NATIONAL GUIDANCE FOR PLASTIC POLLUTION HOTSPOTTING AND SHAPING ACTION

FINAL REPORT FOR MENORCA

December 2020

Implemented with ea + Quantis

Funded by the Didier et Martine Primat Foundation
Report published in December 2020, with results for year 2018

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To be cited as:
IUCN-EA-QUANTIS, 2020, National Guidance for plastic pollution hotspotting and shaping action, Country report Menorca
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The IUCN Centre for Mediterranean Cooperation (IUCN-Med) opened in Malaga (Spain) in October 2001 with the core support of the Spanish Ministry of Environment and the regional Government of Junta de Andalucia. The Centre’s mission is to influence, encourage and assist Mediterranean societies to conserve and use sustainably the natural resources of the region and work with IUCN members and cooperate with all other agencies that share the objectives of IUCN.

www.iucn.org/regions/mediterranean

EA is a research consultancy based in Switzerland, member of the European Network of Ecodesign Centres (ENEC). EA has developed a unique expertise in the field of marine plastic pollution and plastic footprinting. - www.e-a.earth

Quantis is a leading sustainability consulting firm specialized in supporting companies to measure, understand and manage the environmental impacts of their products, services and operations - www.quantis-intl.com
ACKNOWLEDGEMENT

It is with deep gratitude that the IUCN Plastic Waste Free Islands Med (PWFI Med) project leaders wish to thank the various partners from government, private sector and industry, academia and research, civil society and non-governmental organizations that contributed to this work through their participation in workshops, meetings, field excursions, and related consultations within the country.

This work could not have been accomplished, first and foremost, without the partners and stakeholders who supported the data collection efforts within each country. Finally, the tremendous technical guidance, cooperation, and support from Feng Wang and Ran Xie of the UNEP was pivotal in the development of the hotspotting methodology guidance.

Above all, the PWFI Med team acknowledges the generous support of the Didier and Martine Primat Foundation.

IUCN wishes to thank the Socio-environmental Observatory of Menorca (OBSAM) for their strategic guidance and support in ensuring that national activities and engagements were executed in a smooth manner. Special thanks to Joana Mendes and Eva Marsinyach for their support and providing data for this study.

The PWFI Med team would also like to thank the Department of Environment, the Menorca Biosphere Reserve Agency, and the Consortium of Waste and Energy of the Menorca Island Council (CIM), the General Directorate of Waste and Environmental Education and the Agency of Tourism Strategy of the Government of the Balearic Islands (GOIB), the Menorca Preservation Fund, the Balearic Group of Ornithology and Defence of Nature (GOB Menorca), the World Network of Island and Coastal Biosphere Reserves (ZERO Plastic Group), the LEADER-GALP- Local Fisheries Action Group of Menorca, the “Per la mar viva” group, the Marilles Foundation, and the Save the Med Foundation, for their support to this work.

In addition, the PWFI Med team extends its gratitude to colleagues at IUCN Secretariat.
SUMMARY AT A GLANCE

Global view on plastic in Menorca

90% Collection rate
10% Mismanaged
14% Collection for recycling
0% Domestic recycling rate

78 t Leakage
0.8 Kg Per capita leakage

Hotspots

Most critical polymers
- PET
- LDPE
- PP
- Synthetic rubber
- HDPE
- Polyester
- PS
- PVC
- Other

Number of hotspots per waste management stage
- Waste generation
- Waste segregation
- Waste collection
- Leakage while waiting for collection
- Waste related behaviors
- Waste management infrastructure

Shaping action from the hotspots

8 Actionable Hotspots
9 Priority Interventions

Alaior and Mahón Municipalities responsible for 56% of the plastic leakage
INTRODUCTION TO THE GUIDANCE
Provides the objectives of the Guidance, and introduces its associated workflow and main deliverables.

PLASTIC POLLUTION HOTSPOTS
Provides a detailed assessment of plastic leakage across five distinct yet complementary hotspots categories and draws clear statements to help shape action.

SHAPING ACTION
Provides a preliminary set of possible interventions and instruments in line with the plastic pollution hotspots results.

APPENDICES
Provides additional information including results data tables, hotspot score assessments and modelling assumptions.

BIBLIOGRAPHY
PLASTIC POLLUTION HOTSPOTS

2.1 Country Overview
Provides an outlook of the leakage assessment at the country level.

2.2 Detailed Hotspots Results
Provides a visual analysis and key interpretations across five complementary categories in which hotspots are prioritised based on a plastic leakage assessment.

2.3 Actionable Hotspots
Formulates clear statements based on the detailed hotspot analysis to help shape action towards plastic leakage abatement.
STRUCTURE AND OBJECTIVE OF THIS PRESENTATION

SHAPING ACTION

3.1 Interventions
Suggests meaningful actions based on the actionable hotspots drawn from the detailed plastic hotspot analysis.

3.2 Instruments
Provides a list of possible instruments to implement and monitor progress of suggested interventions.
1. Structure and Objective of this Presentation

2. Data Repository
   Provides data tables with the detailed figures behind the graphs.

3. Data Quality Assessment
   Provides an in-depth analysis of the quality scores behind the graphs.

4. Appendices

5. Bibliography
ICONS AND COLOUR CODE TO GUIDE THE READER

- Reference to the methodology (module/tool)
- Reference to the appendices
- Key take away as the main conclusion of a graph or result in a written format
- Learnings, that complement the key take aways with more details, of information that is not necessarily visible on the graph
- Limitations of the study, can be inaccurate data or gap in the modelling
- Things we foresee to unlock the limitations. They can serve as guidance for future studies

Methodology and appendices
Sections slides
Results and interpretations
**Domestic waste:** Waste generated within the country.

**Uncollected**: Waste fraction (including littering) that is not collected by the formal sector.

**Informal sector:** Individuals or a group of individuals who are involved in waste management activities, but are not formally registered or formally responsible for providing waste management services. Newly established formalized organizations of such individuals; for example, cooperatives, social enterprises and programs led by non-governmental organizations (NGOs), can also be considered as the informal sector for the purpose of this methodology.

**Properly disposed**: Waste fraction that is disposed in a waste management system where no leakage is expected to occur, such as an incineration facility or a sanitary landfill. We define a sanitary landfill as a particular area where large quantities of waste are deliberately disposed in an uncontrolled manner (e.g., waste being covered on a daily basis, as well as the bottom of the landfill designed in a way to prevent waste from leaching out). Landfilling is mainly the result of a formal collection sector.

**Improperly disposed**: Waste fraction that is disposed in a waste management system where leakage is expected to occur, such as a dumpsite or an unsanitary landfill. A dumpsite is a particular area where large quantities of waste are deliberately disposed in an uncontrolled manner, and can be the result of both the formal and informal sectors. A landfill is considered as unsanitary when waste management quality standards are not met, thus entailing a potential for leakage.

**Littering**: Incorrect disposal of small, one-off items, such as: throwing a cigarette, dropping a crisp packet, or a drink cup. Most of the time these items end up on the road or side-ways. They may or may not be collected by municipal street cleaning.

**Mismanaged waste**: It is defined as the sum of uncollected and improperly disposed waste. It is plastic that is prone to be released to the environment. The mismanaged waste index is the ratio of the mismanaged waste and the total waste. It is abbreviated as MWI and its value given in percentage.

**Leakage**: It is defined as the plastic released to the to rivers and oceans. The leakage rate is ratio between leakage and total waste generated, and its value is given in percentage.

**Release rate**: It is defined as the ratio between leakage and total mismanaged waste, and its value is given in percentage.

**Macro-plastic**: Large plastic waste readily visible and with dimensions larger than 5 mm, typically plastic packaging, plastic infrastructure or fishing nets.

**Micro-plastic**: Small plastic particulates below 5 mm in size and above 1 mm. Two types of micro-plastics are contaminating the world’s oceans: primary and secondary micro-plastics. In this study, we focus on primary micro-plastics which are are plastics directly released into the environment in the form of small particulates.

**Mass balance**: Mass balancing is a mathematical process aiming at equalising inputs and outputs of a given material flow across a system boundary. In our case, inputs consist of domestic production and imports while outputs consists of exports, waste generation and increase of stock. A mass balance allows to check data consistency and helps reconcile different datasets when needed.

**Formal sector**: Waste management activities planned, sponsored, financed, carried out or regulated and/or recognized by the local authorities or their agents, usually through contracts, licenses or concessions.

**Informal sector**: Individuals or a group of individuals who are involved in waste management activities, but are not formally registered or formally responsible for providing waste management services. Newly established formalized organizations of such individuals; for example, cooperatives, social enterprises and programs led by non-governmental organizations (NGOs), can also be considered as the informal sector for the purpose of this methodology.

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WHAT WE MEAN BY PLASTIC LEAKAGE / IMPACTS

By plastic leakage we refer to a quantity of plastic entering rivers and the oceans.

By plastic impact we refer to a potential effect the leaked plastic may have on ecosystems and/or human health.

# Parameters ruling the leakage quantification in the model

- General waste management
- Recycling
- Wastewater and run-off water management
- Plastic consumption patterns
- Population density
- Value of the polymer
- Size of application
- Type of use
- Distance to shore and rivers
- Hydrological patterns

# Parameters ruling qualitative impact assessment

- Beach clean-up data
- Size and shape of applications
- Presence of toxic substances in polymers or additives

Leaked plastic stems from uncollected and improperly disposed waste.

Note that the rest of the uncollected and improperly disposed plastic may be leaking into other environmental compartments such as "soil", "air" or "other terrestrial compartment" as defined in the Plastic Leak Project (PLP) guidance.

This information is not required to shape action but could be calculated using the PLP guidance.

RELATED TO THE PLP GUIDANCE
# LEAKAGE PATHWAY AT A GLANCE

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<tbody>
<tr>
<td>Land sources of plastic waste (including imports and exports, domestic production and change of stock)</td>
<td>Collected (through the formal waste collection system or informal sector)</td>
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<tr>
<td>Collected</td>
<td>Collected for recycling</td>
<td>Domestic recycling</td>
<td>Leaksage</td>
</tr>
<tr>
<td>Properly disposed</td>
<td>Improperly disposed</td>
<td>Export of waste</td>
<td></td>
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<tr>
<td>* Sanitary landfills</td>
<td>* Dumpsites</td>
<td>Mismanaged</td>
<td></td>
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<td>* Incineration facilities</td>
<td>* Unsanitary landfills</td>
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Plastic pollution hotspots: Menorca
## Key Abbreviations and Units

### Polymer Abbreviations

<table>
<thead>
<tr>
<th>NAME</th>
<th>ABBREVIATION</th>
<th>TYPICAL PRODUCTS</th>
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<tbody>
<tr>
<td>Polyethylene Terephthalate</td>
<td>PET*</td>
<td>bottles, food wrappings</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>PP</td>
<td>hot food containers, sanitary pad liners</td>
</tr>
<tr>
<td>Low-density Polyethylene</td>
<td>LDPE</td>
<td>bags, container lids</td>
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<tr>
<td>High-density Polyethylene</td>
<td>HDPE</td>
<td>milk containers, shampoo bottles</td>
</tr>
<tr>
<td>Polystyrene</td>
<td>PS</td>
<td>food containers, disposable cups,</td>
</tr>
<tr>
<td>Polyvinyl Chloride</td>
<td>PVC</td>
<td>construction pipes, toys, detergent bottles</td>
</tr>
</tbody>
</table>

*In this study, PET resins are distinguished from Polyester which includes polyester fibres, polyester films and polyester engineered resins.

### Key Units

<table>
<thead>
<tr>
<th>NAME</th>
<th>SYMBOL</th>
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<tbody>
<tr>
<td>Kilogram</td>
<td>kg</td>
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<tr>
<td>Tonne</td>
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<tr>
<td>Kilo tonne (or thousand tonne)</td>
<td>kt</td>
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<tr>
<td>Mega tonne (or million tonne)</td>
<td>Mt</td>
</tr>
<tr>
<td>Kilometer</td>
<td>km</td>
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<tr>
<td>Square kilometer</td>
<td>km²</td>
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### Calculation Variables

<table>
<thead>
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<th>NAME</th>
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<tr>
<td>Mismanaged waste index</td>
<td>MWI</td>
</tr>
<tr>
<td>Leakage rate</td>
<td>LR</td>
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<tr>
<td>Release rate</td>
<td>RR</td>
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</table>
INTRODUCTION TO THE GUIDANCE

National guidance for plastic pollution hotspotting and shaping action
The guidance allows users to:

1. Generate country-specific plastic waste management datasets
2. Identify plastic leakage and pollution hotspots
3. Prioritise actions
RELATIONSHIP BETWEEN HOTSPOTS, INTERVENTIONS AND INSTRUMENTS

The guidance is built upon the backbone of three questions: where to act? (Hotspots), what to do? (Interventions) and how to do it? (Instruments)

1. A component of the system that directly or indirectly contributes to the magnitude of plastic leakage and/or its impacts. It can be a component of the system, a type of product/polymer or a region within the country.

2. An action that can be taken to mitigate the leakage from a given hotspot or reduce its impacts.

3. A practical way to implement the intervention and enable progress.

Examples
- Low recycling rate for flexible packaging
- Single-use plastic bags
- Low waste collection rate in rural areas
- Implement better eco-design + chemical recycling
- Reduce plastic bag use in the country
- Increase waste collection
- Develop funding mechanism through EPR scheme
- Ban on plastic bags / introduce re-usable alternative
- Help local waste pickers to create a revenue stream
<table>
<thead>
<tr>
<th>MODULES</th>
<th>INPUT TOOLS</th>
<th>ASSESSMENT TOOLS</th>
<th>OUTPUT TOOLS</th>
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<tbody>
<tr>
<td>T1</td>
<td>INVENTORY OF PLASTIC FLOWS</td>
<td>Inventory of data sources and data gaps</td>
<td>COMTRADE data extraction</td>
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<tr>
<td>T2</td>
<td>CHARACTERISATION OF WASTE MANAGEMENT</td>
<td>Data collection templates</td>
<td>Fisheries model</td>
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<tr>
<td>T3</td>
<td>MODELLING POLYMER/APPLICATION/SECTOR HOTSPOTS</td>
<td>Waste model canvas</td>
<td>COMTRADE data extraction</td>
</tr>
<tr>
<td>T4</td>
<td>IDENTIFICATION OF WASTE MANAGEMENT HOTSPOTS</td>
<td>Waste data by archetype</td>
<td>Fisheries leakage calculation</td>
</tr>
<tr>
<td>T5</td>
<td>MODELLING REGIONAL HOTSPOTS</td>
<td>GIS model</td>
<td>Leakage calculation</td>
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<td>T6</td>
<td>ASSESSING IMPACTS</td>
<td>Plastic application impact assessment</td>
<td>GIS modelling quality assessment</td>
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<tr>
<td>S1</td>
<td>ACTIONABLE HOTSPOT FORMULATION</td>
<td>Interventions selection</td>
<td>Interventions prioritisation</td>
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<tr>
<td>S2</td>
<td>INTERVENTION IDENTIFICATION</td>
<td>Interventions library template</td>
<td>Interventions library template</td>
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<td>S3</td>
<td>INSTRUMENT ALIGNMENT</td>
<td>Instruments library template</td>
<td>Instruments library template</td>
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This report intends to present **only the results of the analysis** and not the detailed modelling process.

Additional information on the methodology and modelling process can be found directly in the **modules and tools** associated with the guidance and highlighted by this icon.
2 PLASTIC POLLUTION HOTSPOTS
2.1 COUNTRY OVERVIEW
Summary of the results for all plastics in the country

- **Key take-aways**
  - 10,220 tonnes of plastic waste generated in Menorca in 2018, from which 2,476 tonnes (24%) are attributed to the tourism sector. Plastic waste generation per capita amounts to 111 kg/cap/year (including tourists on annual basis).
  - 90% collection rate on average.
  - No recycling facilities in Menorca. Around 14% of plastic waste is exported for recycling.
  - 7734 tonnes of plastic waste are landfilled (assuming no incineration facility is in place).
  - 10% of plastic waste is mismanaged in Menorca (either littered or uncollected).
  - 78 tonnes of plastic leak into waterways from Menorca in 2018, including 19 t (24%) attributed to the tourism sector. This corresponds to a 1% leakage rate and 0,8 kg/cap/year leakage per capita.

**Note:** For simplicity, in this figure, we removed a part of the “leakage” from the “uncollected” so that the “uncollected” value displayed corresponds to a post-leakage situation.
MACRO-LEAKAGE VS MICRO-LEAKAGE [2018]

Key take-aways
- Micro-leakage contributes for 7% of the overall country leakage. This is mainly driven by tyre dust from abrasion during road transportation.

Limitations
To estimate tyre abrasion, we used the average distance travelled by car in Spain (ODYSSEE-MURE, 2020) divided by two (as mobility on the island is assumed to be reduced compared to a mainland country). We assumed that trucks are covering the same average distance as cars.

More details available in Appendices

* The methodology used to calculate micro-plastics leakage is based on the Plastic Leak Project (2019)

72 t Macro-leakage

78 kt

TO WATERWAYS AND OCEANS:

5.6 t Micro-leakage

5.1 t Tyre dust

0.3 t Textile fibers

0.2 t Cosmetics

0 t Pellets

Plastic pollution hotspots: Menorca
OPEN BURNING: A ROUGH ESTIMATE [2018]

1059 t
Total plastic mismanaged

60% Potentially released into the air as noxious chemical substances through open burning

POLLUTION TO THE AIR: 635 t

Although we do not have specific data on burning, we suggest a rough estimate of how much plastic could be polluting the air by using the assumptions made in the *Breaking the Plastic Wave* report (Lau et al., 2020): 60% of uncollected plastic waste and 13% of plastic waste at dumpsites are burnt on average worldwide. In the case of Menorca, it would translate into having 60% of the total plastic mismanaged ending up polluting the air through open burning.

Investigate open burning practices and conduct field studies to estimate the amount of mismanaged plastic waste that is burned.
2.2 DETAILED HOTSPOTS RESULTS
5 CATEGORIES OF HOTSPOTS

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WHAT is leaking?
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WHAT is leaking?
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WHAT is leaking?
WHAT is leaking?
WHAT is leaking?
POLYMER HOTSPOTS
OBJECTIVE AND INSTRUCTIONS

Key question answered:
Which polymers are most critical in the country regarding plastic leakage?

How to read the polymer hotspot graph?
1. Determine leakage from mismanaged waste
2. Focus on leakage and leakage rate
3. Select hotspots based on absolute and relative leakage
4. Assess the quality score of the results

What are the bar components of the polymer mass balance graph?

For more details, please read the Methodology.
MASS BALANCE BY POLYMER [2018]

Quality Score

LEGEND
- Waste Export
- Recycling
- Properly managed
- Uncollected

Quality Score: 2.0
MISMANAGED WASTE AND LEAKAGE BY POLYMER [2018]

Uncollected Domestic waste Improperly disposed Leaked

<table>
<thead>
<tr>
<th>Polymer</th>
<th>Mismanaged</th>
<th>Leakage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDPE</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>PET</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>PP</td>
<td>6%</td>
<td>0.5%</td>
</tr>
<tr>
<td>PVC</td>
<td>23%</td>
<td>1%</td>
</tr>
<tr>
<td>HDPE</td>
<td>12%</td>
<td>1%</td>
</tr>
<tr>
<td>Synthetic Rubber</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>PS</td>
<td>15%</td>
<td>1%</td>
</tr>
<tr>
<td>Polyester</td>
<td>5%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

X% | Mismanaged Waste Index (MWI)
X% | Leakage Rate (LR)

Quality Score

Domestic waste
Improperly disposed
Uncollected
Leaked

2.0
**Key take-aways:**

- **LDPE** is the top contributor in absolute leakage (22 t), with a leakage rate of 1%.

- **PET** and **PP** follow with 18 t and 13 t of leakage respectively, with a leakage rate of 1% and 0.5% respectively.

- Although **Synthetic Rubber** ranks low in absolute leakage (5 t), 2% of its generated waste leaks into the oceans and waterways, especially due to microleakage from tyre abrasion.
### POLYMER HOTSPOTS: INTERPRETATION AND LIMITATIONS

#### LDPE
LDPE is the top polymer by absolute leakage. Together with PP it is the polymer with the highest waste generation. LDPE is mostly used in the packaging sector, and packaging items tend to have higher chances of being littered and get released to the sea.

#### PET
PET is identified as a main hotspot both by absolute and by relative leakage. PET is the third polymer by waste generation and 26% of PET is exported for recycling. Nonetheless, because PET is almost exclusively used in packaging and packaging on-the-go items have higher chances of leaking to the environment, there are still 18 tonnes of PET leaking to the sea.

#### PP
PP is the third polymer by absolute leakage, and the first polymer by total leakage.

#### Synthetic Rubber
Synthetic Rubber is the polymer with the highest leakage rate at 2%. This is due to the micro-leakage from tyre abrasion which contributes to 95% of the Synthetic Rubber leakage.

Of the 283 tonnes of Synthetic Rubber waste estimated to be generated in Menorca in 2018, only 25 tonnes were recorded to be disposed to waste management facilities in Menorca, for recycling. We assumed the remaining non-littered Synthetic Rubber to be still as likely as other waste to be collected, but there is no actual insight on where this waste might be disposed of.

Investigate the fate of Synthetic Rubber which is not collected for recycling.
POLYMER HOTSPOTS: INTERPRETATION AND LIMITATIONS

All polymers

The difference in leakage rate between the different polymers is of the order of 1%, therefore absolute leakage is a better indicator for hotspot selection in the case of Menorca.

Waste generation by polymer was determined by scaling down the waste generation of Spain, the assumption being that the waste generation per capita is the same across Spain and Menorca.

Perform characterisation study of waste generation in Menorca at household level.
APPLICATION HOTSPOTS
OBJECTIVE AND INSTRUCTIONS

Key question answered:
Which applications are most critical in the country regarding plastic leakage?

What are the bar components of the application mass balance graph?

How to read the application hotspot graph?

1. Determine leakage from mismanaged waste

2. Focus on leakage and leakage rate

3. Select hotspots based on absolute and relative leakage

4. Assess the quality score of the results

For more details, please read the Methodology
NOT APPLICABLE WITH CURRENT DATA FOR MENORCA
OBJECTIVE AND INSTRUCTIONS

Key question answered:
Which sectors are most critical in the country regarding plastic leakage?

What are the bar components of the sector mass balance graph?

- **Long-lived products**: products that are disposed after the year of study (Life-time > 1 year)
- **Short-lived products**: products that are disposed within the year of study (Life-time < 1 year)

How to read the sector hotspot graph?

1. Determine leakage from mismanaged waste
2. Focus on leakage and leakage rate
3. Select hotspots based on absolute and relative leakage
4. Assess the quality score of the results

For more details, please read the Methodology
MASS BALANCE BY SECTOR [2018]

Quality Score

LEGEND
- Waste Export
- Recycling
- Properly managed
- Uncollected

Quality Score: 1.8

Packaging
Tourism
Automotive-tyres
Fishing
Construction
Agriculture
Automotive-other
Textile
Medical
Electrical & electronics
Others

Sales (tonnes)

1
2
3
4
5
MISMANAGED WASTE AND LEAKAGE BY SECTOR [2018]

Quality Score

1.8

Packaging | Tourism | Automotive-Nes | Fishing | Construction | Agriculture | Automotive-other | Textile | Medical | Electrical & electronics | Others
---|---|---|---|---|---|---|---|---|---|---
11% | 10% | 7% | 2% | 22% | 10% | 0.2% | 6% | 0.5% | 10% | 0.2% | 6% | 0.2% | 10% | 1% | 6% | 0.1% | 11% | 0.5%

Domestic waste
Improperly disposed
Uncollected
Leaked

X% | Mismanaged Waste Index (MWI)
X% | Leakage Rate (LR)
Plastic pollution hotspots: Menorca

**Key take-aways**

- The packaging sector contributes to 40% of the total plastic leakage with 42 t of packaging waste leaking.
- The tourism sector is the 2nd highest contributor to plastic leakage in absolute value (19 t).
- The automotive-tyre sector ranks 3rd in absolute leakage (5 t) and 2nd in relative (2%) due almost entirely to microplastic leakage from tyre abrasion.
- The fishing sector has the highest leakage rate (22%).

### SECTOR HOTSPOTS [2018]

<table>
<thead>
<tr>
<th>Sector</th>
<th>Leakage (in tonnes)</th>
<th>Leakage rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging</td>
<td>42</td>
<td>22%</td>
</tr>
<tr>
<td>Automotive-tyres</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Tourism</td>
<td>19</td>
<td>10%</td>
</tr>
<tr>
<td>Fishing</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td>Construction</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Automotive-other</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Textile</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Electrical &amp; electronics</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Medical</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Quality Score**

- 1.8

---

3 highest leakage contributors in absolute OR relative value

Highest leakage contributors in absolute AND relative value
SECTOR HOTSPOTS: INTERPRETATION AND LIMITATIONS

Tourism

The tourism sector makes up for 22% of the waste in Menorca, with almost 2500 tonnes of waste generated for tourist related activities.

We assume that tourists have the same daily per capita plastic waste generation as resident population. Therefore, we attribute a share of the waste from all sector to the tourism sector, based on the tourist population. See the appendix for more details.

Studies could be conducted to identify tourists waste generation patterns.

Limitations

Packaging

Most of the plastic waste generation in Menorca comes from Packaging sector. 5618 tonnes of plastic waste from packaging were generated in Menorca in 2018 (22% of it has been attributed to the tourism sector). Due to the on-the-go nature of packaging products, plastic from packaging has one of the highest MWI, with 11% of plastic estimated to be uncollected in Menorca.

Learnings

Fishing

4 tonnes of fishing gears were estimated to be lost at sea in Menorca in 2018. This amounts to 6% of the total country leakage. More information on the fishing sector can be found in appendix.

Unlocking limitations

Learnings
OBJECTIVE AND INSTRUCTIONS

Key question answered:
Which areas are most critical in the country regarding plastic leakage?

1) Overlaying different information available at city / district / sub-district level and/or modelled through archetypes...

2) ... and using geographic, hydrographic and demographic information...

3) ... allows to compute a leakage map and identify regional hotspots
Plastic waste generation from resident population

7744 tonnes/year

Key take-aways

- Residents contribute to generating 78% of the total of waste generated in Menorca.
- 93% of it is generated in urban areas.

Limitations

- 93% of the waste generated by the resident population comes from urban areas, because 93% of the population lives in urban areas. Mahón et Ciutadella de Menorca have the highest absolute waste generation, while urban nuclei in Es castell, Ferreries and Es Migjorn Gran have the highest waste generation per km².

- The map does not show the waste generation distribution in rural areas. Only 7% of the total 7744 tonnes of waste generated by the resident population come from rural areas. Nonetheless, data on waste generation by the rural population per municipality are available in appendix.

Learnings

If necessary, gather further information on geographical distribution of the rural population.

More details available in Appendices

Unlocking limitations
Plastic waste generation from tourist population

2242 tonnes/year

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Waste generated on beaches t/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciutadella de Menorca</td>
<td>167</td>
</tr>
<tr>
<td>Ferreries</td>
<td>70</td>
</tr>
<tr>
<td>Es Migjorn Gran</td>
<td>36</td>
</tr>
<tr>
<td>Es Mercadal</td>
<td>47</td>
</tr>
<tr>
<td>Alaior</td>
<td>57</td>
</tr>
<tr>
<td>Mahón</td>
<td>80</td>
</tr>
<tr>
<td>Sant Lluís</td>
<td>51</td>
</tr>
<tr>
<td>Es Castell</td>
<td>75</td>
</tr>
</tbody>
</table>

- **Tourists contribute to generate 22% of the total waste in Menorca.**
- **26% of the waste generated by tourists is generated on beaches.**

**Learnings**

- In Es Migjorn Gran municipality 55% of the waste is due to tourists, while in Mahón only 6% of the waste is due to tourists.
- In Ferreries and Es Castell most of the waste from tourism activities is generated on beaches.
- 36% of the tourists waste is generated in Ciutadella de Menorca.

**Limitations**

- We assume that tourists dispose of their waste partly on beaches (60% of their packaging waste) and partly in the vicinity of their overnight stay location.
- We assume waste generation on a beach is proportional to the beach surface area.
- If necessary, identify specific attractions other than beaches and estimate number of tourists and average time spent there by a tourist in order to allocate part of their waste generated.

**Unlocking limitations**

- More details available in Appendices

Plastic pollution hotspots: Menorca
WASTE COLLECTION: MAP AND INTERPRETATIONS [2018]

Key take-aways

- Waste collection averages at 90% on the island of Menorca.

Learnings

- Es Mercadal, at 99%, has the highest collection rate. Ferreries, at 75%, has the lowest collection rate.

Limitations

- Tourists population distribution by municipalities is critical in order to have a correct picture of waste management.

Unlocking limitations

- The waste collection rate by municipality is determined only by looking at the municipal solid waste generation and collection quantities by province. No information was available on non-municipal waste.

- It is crucial to gather better insight on management of industrial waste, especially from construction and automotive sectors.

Average waste collection rate

90%

Tourists population distribution by municipalities is critical in order to have a correct picture of waste management.
**MISMANAGED WASTE INDEX: MAP AND INTERPRETATIONS [2018]**

**Average waste mismanagement rate**

10%

**Key take-aways**

- The average MWI is 10% in Menorca.
- Waste mismanagement in Menorca is due to uncollected waste.

**Learnings**

- Generally, mismanaged waste can come either from waste collected but improperly disposed (in open dumps or unsanitary landfills), or from uncollected waste. In Menorca there is no improper disposal of waste, therefore all mismanaged waste comes from uncollected waste.

**Limitations**

- We are not accounting for mismanagement of waste exported for recycling in the country of destination.

**Unlocking limitations**

- Gather better insight on the fate of waste exported for recycling. Spain, for example, exports waste primarily to Malaysia, Viet Nam, China, Thailand, where part of the waste is mismanaged.
LEAKAGE OF MACRO-PLASTICS FROM RESIDENT POPULATION

53 tonnes / year

- 53 tonnes of macro-leakage from mismanaged plastic waste are due to the resident population of Menorca.
- On average a resident of Menorca contributes to 0.6 kg of plastic leakage per capita per year.
- Only 6% of the total leakage comes from rural areas.

94% of the leakage due to the resident population comes from urban areas.

The areas with the highest leakage density are in Es Castell.

41% of the leakage generated by the resident population comes from Mahón, due to the high number of resident population and MWI of 13%.

It is not possible to visualize on the map the leakage due to the rural population. Nevertheless, its contribution to the total leakage is of only 6%.

If necessary, gather more granular information of rural population distribution by km².
Plastic pollution hotspots: Menorca

REGIONAL LEAKAGE FROM TOURISTS: MAP AND INTERPRETATIONS [2018]

Leakage from tourist population

15 tonnes / year

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Leakage from beaches t/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciutadella de Menorca</td>
<td>0.3</td>
</tr>
<tr>
<td>Ferreries</td>
<td>1.3</td>
</tr>
<tr>
<td>Es Migjorn Gran</td>
<td>0.2</td>
</tr>
<tr>
<td>Es Mercadal</td>
<td>0.02</td>
</tr>
<tr>
<td>Alaior</td>
<td>1.0</td>
</tr>
<tr>
<td>Mahón</td>
<td>0.8</td>
</tr>
<tr>
<td>Sant Lluís</td>
<td>0.3</td>
</tr>
<tr>
<td>Es Castell</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Key take-aways

- Tourists cause the leakage of 15 tonnes of plastic/year, i.e. 23% of the total leakage.
- 33% of the tourists leakage comes from beaches.

Learnings

- The municipalities with the most polluted beaches are Ferreries, Es Castell and Alaior, this is mostly caused by the lower collection rates in these municipalities.
- Most of the leakage from tourists in the vicinity of their overnight stay, comes from Alaior, with 4.3 t/y of leakage.

More details available in Appendices
**OBJECTIVE AND INSTRUCTIONS**

**Key question answered:**
Which waste management stages are most critical in the country regarding plastic leakage?

1) We decided for each element* of the waste management system if its contribution to leakage mitigation is positive (coolspot), neutral or negative (hotspot)

### Waste management stage | Potential hotspot | Is it a hotspot? | Justification | Source
---|---|---|---|---
Plastic waste import | | HOTSPOT | Only 1% of the waste imported in this country is treated on the island; the remaining 99% is imported. The formal sector only receives imported waste (less than 10% of the total), and it does not recycle domestic waste (CIA, 2020). Domestic waste is imported be the informal sector in informal solutions. | IPA Interview and CCD report N/A 2014
Plastic waste export | | | | |
Plastic waste per capita generation | | | | |
Share of plastic in waste stream | | HOTSPOT | Vietnam is a LAC-BC plastic waste hotspot on average, but the share of plastics in the waste stream is lower. According to the study, VNCLUDS 2018, the waste characterization indicates | VNCLUDS 2018 study on waste characterization in Vietnam.

2) Understand at a glance the status of the waste management system in the country with this dashboard

*For detailed element descriptions and methodology, refer to tool T4.1*
**WASTE MANAGEMENT HOTSPOTS**

### Key take-aways

- Plastic waste per capita generation (111 kg/cap/day) is well above the Western Europe average* (64 kg/cap day).
- In 2018, compostable is still not segregated at source.
- Waste collection rate (90%) is below average in high income countries 96%.
- Waste bins design does not prevent from leakage while waiting for collection.
- Wind and rain are driving release of littered waste within different compartments of the environment.
- Littering is driven by the high tourist season.
- Positive aspects include well-functioning infrastructures, decent cleaning frequency and efficient waste water management.

---

### WASTE GENERATION

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic waste import</td>
<td>Plastic waste export</td>
<td>Plastic waste per capita generation</td>
</tr>
</tbody>
</table>

### WASTE SEGREGATION

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segregation of compostable waste</td>
<td>Segregation of recyclable plastics</td>
<td>Segregation by the informal sector</td>
</tr>
</tbody>
</table>

### WASTE COLLECTION

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal collection of municipal waste</td>
<td>Formal collection of industrial waste</td>
<td>Value of recycled plastics</td>
</tr>
</tbody>
</table>

### LEAKAGE WHILE WAITING FOR COLLECTION

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of waste bins</td>
<td>Frequency of collection</td>
<td>Climatic conditions</td>
</tr>
</tbody>
</table>

### WASTE RELATED BEHAVIOURS

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Littering driven by cultural habits</td>
<td>Littering due to a lack of public waste bins</td>
<td>Frequency of fly-tipping</td>
</tr>
</tbody>
</table>

### WASTE MANAGEMENT INFRASTRUCTURE

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of waste in dumpsites</td>
<td>Share of waste in unsanitary landfills</td>
<td>Informal recycling</td>
</tr>
</tbody>
</table>

### POST-LEAKAGE MANAGEMENT

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of city cleaning and sweeping</td>
<td>Frequency of waterway cleaning</td>
<td>Frequency of coastal clean-up</td>
</tr>
</tbody>
</table>

### WASTE WATER MANAGEMENT

<table>
<thead>
<tr>
<th>Source</th>
<th>Collection</th>
<th>End-of-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management of run-off waters</td>
<td>Waste water collection</td>
<td>Waste water treatment efficiency</td>
</tr>
</tbody>
</table>

---

* * Average plastic waste generation per capita values are derived from the What a Waste 2.0 database (Kaza et al., 2018)
2.3 ACTIONABLE HOTSPOTS
Plastic pollution hotspots: Menorca

HOTSPOTS IN BRIEF

Polymer Application Sector Regional

PET LDPE PP Synthetic Rubber HDPE Polyester PS PVC Other

Packaging Automotive-tires Tourism Fishing Medical Textile Agriculture Electrical & electronics Automotive-other Construction

3 highest leakage contributors in absolute OR relative value
Highest leakage contributors in absolute AND relative value

Waste management

- Plastic waste import
- Plastic waste export
- Plastic waste per capita generation
- Share of plastics in waste stream

- Segregation of inappropriate waste
- Segregation of recyclable plastics
- Segregation by the informal sector
- Public infrastructure availability

- Formal collection of municipal waste
- Formal collection of industrial waste
- Value of recycled plastics
- Value of non-recycled plastics

- Design of waste bins
- Frequency of collection
- Climatic conditions
- Other (e.g. animals)

- Littering driven by cultural habits
- Littering due to a lack of public waste bins
- Frequency of fly-tipping
- Frequency of illegal burning

- Share of waste in dumping
- Share of waste in unsanitary landfills
- Informal recycling
- Recycling capacity

- Frequency of city cleaning and sweeping
- Frequency of waterway cleaning
- Frequency of coastal clean-up
- Frequency of other clean-up activities

- Management of run-off waters
- Waste water collection
- Waste water treatment efficiency
- Fate of WWTP sludges

Negative contribution to the leakage
Positive contribution
Neutral contribution
Not assessed

Municipalities
Leakage from beaches t/y
Ciutadella de Menorca 0.3
Ferreries 1.3
Es Migjorn Gran 0.2
Es Mercadal 0.02
Alaior 1.0
Mahón 0.8
Sant Lluís 0.3
Es Castell 1.1
Plastic pollution hotspots: Menorca

<table>
<thead>
<tr>
<th>[#]</th>
<th>ACTIONABLE HOTSPOT</th>
<th>[ ]/ [●]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic generation per capita in Menorca is well above Western Europe average and is the main driver to leakage.</td>
<td>■</td>
</tr>
<tr>
<td>2</td>
<td>PET and LDPE, used for example in bottles or bags respectively, are seriously leaking in Menorca because of a high consumption and littering behaviours.</td>
<td>●</td>
</tr>
<tr>
<td>3</td>
<td>Packaging is the most leaking sector in Menorca that consumes important quantities of plastic and covers products with high leakage potential.</td>
<td>●</td>
</tr>
<tr>
<td>4</td>
<td>Tourism has also a high leakage impact due to a high number of tourists who probably consume more single-use plastics with a high leakage potential.</td>
<td>●</td>
</tr>
<tr>
<td>5</td>
<td>The automotive-tyre and fishing sectors have a moderate plastic leakage impact but have the highest leakage rates driven by micro-plastic from tyre abrasion for the automotive-tyre sector and the potential loss of fishing gears at sea for the fishing sector.</td>
<td>●</td>
</tr>
<tr>
<td>6</td>
<td>Plastic waste is leaking because of a lack of adequately designed bins combined with frequent rain and wind that carry plastic items into different environmental compartments, including the ocean and waterways.</td>
<td>■</td>
</tr>
<tr>
<td>7</td>
<td>Most of the plastic leakage is stemming from urban areas close to the coast (&lt;2km).</td>
<td>●</td>
</tr>
<tr>
<td>8</td>
<td>Beaches are a leakage hotspot as they have high densities of waste generation and leakage.</td>
<td>●</td>
</tr>
</tbody>
</table>

**ACTIONABLE HOTSPOTS LIST**

- **GENERIC** (Concerns all plastic types and all regions)
- **SPECIFIC** (Concerns specific plastic types and all regions)
Each actionable hotspot can address plastic pollution at one or multiple stages along the plastic value chain. We notice that the list of actionable hotspots for Menorca calls for interventions at both plastic source and end-of-life stages.
3 SHAPING ACTION
3.1 INTERVENTIONS
**METHODOLOGY FOR IDENTIFYING INTERVENTIONS**

**STEP 1:** choose up to 3 interventions for each actionable hotspot

**STEP 2:** assess criteria levels for each chosen intervention

<table>
<thead>
<tr>
<th>Interventions (I)</th>
<th>Leakage mitigation potential*</th>
<th>Unintended consequences**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>I2</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>I3</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>I4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I5</td>
<td></td>
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<tr>
<td>...</td>
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<tr>
<td>I79</td>
<td>medium</td>
<td>high</td>
</tr>
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<td>I80</td>
<td></td>
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</tr>
<tr>
<td>I81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I82</td>
<td>high</td>
<td>medium</td>
</tr>
<tr>
<td>I83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* **Leakage mitigation potential:** high mitigation potential actions are those that contribute to meaningful reductions of plastic leakage and impacts.

**Unintended consequences:** highly consequential actions are those most likely to generate unintended environmental or socio-economic trade-offs (e.g., substitution from plastic to another material may generate additional environmental impacts such as GHG emissions).

**STEP 3:** visualise priority interventions in the top right corner of the chart
Points are randomly distributed within the designated box to avoid overlapping. Each box on this 9 facets grid corresponds to a couple low/low or low/medium or low/high, etc. Only the facet in which the point falls into should be accounted for, not its relative position to points nearby.

The list of interventions results from the hotspot analysis; it is currently based on the authors perception. A final version of the interventions should be elaborated through a multi-stakeholder consultation process.

Set up a workshop for a multi-stakeholder process and repeat the interventions selection procedure.
Interventions may occur at any point along the value chain. We categorise them into six types of approaches along the value chain.

<table>
<thead>
<tr>
<th>Category</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RE-DESIGN</strong></td>
<td><strong>SUSTAINABLE PRODUCTION</strong></td>
</tr>
<tr>
<td></td>
<td>Design plastic products with highly recoverable and recyclable materials</td>
</tr>
<tr>
<td></td>
<td>while improving reusability and repairability, and rethink sustainable business models to minimise risks of plastic leakage.</td>
</tr>
<tr>
<td><strong>REDUCE</strong></td>
<td><strong>SUSTAINABLE CONSUMPTION AND LIFESTYLES</strong></td>
</tr>
<tr>
<td></td>
<td>Reduce demand for &amp; use of problematic or unnecessary plastic materials and products</td>
</tr>
<tr>
<td><strong>RECUPIRATE</strong></td>
<td><strong>WASTE COLLECTION SYSTEMS</strong></td>
</tr>
<tr>
<td></td>
<td>Maximise collection of plastic waste</td>
</tr>
<tr>
<td><strong>RENOVATE</strong></td>
<td><strong>WASTE INFRASTRUCTURE</strong></td>
</tr>
<tr>
<td></td>
<td>Build capacity to increase efficiency of proper treatment and final disposal</td>
</tr>
<tr>
<td><strong>RECYCLE</strong></td>
<td><strong>PLASTIC RECYCLING</strong></td>
</tr>
<tr>
<td></td>
<td>Increase recycling rates through design and infrastructure that facilitate better segregation, collection, disassembly, recycling and recovery</td>
</tr>
<tr>
<td><strong>REMOVE</strong></td>
<td><strong>CLEAN-UP SOLUTIONS</strong></td>
</tr>
<tr>
<td></td>
<td>Post-leakage cleaning of the environment</td>
</tr>
<tr>
<td>[INTERVENTION CLASS]</td>
<td>[PRIORITY INTERVENTION]</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SUSTAINABLE PRODUCTION</td>
<td>Promote design of material or process that favour reuse of plastic objects (e.g. deposit scheme)</td>
</tr>
<tr>
<td>SUSTAINABLE CONSUMPTION AND LIFESTYLES</td>
<td>Reduce littering in urban areas</td>
</tr>
<tr>
<td>SUSTAINABLE CONSUMPTION AND LIFESTYLES</td>
<td>Reduce demand for, and use of, single-use, especially on-the-go, plastics</td>
</tr>
<tr>
<td>WASTE COLLECTION SYSTEMS</td>
<td>Plan more frequent waste collection in areas prone to plastic leakage</td>
</tr>
<tr>
<td>WASTE INFRASTRUCTURE</td>
<td>Ensure recuperation of used fishing gears</td>
</tr>
<tr>
<td>WASTE INFRASTRUCTURE</td>
<td>Reduce losses from waste management equipment (bins, transport)</td>
</tr>
<tr>
<td>WASTE INFRASTRUCTURE</td>
<td>Increase density of waste bins in specific areas prone to leakage</td>
</tr>
<tr>
<td>CLEAN-UP SOLUTIONS</td>
<td>Clean beaches and/or polluted areas</td>
</tr>
<tr>
<td>CLEAN-UP SOLUTIONS</td>
<td>Retrieve lost fishing gears from the marine environment</td>
</tr>
</tbody>
</table>
3.2 INSTRUMENTS
**METHODOLOGY FOR IDENTIFYING INSTRUMENTS**

**STEP 1:** choose up to 3 instruments for each intervention selected in S2

<table>
<thead>
<tr>
<th>Intervention (I)</th>
<th>Instruments (J)</th>
<th>Feasability*</th>
<th>Synergies**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I2</td>
<td>J1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>J2</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>I79</td>
<td>J3</td>
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<td>high</td>
</tr>
<tr>
<td>I82</td>
<td>J4</td>
<td></td>
<td></td>
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<td></td>
<td>J5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>J79</td>
<td>medium</td>
<td>low</td>
</tr>
<tr>
<td></td>
<td>J80</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>J81</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>J82</td>
<td>high</td>
<td>medium</td>
</tr>
<tr>
<td></td>
<td>J83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**STEP 2:** assess criteria levels for each chosen instrument

**STEP 3:** visualise priority instruments in the top right corner of the chart

---

* **Feasability:** technical and socio-economic assessment of each instrument should be performed. We do not assert a method to perform the assessment as this is beyond the scope of the Guidance. The user can decide on the method to use based on resources available. A by default qualitative assessment with three levels is suggested.

**Synergies:** Some instruments may be beneficial to multiple interventions, thus creating a positive synergetic effect. This criterion does not only evaluate the number of suggested interventions benefitting from an instrument, but also assess if the proposed instrument harmonises well with instruments already in place.
LIST OF POSSIBLE INSTRUMENT CATEGORIES

- Knowledge creation: Database, Mapping, Expertise, Businesses
- Awareness raising: Citizens, Waste sector, Partnership, Structuration
- Innovation: Policy / Regulatory, Standardisation, Monitoring
APPENDICES
4.1 DATA REPOSITORY
## Detailed Shares by Polymer

<table>
<thead>
<tr>
<th>Polymer Type</th>
<th>Waste produced in country</th>
<th>Domestic recycling of collected</th>
<th>Export of collected</th>
<th>Properly disposed</th>
<th>Improperly disposed</th>
<th>Uncollected</th>
<th>Tot</th>
<th>Collected</th>
<th>Mismanaged</th>
<th>Leaked</th>
<th>Waste produced and imported</th>
<th>Domestic recycling incl imported</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET</td>
<td>1781</td>
<td>0%</td>
<td>26%</td>
<td>65%</td>
<td>0%</td>
<td>9%</td>
<td>100%</td>
<td>91%</td>
<td>9%</td>
<td>1.0%</td>
<td>1781</td>
<td>0%</td>
</tr>
<tr>
<td>PP</td>
<td>2642</td>
<td>0%</td>
<td>7%</td>
<td>87%</td>
<td>0%</td>
<td>6%</td>
<td>100%</td>
<td>94%</td>
<td>6%</td>
<td>0%</td>
<td>2642</td>
<td>0%</td>
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<tr>
<td>Polyester</td>
<td>264</td>
<td>0%</td>
<td>0%</td>
<td>95%</td>
<td>0%</td>
<td>5%</td>
<td>100%</td>
<td>95%</td>
<td>5%</td>
<td>0%</td>
<td>264</td>
<td>0%</td>
</tr>
<tr>
<td>LDPE</td>
<td>2652</td>
<td>0%</td>
<td>18%</td>
<td>73%</td>
<td>0%</td>
<td>9%</td>
<td>100%</td>
<td>91%</td>
<td>9%</td>
<td>1%</td>
<td>2652</td>
<td>0%</td>
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<tr>
<td>HDPE</td>
<td>663</td>
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<td>25%</td>
<td>63%</td>
<td>0%</td>
<td>12%</td>
<td>100%</td>
<td>88%</td>
<td>12%</td>
<td>1%</td>
<td>663</td>
<td>0%</td>
</tr>
<tr>
<td>PS</td>
<td>481</td>
<td>0%</td>
<td>7%</td>
<td>78%</td>
<td>0%</td>
<td>15%</td>
<td>100%</td>
<td>85%</td>
<td>15%</td>
<td>1%</td>
<td>481</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>171</td>
<td>0%</td>
<td>0%</td>
<td>94%</td>
<td>0%</td>
<td>6%</td>
<td>100%</td>
<td>94%</td>
<td>6%</td>
<td>0%</td>
<td>171</td>
<td>0%</td>
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<tr>
<td>Synthetic Rubber</td>
<td>283</td>
<td>0%</td>
<td>9%</td>
<td>83%</td>
<td>0%</td>
<td>7%</td>
<td>100%</td>
<td>93%</td>
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<td>2%</td>
<td>283</td>
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<tr>
<td>PVC</td>
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<td>7%</td>
<td>71%</td>
<td>0%</td>
<td>23%</td>
<td>100%</td>
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<td>0.6%</td>
<td>1283</td>
<td>0%</td>
</tr>
<tr>
<td>All</td>
<td>10220</td>
<td>0%</td>
<td>14%</td>
<td>76%</td>
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<td>10%</td>
<td>100%</td>
<td>90%</td>
<td>10%</td>
<td>1%</td>
<td>10220</td>
<td>0%</td>
</tr>
</tbody>
</table>

- **Waste** = Collected + Uncollected
- **Collected** = Domestic recycling of collected + Export of collected + Properly disposed + Improperly disposed
- **Mismanaged** = Improperly disposed + Uncollected
### Waste Management by Municipality

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciutadella de Menorca</td>
<td>27109</td>
<td>2114</td>
<td>11156</td>
<td>2284</td>
<td>178</td>
<td>650</td>
<td>167</td>
<td>98%</td>
<td>2%</td>
<td>3.9</td>
<td>0.3</td>
<td>1.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Ferreries</td>
<td>4559</td>
<td>136</td>
<td>918</td>
<td>384</td>
<td>11</td>
<td>52</td>
<td>70</td>
<td>75%</td>
<td>25%</td>
<td>5.0</td>
<td>0.2</td>
<td>0.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Es Migjorn Gran</td>
<td>1321</td>
<td>49</td>
<td>1836</td>
<td>111</td>
<td>4</td>
<td>104</td>
<td>36</td>
<td>92%</td>
<td>8%</td>
<td>0.5</td>
<td>0.02</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Es Mercadal</td>
<td>4537</td>
<td>251</td>
<td>3826</td>
<td>382</td>
<td>21</td>
<td>216</td>
<td>47</td>
<td>99%</td>
<td>1%</td>
<td>0.1</td>
<td>0.01</td>
<td>0.1</td>
<td>0.02</td>
</tr>
<tr>
<td>Alaior</td>
<td>8296</td>
<td>716</td>
<td>4400</td>
<td>699</td>
<td>60</td>
<td>248</td>
<td>57</td>
<td>77%</td>
<td>23%</td>
<td>8.7</td>
<td>0.9</td>
<td>4.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Mahón</td>
<td>27313</td>
<td>1279</td>
<td>1530</td>
<td>2301</td>
<td>108</td>
<td>86</td>
<td>80</td>
<td>87%</td>
<td>13%</td>
<td>20.9</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Sant Lluís</td>
<td>6156</td>
<td>736</td>
<td>4400</td>
<td>519</td>
<td>62</td>
<td>248</td>
<td>51</td>
<td>91%</td>
<td>9%</td>
<td>2.7</td>
<td>0.3</td>
<td>1.6</td>
<td>0.3</td>
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<tr>
<td>Es Castell</td>
<td>6878</td>
<td>470</td>
<td>956</td>
<td>579</td>
<td>40</td>
<td>54</td>
<td>75</td>
<td>81%</td>
<td>19%</td>
<td>8.1</td>
<td>0.5</td>
<td>0.7</td>
<td>1.1</td>
</tr>
</tbody>
</table>
4.2 DATA QUALITY ASSESSMENT
Recycling of imported waste" together with "recycling of domestic waste" constitute the country’s "recycling" bar.

Data as reported by Vietnam to UN

Plastics Europe, 2018 | Sector to polymer mapping

2018 | Production quantities by polymer in Spain

Ports de Baleares, 2016 | Import export of cars to Menorca 2016

Consorci de residus i energia de menorca, 2018 | Total quantity of plastic collected for recycling (sometimes the polymer is known)

This study - Polymer | Plastic waste by polymer (shares)

No domestic recycling of plastic in Menorca

Trade data for Spain 2018

Total quantity of plastic

Plastics Europe plastic by sector (shares) based on EU market | Trade data and production data downsized to Menorca from Spain based on population share resident + tourist

Polymer flowchart

UNEP, IUCN & Life Cycle Initiative, 2020
## SECTOR HOTSPOTS
### DATA QUALITY ASSESSMENT

<table>
<thead>
<tr>
<th>Raw data</th>
<th>Modelling</th>
<th>Final metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reliability</strong></td>
<td><strong>Temporal</strong></td>
<td><strong>Granularity</strong></td>
</tr>
<tr>
<td>This study - polymer</td>
<td>2018</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Plastic Europe, 2018</td>
<td>Plastic by sector</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Consorci de residus i energia de menorca, 2018</td>
<td>Plastic waste</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Plastic waste characterization for electrical &amp; electronic, automotive-tyres and agriculture sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Consorci de residus i energia de menorca, 2018</td>
<td>Plastic collected for recycling by sector</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>This study - Sector</td>
<td>Waste generated by sector</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Plastic Leak Project, 2019</td>
<td>Littering rate by Sector (based on product size and type of usage)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>This Study - Sector</td>
<td>Micro-leakage by sector (see additional notes)</td>
<td></td>
</tr>
</tbody>
</table>
 Properly disposed

SECTOR HOTSPOTS
MODELING NOTES (1/2)

We only have information on waste management for the municipal waste. To extrapolate and have information relative to all waste, we assume that the collection rate of municipal and non-municipal waste is similar. This is just a hypothesis and an in-depth analysis on the fate of non-municipal industrial waste is needed, especially for the waste coming from Construction and Automotive sectors.

To compute the collection rate for the municipal waste, we identify some sectors as being treated by the municipal waste management facility. These are: Packaging, Medical, Textile, Automotive-tyres, Electrical and Electronics, Fishing, and Agriculture. While the remaining sectors are considered as non-municipal. Tourism is not considered in this analysis (see additional notes on tourism). We compute the share of municipal waste collected as: municipal waste collected / tot municipal waste generated. This value is then used to determine the total waste collected. We distribute the total waste collected by sector based on the non-littered and non-micro-leaked share of waste that each sector has, i.e. collected by sector = (waste - littered - micro-leaked by sector) / (tot waste - tot littered - tot micro-leaked)*tot waste collected.

The properly managed part of the collected = collecte - export of waste ( - recycled = 0).

Micro-leakage contribution

• **Automotive-tyres (Tyre dust):** loss and leakage of synthetic rubbers particles from tyres to the marine environment is calculated based on the methodology described in PLP (2019). Its contribution to leakage is included in "Automotive-tyres". Data on vehicle numbers for 2018 were provided by OBSAM and average distance travelled is based on the average in Spain for 2017 (Enerdata, 2020) which is arbitrarily divided by two as car usage on the island is assumed to be less than on mainland.

• **Textile (Textile fibers):** loss and leakage of textile fibers to the marine environment is calculated based on the methodology described in the Plastic Leak Project (2020)

• **Others (Cosmetics):** loss and leakage of plastic micro-particles from cosmetics to the marine environment is calculated based on the methodology described in Plastic Leak Project (2020)

• **Others (Pellets):** loss and leakage the marine environment of plastic pellets during transportation and production stages is calculated based on the methodology described in Plastic Leak Project (2020)
**SECTOR HOTSPOTS MODELLING NOTES (1/2)**

**Fishing:** Data on number of fishing vessels (artisanal and commercial) comes from OBSAM. We assume artisanal vessels have one longline and one gillnet, while commercial vessel use on midwater trawl. By default plastic weights by fishing gear type were derived from technical designs found in multiple publications including FAO and Nédélec et al., 1990. Combining these two pieces of information yields the net plastic input from fishing gears. By estimating the lifetime of a fishing net and by looking at the GDP growth of Spain, we estimate the amount of fishing nets going to waste from previous years.

**Medical:** In order to know the amount of plastic going to waste from the medical sector we multiply the number of hospital beds in Menorca (OBSAM, 2020) by the occupancy rate (80%), the amount of waste generated per bed per day (Minoglou et al., 2017), and the plastic share of medical waste (20%).

**Tourism:** Data on number of tourists and average stay length comes OBSAM. We assume tourist and local population have the same daily plastic waste generation. We assume that tourists contributes to waste generation in all sectors, not only packaging. For example, cars are made available for renting for tourists (automotive-tyres and automotive-others). We therefore compute all waste management quantities for the tourism sector by computing the analysis without the tourism sector and the allocating a share of each sector to the tourism based on the tourist population share. The tourist population share is computed as $= \text{nb tourists} \times \text{average lengths of stay} / 365 / \text{total resident population}$. 


### REGIONAL HOTSPOTS DATA QUALITY ASSESSMENT (1/2)

#### Raw data

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Quality Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consorci de residus i energia de menorca, 2018</td>
<td>Plastic waste collected for recycling by region</td>
<td>1</td>
</tr>
<tr>
<td>Consorci de residus i energia de menorca, 2018</td>
<td>Municipal plastic waste collected by region</td>
<td>1</td>
</tr>
<tr>
<td>OBSAM, 2020</td>
<td>Waste generated per capita per sector</td>
<td>2</td>
</tr>
<tr>
<td>DT, 2018</td>
<td>Number of beds per region</td>
<td>1</td>
</tr>
<tr>
<td>DESM, 2018</td>
<td>NASA population forecast for 2020 on 1km² grid</td>
<td>1.5</td>
</tr>
<tr>
<td>DESMAM, 2020</td>
<td>Total number of tourists + average length of stay</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Modelling

<table>
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<tr>
<th>Source</th>
<th>Description</th>
<th>Quality Score</th>
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<tbody>
<tr>
<td>Consorci de residus i energia de menorca, 2018</td>
<td>Plastic waste collected for recycling by region</td>
<td>1</td>
</tr>
<tr>
<td>Consorci de residus i energia de menorca, 2018</td>
<td>Municipal plastic waste collected by region</td>
<td>1</td>
</tr>
<tr>
<td>OBSAM, 2020</td>
<td>Waste generated per capita per sector</td>
<td>2</td>
</tr>
<tr>
<td>DT, 2018</td>
<td>Number of beds per region</td>
<td>1</td>
</tr>
<tr>
<td>DESM, 2018</td>
<td>NASA population forecast for 2020 on 1km² grid</td>
<td>1.5</td>
</tr>
<tr>
<td>DESMAM, 2020</td>
<td>Total number of tourists + average length of stay</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Final metric

<table>
<thead>
<tr>
<th>Metric</th>
<th>Relaxation</th>
<th>Temporal</th>
<th>Geographic</th>
<th>Granularity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste generated</td>
<td>See additional notes</td>
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<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Collected for recycling</td>
<td>-</td>
<td>1</td>
<td>-</td>
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<td>-</td>
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<td>Mismanaged waste</td>
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#### Quality Score

- **Score:** 2.1
### Regional Hotspots

#### Data Quality Assessment (2/2)

<table>
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<th>Modelling</th>
<th>Final metric</th>
<th>Score</th>
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<td><strong>Temporal</strong></td>
<td><strong>Geographic</strong></td>
<td><strong>Granularity</strong></td>
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<td>Share of Mismanaged</td>
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#### Quality Score

```
Regional Hotspots: Menorca

1. **Quality Score**: 2.1
2. **Reliability**: 2.0
3. **Temporal**: 2018
4. **Geographic**: 1
5. **Granularity**: 1
6. **Final metric**: Share of Mismanaged
7. **Score**: 2.0
```

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*With max release rate from Jambeck et al., 2015: 25%; D1 short < 2 km, D2 long > 100 km (Sistemiq), R1 small < 1st quartile of world runoff, R3 large > 3rd quartile of world runoff (Lebreton et al.; 2017)*
SECTOR HOTSPOTS MODELLING NOTES

Properly disposed

We identified 4 sources of waste generation: resident urban population, resident rural population, tourists at hotels, and tourists on beaches.

We assume that urban resident population and rural resident have the average per capita waste generation for Menorca. The average per capita waste generation is computed as: tot plastic waste / (resident population + tourist population). Where the tourist population = nb tourists* average length of stay/365.

For the resident urban population, we have access on very detail spatial population distributions by urban nuclei within the different municipalities. For the rural population instead we only have data by municipalities, but we lack a more granular spatial information.

For the tourist population we have information of hotel localization and for each hotel we know the number of beds. The number of tourists by municipality is determined as : nb beds per municipality/ tot nb of beds * tourist population. For the waste generation of tourists on beaches, we assume that the tourists presence on a beach is proportional to the area of the beach. Additionally we assume that tourists dispose on beaches 60% of their per capita plastic packaging waste. The remaining per capita plastic waste is attributed to tourists at hotels.

This more elaborated and more granular split is done to reconcile waste management data for municipalities such as Es Mercadal where plastic waste collection is higher than plastic waste generated by the resident population and by the tourists at hotels. Only when considering the additional waste generated by the tourists activities on the beaches we are able to recover a consistency between waste generation and waste collection.

Fishing: Plastic leakage from fisheries can be divided into three component:

1) Leakage due to gears lost at sea during fishing operations;

2) Leakage from gears discarded and mismanaged on land → set to zero for Menorca;

3) Leakage from plastic waste littered overboard by some fishermen → set to zero for Menorca;

To know how many fishing gear by type see Additional notes of sector hotspot analysis. Leakage due to gears lost at sea is computed using loss rates by fishing gear type provided by Richardson et al. (2019). For some fishing gears, loss is considered for fragments of the gear only, thus we had to make an assumption on how big a fragment would be (10%, 50% or 90% of a gear unit). Our default calculation takes the assumption of a fragment representing 50% of a gear unit.
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MENORCA
Country report

Published in December 2020,
with results for year 2018

Implemented with
Funded by the Didier et Martine Primat Foundation