

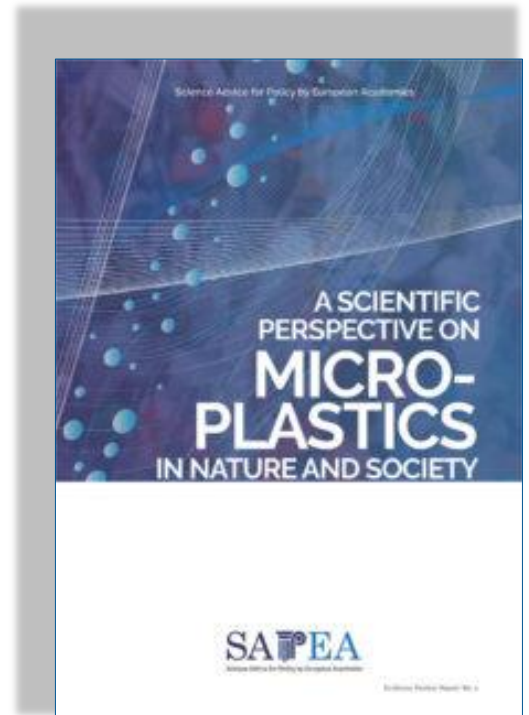
Microplastics in nature and society

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

Bart Koelmans

Wageningen University, The Netherlands

bart.koelmans@wur.nl



25 Working Group Members

Professor Bart Koelmans, University of Wageningen (Netherlands), Chair

Associate Professor Dr Sabine Pahl, University of Plymouth (United Kingdom), Vice-Chair

Professor Thomas Backhaus, University of Gothenburg (Sweden)

Dr Filipa Bessa, University of Coimbra (Portugal)

Professor Geert van Calster, KU Leuven (Belgium)

Dr Nadja Contzen, University of Groningen (Netherlands)

Richard Cronin, Water and Marine Advisory Unit (Ireland)

Professor Tamara Galloway, University of Exeter (United Kingdom)

Professor Andy Hart, Newcastle University (United Kingdom)

Dr Lesley Henderson, Brunel University London (United Kingdom)

Assistant Professor Dr Gabriela Kalčíková, University of Ljubljana (Slovenia)

Professor Frank Kelly, King's College London (United Kingdom)

Dr Bartłomiej Kolodziejczyk, Stockholm University (Sweden)

Professor Elda Marku, University of Tirana (Albania)

Professor Wouter Poortinga, Cardiff University (Wales, United Kingdom)

Professor Matthias Rillig, Freie University Berlin (Germany)

Associate Professor Dr Erik Van Sebille, Utrecht University (Netherlands)

Professor Linda Steg, University of Groningen (Netherlands)

Professor Josef Steidl, Czech Technical University Prague (Czech Republic)

Dr Julia Steinhorst, Institute for Advanced Sustainability Studies (Germany)

Associate Professor Dr Kristian Syberg, Roskilde University (Denmark)

Professor Richard Thompson, University of Plymouth (United Kingdom)

Associate Professor Dr Martin Wagner, Norwegian University of Science and Technology (Norway)

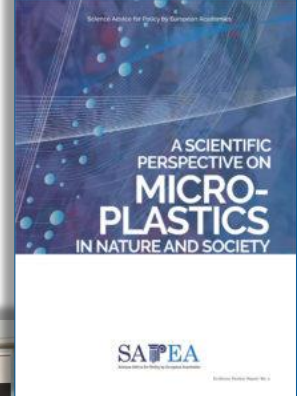
Professor Annemarie van Wezel, KWR Watercycle Research Institute and Utrecht University (Netherlands)

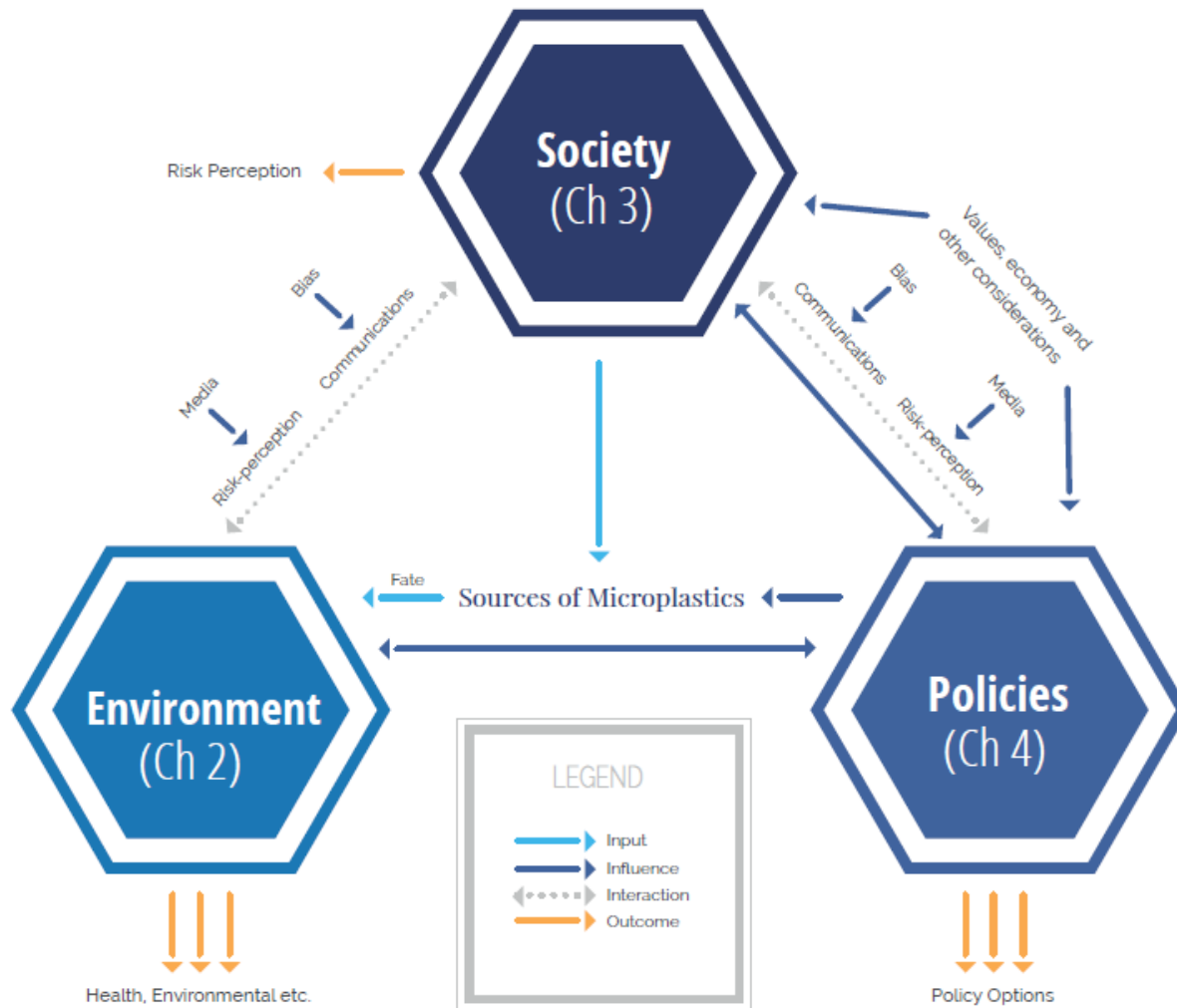
Dr Kayleigh Wyles, University of Surrey (United Kingdom)

Dr Stephanie Wright, King's College London (United Kingdom)

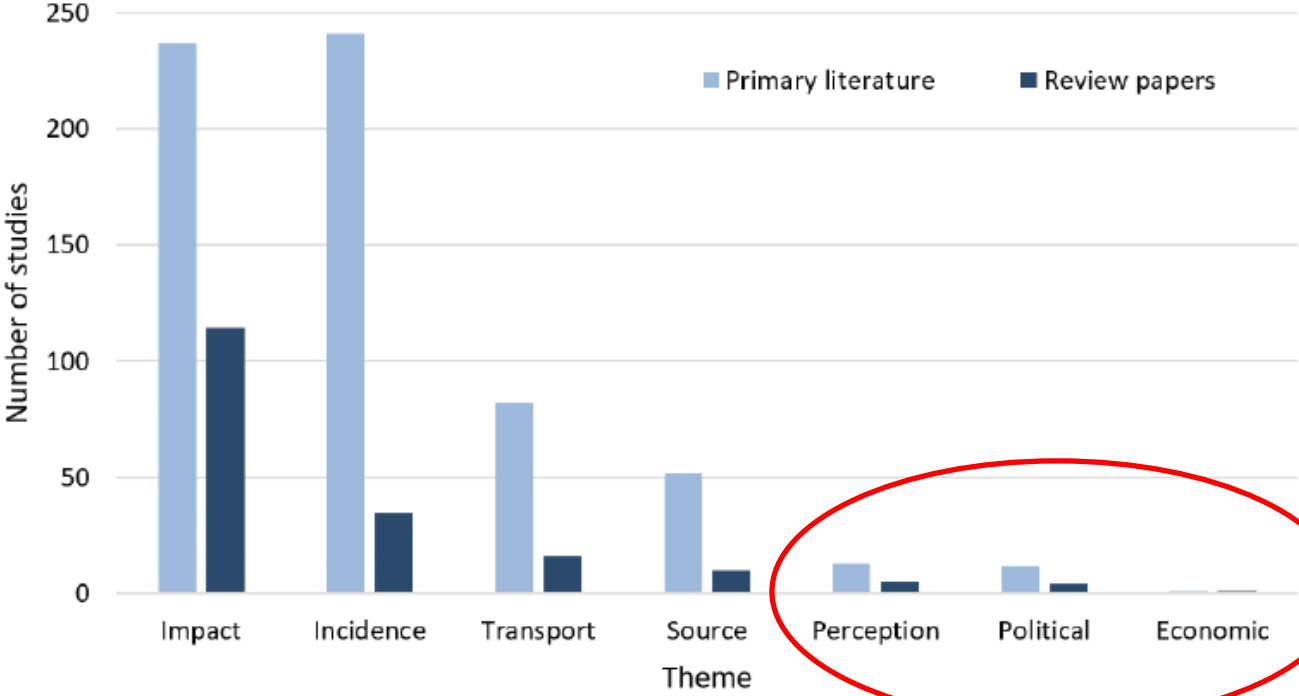
A Scientific Perspective on: Microplastics in Nature and Society

- Evidence review report (ERR)
- Separate known from unknown
- Options for policy (Pielke: honest broker role)
- Systematic literature search
- A review of reviews
- New literature 2016-2018.
- 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





Gaps - Systematic literature review micro/nanoplastics



Workshop Berlin
Social Scientists

Figure 7. The number of studies within each theme for primary literature and review papers in the systematic map database.

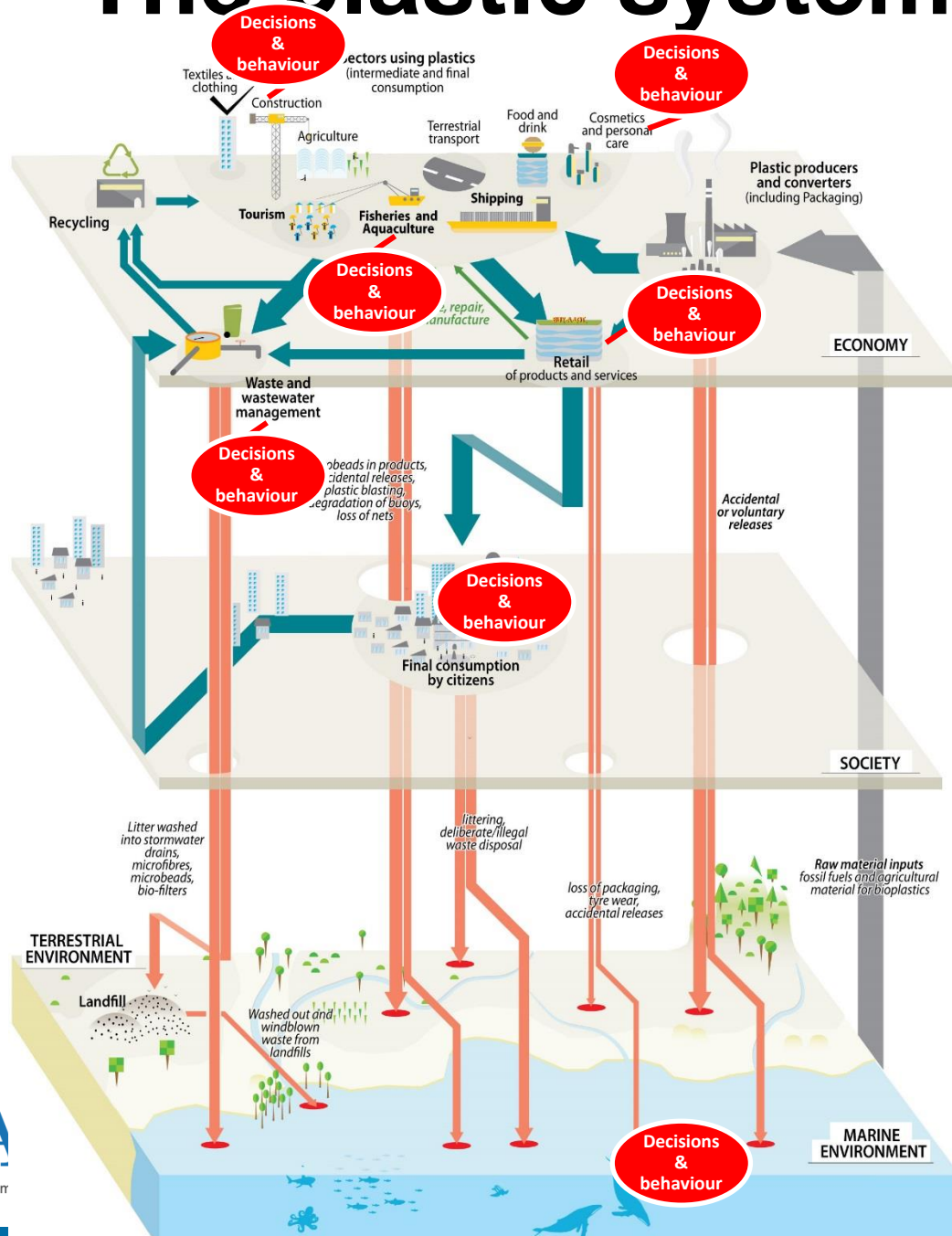


The plastic system

Economic sectors

Society

Environment



Decisions & behaviours

Perceptions & communications drive action

Not just 'general public'

Credit: GRID-Arendal and Maphoto/Riccardo Pravettoni

The plastic system



Media reporting

Recycl



TERREST ENVIRON

La

THEATERAMSTERDAM

3 October 2019

PLASTIC HEALTH SUMMIT

HOW TO TAKE
CARE OF THE
NEXT
GENERATION?

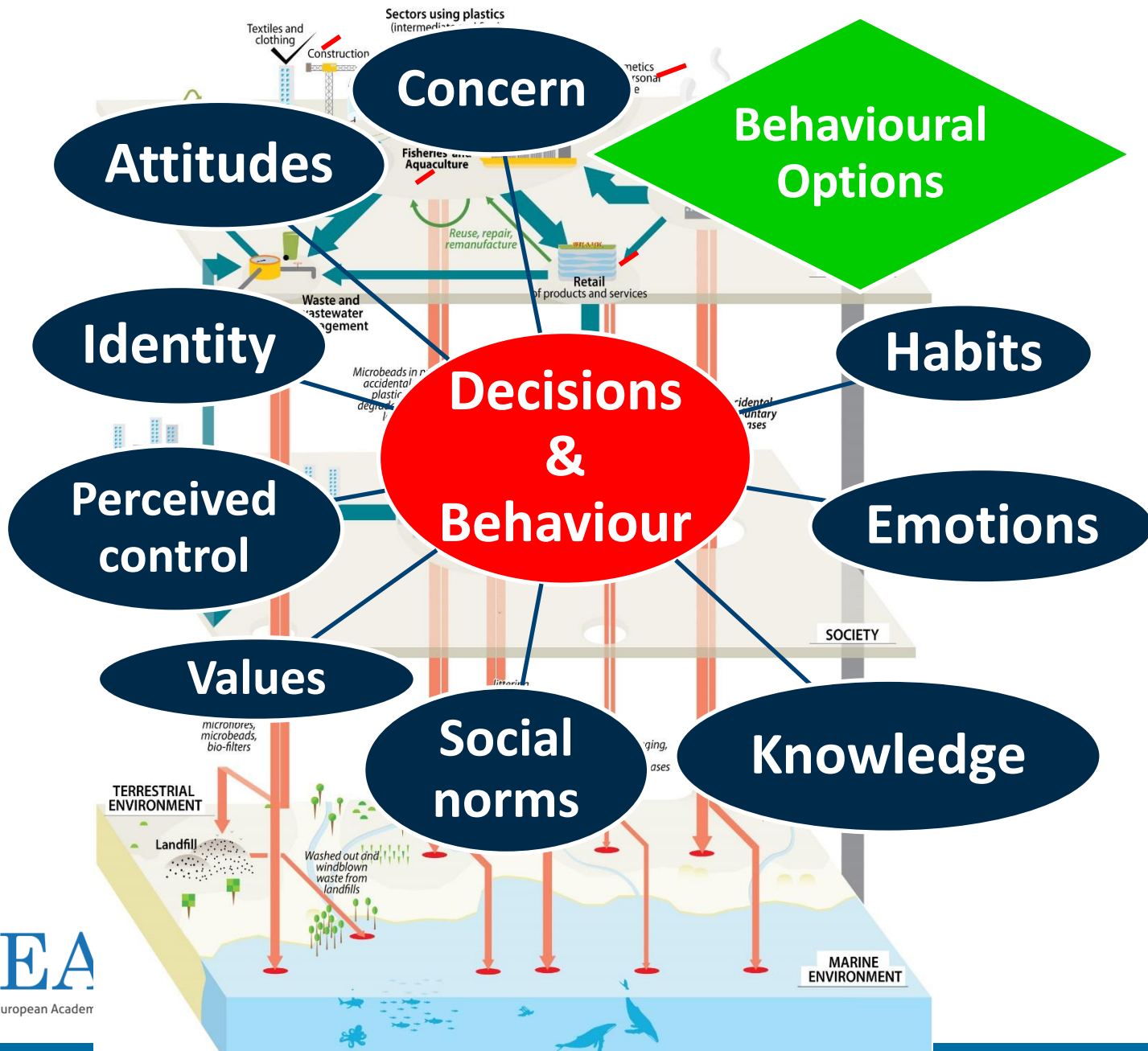


ZonMw

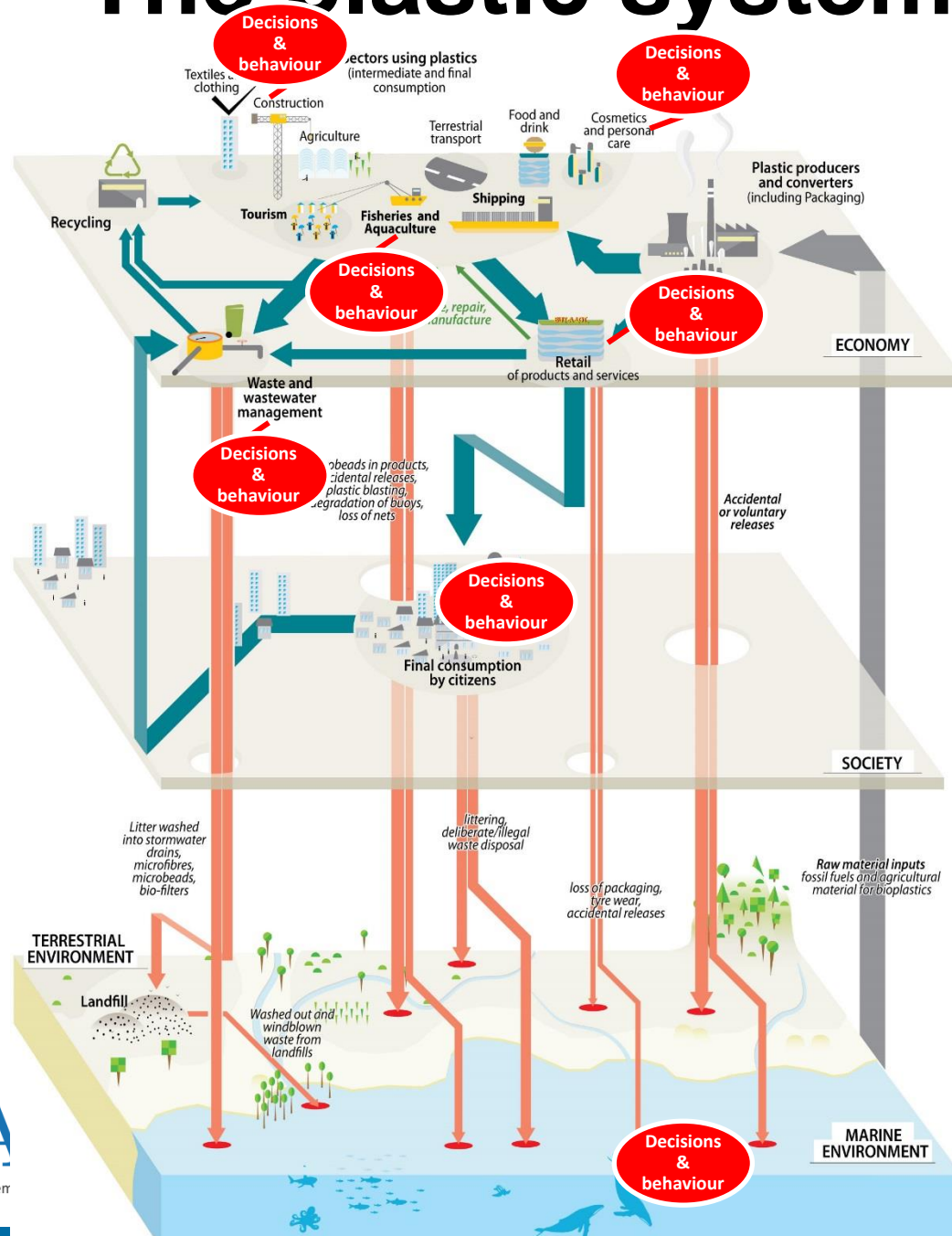
PLASTIC HEALTH
COALITION

PLASTIC
SOUP
FOUNDATION

The plastic system



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

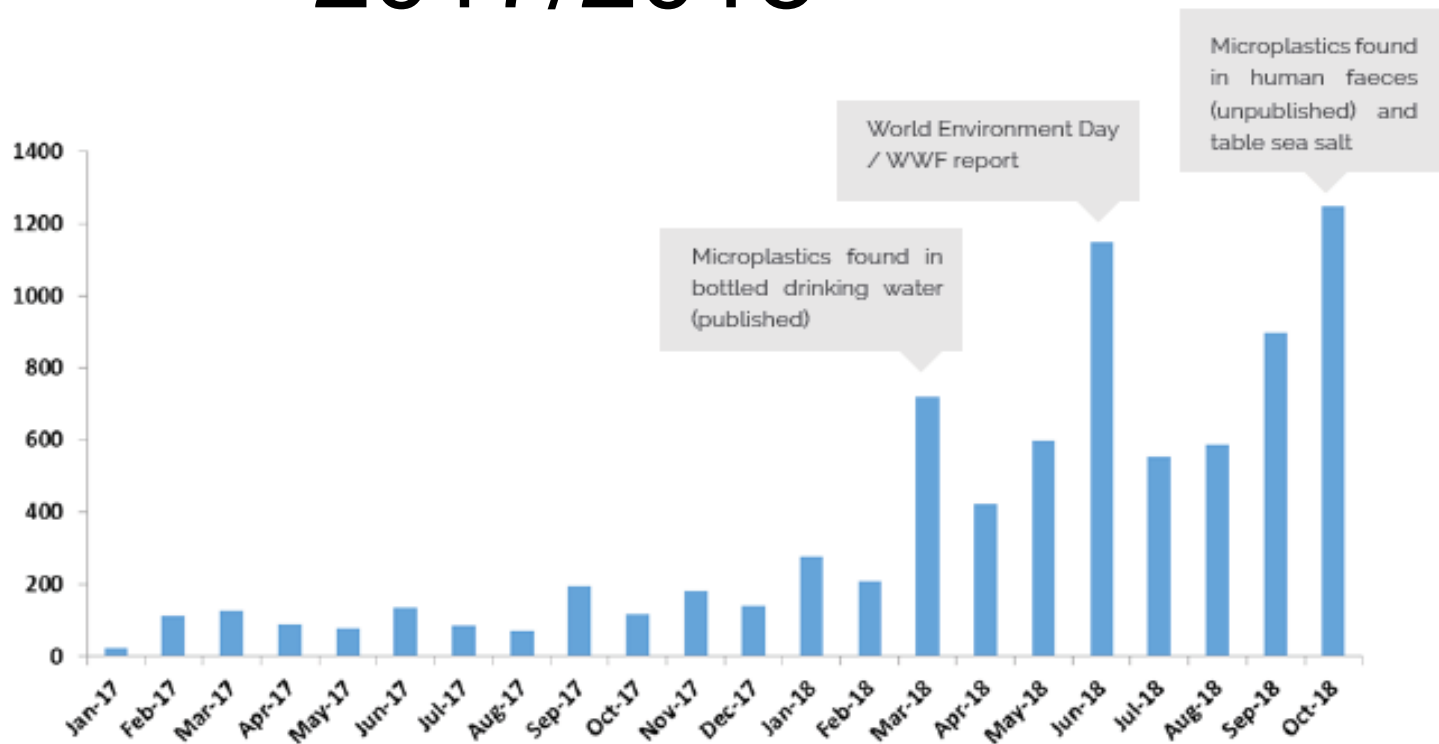


Figure 5: Monthly number of news items extracted from EMM since January 2017 (JRC, personal communication). News published in over 70 languages in traditional or social media on microplastics were monitored with the EMM. A total of 6433 media news items were collected on microplastics between January 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



**Slovic (1987): Perception of risk:
2 factors: unknown and dread**

SAPEA evidence review report

Ch 3 Summary

Risk perception & communication

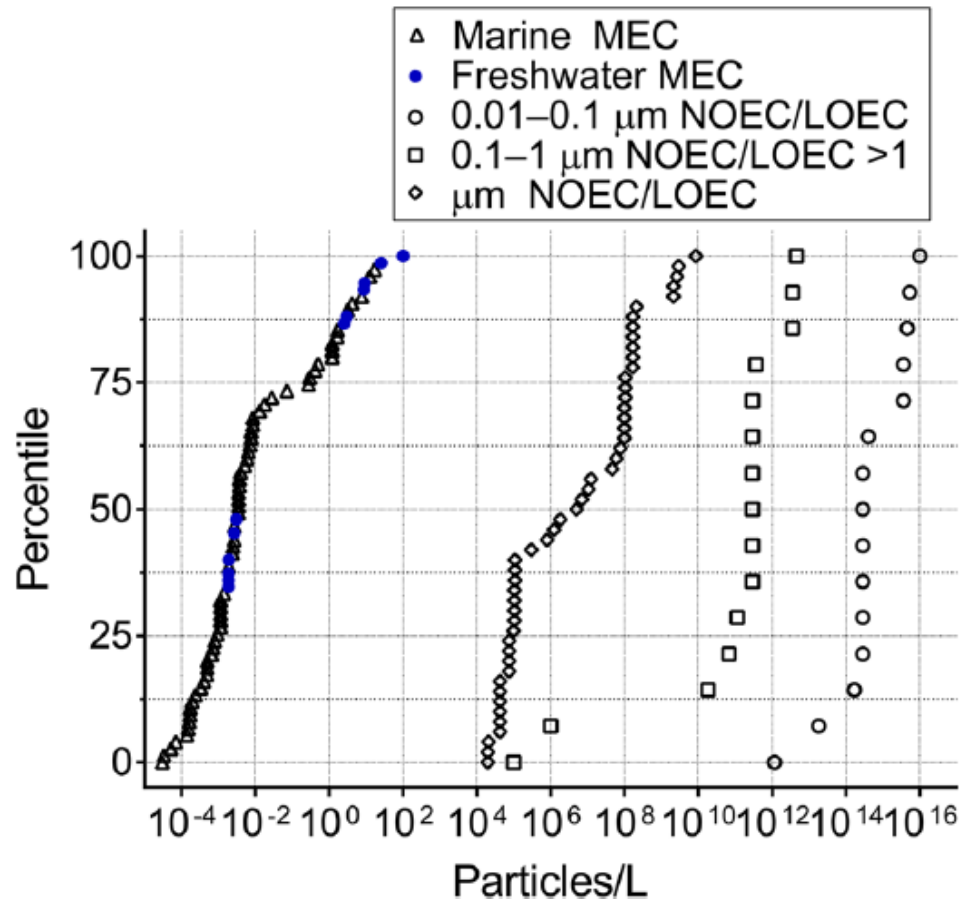
- Risk assessment process can differ substantially between experts and non-experts
- One is not intrinsically better than the other
- **-> social amplification and/or attenuation**
- Risk communication is NOT just about facts; trust and values matter
- Transparent communication, incl. about uncertainty, 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



Risk - Natural sciences; SAPEA Ch2

Literature + expert elicitation procedure:

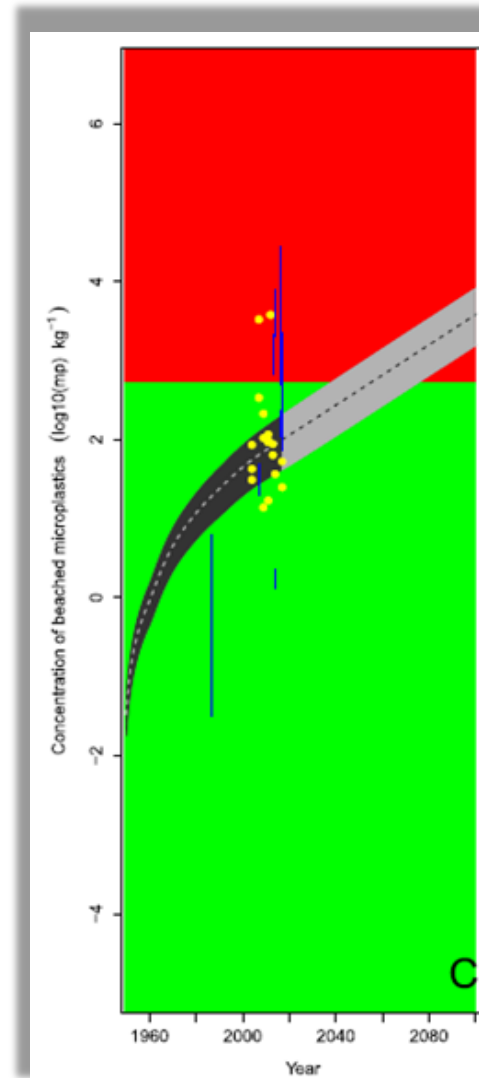
Limited evidence; only 3 studies quantified PEC/PNEC type of risk.



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.



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

	MPs explicitly?
Product legislation – market authorisation	
REACH	y
SUP	y
Packaging/waste	n
Food contact materials	n
Waste & emission legislation	
Industrial emissions directive	n
Waste framework Directive	n (litter)
Packaging and Waste	n
Landfill directive	n
Port reception facilities	n
Urban wastewater treatment	n
Quality of the receiving environment	
Drinking water directive	n (r?)
Water framework directive	n
Marine strategy framework directive	y
Ambient air quality directive	n
Non-binding strategies	
EU Plastic strategy	y
EU Action plan for circular economy	n

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.



