



# Scientific Facts on Marine litter and microplastics

**Source document:**  
GESAMP (2010)  
**Summary & Details:**  
GreenFacts

**Context** - The global production of plastics is increasing, and that increase is accompanied by an increase in plastic waste.

Part of this waste makes its way into the marine environment in the form of micro-plastics, small particles of plastic that can either be produced as plastic pellets, or result from the degradation of plastic objects such as bags, clothes, household items as well as building materials and fishing and aquaculture gear that has been discarded or lost.

What do we know about the extent of this problem?

You can also read a recent highlight on the topic: Sources, fate & effects of micro-plastics in the marine environment. [see <http://news.greenfacts.org/2013/03/sources-fate-effects-of-micro-plastics-in-the-marine-environment/>]

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This Digest is a faithful summary of the leading scientific consensus report produced in 2010 by The Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP):

*"Proceedings of the GESAMP International Workshop on micro-plastic particles as a vector in transporting persistent, bio-accumulating and toxic substances in the oceans"*

The full Digest is available at: <https://www.greenfacts.org/en/marine-litter/>



This PDF Document is the Level 1 of a GreenFacts Digest. GreenFacts Digests are published in several languages as questions and answers, in a copyrighted user-friendly Three-Level Structure of increasing detail:

- Each question is answered in Level 1 with a short summary.
- These answers are developed in more detail in Level 2.
- Level 3 consists of the Source document, the internationally recognised scientific consensus report which is faithfully summarised in Level 2 and further in Level 1.

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## 1. Introduction: plastic waste and micro-plastics in the oceans.

Global production of plastics is increasing every year (245 million metric tonnes in 2008) and the amount of plastic litter that is finding its way into the environment and into the oceans is also increasing, especially in the areas of the world where waste management practices are not keeping up with this rapid increase.



The amount of plastic waste is increasing

Although it is known that the amount of plastic waste is increasing, there is a general lack of information on how much of this plastic debris finds its way to the oceans and on how much of it there already is in the oceans. Once micro-plastics are in the oceans, this transport and deterioration process is not possible to influence. The only point of control is on the amount of waste that enters the oceans.

The widespread occurrence of large plastic fragments in the sea and the direct impact this can have both on marine fauna and on legitimate uses of the environment has been well documented. In recent years the existence of smaller plastic particles referred to as micro-plastics and their potential impact has received increasing attention. This concerns particles smaller than 5 mm, and there is increasing evidence that such particles can be ingested by marine organisms, and could harm them, although the effect of micro-plastic fragments on the health of animals is still largely unknown.

## 2. What kind of plastic waste ends up in the marine environment?

The term plastic encompasses a wide range of polymers, including rubbers, elastomers, textiles, and thermoplastics. The global production of plastics has increased from 1.5 million metric tonnes in 1950 to reach 245 million metric tonnes in 2008. Plastics are produced all around the globe, and the continuing growth of the demand will be met with increasing production.



Truly biodegradable plastics tend to be expensive and are not suitable for all applications.

In Europe in 2009, of the 45 million metric tonnes of plastics consumed, 11 million ended up in landfills or in the environment. It is acknowledged by industry and Government alike that recovery and recycling of plastics need to increase dramatically.

There are some newer plastic types on the market, for instance used in carrier bags or packaging, that are often assumed to be biodegradable. These include so called "Bio-plastics" that do come from renewable resources but are not necessarily biodegradable. To be called "biodegradable" a material needs to be broken down by living organisms in specific conditions into its constituent parts: carbon dioxide, water, inorganic compounds and biomass. These conditions may occur in industrial composters but not in the ocean, and thus many "biodegradable" plastics will not break down in the oceans any faster than other plastics. Truly biodegradable plastics, such as polylactic acid (PLA), tend to be more expensive and are not suitable for many applications requiring durability.

The majority of plastic waste entering the seas and oceans originates from land-based sources, but there are also sources in the oceans such as ships, oil platforms, and fishing or aquaculture operations.

### 3. What are micro-plastics and how do they enter the marine environment?

Micro-plastic particles, defined here as particles of less than 5mm in size, can arise through four separate processes:

- i. deterioration of larger plastic fragments;
- ii. direct release of micro particles into waterways and via wastewater treatment;
- iii. accidental loss of industrial raw materials during transport or trans-shipment, at sea or into surface waterways;
- iv. discharge of sewage.



It is likely that the amount of plastic waste in the ocean will continue to increase, driven primarily by the inexorable rise in plastics consumption and the continued inadequacy of re-use, recycling and waste management practices in many parts of the world.

Lethal interactions of large plastic items with animals such as seabirds, marine mammals and turtles through entanglement or ingestion are relatively well known, but the non-lethal impacts on individuals and populations are unclear. Even less is known about the potential impacts of micro-plastics on a wide range of smaller organisms, exposed to various particle sizes and chemical constituents.

### 4. Can micro-plastics transport contaminants into the marine environment?

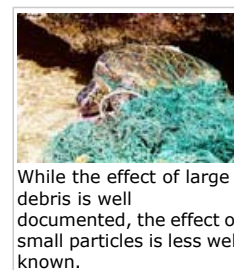
Persistent, bioaccumulating and toxic compounds can be present in the atmosphere or in water. Plastics found in the ocean contain some of these contaminants, either as additives added to the plastics during their production or as compounds that attach to plastics once they are in the environment.

The fate of those contaminants attached to plastics is unclear. The way contaminants are attached to micro-plastics, by absorption into the polymer, is reversible, and plastics can act as transporters from one area to another, semi-permanent 'sinks' or potential additional sources if ingested. Another possibility is that for some contaminants the transport through plastics would be minor compared to the transport of these contaminants through the atmosphere.

### 5. What is the impact of micro plastics on the marine environment?

Ingestion of plastics by animals can already be considered an undesirable exposure, no matter what other implications it might have. This ingestion could have detrimental effects on the health of animals either directly through the presence of plastics in their digestive system, or through the release of chemicals.

While these chemicals and their potential effects on organisms in the environment are well known, the way they interact with plastics once they are in the gut of animals is less known. The fact that such chemicals have been identified in plastics in the open ocean could on its own indicate that there is the potential for harm. However, this should be balanced by the knowledge that even in the absence of plastics, these contaminants are present in the environment and accumulate within the food chain. The real unknown is to what extent plastics increase exposure of organisms to contaminants.



One interesting approach to dealing with management of the coastal zone is to integrate the concepts of ecosystem services and their valuation which might make tackling the problem more attractive when considering the cost for action. It is however very difficult to apply cost-benefit analysis to ecosystems.

## **6. What is currently being done in the world about the marine litter?**

Here are examples of different initiatives that have been undertaken in the world by different stakeholders. Click on 'more' to have more information.

6.1 Land-based sources: achievements within the UN system at a global scale

6.2 Ship- and platform-based plastic litter – MARPOL 73/78 Annex V

6.3 UN global assessment processes

6.4 Examples of Regional Assessments

6.5 European Commission initiatives

6.6 USA, National initiatives

6.7 Coastal municipalities and local authorities

6.8 Chemical industry policies regarding marine litter

6.9 Non-governmental Organizations

6.10 Round-table discussion

## **7. Is a global assessment of micro-plastics in the marine environment necessary?**

A global assessment of micro-plastics could be beneficial at this time and there is both sufficient public concern and a need to provide further objective information on the topic to enable policy makers to act. This assessment would need to take into account not just micro plastics but also marine debris in general, in order to understand the general context and processes involved.

## **8. Conclusions**

- There is a need to identify and develop global environmental standards, as well as broadly applicable indicators, with which to benchmark these standards.
- There is a need for better understanding of the dynamics of persistent, bioaccumulative and toxic compounds (PBTs) in relation to plastics.
- Methods need to be developed to measure and to limit the quantities of plastics entering the oceans.

The main conclusion is that there is still very limited information on micro-plastics in the oceans. We do not know how much of it makes its way to the ocean and how it behaves

once it is in the ocean, both in terms of movement in the ocean and in terms of degradation, fragmentation, and modification of properties due to weathering. In addition, very little is known on the possibility for micro plastics to carry contaminants and on the effect on the environment of plastic fragments.