"An Introduction to Plastic Pollution”
PART II

Sources, Pathways and Sinks of Marine Litter

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Sources, pathways and sinks of plastics

**LAND**
- UV radiation: Breaks down macroplastics into microplastics
- Natural disasters
- Wind: Wind transports plastics
- Atmosphere: Plastic particles accumulate in the atmosphere (and birds), where they can be transported over long distances
- Precipitation: Precipitation transports plastics to different places
- Abrasion of tyres is a significant source of microplastics

**SEA**
- Plastic sources
- Temporary sinks
- Environmental processes
- Permanent sinks

- The distinction between temporary and permanent sinks is for a 100-year timescale and is indicative only.

- Coastal habitats: Mangroves, coral reefs, salt marshes, etc.
- Currents: Ocean currents and gyres concentrate and move plastics in the marine environment
- Water column
- Sediments
- Trenches and canyons
- Biofouling and bioaccumulation: Plastics aggregate as microorganisms and algae accumulate on them. They are ingested by fish, transported, and redistributed through faecal pellets. The chemicals associated with the plastics may bioaccumulate.

**Sources**
- Marine-based sources: Shipping, Coastal habitats, Ice, Fishing, Offshore

**Pathways**
- inland transportation
- river discharge
- wastewater systems
- sea and ocean current
- biodeposition

**Sinks**
- biodeposition
- sediments
- permanent sinks

**Marine life**
- Marine life interacts with plastic debris, as well as a transporter

Source: GRID Arendal (2020)
Major sources and sinks of microplastics and marine litter

Source of plastics: CAPITAL LETTERS
Sink for plastics: Italic letters

Source: UNEP 2021.
Illustrated by GRID-Arendal
<table>
<thead>
<tr>
<th>Estimated emissions of plastic waste (million metric tons per year)</th>
<th>Source-to-sea aspect</th>
<th>Projected emissions of plastic waste (million metric tons per year) under certain conditions</th>
<th>Approach used</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-23</td>
<td>Entered aquatic ecosystems in 2016</td>
<td>53 by 2030</td>
<td>Integrating expected population growth, annual waste generation per capita, the proportion of plastic in waste; incorporating an increase in plastic materials associated with predicted production increases, and the proportion of inadequately managed waste by country (Borelle et al. 2020)</td>
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<tr>
<td>9-14</td>
<td>Entered the aquatic systems in 2016</td>
<td>23-37 by 2040 (equivalent to 50 kg of plastic per metre of coastline worldwide)</td>
<td>Modelled stocks and flows of municipal solid waste and four sources of microplastics through the global plastic system, using five scenarios (2016–2040) and assuming no effective action is taken (Lau et al. 2020)</td>
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<td>0.8-2.7</td>
<td>Entered the oceans from global riverine systems in 2015</td>
<td>--</td>
<td>Based on &gt;1,000 rivers, calibrated using field observations (Meijer et al. 2021)</td>
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</tbody>
</table>
In 1756, the Russian scientist Mikhail Lomonosov formulated the law of mass conservation:

“In an isolated system, matter is neither created nor destroyed!”
Harris et al., 2021 - Taking a mass-balance approach to assess marine plastics in the South China Sea
One Integrated Marine Debris Observing System for a Clean Ocean
Satellite Activity of Ocean Decade Laboratory: A Clean Ocean

> Online Poster Session & Live Event
> 17 to 19 Nov 2021
THANK YOU FOR YOUR ATTENTION!

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• From Pollution to Solution: A Global Assessment of Marine Litter and Plastic Pollution
• Drowning in Plastics: Marine Litter and Plastic Waste Vital Graphics
• ...