

# Mapping of global plastics value chain and plastics losses to the environment

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With a particular focus on marine  
environment



# Acknowledgements

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We thank the United Nations Environment Programme Consumption and Production Unit and Life Cycle Initiative Unit (Economy Division) and Marine and Coastal Ecosystems Branch (Ecosystems Division): Elisa Tonda, Sandra Averous, Chang Yan, Llorenç Milà i Canals, Feng Wang, Heidi Savelli, and Kanako Hasegawa, for supervision in the organization and editing of the report. We thank Isabelle Van der Beck and Jill Raval (the United Nations Environment Programme) for the guidance and support on the Global Environment Facility project "Addressing Marine Plastics - A Systemic Approach".

We also thank partners of the Global Environment Facility project: Ellen MacArthur Foundation, Ocean Conservancy, and GRID-Arendal; participants of the workshop "Multi-stakeholder consultation workshop on a systemic approach to marine plastics" hosted during 15-16 February 2018 in Paris, for the comments and reviews provided to this report.

Recommended citation: United Nations Environment Programme (2018). Mapping of global plastics value chain and plastics losses to the environment (with a particular focus on marine environment). Ryberg, M., Laurent, A., Hauschild, M. United Nations Environment Programme. Nairobi, Kenya.

Design and layout: Marie Moncet

Design cover: Ana CARRASCO

Printed by: UNESCO Photos: © Paparacy; Extarz; imagineStoc;  
LightField Studios / Shutterstock.com

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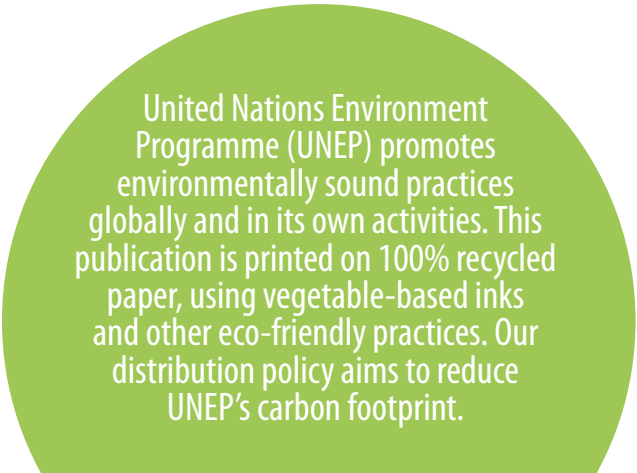
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Job Number: DTI/2193/PA



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**Addressing  
Marine Plastics**  
A Systemic Approach

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# List of Acronyms

|                |                                                                                     |
|----------------|-------------------------------------------------------------------------------------|
| CIS            | Commonwealth of Independent States                                                  |
| C&D            | Construction and Demolition                                                         |
| EoL            | End-of-Life                                                                         |
| ELV            | End-of-life vehicles                                                                |
| ETRMA          | European Tyre & Rubber Manufacturers' Association                                   |
| EU             | European Union                                                                      |
| GESAMP         | Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection |
| GDP            | Gross Domestic Product                                                              |
| kg             | Kilograms                                                                           |
| Mt             | Million tonnes                                                                      |
| MMF            | Morgan-Mercer-Flodin model                                                          |
| m3             | Cubic meters                                                                        |
| MSW            | Municipal Solid Waste                                                               |
| NAFTA          | North American Free Trade Agreement                                                 |
| NGO            | Non-Governmental Organization                                                       |
| OECD           | Organisation for Economic Co-operation and Development                              |
| PBDE           | Polybrominated diphenyl ether                                                       |
| POP            | Persistent Organic Pollutants                                                       |
| UN             | United Nations                                                                      |
| UN Environment | United Nations Environment Programme                                                |
| USD            | United States Dollar                                                                |
| UV             | Ultraviolet                                                                         |
| WEEE           | Waste Electrical & Electronic Equipment                                             |
| WWTP           | Wastewater treatment plant                                                          |

# Types of plastics

|       |                                 |
|-------|---------------------------------|
| ABS   | Acrylonitrile butadiene styrene |
| AKD   | Alkyd                           |
| ASA   | Acrylonitrile styrene acrylate  |
| CA    | Cellulose acetate               |
| EPS   | Expanded polystyrene            |
| HDPE  | High density polyethylene       |
| LDPE  | Low density polyethylene        |
| LLDPE | Linear low density polyethylene |
| PA    | Polyamide                       |
| PAN   | Polyacrylonitrile               |
| PC    | Polycarbonate                   |
| PE    | Polyethylene                    |
| PET   | Polyethylene terephthalate      |
| POM   | Polyoximethylene                |
| PP    | Polypropylene                   |
| PS    | Polystyrene                     |
| PMA   | Poly methylacrylate             |
| PUR   | Polyurethane                    |
| PVA   | Polyvinyl alcohol               |
| PVAc  | Polyvinyl acetate               |
| PVC   | Polyvinylchloride               |
| SAN   | Styrene-acrylonitrile           |
| SBR   | Styrene-Butadiene Rubber        |

# Executive summary

Plastics have become one of the most ubiquitous materials used globally, and global production has on average increased by about 9% per year since 1950. The plastic industry has become a major economic actor with revenue of about 1,722 billion Euros in 2015. The issue of plastics ending up in the oceans and harming marine lifeforms has been known since the 1970s. Research focusing on the impacts associated with exposure of organisms to marine micro- and macroplastics has been ongoing for years. However, studies linking the processes in the plastic value chain to plastics being released to the oceans are only starting to emerge.

## Plastics losses from the plastics value chain

This report provides a comprehensive global mapping of plastic losses to the environment throughout the plastic value chain using 2015 as the reference year. This mapping covers plastics production and

density polyethylene & linear low density polyethylene (LDPE, LLDPE; 12%), polyvinylchloride (PVC; 11%), high density polyethylene (HDPE; 10%), and polyethylene terephthalate (PET; 5%) which in total account for more than 50% of total plastics usage.

It was found that approximately 3.0 and 5.3 million tonnes of micro- and macroplastics, respectively, are annually lost to the environment. The largest sources of microplastic losses were from abrasion of tyres, and city dust, which include abrasion of plastics from e.g. shoe soles, exterior paints, and road markings. The primary sources of macroplastic losses stem from mismanaged municipal solid waste (i.e. open dumping and inadequate landfilling), accounting for about half of the macroplastics lost to the environment. Littering of plastic waste and loss of fishing gears and other equipment related to maritime activities were also major sources of macroplastic losses.

## Hotspots with regard to potential impact on the marine environment

Measurements or models providing a link between losses to the environment and subsequent releases of plastic to the oceans are lacking. However, a

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