

## 7 Mauritius

### 7.1 Marine plastic pollution in Mauritius

Mauritius does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).<sup>265</sup> 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.<sup>266</sup> 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.<sup>267</sup>

The country has a population of over 1.27 million, of which 40.8 percent are considered urban.<sup>268</sup> Population density is 626 per km<sup>2</sup>, 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

<sup>265</sup> MPP is generally considered to account for about 80 percent of marine litter or debris.

<sup>266</sup> See Jambeck et al., 2014 for a description of the methodology.

<sup>267</sup> 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..>

<sup>268</sup> World Bank, 2019. <https://data.worldbank.org/>.

are generated daily.<sup>269</sup> 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.<sup>270</sup> 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.<sup>271</sup> The proportion of plastic in waste varies between industrial (6 percent), commercial (16 percent) and domestic (15 percent) sources.<sup>272</sup> 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.<sup>273</sup>

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.<sup>274</sup> 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.<sup>275</sup> 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.<sup>276</sup>

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.

<sup>269</sup> 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.

<sup>270</sup> Environment Statistics – 2018.

<sup>271</sup> 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).

<sup>272</sup> Kowlessor, P. Plastics Management in Small Islands Developing States. Presentation: [https://www.uncrd.or.jp/content/documents/2654Plenary%20Session\(3\)-Presentation\(6\)-Prakash%20Kowlessor.pdf](https://www.uncrd.or.jp/content/documents/2654Plenary%20Session(3)-Presentation(6)-Prakash%20Kowlessor.pdf)

<sup>273</sup> 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.

<sup>274</sup> 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, Chamillal D S, Munhurrin G., 2011. Overview of non-hazardous solid waste in the small island state of Mauritius. Resources Conservation & Recycling, 2011, 55 (11): 966 – 972.

<sup>275</sup> 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).

<sup>276</sup> 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.

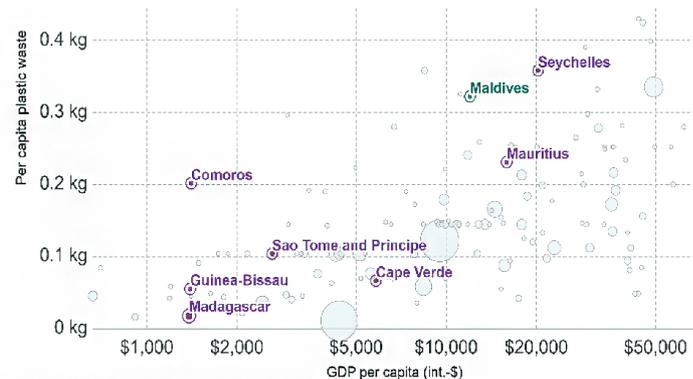
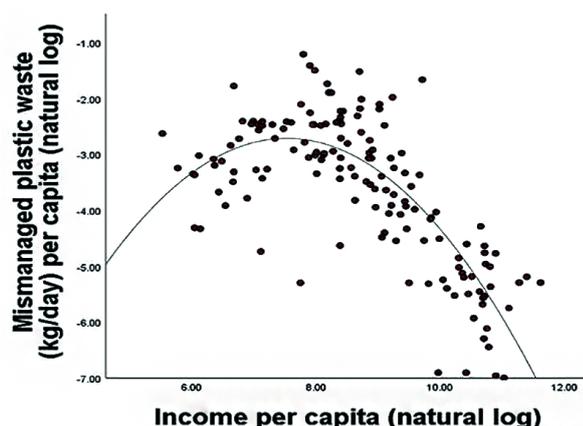
MPP in Mauritius is estimated at about 158 tons per year (Table 16). The sources and assumptions are provided in the table or in the text. As additional or more accurate information becomes available, this preliminary estimated can be adjusted accordingly.

**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).<sup>277</sup> 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**



Source: Jambeck et al. (2015) & World Bank – WDI

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

<sup>277</sup> 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.<sup>278</sup> 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.<sup>279</sup>

### 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.<sup>280</sup> Plastic bags were banned in 2014. A waste segregation project promoted awareness of recycling of plastic

<sup>278</sup> 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.

<sup>279</sup> PET 31%, LDPE and PVC 16% each, PP 14%, HDPE 12% and PS 4%. See Charbouillet op. cit.

<sup>280</sup> 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):<sup>281</sup>

- 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)<sup>282</sup> 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/><sup>283</sup>

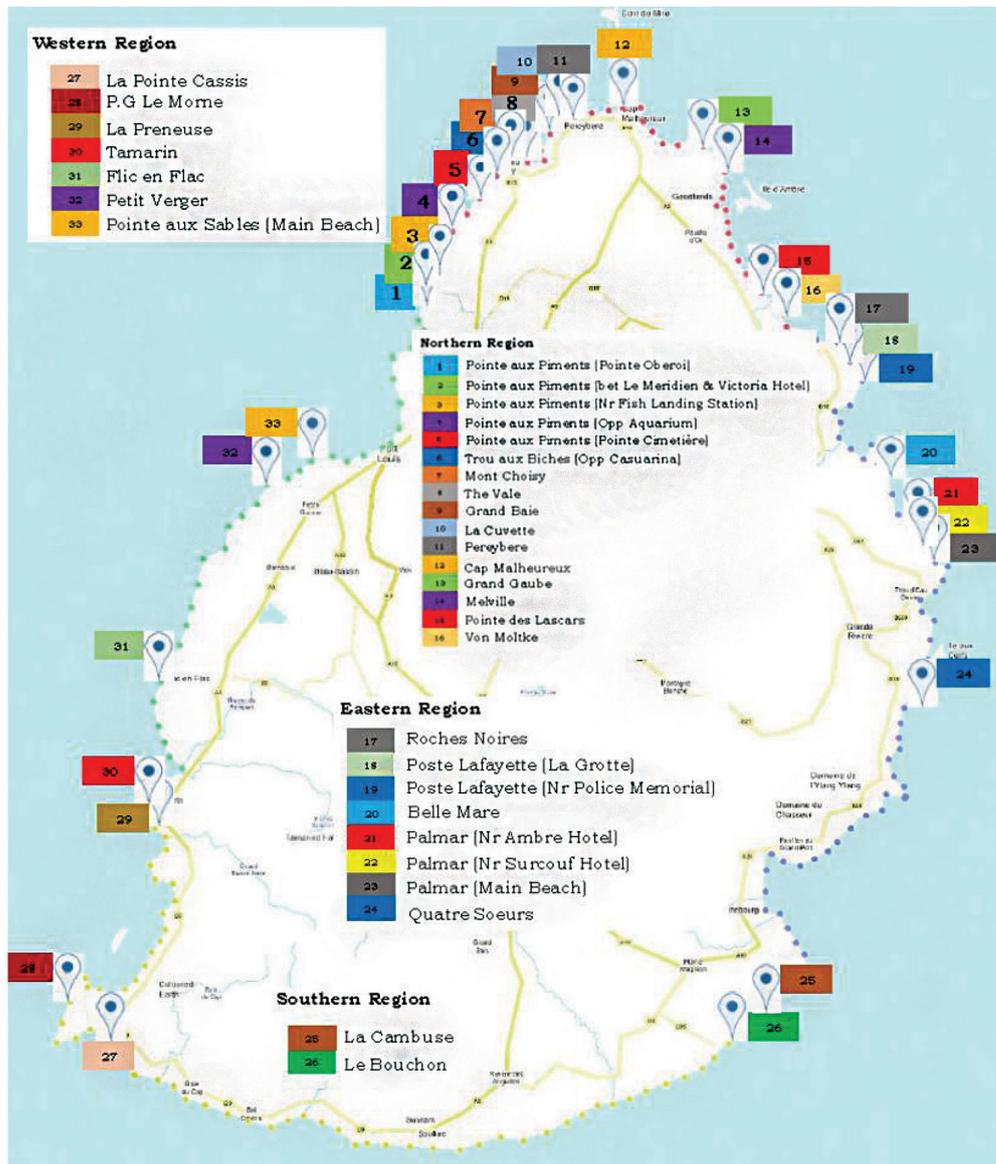
<sup>281</sup> KPMG, 2009.

<sup>282</sup> <https://www.beachauthority.mu/>. Customer Charter <http://beachauthority.mu/pdf/CustomerCharter2016.pdf>

<sup>283</sup> 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.<sup>284</sup> Losses are generally related to the type of gear and location where the fishing

<sup>284</sup> 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 lose 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**

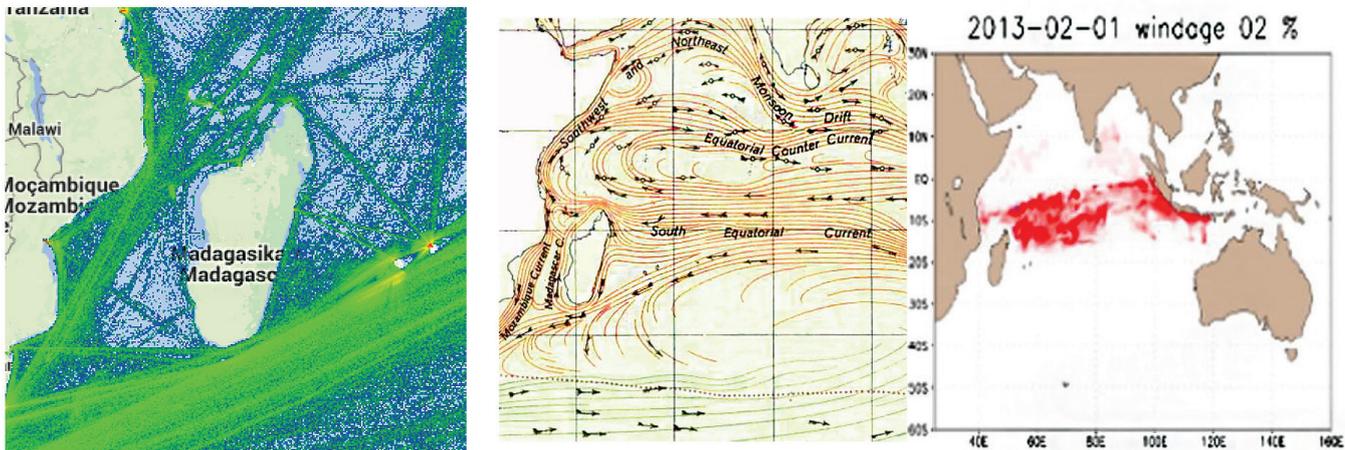


In addition to MPP from shipping, the construction and disposal of fiberglass (GRP) boats for fishing or leisure is a potential source of MPP, particularly as GRP presents difficulties in recycling. Disposal of GRP boats can be costly, such that owners may allow boats to sink or 'rot' on the beach.

### 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).<sup>285</sup> 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.<sup>286</sup>

### 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.<sup>287</sup> 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.<sup>288</sup> Mauritius imported over 1600 tons of tyres in 2019. As

<sup>285</sup> 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.

<sup>286</sup> 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](http://www.pnas.org/cgi/doi/10.1073/pnas.1909816116).

<sup>287</sup> 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.

<sup>288</sup> 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.<sup>289</sup>

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.<sup>290</sup>

## 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.<sup>291</sup> 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<sup>2</sup> as exempted plastic bags.<sup>292</sup>

<sup>289</sup> 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/>

<sup>290</sup> 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.

<sup>291</sup> 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](https://www.mu.undp.org/content/mauritius_and_seychelles/en/home/news-centre/news/successful-host-of-consultative-workshop-on-national-policy.html).

<sup>292</sup> 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.<sup>293</sup> 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/ 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 more precisely the scale of MPP, the main causes and the responsibilities for addressing those causes

<sup>293</sup> 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.<sup>294</sup> 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.<sup>295</sup> 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.<sup>296</sup> 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.<sup>297</sup> 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.

<sup>294</sup> Kelleher, K. 2017. Fisheries and aquaculture. Chapter in: The Ocean Economy in Mauritius. Making it happen, making it last. World Bank

<sup>295</sup> 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%).

<sup>296</sup> Small-scale fishers often create local or 'proprietary' systems of marking fishing gear to prevent theft, or help in the recovery of lost gear.

<sup>297</sup> 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.<sup>298</sup>

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.<sup>299</sup> IMO auditors plan to carry out an audit of Port Louis Harbour on specific port control and environmental aspects by February 2020.<sup>300</sup> 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].”<sup>301</sup>

<sup>298</sup> 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>.

<sup>299</sup> Cleaning is done by Froid des Mascareignes Ltd and the debris is collected by Polypet Recyclers Co Ltd.

<sup>300</sup> 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>

<sup>301</sup> 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.<sup>302</sup> 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.<sup>303</sup> 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.<sup>304</sup>

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.<sup>305</sup> 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.<sup>306</sup>

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:<sup>307</sup>

- 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.

<sup>302</sup> 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>.

<sup>303</sup> 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.

<sup>304</sup> N. Jhigut, 2016. Implementing source separation of household waste in Mauritius The J. of the Inst. of Engrg. Mauritius 2016 (2016); UCCIIOI, 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.

<sup>305</sup> 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; Kowlessor, P. 2020. An Overview of Circular Economy in Mauritius. In Circular Economy: Global Perspective. Springer.

<sup>306</sup> Budget Speech 2020-2021.

<sup>307</sup> 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 Recycling 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 Ltd. 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.<sup>308</sup>

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.<sup>309</sup> Several reports outline alternative approaches to re-use and recycling, including practices, economic and financing issues and lessons from Asia and small islands.<sup>310</sup> The companion report on circular economy, prepared under this project, also provides additional perspectives.

<sup>308</sup> 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/>

<sup>309</sup> See Alicia Swim and arts 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>

<sup>310</sup> 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.<sup>311</sup> 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.<sup>312</sup>

The 2019/20 Budget made provision for a national campaign on household waste separation and provision of bags for the segregation.<sup>313</sup> 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

<sup>311</sup> 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.

<sup>312</sup> 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/>.

<sup>313</sup> Budget Measures for Financial Year 2019/20

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.<sup>314</sup> A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

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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).

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<sup>314</sup> 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>.