potential measures to combat MPP

4.2.1 Policy and planning

Policies. There is no policy or plan to combat MPP. There is no integrated national policy on solid waste management, although the environment ministry and local authorities have policy positions. A comprehensive information system on waste quantities, composition, or disposal upon which to effectively plan initiatives is lacking. Solid waste management lacks specific budget allocations and a tax base, such as universal collection charges or import taxes on plastics. Waste collection and waste disposal has been described as "anarchique". The business environment is constrained by burdensome laws inhibiting investment in enterprises that could add value to waste or provide services.[103]

Constraints. These deficiencies are the result of deeper systemic structural problems of governance in terms of institutional arrangements, resourcing and finance and regulation. There is a lack of cooperation and coordination among the multiple actors and governance levels involved: the Union

[102] Collins, C., J. C. Hermes, and C. J. C. Reason (2016), First dedicated hydrographic survey of the Comoros Basin, J. Geophys. Res. Oceans, 121, 1291–1305, doi:10.1002/2015JC011418.; Quartly, G.D., et al. 2013. Mozambique Channel eddies in GCMs: A question of resolution and slippage. Ocean Modelling Volume 63, March 2013, Pages 56-67

[103] Comoros 'Doing Business 2020' score is 47.9 compared to a Sub-Saharan Africa score of 51.8 and a score of 81.5 for Mauritius.

government, the three island governments, the Commission de l'Environnement des îles, the municipal authorities (mairies) which have the direct responsibility for solid waste management, contractors engaged in provision of waste collection and a range of civil society organisations engaged in reuse and recycling.[104]

Institutions. The main responsibilities are split. The communes are responsible for the organisation, management and implementation of waste services and cleaning of public areas, collection, transport, handling and disposal of solid wastes. The Union government is responsible for dangerous wastes, for legislation, for setting norms and for any international cooperation required.

The island-level governments are responsible for the island's waste management plan, the identification and management of the waste disposal sites and the monitoring and control of waste management. In Moroni the Environment Commission (rather than the mairie) contracts the private service providers which collect household waste. Le Comité de Pilotage des Villages des Riverains is responsible for control of the main landfill, while communities are represented by L'Union des Associations de Moroni.[105] Service contracts may lack clarity and performance measures, but as budget management is weak, contractors also risk late payment.

The waste management problem, and the resulting marine pollution is well recognised in the national vision:

" Dans le cadre de la gestion des déchets et de la salubrité publique, le pays n'arrive toujours pas à proposer un mécanisme durable de lutte de contre ce fléau, car les infrastructures adéquates ne sont pas encore mises en place et aucun mécanisme durable de gestion des déchets n'a été jusqu'à présent défini."[106]

A recent decree approved the establishment of a national waste management authority.[107] The authority will be established under the environment ministry with four departments and island level 'antennae'. Revenues are to be derived from the government budget, from service charges, levies on waste removal, entry charges for landfill sites, from loans and grants.[108]

Plans. Several analyses and plans have been prepared in the past.[109] They have identified the problems and proposed various sectoral or island-level solutions, but the structural constraints outlined above have generally blocked comprehensive implementation. Because the intertwined technical, financial, institutional and environmental education issues all need to be systematically addressed, development partners have not engaged in what is likely to be a long-term endeavour. In 2019, an major solid waste management investment plan was prepared as an input for the Development Partners Conference (Table 8).[110] The proposal (2019 Plan) is focused largely on capital investment. It is not backed by any feasibility analysis or a plan for sustainable financing, although a 2014 study does provide estimates of recurrent costs and indicates the sources of finance.[111] Plan Comores Emergent 2030 has suggested a waste management policy with enhanced reliance on voluntary stakeholder actions.[112]

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[104] The 2 Mains NGO has been particularly active, fostering waste separation, composting, 'valorisation' awareness and cooperation among communes. http://www.2-mains.org/index.php?option=com_content&view=article&id=6&Itemid=115,

[105] Hydroconseil/ Ecogeos, 2014. Diagnostic de la filière déchets à Moroni (et dans les communes environnantes). Rapport 2. Assistance technique pour améliorer la gestion des déchets solides à Moroni, Comores. Banque Mondiale. This study provides an analysis of the institutional issues.

[106] Plan Comores Emergent 2030.

[107] Decree 20/104 (August 2020).

[108] Currently, only Domoni, Moroni and Fumboni communes are understood to apply household waste charges.

[109] PNUD/IAGU, Union des Comores, Plan de gestion intégrée des déchets solides ménagers et hospitaliers dans l'agglomération de Moroni. Etude réalisée par l'Institut Africain de Gestion Urbaine (IAGU); PNUD, 2007. Union des Comores. Formulation d'un programme de gestion intégrée de déchets solides pour les principales villes. Rapport de mission exploratoire; Mousfou, 2017; Plan de Développement Urbain de Moroni. Document de synthèse.

[110] Conférence des Partenaires au Développement des Comores, Paris: 02 - 03 décembre 2019. Conference des Partenaires au Developpement des Comores. Projet structurant : Gestion intégrée des déchets en Union des Comores.

[111] Hydroconseil/ Ecogeos, 2014. (World Bank).

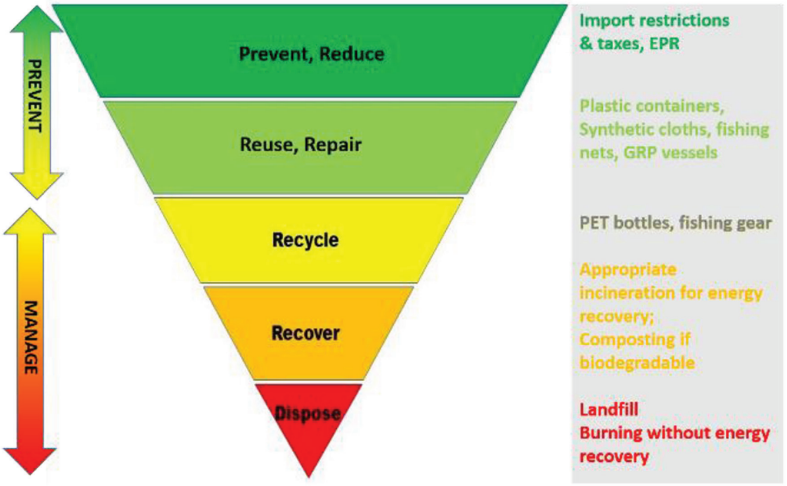
[112] "Mettre en place une politique nationale volontariste de gestion des déchets."

Table 8. Integrated waste management project proposal (2019 Plan)

Component	€ million	%
Disposal of wastes	10	29%
Waste collection	10	29%
'Valorisation' of wastes	12	34%
Institutional development	2	6%
Communication and best practices	1	3%
Total	35.6	100%

The 2019 Plan provides a useful start in recognising that substantial investment is required, but perhaps underestimates the underlying structural challenges and that without institutional reforms the proposed capital investments may be less than successful. An outline national plan to combat MPP could be prepared if the 2019 Plan is advanced. If the establishment or resourcing of the proposed national waste management authority is delayed, a ministerial-level task force, or working group could be established to improve cooperation between key institutions, including through memoranda of understanding, budget alignment and sharing of information.

Figure 18. The waste hierarchy



A task force could include representatives of the environment ministry, municipal authorities, finance ministry, chamber of commerce, the media and concerned NGOs; and in the case of MPP, the fisheries administration, port authority and tourism stakeholders. The NGOs could include resident's associations and representatives which could gradually develop locally adapted and effective waste management practices, including greater separation of wastes and improved opportunities for reuse and recycling.[113] Consideration could be given to the organisation of waste pickers and development of EPR in relation to major waste items, such as PET bottles. Investments could possibly prioritise the various forms of community actions, including voluntary local clean-ups, deployment of youth groups, innovation in reuse and recycling and partnerships with business with a view to the use of unskilled labour to add value to waste. Greater community engagement could potentially secure the resources which are not available to municipal authorities through voluntary efforts or through labour paid by adding value to waste. In particular, composting appears to have considerable potential given the low productivity of some of the soils in Comoros.[114]

MPP needs to be seen in the context of overall waste management in Comoros, the level of poverty, the governance challenges, the competing national development priorities, and the scarcity of human and financial resources and the lack of vision on solutions which can be adapted to the local conditions.

[113] NGOs with potential to contribute to a circular economy include: Le Réseau des Jeunes Entrepreneurs-Plateforme Nationale, L'association Banda Bitsi, L'FOICOM, Association 2Mains, SHAWIRI, Synergie Jeunes, SHINOON CoWorking , Association DAHARI, Maecha, FNACFA.

[114] 2-Mains, Ulanga Traitement, Banda Bitsi.

4.2.2 Regulation

The basic law on environmental protection (1994) prohibits dumping waste along the roadside or near houses.[115] It obliges all citizens and entities to practice ecologically sound waste management, but does not specify the modalities of application. A 2017 law prohibits the production, import, sale and distribution of non-biodegradable low density plastic bags.[116] It appears that these and other relevant laws are not effectively applied and are generally ignored.[117] Given effective enforcement, reduction in import of non-essential plastics using bans or import taxes could be envisaged, i.e., for selected single- use-plastics (SUPs) and a ban on the import of cosmetics containing microbeads. This could both potentially reduce consumption and provide revenue, while possibly creating a market for local products (e.g. schoolbags made from local, or reused materials). The problem with waste PET bottles appears so great that a substantial import tax could be considered to reduce imports and provide incentives for production of water local drinks in reused glass bottles or in larger water containers.

4.2.3 Fisheries

Given the nature of the small-scale fisheries, marking of fishing gear and 'fishing' for lost gear may not be practical. However, 'fishing' for lost gear and other MPP by volunteer divers at prime tourist dive sites near the marine park, or near main beaches may be of value. Designation of sites for collection of waste fishing gear, possibly through the Syndicat National pour le Développement de la Pêche aux Comores (SNDPC) and EPR arrangements with importers for responsible disposal could be of practise value in addressing fisheries MPP. FADs are likely to be a source of marine debris from the tuna fleet which also fishes in other WIO countries. Analyses of beach litter from the Seychelles suggest that garbage from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the Comoros EEZ. As industrial vessels operating in Comoros do not visit port, there is a lack of information on vessel garbage disposal, or disposal of waste fishing gear by industrial vessels.

For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements can be applied to fishing vessels.[118] Recycling of nets and ropes may require the economies of scale which may only be feasible through regional schemes (e.g. catalysed by SWIOFC or IOC), through close engagement with businesses and possibly with economic support from EPR arrangements with importers. Studies suggest that the direct economic costs and benefits of fishing gear EPR schemes, such as deposit-return arrangements, or 'environmental taxes' on fishing gear imports are considered to be about equal (excluding indirect environmental benefits). However, the distribution of costs can be skewed, e.g., if manufacturers simply increase the cost of gear to fishers to cover EPR.[119] Fishers could introduce local rules to curtail gillnets in rocky areas where nets are frequently lost, as ghost fishing impacts on all fishers.

[115] Article 54, Loi-cadre N° 94-018 relative à l'environnement. See also: Loi N°11-001/AU portant code de la santé publique.

[116] Law 17/011/AU of 2017 banning plastic bags.

[117] 67% of people interviews on Anjouan reported that they dumped rubbish within 200m of their house.

[118] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear. Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

[119] EC, 2018. Study to support impact assessment for options to reduce the level of ALDFG Final Report 22-02-2018. https://webgate.ec.europa.eu/maritimeforum/en/system/files/Final%20Report%20Plastics%20from%20Fishing%20Gear%20Delivered.pdf.

There are a range of guidelines available to prevent marine debris from fishing vessels. Workshops have been held, but it is unclear to what extent best practices are implemented in Comoros, or regionally. A 2019 African regional workshop indicated a low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.[120]

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly as foreign vessels fishing in Comoros land catches elsewhere (e.g., Port Louis, Victoria, Diego Suarez) and do not make port calls to Comoros. This could start with resolutions by IOTC, SEAFO, possibly phasing in MARPOL Annex V requirements for vessels; introducing measures with respect to marking gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and could be an approved regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of any future EU fisheries access agreement.

Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. Abandoned GRP vessels present a growing plastic waste problem and are likely to degrade to marine microplastics if abandoned on beaches. Most countries have no provision for appropriate disposal of GRP vessels. Rules for their disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

4.2.4 Shipping and tourism

Ensuring that Comoros meets its obligations under MARPOL Annex V is the key action. Engagement between vessels operators and agents, port officials and waste disposal enterprises can help to ensure compliance on ships garbage disposal. Clarity on responsibilities for control, for inspection of ship's waste management logbooks and monitoring of practices at smaller ports may require agreements between port authorities, responsible ministries and municipal waste management authorities. Dialogues could also help in separation of recyclables in ship's garbage.[121] Possible dialogues with IMO and regional port authorities could ensure coordinated measures to prevent dumping of waste by other shipping in the Northern Mozambique Channel and to foster codes of conduct for regional shipping lines.[122] MARPOL Annex V also applies to the disposal of garbage from fixed or floating platforms engaged in the exploration or exploitation of seabed oil and gas and should be stipulated in the relevant authorisations.

Tourism is not considered a significant driver of MPP and may provide an incentive to maintain the cleanliness of beaches and waterfronts.

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[120] Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

[121] A wide range of IMO guidelines are available: Prevention of Pollution by Garbage from Ships https://www.imo.org/en/OurWork/Environment/Pages/Garbage-Default.aspx; Resolution MEPC.220(63) Guidelines for the Development of Garbage Management Plans; 2017 Guidelines for the implementation of MARPOL Annex V. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf; IMO, 2018. Consolidated guidance for port reception facility providers and users. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf.

[122] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report (although Comoros may not currently receive cruise ships, the commitment on phasing out of SUPs is of interest).

4.2.5 Awareness of MPP

There is an awareness of MPP in Comoros as evidenced by the Comoros ratification of the Nairobi Convention's LBSA Protocol, ratification of MARPOL Annex V, and national legislation on plastic bags. A number of awareness programmes have taken place, or are part of environmental sustainability projects (Figure 19).[123] A range of approaches to raising awareness is detailed in the main AIODIS report.

Almost 90 percent of persons surveyed on Anjouan considered that beach pollution posed a problem.[124] Bad smell, mosquitos, risk of injury and reducing the attractiveness of the beach were cited as the main impacts. After sand extraction, dumping of wastes is seen as the most important cause of beach degradation by 36 percent of coastal villagers and by 14 percent of fishers interviewed. On Anjouan, there is a pernicious link between extraction of beach sand and dumping of waste in the littoral area. Because sand extraction contributes to erosion and collapse of sea walls, dumping of rubbish in the sand pits is seen as necessary to stop erosion. In some cases, there is a demand for more sea walls rather than the politically more difficult prevention of sand extraction and waste dumping.

In 2013, a stakeholder survey indicated the origin of marine debris on the beaches was attributable as follows: households 36 percent; commerce 30 percent; other industries (agriculture, fishing) 31 percent; and also mentioned tourism and shipping (1 percent each). The survey noted a belief that the littoral zone was generally the only area available for dumping as there was little or no 'public land'.

Figure 19. Awareness activities and related projects

[123] https://www.gcca.eu/videos/beach-clean-2019-gcca-comoros-plastic-bags; L'Alliance Mondiale contre le Changement Climatique (AMCC) https://amcc-comores.info/pdf/la-pollution-plastique/.

[124] Sinane, 2013.

In the case of Comoros, the existing awareness may need to be channelled into practical actions, such as the separation of plastic waste, access to sources of funding for recycling, possibilities with regard to EPR schemes and development of a business case for 'valorisation' of waste streams.[125] In 2020, it was indicated that an awareness campaign on urban 'cleanliness' would be launched.[126] In addition to public awareness campaigns, awareness activities can build on the work of environmental NGOs by focusing on: raising community pride in cleanliness; establishing more formal relationships between waste buyers and informal waste-pickers; supporting SMEs that can foster innovation that adds value to waste; and on the development of materials for school curricula. Campaigns can also focus on voluntary actions and procurement policies, e.g.: elimination of SUPs and reduction of plastics in public procurement, beach cleaning in tourist areas, codes of industry conduct to reduce SUPs and plastic waste, and EPR schemes to improve markets for waste products.[127]

4.2.6 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (and global) action. In cooperation with other countries, Comoros could consider several initiatives:

- preparation of a joint strategic plan on MPP under the Nairobi Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Nairobi LBSA Protocol
- preparation of a funding submission by the Nairobi Convention secretariat for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-up through existing initiatives, and preparation of a strategic plan on MPP
- further use of the regional projects supported by the IOC and Cap Business (e.g. in relation to recycling of PET bottles).

In conjunction with other countries, Comoros could also consider initiating a dialogue in the regional economic commissions (COMESA, SADC) on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic waste (and other recyclable waste) would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for fishing nets, soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO.

[125] World Bank, 2019. Country Economic Memorandum: Background Note 6. Stock take on business environment reform in São Tomé and Príncipe.

[126] "uma campanha que vai ser realizada na televisão e nas rádios [...] destinada aos munícipes". QW Noticias 20 August 2020. https://www.dw.com/pt-002/###-est%C3%A1-cansada-do-problema-do-lixo/a-54636646.

[127] Mohamed, Naïda, 2015. Les activités génératrices de revenus basées sur le recyclage des déchets dégradables, métalliques, plastiques et en verre aux Comores. Plan de gestion durable des déchets dans la région de Domoni, Anjouan, Comores; Chevalley, Isabelle., 2011. Recyclage et valorisation des déchets de la Grande Comore. Terre e Faune. Coastal clean-ups: Plongeurs du Monde, Parc National de Mohéli aux Comores, 2019. Work by youth groups, e.g., Mitsamihouli. Maire de Foumboni awareness: https://www.youtube.com/watch?v=tR4d4tsNqyI. Employment from waste management : Banda Bitsi. Transforme la pollution marine en opportunité d'emplois durable et pérenne. Comores Zéro Déchets 2023.

At the level of AIODIS and Africa, Comoros could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA. A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

4.2.7 Resources

Comoros' fiscal revenue is less than half of the SSA average (8.3 percent versus 17.7 percent of GDP in 2018) and the management of public finances is complicated by budget overruns, reallocations inter-island allocation issues and a high public service wage bill that crowds out other priority spending.[128] Until its inclusion in the Conférence des Partenaires au Développement des Comores (2019) portfolio,[129] solid waste management does not appear to have had a high priority in the national development agenda, or those of the development partners and the problem has been 'dissipated' by other challenges, such as water, sanitation and health.

As solid waste management is now included in the 'portfolio' of development proposals, opportunities are likely to arise to include catalytic actions to combat MPP and solid waste management into projects and any initiatives that target the several related SDGs (Figure 20). National 'state of the environment' reports could include indicators on urban waste management (SDG 11), plastic consumption (SDG 12) and marine pollution (SDG 14). The relationship of MPP and solid waste management to the SDGs is illustrated in Figure 20.

In the absence of major funds for infrastructure investment, lower-cost interventions, including awareness raising and use of incentives to consumer and household behaviour on waste management could be targeted. Catalytic interventions could be identified as part of projects that address the relevant SDGs. In particular, community initiatives to manage waste and improved synergies between any existing public and private efforts could be considered. Lessons could possibly be learned from experiences in organising informal waste-pickers to sort, collect, reuse, or recycle wastes generated by households, commercial establishments, hospitals, markets and other producers of wastes.[130] Further studies could be prepared possibly as part of university theses, but organised in such a way as to target gaps in understanding of waste management, to identify options for waste valuation or for production of local products to substitute imported plastics.[131]

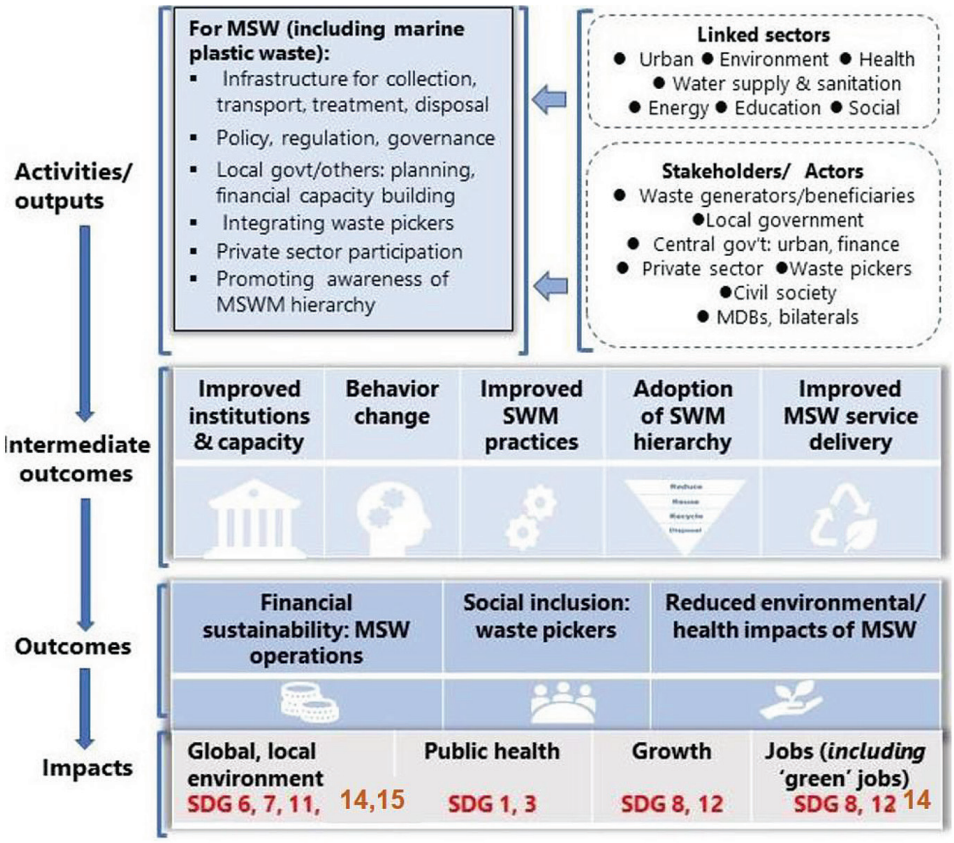
128 IMF, 2020.

[129] Fiche : Projet de Gestion Intégrée des Déchets en Union des Comores.

[130] Informal Economy Monitoring Study (IEMS). Pune's Waste Pickers: Realities & Recommendations.

[131] Accelerating the Circular Economy in Africa – Lessons from Algeria, Ethiopia, and Rwanda. https://vimeo.com/484171717; Angola. Desburocratização do mercado do lixo. https://www.angop.ao/noticias/ambiente/jomo-fortunato-quer-desburocratizacao-do-mercado-do-lixo/

Figure 20. Links between management of municipal solid waste and the SDGs



Source: World Bank, Independent Evaluation Group.
Note: MSW = municipal solid waste; MDB = multilateral development bank; MSWM = municipal solid waste management; SWM = solid waste management.

The main project report provides greater detail and discussion of option for recycling of plastic waste. Reference can also be made to companion reports on the circular economy.

5 Madagascar

5.1 Marine plastic pollution in Madagascar

Madagascar does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).[132]. This report is a first step to estimate the scale of MPP, to describe the sources of MPP and to develop a national dialogue and action plan on MPP with particular emphasis on use of the existing solid waste management initiatives, developing awareness among key stakeholders and identifying practical steps to combat MPP.

5.1.1 Sources of marine plastic pollution

There are three main sources of MPP in Madagascar:

- mismanaged, or unmanaged solid waste, which is by far the most important
- marine sources are mainly fishing activities, shipping, offshore oil and gas platforms and a minor contribution from marine tourism
- plastics may also be transported by ocean currents from other countries.

The different sources are discussed in more detail below. Plastic waste is part of a much broader waste management problem, one of a range of sustainable development challenges faced by Madagascar. This note provides a preliminary estimate of marine plastic pollution (MPP) in Madagascar and provides a synthesis of available information on MPP.

5.1.2 Estimate of marine plastic pollution and its basis

MPP is estimated primarily as a function of mismanaged land-based solid waste in Madagascar with some additions to reflect the marine sources.[133] The estimate of MPP relies on several assumptions based on population, solid waste generation, the proportion of plastic in the waste and the amount of mismanaged plastic waste that is transported into the marine environment. The basis for these assumptions is set out below. Alternative estimates of mismanaged plastic waste have not been explored at this stage.[134]

The country has a population of over 27 million (about 87 percent of the total IOC-member country population) and a population density an order of magnitude less than most of the IOC countries. Less than 40 percent of the population is 'urban' and about 60-70 percent live in unplanned/informal housing or 'bidonvilles' which are often in small high-density plots and which are not effectively serviced by any formal solid waste collection or management.[135] Of the urban population, 5 percent live in coastal areas.[136] It is assumed that a similar proportion of rural dwellers live in coastal areas. For the purposes of the MPP estimate, the population is divided into four groups: urban coastal, rural costal, urban inland and rural inland.

[132] MPP is generally considered to account for about 80 percent of marine litter or debris.

[133] See Jambeck et al., 2014 for a description of the methodology.

[134] Cordier, M. et al, 2020. Plastic pollution and economic growth: the influence of corruption and the lack of education. 2020. https://hal.archives-ouvertes.fr/hal-02862787..

[135] Urban 37.9%, 10.2 million (2019) https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=MG; ONU-Habitat, 2010.

[136] http://geodata.grid.unep.ch/mod_table/table.php

Madagascar's topography is highly variable such that most of the populous highland areas are drained to the eastern coast (Mozambique Channel). The topography of the eastern estuaries, combined with the high soil erosion means that a substantial proportion of the waste plastic waste that is washed into the lower catchments is likely to get 'trapped' and buried in the estuarine mudflats and become a 'coastal plastic sink'. The estimate of MPP is adjusted to reflect this assumption, as it is considered that this a coastal plastic sink is not MPP. The tidal range varies widely around the island with a range of 1-5m which suggests that waste dumped on the shoreline could potentially be washed into the marine environment and result in MPP, particularly when flooding or storm surges occur.[137]

The collection and disposal of household solid waste varies widely by municipality, or city. There is little or no collection in the 'bidonvilles', while collection can be 50 percent or greater in quartiers where households pay collection fees either to private contractors or to the local council (mairie). Although many municipalities have plans for managed landfills, few are effectively controlled and there is a general lack of sanitary landfills. The mismanagement of solid waste means that the waste plastic can be leaked or transported into the ocean by rainfall and flooding, by dumping directly into rivers or the sea, by dumping on the shore, or by wind which carries plastic from dumps, or plastic particles from burning plastic.

Household solid waste generation is estimated at 0.37 kg/person/day.[138] Other studies provide a range of estimates. In 2016, household waste was estimated at 680,850 tons (28 kg/person/year, or <0.1 kg/person/day), a likely underestimate as it is an order of magnitude less than several other IOC countries.[139] For the purposes of the estimate, it is considered that 60 percent of urban solid waste and 90 percent of rural solid waste is mismanaged. While this value differs from that used in preparation of the 2014 global estimate, it reflects a common practice of dumping waste directly into the sea, on the shore, or into rivers and waterways.[140]

Plastic comprised 5.79 percent of urban solid waste in a 2003 survey at the Antananarivo landfill, an increase from 2 percent in 1996.[141] A 2014 study indicated that 10 percent of the waste was plastic and the municipality of Moramanga estimated 12 percent in 2010.[142] As all the assessments were done on urban waste, a value of 5 percent is used for the estimate, as plastic generally comprises a lower proportion of rural waste.

The estimate of microplastic marine pollution is based exclusively on tyre abrasion and is estimated at 22 tons/year. The estimate, its basis and assumptions made are described below. The import of fishing nets is used as a proxy for generation of MPP from fisheries. In 2019, the imports were 604 tons and 50 percent of this quantity is considered to be lost or abandoned nets and gear and effectively MPP.[143] Comprehensive information on MPP from shipping and from non-Madagascar sources is not available and the values in are placeholders which can be replaced with estimates based on future assessments.

MPP from solid waste mismanagement, from fisheries, from shipping and from non-Madagascar sources (e.g., ocean currents) are briefly discussed in other sections.

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137 Risk of cyclones, river and coastal flooding in Madagascar is considered 'high'. https://thinkhazard.org/en/report/150-madagascar/FL

138 World Bank,2018. What a Waste 2.0. The Ministère de l'Environnement, indicated a rate of 0.35 kg/perons/year at a séminaire du 18 juin 2019 à Maurice. Randrianasolo, A. provided an estimate of 0.4 kg/person/day in 2019 Table ronde 6: L'implication des CUA.

139 COI, 2019. Plan d'action de réduction et de gestion des déchets dans les pays de la COI. Janvier 2019. A 2014 study provided an estimate of 0.6 kg/person/day (Artelia Madagascar, 2014).

140 Jambeck et al., 2014 consider that 10-20% of mismanaged waste in the coastal area leaks into the marine environment. The 5% value used here appears consistent with direct observations made in some African countries.

141 Service de Maintenance de la Ville d'Antananarivo (SAMVA), 2003.

142 Naldéo (2014).

143 Comtrade, HS codes 5404 & 5608.

MPP in Madagascar is estimated at about 3,480 tons per year (Table 9). The sources and assumptions are provided in the table or in the text. As additional or more accurate information becomes available, this preliminary estimated should be adjusted accordingly.

Table 9. Estimated marine plastic pollution in Madagascar

Item	Total	Urban			Rural			Source/ Assumption
		Total	Coastal	Inland	Total	Coastal	Inland	
Population total (million)	27,691,018	10,211,000	1,384,551	8,826,449	17,480,018	1,384,551	16,095,467	World Bank 2020 (projection); coastal 5% see text
Total waste (tons/year)	3,768,759	3,807,456	516,268	3,291,187	6,517,912	516,268	6,001,643	World Bank, What a Waste 2.0; see text
Waste average (kg/person/day)	0.37	0.37	0.37	0.37	0.37	0.37	0.37	calculation (MEEF estimates 0.35)
Plastic (%) of waste	4.0%	4%	4%	4%	2%	2%	2%	assumptions, see text
Plastic waste (tons/year)	150,750	152,298	20,651	131,647	130,358	10,325	120,033	calculation
Mismanaged plastic waste (%)		60%	60%	60%	90%	90%	90%	assumptions, see text
Mismanaged plastic waste (tons/year)	208,701	91,379	12,390	78,988	117,322	9,293	108,030	calculation
Transport to marine environment (%)			5%	1%		5%	1%	assumptions
MPP from mismanaged solid waste (tons/year)	2,954	1,409	620	790	1,545	465	1,080	10% of mismanaged plastic waste
Shipping (tons/year)	100							Shipping 100 tons (assumed)
Fisheries (tons/year)	302							Net imports 604 tons x 50% + shipping 100 tons (assumed)
Microplastics	22							see table on microplastics (car tyres only)
Non-Madagascar sources	100							assumption (from ocean sources)
Estimated MPP (tons/year)	3,478							calculation

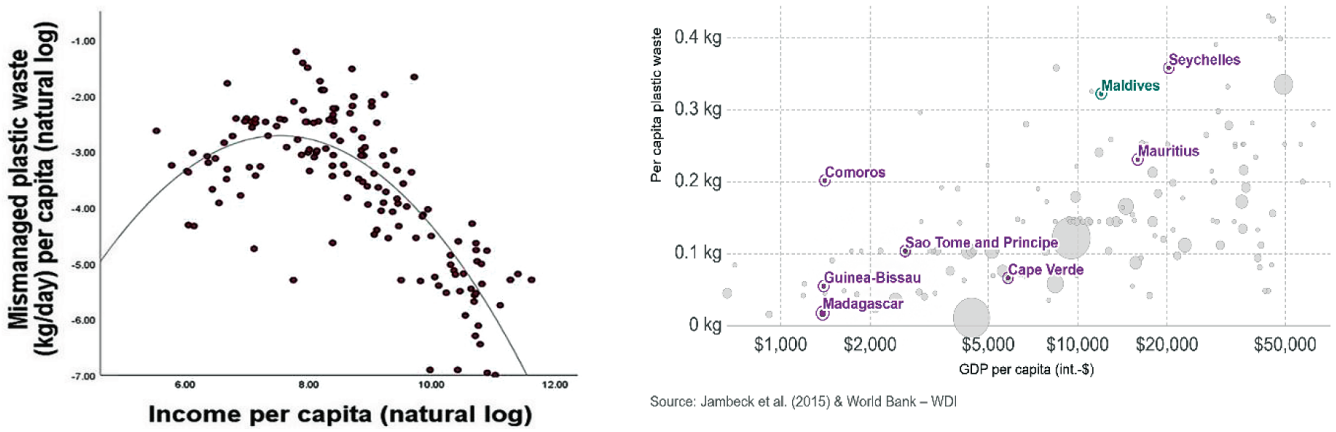
5.1.3 Urban plastic waste

A number of different studies estimate the percentage of plastic in household waste, or collected waste (which may include waste from restaurants or other businesses). A 2012 study estimates 5.8 percent plastic in Antananarivo household waste.[144] A different study on Antananarivo estimated that 68,985 tons of waste plastic is produced annually on the basis of GDP/person, that 48 percent of urban household solid waste is collected and that 10 percent of the collected waste is plastic.[145]

In general, the studies indicate that plastic waste is increasing from <2 percent of household waste in the late 1990s to 4-10 percent in 2020; that the percentage of plastic varies by area (quartier, maire, or other unit of waste collection); that plastic waste in rural areas may be lower than in urban areas; and that informal collection of PET bottles and other reusable/ recyclable plastics may reduce the percentage of plastic in household waste that is formally collected or appears in waste surveys.

There is a relationship between plastic waste and income levels (Figure 21).[146] The current decrease in Madagascar's GDP/capita may temporarily reduce plastic consumption, although this may be slightly offset by the increase in the use of plastics to combat the pandemic.

Figure 21. Relationship between income and mismanaged plastic waste



Sources: Barnes, 2019; Jambeck, et al. 2015.

5.1.4 Management of solid waste

It is estimated that only about 10 percent of household waste is disposed of at authorised sites, about 40 percent at unmanaged or inadequate sites and 50-70 percent is illegally dumped. Urban solid waste collection rates vary widely by municipality and current collection levels have increased substantially from 2011 when 21 percent of urban solid waste was collected. Technical and financial resources to manage waste are often deficient at national and municipal government levels as solid waste management has generally been a relatively low priority and tends to rely on external development assistance for capital expenditure. However, a growing number of private enterprises are engaged in

[144] UN –Habitat Gevalor, 2012. Identification des opportunités de recyclage et évaluation rapide du secteur de la gestion des déchets solides à Antananarivo (Madagascar). Mai 2012. https://documents.plateforme-re-sources.org/wp-content/uploads/2020/12/A43-Diagnostic-des-possibilites-de-recyclage-des-dechets-a%CC%80-Antananarivo-Gevalor.pdf.

[145] COI, AFD, Seureco, Naldeo, 2014. Etude de diagnostic pour une gestion optimisee des dechets dans l'Ocean Indien. Commission de l'Ocean Indien. COI/AO/2013/007. The estimates of collection and percentage plastic appear high. Some of the information is sourced from AGETIPA. See also: WIOMSA, 2007. A Regional Overview & Assessment of Marine Litter Related Activities in the West Indian Ocean Region. UNEP and Lwandle Technologies Pty Ltd.; In 2016, plastic was 13.3% of collected waste and 9%t of market waste in Moramanga. Ramandraiarivony, M.A.F., 2016. La gestion des dechets solides dans la Commune urbaine de Moramanga. Université d'Antananarivo.

[146] Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505

plastic waste management and recycling.[147] Many of the relevant laws are either not enforced, or poorly enforced.[148] There are numerous inter-related causes of mismanaged solid and plastic waste (Box 3).

Box 3. Causes of mismanaged plastic waste and solid waste in general

Uncontrolled urban expansion is a primary cause.

Policies. There is a lack of comprehensive waste management policies, plans, or strategies. These weaknesses contribute to weak budget management; lack of a comprehensive approach based on economic analyses (including on economic losses attributable to disease, contaminated water and air pollution); poor development of fiscal incentives; and weak enforcement of regulations.

Governance weaknesses ranging from an inability to collect fees for waste services to irregularities in private contracts for waste services, and lack of clarity with regards to overlapping jurisdiction and financial responsibilities.

Laws. Lack of coherence in the regulations and general lack of awareness and application of laws.

Economies of scale in reuse/recycling. Decentralised waste management responsibilities to municipal level fragments the value chains for recycling of plastics and accentuates the high transport costs for low value waste.

Awareness. There is a general lack of awareness of environmental issues and impacts of mismanaged waste. There are difficulties in translating awareness among consumers and households into sustainable practices such as sorting of waste.

Technical capacity is weak, particularly in relation to policy, planning, governance and financing of waste management.

Financial resources are lacking. The waste management responsibilities given to the local authorities are not matched by either central government budget allocations, by local taxes, or revenues from user charges for waste collection. Households also have limited ability to pay for services. This results in dependence on development assistance for capital investment in infrastructure such as design and construction of managed landfills and failure to maintain and replace assets (garbage trucks, bulldozers, compacters, incinerators).

Sources: Ramandraiarivony, 2016, Randrianasolo, 2019, UN Habitat, Gevalor.[149]

[147] Groupe Adonis Environnement is understood to be involved in recycling of PET bottles.

[148] UN Habitat, 2012. Madagascar: Profil Urbain National. Gevalor, 2015. Valorisation des déchets fermentescibles à Antananarivo. Rapport de terrain nº2. 5/10/2015. Projet ORVA2D.

[149] Ramandraiarivony, M.A.F., 2016.La gestion des dechets solides dans la Commune urbaine de Moramanga. Université d'Antananarivo; Randrianasolo , A. Table ronde 6 : L'implication des CUA

Figure 22. Plastic waste in coastal and urban areas

Nosy Komba *Tamatave* *Tamatave*

Figure 23. Informal and formal waste management

5.1.5 Plastic pollution on beaches.

Although there have been numerous beach clean-ups, there has been little systematic assessment of MPP or marine litter. One coastal city is reported to generate 100m^3 of plastic waste per day. Preliminary data from an ongoing beach litter monitoring project notes that plastic beach litter in inhabited areas is six time that in uninhabited areas. The coastline is often seen as a "free" for waste disposal and benefits from a 'free tidal removal service'. There is a widespread use of open dump sites, open air burning, dumping in waterways, mangrove areas or on the shore.

Table 10. Quantities of plastic collected in beach litter surveys (kg)

Location	Un-inhabited beaches	'Urban' beaches	Un-inhabited : Urban
Nosy Be	7	270	1:39
Sainte Marie	136	452	1:3
Tuléar	16	120	1:8
Fort Dauphin	24	169	1:7
Total/Average	183	1011	1:6

Presentation. Suivi et évaluation des déchets marins à Madagascar (2019-2021).[150]

Fisheries. As there is no direct information on MPP from fisheries in Madagascar, the estimate given in should be considered as a 'place-holder' until such time as further information is available. Both local small-scale and large-scale fisheries and foreign fishing are potential sources of MPP through lost gear and garbage disposal.[151] Losses are generally related to the type of gear and location where the fishing takes place. The import of fishing nets is used as a proxy for generation of MPP from fisheries. It should be noted that small-scale coastal fisheries, inland fisheries, industrial trawl and tuna fisheries and aquaculture all use nets. In 2019, the imports were 604 tons and 50 percent of this value is assumed to represent the MPP generated.[152]

Shipping. Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Madagascar has a network of 17 ports.[153]. Only five ports (Antsiranana, Toliara, Vohémar, Toamasina, Tolagnaro) are considered to have adequate port facilities and 75 percent of freight goes through Toamasina port. The 12 remaining ports provide regional service for smaller vessels and have limited facilities. The Agence Portuaire Maritime et Fluviale is responsible for port management and the relevant MARPOL implementing arrangements appear to be in force under the law.[154]

Figure 24. Fisheries and shipping are sources of MPP

Images: beche-de-mer pens, Tomasina port, gillnets

Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. Arrangements for disposal of ships garbage in smaller ports or landing sites in Madagascar may

[150] GRET e RanEau, 2019. Déchets : Quelles solutions pour nos villes Malagaches? Atelier, Nov 2019. Institut Français de Madagascar

[151] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

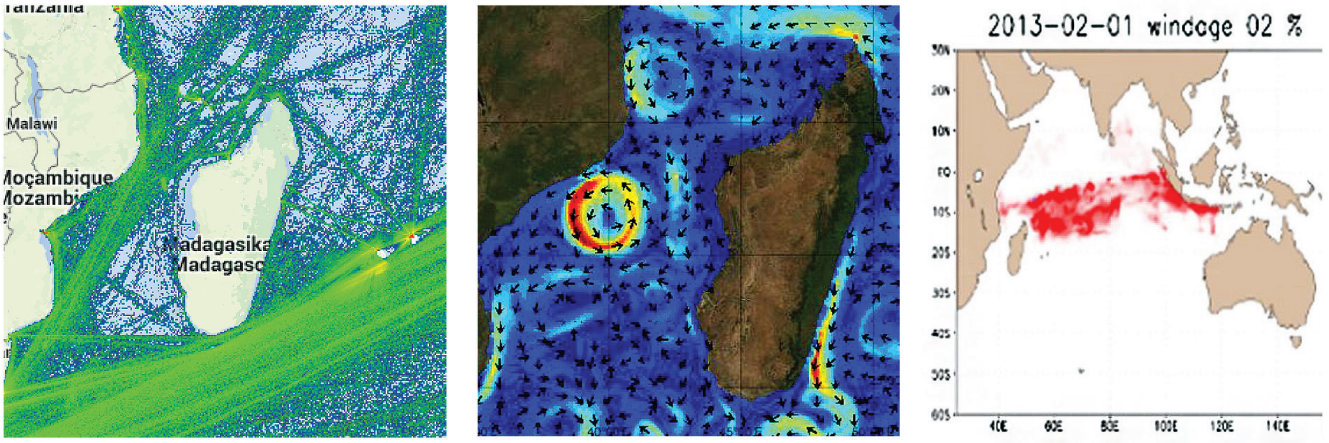
[152] Comtrade, HS codes 5404 & 5608.

[153] Toamasina, Antsiranana, Nosy Be, Mahajanga, Toliara, Antalaha, Vohémar, Morondava, Tolagnaro, Port Saint-Louis, Morombe, Manakara, Antsohihy, Maintirano, Sainte Marie, Maroantsetra and Antalaha.

[154] https://www.apmf.mg/en/apmf. See, e.g.: Decret No. 2O17- 920.

need attention. In addition, growing offshore oil/gas exploration activities can be a source of MPP and effective waste management may require to be specified or included in any revisions of the legislation on marine pollution or in the terms and conditions of concessions.

Figure 25. Shipping traffic density, current eddies and plastic carried by ocean currents (model)



Images : AIS shipping, surface currents, model of plastic transport

Foreign sources of MPP. It is likely that the Agulhas current can transport some MPP originating from the East African mainland to Madagascar. However, the surface current systems appear to form eddies rather than act as a major carrier of marine debris.[155] Shipping traffic is relatively light in the Northern Mozambique Channel compared to off the southeast corner of Madagascar (Figure 25). However, specific information on the quantities of MPP arriving in Madagascar is not available and beach clean-up activities do not sort debris by possible origin. The current study on beached marine debris (Table 10) may enable a determination of different sources. Studies of beach debris in South Africa suggest a useful approach to determining origins.[156] In particular the analysis of plastic in beach litter at Fort Dauphin, in comparison with other sites, is of particular interest given the proximity of a major shipping lane.

Microplastics. The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In Madagascar, slow-moving rivers and extensive estuaries means that microplastics are less likely to get flushed into the ocean. The main sources are likely to be untreated waste water (cosmetics, cleaning agents, laundry); road runoff of rainwater containing microplastics from car tyre abrasion; and air-borne microplastics resulting from burning and breakdown of macroplastics by wind and sun. As the area of surfaced/tarmac road is relatively small in Madagascar, microplastics from tyre abrasion are likely to be trapped in the soil before reaching the sea. The preliminary estimate of microplastic marine pollution is set out in Table 11. It is provided as a basis for more accurate future estimates.

[155] Collins, C., J. C. Hermes, and C. J. C. Reason (2016), First dedicated hydrographic survey of the Comoros Basin, J. Geophys. Res. Oceans, 121, 1291–1305, doi:10.1002/2015JC011418.; Quartly, G.D., et al. 2013. Mozambique Channel eddies in GCMs: A question of resolution and slippage. Ocean Modelling Volume 63, March 2013, Pages 56-67

[156] Ryan, P.G. 2019. Rapid increase in Asian bottles in the South Atlantic Ocean indicates major debris inputs from ships. 20892–20897 PNAS October 15, 2019 vol. 116 no. 42. www.pnas.org/cgi/doi/10.1073/pnas.1909816116.

Table 11. A. Estimate of microplastic marine pollution from car tyres in Madagascar

	A. tyres	B. vehicles	source/ assumptions
A. Madagascar car tyres 2019 (tons)	10,145		UN Comtrade, imports 2019
B. Vehicles in service (numbers)		236,979	2015 data (who.it/gho/data)
A. Annual microplastic loss (tons)	1,014		10% Kole et al.
B. Weight loss all /vehicles/year (tons)		435	1.84 kg/vehicle/year based on India
Retention in soil/ river beds	913	391	90% retention by soil (Kole)
Transport to the ocean (generic)	101	43	10% (generic)* (Kole)
Adjusted by -50% (Madagascar)	51	22	unsurfaced roads/ river topography

Source Kole et al.[157] **Adjustment of -50% is made because the 10% transport estimate is from countries with widespread surfaced roads and urban areas which facilitate tyre microplastic runoff.* Most recent data available: https://apps.who.int/gho/data/node.main.A995?lang=en

5.2 Existing and potential measures to combat MPP

5.2.1 Policy and planning

Policies. There is no overall policy or plan to combat MPP. In 2010, Madagascar prepared a national strategy on pollution management, and while several municipalities have solid waste management plans, there does not appear to be either a national policy or strategic plan on integrated solid waste management. However, a variety of policy instruments have direct relevance. Some sectoral waste management policies and plans exist, e.g., for medical waste, for dangerous chemicals, and for implementation of obligations under international conventions (e.g. Basel, Bamako, mercury) and some ministries and municipalities also have detailed plans at various stages of implementation.[158] A comprehensive information system on waste quantities, on composition, or on waste disposal, upon which to effectively plan initiatives, is lacking. In 2015, the health costs associated with pollution were estimated at $117-166 million, or a loss of productivity equivalent to 1.2-1.7 percent of GNP.[159] Key policy instruments include:

- Charte de l'Environnement Malagasy. Loi n°90-033 du 21 Décembre 1990 (CEM), décret d'application n°99-954.
- Politique et Stratégie Nationale de l'Assainissement (la PSNA) adopté par le décret N° 2008 -319 du 28 Février 2008
- Politique Nationale Environnementale (PNE) de janvier 2010
- Ministère de L'environnement et des Forets, 2010. Stratégie nationale pour la gestion des pollutions, Madagascar, 2010
- Programme Environnemental Pour le Développement Durable, 2016.[160]

[157] Kole. P.J. at al. 2017. Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment. Int. J. Environ. Res. Public Health 2017, 14, 1265; doi:10.3390/ijerph14101265.

[158] Min. de la Sante Publique, 2017. Politique Nationale de Gestion des Déchets Médicaux et de la Sécurité des Injections à Madagascar. Edition 2017.

[159] MEEF, 2018. Plan d'action en Matière de Santé et de Pollution de Madagascar. Ministère de l'Environnement, de l'Écologie et des Forêts de Madagascar.

[160] MEEF, 2016. Programme Environnemental Pour le Développement Durable. Document de référence pour les liens entre le développement durable et les dimensions environnementales. Août 2016.

The 2010 environment strategy was based on three pillars: (i) prevention (reduction, monitoring, capacity building); (ii) reduction of impacts; and (iii) effective management (policies, coordination). Following adhesion to the Manila Declaration (2012), additional efforts were made through a plan of action which included attention to marine debris and a project which established some managed landfills.[161] The waste management problem, and the resulting marine pollution and its impacts are recognised at national levels.[162] However, implementation of the various policies and plans have experienced difficulties as a result of the deeper systemic structural problems of governance, the institutional arrangements, resourcing and finance and regulation.

Box 4. Extracts from the national environmental reports (2012, 2016)

"…from a legislative and regulatory point of view, the existing texts do not suggest an easy application because of the absence of implementing decrees for many laws. From standpoint of infrastruct, those needed for disposal and treatment are quasi-inexistant in all the country's larger settlements. From the perspective of institutions, those involved in the concerned domains are numerous but very compartmentalised. Coming to monitoring and control, the activities are often carried out on a one-off basis, not a systematic one. As regards policy, Madagascar doesn't have any yet to manage pollution.

« Generally speaking, access to water and waste management tend to deteriorate in line with an increasing demographic concentration in towns. At present, Antananarivo is ranked among the dirtiest cities in the world, with its heaps of waste.

« As yet, there is no sorting facility in Madagascar and, in general terms, waste is not treated in view of transformation or recycling or any form of value recuperation.

Sources.[163]

Regulation. Selected legislation of relevance to MPP is listed below (Box 5).

[161] E.g., Gestion Intégrées des Déchets Solides (closure of Andralanitra).

[162] République de Madagascar. 2014. Stratégie Nationale de Gestion des Risques et des Catastrophes 2016 – 2020.

[163] Ministère de l'Environnement et des Forêts, 2012, Rapport sur l'état de l'environnement de Madagascar; Programme Environnemental Pour le Développement Durable (2016) ; MEEF, 2016. Programme Environnemental Pour le Développement Durable. Document de référence pour les liens entre le développement durable et les dimensions environnementales. Août 2016. See also: Carret, Jean-Christophe, 2013. Madagascar - Country Environmental Analysis (CEA): taking stock and moving forward (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/599641468054534317/Madagascar-Country-Environmental-Analysis-CEA-taking-stock-and-moving-forward.

Box 5. Selected legislation of relevance to MPP

Environment and pollution
- Law n° 2015-003 of January 20, 2015 establishing an updated Malagasy Environment Charter ;
- Framework-law n° 99-021 of August 19, 1999, setting the policy to manage industrial pollution ;
- Decree n° 2008-319 of February 28, 2008 establishing the adopted national sanitations policy and strategy. portant adoption de la politique et stratégie nationale de l'assainissement (PSNA).

Plastic bags
- Decree n°2017-010 prohibiting the production, importation, stockpiling and use of plastic sacks and bags on the national territory (thickness above 50 microns is authorised) http://www.cnlegis.gov.mg/

Urban management
- Law n° 95-035 of October 3, 1995, setting the charges for urban sanitation, amended by law n° 2013-002 of August 2, 2013 ;
- Decree n° 63-192 of March 27, 1963, setting town planning and habitat codes, modified in 1969 by decree n° 69-335 ;
- Law n° 95-035 enacted in 1995, allowing the creation of bodies entrusted with urban sanitation and empowered to set charges for the latter (also known as SAMVA law).
- Decree n° 96.173 reorganising Antananarivo's Urban Maintenance Autonomous Service (SAMVA Decree, 1996) ;
- Decree N° 2008-881 organising Urban Sanitation within the urban limits of Antananarivo, in 2008
- Decree n° 2009-1166 reshuffling and reorganising Antananarivo's Urban Maintenance Autonomous Service (SAMVA)

Water
- Law n° 98-029 enacting the Water Code, on January 20, 1999, followed, in 2003, by 13 implementation decrees.

Institutions. The main responsibilities are split.[164] The communes are responsible for the organisation, management and implementation of waste services and cleaning of public areas, collection, transport, handling and disposal of solid wastes. The central government is responsible for dangerous wastes, for legislation, for setting norms and for any international cooperation required. Service contracts may lack clarity and performance measures, but as budget management is weak, contractors also risk late payment.

A national MPP strategy? A national effort to combat MPP needs to be seen in the context of overall waste management in Madagascar, the level of poverty, the governance challenges, the competing national development priorities, and the scarcity of human and financial resources and cost-effective solutions which can be adapted to the local conditions. Within the context of a national integrated solid waste management strategy a national strategic plan on MPP could be prepared. A specialised MPP working group could be established with a national solid waste task force. The key actors could include, e.g., environment ministry, municipal authorities, finance ministry, chamber of commerce, the media and concerned NGOs, and representatives of the waste-pickers, or 'bennes'. The MPP working group could include the fisheries administration, marine and port authorities, tourism stakeholders and enterprises involved in the plastics and retail industries.

[164] For details see: See UN Habitat 2012 p. 76

5.2.1 Fisheries

Over 100,000 small-scale fishers catch about 135,000 tons of fish per year. About 78 percent use boats, mainly dugout canoes and fish with gillnets, lines and traps.[165] There are also industrial shrimp trawl and tuna fisheries. There are about 18,000 inland fishers and an aquaculture industry that also uses nets and other plastic-based products.

Given the nature of the small-scale fisheries, comprehensive marking of fishing gear and 'fishing' for lost gear may not be practical, except near marine parks or prime tourist/ dive sites, or where volunteer divers can be used.[166] Designation of sites for collection of waste fishing gear, possibly through the fisheries associations and EPR arrangements with importers for responsible disposal could be of value in addressing fisheries MPP. Pilot schemes could be considered in areas where there are existing fisheries management plans.[167] EPR initiatives could be initiated at a regional level through the Fédération des Pêcheurs Artisans de l'Océan Indien, (FPAOI).

FADs are likely to be a source of marine debris from the tuna fleet, which also fishes in other WIO countries. Analyses of beach litter from other WIO countries suggest that garbage from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the Madagascar EEZ.

For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements can be applied to fishing vessels.[168] Recycling of nets and ropes may require the economies of scale which may only be feasible through regional schemes (e.g. catalysed by SWIOFC or IOC), through close engagement with businesses and possibly with economic support from EPR arrangements with importers.

There are a range of guidelines available to prevent marine debris from fishing vessels. Workshops have been held, but it is unclear to what extent best practices are implemented in Madagascar, or regionally. A 2019 African regional workshop indicated a generally low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.[169]

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly as foreign vessels may land catches elsewhere (e.g., Port Louis, Victoria, Durban) and may not make port calls to Madagascar. This could start with resolutions by IOTC and SEAFO, possibly phasing in MARPOL Annex V requirements for vessels; introducing measures with respect to marking gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and could be an approved regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of any future EU fisheries access agreement.

Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. Abandoned GRP vessels present

[165] Fisheries represents 5% of GDP and 13% of exports and provides about 20% of animal protein consumption.

[166] Small-scale fishers often create local or 'proprietary' systems of marking fishing gear to prevent theft, or help in the recovery of lost gear.

[167] E.g., Ambaro, Antongil Bay, and Androy and Atsimo-Atsinanana areas.

[168] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear. Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

[169] Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

a growing plastic waste problem and are likely to progressively degrade to marine microplastics if abandoned on beaches. Most countries have no provision for appropriate disposal of GRP vessels. Rules for their disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

5.2.2 Shipping and tourism

Ensuring that Madagascar meets its obligations under MARPOL Annex V is the key action. Engagement between vessels operators and agents, port officials and waste disposal enterprises can help to ensure compliance on ships garbage disposal. Clarity on responsibilities for control, for inspection of ship's waste management logbooks and monitoring of practices at smaller ports may require agreements between port authorities, responsible ministries and municipal waste management authorities. Dialogues could also help in separation of recyclables in ship's garbage.[170] Possible dialogues with IMO and regional port authorities could ensure coordinated measures to prevent dumping of waste by shipping in the region and to foster codes of conduct for regional shipping lines.[171] MARPOL Annex V also applies to the disposal of garbage from fixed or floating platforms engaged in the exploration or exploitation of seabed oil and gas and should be stipulated in the relevant authorisations.

Tourism is not considered a significant driver of MPP and may provide an incentive to maintain the cleanliness of beaches and waterfronts.

5.2.3 Circular economy

There are a number of companies that manage or recycle plastic waste. They are concentrated in the larger cities and several NGOs are engaged in supporting awareness raising, organisation of waste pickers (locally termed 'bennes'). Madagascar's Rural Access Index shows that only 11.4 percent of the population have access to a good road network and the mountainous terrain also means that Madagascar has one of the highest transport costs in Africa ($0.14/km/ton), both of which constrains scaling up of waste collection. Consideration could be given to the organisation of waste pickers and development of EPR in relation to major waste items, such as PET bottles. About 19 percent of Tana households sort waste, of which 70 percent sort plastic bottles. There are over 20 companies involved in plastic manufacture and/ or recycling (Box 6). In addition to plastic recycling, there is a thriving market for reuse of wastes (***Figure 26***).

[170] A wide range of IMO guidelines are available: Prevention of Pollution by Garbage from Ships https://www.imo.org/en/OurWork/Environment/Pages/Garbage-Default.aspx; Resolution MEPC.220(63) Guidelines for the Development of Garbage Management Plans; 2017 Guidelines for the implementation of MARPOL Annex V. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf; IMO, 2018. Consolidated guidance for port reception facility providers and users. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf.

[171] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report.

Box 6. Enterprises involved in plastic manufacture and / or recycling

- Groupe Adonis Environnement, Antananarivo Cleaning and milling of various plastics for resale, >80 tons/year
- Madacompost, Mahajanga. Recycling of plastics (LDPE/PEBD), manufacture of bricks and pavement, 80 tons/year.
- MGETHAN Mi Harisoa, Antananarivo. Recycling of plastics (LDPE), manufacture of bricks, tiles and pavement (sand, cement, plastic).
- Plastik 2000 Ankadimbahoaka. Sorting, washing, milling and granulation f plastics collected by informal waste collectors. Resale for local manufacture (e.g. PET bottles)
- Société SMTP Antananarivo. Plastic manufacturer (sandals, many other products). Recycling of PET and industrial plastic packaging, 160 tons/year.
- SVITAPLAST Antananarivo. Manufacture of plastic items, buckets, bottle tops.
- Star. About 800 tons of waste plastic processed (2012), including for export.
- Le Relais Madagascar provides a public waste sorting service in Fianarantsoa and sends the products to various enterprises.
- SARL Madacompost, Majunga sorts about 7,000 tons of waste per year.
- Others include: Vohitra Environnement, CNRIT, Plastim'at (Antananarivo)

Sources: Charbuillet and others.[172]

Figure 26. Plastic reuse in Madagascar

Images : PET bottle wall; Tana 'marche des bennes'; hot sauce, Diego Suarez

About 9,000 tons of plastic packaging are imported annually. This is a significant market – about 0.6 percent of imports with a value of over $24 million and average import value of $2.7/kg.[173] Madagascar benefits from a number of strengths and opportunities to expand the circular economy for plastics:[174]

- increase in household waste collection and increased sorting of waste by households
- gradual establishment of coordination mechanisms between solid waste management stakeholders
- existing plastics industry and local markets for reuse and recycled plastic; possible opportunities for incineration for energy

[172] Charbuillet, C. et J.-M. Meurville, 2018 Etude de la gestion des déchets plastiques de la zone COI. Arts et Meties, ParisTech, AMValor, Inst, Carnot; UN–Habitat, 2012; Gevalor, 2015. Valorisation des déchets Antananarivo; Gevalor, 2012. Identification des opportunités de recyclage et évaluation rapide du secteur de la gestion des déchets solides à Antananarivo (Madagascar). Mai 2012. https://documents.plateforme-re-sources.org/wp-content/uploads/2020/12/A43-Diagnostic-des-possibilites-de-recyclage-des-dechets-a%CC%80-Antananarivo-Gevalor.pdf

[173] Comtrade, HS code 3923 for 2017-19 period.

[174] UN Habitat; Gevalor et al., 2015. Valorisation des déchets fermentescibles à Antananarivo. Rapport de terrain nº2 5/10/2015. Projet ORVA2D.

- low labour costs and an important (if disorganised) informal collection, sorting and resale services. Opportunities to help organise waste workers on a business footing with improved health and labour conditions.[175]
- opportunities for entrepreneurs and innovators (but limited support)
- wide range of NGOs and local associations with experience of the sector
- potential to access financing from a range of projects which target SDGs (see below).

5.2.4 Awareness of MPP

While Madagascar has ratified the Nairobi Convention's LBSA Protocol, MARPOL Annex V and enacted national legislation on plastic bags, there is generally a low level of awareness of MPP and of the impacts of mismanaged solid waste on wellbeing.

A useful first step is to develop a national waste management plan upon which a strategy to combat MPP can be developed. Generic approaches to developing a MPP strategy and awareness initiative are described in the main report.

In the absence of a 'master plan' for MPP, awareness initiatives can target major sources of MPP. These would need to be clearly identified, but could include major coastal cities, ports and fisheries. Generic awareness products, such as materials for school curricula (see main report) could be adapted to local conditions and local MPP plans developed as 'add-on' to municipal and port solid waste management plans. At community level, awareness initiatives may need to be channelled into practical actions, such as the separation of plastic waste, access to sources of funding for recycling, possibilities with regard to EPR schemes and development of a business case for 'valorisation' of waste streams. It is important to acknowledge that targeting plastics in isolation from other solid waste value chains may not be a viable strategy. Campaigns can also focus on voluntary actions and procurement policies, e.g.: elimination of SUPs and reduction of plastics in public procurement, beach cleaning in tourist areas, codes of industry conduct to reduce SUPs and plastic waste, and EPR schemes to improve markets for waste products.

Although awareness of MPP is low, there is a growing awareness of the waste management problem and experiences in finding solutions which are adapted to local conditions.[176] NGOs and community organisations are often closely engaged in organising waste separation, waste collection services and payment schemes, raising awareness and community pride in cleanliness of streets and informal markets. NGOs are also engaged in studies of waste value chains, recycling and reuse initiatives.

Madagascar has a relatively high literacy rate (about 75 percent) so that mandatory labelling of plastic products to encourage recycling could be useful. The low rural population density presents a challenge to awareness raising as media such as radio has limited power. Awareness campaigns could potentially be associated with other initiatives on health, water, sustainability, or conservation in order to lower costs and link messaging to community priorities or projects.

[175] See, e.g.: Sonia Dias, Sonia. Integrating Informal Workers into Selective Waste Collection; The case of Belo Horizonte, Brazil. http://www.inclusivecities.org/research/BN6_Dias.pdf.

[176] GRET e RanEau, 2019. Déchets: Quelles solutions pour nos villes Malagaches? Atelier, Nov 2019. Institut Français de Madagascar.

5.2.5 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (and global) action. In cooperation with other countries, Madagascar could consider several initiatives:

- preparation of a joint strategic plan on MPP under the Nairobi Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Nairobi LBSA Protocol
- preparation of a funding submission by the Nairobi Convention secretariat for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-ups through existing initiatives, and preparation of a strategic plan on MPP
- further use of the regional projects supported by the IOC and Cap Business (e.g. in relation to recycling of PET bottles).

In conjunction with other countries, Madagascar could also consider initiating a dialogue in the regional economic commissions (COMESA, SADC) on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic waste (and other recyclable waste) would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for fishing nets, soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO.

At the level of AIODIS and Africa, Madagascar could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA. A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

5.2.6 Resources

In Madagascar the political decentralisation is not matched with the budgetary decentralisation. The budget allocation from the central government is rarely over 15 percent of local recurrent expenditures on solid waste management.[177] Revenues collected by the local authorities rely heavily on sale of services, such as vendor fees from public markets. Local authorities face a range of structural difficulties in collecting local taxes from commercial establishments or residents, due to unclear land title, or deficient business registration. In the case of Antananarivo, the budget expenditure was 0.04 percent of GNI compared to expenditure of 0.2 percent on average for developing countries.[178] Antananarivo spends €0.6/person/year on solid waste management compared to €5.8/person/year in Lomé.[179].

Given that the financial resources are not available, lessons from some Malagasy local authorities and from other island countries could be more widely applied (Box 7). In the absence of major funds for infrastructure investment, lower-cost interventions, including awareness raising and use of incentives

[177] UN Habitat, 2012. Madagascar: Profil Urbain National.

[178] Charbuillet, op. cit.

[179] AFD, 2018. Les déchets, combien ça coûte? Synthèses des Études et Recherches de L'AFD. https://documents.plateforme-re-sources.org/documents/a285-les-dechets-combien-ca-coute/?res-country=76&res-theme=0&res-type=0&res-search&res-page=1&res-options=0.

to improve consumer and household behaviour on waste management could be targeted.[180] Catalytic interventions could be identified as part of projects that address the relevant SDGs (Figure 27). In particular, community initiatives to manage waste and improved synergies between any existing public and private efforts could be targeted. Lessons could possibly be learned from experiences in organising informal waste-pickers to sort, collect, reuse, or recycle wastes generated by households, commercial establishments, hospitals, markets and other producers of wastes.[181] Further studies could be prepared possibly as part of university theses, but organised in such a way as to target gaps in understanding of waste management, to identify options for waste valuation or for production of local products to substitute imported plastics.[182] Some reports indicate a shortage of plastic waste for recycling suggesting opportunities to improve collection and sorting.

Box 7. Low-cost urban waste management. Lessons from Haiti

Tested approach

- Local skills' consolidation, raised awareness : waste caracterisation and presentation of results at a public meeting ;
- Clean neighbourhood competition to help search for leading neighbourhoods ;
- Collaboration with a youth association & involvement with civil society (monitoring committee) ;
- Search with the municipality for a landfill site ;
- Development of economic activities and jobs (pre-collection - sorting - composting - recyclables' sales - handicraft).

Outcomes

- Better knowledge of the reservoir ;
- Pre-collection enterprise, sorting and value recuperation bring about numerous trained local players ;
- Population and schoolgoers sensitised ;
- Accredited landfill site, in the process of being acquired.

Which lessons ? The needs :

- a leader, from the community or the municipality, to shoulder such a project ;
- rope residents in as much as possible as their participation will be required to reduce costs ;
- start at a small scale, a pilot stage ;
- insist to obtain players' interest, on the experimental, scientific side of the pilot operation ;
- place the municipality in front of its responsibilities while helping it to find means to act, training the staff ;
- train interested players to manage small enterprises : de petites entreprises
- place the required means in marketing efforts upon materials recoverable value.

Source : Gaston, Jean. 2018.[183]

[180] Solid waste management is not generally included in the programmes of major development partners. See e.g.: World Bank, 2020. Madagascar Country Economic Memorandum: Maximizing the Upturn to Foster a More Resilient Economy. February 2020. Where support is provided, it is often in a disjointed manner where studies and plans are not followed up with coherent institutional support and capacity building for implementation over an extended period.

[181] Informal Economy Monitoring Study (IEMS). Pune's Waste Pickers: Realities & Recommendations.

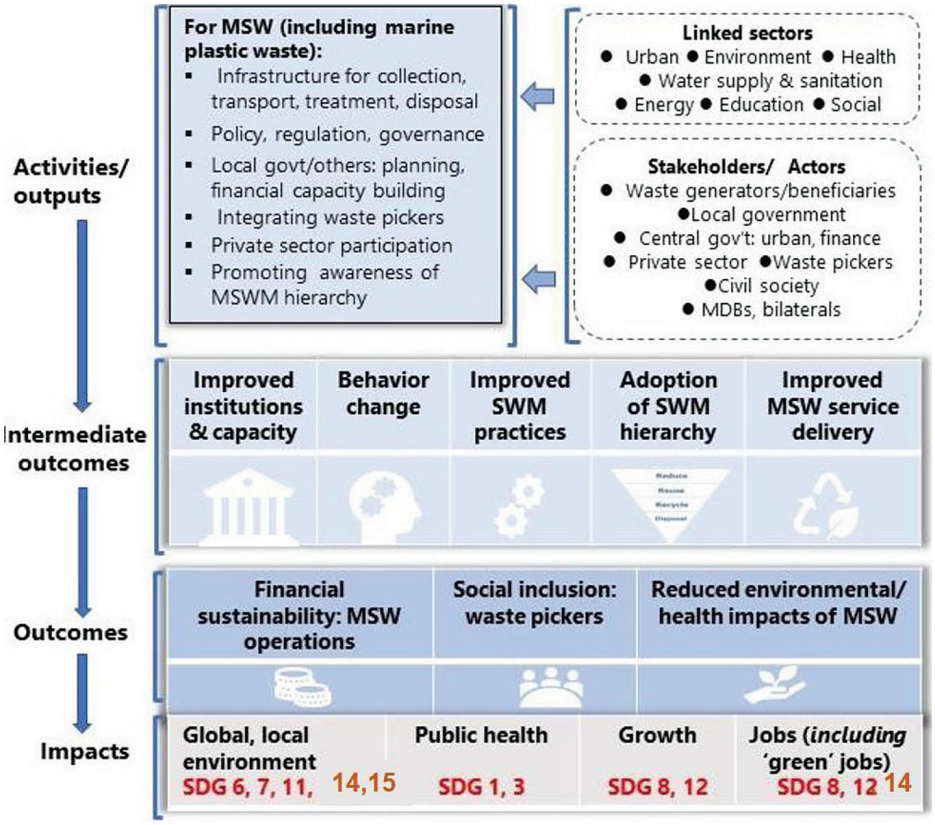
[182] Accelerating the Circular Economy in Africa – Lessons from Algeria, Ethiopia, and Rwanda. https://vimeo.com/484171717; Angola. Desburocratização do mercado do lixo. https://www.angop.ao/noticias/ambiente/jomo-fortunato-quer-desburocratizacao-do-mercado-do-lixo/

[183] Gaston, Jean. 2018. Gestion integrée des déchets à bas coût. Exemple de Gros-Morne en Haïti Conference de Dakar 23-25 Novembre 2017 (Université Quisqueya (Haïti), CEFREPADE, AOG).

Resources, motivation and scale. Waste management is generally a local responsibility and financing the costs involved is a primary concern. Contracts for collection and disposal are often granted on the basis of least cost and do not include provisions for recycling as the local authority is generally unable to obtain a direct benefit from reuse and recycling. The economies of scale for recycling often requires regular supply over an area larger than that of the local authority (e.g. several mairies) and coordination on such initiatives between the local authorities is rare. Local authorities lack of responsibility for waste management in unplanned settlements, particularly when no local taxes or service charges are paid by these 'bidonvilles'. In order to create incentives for manufacturing based on raw material from recycled plastic, any additional costs of recycling (such as internal recycled waste transport costs) may need to be offset by tariffs on imported raw materials, at least until such time as the local supply of recycled raw material is assured.[184] Import tariffs on SUPs or products with microbeads could be 'ring-fenced' and directed to managing plastic waste.

Investments could possibly prioritise the various forms of community actions, including beach clean-ups, deployment of youth groups, innovation in reuse and recycling and partnerships with business with a view to the use of unskilled labour to add value to waste. Greater community engagement could potentially secure the resources which are not available to municipal authorities through voluntary efforts or through labour paid by adding value to waste.

Figure 27. Links between management of municipal solid waste and the SDGs



Source: World Bank, Independent Evaluation Group.
Note: MSW = municipal solid waste; MDB = multilateral development bank; MSWM = municipal solid waste management; SWM = solid waste management.

The main project report provides greater detail and discussion of option for recycling of plastic waste and resourcing and financing opportunities. Reference can also be made to companion reports on the circular economy (in preparation under a separate consultancy).

[184] Baud, I. and Post, J. 2016. Between markets and partnerships: Urban Solid Waste Management and contributions to sustainable development. GBER Vol. 3 No.1 pp 46-65.

6 Maldives

6.1 Marine plastic pollution in Maldives

Maldives has many of the elements required for a comprehensive national strategy to address marine plastic pollution (MPP).[185] This report is a first step to estimate the scale of MPP, to describe the sources of MPP and to provide a basis for a national dialogue and action plan on MPP. It places particular emphasis on the use of the existing solid waste management system and awareness-building initiatives; on environmental sustainability policies, on development of the circular economy, on regional cooperation and on identifying practical steps to combat MPP. The report is a working paper intended as a basis for stakeholder consideration and to be used to develop more in-depth analyses, to help align existing activities in Maldives, to identify possible gaps and areas requiring additional efforts.

6.1.1 Sources of marine plastic pollution

There are three main sources of MPP in Maldives:

- mismanaged, or unmanaged solid waste and litter, which is the most important
- marine sources, mainly fishing activities, tourism and shipping and
- plastics that may be transported by ocean currents from other countries.

The different sources are discussed in more detail below. Plastic waste is part of a much broader waste management problem, one of a range of sustainable development challenges faced by Maldives. The following sections provide a preliminary estimate of marine plastic pollution (MPP) in Maldives and provides a synthesis of available information on MPP. including on microplastic marine pollution.

Maldives is unique in the WIO region with almost 1200 islands stretching over 870 km (north-south) but with only about 300 km^2 land area. The islands are grouped in 26 atolls (for administrative purposes 20 atolls clustered in 7 provinces). The economic geography has created major solid waste management problems.[186] Scarcity of 'natural' water supplies has led to particularly extensive use of and dependence on bottled water and plastic containers. Manufacture of local consumer products is largely insignificant so that many products are imported in various forms of plastic containers, or packaging. Land scarcity has led to the creation of a 'waste island' or dedicated landfill island and the cost of waste transport from islands to managed disposal sites is high. The important tourism component the economy generates significantly more per capita plastic waste than the resident's economy.[187] Landfill sites also face a significant threat from sea-level rise or potential disturbance as a result of any future tsunami.

6.1.2 Estimate of marine plastic pollution and its basis

MPP is estimated primarily as a function of mismanaged land-based solid waste in Maldives with some additions to reflect the marine sources.[188] The estimate of MPP relies on several assumptions based on population, solid waste generation, the proportion of plastic in the waste and the amount of mismanaged plastic waste that is transported into the marine environment. The basis for these assumptions is set out below.

[185] MPP is generally considered to account for about 80 percent of marine litter or debris.

[186] Similar issues are faced by a number of Pacific island atoll countries.

[187] Tourism accounts for over 30% of GDP and over 60% of foreign currency earnings (excluding 2020). About 80 islands have tourist resorts and tourist arrivals exceed one million/year (about 27,500 beds with 80% occupancy).

[188] See Jambeck et al., 2014 for a description of the methodology.

The population is about 540,000 thousand, of which 40.2 percent are considered urban.[189] Population density is about 1,800 per km^2, which is several times that of other AIODIS. However, the average population density does not reflect the far higher density of the 'urban' islands, as Malé has a population density of over 65,000 per km^2. For the purposes of the MPP estimate, the entire population is 'coastal'. By this is meant, that mismanaged plastic waste in any part of Maldives could potentially be transported to the sea by rain, flooding, wind, by deliberate dumping or littering on the shore, or at sea, or by atmospheric transport of particles of waste plastic which is frequently burned.

In 2017, total solid waste was estimated at about 280,000 tons and this is the value used to calculate MPP from solid waste.[190] While the total waste transported to the waste disposal site at Thilafushi in 2017 was reported at over 430,000 tons, this may reflect disposal of some waste which had accumulated on the islands for several years, or occasional construction waste. In 2019, Waste Management Zone 3 and/or Greater Malé and its outer island alone was estimated to generated 305,000 tons and 282,000 tons of mixed solid waste respectively.[191] A 2011 study estimated that 19,000 tons per year was generated in the four northern atolls.

Solid waste generation differs between urban (1.8 kg/person/day), rural/ island (0.8 kg/person/day) and resorts (3.5 kg/person/day).[192] Based on these differentiated values, the total waste generated is estimated at approximately 260,000 tons/ year (Table 12). Recent information on increased tourist bed capacity suggests that the contribution of 'resorts' may be underestimated when all tourist accommodation is included.[193]

Table 12. Estimated waste generation in Maldives

	Urban	*Islands*	*Resorts**	
Total population	540,544		resort beds	33,000
Population (%)	0.35	0.66	occupancy %	0.8
Population	186,488	354,056	beds per day	26,400
			tourist days/year*	9,636,000
Waste/person/day (kg)	1.8	0.8		3.5
Waste per year (tons)	122,522	103,384		33,726
Total waste per year (tons)	259,633			
Waste/resident/day (kg)	1.32			

*Sources: see text. * the number of tourist days/yr is a conservative estimate and may be higher (see 6.2.4).*

Studies indicate that on average, 5.3 percent of waste is plastic.[194] The proportion of waste that is 'managed' varies by island or waste management area, as waste management plans are progressively implemented in the seven waste management zones. In Malé, most of the waste is collected and transferred to the regional 'waste island'. However, there is still substantial littering and disposal

[189] World Bank, 2019. https://data.worldbank.org/.

[190] World Bank, What a Waste 2.0. Other estimates range up to more than 350,000 tons annually. See also: Saleem, A. 2018. Environmental and Social Management Plan for the Establishment of Island Waste Management Centre in Th. Thimarafushi. Ministry of Environment and Energy.

[191] ADB, 2018. Greater Malé Environmental Improvement and Waste Management Project. Project Document. Different sources provide quite different estimates of waste generation. See also: Regional Waste Management Facility at Thilafushi – Greater Malé Waste to Energy Project.

[192] World Bank, 2017. Maldives Clean Environment Project. Project Appraisal Document. A 2015 report prepared for the Ministry of Tourism cited higher rates: urban 2.8 kg; island 1 kg and resort 7.2 kg. Ministry of Tourism (2015): Assessment of Solid Waste Management Practices and its Vulnerability to Climate Risks in Maldives - Increasing Climate Change Resilience of Maldives through Adaptation in the Tourism Sector, Maldives.

[193] Assuming that planned resort expansion has occurred and including some 133 tourist vessels with about 2,500 beds, there may be as many as 41,000 beds available. https://timesofaddu.com/2021/01/17/41780-tourist-beds-operational-in-maldives. However, the level of occupancy of the guesthouses and vessels is unclear.

[194] World Bank PAD (2017).

into the ocean. It is assumed that 5 percent of the plastic waste is mismanaged in Malé and of the mismanaged waste, 10 percent is transported or leaked into the ocean (e.g., plastic bottles, food wrappers, cigarette butts). Less than 1 percent of the waste generated by the resorts is assumed to be mismanaged, but all such mismanaged waste is considered to be leaked into the ocean. In the islands, it is assumed that 20 percent of the waste is 'mismanaged' as a substantial part of the organic waste is composted, at least on some islands. It is assumed that 20 percent of the mismanaged plastic waste is leaked into the ocean. This may occur through direct dumping, littering, by being blown from open waste dumps, or by particles from burning plastic. While there is little quantitative evidence for the assumptions, the collection of significant quantities of plastic during beach clean-ups suggests significant levels of MPP.[195] In addition, analysis of beached marine debris in the Chagos Archipelago indicates that bottles originating from Maldives were the third most common (after Indonesia and China).

Based on the above assumptions a preliminary conservative estimate of the annual MPP generated by mismanagement of solid waste is 256 tons/year (for a total waste estimate of 260,000 tons) and 275 tons/year when adjusted for 2017 total waste estimate of 280,000 tons/year (Table 13). The assumptions can be modified when more robust values are determined.

Table 13. Estimation of marine plastic pollution from solid waste mismanagement

	Urban	Islands	Resorts	Total	Source
Total waste	122,522	103,384	33,726	259,633	Table 12
Plastic waste (% and tons)	6,494	5,479	1,787	13,761	WorldBank,5.3%
Mismanaged waste (%)	5%	20%	0.25%		assumed
Mismanaged plastic waste (tons)	325	1,096	4	1,973	calculation
Transport to ocean (%)	10%	20%	100%		assumed
Transport to ocean (tons)	32	219	4	256	calculation

Source: see text.

The preliminary estimate of microplastic marine pollution is based exclusively on tyre abrasion and is estimated at 5-17 tons/year. This estimate, its basis and underlying assumptions described in section0 and presented in Table 11. Given the recorded high levels of microplastic marine pollution in Maldives, attention could be directed to other sources (e.g. textiles, microbeads, marine paint) for any future estimates. The import of fishing gear is used as a proxy for generation of MPP from fisheries. In 2018, imports were approximately 180 tons ($2.5 million) and 10 percent of this quantity is considered to be lost or abandoned nets and gear and effectively MPP.[196] Comprehensive information on MPP from shipping and from non-Maldives sources is not available and the values in are 'placeholders' which can be replaced as specific information becomes available. The estimate for non-Maldives sources is loosely based on quantitative information on beached plastic litter in the Chagos Archipelago. Additional background information on the generation of MPP from solid waste mismanagement, from fisheries, from shipping and from non-Maldives sources (e.g., via ocean currents) is presented in other sections below.

A preliminary estimate of total MPP in Maldives is 314 tons per year (Table 14). The sources and assumptions are provided in the table or in the above text. As additional or more accurate information becomes available, this preliminary estimate can be adjusted accordingly.

[195] An analysis of 'Save the Beach' clean-ups in 2016 indicated that 5.7% of the beach debris (by weight) was plastic (excluding composites).

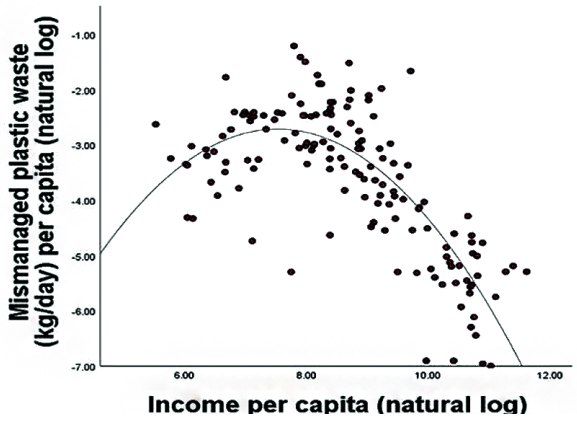
[196] Comtrade HS codes 5608 and 9507. The main tuna/ pelagics fishery is primarily a line (rather than net) fishery, but nets are used for baitfishing and reef/lagoon fishing.

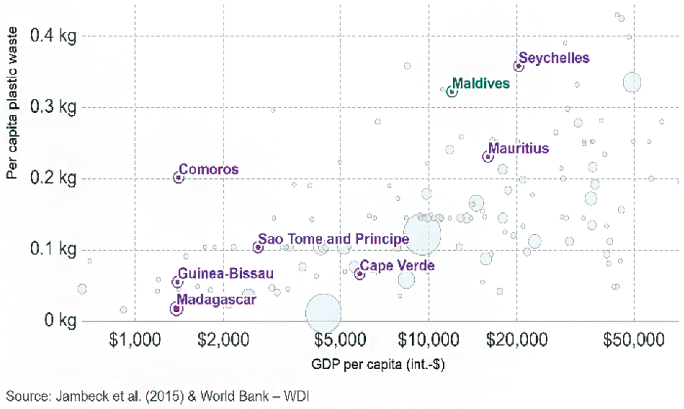
Table 14. Estimated marine plastic pollution in Maldives

Item	Total	Source/ Assumption
MPP from mismanaged solid waste (tons/year)	276	see Table 12
Shipping (tons/year)	5	local and int. shipping 5 tons (assumed)
Fisheries (tons/year)	18	10% of imports of fishing gear (assumed) 180 tons
Microplastics at least (tons)	5	see Table 11 (car tyres only) range 5-17 tons
Non-Maldives sources	10	assumption (from ocean sources)
Estimated MPP (tons/year)	314	calculation

There is a relationship between plastic waste and income levels (Figure 28).[197] The current decrease in Maldives' GDP/capita may temporarily reduce plastic consumption, although this may be slightly offset by the increase in the use of plastics to combat the pandemic.

Figure 28. Relationship between income and mismanaged plastic waste





Sources: Barnes, 2019; Jambeck, et al. 2015.

6.1.3 Management of solid waste

Solid waste management (SWM) is at various stages of development in different islands and atolls and in the seven different waste management zones (Figure 29).[198] The problems are well understood and solutions have been set out in the 2008 and 2015 waste management plans (see 4.2.1).

Several investment projects have contributed or continue to contribute to effective SWM. Of particular note are those supported by Japan, the World Bank and the ADB (see 4.2.1). Basically, the national waste management plan is being implemented island-by-island, atoll-by-atoll and SWM zone-by-zone.

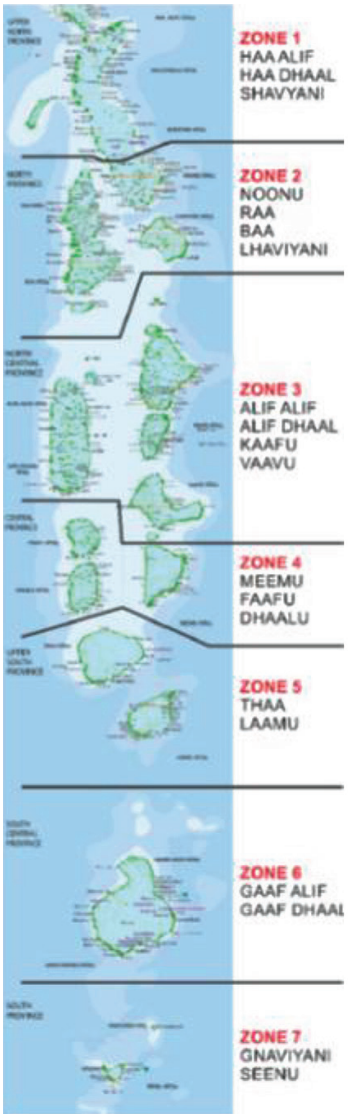
[197] Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505

[198] Peterson, C. 2013. Assessment of Solid Waste Management Practices and Its Vulnerability to Climate Risks in Maldives Tourism Sector. Ministry of Tourism, Arts and Culture.

The plans have a similar basic model. Major investments are largely dependent on the external funding while the financial sustainability of the schemes is still embryonic and linked to the logistic demands of the zones. The main components of the model include:

- island waste management plans with a focus on household, business and community engagement to segregate of waste streams. Organic waste is composted, recyclable waste, including plastics, is to be sorted for sale and residual waste collected and transported to island waste management centres (IWMCs) and from there to Regional Waste Management Facilities (RWMFs).[199]
- various community charges will be levied to cover a significant proportion of costs
- the Waste Management Corporation (WAMCO) is tasked to operate the collection services and management of the RWMFs and any managed landfills, such as on Thilafushi.
- the Thilafushi landfill, which serves the greater Malé region, is to be effectively managed (e.g. cessation of open burning, prevention of leaching)
- a suite of educational and awareness initiatives will enhance engagement at all levels
- supporting legislation will be enacted, including on SUPs and on EPR
- the plan(s) will be monitored, not only in terms of physical performance, but also in terms of cost-effectiveness and distribution of costs.

Figure 29. Waste management zones



The Ministry of Environment and Energy has primary responsibility for SWM. It has a dedicated Waste Management and Pollution Control Department, for which the Waste Management Regulation (No 2013/R-58) is a key legislative instrument. The Environmental Protection Agency has a major operational role in handling EIAs and environmental monitoring. The Waste Management Corporation (WAMCO) is responsible for the SWM in the Greater Malé area, for the management of the Thilafushi landfill and regional/zone waste management centres (RWMC). Local government institutions at island (Island Councils), atoll (Atoll Councils) or regional levels are the 'front line' of SWM and its coordination and financing. The Ministry of Housing owns Thiafushi Corporation which controls Thilafushi island, the only officially designated area where large scale handling, processing, and disposal of solid waste is undertaken. Numerous businesses, community organisations and NGOs are actively involved in solid waste management and associated activities (e.g., promotion of sustainable consumption, recycling, raising awareness and beach clean-up).

[199] Over 130 IWMC have been established since 2004.

Figure 30. Mismanaged plastic waste in island and urban areas

Hoandehoo (2018)

Malé region

Thilafushi

While considerable progress has been made, the standard of waste management at island level is reported to be highly variable. Local practices differ widely. For example, Maafushi Island (Kaafu atoll) council working with guesthouses (a major revenue source) organise cleaning of the harbour and seashore several times a week and the council employs workers to clean public areas daily. Some IWMCs are reported to be at full capacity and waste, including plastics can simply be dumped in the sea or on the shore, where it may be washed into the sea by high tides or storms. Little or no sorting of waste occurs on some islands. With dynamic leadership and higher awareness, other islands are making steady progress. As a result, without detailed review of Island Council reports and related information, the overall picture of waste management and the scale of mismanaged waste remains unclear.

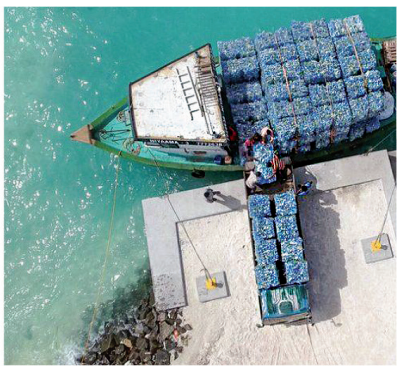
In 2019, Maldives imported about $85,000 worth of plastic goods, excluding resins, products in plastic packaging and fishing gear. There are at least three major producers of PET bottles for water or soft drinks.[200]

Solid waste from the Greater Malé area and from resorts across the Maldives, is transported to the Thilafushui landfill (Figure 9). The plastic and metal is recycled. While e-waste and hazardous waste is segregated the landfill remains an environmental threat. Construction waste is landfilled in the 'lagoon' to increase the land area of Thilafushi, which is later leased for industrial use (e.g. fuel storage). There are plans for waste to energy plants to be installed at Thilafushi. The RWMCs are subject to technical and economic feasibility analyses and to EIAs.[201]

Figure 31. Formal waste management

Malé collection

Burning at Thilafushui landfill



Parley, PET recycling

[200] Malé' Water and Sewerage Company (MWSC) is a PPP engaged in desalination and wastewater management, Coca Cola and Happy Market Pvt.Ltd.

[201] Although somewhat out of date, the following video clips illustrate the nature of some of the waste management issues: '*HILAFUSHI GON'DUDHOH, waste final destination in Maldive*' (2013). https://vimeo.com/69882321. 'Gon'dudhoh' is Maldive word for beach and also means dumping area. '*Dumpsters*' (2013) https://vimeo.com/54336860.

6.1.4 Plastic pollution and the tourist industry

Although tourists generate an estimated 3.5 kg of solid waste per day and resorts account for about 13 percent of total solid waste, direct MPP from the tourist industry is considered to be low (4 tons/year), as the resorts have a relatively high standard of SWM and are required to comply with resort waste management regulations.[202] As part of their licencing conditions, a resorts is obliged to operate waste treatment equipment, such as a compacter (e.g. for plastic bottles, cans, packaging), incinerator, and bottle crusher. Many resorts do not use SUPs, unless guests specifically request a product.

Figure 32. Marine plastic clean-up activities in Maldives

However, it is unclear if the implementation of the solid waste management practices required in guest houses and marinas is effective.[203] Microplastic pollution from tourism may be considerable if large quantities of synthetic textiles are laundered and waste-water is discharged without removal of microfibers (see 6.2.8).[204] Much of the resort waste is shipped to Thilafushi, and while this eliminates a local problem, to a certain extent it merely allows the waste problem to accumulate at Thilafushi. A range of measures are planned to reduce all tourism-generated waste; reduce waste being sent to Thilafushi; and to secure the site against natural hazards (e.g. sea-level rise).

Many of the resorts are fully engaged in efforts by the business community and civil society to reduce MPP and build a more circular tourist economy. The resorts often take a leadership role as the reputation of Maldives tourism and resort incomes rely on clean seas. For example, Vakkaru Maldives has carried out beach clean-up at Baa Atoll Muthaafushi. In some cases, the underwater clean-ups are organised by dive centres. However, data from clean-ups does is rarely standardised or compiled to provide a quantitative picture of the sources, scale and rate of accumulation nationally, or in different atolls.[205] Many resorts have guest 'codes of conduct' to ensure effective solid waste management. Several hotels participate in EarthCheck, a means to assess the resort's impact on the environment, local economy and cultural-heritage. The resorts have also contributed at a policy level through the Malé 3R Declaration.[206]

[202] https://www.ststworld.com/thilafushi-maldives/. See also: Petersen, op.cit.

[203] Maldives has about 130 resorts (about 29,000 beds), over 480 guesthouses (about 8,000 beds), 12 hotels (1700 beds), over 200 dive centres and over 130 tourist vessels (about 2,400 beds).

[204] Modern waste-water treatment should remove over 95 percent of microplastics. However, these remain in the sludge, which ultimately leak into the sea.

[205] Various international guidelines for standardised survey, analyses and reporting are available.

[206] 'Resorts in Maldives for the Promotion of 3Rs and Resource Efficiency Towards Protection of Local Environment and Marine Ecosystem'. Sixth Regional 3R Forum in Asia and the Pacific, 16–19 August 2015, Malé, Maldives. Maldives National 3R Day 16th August 2015.

Figure 33. Sources of MPP: tourism, fisheries, boat building and repair



6.1.5 Fisheries

As there is no direct information on MPP from fisheries in Maldives, the estimate given in should be considered as a 'place-holder' until such time as further information is available. Both local small-scale and large-scale fisheries and foreign fishing are potential sources of MPP through lost gear and at-sea garbage disposal.[207] Losses are generally related to the type of gear and location where the fishing takes place. The import of fishing gear (nets, lines, buoys) is used as a proxy for an estimation of MPP from local fisheries. In 2018, total import of fishing gear (nets, lines, buoys) was 180 tons valued at $2.5 million. FADs which use plastic ropes and netting are extensively deployed may also be lost and contribute to MPP. The quantities of lost gear from foreign fishing (longlines, gillnets, FADs) which may become lost and drift into the Maldives EEZ is unknown.

Maldives undertook a significant expansion of its fishing fleet over the last 10-15 years (over 1,200 vessels). Many of the new vessels used fiberglass (GRP) in part of the construction. GRP is technically difficult to recycle and disposal of GRP boats can be costly, such that owners may allow boats to sink or 'rot' on the beach or in harbours. Import of plastic resin in 2016 was over 9,600 tons but declined significantly in following years.[208] While some of the imports may have been used for other purposes (e.g., manufacture of PET bottles), it suggests that unless appropriate disposal of end-of-life GRP vessels is practiced, GRP vessels may be a future source of MPP. In 2017, in association with Parley, the government launched a campaign to enlist fishers in recovery of marine plastic.[209]

6.1.6 Shipping

Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. In addition, in some countries, growing offshore oil/gas exploration activities can be a source of MPP and effective waste management may require to be specified or included in any revisions of the legislation on marine pollution or in the terms and conditions of concessions. The Ministry of Transport & Civil Aviation, the Maldives Transport Authority and the Maldives Port Authority share responsibilities for control of ships waste.

[207] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

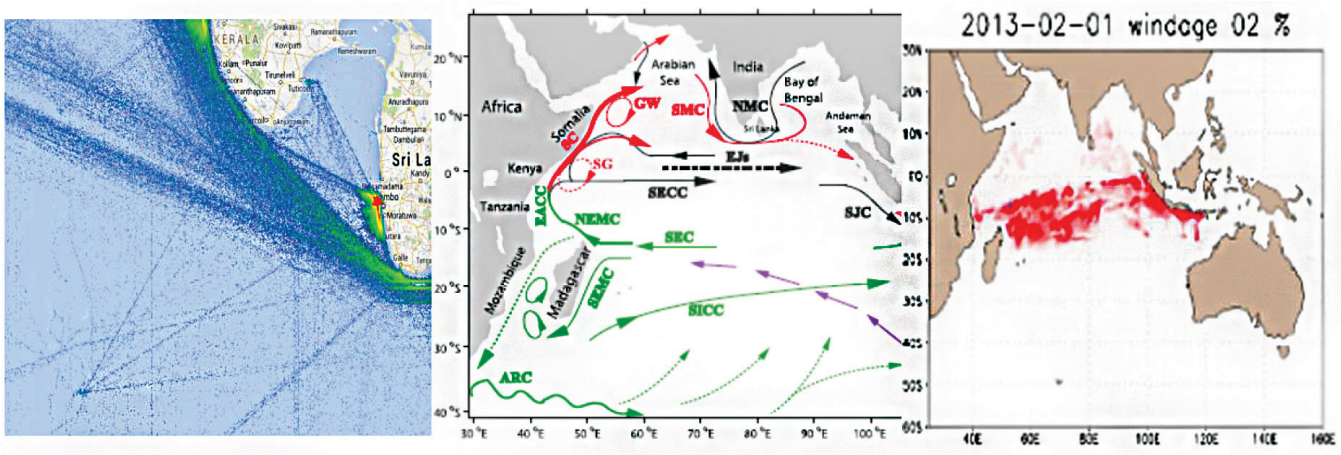
[208] A detailed breakdown of plastic imports would be required to distinguish the various end uses. Recorded imports of PET resin alone have fluctuated 600-1,900 tons (2011-2016) suggesting some mis-declaration in customs records.

[209] https://maldivesindependent.com/environment/maldives-announces-campaign-to-intercept-ocean-plastic-131100.

6.1.7 Ocean currents and MPP

Other than regional fisheries and shipping, the main external source of MPP is waste carried from Southeast Asia and from South Asia. With the exception of Maldives, South Asian coastal countries rank among the global 'top twenty' in terms of quantity of mismanaged plastic waste (Sri Lanka is ranked among the top six). Rivers are considered to be the primary source of MPP and the Ganges and the Indus are ranked among the top twenty global river sources of MPP. Models suggest that MPP from Southeast Asia may largely pass to the south of Maldives. It is certainly washed up on the Chagos archipelago, Alphonse Is. (Seychelles), St. Brandon and Agalega.[210] The Northeast Monsoon Currents are likely to carry MPP from the Bay of Bengal (see Figure 25). It is unclear if MPP from the western side of the Indian sub-continent is transported to Maldives, but a 'new' World Bank-funded project is likely to generate a greater understanding of MPP origins and transport the region. Maldives has an approved Marine Litter Action Plan, which recognises that seasonal changes in the patterns of surface ocean circulation may transport MPP, including FADs from major WIO tuna fishing areas via the Somali Current and other currents.[211]

Figure 34. Shipping traffic density, surface currents and plastic carried by ocean currents (model)



In 2018, about 60 tons of beach litter was collected on Diego Garcia, while volunteer clean-ups collect about 2 tons per year. In general, the beach debris is 80 percent plastic. There are ongoing efforts to assess the 'replenishment', i.e., the rate of accumulation of beached debris. As the local generation of plastic waste is negligible, the plastic in the beached marine debris has been transported by ocean currents.[213]

[210] Peng, S. et al. 2015. Characteristics of the Near-Surface Currents in the Indian Ocean as Deduced from Satellite-Tracked Surface Drifters. Part I: Pseudo-Eulerian Statistics. Journal of Physical Oceanography 45(2):441-458.

[211] EPA, 2018. Maldives Marine Litter Acton Plan, Maldives. Environmental Protection Agency.

[212] South Equatorial Current (SEC), South Equatorial Countercurrent (SECC), South Indian Ocean Countercurrent (SICC), Northeast and Southeast Madagascar Current (NEMC and SEMC), East African Coastal Current (EACC), Somalia Current (SC), Equatorial Jets (EJs), Southwest and Northeast Monsoon Currents (SMC and NMC), Northeast and Southeast Madagascar Currents (NEMC and SEMC), Great Whirl (GW), and South Gyre (SG). Summer (winter) red (black), all seasons green. Line thickness here represents the strength of current. For the ocean drift model see: Peng, S. et al. op. cit.

[213] https://biot.gov.io/wp-content/uploads/2018-Annual-Report-BIOT-Final.pdf; https://www.darwininitiative.org.uk/documents/DPLUS090/24980/DPLUS090%20AR1%20-%20edited.pdf.

Plastic comprised 87 percent (by number of items) of beached marine debris on remote beaches in the Lakshadweep Islands, of which 45 percent and 35 percent was attributed to fishing and tourism respectively.[214] Kochi (Kerala) is estimated to produce 5-14 tons of MPP per day.[215] In 2014, over 20 percent of the beach marine debris in Kerala was plastic, in Lakshadweep about 45 percent and in Maharashtra 80 percent. Kerala and Maharashtra beaches recorded levels of about 4 gm/m^2 while Goa and Karnataka had levels over 170 gm//m^2.[216] Particularly high levels of MPP and marine litter are reported from Sri Lanka, originating from mismanaged solid waste, tourism and from fisheries.[217]

A 2010 survey on 15 of the St. Brandon islets (38 km of shoreline) recovered 50,000 items of which 79 percent were plastic. Flip-flops alone were 23 percent. The labelling indicated the products were mostly of Asian origin (i.e., brands generally not sold in the region).[218] As St. Brandon is some 3,350 km from the source of these items, they have either been transported by the South Equatorial Current and Equatorial Counter Current or dumped from fishing or cargo vessels. However, specific information on the quantities of MPP arriving in Maldives is not available and beach clean-up activities do not sort debris by possible origin. Studies of beach debris in South Africa suggest a useful approach to determining the origins.[219]

6.1.8 Microplastics

The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In Maldives, the close proximity to the sea and high seasonal rainfall means that a significant proportion of microplastic pollution is likely to get flushed into the ocean. The main sources are likely to be road runoff of rainwater containing microplastics from car tyre abrasion; untreated waste water (microbeads in cosmetics, cleaning agents, laundry); and air-borne microplastics from paints or building materials; and breakdown of macroplastics by wind and sun and by wave action on beached plastics.

The populous Naifaru island (Lhaviyani Atoll) has been found to have particularly high concentrations of microplastics in sediments (55-1127.5 particles per kg), even higher than a highly populated site in Tamil Nadu (3-611 particles per kg). Similar concentrations were found on inhabited and uninhabited islands elsewhere in the Maldives (197-822 particles/ kg).[220] Sampling at the remote, low population, Faafu Atoll found 22.8±10.5 particles/m^2 in the beach sediments. The plastics included polyethylene, polypropylene, polystyrene, polyvinylchloride, polyethyleneterephtalate, and polyamide and charred

[214] Kaviarasan, T. et al. 2020. Assessment of litter in the remote beaches of Lakshadweep Islands, Arabian Sea. Marine Pollution Bulletin Volume 161, Part B, December 2020, 111760.

[215] Das, S. et al. 2020. Assessing Marine Plastic Pollution in India. IEG Working Paper No. 389. Delhi. The estimates are based on the approach taken by Jambeck, 2015. See also: Annepu, R K (2012): Sustainable solid waste management in India, Waste-to-Energy Research and Technology Council (WTERT), Columbia University, Earth Engineering Center. http://www.seas.columbia.edu/earth/wtert/sofos/Sustainable%20Solid%20Waste%20Management%20in%20India_Final.pdf.

[216] Kaladharan, P. 2017. Prevalence of marine litter along the Indian beaches: A preliminary account on its status and composition. J. Mar. Biol. Ass. India, 59 (1), January-June 2017.

[217] Gunasekara, A.J.M. 2018. Status of Marine Litter Management in Sri Lanka. Report to the South Asian Cooperative Environment Programme. Marine Environment Protection Authority.

[218] Bouwman, H., et al. (2016). «The flip-or-flop boutique: Marine debris on the shores of St Brandon's rock, an isolated tropical atoll in the Indian Ocean.» Marine environmental research 114: 58-64. For additional studies see: Duhec, A. V., et al. (2015). Composition and potential origin of marine debris stranded in the Western Indian Ocean on remote Alphonse Island, Seychelles. Marine pollution bulletin 96(1): 76-86; Barnes, D., 2004. Natural and plastic flotsam stranding in the Indian Ocean. The effects of human transport on ecosystems: Cars and planes, boats and trains. Davenport, D. & Davenport, J. (Eds.). Royal Irish Academy, Dublin, 193-205.

[219] Ryan, P.G. 2019. Rapid increase in Asian bottles in the South Atlantic Ocean indicates major debris inputs from ships. 20892–20897 PNAS October 15, 2019 vol. 116 no. 42. www.pnas.org/cgi/doi/10.1073/pnas.1909816116.

[220] Maldive Times, August 5, 2020. https://maldivestimes.com/maldives-records-highest-level-of-micro-plastic-pollution-on-the-planet/; Patti, T.B. et al. 2020. Spatial distribution of microplastics around an inhabited coral island in the Maldives, Indian Ocean. Science of The Total Environment. Volume 748, 15 December 2020, 141263.

microplastic particles, presumed to be associated with burning waste on, or near beaches.[221] A 2011 beach litter survey on Faafu (Nilandhoo) found that 57 percent of the waste was plastic.

There is speculation that the elevated levels of microplastics are attributable to leakage from waste sites, including Thilafushi; from the continued breakdown of microplastic already in coastal sinks; or transported by currents from outside Maldives. Other possible sources include the overflow of septic tanks, inadequate sewage and waste-water treatment, or disposal of sludge. There is likely to be a high runoff of microplastic on Malé as it is a dense built environment where microplastics from tyre dust, paint and building materials are likely to be washed directly into the ocean.

The marine microplastic pollution load was estimated on the basis of car tyre abrasion, which is considered to be a major main source of marine microplastic pollution, at least on Malé. It is estimated (i) on the basis of tyre imports and (ii) on a generic loss of tyre mass per vehicle (Table 11). The stock of motor vehicles in Maldives is approximately 92,000 each of which generates about 1.8 kg of microplastic waste per year, as tyres are compound of plastics and rubber.[222] Maldives imported an estimated 490 tons of tyres in 2019. As the roads are in close proximity to the sea in Maldives, microplastics from tyre abrasion are likely to be washed into the sea. The preliminary estimate of microplastic marine pollution ranges from 5-17 tons/year as set out in Table 11. The table is provided as a basis for more accurate future estimates.

Table 15. A. Range of estimates of microplastic marine pollution from car tyres in Maldives

	A. tyres	B. vehicles	source/ assumptions
A. Maldives car tyres 2019 (tons)	490		calculation from import value
B. Vehicles in service (numbers)		92,983	Maldives Transport Authority
A. Annual microplastic loss (tons)	49		10% Kole et al.
B. Weight loss all /vehicles/year (tons)		171	1.84 kg/vehicle/year based on India
Retention in soil	44	154	90% retention by soil (Kole)
Transport to the ocean (generic)	5	17	10% (generic) (Kole)

Source Kole et al.[223]

There is already an awareness of marine microplastic pollution, e.g., a workshop was held in 2019 in South Ari Atoll focused on the uptake of microplastics by whale sharks. The Environment Minister and the Parliamentary Committee on Environment and Climate Change has noted the high levels.[224]

6.2 Existing and potential measures to combat MPP

Maldives does not have specific policy or plan to combat MPP. However, the suite of national waste policies and plans and specific regulations on plastic, and on SUPs in particular, implement, or set out a comprehensive set of strategic actions which effectively comprise most of the elements of a national plan to combat MPP.

[221] Saliu F, et al. 2018. Microplastic and charred microplastic in the Faafu Atoll, Maldives. Mar Pollut Bull. 2018 Nov;136:464-471. See also: Imhof, H.K., et al. 2017. Spatial and temporal variation of macro-, meso- and microplastic abundance on a remote coral island of the Maldives, Indian Ocean. Mar Pollut Bull. 2017 Mar 15;116(1-2):340-347.

[222] Tyres contain up to 30% plastic resins and/or textiles.

[223] Kole. P.J. at al. 2017. Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment. Int. J. Environ. Res. Public Health 2017, 14, 1265; doi:10.3390/ijerph14101265.

[224] https://raajje.mv/93507.

6.2.1 Policy and planning

The Constitution of Maldives (2008) states that it is a "fundamental duty of the state to protect and preserve the biodiversity, resources and beauty of the country for the benefit of present and future generations' as well as ensuring every citizen has the right to a safe environment". The Maldives aspiration for environmental protection and conservation is set out in the Vision 2020 statement.[225]

Policies

In 2008, a national policy on solid waste management was approved.[226] It sets out quantitative targets and how generic principles of waste management (polluter pays, waste hierarchy, BATNEEC and others) will be implemented in Maldives, defines key waste management terms and governance modalities at national, island and atoll levels. It sets out strategic actions across 11 policy areas:

- coordinate and align the roles and responsibilities of public bodies at national, regional and island levels and support implementation capacity
- engage waste producers with regard to their duties and responsibilities
- subsidiarity – waste to be managed at the lowest possible level as far as practicable (e.g. household, community, island, atoll) with higher level provisions for recycling and for disposal of waste which cannot be adequately disposed of at local levels (e.g. regional managed landfill or other appropriate approach).
- provide for effective management of special wastes and discourage noxious products
- sound information basis for plans
- financial viability of the waste management system
- consolidate the relevant legislation
- engage the private sector
- introduce financial incentives to promote more sustainable behaviours
- raise awareness.[227]

In 2015, an updated policy makes reference to additional principles, such as those underpinning EU policies.[228] These include the 3Rs (reduction, reuse, recycle), EPR and waste to energy. The policy describes 16 strategic actions, including:

- regulations and incentives for re-use and recycling
- further specification of waste management responsibilities
- development of legislation for a deposit refund system for P.E.T. bottles
- development of a national information system for waste management
- measures to implement the polluter pays principle including through waste management fees

[225] See also: Republic of Maldives Ministry of Environment and Energy, National Biodiversity Strategy & Action Plan 2016–2025 (NBSAP) (2015).

[226] Ministry of Environment, 2008. National Solid Waste Management Policy for the Republic of the Maldives. Ministry of Environment, Energy and Water. Environment Research Centre, UNDP. Malé, Maldives. January 2008. This is understood to have been partly based on an older framework: Government of Maldives, Ministry Environment Energy and Water. National Framework for Solid Waste Management in the Maldives. United Nations Development Programme.

[227] https://www.facebook.com/environment.gov.mv/videos/1403271556677615/

[228] National Waste Management Policy (2015) https://www.environment.gov.mv/v2/en/download/4584. The Ministry of Health with the assistance of the World Health Organisation developed a National Health Care Waste Management Policy and Strategy (2015-2021).

- modalities for waste management infrastructure development (criteria, location, scale)
- determines 7 regional waste management 'catchment' areas for provision of selected regional services
- development of appropriate technologies
- financing modalities, including consideration of a waste management fund and EPR.

A Clean Blue Maldives Charter, endorsed by the office of the President, committed parties to a range of specifically actions to prevent, reduce and manage plastic waste.[229] Several policy initiatives, generally backed by legislation, have been put in place to ban certain types of plastic bags; to reduce the use of plastic bottles (including an import tax on PET resin) and food containers; and more recently to eliminate single-use-plastics. In 2019, the parliament passed a resolution to ban single-use plastics in Maldives from 2025. A national Plastic Committee comprising government and civil society representatives was established by the Ministry of Environment and developed a Single Use Plastic (SUP) phase-out policy with the following elements:[230]

- bans on the import, production and sale of specific SUP products
- market based instruments (import tariffs and consumer levies, support for local SUP substitutes)
- strengthened national waste data and setting reduction targets for plastic packaging
- extended producer responsibility (EPR) including deposit refund system (DRS) environmental product design, separate collection, and end-of life management of single-use plastic
- strategies for sustainable provision of alternatives
- education and awareness.

In December 2020, Law No:31/79 (Export-Import Act of Maldives) was amended to enable listing of SUP products to be phased out. These measures come into effect in mid-2021. Other relevant policy instruments include the National Water and Sewerage Policy (2017).

Maldives is party to the relevant international conventions on waste management and has the required action plans and other measures, e.g., for medical waste, for dangerous chemicals, and for implementation of obligations under international conventions (e.g. Basel, Bamako, mercury). The responsibilities of the various actors have been described above. A cross ministerial process, including CSO actors and WAMCO, have been involved in alignment of policies and plans with the SDGs.

Plans

The plans essentially implement the policies described above and deploy a comprehensive array of initiatives, including: institutional and infrastructure development, education and awareness; legislation; fiscal measures; engagement of the business community and civil society; support for a circular economy; and leadership in international campaigns. A number of investment projects are of note:

- Environmental Management Project (World Bank, P108078) 2008 ($15.6m)
- Maldives Clean Environment Project (World Bank, 2016)
- Greater Malé Environmental Improvement and Waste Management Project (ADB/ Japan Fund, GoM, 2018) ($40m loan) addresses SWM in the Greater Malé region. Phase II is expected to

[229] See also: Maldives Parliament Resolution of 2019 and the Presidential declaration at the 74th session of the UNGA in 2019. https://presidency.gov.mv/Press/Article/22264

[230] Nashfa, H. 2019. Single Use Plastic Phase-out policy for Maldives 2020-2023 (draft). Ministry of Environment. Republic of Maldives. See also: Duvat, V.K.E., Magnan, A.K. Rapid human-driven undermining of atoll island capacity to adjust to ocean climate-related pressures. Sci Rep 9, 15129 (2019). https://doi.org/10.1038/s41598-019-51468-3.

address the rehabilitation of the Thilafushi dumpsite, including through a 'waste-to-energy' 8MW facility (total cost est. $150m)[231]

- Urban Development and Resilience Project (World Bank, 2020) will finance sewage treatment and stormwater management schemes which may contribute to reduced MPP.
- The EU-supported 'switchasia' programme focuses on SDG 12 "Sustainable Consumption and Production" (SCP). In 2020 a specific financing window for single-use plastics in the tourism sector was developed by the SCP Facility and approved by both the government and the EU Delegation.[232]
- USAID Clean Cities Blue Oceans.

The World Bank-financed Maldives Environmental Management Project (2008-2016) supported development of Island Waste Management Centers (IWMCs) in four atolls of the North central region (12 out of 22 islands) where waste was segregated and 30 percent of the organic waste was composted. Island Waste Management Plans (IWMP) were endorsed by the Island Councils and approved by the EPA for 22 islands. Although the internal success rating of the project was judged 'unsatisfatory', importantly, the project established a range of economic and logistic metrics for island waste management; the costs associated with local collection and transport to IWMCs; and the distribution of costs between households, island administrations, resorts, WAMCO and others.[233] In addition, the project provided a field-level assessment of the environmental risks associated with construction, waste transportation, treatment and operations of SWM in fragile atoll ecosystems. It also provided a basis for mapping alternative logistics and cost structures, the modalities for cooperation between multiple stakeholders and the institutional requirements (legislation, corporate engagement, incentives) for waste reduction and reuse/ recycling.

The Maldives Clean Environment Project (World Bank, P160739) aims to support the implementation of the national SWM strategy at national level through instituting or improving planned measures (e.g. on SUP, EPR, fiscal measures, tariff regimes, user charges); through environmental and economic analyses; and capacity building. It also targets establishing the functional effectiveness of the SWM system in Zones IV and V, in particular with respect to the IWMCs and RWMCs, managed by WAMCO (Zones II, IV and V).

In Zone VI a Regional Waste Management Strategy and Action Plan identified priority strategies and practical actions to be achieved 2019-2023 by addressing key issues, needs and challenges in implementing the national solid waste policy at regional and island levels.[234] The actions envisaged included: (i) efforts to maximize public awareness, waste separation, proper collection, composting and temporary storage of recyclables and residuals at the island level; and (ii) at the regional level, to improve appropriate technologies and infrastructure, sustainable financial systems, institutional building and private sector involvement.[235]

[231] Ministry of Environment, 2020. Environmental Impact Assessment Thilafushi Dumpsite Rehabilitation. Greater Malé Waste-to-Energy Project (Phase 2, Outcome 2), July 2020. See also: Saleem, A. 2018. Environmental and Social Management Plan for the Establishment of Island Waste Management Centre in Th. Thimarafushi. Ministry of Environment and Energy.

[232] https://www.switch-asia.eu/countries/south-asia/maldives/.

[233] Cost of transport from IWMCs to RWMCs can be as much as 50% of the total SWM costs.

[234] A collaboration between the Ministry of Environment, IGES, UNEP supported by Japan's Ministry of Environment.

[235] Gamaralalage, P.J.D. et al. 2019. Regional Waste Management Strategy and Action Plan for Zone 6 in Maldives. Ministry of Environment, Maldives. https://www.ccet.jp/publications/regional-waste-management-strategy-and-action-plan-zone-6-maldives.

A number of other plans are of relevance to MPP:

- Ministry of Environment, 2016. National Biodiversity Strategy and Action Plan of the Maldives 2016-2025
- the Strategic Action Plan (2019-2023) makes specific reference to waste as a resource; to enforce the phase out of importation, production and use of single use plastics; and to develop and implement a national recycling strategy for plastics and other recyclables
- Fifth Tourism Master Plan (2019) aims at a substantial increase in the number of beds and to improve the governance framework and in particular the regulation of the guest-house segment.

6.2.2 Regulation.

Selected legislation of relevance to MPP is listed below (Box 8 and Box 9).[236]

Box 8. Selected legislation related to MPP

Environment and pollution

- Environmental Protection and Preservation Act of Maldives (Law No. 4/93) Basic and associated regulations notably the EIA regulations Environmental Impact Assessment Regulations (2007)
- Regulation on the Preparation of Environmental Impact Assessment Report 2012 (No. 2012/R-27)(EPPA)
- Environment Protection and Preservation Act of Maldives, 1st Amendment (on institutional arrangements)
- Waste Management Regulation (2013/R-58). Each island is required to have its own waste management site that is approved by the EPA
- Sewage Disposal Regulations 1996.

Tourism

- Maldives Tourism Act (Law No. 2/99)
- Regulation on the Protection and Conservation of Environment in the Tourism Industry 2006 (incl provisions on waste management and sewage).

SUPs, plastic bags and bottles

- Single-Use Plastic Phaseout Regulation in 2020
- Producer Responsibility on Packaging Regulation

[236] For a description of the relevant legislation see the following: Ministry of Environment and Energy, 2016. Maldives Clean Environment Project Environmental and Social Assessment and Management Framework (ESAMF) & Resettlement Policy Framework (RPF). https://ewsdata.rightsindevelopment.org/files/documents/39/WB-P160739_z4NesDM.pdf; Techera, E. and M. Cannell-Lunn 2019. A review of environmental law in Maldives with respect to conservation, biodiversity, fisheries and tourism. Asia Pacific Journal of Environmental Law. November 2019, 22(2):228-256.

Box 9. Regulation on waste management in the tourism sector

Section 5 of the Regulation on the Protection and Conservation of Environment in the Tourism Industry (Maldives Tourism Act, Law No. 2/99) addresses the provisions concerning solid waste management for the tourism sector. Among the requirements of the regulation are:

- waste collection bins with lids are to be placed for convenient use on leased tourist properties such as resorts.
- the components of discarded wastes (food, glass, metals, toxic or hazardous materials) are to
- are to be separately collected.
- waste disposal is to be done in a manner that will have the least impact on the environment.
- all tourist resorts are top have and use incinerators, compactors and bottle crushers.
- waste is to be disposed in the designated in a region or, in the absence of a designated area,
- disposed in a manner that is least harmful to the environment.
- waste burning is only to be done in an incinerator, which means open burning is prohibited.
- combustibles such as plastics that may produce noxious emissions are not be burned but
- rather separately collected and delivered to a designated waste management area.
- monitoring data on vessels, including the capacity and proper logs on trips made for waste
- disposal in an island or part of it leased for tourism purpose, are to be maintained.
- tourist vessel such as safari boats are to have a system for waste collection and storage until such waste can be taken to a designated place for waste

The EPPA regulation, implemented by the Environmental Protection Agency (EPA) addresses five main waste management areas: (i) definition of standards for waste collection, transfer, treatment, storage, waste site management, landfills and managing hazardous waste; (ii) procedures for waste site permit approvals; (iii) standards and permits required for waste transport on land and sea, including trans-boundary movements; (iv) reporting and monitoring requirements and procedures; and (v) procedures to enforce waste management regulations.

6.2.3 A national MPP action plan?

A national action plan on MPP could readily be prepared as a synthesis of elements of the existing strategies and plans, as the key components already exist. A specialised MPP working group, or task force could be established to consolidate these elements, determine how they can best be aligned, and identify any gaps. The closely related development of the circular economy may require an additional and more industry/ innovation/ investment- targeted working group.

A strategic action plan on MPP could include some or all of the following elements:[237]

- anchoring the action plan in existing policies, plans, legislation and institutions
- establishing more precisely the scale of MPP (including microplastics) and the main causes and the responsibilities for addressing those causes
- complement the vision of a low/no plastic waste society by identifying long-term aspirational goals, immediate and longer-term actions, supporting key investments and means of coordination, monitoring and review

[237] See: EPA, 2018. Maldives Marine Litter Action Plan, Maldives.

- evaluate existing levels of awareness and inform planned national awareness campaigns and the work of the CSOs and business community, including in relation to public perception on the costs and benefits of different actions the allocation of costs between consumers, business and government
- further development and application of codes of conduct to reduce plastic waste and MPP, e.g. through tourism organisations, cruise lines, dive centres, supermarkets, beach users and fisher associations
- developing an 'all-of- business' approach through engagement of all businesses to ensure reduction, reuse and recycling, including the application of EPR schemes, fiscal measures and promotion of schemes for use of renewable containers, e.g., for shampoos, detergents, water
- baseline studies to establish the economic impacts of MPP
- identify the resources and financing which may be required to bridge any gaps, to consolidate activities or initiate any catalytic measures required
- consider further regional initiatives, including on exploring opportunities for harmonised regional product bans or 'environmental import tariffs', exploring regional 'agreements' with major soft drinks suppliers for economies of scale in regional EPR and recycling (see 6.3.8).

6.2.4 Fisheries

There are basically two types of fisheries in Maldives: the tuna fisheries use lines and small-mesh nets (for bait-fishing); the 'reef/ lagoon' fisheries use both lines and nets. The Olive Ridley project removed over 730 lost nets (July 2013 - June 2017). The origin of the nets was unclear, but were very unlikely to be from the Maldives tuna line fisheries. Maldives licenses over 800 traditional fishing vessels and requires licensed fishers to collect any drifting plastics encountered. The debris is then handed over to designated collection points (e.g. at fish processing plants) and delivered to Parley for the Oceans for recycling to yarn or fabrics.[238]

FADs are likely to be a source of marine debris from the tuna fishery, as about 50 anchored FADs are used in Maldives and many other drifting FADs throughout the region. Approaches to reducing MPP from FADs are under study or being implemented in Maldives and in other regions.[239] There are complete records of anchored FAD losses and recovery in Maldives. Assuming that 10 percent of drifting FADs are lost by the purse seine fishery (not operational in Maldives), it is possible that about 2,450 FADs may be lost annually in the IOTC region.[240] Analyses of beach litter in the region suggests that both ships garbage and lost fishing gear from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the Maldives EEZ.

A series of regional workshop (2019) indicated a generally low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.[241] Workshops have been held, but it is unclear to what extent best practices are implemented in Maldives, or regionally. Given the nature of the fisheries in Maldives, comprehensive marking of fishing gear may not be practical, except for nets set

[238] https://www.parley.tv/#fortheoceans

[239] IPNLF, 2016, Fish Aggregating Device Management, IPNLF Issue Brief; Baske, A. et al. 2019. Options for Improving dFAD Recovery and Accountability to Minimize Marine Coastal Habitat Damage and Marine Litter. nsuworks.nova.edu; Moreno, G. et al. 2018. Moving away from synthetic materials used at FADs: evaluating biodegradable ropes degradation. Collect. Vol. Sci. Pap. ICCAT 74 (5), 2192-2198.

[240] Adam, M. Shiham, 2019. Use of Anchored FADs in the Maldives – Notes for a Case Study for Assessing ALDFG. IOTC-2019-WPTT21-58.

[241] Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

near marine parks or prime tourist/ dive sites, or where volunteer divers can be used for recovery.[242] For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements could be applied to fishing vessels.[243]

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly as foreign vessels generally do not make port calls to Maldives. This could start with resolutions by IOTC and SEAFO, possibly phasing in MARPOL Annex V requirements for vessels; introducing measures with respect to marking gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and could be an approved regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of any future EU fisheries access agreement. EPR schemes for waste fishing gear may require the economies of scale which may only be feasible through regional schemes (e.g. catalysed by SWIOFC, IOTC, or the International Pole & Line Foundation (IPNLF)), through close engagement with businesses and possibly with economic support from EPR arrangements with importers.

Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels will progressively reach the end of their useful life. Abandoned GRP vessels present a growing plastic waste problem and are likely to progressively degrade to marine microplastics if abandoned. Most countries have no provision for appropriate disposal of GRP vessels. Rules for their disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the extended life of these boats.

6.2.5 Shipping and tourism

Ensuring that Maldives meets its obligations under MARPOL Annex V is the key action required. Maldives Ports Ltd. is responsible for all Maldives ports. Dialogues with vessel operators and ships agents can help in separation of recyclables in ship's garbage.[244] Dialogues with IMO and regional port authorities could help ensure coordinated measures to prevent dumping of waste by shipping in the region and to foster codes of conduct for regional shipping lines.[245] MARPOL Annex V also applies to the disposal of garbage from fixed or floating platforms engaged in the exploration or exploitation of seabed oil and gas and should be stipulated in the relevant authorisations.[246]

The regulations applying to tourist resorts have been described above (Box 8). Tourism is recognised as a significant regional source of MPP and the target of the regional Prevention of Marine Litter in the Lakshadweep Sea (PROMISE) project (Box 10).

[242] Small-scale fishers often create local or 'proprietary' systems of marking fishing gear to prevent theft, or help in the recovery of lost gear.

[243] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear. Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

[244] A wide range of IMO guidelines are available: Prevention of Pollution by Garbage from Ships https://www.imo.org/en/OurWork/Environment/Pages/Garbage-Default.aspx; Resolution MEPC.220(63) Guidelines for the Development of Garbage Management Plans; 2017 Guidelines for the implementation of MARPOL Annex V. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf; IMO, 2018. Consolidated guidance for port reception facility providers and users. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf.

[245] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report.

[246] Some exploratory drilling has taken place, e.g. in the Kardiva Channel/ Goidhoo Atoll area.

Box 10. Prevention of Marine Litter in the Lakshadweep Sea (PROMISE) project

The rapidly expanding tourism in Maldives, Sri Lanka and India tourism industries has been identified as a significant contributor to marine litter and MPP in the Lakshadweep Sea largely due to high consumption rates of convenience products wrapped in single-use plastic packaging.

The PROMISE project (2020-24) is part of the SWITCH-Asia II, an EU-supported initiative to promote Sustainable Consumption and Production (SCP). The project targets the prevention and leakage of wastes from land-based sources into the Lakshadweep Sea. The project partners include the Maldives National University, Parley for the Oceans and others.

The objective of PROMISE is to promote source-to-sea solutions to reduce marine littering in tourism clusters along the Lakshadweep shorelines of the Maldives, Sri Lanka and India with a particular focus on waste minimisation in small and medium tourism enterprises (MSMEs). PROMISE will:

- establish a knowledge base for the status quo of marine littering in tourism clusters along Lakshadweep shorelines
- conceptualise and initiate a "Lakshadweep Zero Waste Alliance"
- strengthen regional policy frameworks for waste management in coastal areas and contribute to reduced waste generation and littering in all three target countries
- inform wider stakeholder network about the approaches to waste prevention
- promote regionally integrated source-to-sea solutions to reduce marine littering in tourism clusters and strengthen the position of micro, in the tourism cluster and of regional governance mechanisms
- use the Resource Efficient Cleaner Production (RECP) approach and the Avoid. Intercept. Redesign. (AIR) scheme developed by Parley for the Oceans
- support zero-waste business models and operations through knowledge exchange, access to finance and improved supply chains and governance.

https://www.switch-asia.eu/project/promise/; https://projectpromise.eu/

https://www.adelphi.de/en/project/prevention-marine-litter-lakshadweep-sea-promise

6.2.6 Circular economy

Maldives is committed to a circular economy (CE). For example, in 2015 Maldives hosted the Asia Pacific 3Rs (Reduce Recover Recycle) Forum and strengthened the link between the 3Rs Initiative and the SIDS SAMOA Pathway.[247] The companion report on circular economy, prepared under this project, also provides additional perspectives.

Single-use plastics have been banned in some offices and all school premises. Some cafés and restaurants in the capital have also stopped using straws and plastic bottles. Many tourist resorts, NGOs and government initiatives are pro-active in support of circular economy or related initiatives.

PET bottles are collected and extensively recycled for export.[248] However, a new water bottling plant that will produce 10,000 plastic bottles every hour is being set up in Kulhudhuffushi.[249] Recorded

[247] For details see: 3R as an Economic Industry- Next Generation 3R Solutions for a Resource Efficient Society and Sustainable Tourism Development in Asia and the Pacific. https://www.env.go.jp/recycle/3r/en/index.html; https://www.env.go.jp/recycle/3r/en/results/10.html

[248] Nashfa, Hawwa. 2016. Implementing a Deposit Refund System for P.E.T bottles in the Maldives. An ex-ante analysis of political feasibility based the models of Kiribati and Palau. Thesis, IIIEE, Lund, Sweden.

[249] Reportedly by Malé' Water and Sewerage Company (80% government-owned) and Island Beverages Maldives.

exports of waste plastic were 434 tons ($58,000) in 2017, but lower in 2018.[250] In 2015, through a concessional loan of about $6 m, the Abu Dhabi Fund for Development (ADFD) is supporting a waste-to-energy project to incinerate an estimated 55,000 tons of waste per year and provide power to Vandhoo, Addu and Kulhudhuffushi.[251]

Occupancy at Soneva Jani resort is often the highest in the Maldives. The resort is committed to development the most sustainable way possible. This includes using sustainable materials, recycling waste, eliminating plastics, conserving water, and preserving and protecting the local ecosystem. For example, water is supplied in reusable glass bottles, filled with water made at the island's reverse-osmosis plant. Shampoo and shower gel is delivered in large 5-gallon tubs that are used to fill ceramic bottles that are refilled when empty.[252]

In common with several other AIODIS countries Maldives has a number of CE constraints. These include: high cost of collection and transportation of the wastes; relatively high cost of labour, energy; a weak manufacturing base; shortage of technical skills; and fragmented internal tourist and Maldives resident's markets. Several reports outline generic and alternative approaches to re-use and recycling, including the technical, economic and financing issues and lessons from Asia and small island economies.[253]

6.2.7 Awareness of MPP

Maldives has ratified MARPOL Annex V and enacted national legislation on plastic bag and SUPs. Maldives has a high level of engagement in a range of international initiatives on MPP, or marine litter (see regional initiatives below). Maldives is not party to the Nairobi Convention.

During the preparation of national and regional SWM plans, there has been extensive collaborative studies, peer-learning, consultation with the participation of stakeholders at national, regional and island levels and with business and civil society groups. This has contributed to a broad understanding of SWM and the 'plastics problem'.[254]

Specifically, a wide range of awareness activities on waste management in general and on management of plastic waste have already been undertaken in Maldives (e.g., Box 11). Awareness activities are supported as part of the core strategic actions under the national SWM plans and are executed by government agencies, responsible businesses (including the tourism sector) and be a range of civil society organisations (Box 12).

[250] Comtrade HS code 3915. No data available for 2019 and 2020. Maldives Custom Service (2015): Quality and Value of Recycle Materials, Statistics 2015. https://www.customs.gov.mv/Statistics.

[251] https://waste-management-world.com/a/abu-dhabi-backed-4mw-waste-to-energy-project-to-move-forward-in-the-maldives.

[252] https://soneva.com/soneva-jani

[253] Lachmann et al. 2017. Marine plastic litter on Small Island Developing States (SIDS): Impacts and Measures. Appendix 3: Details for initiatives that (re-)use plastic litter; Weekes, J.G. et al. 2020. Solid waste management system for small island developing states. Global Journal of Environmental Science and Management (GJESM) https://www.gjesm.net/; UNCDR, 2020. UNCRD 10th 3R Forum. State of Plastics Report. https://sdgs.un.org/documents/uncrd10th-3r-forumstate-plastics-report-25105

[254] E.g., see: https://internationalwasteplatform.org/say-no-to-open-plastic-burning-2/

Box 11. High-level engagement on 'grass-roots' issues

The Maldives First Lady, spoke on the Maldives' Single Use plastic phase out plan, which comes into effect on 1 June 2021. The First Lady reflected on several challenges:

- the success of the plan relies upon commitment towards shaping policies, regulations and the enforcement as well as behavioural changes to adapt over time.
- some lifestyle changes that can be brought through simple actions such as carrying reusable water bottles, reusable bags
- taking 'Tupperware' to buy hedhikaa (snacks)
- make it 'fashionable' to exchange used clothing to reduce waste and use of synthetic textiles
- get involved in clean-up activities
- pick up waste where and when possible
- speak out against littering or dumping of waste
- encourage friends and family to adopt some of these life style changes
- participate in dialogues to find solutions for the disposal of waste in a responsible manner.

Adapted from : https://presidencymaldives.gov.mv/Press/Article/24269 (25/01/2021).

Recently (January 2021), the Maldives Ocean Plastics Alliance (MOPA) launched the 'Plastic Reverse Logistics Project' which draws together an alliance of PET bottle manufacturers, importers, retailers, distributors and end-users of PET bottles, as well as regulators and policymakers. The project will collect PET bottles from over 120 retail outlets for recycling through the Parley Maldives initiative.[255] The Biodiversity Environment Awareness Maldives (BEAM) also has a collaborative effort with Parley Ocean School to implement an 'Avoid. Intercept. Redesign' (AIR) strategy. BEAM collects and exports about one 40-foot container of waste PET bottles a week. The recycled plastic is used for manufacture of sports gear by Adidas, including kits for major professional sports teams such as FC Bayern Munich, Real Madrid and Manchester United FC. Parley Ocean Schools is a youth-driven resolution to ban single use plastics was approved by parliament on July 4, 2019. Parley Maldives has introduced plastic interception and baling sites in island communities and more than 70 schools; collaborative cleanups on affected coastlines; and the recycling center and innovation lab in Malé.[256]

[255] Maldive Times, January 25, 2021. https://maldivestimes.com/environment-minister-launches-mopas-flagship-plastic-reverse-logistics-project/.

[256] https://www.parley.tv/updates/parleymaldives?rq=maldives.

Box 12. 'National Best Practice Example' award for waste management

Hoandedhoo Island Development Society, a local NGO, secured funding for a waste management project concept under the Mangroves for the Future Small Grant initiative.

Community and Island Councils consultations and a door-to-door campaign developed a participatory plan for the management of waste in the islands based on education and inclusion. This was backed by town hall meetings and training workshops including on awareness of the importance of separating different types of waste. Surveys of households' willingness to pay provided a basis for local council waste charges to support waste collection services and transfer to waste management centres.

To foster leadership and sustainability, the Island Council set up a community committee to oversee the WM system and secure additional resources for waste bins and further training (e.g. in composting). A government-built waste management centre was built on one island.

In a similar initiative, residents on the island of Maalhos restricted the use of plastic water bottles, built a small recycling centre to separate plastics from other solid waste for reuse, and introduced a glass water bottling centre that is now a thriving business enterprise.[257]

Source: https://www.iucn.org/news/asia/201801/garbage-garbage-out-waste-management-maldives
Mangroves for the Future (MFF) is a partnership-based regional initiative.

Studies on awareness provide useful insights. In Ukulhas (Zone III), 97 percent of respondents in a 2016 study, acknowledged that fees should be paid for waste collection services, and 80 percent of respondents across all educational groups were aware that plastic was harmful to the environment. However, despite this, only 50 percent were willing to use recyclable shopping bags, while 31 percent were unwilling. Statistically, there was no association between people who think plastic was harmful and their willingness to use recyclable shopping bags.[258]

Other awareness instruments include:

- Saafu Raajje campaign (2015)
- National Biodiversity Strategy and Action Plan 2016-2025
- Save the Beach
- International Coastal Clean-up Day
- Maldives Marine Litter Acton Plan[259]
- Korallion Lab (scientific level)

6.2.8 Regional initiatives

Maldives can potentially benefit from regional initiatives directed at the WIO and at South Asia. On the environmental front, Maldives is a participant in the Bay of Bengal Programme and a member of South Asia Cooperative Environment Programme (SACEP). Several studies and the SACEP country reports review the status of MPP and marine litter in South Asia.[260] The Regional Marine Litter Action Plan for

[257] https://blogs.worldbank.org/endpovertyinsouthasia/world-oceans-day-south-asia-launches-new-initiative-fight-plastic-pollution.

[258] Shadiya, F. 2016. Effectiveness of Solid Waste Management in the Maldives: A Case Study from Ukulhas. Thesis, Villa College, February 2016.

[259] EPA, 2018. Maldives Marine Litter Acton Plan, Maldives. Environmental Protection Agency.

[260] SACEP, 2018. Regulating Marine Litter and Plastic Wastes in the South Asian Seas Region; Kapinga, C.P and S.H. Chung, 2020. Marine Plastic Pollution in South Asia. UNESCAP.

South Asian Seas Region provides a comprehensive framework for action.[261] This is supplemented by a 'roadmap' that sets targets for 2030. The targets are linked to SDGs and specify a phase-out of single-use plastics; all plastic packaging to be either recyclable, reusable or compostable; and a reduction in MPP of all kinds.[262] The high level of regional plastic pollution attributable to rivers is addressed through a regional project which is partly based on the Regional Marine Litter Action Plan (Box 13).

Box 13. Regional project: Plastic free Rivers and Seas for South Asia

The objective of the Plastic Free Rivers and Seas for South Asia Project is to strengthen innovation and coordination of circular economy solutions to plastic pollution flowing into South Asian Seas. The project is supported by the World Bank and implemented by SACEP.

The Project has three components. Component 1 provides competitive block grant investments to reduce plastic waste through investment in a circular plastic economy solutions and disseminate knowledge of solutions. Component 2 leverages public and private sector engagement and solutions to develop and/or improve national and regional plastic pollution mitigation strategies, action plans, policies and industry standards.

The project will support development of: enabling policies, standards, analytics to enable strategies and action plans to harmonize plastic pollution mitigation measures. It will develop and implement a multi-year plastic policy support program including through leading universities and organizations; develop databases for lifecycle analysis, data collection, and modelling in selected industry value chains; and support communication activities. It will enable regional PPPs for a regional circular economy for plastics.

Closer regional institutional alignment is also envisaged through an Inter-Regional Organization Dialogue Committee, initially comprising SACEP and IORA.

Source: https://projects.worldbank.org/en/projects-operations/project-detail/P171269;[263]
http://www.sacep.org/programmes/plastic-free-rivers-and-seas-for-south-asia

As already noted (Box 10), from 2021, the 'Prevention of Marine Litter in the Lakshadweep Sea' (PROMISE) project will address marine littering in tourism clusters in the Maldives, Sri Lanka and India. The Bay of Bengal Large Marine Ecosystem Project is another relevant regional initiative.

With regard to economic and trade dimension of MPP, Maldives is a member of the South Asian Association for Regional Cooperation (SAARC) and the Indian Ocean Rim Association (IORA). In relation to the circular economy, Maldives is party to the Regional 3R Forum in Asia and the Pacific which promotes a range of policy and technical approaches to address plastics in the circular economy (Box 14).

[261] SACEP (2019). Regional Marine Litter Action Plan for South Asian Seas Region. South Asia Co-operative Environment Programme, Colombo. Based on a review of marine litter challenges in five coastal states (Bangladesh, India, Maldives, Pakistan, and Sri Lanka) and in the region,

[262] SACEP, 2019. A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030. The Roadmap was developed with the support of the Ministry of Environment, Japan through UNEP IETC.

[263] SACEP, 2019. A Roadmap for Sustainable Waste Management and Resource Circulation in South Asia, 2019-2030. The Roadmap was developed with the support of the Ministry of Environment, Japan through UNEP IETC

Box 14. Key messages from the 2014 3R Forum

- Wastes and emissions are intrinsically linked with overall resource use; natural resources and ecological assets are being used at increasing rate enabling economic growth and fuelling unprecedented grow of cities;
- The goal of improving resource efficiency and reducing the waste and emission intensity for Asia-Pacific economies has become a significant driver of government policies and programs;
- Establishing new forms of cooperation and partnerships between govt., business, community will underpin successful implementation of 3Rs.
- 3R needs to be linked to other policy domain such as climate mitigation and adaptation, energy and water security, urban air pollution, and supply security of critical natural resources.
- Eco-parks and eco-towns need to encompass a range of eco-initiatives including biodiversity and resource efficiency and promote it across the region.
- Triangular cooperation (Govt-Scientific-Private) is key to develop viable and effective business models in 3Rs and waste management.
- Establishment of research, innovation and practice (RIP) parks in the region should be established and support Waste to Resource (W2R).
- Sustainability and resiliency of cities, and thereby the role of 3Rs, are critically important in post 2015 development agenda.
- 3R+R (reduce, reuse, recycle and return), regional cooperation and partnerships are key to sustainable waste management in Small Island Developing States (SIDS). Plastic litter is a major pollution issue in coastal and marine environments of SIDS and needs special attention. Integration of 3R in regional programmes dealing with climate change, disaster management, and biodiversity management should be considered as a priority

Source: 5th Regional 3R Forum in Asia and the Pacific, 2014

While Maldives already has significant engagement in regional efforts to combat MPP, in the context of AIODIS, Maldives could consider:

- linkage of the Nairobi Convention actions to those of the SACEP Regional Marine Litter Action Plan
- cooperation in preparation of a funding submission for a regional MPP monitoring programme, including MPP from distant sources, collating information on beach clean-ups through existing initiatives, and preparation of a strategic plan on MPP

Maldives could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing initiatives, such as SIDS and IORA. Such engagement could also contribute to the oceans agenda of UNGA and UNEA.[264] There is also scope for alignment of the SACEP plan with any WIO initiatives.

In the plastics economy sphere, Maldives could also consider initiating a dialogue in the South Asian Association for Regional Cooperation (SAARC) on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic waste (and other recyclable waste) would be a useful interpretation of the new Basel rules. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected

[264] Wienrich, N., Weiand, L., & Unger, S. (2021). Stronger together: The role of regional instruments in strengthening global governance of marine plastic pollution. IASS Study, February 2021; Carlini, G., & Kleine, K. (2018). Advancing the international regulation of plastic pollution beyond the UNEA resolution on marine litter and microplastics. Review of European, Comparative and International Environmental Law, 27(3), 234 – 244. https://doi.org/10.1111/reel.12258.

SUPs can also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for fishing nets, soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (such as bottled drinks manufacturers - see main report), and inform ongoing discussion on plastic and the environment within the WTO.

The main project report provides greater detail and discussion of option for recycling of plastic waste and resourcing and financing opportunities. Reference can also be made to companion report on the circular economy (in preparation under a separate consultancy).

7 Mauritius

7.1 Marine plastic pollution in Mauritius

Mauritius does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).[265] This report is a first step to estimate the scale of MPP, to describe the sources of MPP and to develop a national dialogue and action plan on MPP. It places particular emphasis on the use of the existing solid waste management system and awareness-building initiatives; on environmental sustainability policies, on development of the circular economy, on regional cooperation and on identifying practical steps to combat MPP. The report is a working paper intended as a basis for stakeholder consideration and to be used to develop more in-depth analyses, to help align existing activities in Mauritius, to identify possible gaps and areas requiring additional efforts.

7.1.1 Sources of marine plastic pollution

There are three main sources of MPP in Mauritius:

- mismanaged, or unmanaged solid waste and litter, which are the most important
- marine sources which are mainly fishing activities, shipping and beach tourism, and
- plastics that may be transported by ocean currents from other countries.

The different sources are discussed in more detail below. Plastic waste is part of a much broader waste management problem, one of a range of sustainable development challenges faced by Mauritius. The following sections provide a preliminary estimate of marine plastic pollution (MPP) in Mauritius and provides a synthesis of available information on MPP. including on microplastic marine pollution.

7.1.2 Estimate of marine plastic pollution and its basis

MPP is estimated primarily as a function of mismanaged land-based solid waste in Mauritius with some additions to reflect the marine sources.[266] The estimate of MPP relies on several assumptions based on population, solid waste generation, the proportion of plastic in the waste and the amount of mismanaged plastic waste that is transported into the marine environment. The basis for these assumptions is set out below. Alternative estimates of mismanaged plastic waste have not been explored at this stage.[267]

The country has a population of over 1.27 million, of which 40.8 percent are considered urban.[268] Population density is 626 per km^2, among the highest of African countries. For the purposes of the MPP estimate, the entire population is considered to be 'coastal'. This means that mismanaged plastic waste in any part of Mauritius could potentially be transported to the sea by rain, flooding, wind, or deliberate dumping or littering on the shore, or at sea.

About 98 percent of household solid waste is collected and about 84 percent of total waste is collected. Almost all waste is considered effectively managed. Some households compost bio-waste and several industries have specific means of waste disposal and may transport waste to the only managed sanitary landfill site where all unused, or non-recycled waste is disposed. About 1,488 tons of waste

[265] MPP is generally considered to account for about 80 percent of marine litter or debris.

[266] See Jambeck et al., 2014 for a description of the methodology.

[267] Cordier, M. et al, 2020. Plastic pollution and economic growth: the influence of corruption and the lack of education. 2020. https://hal.archives-ouvertes.fr/hal-02862787..

[268] World Bank, 2019. https://data.worldbank.org/.

are generated daily.[269] Total solid waste has been increasing at a rate of 1.5 percent per year from 480,000 tons in 2015. In 2019, the reported solid waste landfilled at Mare Chicose was 537,147 tonnes, 1.1 percent less than in 2018 (543,197 tonnes). An additional 6 percent of total waste is directed to composting and does not go to Mare Chicose. The per capita landfill was 1.22 kg/person/day in 2018.[270] The total solid waste generated in 2019 is estimated at over 570,000 tons.

Several studies indicate a high proportion of plastic in Mauritius solid waste, estimated at about 12.4 percent in Port Louis and as much as 14 percent in 2018.[271] The proportion of plastic in waste varies between industrial (6 percent), commercial (16 percent) and domestic (15 percent) sources.[272] For the purposes of the estimate, 10 percent of waste is conservatively considered to be plastic. This gives a total estimated quantity of plastic waste of at least 57,000 tons/year.[273]

While solid waste is well-managed in Mauritius, some 'leakage' is evident from beach clean-ups. It is assumed that 2 percent of plastic waste is 'unmanaged', either as a result of littering, illegal dumping, or smaller items entering waste water, or sewage.[274] The hydrography and high seasonal rainfall of Mauritius is such that any plastic litter which is not collected is likely to be washed into the numerous ravines and eventually into the sea. There appears to be few storm drain traps or other means to prevent debris entering the sea, although the national budget provides significant funds for cleaning of drains, roads, rivers and public sites.[275] It is assumed that 10 percent of the mismanaged plastic waste leaks into the ocean.

The estimate of microplastic marine pollution is based exclusively on tyre abrasion and is estimated at 17-102 tons/year. This estimate, its basis and underlying assumptions described below (0).

The import of fishing nets is used as a proxy for generation of MPP from fisheries. In 2019, the imports of monofilament nets were 67 tons and 10 percent of this quantity is considered to be lost or abandoned nets and gear and effectively MPP.[276]

Comprehensive information on MPP from shipping and from non-Mauritius sources is not available and the values in are placeholders which can be replaced with estimates based on any future assessments. The generation of MPP from solid waste mismanagement, from fisheries, from shipping and from non-Mauritius sources (e.g., ocean currents) are further discussed in other sections below.

[269] A 2015 study indicated that waste generation rates for SIDS averaged 1.29 kg/capita/day, while OECD countries had a mean value of 1.35kg/capita/day. See also: Mohee, Romeela et al. 2015. Current status of solid waste management in small island developing states: A review. Waste Management 2015 43 p. 539-549. A rate of 1.11 kg/person/day was reported for 2017. Africa Solid Waste Management Data Book 2019. For an older assessment see: GoM. 2000. Feasibility study final report on Environmental Solid waste management programme, Mauritius. Fichtner GmBh for the Republic of Mauritius; 2000. p. 2–48.

[270] Environment Statistics – 2018.

[271] Mulloo, J. 2016. Le ramassage et traitement de déchets a l'Ile Maurice. Conseil Municipal de la Cite de Port-Louis; Ministry of Environment, Solid Waste Management and Climate Change, 2021; A rate of 1.11 kg/person/day was reported for 2017. Africa Solid Waste Management Data Book 2019. Fitchener (2000) reported 7.9% and Mohee (2002) reported 13% plastic. The National Waste Characterization Study (2013) gives a mean of 9% (10% urban, 7% rural).

[272] Kowlesser, P. Plastics Management in Small Islands Developing States. Presentation: https://www.uncrd.or.jp/content/documents/2654Plenary%20Session(3)-Presentation(6)-Prakash%20Kowlesser.pdf

[273] In 2014, plastic waste was estimated at 38,700 tons. Naldeo and Seureca, 2014. Etude de diagnostic pour une gestion optimisée des déchets dans l'Océan Indien. COI and AFD. On the basis of 9% plastic in solid waste, Charboulliet estimated that 61,635 tons of plastic waste was generated in 2018.

[274] Only a proportion of the waste water is treated. In 2000, it was estimated that about 12 percent of solid waste was dumped 'illegally', particularly in rural areas where waste collection was less frequent. See: Foolmaun R K, Chamilall D S, Munhurrun G., 2011. Overview of non-hazardous solid waste in the small island state of Mauritius. Resources Conservation & Recycling, 2011, 55 (11): 966 – 972.

[275] Eco-bins are to be installed on beaches and nets at major sea outfalls to ensure that most of the plastic wastes are collected and diverted to recyclers (Budget Speech 2020-2021 Annex).

[276] Statistics Mauritius, HS code 5404. Any imported corded netting is considered to be imported for the regional purse seine fishery and does not necessarily contribute to waste in the Mauritius EEZ.

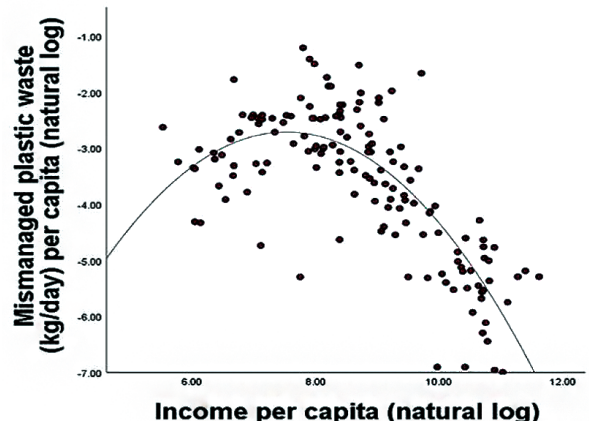
MPP in Mauritius is estimated at about 158 tons per year (Table 16). The sources and assumptions are provided in the table or in the text. As additional or more accurate information becomes available, this preliminary estimated can be adjusted accordingly.

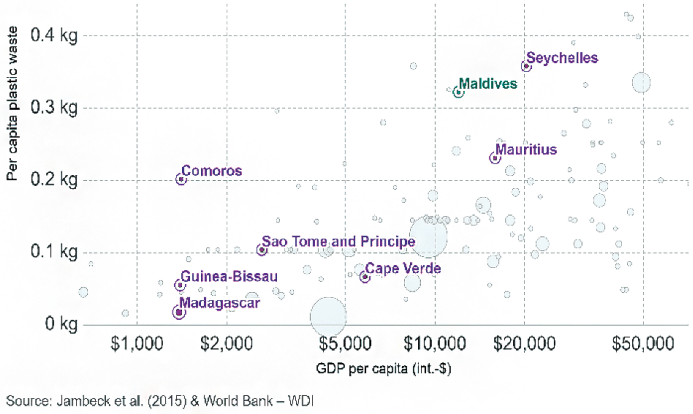
Table 16. Estimated marine plastic pollution in Mauritius

Item	Total	Source/ Assumption
Population total (million)	1,270,000	World Bank 2020
Total waste (tons/year)	571,395	World Bank, What a Waste 2.0; see text
Waste average (kg/person/day)	1.2	calculation
Plastic (%) of waste	10%	assumptions, see text
Plastic waste (tons/year)	57,139	calculation
Mismanaged plastic waste (%)	2%	assumptions, (including litter) see text
Mismanaged plastic waste (tons/year)	1,143	calculation
Transport to marine environment (%)	10%	assumptions
MPP from mismanaged solid waste (tons/year)	114	calculation
Shipping (tons/year)	10	Shipping 10 tons (assumed)
Fisheries (tons/year)	6.7	10% of imports of mono nets 67 tons
Microplastics at least (tons)	17	see table Table 11 tyres only) range 17-102 tons
Non-Mauritius sources	10	assumption (from ocean sources)
Estimated MPP (tons/year)	158	calculation

There is a relationship between plastic waste and income levels (Figure 35).[277] The current decrease in Mauritius' GDP/capita may temporarily reduce plastic consumption, although this may be slightly offset by the increase in the use of plastics to combat the pandemic.

Figure 35. Relationship between income and mismanaged plastic waste





Sources: Barnes, 2019; Jambeck, et al. 2015.

7.1.3 Management of solid waste

Over 90 percent of solid waste is collected either through municipal or private collection schemes. The waste is partially sorted for recycling, composting, or other primary treatment (e.g. e-waste) at five 'regional' sites after which the remaining waste is sent to the sanitary landfill at Mare Chicose. Methane extracted at Mare Chicose is used for production of electricity. A waste characterisation update study was commissioned in 2019 and AFD has funded a study for the new solid waste management strategy

[277] Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505

and action plan focussing on resource recovery and recycling.[278] Waste separation at source (e.g., by households) is low, but there are plans to initiate a comprehensive waste recycling programme which will include sorting of waste for recycling at producer, or household level. Further separation of wastes is expected to be implemented only when composting plants and sorting units are commissioned and operational in 2023/2024.

The Ministry of Environment, Solid Waste Management and Climate Change has overall responsibility for solid waste management. The local councils are responsible for collection and public cleanliness in their areas. The Beach Authority has responsibility for ensuring collection and disposal of beach litter and debris. The Mauritius Port Authority is responsible for waste generated by shipping.

Figure 36. Mismanaged plastic waste in rural, coastal and urban areas

We-Recycle

L'express

most common beach MPP

Figure 37. Formal waste management

In 2015 about 38 percent of waste was composted. Collection represents about 55 percent of the costs associated with solid waste management, landfill 27 percent of costs and transfers and transport to the landfill 18 percent. Studies suggest that proportion of different types of plastic is similar to that in France.[279]

7.1.4 Rodrigues

In some ways, Rodrigues has been considered to have a more advanced solid waste management regime than Mauritius island. Rodrigues produces some 15-20 tons of waste per day. The Environment Commission has developed a landfill site at Grenade to cater for the increase in solid waste.[280] Plastic bags were banned in 2014. A waste segregation project promoted awareness of recycling of plastic

[278] Ministry of Environment, 2020; Gov. of Mauritius/ AFD, 2017. Strategy and action plan for a new solid waste management and resource recovery system for Mauritius and project preparation support for the implementation of the strategy SWMD. Project 16/AFD/CLD/Mauritius/1.

[279] PET 31%, LDPE and PVC 16% each, PP 14%, HDPE 12% and PS 4%. See Charbouillet op. cit.

[280] KPMG Rodrigues Regional Assembly Final SIDPR July 2009.

and composting of organic waste. Waste is sorted on Rodrigues as a result of the awareness campaign and recycling receptacles have been installed at Port-Mathurin. The Beach Authority Act 2002 also applies to Rodrigues and empowers the Beach Authority to undertake the day to day cleaning of public beaches, establish standards for use (e.g. by traders) and cleanliness;

The 2009 report made the following critical observations (which may no longer be applicable):[281]

- littering and dumping on landscapes and lagoon;
- despite awareness campaigns, the impression was that few Rodriguans are aware of the negative impacts of mismanaged solid waste
- a lack of individual and collective responsibilities and community based rural collection programmes
- lack of awareness in waste reduction activities and existence of some cultural barriers to environment protection and cleanliness;
- pollution by plastic carry bags, empty bottles, used batteries, rocks, used oil, used tyres etc.;
- fragmented approach to waste management due to absence of qualified personnel and lack of innovative waste management technology;
- lack of a civic amenity centres for bulky wastes and lack of proper arrangements for management, collection and disposal of cyclonic wastes.

7.1.5 Plastic pollution on beaches.

The Beach Authority, established in 2002 under the Beach Authority Act, working with the local authorities, is responsible for the maintenance and cleanliness of 130 public beaches(48 km)[282] It is supported by recurrent and capital grants and revenues from beach user charges. Expenditures (2017-18) were about $1.4 million and the recurrent grant covered over 60 percent of expenditures.

The composition of a clean-up at Grande Riviere Noire was over 87 percent plastic by number of items (Table 10). The clean-up collected 8.65 tons of marine debris over 19 km of shoreline (0.46 tons per km). Although the composition of the clean-up was reported by number of items rather than by weight, it nevertheless confirms the importance of plastic waste in the marine debris found on beaches.

Table 17. Composition of marine litter in beach clean-up

Category/ items	Rank	% by number
Plastic (all, incl. fishing gear)		87.4%
Cigarette butts	1	16.7%
Plastic bottles	2	18.4%
Plastic bags	3	9.4%
Food wrappers	4	7.9%
Fishing gear	-	<1%
Litter less than 2.5 cm		
Plastic		77%
Glass		23%

Source: https://www.coastalcleanupdata.org/[283]

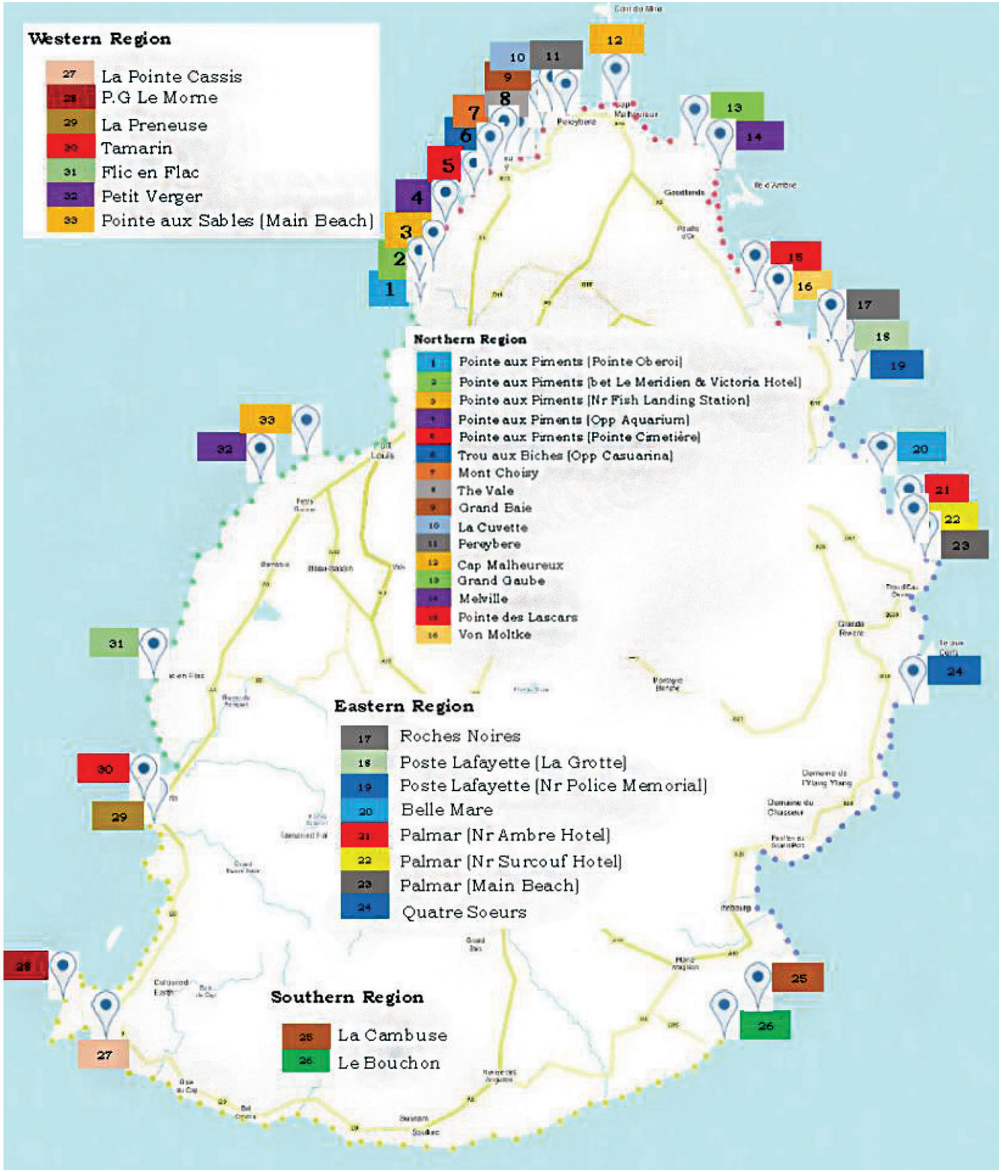
[281] KPMG, 2009.

[282] https://www.beachauthority.mu/. Customer Charter http://beachauthority.mu/pdf/CustomerCharter2016.pdf

[283] See also: Lachmann, F. et al. (2017. Marine plastic litter on Small Island Developing States (SIDS): Impacts and measures. Swedish Institute for the Marine Environment, University of Gothenburg; Shelbourne, G. and N. Ray. (no date) A Plastic Survey of Blue Bay and Pointe D'Esny, Mauritius.

In associations with local authorities, hotels and NGOs, the Beach Authority organises beach clean-ups and awareness events on keeping Mauritius' beaches clean (Figure 38). However, the composition of the litter is not reported in the organisation's publications. Tourism is not considered a significant driver of MPP and may provide an incentive to maintain the cleanliness of beaches and waterfronts. However, efforts could be directed to raising awareness on littering by cigarette butts as they are the largest item of beach litter.

Figure 38. Beach clean-ups and awareness events organised by the Beach Authority



Source: Clean-Up Mauritius and Embellishment Campaign Volume 16

7.1.6 Fisheries

As there is no direct information on MPP from fisheries in Mauritius, the estimate given in should be considered as a 'place-holder' until such time as further information is available. Both local small-scale and large-scale fisheries and foreign fishing are potential sources of MPP through lost gear and at-sea garbage disposal.[284] Losses are generally related to the type of gear and location where the fishing

[284] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

takes place. The import of monofilament fishing nets is used as a proxy for an estimation of MPP from local fisheries as the import of multifilament nets is likely to be for the largely foreign tuna fleet which uses Port Louis as a logistic hub, but undertakes limited fishing activities in the Mauritius EEZ.

Small-scale coastal fisheries, industrial tuna fisheries and aquaculture all use nets. In 2019, total import of nets was 604 tons valued at $3.9 million. As indicated above, in 2019, the imports of monofilament nets were 67 tons and 10 percent of this quantity is considered to be lost or abandoned nets and gear and effectively MPP. A more detailed estimate could estimate losses of lines, buoys, fish boxes and other fishing gear.

The industrial tuna vessels may also loose net material, lines and other gear. In particular, FADs may be lost. While most of the tuna fishing takes place outside Mauritius' waters, lost gear and FADs can certainly drift into the vast EEZ.

7.1.7 Shipping

Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. In addition, in some countries, growing offshore oil/gas exploration activities can be a source of MPP and effective waste management may require to be specified or included in any revisions of the legislation on marine pollution or in the terms and conditions of concessions.

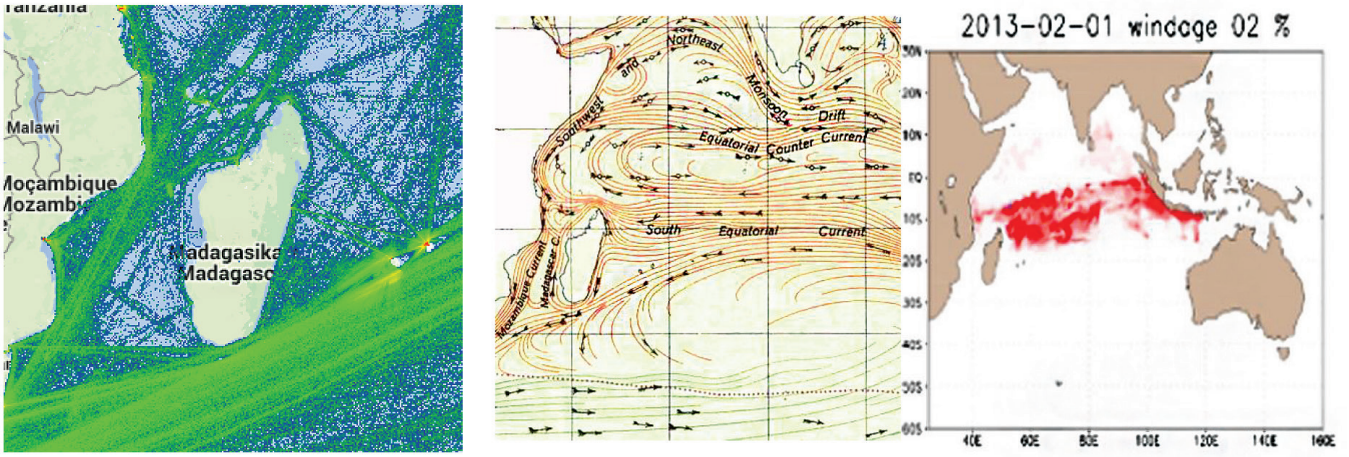
Figure 39. GRP boats and tourism are sources of MPP

In addition to MPP from shipping, the construction and disposal of fiberglass (GRP) boats for fishing or leisure is a potential source of MPP, particularly as GRP presents difficulties in recycling. Disposal of GRP boats can be costly, such that owners may allow boats to sink or 'rot' on the beach.

7.1.8 Ocean current and MPP

Other than fisheries and shipping, the main external source of MPP is the waste carried from Southeast Asia and possibly a smaller amount from South Asia. Although the models suggest that this MPP passes to the north of Mauritius island, it is washed up on St. Brandon and Agalega and may also be trapped in shallower areas of the Mascarene plateau.

Figure 40. Shipping traffic density, current eddies and plastic carried by ocean currents (model)



Images : AIS shipping, surface currents, model of plastic transport

A 2010 survey on 15 St. Brandon islets (38 km of shoreline) recovered 50,000 items of which 79 percent were plastic. Flip-flops alone were 23 percent. The labelling indicated the products were mostly of Asian origin (i.e., brands not sold in Mauritius).[285] As St. Brandon is some 3,350 km from the source of these items, they have either been transported by the South Equatorial Current and Equatorial Counter Current or dumped from fishing or cargo vessels. However, specific information on the quantities of MPP arriving in Mauritius is not available and beach clean-up activities do not sort debris by possible origin. Studies of beach debris in South Africa suggest a useful approach to determining origins.[286]

7.1.9 Microplastics

The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In Mauritius, the hydrography and high rainfall means that a significant proportion of microplastic pollution is likely to get flushed into the ocean.[287] The main sources are likely to be road runoff of rainwater containing microplastics from car tyre abrasion; untreated waste water (microbeads in cosmetics, cleaning agents, laundry); and air-borne microplastics resulting from paints, building materials and breakdown of macroplastics by wind and sun.

Microplastic pollution is estimated on the basis of car tyre abrasion which is considered to be the main source of marine microplastic pollution. It is estimated (i) on the basis of tyre imports and (ii) on a generic loss of tyre mass per vehicle (Table 18). In 2018, the stock of motor vehicles in Mauritius was approximately 556,000, each of which generates about 1.8 kg of microplastic waste per year, as tyres are compound of plastics and rubber.[288] Mauritius imported over 1600 tons of tyres in 2019. As

[285] Bouwman, H., et al. (2016). «The flip-or-flop boutique: Marine debris on the shores of St Brandon's rock, an isolated tropical atoll in the Indian Ocean.» Marine environmental research 114: 58-64. For additional studies see: Duhec, A. V., et al. (2015). Composition and potential origin of marine debris stranded in the Western Indian Ocean on remote Alphonse Island, Seychelles. Marine pollution bulletin 96(1): 76-86; Barnes, D., 2004. Natural and plastic flotsam stranding in the Indian Ocean. The effects of human transport on ecosystems: Cars and planes, boats and trains. Davenport, D. & Davenport, J. (Eds.). Royal Irish Academy, Dublin, 193-205.

[286] Ryan, P.G. 2019. Rapid increase in Asian bottles in the South Atlantic Ocean indicates major debris inputs from ships. 20892–20897 PNAS October 15, 2019 vol. 116 no. 42. www.pnas.org/cgi/doi/10.1073/pnas.1909816116.

[287] Devi, S.L et al. 2021. A pioneer assessment of microplastics in selected coastal mangrove forests of Mauritius. Oral presentation. Mar Pollut Bull . 2021 Feb 3;164:112019. doi: 10.1016/j.marpolbul.2021.112019. Plastic particles made up about 40% of the marine debris.

[288] Statistics Mauritius, 2018. Tyres contain up to 30% plastic resins and/or textiles.

the area of surfaced/tarmac road substantial in Mauritius, microplastics from tyre abrasion are likely to be washed into storm drains and into the sea. Microplastic pollution may also be generated by the textile industry although clothing made from synthetic fabrics are not usually washed prior to sale. Mauritius imported over 4,200 tons of synthetic fabrics in 2019, all of which are plastics. The possible contribution to microplastic pollution by the textile and garment industry has not been established.[289]

The preliminary estimate of microplastic marine pollution ranges from 17-102 tons/year as set out in Table 11. The table is provided as a basis for more accurate future estimates.

Table 18. A. Range of estimates of microplastic marine pollution from car tyres in Mauritius

	A. tyres	B. vehicles	source/ assumptions
A. Mauritius car tyres 2019 (tons)	1,664		UN Comtrade, imports 2019
B. Vehicles in service (numbers)		556,001	Statistcs Mauritius 2018
A. Annual microplastic loss (tons)	166		10% Kole et al.
B. Weight loss all /vehicles/year (tons)		1,023	1.84 kg/vehicle/year based on India
Retention in soil/ river beds	150	921	90% retention by soil (Kole)
Transport to the ocean (generic)	17	102	10% (generic) (Kole)

Source Kole et al.[290]

7.2 Existing and potential measures to combat MPP

7.2.1 Policy and planning

The concept of 'Maurice Ile Durable' and the 'Achieving Meaningful Change' address (2015) underpins a wide range of policies focused on a sustainable economy.[291] Mauritius does not have specific policy or plan to combat MPP and an updated national strategic plan on solid waste management (SWM) is being implemented. The National Environment policy identifies sustainable consumption as an aim and stresses the 'reduce, reuse, recycle' approach.

A wide range of regulations exist, in particular under the Environment Protection and the Local Government acts. Act. Mauritius is party to the relevant international conventions on waste management and has the required action plans and other measures, e.g., for medical waste, for dangerous chemicals, and for implementation of obligations under international conventions (e.g. Basel, Bamako, mercury). The responsibilities of the various actors have been described above.

7.2.2 Regulation.

Selected legislation of relevance to MPP is listed below (Box 15). The 'plastic' regulations require permits to import, or manufacture. Collection of wastes also requires a permit which may constrain informal collection. The older plastic bag regulations are not considered to be effectively implemented. The plastic bag regulations are being amended to include possession of plastic bags as an offence; and to delist transparent roll-on bags and pocket bags of less than 300 cm^2 as exempted plastic bags.[292]

[289] For upcycling of waste textiles in Mauritius see: https://twyg.co.za/beyond-the-age-of-waste-meet-the-designers-creating-a-circular-future-in-mauritius/

[290] Kole. P.J. at al. 2017. Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment. Int. J. Environ. Res. Public Health 2017, 14, 1265; doi:10.3390/ijerph14101265.

[291] See also: Assises de l'Environnement (2019) and the Consultative Workshop on National Environmental Policy (2020). https://www.mu.undp.org/content/mauritius_and_seychelles/en/home/news-centre/news/successful-host-of-consultative-workshop-on-national-policy.html.

[292] Budget Speech 2020-2021, Annex.

The 'Single-Use-Plastics Act' (SUP Act) bans the import of SUP cutlery, plates, cups, bowls, trays and other SUP items and encourages use of biodegradable substitutes.

Box 15. Selected legislation related to MPP

Environment and pollution

- Environment Protection Act 2002, Environment Protection (Amendment) Act 2008
- Environmental Regulations and Standards under the EPA 2002
- Environment Protection (Industrial Waste Audit) Regulations 2008
- Beach Authority Act 2002
- Use of Public Beach Regulations 2004

Local government

- Local Government Act 2011
- Local Government (Public Beaches) Regulations 1992
- Local Government Act (Dumping and Waste Carriers) Regulations 2003, which defines 'waste'
- Local Government Act (Registration of Scavenging Contractors) Regulations 2004
- Local Government Act (Registration of Recycler and Exporter) Regulations 2013
- Black River District Council (Collection and Disposal of Refuse) (Amendment) Regulations 2005 is an example of a local regulation

Plastic bags and bottles

- Environment Protection (Banning of Plastic Bags).
- Environment Protection (Polyethylene Terephthalate (PET) bottle Permit) Regulation 2001
- Environmental Protection (Banning of Plastic Banners) Regulations 2008
- and Reg. 2020 (GN 197 of 2020)
- Environment Protection (Control of single use plastic products) Regulations 2020
- Environment Protection (Banning of Plastic Bags) Regulations 2015 and Amendment 2015
- Environment Protection (Banning of Plastic Bags) Regulations 2020 GN 197 of 2020

7.2.3 A national MPP action plan?

Within the context of a national integrated solid waste management strategy a national action plan on MPP could be prepared.[293] A specialised MPP working group could be established within a national solid waste task force. The key actors could include, e.g., environment ministry, municipal authorities, finance ministry, chamber of commerce, media representatives and concerned NGOs. The MPP working group could include the Beach Authority, fisheries administration, marine and port authorities, tourism stakeholders and enterprises involved in the plastics and retail industries. The closely related development of the circular economy may require an additional and more industry/ innovation/ investmen- targeted working group.

A strategic action plan on MPP could include some or all of the following elements:

- anchoring the action plan in existing policies, plans, legislation and institutions
- establishing more precisely the scale of MPP, the main causes and the responsibilities for addressing those causes

[293] The 2017 Strategy and Action Plan proposes a range of stakeholder coordination initiatives.

- set out a vision of a low/no plastic waste society identifying long-term aspirational goals, immediate and longer-term actions, suggested investments and means of coordination, monitoring and review.
- suggest awareness campaigns targeted at decision-makers, local authorities, consumers and businesses or other priority targets
- development of codes of conduct to reduce plastic waste and MPP, e.g. through tourism organisations, cruise lines, supermarkets, beach users and fisher associations
- develop a coordinated approach by businesses engaged in plastic waste sorting, reuse and recycling, including in relation to EPR schemes, fiscal measures and possible cross-support to value chains which may be less economically viable (e.g. waste transport from Rodrigues)
- identify the resources and financing which may be required, including for innovation and the plastics circular economy, and in particular any catalytic measures required
- consider regional initiatives, including on exploring opportunities for harmonised product bans or 'environmental import tariffs'; for regional 'agreements' with major soft drinks suppliers for economies of scale in regional EPR and recycling (see 6.3.8).

7.2.4 Fisheries

Mauritius coastal fisheries (including Rodrigues) harvest about 3,500-4,000 tons per year with about 1,000 tons attributable to the sport/ amateur fishery.[294] About 2,000 small wooden, or GRP vessels are used. Because of the rocky and coralline sea bottom, it is likely that a significant amount of netting and lines are lost.[295] A relatively small aquaculture industry also uses nets for sea cages.

Given the nature of the small-scale fisheries, comprehensive marking of fishing gear and 'fishing' for lost gear may not be practical, except near marine parks or prime tourist/ dive sites, or where volunteer divers can be used.[296] Designation of sites for collection of waste fishing gear, possibly through the fisheries associations, and EPR arrangements with importers to ensure responsible disposal could be of value in addressing fisheries MPP. Pilot schemes could be considered in areas where there are existing fisheries management plans. EPR initiatives could also be initiated at a regional level through the Fédération des Pêcheurs Artisans de l'Océan Indien, (FPAOI).

FADs are likely to be a source of marine debris from the tuna fleet, which also fishes in other WIO countries. Analyses of beach litter from other WIO countries suggest that garbage from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the Mauritius EEZ.

For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements can be applied to fishing vessels.[297] Recycling of nets and ropes may require the economies of scale which may only be feasible through regional schemes (e.g. catalysed by SWIOFC, IOTC, or IOC), through close engagement with businesses and possibly with economic support from EPR arrangements with importers.

[294] Kelleher, K. 2017. Fisheries and aquaculture. Chapter in: The Ocean Economy in Mauritius. Making it happen, making it last. World Bank

[295] In the EU, about 20% of fishing gear is lost annually. However, this varies considerably by area and gear. Fishers report a relatively low loss of gillnets in the EU (<5%).

[296] Small-scale fishers often create local or 'proprietary' systems of marking fishing gear to prevent theft, or help in the recovery of lost gear.

[297] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear. Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

There are a range of guidelines available to prevent marine debris from fishing vessels. Workshops have been held, but it is unclear to what extent best practices are implemented in Mauritius, or regionally. A 2019 African regional workshop indicated a generally low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.[298]

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly as foreign vessels may land catches elsewhere (e.g., Victoria, Durban) and may not make port calls to Mauritius. This could start with resolutions by IOTC and SEAFO, possibly phasing in MARPOL Annex V requirements for vessels; introducing measures with respect to marking gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and could be an approved regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of any future EU fisheries access agreement.

Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. Abandoned GRP vessels present a growing plastic waste problem and are likely to progressively degrade to marine microplastics if abandoned. Most countries have no provision for appropriate disposal of GRP vessels. Rules for their disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

7.2.5 Shipping and tourism

Ensuring that Mauritius meets its obligations under MARPOL Annex V is the key action required. Mauritius Ports Authority (MPA) is responsible for all Mauritius ports. The MPA Port Waste Management Plan covers the management of all types of prescribed wastes under MARPOL for vessels calling at Port Louis. A 2018 Memorandum of Understanding between the MPA and a private company enables cleaning of floating debris from the port on a daily basis.[299] IMO auditors plan to carry out an audit of Port Louis Harbour on specific port control and environmental aspects by February 2020.[300] The MPA Quality and Environmental Policy Statement reads:

> "reduction of waste through responsible use of resources and as far as practicable favour the reuse, recycling and purchase of materials from sustainable sources [and that] relevant ISO Standards requirements including those pertaining to identified environmental aspects [will be applied]."[301]

[298] Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. https://doi.org/10.4060/ca9348en.

[299] Cleaning is cone by Froid des Mascareignes Ltd and the debris is collected by Polypet Recyclers Co Ltd.

[300] Mauritius Ports Authority. 2020. Annual Report 2019. See also: Ports (Operations and Safety) Regulations 2005. Part XII - Conservancy, pollution and environmental protection. http://www.mauport.com/sites/default/files/public/Ports%20%28Operations%20%26%20Safety%29%20Regulations%202005.pdf

[301] See also: Mohee, R. et al. 2012. Inventory of waste streams in an industrial port and planning for a port waste management system as per ISO14001. Ocean & Coastal Management Volume 61, June 2012, Pages 10-19. During the period April 2009 to May 2010 plastics represent 60% of ship waste and 608–782 tons of waste are expected on the waterside by 2014 (UNEP GEF WIO–Lab Solid Wastes Demo Project).

Dialogues with vessel operators and ships agents may help in separation of recyclables in ship's garbage.[302] Dialogues with IMO and regional port authorities could help ensure coordinated measures to prevent dumping of waste by shipping in the region and to foster codes of conduct for regional shipping lines.[303] MARPOL Annex V also applies to the disposal of garbage from fixed or floating platforms engaged in the exploration or exploitation of seabed oil and gas and should be stipulated in the relevant authorisations.

7.2.6 Circular economy

Mauritius already implements a number of circular economy initiatives in relation to plastics. A number of corporations, NGOs and local associations are engaged in recycling, export of plastic waste, manufacturing using recycled waste and a number of studies have explored various economic and technical aspects of reduction, reuse and recycling. The studies focus on separation of wastes, possibilities for PET recycling, and a range of related challenges.[304]

The Government of Mauritius has introduced sustainable public procurement which aims at making public expenditure more sustainable in terms of social, environmental and economic policies.[305] Eco-bins are to be made available for collection of plastic wastes and the Ministry of Environment is to promote separation of waste at source. Importantly, recycling activities are to be classified as a manufacturing activity in order to benefit from fiscal and other incentive schemes.[306]

The 'PET Bottle Regulation' is a form of EPR and places the onus for disposal on the bottling companies. In response, the Mauritius Bottlers Association (MBA) introduced a form of deposit/return scheme at supermarkets and beaches and payments of $0.25 per kg of PET, which is then flaked and exported with about 40 percent of the bottles passing through this system. Box 16 lists enterprises and organisations involved in plastic waste reuse or recycling.

Despite the recent inclusion of recycling as manufacturing, the sector is reported to have a number of constraints. These include:[307]

- lack of effective legislation and standards for export of waste plastics
- lack of incentives from the Government.
- high cost of collection and transportation of the wastes
- relatively high cost of labour and shortage of technical skills
- low public awareness.

[302] A wide range of IMO guidelines are available: Prevention of Pollution by Garbage from Ships https://www.imo.org/en/OurWork/Environment/Pages/Garbage-Default.aspx; Resolution MEPC.220(63) Guidelines for the Development of Garbage Management Plans; 2017 Guidelines for the implementation of MARPOL Annex V. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf; IMO, 2018. Consolidated guidance for port reception facility providers and users. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf.

[303] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report.

[304] N. Jhighut, 2016. Implementing source separation of household waste in Mauritius The J. of the Inst. of Engrg. Mauritius 2016 (2016); UCCIOI, 2020. Approche régionale de la gestion des déchets dans l'Océan Indien. Rapport final consolidé. Verso/Girus/Dynamia; Board of Investment., Smart Cities-Smart Mauritius-Building Intelligent, Innovative and Sustainable Cities of the Future, 2016; Foolmaun, R.K. et.al. 2012. Comparative life cycle assessment and life cycle costing of four disposal scenarios for used polyethylene terephthalate bottles in Mauritius, Environmental Technology, September 2012.

[305] Ministry of Social Security and Sustainable Development, Sustainable Consumption and Production: Best Practices in Mauritius, Government of Mauritius, 2013; Z. Allam, 2017. Building a conceptual framework for Smarting an existing city in Mauritius: The case of Port Louis. J. of Biourban. 4, 2017; Kowlesser, P. 2020. An Overview of Circular Economy in Mauritius. In Circular Economy: Global Perspective. Springer.

[306] Budget Speech 2020-2021.

[307] Beerachee, B., 2012. Overview of Wastes Management in Mauritius. SWMD, Ministry of Local Government and Outer Islands, Mauritius. Presentation, Seoul, Korea, 05 September 2012.

Box 16. Enterprises involved in plastic manufacture and / or recycling

- Soge International Company Limited. Export of PET bottles
- Polypet Recyclers Ltd. Export of PET bottles
- Atics Ltd. Export of PET bottles and plastic films
- Steel Scrap Ltd Export of PET bottles
- Paper link ltd Exporter of LDPEbd and HDPE
- Island Waste Ltd – Export of plastic bags
- Surfrider Co Recycling different plastics
- Neel Trading And Facilities – Exporter of PET bottles and other plastics
- Philippe Polybags Manufacturer ltd Recyling of different plastics
- Balti Plastics Ltd : Export of granules
- Viper Transport & Co Ltd Recyclage de plastiques
- Mission Verte (NGO). Collection, reuse
- WeCycle. Plastic export.
- Green Ldt. Plastic export
- Phoenix Bev. 500kg/hour PET recycling
- Polypet Recyclers, Reso Green, Sufrider et Balti plastic – collection of PET bottles
- Plaspak Ltd. Recycling of plastic bags and films (PE)
- Power Plastic. Collection and recycling of many types of plastics
- DKD Co Ltd. Recycling of plastic bags and films
- Reso Green. Collection
- Maurice G.Runghen et Co. Plastics and other wastes
- Alicia Swim, swimwear made from fishing nets and plastic from the sea
- Sotravic. Management of Mare Chicose https://www.sotravic.net/
- Belle Verte. https://www.facebook.com/bellevertemaurice/

Sources: Charbuillet 2018 and other sources.[308]

Note: Since China's ban on waste plastic imports and the recent requirements under Basel, some of these enterprises may not be active in the export of waste plastic. This provisional list can benefit from verification and updating.

As a result of the island economics and tourist market a range of up-cycling innovations have been developed.[309] Several reports outline alternative approaches to re-use and recycling, including practices, economic and financing issues and lessons from Asia and small islands.[310] The companion report on circular economy, prepared under this project, also provides additional perspectives.

[308] Charbuillet, C. et J.-M. Meurville, 2018 Etude de la gestion des déchets plastiques de la zone COI. Arts et Meties, ParisTech, AMValor, Inst, Carnot; Le processus de recyclage: les différents acteurs à Maurice https://www.wecycle.mu/2018/09/03/processus-recyclage-acteurs/

[309] See Alicia Swim anda rts and crafts products: https://twyg.co.za/beyond-the-age-of-waste-meet-the-designers-creating-a-circular-future-in-mauritius/; https://twyg.co.za/wp-content/uploads/2021/01/circular-design-final.pdf

[310] Lachmann et al. 2017. Marine plastic litter on Small Island Developing States (SIDS): Impacts and Measures. Appendix 3: Details for initiatives that (re-)use plastic litter; Weekes, J.G. et al. 2020. Solid waste management system for small island developing states. Global Journal of Environmental Science and Management (GJESM) https://www.gjesm.net/; UNCDR, 2020. UNCRD 10th 3R Forum. State of Plastics Report. https://sdgs.un.org/documents/uncrd10th-3r-forumstate-plastics-report-25105

7.2.7 Awareness of MPP

While Mauritius has ratified the Nairobi Convention's LBSA Protocol, MARPOL Annex V and enacted national legislation on plastic bag and SUPs, and despite various campaigns promoting recycling and combatting litter, there is reportedly a generally a low level of awareness of MPP.

A key foundation for a coherent awareness campaign is the national waste management plan upon which a strategy to combat MPP can be developed. Any awareness campaign on MPP can be built on this foundation and target specific groups and issues, such as decision-makers, retailers, beach users, or environmental education in schools. Under the 2017 Plan, a range of education and awareness campaigns are proposed.[311] Generic approaches to developing a MPP strategy and awareness initiatives are described in the main report. However, Mauritius has a range of existing initiatives through which awareness is already being raised and public engagement is increasing.[312]

The 2019/20 Budget made provision for a national campaign on household waste separation and provision of bags for the segregation.[313] Ideally a campaign will set out the economic, conservation and aesthetic arguments to enlist consumers, businesses and public representatives in a shared vision of clean beaches and waters, while specific campaigns target behaviours (e.g. disposal of cigarette butts), or lay the groundwork for a ban on products with microbeads. Mauritius has a high literacy rate, so mandatory labelling of plastic products and containers to encourage recycling or proper disposal could be useful. Awareness campaigns could potentially be associated with other initiatives on health, water, sustainability, or conservation in order to lower costs and link messaging to community priorities or projects.

7.2.8 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (and global) action. In cooperation with other countries, Mauritius could consider several initiatives:

- preparation of a joint strategic plan on MPP under the Nairobi Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Nairobi LBSA Protocol
- preparation of a funding submission by the Nairobi Convention secretariat for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-ups through existing initiatives, and preparation of a strategic plan on MPP
- further use of the regional projects supported by the IOC and Cap Business (e.g. in relation to recycling of PET bottles).

In conjunction with other countries, Mauritius could also consider initiating a dialogue in the regional economic commissions (COMESA, SADC) on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic waste (and other recyclable waste) would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for fishing nets, soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour

311 See the GoM/AFD 2017 Plan, Strategic Area V, which proposes 8 inter-related tasks, including enhanced stakeholder consultation/ cooperation and waste monitoring and 30 awareness/ education campaigns per year over 2 years with a cost of about $350,000.

312 Clean-Up Mauritius and Embellishment Programme - «Moris Nou Zoli Pei»; https://www.preciousplastic.mu/; https://sst.org.za/projects/african-marine-waste-network/wiomsa-marine-litter-monitoring-project/mauritius/.

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of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (such as bottled drinks manufacturers - see main report), and inform ongoing discussion on plastic and the environment within the WTO.

At the level of AIODIS and Africa, Mauritius could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA.[314] A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

The main project report provides greater detail and discussion of option for recycling of plastic waste and resourcing and financing opportunities. Reference can also be made to companion report on the circular economy (in preparation under a separate consultancy).

[314] Wienrich, N., Weiand, L., & Unger, S. (2021). Stronger together: The role of regional instruments in strengthening global governance of marine plastic pollution. IASS Study, February 2021; Carlini, G., & Kleine, K. (2018). Advancing the international regulation of plastic pollution beyond the UNEA resolution on marine litter and microplastics. Review of European, Comparative and International Environmental Law, 27(3), 234 – 244. https://doi.org/10.1111/reel.12258.

8 Seychelles

8.1 Marine plastic pollution in Seychelles

Although Seychelles pursues a range of actions to curb plastic pollution, Seychelles does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).[315] This report is a first step to estimate the scale of MPP, to describe the sources of MPP and to develop a national dialogue and action plan on MPP. It places particular emphasis on the existing solid waste management system and awareness-building initiatives; on environmental sustainability policies, on development of the circular economy, on regional cooperation and on identifying practical steps to combat MPP. The report is a working paper intended as a basis for stakeholder consideration and to be used to develop more in-depth analyses, to help align existing activities in Seychelles, to identify possible gaps and areas requiring additional efforts.

8.1.1 Sources of marine plastic pollution

There are three main sources of MPP in Seychelles:

- mismanaged, or unmanaged solid waste and litter - the most important
- marine sources - mainly local and foreign fishing activities, shipping and tourism, and
- plastics that may be transported by ocean currents from other countries.

The different sources are discussed in more detail below. Plastic waste is part of a broader waste management problem, one of a range of sustainable development challenges faced by Seychelles. The following sections provide a preliminary estimate of marine plastic pollution (MPP) in Seychelles and provides a synthesis of available information on MPP, including on microplastic marine pollution.

8.1.2 Estimate of marine plastic pollution and its basis

MPP is estimated primarily as a function of mismanaged land-based solid waste in Seychelles with some additions to reflect the marine sources.[316] The estimate of MPP relies on several assumptions, based on population, on solid waste generation, on the proportion of plastic in the waste and the amount of mismanaged plastic waste that is transported into the marine environment. The basis for these assumptions is set out below. Alternative approaches to estimating mismanaged plastic waste have not been explored at this stage.[317]

MPP in Seychelles is estimated at about 400 tons per year (Table 1). The information sources and assumptions are provided in the table or in the following text. As additional or more accurate information becomes available, this preliminary estimate can be adjusted accordingly.

[315] MPP is generally considered to account for about 80 percent of marine litter or debris. Jambeck et al. (2019) suggested the development of a 'marine litter action plan' for Seychelles.

[316] See Jambeck et al., 2014 for a description of the methodology.

[317] Cordier, M. et al, 2020. Plastic pollution and economic growth: the influence of corruption and the lack of education. 2020. https://hal.archives-ouvertes.fr/hal-02862787..

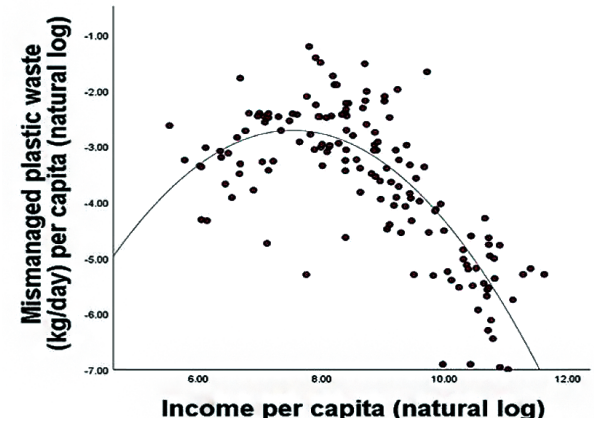
Table 19. Estimated marine plastic pollution in Seychelles

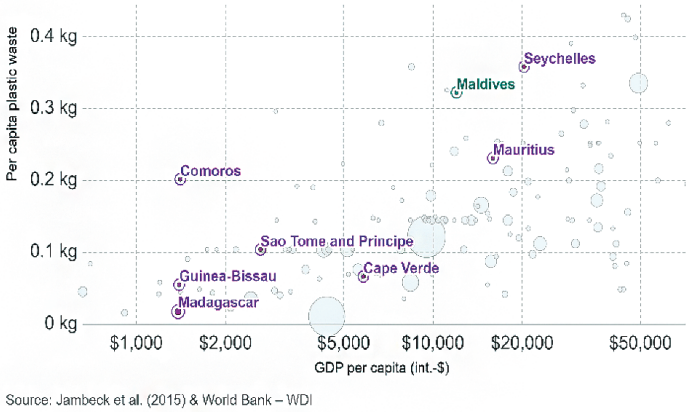
Item	Total	Source/ Assumption
Land-based sources (LBS)		
Population	98,000	World Bank 2020 (projection); 100% coastal
Waste average (kg/person/day)	1.6	World Bank, What a Waste 2.0; see text
Total waste (tons/year)	56,159	calculation
Plastic (%) of waste	10%	assumption, see text
Plastic waste (tons/year)	5,616	calculation
Mismanaged plastic waste (%)	5%	assumption, see text
Mismanaged plastic waste (tons/year)	281	calculation
Transport to marine environment (%)	50%	Assumption (100% os Seychelles is 'coastal')
Less beach/ coastal marine debris/ litter collection	-10%	assumption based on Jambeck 2019.
MPP from mismanaged solid waste (tons/year)	112	calculation
plus microplastics (tons)	17	see table 2
Total from LBS (tons/year)	129	calculation
Marine sources		
Domestic shipping (tons/year)	2	assumption domestic shipping / port operations
Domestic fisheries (tons/year)	26	assumption, based on import of nets (as proxy)
Non-Seychelles ocean sources		
International shipping	5	assumption (shipping in transit through EEZ)
Foreign fishing	236	assumption
MPP from ocean currents	5	assumption
Estimated MPP (tons/year)		
- domestic sources	157	calculation
- foreign sources	246	calculation
TOTAL (tons/year)	**403**	calculation

There is a relationship between plastic waste and income levels (Figure 1).[318] In Seychelles, tourism is a major generator of plastic waste and while tourism has temporarily declined, this may be slightly offset by the increase in the use of plastics to combat the pandemic.

[318] Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505

Figure 41. Relationship between income and mismanaged plastic waste





Sources: Barnes, 2019; Jambeck, et al. 2015.

8.1.3 Mismanaged solid waste

The Seychelles has 115 islands has a population of over 98,000 (2020), of which 56 percent are considered urban (2019).[319] Population density is 214 per km^2 for a total land area of 460 km^2. For the purposes of the MPP estimate, the entire population is considered to be 'coastal'. This means that mismanaged plastic waste in any part of Seychelles could potentially be transported to the sea by rain, flooding, wind, or by deliberate dumping or littering on the shore, or at sea.

The country generates an estimated 56,000 tonnes of waste per year, which is projected to increase as a function of population growth and tourism.[320] The Solid Waste Masterplan (2020-2035) projects an increase from 48,000 to 60,000 tons/ year over the plan period.[321] LWMA provides a value of 51,554 tons of municipal and commercial waste alone for 2020 and indicates total waste of over 95,000 tons/ year (including scrap metal green waste and other wastes). LWMA indicates that over 41,000 tons was received at the Providence waste dump in 2019, of which 88 percent was from Mahé (9 percent and 3 percent from Praslin and La Digue respectively). The Ministry of Environment indicates that 70,000 tons of waste is generated per year and estimates of waste received at Providence ranges as high as 75,000 tons in 2010.[322] As indicated above, a value of 56,000 tons is used for the purposes of the MPP estimate and could be adjusted as may be required. There is reported to have been a 100 percent increase in waste dumped during the last 15 years.[323]

There ae no official values on municipal waste collection efficiency. The Solid Waste Masterplan for Seychelles (2020-2035) assumes a rate of 90 percent efficiency (apparently based on a 2016 study by ETH).[324] However, in addition to the formal waste collection, informal waste collection is significant as 'waste pickers' benefit from a number of schemes that enable payment for used aluminium cans and PET bottles. An older study suggested that PET bottles collected and recorded at the redeem

[319] World Bank, 2020. https://data.worldbank.org/.

[320] Based on 1.57kg/cap/day (World Bank, What a Waste 2.0, 2018), a value which is used for the purposes of this study. A lower value is provided for 'municipal waste generation' in the Solid Waste Masterplan for Seychelles (2020-2035), which assumes that the rural population generate less waste (or that the rural organic waste does not enter the 'formal' waste management/ collection system). A 2017 study (Darmstadt University) suggested a rate of 2.45 kg/cap/day for Mahé. A definitive vale for waste generation is difficult to establish.

[321] COWI, 2020. Solid Waste Masterplan for Seychelles (2020-2035).

[322] http://www.meecc.gov.sc/index.php/what-we-do/waste-management/.

[323] Presentation, Victoria Alis (The Ocean Project Seychelles) citing TdLab, 2018.

[324] Lai A., Hensley J., Krütli P., & Stauffacher M. (Eds.) (2016). Solid Waste Management in the Seychelles. USYS TdLab Transdisciplinary Case Study 2016. ETH Zürich, USYS TdLab.

centre originated in equal shares from the informal sector, from households and businesses. Given the important informal sector and that most if not all hotel waste is effectively managed, waste collection efficiency is assumed to be 95 percent, meaning that 5 percent of waste is considered 'mismanaged'. MPP can result from illegal dumping, 'accidental' leakage during waste collection/ disposal, or littering and it is assumed that all mismanaged plastic waste can be washed into the marine environment. A 2019 study suggests that some of the leakage of litter to the marine environment may be offset by beach and urban clean-ups.[325] The 5 percent leakage of mismanaged waste has been adjusted to reflect this activity (an assumed 20 percent reduction).

Studies suggest that between 9.7 percent and 13 percent of municipal solid waste is plastic. However, some studies exclude 'green waste' (i.e., from garden maintenance) and these values probably refer to household waste that excludes some green waste which may be composted at household level. A value of 10 percent is used for the purposes of this estimate, but the recent introduction of bans on some plastics may significantly reduce this proportion in the near future.

8.1.4 Management of solid waste

he Ministry of Environment, Energy and climate Change is responsible for the development and the implementation of all waste management policy, legal and regulatory frameworks. The Landscape and Waste Management Agency (LWMA) is the Agency responsible for the cleaning and beautification of Seychelles. Waste Management Trust Fund (WMTF) coordinates the levy on aluminium cans and PET bottle at six redeem centres. A number of NGOs are active in addressing plastic pollution, engaged in policy and advocacy, in beach clean-ups or development of alternative products. The tourism industry is also prominent in efforts to combat MPP.

Various studies have identified several issues. These include:

- the high quantities of packaging waste and consumer plastic per person
- the limited capacity for landfill[326]
- lack of waste separation at household level
- cost of transport of waste from islands to the landfill site on Mahé.

A limited number of waste management companies undertake waste collection and disposal.[327] Some households compost bio-waste and several industries have specific means of waste disposal and may transport waste to the only managed sanitary landfill site where all unused, or non-recycled waste is disposed.[328] A ban on single use plastic bags came into force in 2017 and has reduced the amount of plastic waste disposed at the landfills.

[325] Jambeck, J.R. et al. 2019. Seychelles Circularity Assessment Protocol (CAP): Plastic Leakage Results and Recommendations A Report to the World Bank. https://documents1.worldbank.org/curated/en/615801576750964577/pdf/Seychelles-Circularity-Assessment-Protocol-Plastic-Leakage-Results-and-Recommendations-A-Report-to-the-World-Bank.pdf

[326] While methane emissions from landfill are included in the Seychelles NDC under the Paris Agreement, the extent to which planned mitigation measures have been implemented is unclear.

[327] E.g., http://www.wastea.sc/.

[328] Seychelles export of plastics was US$255,000 during 2019 (Comtrade).

Figure 42. Forms of waste management

8.1.5 Plastic pollution on beaches

There is a negative relationship between the amount of beach litter and beach visits, which potentially can influence the image of Seychelles as a tourist destination.[329] Local authorities, hotels and NGOs organise beach clean-ups and awareness events on keeping Seychelles' beaches clean (Figure 3). The NGOs and initiatives involved include: the Island Conservation Society (ICS), the Seychelles Islands Foundation (SIF), the Ocean Project Seychelles (TOP), Dive against Debris and Parley. For example, the Ocean Project hosted over 40 coastal clean ups, engaging 1200 volunteers that collected over 8 tons of beach/ marine debris. The LWMA and the Seychelles Sustainable Tourism Foundation (SSTF) hosted the "Seychelles' Biggest Beach Clean Up", where plastic comprised 51 percent of the debris by number of items. Plastic comprises over 55 percent of items on all clean-ups: almost 2 kg of debris per kilometre of beach.[330] In general, plastic from food and drink containers dominate the 'urban' beaches, while fishing gear and flip-flops tend to dominate the marine debris collected on the outer islands.

Figure 43. Beach clean-up, FAD removal, and marine debris removal from Aldabra

The clean-up operation on Aldabra atoll is of particular note. About 3.5 tons of marine debris was collected and removed at a cost of $8,900 per tonne. About 70 percent (by weight) of the debris was plastic, 83 percent of which was attributed to fisheries and 7 percent comprised flip-flops originating from outside the Seychelles. An estimated 513 tons of marine debris remains on Aldabra. Its removal from the World Heritage site would cost an estimated $4.68 million.[331]

[329] Brouwer, R. 2017. The Social Costs of Marine Litter Along the European Coasts March 2017. Ocean & Coastal Management 138:38-49.

[330] https://www.coastalcleanupdata.org/.

[331] Burt, A.J., Raguain, J., Sanchez, C. et al. 2020. The costs of removing the unsanctioned import of marine plastic litter to small island states. Sci Rep 10, 14458.

8.1.6 Fisheries

As there is no direct information on MPP from fisheries in Seychelles, the estimate given in Table 1 should be considered as a 'place-holder' until such time as further information is available. Both local small-scale and large-scale fisheries and foreign fishing are potential sources of MPP through lost gear and at-sea garbage disposal.[332] The import of fishing nets is used as a proxy for generation of MPP from fisheries, i.e., from lost nets, lines, ropes, buoys, fish containers, FADs and degradation of GRP (fiberglass) vessels. In 2018, Seychelles import of nets (HS 56811) was over 1,300 tons.[333] A significant proportion of the imported fishing gear is destined for the domestic and foreign tuna purse seine fleet, where losses of netting is low and some waste netting is collected for recycling and export from Seychelles. Nevertheless, there is a significant loss of purse seine FADs and longline gear (buoys, lines) within the Seychelles EEZ which is the most heavily fishing EEZ in the region.[334] It is assumed that 1 percent of the imports are used for domestic non-tuna fisheries and 9 percent of the imports are used by the Seychelles tuna fleet. Assuming 20 percent annual loss of fishing gear, the domestic fishing industry is estimated to generate 26 tons/ year of MPP. On this basis, and assuming a similar loss of gear, the foreign tuna fishing activities generate an additional 236 tons/year of MPP.

Recorded exports of netting from Seychelles is low but recorded exports of plastic waste (which may include netting) are in the order of 500-700 tons/year. The Seychelles Department of Blue Economy in collaboration with the Organisation of Frozen Tuna Producers (OPAGAC) and the Seychelles Fishing Authority are studying the scale of the issue and options to reduce/reuse/recycle waste netting and fishing gear.[335]

8.1.7 Shipping

Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. In addition, in some countries, growing offshore oil/gas exploration activities can be a source of MPP and effective waste management may require to be specified or included in any revisions of the legislation on marine pollution or in the terms and conditions of concessions. The cruising industry may also generate significant waste, though in general, cruise lines adhere to MARPOL rules.

Figure 44. Shipping, scrapped GRP boats and tourism are sources of MPP

[332] FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

[333] https://wits.worldbank.org/trade/comtrade/en/country/ALL/year/2018/tradeflow/Exports/partner/SYC/product/560811# .

[334] This is also evidenced by a study on marine debris on Aldabra atoll, where 80% of the debris was fishing gear.

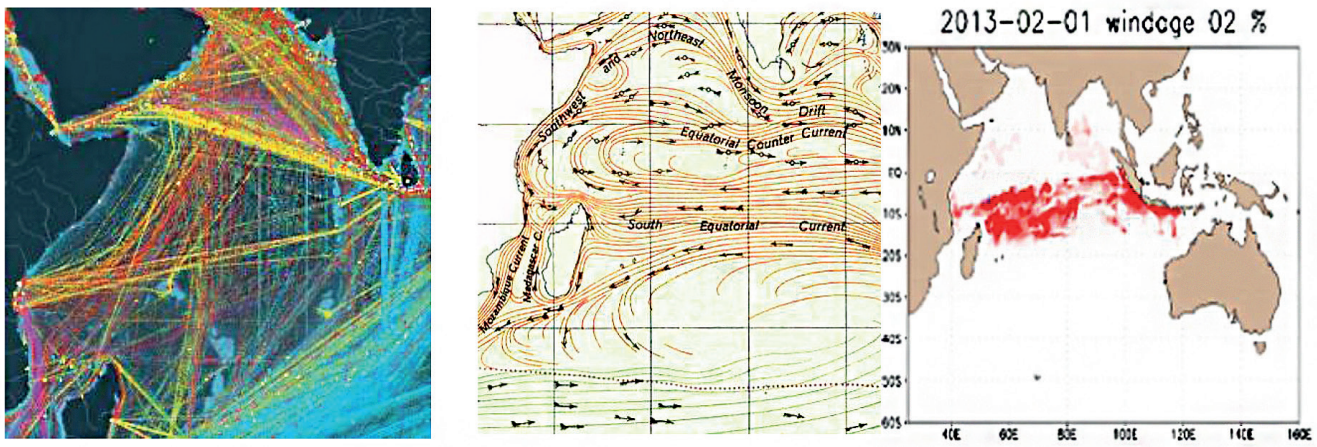
[335] http://www.seychellesnewsagency.com/articles/15261/Seychelles+looks+to+re-use%2C+recycle+fishing+nets%2C+saving+landfill+space

Comprehensive information on MPP from shipping and from non-Seychelles sources is not available. The values in Table 1 are placeholders which can be replaced with estimates based on any future assessments. In addition to MPP from shipping, the construction and disposal of fiberglass (GRP) boats for fishing or leisure is a potential source of MPP, particularly as GRP presents difficulties in recycling (Figure 4). Disposal of GRP boats can be costly, such that owners may allow boats to sink or 'rot' on the beach. A range of other plastics are also used in the marine sector – marine paints, pontoons, sails, cordage and products used in ship and vessel repair or maintenance and all contribute to MPP.

8.1.8 Ocean current and MPP

Quantification of the external sources of MPP is challenging. A distinction must be made between MPP present in the EEZ (e.g., suspended in the water column) and beached MPP (lying on the shore), which may not be representative of MPP as a whole. Several studies (on Aldabra, Alphonse Islands (Seychelles) and similar studies on St. Brandon (Mauritius) and in the Chagos indicate that substantial quantities of beached plastic originates from Asian sources, from disposal at sea by shipping and from fisheries activities.[336] A more recent study on Cousine Island indicates an accumulation rate of almost 3,000 items per km^2 per year, of which 80 percent is plastic.[337] However, it is not possible to make a realistic estimate of the quantity of MPP in Seychelles which is attributable to non-Seychelles sources.[338] Studies of beach debris in South Africa suggest a useful approach to determining origins.[339] No information is available on the quantities of MPP in the WIO water column. In summary, other than fisheries and shipping, the main external source of MPP is the waste carried from Southeast Asia and possibly a smaller amount from South Asia, mainland Africa and the Middle East. Models suggest that this MPP is driven by the South Equatorial Current through the southern part of the Seychelles EEZ (Figure 5). An assumed value of 5 tons per year is included in the estimate as a 'holding' figure which should be revised when relevant information on external sources of MPP becomes available.

Figure 45. Shipping traffic density, current eddies and plastic carried by ocean currents



Images : AIS shipping, surface currents, model of plastic transport from SE Asia

[336] Details of these studies are presented elsewhere in this report.

[337] S.W.Dunlop et al. 2020. Plastic pollution in paradise: Daily accumulation rates of marine litter on Cousine Island, Seychelles. Marine Pollution Bulletin. Volume 151, February 2020, 110803

[338] The quantities of beached plastic depend on numerous factors, e.g., the location and orientation of the beach, current systems, such that it is not possible to extrapolate to entire shorelines. In addition, the attribution of many plastic items to a source can be problematic, especially if the item is degraded and conversion of item numbers to weights is problematic.

[339] Ryan, P.G. 2019. Rapid increase in Asian bottles in the South Atlantic Ocean indicates major debris inputs from ships. 20892–20897 PNAS October 15, 2019 vol. 116 no. 42. www.pnas.org/cgi/doi/10.1073/pnas.1909816116.

8.1.9 Microplastics

The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In Seychelles, the hydrography and high rainfall means that a significant proportion of microplastic pollution is likely to get flushed into the ocean. The main sources are likely to be road runoff of rainwater containing microplastics from car tyre abrasion; untreated waste water (microbeads in cosmetics, cleaning agents, microfibers from laundry); air-borne microplastics from paints and building materials; breakdown of macroplastics by wind and sun; and the degradation of macro plastics in the marine environment.

Microplastic pollution is estimated on the basis of car tyre abrasion which is considered to represent about 30 percent of microplastic pollution.[340] Two estimates are made: (i) as a function of the number of vehicles; and (ii) as a function of tyre imports (Table 2). In 2018, the stock of motor vehicles in Seychelles was 20,334 each of which generates about 1.8 kg of microplastic waste per year, as tyres are compound of plastics and rubber.[341] Seychelles imported 640 tons of tyres in 2019.[342] As most of the roads in Seychelles are surfaced, microplastics from tyre abrasion are likely to be washed into storm drains and into the sea, although studies suggest that up to 90 percent may be retained in the soil. The preliminary estimate of microplastic marine pollution from car tyres ranges from 4-6 tons/year as set out in Table 2. If tyre wear is considered to contribute 30 percent, then the total microplastic MPP load ranges from 12-21 tons/ year – an average of 17 tons/year. This value is provided as a basis for more accurate future estimates.

Table 20. Estimates of Seychelles microplastic marine pollution based on car tyre degradation

	A. tyres	B. vehicles	source/ assumptions
Tyre imports 2019 (tons)	640		UN Comtrade, imports 2019
Vehicles in service (numbers)		20,334	Seychelles Licensing Authority 2018
A. Annual microplastic loss (tons)	64		10% Kole et al.
B. Weight loss all /vehicles/year (tons)		37	1.84 kg/vehicle/year based on India
Transport to the ocean (tons)	6	4	10% (90% retention by soil, Kole)
Total estimated microplastic MPP	21	12	Tyre wear 30% of microplastics

Source Kole et al.[343]

8.2 Existing and potential measures to combat MPP

8.2.1 Policy and planning

The relevant policies and plans draw on several foundational policy instruments including those on sustainable consumption, environmental conservation and development of the blue economy. The National Waste Policy 2018-2023 is a key policy instrument (an update to the Solid Waste Management Policy 2014–2018).[344] The policy refers to guiding principles for waste management including: the

[340] Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN. 43pp.

[341] http://www.sla.gov.sc/statistics/traffic-statistics/.Tyres contain up to 30% plastic resins and/or textiles.

[342] HS Code 410110. https://comtrade.un.org/data.

[343] Kole. P.J. at al. 2017. Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment. Int. J. Environ. Res. Public Health 2017, 14, 1265; doi:10.3390/ijerph14101265.

[344] Seychelles National Waste Policy 2018-2023 was approved in December 2018. The overall goal is to ensure that "Waste is managed in a sustainable manner, following the set guiding principles and approaches, in order to protect the integrity of the environment and improve the quality of life in Seychelles".

waste hierarchy, extended producer responsibility (EPR), the polluter-pays principle and the 'reduce, reuse, recycle' approach. It recognises the challenge of reducing waste going to the landfill and the role of a circular economy. More recently, a Solid Waste Masterplan has been prepared.[345] A range of studies have informed the polices and plans.[346] The Landscape and Waste Management Agency (LWMA) is charged with a number of tasks under the policy and is responsible for the cleaning and beautification of Seychelles. It administers waste management contracts for waste collection and landfill management, monitors and manages the different contractors for waste collection, landfill management, and beach and road cleaning in the Seychelles. Policy implementation faces the problems common to small island economies, including: economies of scale, finance, waste which cannot be recycled or reused at island level and a reliance on packaged imports.[347]

The Masterplan (2020-235) highlights a number of issues: weak implementation of previous plans, gaps in the regulatory framework, lack of competition in waste management contracting, financing and capacity challenges and lack of economies of scale.

8.2.2 Regulation

Key primary legislation includes the environment protection act and its regulations.[348] There are import and/or manufacture/distribution ban on plastic bottles and other single-use plastics including bags and polystyrene takeaway boxes, plates, cutlery and cups (2017) and drinking straws (2019).[349] These bans suffer from certain defects. There are exemptions for certain plastic bags and use of certain plastic products. Biodegradable and compostable plastic product are not banned, although Seychelles lacks the appropriate industrial composting facilities and waste separation. It is reported that enforcement of the plastic bag regulations is weak.[350]

Under the Customs Management Act (2011) there is an import levy on PET bottles. Part of the resulting revenues are transferred to the Waste Management Trust Fund (WMTF) to fund the recycling scheme, under which the waste is collected and exported for re-cycling.[351] As of 2020, there is no regulation of products that contain microbeads.[352] Seychelles is party to the relevant international conventions on waste management and has the required action plans and other measures for medical waste, for dangerous chemicals, and for implementation of obligations under international conventions (e.g., Basel, Bamako, mercury).

[345] EU, COWI, 2020. Solid Waste Masterplan for Seychelles (2020-2035).

[346] These studies include: Lai A., Hensley J., Krütli P., & Stauffacher M. (Eds.) (2016). Solid Waste Management in the Seychelles. USYS TdLab Transdisciplinary Case Study 2016. ETH Zürich, USYS TdLab; Nina Seraina Rapold, 2019. A Pathway Towards the Implementation of an Electronic Waste Management System in Seychelles Status Quo Analysis and Assessment of Future Strategies. (Thesis) ETH Zurich, Switzerland, June 2019; Nippon Koei Co., Ltd., 2019. Coastal Waste Management Infrastructure in a Changing Climate. Seychelles Risk Assessment Report. World Bank Group. Washington, D.C. http://documents.worldbank.org/curated/en/688371576750442818/Coastal-Waste-Management-Infrastructure-in-a-Changing-Climate-Seychelles-Risk-Assessment-Report

[347] See: Wang, K.C.M. et al. 2021. Solid Waste Management in Small Tourism Islands: An Evolutionary Governance Approach. Sustainability 2021, 13, 5896.

[348] Government of Seychelles. 2016. Environment Protection Act, Act 18. https://www.seylii.org/sc/Act%2018%20of%202016%20Envt%20Protn%20Act.PDF; Government of Seychelles. 2017. Environment Protection Regulations. https://members.wto.org/crnattachments/2017/TBT/SYC/17_0650_00_e.pdf.

[349] S.I. 38 of 2017 Environment Protection (restriction on importation, distribution, and sale of plastic utensils and polystyrene boxes) Regulations 2017.

[350] ICRI. Summary of legislative and regulatory mechanisms for the protection of coral reefs and associated ecosystems. Seychelles.

[351] COWI, 2020.

[352] In the region, only South Africa is preparing regulations. Eunomia, 2018. Investigating Options for Reducing Releases in the Aquatic Environment of Microplastics Emitted by Products. Eunomia. 23rd February 2018.

8.2.3 A national MPP action plan?

Within the context of the national integrated solid waste management strategy, a national action plan on MPP could be prepared. A specialised MPP working group could be established and include, e.g., environment ministry, municipal authorities, waste management companies, finance ministry, chamber of commerce, the tourism sector, media representatives and concerned NGOs. The groups could also draw on the Seychelles Fishing Authority, the Seychelles Port Authority and enterprises involved in the plastics and retail industries. The development of a plastics circular economy may require an additional industry/ innovation/ investment- targeted working group.

A strategic action plan on MPP could include some or all of the following elements:

- anchoring the action plan in existing policies, plans, legislation and institutions
- establishing the scale of MPP with greater accuracy, the main causes and the responsibilities for addressing the leakages
- further development of the vision of a low/no plastic waste society, identifying long-term aspirational goals, immediate and longer-term actions, suggested investments and means of coordination, monitoring and review
- focused awareness campaigns, for example in relation to household waste separation and opportunities to reduce or substitute plastic packaging
- development of codes of conduct to reduce plastic waste and MPP, e.g. through tourism organisations, cruise lines, supermarkets, beach users and fisher associations
- development of a coordinated approach by businesses to efficiently sort plastic waste and the progressive introduction of EPR schemes, fiscal measures and possible cross-support to waste management value chains which may be less economically viable
- identification of resources and financing which may be required, including for innovation and the plastics circular economy, and in any catalytic measures required
- consider regional initiatives, including on exploring opportunities for harmonised product bans or 'environmental import tariffs'; for regional 'agreements' with major soft drinks suppliers for economies of scale in regional EPR and recycling.

8.2.4 Fisheries

Analyses of beach litter from other Seychelles and other WIO countries suggests that FADs deployed by the purse seine tuna fleet is a significant regional source of marine debris and that garbage from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the Seychelles EEZ. FAO regional workshops have indicated a generally low level of awareness on the scale of lost or abandoned gear. There are a range of guidelines available to prevent marine debris from fishing vessels. It is unclear to what extent best practices are implemented in Seychelles.

Given the nature of the small-scale fisheries, comprehensive marking of fishing gear and 'fishing' for lost gear may not be practical, except near marine parks or prime tourist/ dive sites, or where volunteer divers can be used.[353] Designation of sites for collection of waste fishing gear could be envisaged, possibly through collaboration between the Seychelles Fishing Authority and the Seychelles Fishing Boat Owners Association. EPR arrangements with importers to ensure responsible disposal could be of value in addressing fisheries MPP. EPR initiatives could also be envisaged at a regional level through the Fédération des Pêcheurs Artisans de l'Océan Indien, (FPAOI).

[353] Small-scale fishers often create local or 'proprietary' systems of marketing fishing gear to prevent theft, or help in the recovery of lost gear. In the EU, about 20% of fishing gear is lost annually. However, this varies considerably by area and gear. Fishers report a relatively low loss of gillnets in the EU (<5%).

For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements can be applied to fishing vessels.[354] Recycling of nets and ropes may require the economies of scale which may only be feasible through regional schemes (e.g. catalysed by SWIOFC, IOTC, or IOC), through close engagement with businesses and possibly with economic support from EPR arrangements with importers.[355]

Reduction of MPP from licensed foreign fishing vessels requires a regional approach, particularly as the vessels make port calls throughout the region (e.g., Port Louis, Durban). This could start with resolutions by IOTC and SEAFO, possibly phasing in MARPOL Annex V requirements for vessels; applying measures to mark gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels, and could be an agreed regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of any future EU fisheries access agreement.

Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. Abandoned GRP vessels present a growing plastic waste problem and are likely to progressively degrade to marine microplastics if abandoned (Figure 4). Most countries have no provision for appropriate disposal of GRP vessels. Rules specifying means of disposal and setting out the responsibilities of owners or importers could be considered. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

8.2.2 Shipping and tourism

Ensuring that Seychelles meets its obligations under MARPOL Annex V is the key action required. The Seychelles Ports Authority is the key actor. Dialogues with vessel operators and ships agents may help in separation of recyclables in ship's garbage and help reduce landfill.[356] Dialogues with IMO and regional port authorities could help ensure coordinated measures to prevent dumping of waste by shipping in the region and to foster codes of conduct for regional shipping lines.[357] MARPOL Annex V also applies to the disposal of garbage from fixed or floating platforms engaged in the exploration or exploitation of seabed oil and gas and should be stipulated in any such authorisations.

The Sustainable Tourism Label Seychelles (SSTL), a sustainable tourism certification programme designed specifically for the Seychelles, could include specific provisions for plastics and gradually make such requirements mandatory within the industry.

[354] Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear. Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

[355] Coast of dismantling gear and contamination of ropes or netting by seaweed or other marine organisms are known challenges to recycling of gear.

[356] A wide range of IMO guidelines are available: Prevention of Pollution by Garbage from Ships https://www.imo.org/en/OurWork/Environment/Pages/Garbage-Default.aspx; Resolution MEPC.220(63) Guidelines for the Development of Garbage Management Plans; 2017 Guidelines for the implementation of MARPOL Annex V. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf; IMO, 2018. Consolidated guidance for port reception facility providers and users. https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf.

[357] UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report.

8.2.3 Circular economy

The Seychelles blue economy strategic framework advocates a circular economy approach which aims at reducing waste at all levels of the value chain, especially within the fisheries sector.[358] Seychelles already implements a number of circular economy initiatives in relation to plastics, notably in relation to collection and export of PET bottles.

Figure 46. Waste fishing nets – opportunity for a circular economy

Through cooperation between the Seychelles blue economy initiative, the Spanish tuna vessel operators association and the Seychelles Fishing Authority (SFA), opportunities to develop a circular economy for waste fishing gear are under study.[359] Other CE initiatives include a project to compost seaweed collected from Seychelles beaches which may also contribute to removal of other marine debris from beaches.[360] Composting of green waste is widespread. The 2020 Masterplan emphasises the need for waste separation at source to enable a circular economy, but also flags the weak economies of scale which constrain CE initiatives.

Several generic reports outline alternative approaches to re-use and recycling, including practices, economic and financing issues and lessons from Asia and small islands.[361] The companion report on circular economy, prepared under this project, also provides additional perspectives.

8.2.4 Awareness of MPP

There is a high level of awareness of MPP in the Seychelles, including the personal engagement of the President of the Seychelles in a range of ocean health issues.[362] Seychelles has ratified the Nairobi Convention's LBSA Protocol, MARPOL Annex V and enacted national legislation on plastic bags and SUPs. In 2020, Seychelles hosted the first meeting of the Basel Convention Plastic Waste Partnership working group.

Several NGOs have been closely involved in raising awareness at all levels, not only on MPP, but also on waste reduction and on the circular economy. A number of Seychellois have been trained in collection

[358] Seychelles Blue Economy: Strategic Policy Framework and Roadmap 2018 –2030 is based on wealth creation, social equity, improvement of livelihoods, and environmental conservation.

[359] The Organisation of Associated Producers of Large Freezer Tuna Vessels (OPAGAC) is an association of the operators of 47 tuna purse-seiners fishing in the Atlantic, Indian, and Pacific oceans. See: https://www.nation.sc/articles/10024/new-circular-economy-opportunities-from-discarded-industrial-fishing-nets.

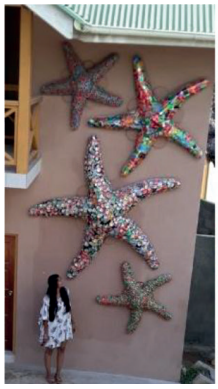
[360] The Seychelles Conservation and Climate Adaptation Trust (SeyCCAT) is supporting Women in Action and Solidarity Organization (WASO), http://vlscop.vermontlaw.edu/2021/01/08/healing-ocean-and-nature/.

[361] Lachmann et al. 2017. Marine plastic litter on Small Island Developing States (SIDS): Impacts and Measures. Appendix 3: Details for initiatives that (re-)use plastic litter; Weekes, J.G. et al. 2020. Solid waste management system for small island developing states. Global Journal of Environmental Science and Management (GJESM) https://www.gjesm.net/; UNCDR, 2020. UNCRD 10th 3R Forum. State of Plastics Report. https://sdgs.un.org/documents/uncrd10th-3r-forumstate-plastics-report-25105

[362] http://www.seychellesnewsagency.com/articles/9274/President+of+Seychelles+shocks+G+meeting+with+photos+of+ocean+trash

and analysis of MPP.[363] The Seychelles Sustainable Tourism Foundation (SSTF) has partnered with other NGOs to help integrate sustainability practices within the tourism sector. The clean-up campaigns have involved more than 1,300 volunteers. Other activities have involved creation of art work from the plastic collected in the beach clean-ups (Figure 7); The Last Straw Seychelles, a campaign to eliminate the use of plastic straws in Seychelles and screening of films on MPP and ocean health at schools and on TV.

Figure 47. High level of awareness of MPP in Seychelles



Waste plastic art

Plastic Arch - youth engagement

Community engagement

A key foundation for a coherent awareness campaign is the national waste management plan upon which a strategy to combat MPP can be developed. Any awareness campaign on MPP can be built on this foundation and target specific groups and issues, such as decision-makers, retailers, beach users, or environmental education in schools. Under the 2017 Plan, a range of education and awareness campaigns are proposed.[364] Generic approaches to developing a MPP strategy and awareness initiatives are described in the main report. The social and economic impact of marine litter and/or MPP in the Seychelles has not been assessed.[365]

8.2.5 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (and global) action. In cooperation with other countries, Seychelles could consider several initiatives:

- preparation of a joint strategic plan on MPP under the Nairobi Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Nairobi LBSA Protocol
- preparation of a funding submission by the Nairobi Convention secretariat for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-ups through existing initiatives, and preparation of a strategic plan on MPP
- further use of the regional projects supported by the IOC and Cap Business (e.g. in relation to recycling of PET bottles).

[363] Collaboration between UNEP / WIOMSA and Min Environment. https://www.marine.science/2021/04/01/seminar-tackling-plastic-pollution-in-the-indian-ocean/

[364] See the GoM/AFD 2017 Plan, Strategic Area V, which proposes 8 inter-related tasks, including enhanced stakeholder consultation/ cooperation and waste monitoring and 30 awareness/ education campaigns per year over 2 years with a cost of about $350,000.

[365] For an approach to such an estimate see: Werner, S., et al. 2016. Harm caused by Marine Litter. MSFD GES TG Marine Litter - Thematic Report; JRC Technical report.

In conjunction with other countries, Seychelles could also consider initiating a dialogue in the regional economic commissions (COMESA, SADC) on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic waste (and other recyclable waste) would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for fishing nets, soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (such as bottled drinks manufacturers - see main report), and inform ongoing discussion on plastic and the environment within the WTO.

At the level of AIODIS and Africa, Seychelles could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA.[366] A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

The main project report provides greater detail and discussion of option for recycling of plastic waste and resourcing and financing opportunities. Reference can also be made to companion report on the circular economy (in preparation under a separate consultancy).

366 Wienrich, N., Weiand, L., & Unger, S. (2021). Stronger together: The role of regional instruments in strengthening global governance of marine plastic pollution. IASS Study, February 2021; Carlini, G., & Kleine, K. (2018). Advancing the international regulation of plastic pollution beyond the UNEA resolution on marine litter and microplastics. Review of European, Comparative and International Environmental Law, 27(3), 234 – 244. https://doi.org/10.1111/reel.12258.

Appendix 2 Resources and Guidelines

Appendix to Part III

Appendix 2.1. Selected multilateral MPP resolutions and reports

UN oceans activities

The Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects. Oceans and the law of the sea Report of the Secretary-General. http://undocs.org/A/71/74

United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea. https://www.un.org/Depts/los/consultative_process/consultative_process.htm

United Nations Environment Assembly (UNEA) resolutions

UNEA 1. http://web.unep.org/environmentassembly/node/41224

UNEA 2 resolution Marine plastic litter and micro-plastics. https://web.unep.org/environmentassembly/resolutions-and-decisions-unea-2

UNEA 3 resolution Marine litter and microplastics. https://web.unep.org/environmentassembly/node/41405

UNEA 4 (2019) Marine Plastic Litter and Microplastics; Innovative Pathways to Achieve Sustainable Consumption and Production; Environmentally Sound Management of Waste; Sound Management of Chemicals and Waste; Protection of the Marine Environment from Land-Based Sources. https://web.unep.org/environmentassembly/proceedings-report-ministerial-declaration-resolutions-and-decisions.

UNEP/EA.4/Res.4 (2019) "Addressing environmental challenges through sustainable business practices".

United Nations Environment Programme (UNEP) reports

UN Environment, Combating Marine Plastic Litter and Microplastics: An Assessment of the Effectiveness of Relevant International, Regional and Subregional Governance Strategies and Approaches (15 February 2018), UNEP/EA..3/INF/5

Ad Hoc Open-Ended Group on Marine Litter and Microplastics, Co-Chairs' Summary of the First Meeting (Nairobi, 29-31 May 2018). UNEP/AHEG/2018/1/6, 60. 2 https://papersmart.unon.org/resolution/uploads/aheg_co_chair_summary_final_0.pdf#overlaycontext=adhoc-oeeg.

GPML (2018). Global Partnership on Marine Litter (GPML) - Purpose, function and organization. New York, NY: UN.

UNEP, 2016. Marine Plastic Debris and Microplastics - Global Lessons and Research to Inspire Action and Guide Policy Change. http://wedocs.unep.org/handle/20.500.11822/7720

UNEP, 2018. Mapping of global plastics value chain and plastics losses to the environment (with a particular focus on marine environment). http://wedocs.unep.org/handle/20.500.11822/26745

UNEP, 2018. Single-use Plastics: A Roadmap for Sustainability. https://wedocs.unep.org/handle/20.500.11822/25496

UNEP, 2016. Marine Litter Legislation: A Toolkit for Policymakers. ISBN 9789280735949. http://wedocs.unep.org/handle/20.500.11822/8630

UNEP, 2018. Exploring the potential for adopting alternative materials to reduce marine plastic litter. ISBN 978-92-807-3703-5. https://wedocs.unep.org/handle/20.500.11822/25485

UNEP, 2018. Legal Limits on Single-Use Plastics and Microplastics : A Global Review of National Laws and Regulations. http://wedocs.unep.org/handle/20.500.11822/27113

UNEP, 2018. Addressing marine plastics: A systemic approach, Stocktaking report, Nairobi. http://wedocs.unep.org/handle/20.500.11822/26746

UNEP, 2020. United Nations Environment Programme (2020). Single-use plastic take-away food packaging and its alternatives - Recommendations from Life Cycle Assessments.

UNEP, 2019. Plastics and Circular Economy: Community Solutions. https://sgp.undp.org//innovation-library/item/download/1784_1c10cd6fb14cdb59312acd3dec6a80ab.html

UNEP, 2019 Addressing Marine Plastics: A Roadmap to a Circular Economy. Wang, F., L. Talaue McManus, R. Xie (eds.). https://gefmarineplastics.org/.

Other International Organizations

IUCN, 2017. Primary Microplastics in the Oceans: A Global Evaluation of Sources. https://portals.iucn.org/library/sites/library/files/documents/2017-002.pdf

Global Environment Facility (GEF). Plastics and the circular economy: A STAP document. https://www.thegef.org/sites/default/files/publications/PLASTICS%20for%20posting.pdf

FAO, 2017. Microplastics in fisheries and aquaculture. http://www.fao.org/3/a-i7677e.pdf

OECD. Improving Markets for Recycled Plastics. Trends, Prospects and Policy Responses. https://www.oecd.org/environment/improving-markets-for-recycled-plastics-9789264301016-en.htm

Nordic Council of Ministers, 2021. Strengthen the Global Science and Knowledge Base to Reduce Marine Plastic Pollution. https://www.norden.org/en/publication/strengthen-global-science-and-knowledge-base-reduce-marine-plastic-pollution.

Appendix 2.2 Other initiatives to combat MPP

In addition to those described in **Error! Reference source not found.**, other selected initiatives on MPP are listed below.[367]

African Marine Waste Network, already described elsewhere.

Alliance to End Plastic Waste 2019 is a plastics industry led initiative to minimize and manage plastic waste with emphasis is on recycling, reusing and repurposing of plastic

APLM - Associao Portuguesa do Lixo Marinho may provide network links for some AIODIS

Basel Convention's 2019 Secretariat of the Basel, • Established to mobilise business, government, academic and civil society resources, interests and expertise to improve and promote the

Bioplastic Feedstock Alliance (2013) WWF and leading consumer provides 'thought leadership' on sustainable use of materials.

Circular Plastics Alliance 2018 EC led recycling focus with over 200 members.

Clean Cities, Blue Ocean 2019 USAID-led focuses on actions to stop urban sources MPP through partnerships, grants and other means

Clean Ocean Initiative https://www.eib.org/en/publications/the-clean-ocean-initiative.htm

Clean Seas Campaign 2017 UNEP led campaign to engage governments, the public and the private sector with focus on SUPs and the GPML

Close the Plastic Tap 2017 IUCN-led programme mobilises a wide range of stakeholders (governments, industries, science and society). Partners include the Coca-Cola Foundation, NORAD.

Cutting River Plastic Waste 2018 Benioff Ocean Initiative and Coca-Cola Foundation is a partnership to combat the flow of plastic waste from rivers to the oceans.

Friends of Ocean Action uses knowledge and influence to help the international community take steps for sustainably use oceans.

Global Tourism Plastics Initiative 2020 UNWTO-led initiative aims to articulate, support and scale-up action by tourism stakeholders to fight plastic pollution and involves some major hotel chains.

International Solid Waste Association (ISWA) Marine Litter Task Force 2017 is an international partnership that aims to improve SWM. ISWA has a wide range of online knowledge materials. https://www.iswa.org/knowledge-base/?v=d2cb7bbc0d23.

NaturALL Bottle Alliance 2017 major plastic bottle/packaging users aim at sustainability of materials Danone, Pepsi, Nestle

Next Wave Plastics 2017 is a consortium of multinational technology and consumer brands developing a global network of ocean-bound plastic supply chains and involves Ikea, HP, Dell, and others

No Plastic Waste Pledge 2019 Minderoo Foundation engages with industry on market-driven solutions for a circular plastics economy.

Ocean Conservancy's International Coastal Cleanup is the largest beach-cleaning event In 2014, more than 560,000 volunteers from 91 countries were involved.

Operation Clean Sweep 2012 American Chemistry Council and The Plastics Industry Association initiative to eliminate loss and promote BAT

[367] Sources: Barrowclough D. and C. Deere Birkbeck 2020. Transforming the Global Plastics Economy: The Political Economy and Governance of Plastics Production and Pollution.GEG WP 142; and other sources

Plastic Pollution Action aims to stop growth in plastic pollution by demonstrating 'investible and scalable' circular economy in selected economies by 2020 and is supported by industry.

Plastic Waste Partnership driven by the Rotterdam and Stockholm Conventions promotes the development of policy, regulation and strategies on the prevention and minimization of plastic waste

PREVENT Waste Alliance https://www.prevent-waste.net/en/

Sea the Future 2019 Minderoo Foundation aims to raise funding for market-driven recycling investment and engages with major industry players (AGC Chemicals Europe, INEOS, BASF, Lyondell Bassell and others).

The New Plastics Economy Initiative 2018 is a partnership between the Ellen MacArthur Foundation, UN Environment and others that aims to overcome the limitations of today's incremental improvements and fragmented initiatives. Its elements include: dialogues, commitments, a Plastic Pact, innovation and outreach. The Initiative is a major driver of other actions, including the New Plastics Economy Global Commitment

The Ocean Changemakers Challenge, a competition run by The Economist, will showcase innovation and business solutions related to sustainable use of the oceans. https://www.f6s.com/oceanchangemakerschallenge/apply.

The Ocean Cleanup develops technologies to rid the ocean of plastic with Maersk, Deloitte and others. https://theoceancleanup.com/partners/

The Plastics Leak Project 2019 provides guidelines for businesses mapping, measuring and forecasting plastic (including microplastic) leakage across their value chains (The Plastic Leak Project (PLP) Guidelines). Adidas, DOW, Mars Inc., McDonald's Corporation are among those involved.

Waste Free Oceans 2011 an alliance of European Plastic Converters to reduce, reuse and ultimately recycle marine litter.

World Plastics Council (2014) major raw plastic producers work with the GPML, UN agencies and others on recycling and SWM

Appendix 2.3 Selected resources for awareness building

Guidance on design of awareness campaigns

OECD, 2015. Behavioural and Experimental Economics for Environmental Policy (BEEP). 2015.

Shogren, J. 2012. Behavioural Economics and Environmental Incentives. OECD Environ. Work. Pap., no. 49, p. 0_1, 2012.

United Nations Environment, UN Global Impact, and Utopies, 2005. Talk the Walk? Advancing Sustainable Lifestyles through Marketing and Communications. 2005.

Center for Research on Environmental Decisions, 2009. The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and Interested Public. New York, 2009.

Gneezy, U., et al. 2011. When and Why Incentives (Don't) Work to Modify Behavior. J. Econ. Perspect., vol. 25, no. 4, pp. 191–210, 2011.

Media and materials

Children's books. https://trashhero.org/wp-content/uploads/2018/04/Trash_Hero_Kids_Book_EN.pdf

Children's board game and student book on waste (Ghana). https://internationalwasteplatform.org/happy-green-ghana/

Ways to reduce plastic in schools. https://internationalwasteplatform.org/poster-less-plastic-in-schools/

Take away meals. Bring your own containers. https://internationalwasteplatform.org/campaign-materials/

MARLISCO (Marine Litter in Europe Seas: Social Awareness and Co-Responsibility) has developed media to raise social awareness on marine litter

Webinars on plastic waste https://internationalwasteplatform.org/events/

Le Sénégal Propre et Vert https://internationalwasteplatform.org/le-senegal-propre-et-vert/

The European Week for Waste Reduction (EWWR) has a range of communication toolkits addressed at four target groups: citizens; schools, businesses; public authorities and NGOs (https://ewwr.eu/tools/#action_developers_toolkit) and several internal actions that apply to several categories have been developed, e.g. for sorting or reduced packaging (https://drive.google.com/drive/folders/1COuSfNVTThhuwdmZpljGG_qiCSOuPhLX)

In Collaboration with the Indonesian Plastic Recycling Association in 2013, Indonesia developed a comprehensive environmental education program for age 4 to 14 in Indonesian schools. The program included 2-day teacher training with focus on reduce, re-use and recycling, impact of waste on environment and establishment of school waste banks.

Mediterranean resources include: Malta invest/ CE https://www.wasteservmalta.com/en/about-us; and https://blueislands.interreg-med.eu/.

Ocean Plastics Academy. Purchase of a range of teaching materials. https://encounteredu.com/partners/common-seas-ocean-plastics-academy.

Course on marine environnent. https://aspea.org/images/aspea/pdf/2%C2%AA_fase_Folheto_CurtMAR_verso.pdf

Associação Portuguesa de Educação Ambiental, 2020. Relatório de Gestão e do Exercício Económico Ano 2019. https://aspea.org/images/aspea/relatorios/Relatorio_Gestao_Exercicio_Economico_2019.pdf

Break Free From Plastics offers a wide range of toolkits. https://www.breakfreefromplastic.org/custom-posts/?bffp_post_type=toolkits&bffp_post_title=toolkits&bffp_post_link=button_link; https://www.breakfreefromplastic.org/library/#resources.

Appendix 2.4 Guidelines on combatting MPP

Shipping

Barcelona Convention, 2019. Operational Guidelines on the Provision of Reception Facilities in Ports and the Delivery of Ship-Generated Wastes in the Mediterranean"

Monitoring

Barnardo T & Ribbink AJ (Eds.). 2020. African Marine Litter Monitoring Manual. African Marine Waste Network, Sustainable Seas Trust. Port Elizabeth, South Africa.

Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area. https://www.ospar.org/documents?v=34422

UNEP, 2020. National guidance for plastic pollution hotspotting and shaping action - Introduction report. Boucher J., et al. UNEP, Nairobi, Kenya.

GESAMP, 2019. Guidelines for the Monitoring and Assessment of Plastic Litter in the Ocean. 2019 #99 (123p.). http://www.gesamp.org/publications/guidelines-for-the-monitoring-and-assessment-of-plastic-litter-in-the-ocean.

Arcadis EU: The proposed target and its indicator: Methodology of the Marine Litter Coordination Group. Technical Guidance Documents on monitoring of marine litter.

CE and technical

Ellen MacArthur Foundation,. 2015. Delivering the circular economy – a toolkit for policymakers. Global Partners of the Ellen Macarthur Foundation.

3Rs, 2021. Guidelines for Corporate Plastic Stewardship. EA/ south pole/ Quantis. https://492cf074-7b7f-49f8-8583-397ad4fd0c39.filesusr.com/ugd/e94bf0_0480d0bd0efa4cf08b56355ca73ebc98.pdf

Publications from the Nordic Council of Ministers, the Nordic Council and associated organisations. www.norden.org/en/publications.

Plastic sorting at recycling centres Guideline, 2015:518

2018. Plastic Waste Markets. Overcoming barriers to better resource utilisation. 2018:525

Council for Scientific and Industrial Research (2015). Co-operative good practice guide in the waste sector: A guideline for co-operatives by co-operatives. CSIR: Pretoria.

The Essentials of Sustainable Packaging. Online and onsite training courses on sustainable packaging topics. https://sustainablepackaging.org/projects/esp/.

Sustainable Packaging Coalition. Design for Recycled Content Guide. https://recycledcontent.org/

International Solid Waste Association. 2016. A roadmap for closing waste dumpsites – the world's most polluted places. Vienna: International Solid Waste Association (ISWA). http://www.iswa.org/fileadmin/ galleries/About%20ISWA/ISWA_Roadmap_Report.pdf

The Circulate Initiative (TCI) "A Sea of Plastics Claims and Credits: Steering Stakeholders Towards Impact" https://d5f869f1-4310-4939-88bb-9d398556b445.filesusr.com/ugd/77554d_eff5a760596a456a9e565ec52bc687ba.pdf

UNEP, no date. The role of packaging regulations and standards in driving the circular economy. http://sos2019.sea-circular.org/wp-content/uploads/2019/11/FINAL_THE-ROLE-OF-PACKAGING-REGULATIONS-AND-STANDARDS-IN-DRIVING-THE-CIRCULAR-ECONOMY.pdf

ISEAL Alliance, 2020. Challenge the Label. https://community.isealalliance.org/challenge.

ISEAL, 2015. Sustainability Claims Good Practice Guide., Version 1.0, May 2015. www.isealalliance.org/sites/default/files/resource/2017-11/ISEAL_Claims_Good_Practice_Guide.pdf .

Filho, W. L. et al. An overview of the problems posed by plastic products and the role of extended producer responsibility in Europe. J. Clean. Prod. 214, 550–558 (2019). Article Google Scholar

Aidt, T., Jia, L. & Low, H. Are prices enough? The economics of material demand reduction. Philos. Trans. A 375, 20160370 (2017).

Nielsen, T. D., Holmberg, K. & Stripple, J. Need a bag? A review of public policies on plastic carrier bags – Where, how and to what effect? Waste Manag. 87, 428–440 (2019).

World Bank, Circular Economy and Private Sector Development: Learning Series. https://www.worldbank.org/en/events/2020/09/21/circular-economy-and-private-sector-development-learning-series#3.

ISO 14021:2016(en) Environmental labels and declarations. https://www.iso.org/obp/ui/#iso:std:iso:14021:en

ISO 15270:2008 Plastics. Guidelines for the recovery and recycling of plastics waste. https://www.iso.org/standard/45089.html

ISO Circular Economy -TC 323. https://www.iso.org/committee/7203984.html; https://www.iso.org/news/ref2292.html; https://www.iso.org/news/ref2402.html.

Socioeconomics, planning and law

UNEP, 2019. Strategies to Reduce Marine Plastic Pollution from Land-based Sources in Low and Middle - Income Countries. P.J.D. Gamaralalage & Kazunobu Onogawa. United Nations Environment Programme, 2019.

Africa Marine Waste Network/ SST. 2017. Strategy for Marine Waste: Guide to Action for Africa. Dec. 2017.

UN Environment (2017). Marine Litter Socio Economic Study, United Nations Environment Programme, Nairobi. Kenya.

Newman, S. et al. 2015. The Economics of Marine Litter. Chapter 14 in Bergmann, M. et al. (Eds.) 2015. Marine Anthropogenic Litter. Springer, 2015.

ISEAL's Code of Good Practice for Setting Social and Environmental Standards.

NORDEN, 2015. Economic policy instruments for plastic waste A review with Nordic perspectives. https://www.norden.org/en/publications

Review of legal instruments: http://apeuk.org/wp-content/uploads/2017/10/OPLI-v4-1.pdf

Appendix 2.5 Resources and finance

A 2019 study estimated that the cost of reducing MPP by 25 percent from 2010 levels using only technology would be in the order of 0.7-1 percent of global GDP (2017). A 2020 a modelled scenario for reduction of plastic pollution suggested a cost of $100 billion/year by 2040 for an 80 percent reduction in MPP.[368] The scenario involved a reduction in MPP from 29 million tons/year to 5 million tons/year. In comparison, the socioeconomic costs of MPP are estimated to be in the order of $2.5 trillion/year suggesting the 'social cost of marine plastic' is between $3,000 and $33,000 per ton per year.[369]

There are several potential sources of finance to implement solutions to 'the plastics problem'. A key discussion is likely to focus on the relative contributions of industry, governments and consumers and how the contributions are equitably managed and tracked. A greater understanding of the important roles of international financial agencies, WTO, standards and technical agencies, consumer watchdogs and their inter-relationships will be required.[370]

World Bank group

Several arms of the World Bank (WB) group are already engaged in combatting MPP. These include the lending operations (IBRD, IDA, IFC), PROBLUE and other trust funds managed by the WB.

Combatting MPP is one of the four target areas of the Blue Economy Action Plan. As of March 2020, the WB blue economy portfolio is around $5.6 billion in active projects. The WB municipal solid waste (MSW) portfolio has two pillars: infrastructure, and policy and institutional development. In the 2010-2020 period, the portfolio was over $3 billion, of which projects/ lending accounted for over $2 billion; IFC investments about $0.5 billion and advisory services and MIGA guarantees less than $200 million. The WB committed over $400 million to waste management in the Africa Region, of which about 7 percent targeted recycling and 3 percent targeted plastics. Over 20 percent of the interventions included some form of support for waste-pickers.[371] Indicators used in the projects include several of direct relevance to MPP, e.g.: rate of recycling and reuse of plastics; number of tourist beaches free of marine litter; fishing nets collected and recycled from targeted fleets. The SWM portfolio in 2020 was $1.3 billion with a further $2 billion pipeline.[372]

Sustainable Development Bond. In 2019, the WB launched a Sustainable Development Bond to draw attention to the challenge of plastic waste pollution in oceans. The fixed rate bond, brokered by Morgan Stanley & Co. LLC. was targeted at both institutional and individual investors in 2019 and raised $10 million.

PROBLUE is a WB-managed, multi-donor trust fund that contributes to the implementation of Sustainable Development Goal 14 (SDG 14), supports the development of integrated, sustainable and healthy marine and coastal resources and is aligned with the World Bank's twin goals of ending extreme poverty and increasing the income and welfare of the poor in a sustainable manner.[373]

[368] Breaking the Plastic Wave.

[369] Beaumont, N.J. et al., 2019. Global ecological, social and economic impacts of marine plastic. Marine Pollution Bulletin. Volume 142, May 2019, Pages 189-195

[370] Barrowclough D., 2020. Financing the shift from plastic – the role of public banks and the Green New Deal. UNCTAD Research Paper, UNCTAD: Geneva.

[371] See: worldbank.org/what-a-waste; Wahba, S. 2019. Financing SWM in Africa. https://africancleancities.org/data/2ndGeneralMeeting/D2_S4-3_Japan_UN-Habitat_MrWahda_EN.pdf.

[372] See also: World Bank, 2018. Small States: Vulnerability and Concessional Finance, Technical Note, OPCS, July 2018.

[373] https://www.worldbank.org/en/programs/problue.

WB projects. In South Asia, a US$50 million regional project will help curb plastic pollution in the region and ramp up eco-innovation to reinvent single-use plastic and production. The WB is supporting SACEP through the Plastic-free Rivers and Seas for South Asia project ($37 million IDA grant). The WB has contributed about $100 million to Indonesia's SWM programme which includes specific MPP reduction targets. The Korea Green Growth Trust Fund (KGGTF) has a partnership with the WB and is supporting studies on MPP.[374] The Japan Policy and Human Resources Development Fund (PHRD) is another WB-managed fund that provides a wide range of assistance and facilitates partnerships, knowledge sharing, resource mobilization and regional and global initiatives to assist developing countries meet the SDGs.[375]

International Finance Corporation (IFC) is the WB Group facility which supports private sector investments, including in waste management or recycling. IFC has provided a $300 million 'blue loan; to address marine plastic pollution. The loan will assist Indorama Ventures, a global plastic resin manufacturer to recycle 50 billion PET bottles a year by 2025, including in Thailand, Indonesia, Philippines, India, and Brazil.[376] IFC has also provided a financing package to Engee Manufacturing Limited, a leading Nigerian manufacturer of PET resin to enable the company to source more than 20 percent of its raw materials from local waste plastics. IFC is also helping banks develop innovative financing instruments earmarked for projects that protect oceans and livelihoods in the blue economy, including by supporting subnational governments and private sector actors along the plastic value chain.

Global Environment Facility supports a number of projects in Ghana, Indonesia and the Caribbean. GEF projects are implemented by international agencies, including the WB, UNEP and UNDP.[377] The projects may address MPP directly, or indirectly. For example, through a biodiversity lens, if plastics are seen to impact on endangered species (such as turtles, or seabirds); to enable invasive species. Support may also be part of a suite of measures to address marine pollution by hazardous waste.

Other development banks, such as the AfDB and ADB are also active, particularly in facilitating investment in SWM, while a range of UN agencies can provide technical and policy advice and capacity building (UNHABITAT, UNESCO, UNIDO).

Bilateral and multilateral initiatives

Sweden (SIDA), Japan, France (AFD), UK and Germany are among the countries committed to supporting reduction in MPP in developing countries. Germany launched the PREVENT Waste Alliance, the S2S Platform and supports a range of projects in Africa, Indonesia and Mexico.[378] With EIB and AFD, Germany's KfW Development Bank has supported the Clean Oceans Initiative.[379] In 2018, the UK government pledged GBP 16.4 million for the Commonwealth Clean Oceans Alliance to reduce marine litter in Commonwealth countries. The Oceans, Marine Debris and Coastal Multi-Donor Trust Fund (MDTF), funded by the governments of Norway and Denmark, is a key backer of Indonesia's Sustainable Oceans Program (ISOP).

[374] E.g., World Bank Group. 2021. Market Study for the Philippines : Plastics Circularity Opportunities and Barriers. East Asia and Pacific Region Marine Plastics Series;. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/35295 .

[375] Japan Policy and Human Resources Development Fund (PHRD). World Bank Group. https://www.worldbank.org/en/programs/japan-policy-and-human-resources-development-fund; Huq, W. Et al. 2018. Japan policy and human resources development fund: catalyst for progress.

[376] https://www.indoramaventures.com/en/home; Thailand PET recycling education. https://www.indoramaventures.com/en/updates/csr-activities/1375/local-recycling-initiatives.

[377] E.g., Reduce marine plastics and plastic pollution in Latin American and Caribbean cities through a circular economy approach ($7 million grant). https://www.iwlearn.net/iw-projects/10547.

[378] https://www.prevent-waste.net/en/.

[379] https://www.eib.org/en/publications/the-clean-ocean-initiative.htm.

NGO, corporate and other initiatives

Numerous NGOs and foundations are engaged in the combat against MPP and global conservation NGOs (e.g. WWF, IUCN) may work in partnerships with bilateral programmes, philanthropic foundations, corporate sponsors, or in the implementation of government-led projects. In addition to development of guidelines and analyses, several NGOs maintain a watching brief on the role of plastic credits.[380] A number of major plastic polluter (Coca-Cola, Unilever, Danone and others) provide various forms of support, e.g., the Coca-Cola Foundation and Benioff Ocean Initiative pledged $11 million to create an innovation network of targeting river plastic pollution. Some of the numerous NGOs and initiatives are noted in Box 17.

Box 17. Other NGOs and initiatives

Advisory Committee on the Protection of the Sea (ACOPS) undertakes scientific, legal and policy research and advisory and public awareness activities, including on MPP.
Basel Action Network (BAN) works to end the trade in toxic wastes and support the aims of the Basel Convention;
Birdlife international network, focus on plastics in seabirds.
US-based Blue Frontier, builds the solution-oriented citizen engagement.
Client Earth, a UK-based charity is focused on harnessing the law to protect the planet
Marine Conservation Society champions wildlife protection, sustainable fisheries and clean seas and beaches.
Marinet is a UK-based community marine campaigning organisation.
Natural Resources Defense Council (USA) uses law, science and activism to protect the environment.
US-based Ocean Conservancy, creates science-based solutions.
US-based Ocean Foundation supports, strengthen, and promote rganizations dedicated to reversing the trend of destruction of ocean environments around the world,
Pew Charitable Trusts, a $5 billion foundation supports a wide range of ocean conservation activities.
Plastic Oceans Foundation is a global non-profit organization dedicated to protecting our oceans from plastic pollution.
Plastic Pollution Coalition, founded in 2009, comprises over 500 NGO members, whose mission is to stop plastic pollution and its toxic impact on humans, animals, and the environment.
Project Aware, with offices in the US, UK and Australia, which works with the diving community on shark conservation and the elimination of ocean debris.
Save Our Seas Foundation (Switzerland) funds and supports research, conservation and education projects worldwide, focusing primarily on charismatic threatened wildlife and their habitats.
Sea Shepherd Foundation intervenes in the high seas to prevent illegal fishing and protect cetaceans and also works on combatting ocean plastic in Cabo Verde and other countries. Sea Shepherd Legal is a nonprofit public interest environmental law firm dedicated to marine conservation. EarthJustice is a USA nonprofit environmental law organization. End Ecocide campaign aims to criminalise 'ecocide', the mass destruction of life and ecosystems.
Others include: Friends of the Earth International network; Friends of Marine Life; Great Whale Conservancy; Greenpeace international network; Live Without Plastic; Oceanic Global; Peace Boat; Plastic Change; Searious Business; Waste Free Oceans; Blue Planet Society; Whale & Dolphin Conservation Society.

[380] The Circulate Initiative, 2021. A Sea of Plastics Claims and Credits: Steering Stakeholders Towards Impact. thecirculateinitiative.org; WWF Position:Plastic Crediting and Plastic Neutrality https://c402277.ssl.cf1.rackcdn.com/publications/1429/files/original/newWWF_Position_on_Plastic_Crediting_and_Plastic_Neutrality_.pdf?1611957221.

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