

Science for Environment Policy

Clarity needed on environmental impact of plastic waste for evidence-based policy

Plastic waste in the environment presents cause for concern, but scientific understanding of its exact impacts is still in its infancy. A team of Dutch scientists has presented recommendations on how to develop a new assessment method which provides clear, specific evidence on the risks of plastic waste. Once developed, this method could inform scientifically sound policies for managing plastic waste.

Many studies have shown that plastic waste in the environment poses potential risks to wildlife and human health, and this issue has rightly become an important political topic. This is a young area of research, however, and there are many scientific uncertainties surrounding this emotive, complex problem. It can, therefore, be difficult to untangle widespread perceptions of plastic waste's *potential* risks from robust evidence on its *actual*, known risks.

For instance, the presence of plastic in the environment is often described as 'huge', but policymakers ideally need more specific and reliable evidence on risks in order to balance the costs and benefits of strategies to tackle the problem, which are neither excessive nor insufficient.

To reduce the scientific uncertainties, the researchers argue, we need a new risk-assessment framework for plastic debris. This could enable a move away from discussions surrounding 'potential' impacts to provide the same clarity that established risk assessments have for many other chemical contaminants. However, much work needs to be conducted first to help develop such a framework; the researchers provide a number of recommendations to guide this task.

For example, ecologically relevant metrics (ERM) need to be defined, which quantify the effects of plastic debris, as well as exposure, on wildlife. The ERM for conventional chemicals in risk assessment is simply 'concentration' (e.g. mass of dissolved chemical per litre of water), but plastics require many ERMs because they come in many types, shapes and sizes, and with various associated chemicals. These can be characterised by many adverse-outcome pathways (AOPs), which describe how specific particles may affect specific species for different exposures. The researchers recommend using an expert panel consultation to define these ERMs and AOPs.

Further work is needed to develop and standardise measurements for plastic debris in the environment, the researchers also recommend. Critically, it is not currently possible to measure all plastics in a given sample (e.g. of water) or to accurately measure all sizes in a sample. Research is also needed for risk assessment to better measure the effects of plastics at a wide range of concentrations, in order to define thresholds for effects for different locations and as environmental concentrations change over time.

For time- and cost-efficiency, the researchers recommend a tiered approach to plastic-debris risk assessment. Under this approach, quick, basic measures can be used as a starting point to indicate whether an AOP is likely. For instance, it can be instantly decided that zooplankton will never suffer from the AOP 'entanglement by fishing rope,' given their size. If an AOP is considered likely, risk assessors can progress to higher-tier testing which uses more detailed and dedicated techniques, such as long-term field experiments.

Risks associated with plastic waste's contaminants¹, such as persistent organic pollutants and pesticides, should be assessed separately to risks associated with the plastic itself, they say. This is because contamination changes over time and varies by location. Contaminants can be assessed through existing, established approaches, such as the Plant Protection Products Regulation² and the Biocidal Products Regulation³ or REACH⁴.

The researchers believe that the risk assessment they describe could ultimately reduce misconceptions and uncertainty about the ecological and human health risks of all sizes of plastic waste, to guide scientifically-sound policies that are appropriate to the scale of the problem.



19 April 2018
Issue 506
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Source: Koelmans, A.A., Besseling, E., Foekema, E., *et al.* (2017). Risks of Plastic Debris: Unravelling Fact, Opinion, Perception, and Belief. *Environmental Science and Technology*. 51(20): 11513–11519. DOI: 10.1021/acs.est.7b02219. This study is [free to view](#).

Contact:
bart.koelmans@wur.nl

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To cite this article/service: "[Science for Environment Policy](#)": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

1. See [Marine Strategy Framework Directive](#), MSFD (2008), in which member states are setting thresholds for quantities of marine litter, taking into account the risk and the actual generated harm.

2. [Regulation \(EC\) No 1107/2009 concerning the placing of plant protection products on the market](#)

3. [Regulation \(EU\) no 528/2012 concerning the making available on the market and use of biocidal products](#)

4. [Regulation \(EC\) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals \(REACH\)](#)