Microplastics

in nature and society

A scientific perspective of the European Academy consortium
Science Advice for Policy by European Academies (SAPEA)

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A Scientific Perspective on:
Microplastics in Nature and Society

- Evidence review report (ERR)
- Separate known from unknown
- Options for policy (Pielke: honest broker role)
- Systematic literature search
- A review of reviews
- Expert judgment
- External review
- Release ERR: January 10th 2019
- Microplastics Pollution Round-table, G7
  Washington, February 2019
- Stakeholder meeting April 26th 2019
- SAM Scientific Opinion April 30th
- Applicable to other topics, e.g. SDGs
Figure 7. The number of studies within each theme for primary literature and review papers in the systematic map database.
The plastic system

Decisions & behaviour

Economic sectors

Society

Environment

Decisions & behaviours

Perceptions & communications drive action

Not just ‘general public’

Credit: GRID-Arendal and Maphoto/Riccardo Pravettoni

http://www.grida.no/resources/6908
The plastic system

Decisions & behaviour

PLASTIC HEALTH SUMMIT

HOW TO TAKE CARE OF THE NEXT GENERATION?

ZonMw PLASTIC HEALTH COALITION PLASTIC SOUP
The plastic system

Concern

Attitudes

Identity

Perceived control

Values

Social norms

Emotions

Habits

Knowledge

Decisions & Behaviour

Behavioural Options

Perceived control
The plastic system

Mechanisms of change

‘top-down’
- Hard/soft law
- Incentives / fines
- Campaigns:
  - Awareness raising
  - Behaviour change

‘bottom-up’
- Voluntary agreements
- Grassroots dynamics
- Self-organised
- Individual leadership
Things *are* happening, e.g.,
Monthly news items on microplastics 2017/2018

**Beach cleans:**
participant numbers have doubled (UK) 2017-2018 (SAPEA, 2019)

Momentum & willingness

Figure 5: Monthly number of news items extracted from EMM since January 2017 (JRC, personal communication). News published in over 70 languages in traditional or social media on microplastics were monitored with the EMM. A total of 6433 media news items were collected on microplastics between January 2017 and July 2018 demonstrating increased coverage of the topic, starting in January 2018 (clear peaks in March, June and September/October are potentially related to specific news stories as indicated).
Environmental Risk Perception

- **Risk** = when the exposure to a stressor (e.g. MP) exceeds the effect threshold for that stressor (e.g. MP)
- **Risk** = situation, event, or activity, which may lead to uncertain adverse outcomes affecting something that humans value
- Technical risk analysis and experts' assessments of risks have no privileged position; they are only one of many possible ways to frame, define, and understand risks.
- "Danger is real, but risk is socially constructed" Slovic, 1999
- Environmental risks special: complex and uncertain; risks for and from the environment; due to aggregated behaviour of many individuals; often temporally and geographically distant; ethics/fairness; stakeholder interests; ‘wicked problems’
- **Risk perception** = subjective judgement about risk associated with situation, event, activity. **Heuristics and biases**: mental shortcuts, e.g.:
  - Availability heuristic
  - Anchoring-and-adjustment heuristic
  - Unrealistic optimism / optimism bias
  - Framing effects
  - **Affect** heuristic, fear vs. anger, sadness, guilt, outrage

Risk perception & communication

- Risk assessment process can differ substantially between experts and non-experts
- One is not intrinsically better than the other
- -> social amplification and/or attenuation
- Risk communication is NOT just about facts; trust and values matter
- Transparent communication, incl. about uncertainty, generally increases trust – *modelling results*?
- Debate around fear messages: denial or action
- Uncertainty over potential human health risks
- Not one-size-fits-all (audiences)
- No substantial plastic pollution denial
Literature + expert elicitation procedure:
Limited evidence; only 3 studies quantified PEC/PNEC type of risk.

Burns & Boxal, 2018, ET&C
Conclusions on risks of microplastics

1. **Currently** there may some locations where environmental concentrations exceed the predicted no-effect level, however, there is **no evidence** for widespread ecological risks.

2. If emissions remain the same, ecological risks may be **widespread within a century**

3. Even though ‘high quality’ risk assessment is not yet feasible, **action to reduce, prevent and mitigate** is suggested (as an **option** for policy)

4. At the same time, it is **important** to develop and use risk assessment approaches to be able to prioritize these actions, and to plan where and when to apply them.

*Everaert et al., 2018, EP*
Chapter 4 - Plastic regulation in EU falls into different categories:

Product legislation – market introduction and approved use
- e.g. REACH and SUP directive

Waste legislation and Emissions to the environment
- e.g. Waste framework directive and Urban waste water treatment directive

Environmental legislation, quality of receiving environment
- e.g. Drinking water directive and Marine Strategy framework directive

Strategies (non-binding)
e.g. EU plastic strategy and EU action plan on circular economy

<table>
<thead>
<tr>
<th>Category</th>
<th>MPs explicitly?</th>
</tr>
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<tbody>
<tr>
<td>Product legislation – market authorisation</td>
<td></td>
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<tr>
<td>REACH</td>
<td>y</td>
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<tr>
<td>SUP</td>
<td>y</td>
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<tr>
<td>Packaging/waste</td>
<td>n</td>
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<tr>
<td>Food contact materials</td>
<td>n</td>
</tr>
<tr>
<td>Waste &amp; emission legislation</td>
<td></td>
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<tr>
<td>Industrial emissions directive</td>
<td>n</td>
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<tr>
<td>Waste framework Directive</td>
<td>n (litter)</td>
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<tr>
<td>Packaging and Waste</td>
<td>n</td>
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<tr>
<td>Landfill directive</td>
<td>n</td>
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<tr>
<td>Port reception facilities</td>
<td>n</td>
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<tr>
<td>Urban wastewater treatment</td>
<td>n</td>
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<tr>
<td>Quality of the receiving environment</td>
<td></td>
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<tr>
<td>Drinking water directive</td>
<td>n (r?)</td>
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<tr>
<td>Water framework directive</td>
<td>n</td>
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<tr>
<td>Marine strategy framework directive</td>
<td>y</td>
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<tr>
<td>Ambient air quality directive</td>
<td>n</td>
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<tr>
<td>Non-binding strategies</td>
<td></td>
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<tr>
<td>EU Plastic strategy</td>
<td>y</td>
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<tr>
<td>EU Action plan for circular economy</td>
<td>n</td>
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</table>
Three governing principles in EU treaty;

The precautionary principle

The proportionality principle

The polluter pays principle

EU regulatory framework

Based on scientific state of the art?
Conclusions from Chapter 4:

Due to a lack of scientific understanding, the precautionary principle has been part of the foundation for current regulation.

Extended producer responsibility can be viewed as an implementation of the polluter pays principle.

In general, measures or protection levels that can be enforced are often laid down in legally binding texts, and these can create new markets for innovative solutions.

It will be important to implement both agreements and legislation which are focused on emission reduction and the use of less hazardous materials.

At present, a systematic overview on policy options and their predicted efficiency and relevance to reduce current and future risks of NMP is not available.
Thank you!
3.3 Knowledge and Risk Perception

- MP evidence very **limited** and **mixed**; focus on **cosmetics**
- US and UK data in 2015 and 2016: lack of awareness of microplastics in cosmetics
- When exposed to samples, microplastics in cosmetics were seen as **unnecessary and unnatural** (Anderson et al.)
- In 2016 German representative survey, around 60% worried about plastic particles in food and drinking water
- More broadly, people are worried about marine pollution and are especially **aware of impacts on wildlife** (rather than on the economy; on human health?)
- Risk perception research in general has shown that expert and non-expert judgement often differs, because they are ruled by different factors; **equally valid**; social amplification and **attenuation** of risk is possible.
3.3 Knowledge and Risk Perception

- (Lack of) visibility of N/MPs could be important
- The public have to rely on experts to assess risks so risk perception becomes a question of trust (White et al.)
- Values matter: Broadly, higher altruistic and biospheric values, relative to egoistic and hedonic values, have been shown to be linked to higher environmental risk perception
- Values, perceived benefits and perceived risk linked to motivations for behaviour change.
- Individual differences, e.g., values; some people’s risk perceptions based on risk-benefit trade-offs; others’ are based on moral reasoning: the inherent rightness or wrongness of the issue.