

Towards the development and application of an ERA framework for microplastic particles

Todd Gouin





SYMPOSIUM PROGRAMME

Towards the Development and Application of an Environmental Risk Assessment Framework for Microplastic



3 November 2018
Sheraton Grand Hotel, Sacramento, California

Organised by



Acknowledgements

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Motivations

- Increasing pressure on assessing the environmental risks, associated with particulates, such as NMs and microplastic
 - Scientific
 - Regulatory
- Challenges towards effective and efficient governance and regulation.
 - **Technical/scientific “problems”:**
 - (standard) test methods are missing or not applicable;
 - test methods are not always relevant
 - **Infrastructure for data management not adequate**
 - doubts about quality of data; no facilities for checking or curation



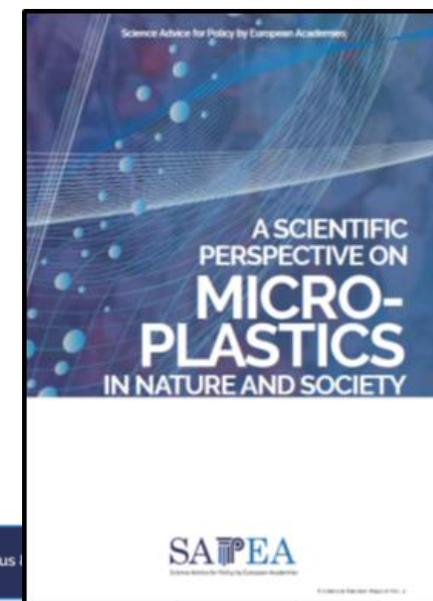
EU Legislation & Policies – SAPEA Report

- Product Legislation
 - REACH
- Waste Legislation & Emissions
 - Waste Framework Directive
 - Packaging & Waste
 - Landfill Framework Directive
- Environmental Legislation
 - Water Framework Directive
 - Marine Strategy Framework Directive
- Non-binding strategies
 - Plastics Strategy
 - Circular Economy

Table 4.1. Overview of EU Legislation and Policies on (Micro-)Plastics

Legislation	Date*	Status & Milestones	Concerned environmental compartment	MPs explicitly targeted?
Product legislation – market introduction and approved use				
REACH (EC 1907/2006) Oxo-degradable plastics and intentionally added microplastics	Implementation in discussion	ECHA will propose a restriction on market introduction or use of microplastics per January 2019, when it is the most appropriate Union-wide measure, is targeted at effects or exposures that cause the risks identified, is capable of reducing these risks to an acceptable level within a reasonable period of time and proportional while being practical and monitorable. Oxo-degradable plastics contain additives which promote the oxidation of the material	Soil/Water	Yes
Single Use Plastics (SUPs) and Fishing Gear (COM (2018)340)	May 2018	Legislative process ongoing	Water (Marine)	Yes
Packaging and Packaging Waste (94/62/EC)	May 2018	Revised version to transpose	Soil/Water	No
Food Contact Materials (1935/2004) and Regulation (EU) No 10/2011 on plastic materials and articles	Aug 2016	Evolving amendments	Soil/Water	No
Waste legislation and Emissions to the environment				
Industrial Emission Directive (2010/75/EU)	Nov 2010	Ongoing BAT BREFs*	Soil/Water	No
Waste Framework Directive (2008/98/EC)	May 2018	Revised version to transpose	Soil/Water/Air	No
Packaging and Packaging Waste (94/62/EC)	May 2018	Revised version to transpose	Soil/Water	No
Landfill Directive (1999/31/EC)	May 2018	Revised version to transpose	Soil/Water/Air	No

Legislation	Date*	Status	Compartment	MPs explicitly targeted?
Port Reception Facilities (proposal)	Jan 2018	Legislative process ongoing	Water (Marine)	No
Urban Waste Water Treatment Directive (91/271/EEC)	May 1991	Ongoing review, pos. rev. 2019	Fresh Water	No
Environmental legislation, quality of receiving environment				
Drinking Water Directive (98/83/EC)	Dec 2017	Review process ongoing	Freshwater	No (but mentioned in proposal for revision)
Water Framework Directive (2000/60/EC)	Dec 2000	Ongoing review, pos. rev. 2019	Fresh Water	No
The Marine Strategy Framework Directive (2008/56/EC) and the amending Directive 2017/845/EC and Commission Decision 2017/848/EC	Jun 2018	Ongoing implementation	Water (Marine)	Yes (marine micro-sized litter)
Ambient Air Quality Directive (2008/50/EC)	Aug 2015	Ongoing review, pos. rev. 2020	Air	No
Strategies (non-binding)				
The EU Plastics Strategy (COM/2018/028)	Jan 2018	/	Soil/Water/Air	Yes
European action plan for the Circular Economy, Closing the loop (COM/2015/0614)	Dec 2015	/	Soil/Water/Air	No





Problem formulation

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- Different instruments appear to address varying aspects related to concerns associated with microplastic
 - Clarity of problem trying to address?

Reduce risk?

Reduce harm?

Reduce release of plastic?

On the question of risk...

Critical Review

Microplastics in the Aquatic Environment: Evidence for or Against Adverse Impacts and Major Knowledge Gaps

Emily E. Burns and Alistair B.A. Boxall*

Environment Department, University of York, Heslington, United Kingdom

“Concentrations detected are orders of magnitude lower than those reported to affect endpoints such as biochemistry, feeding, reproduction, growth, tissue inflammation and mortality in organisms. The evidence for microplastics acting as a vector for hydrophobic organic compounds to accumulate in organisms is also weak. The available data therefore suggest that these materials are not causing harm to the environment.”

Where risk is assessed based on estimating the ratio of PEC/PNEC

Risk assessment framework

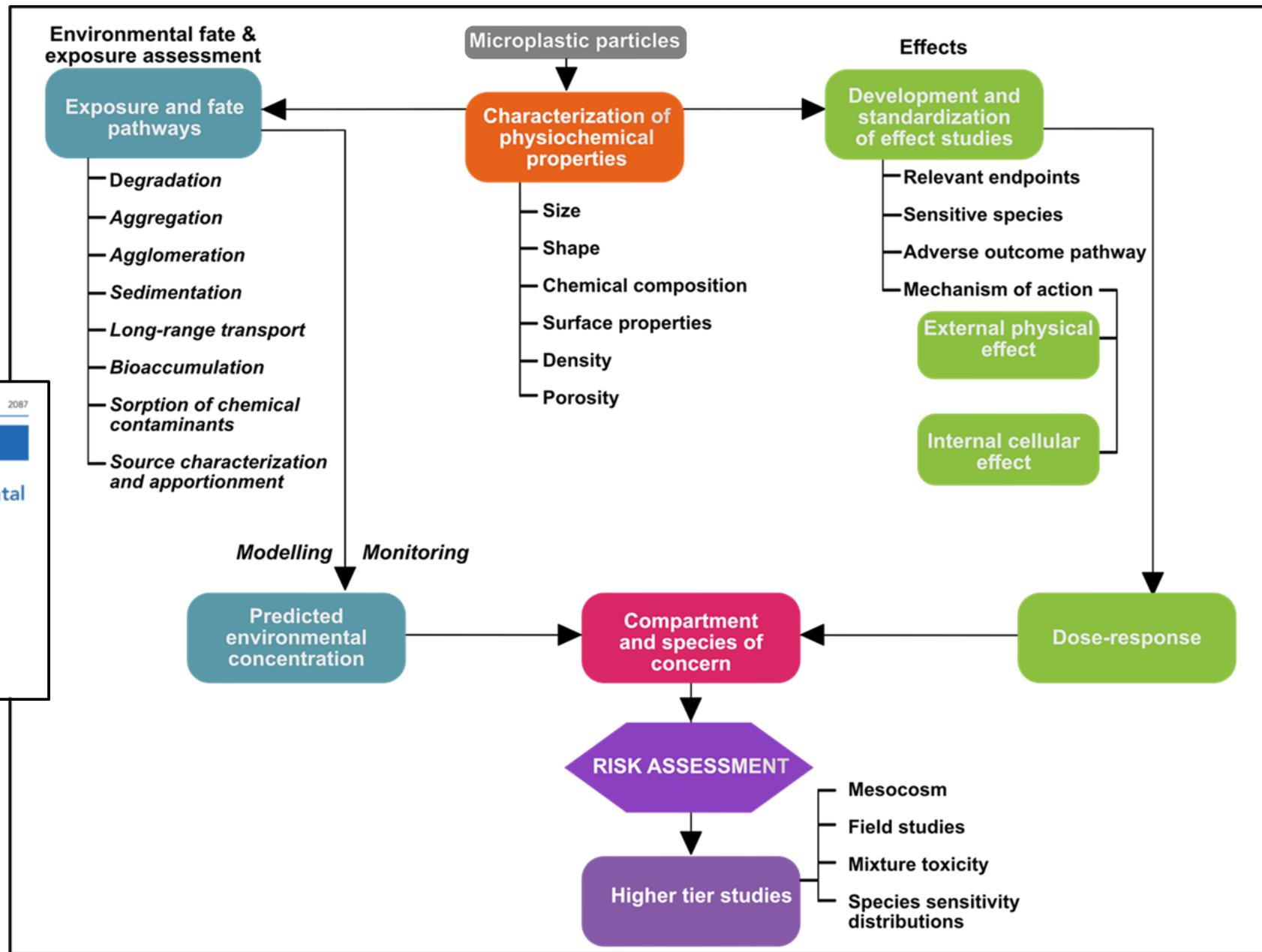
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Critical Review

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Todd Gouin,^{a,*} Richard A. Becker,^b Anne-Gaelle Collot,^c John W. Davis,^d Brett Howard,^e Kunifumi Inawaka,^f Mark Lampi,^g Blanca Serrano Ramon,^h Jay Shi,ⁱ and Philipp W. Hopp^j

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Risk assessment framework

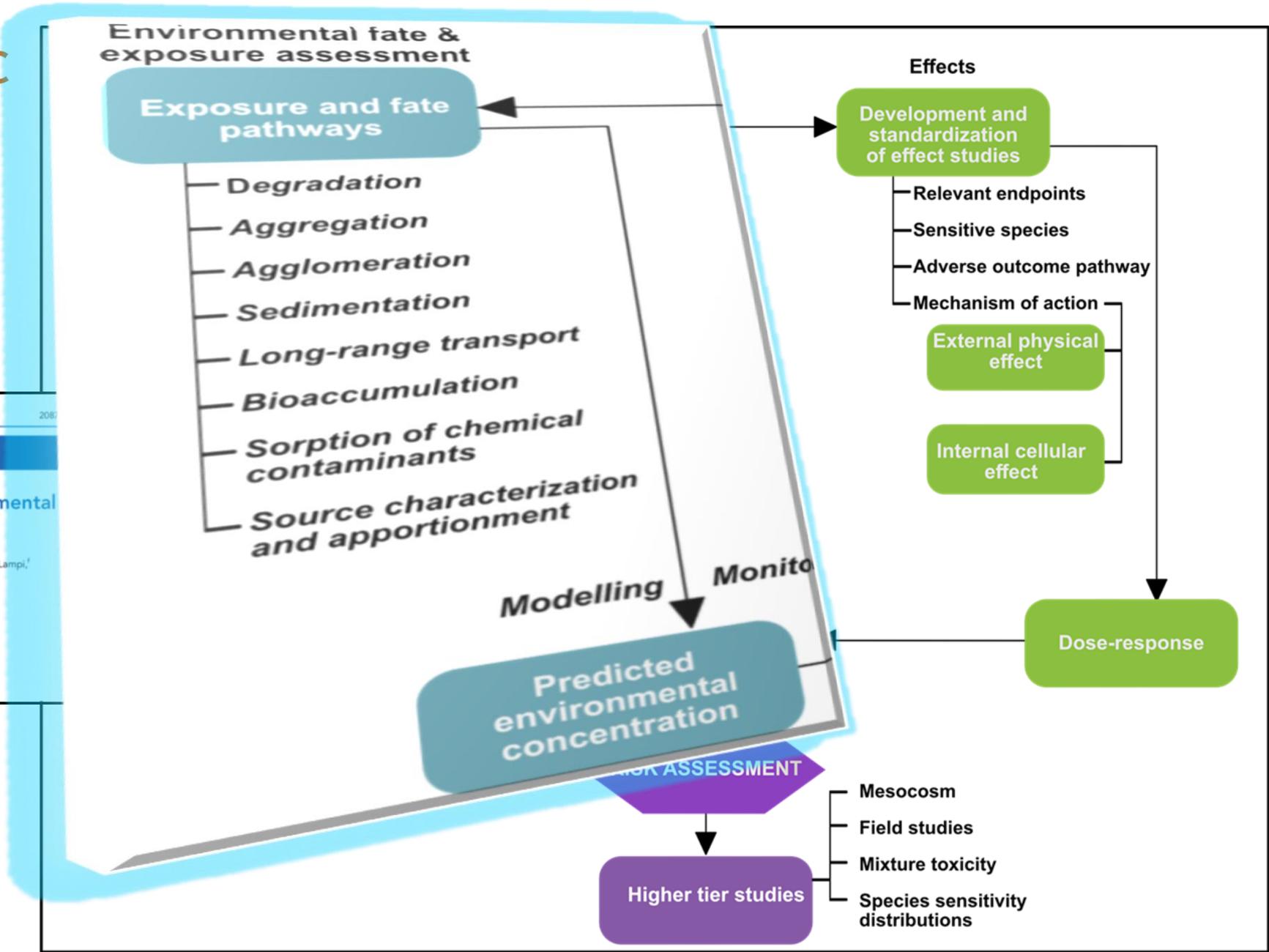
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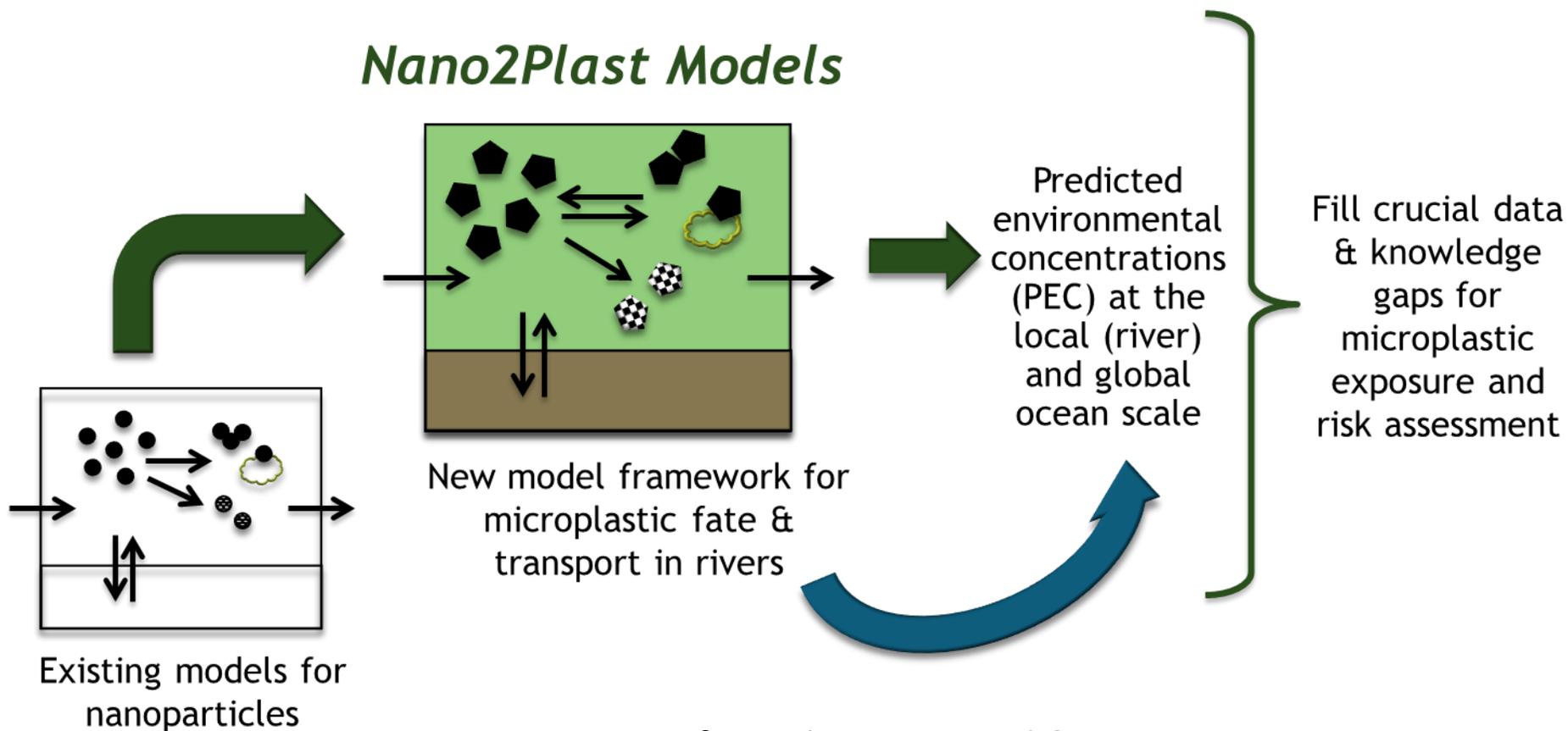
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Environmental fate – CEFIC LRI ECO 48

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Nano2Plast Models



Risk assessment framework

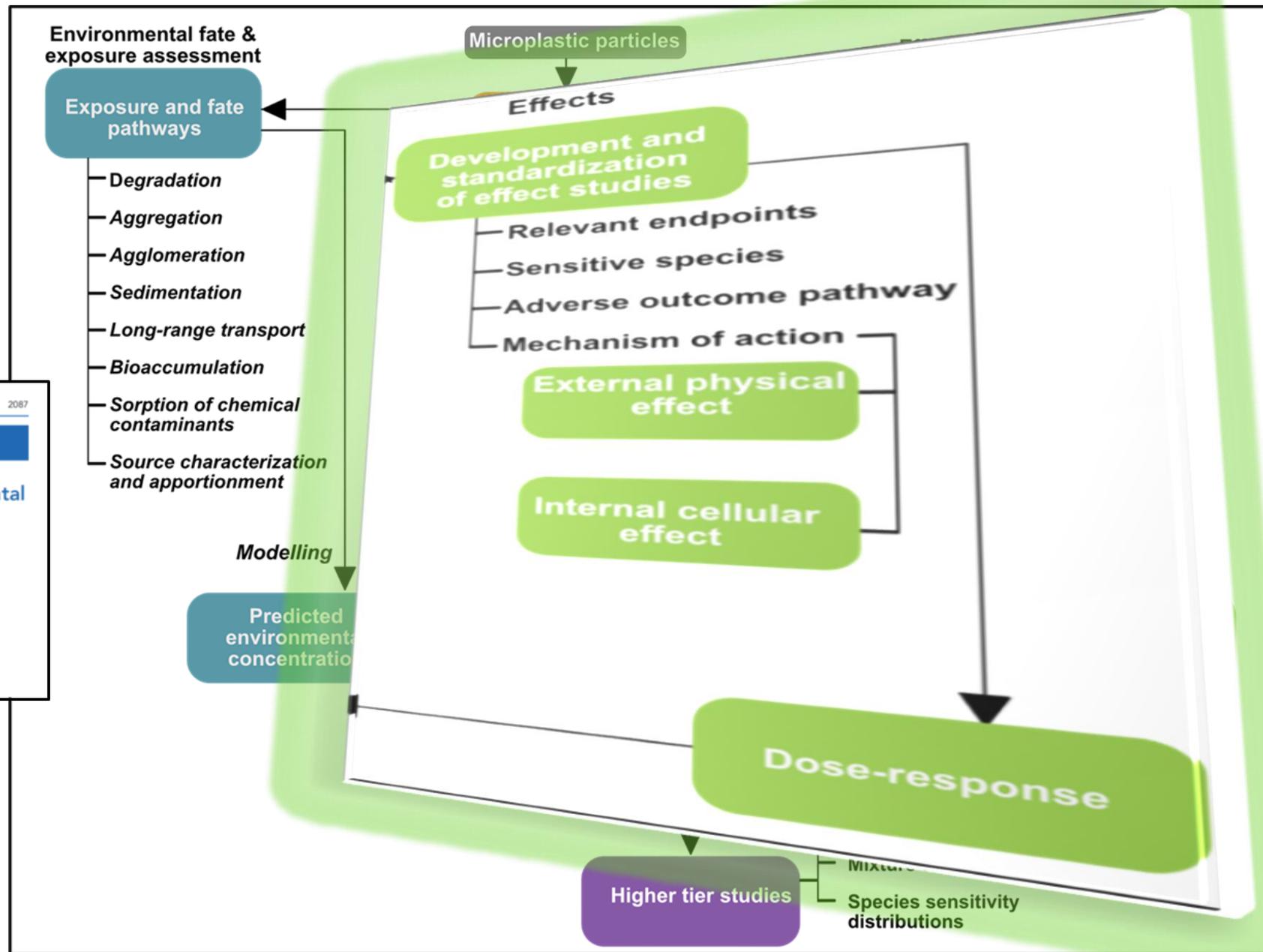
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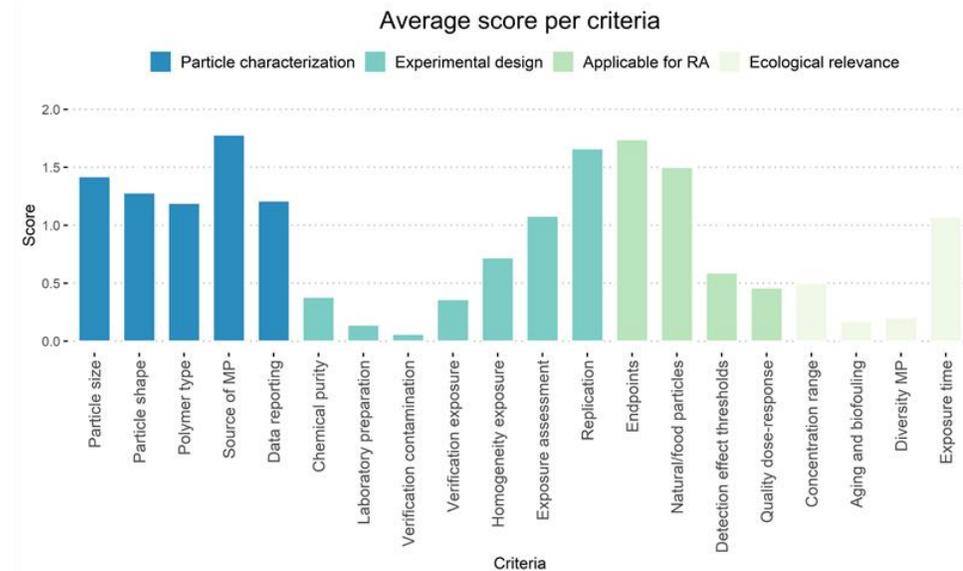
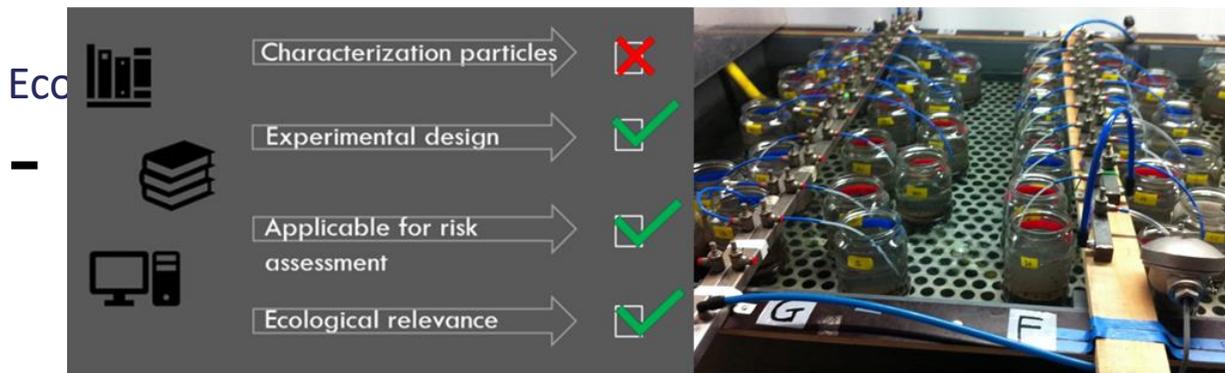
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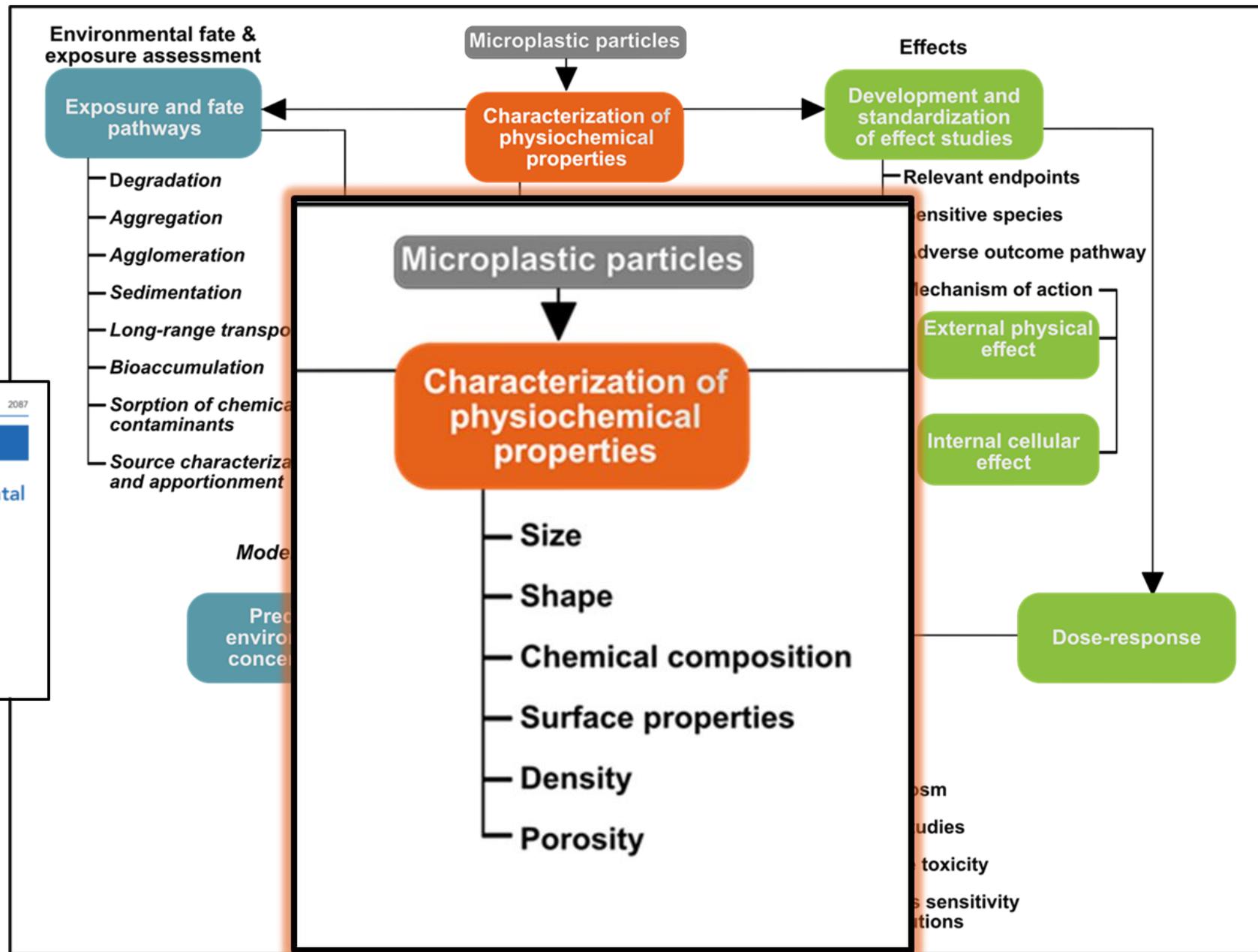
Microplastic Effect Thresholds for Aquatic Species



Hypothesis

That adverse physical effects of MP particles will primarily consist of a decreased nutritional value of ingested particles and/or from physical obstruction, both of which depend on the dose and bioavailability of the complex particle mixture present in nature.

Risk assessment framework



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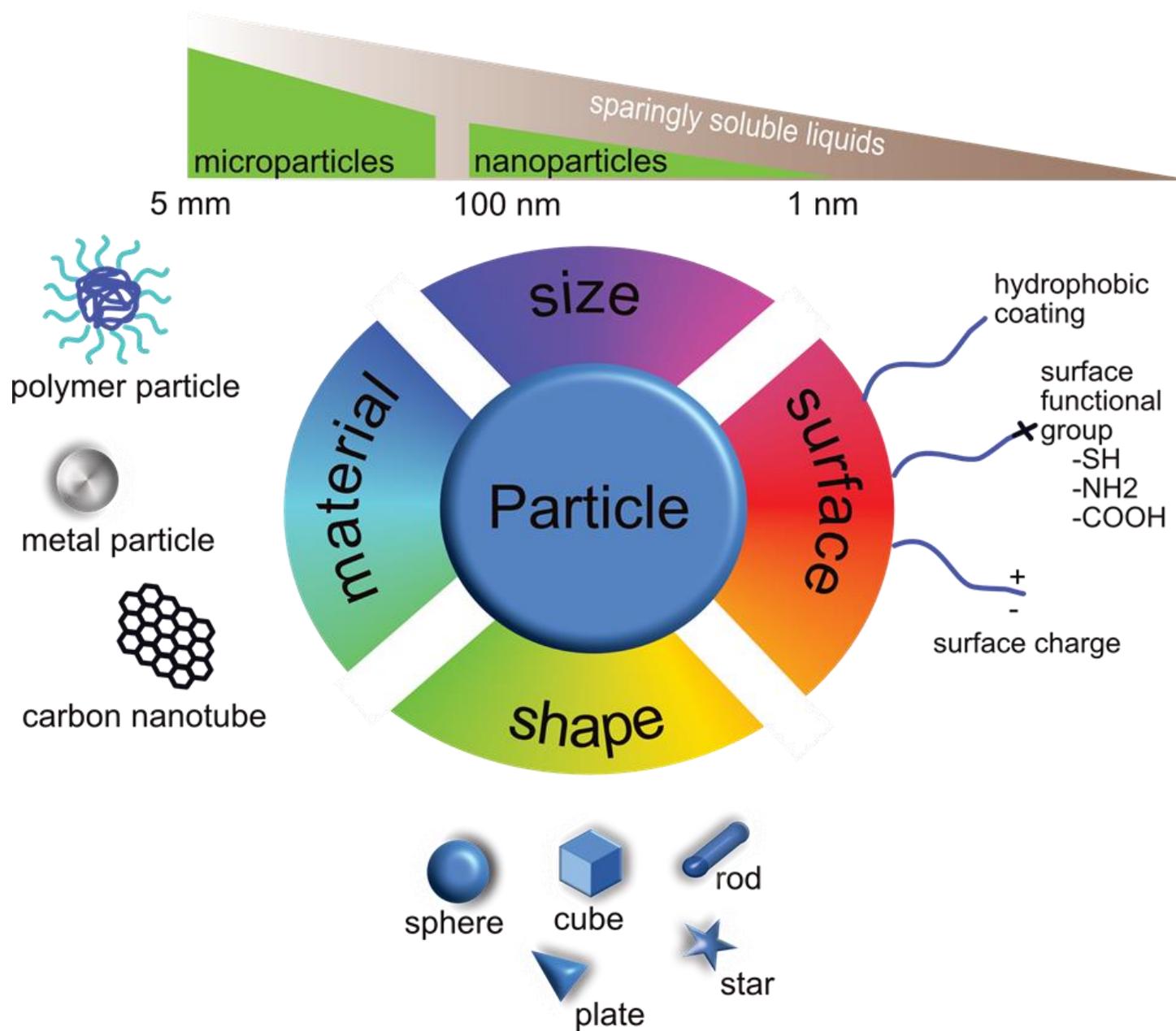
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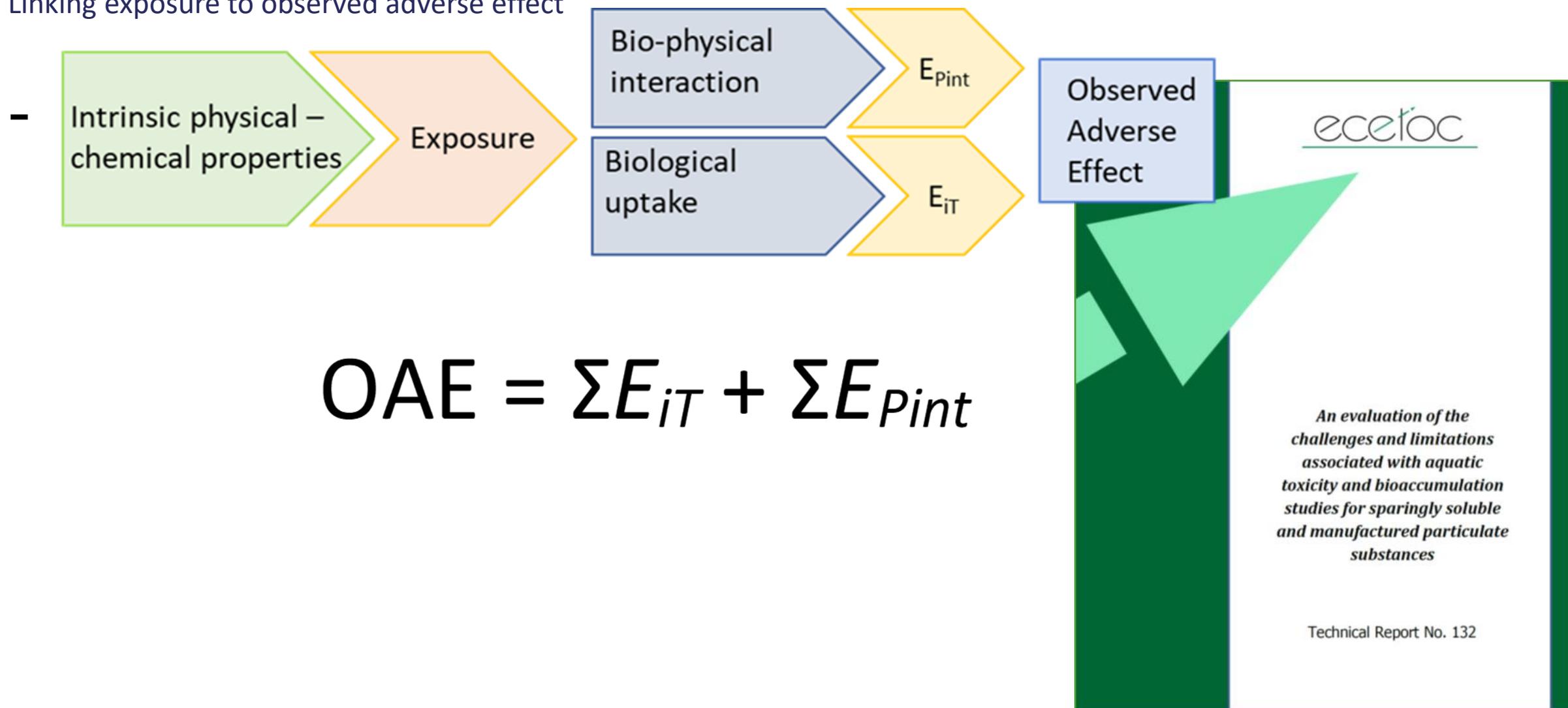
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Intrinsic and Extrinsic properties

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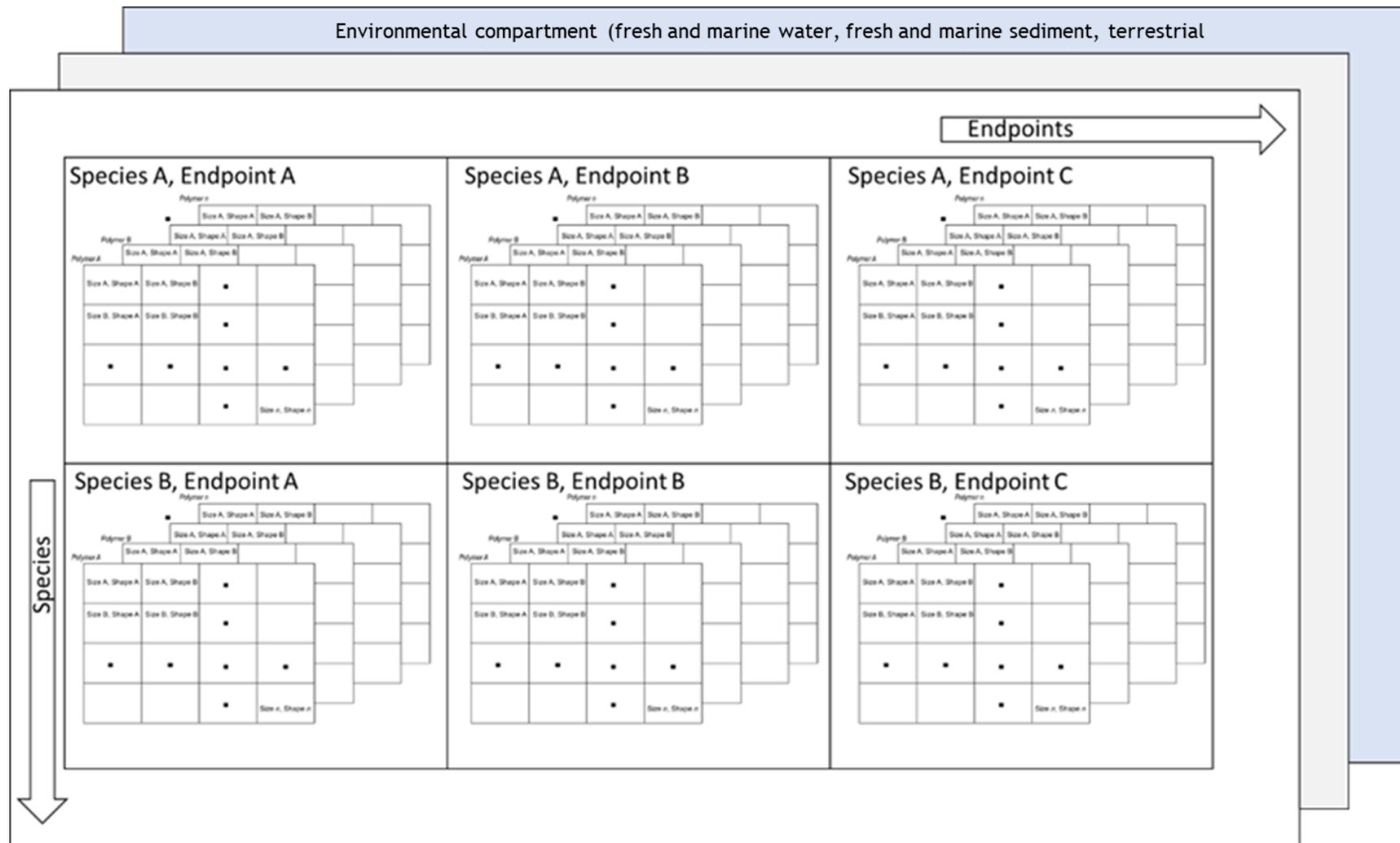


Linking exposure to observed adverse effect



$$OAE = \sum E_{iT} + \sum E_{Pint}$$

Standardized testing – Challenges and limitations



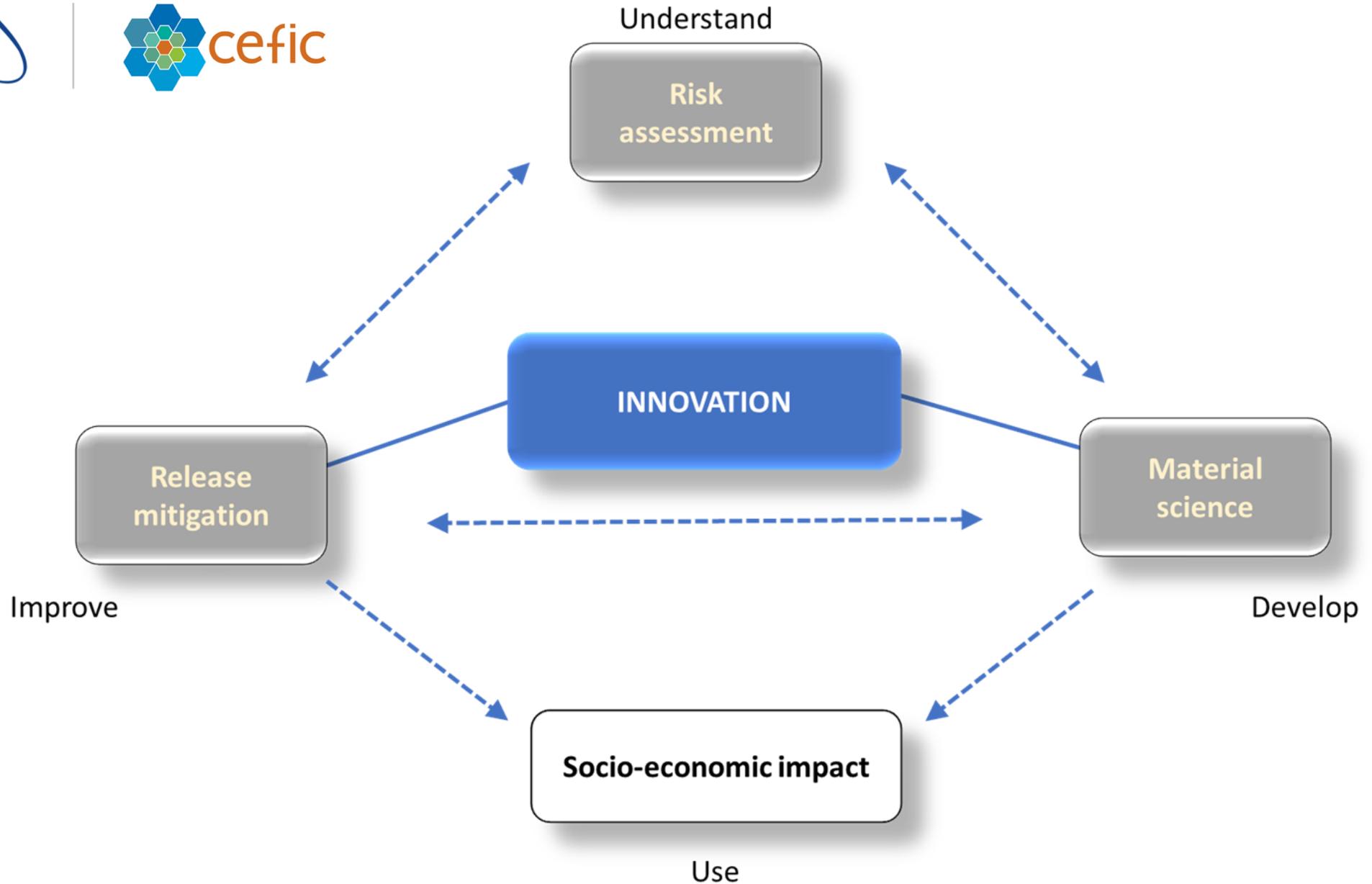
Has regulatory action been helpful?

- Actions to date appear to be reactive to public pressure and do not appear to address dominant sources.
 - “Ban the bead”
 - Single-use plastic
 - Plastic Straws
 - Others?
- Do *ad hoc* responses to public pressure help address uncertainties or frustrate advancing scientific and technological solutions to addressing accumulation of plastic in the environment?
 - Precautionary approaches imply that actions can facilitate innovation, but if actions are inappropriate or disproportionate, they may fail to achieve the end-goal?
- Can a more holistic strategy that is supportive of scientific and technological innovation be adopted that enables regulatory decision-making to be science-based, and which can also incorporate informed precautionary measures?
 - EU Plastics Strategy
 - Circular Economy

Bringing stakeholders together

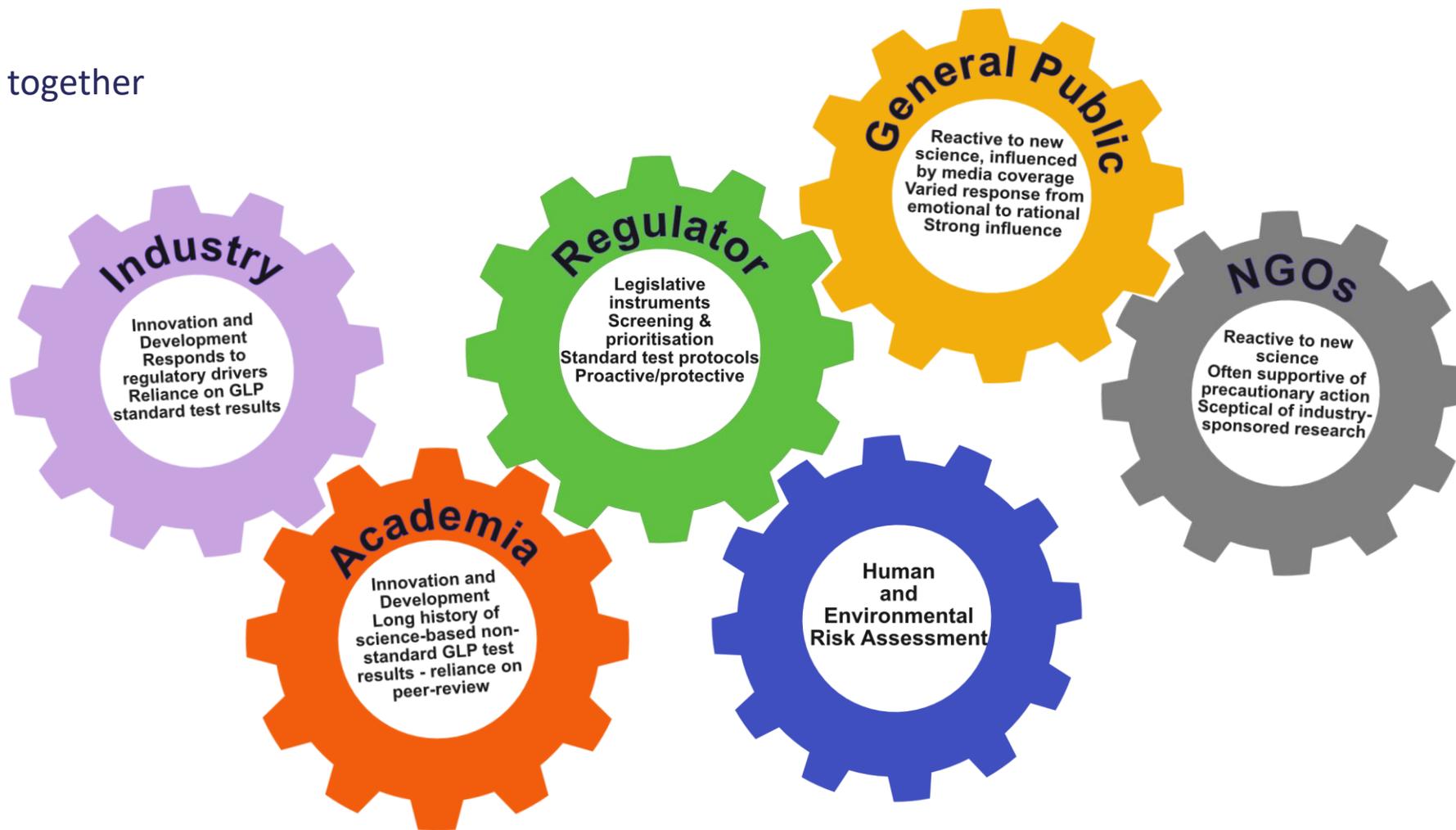
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Bringing stakeholders together

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A Global Plastics Contaminants Program



The Northern Contaminants Program (NCP) works to reduce or eliminate contaminants in traditional foods, and to provide information on contaminants to individuals and communities. It is a multidisciplinary initiative, funded by the Government of Canada, addressing health, science, and communications issues related to contaminants in Canada’s Arctic. It was established in 1991 through the Government of Canada’s Green Plan and Arctic Environmental Strategy.

“It’s good to have aspirational goals...”

What is the Northern Contaminants Program?

The Northern Contaminants Program (NCP) works to reduce or eliminate contaminants in traditional foods, and to provide information on contaminants to individuals and communities.

Indian and Northern Affairs Canada started the Northern Contaminants Program (NCP) in 1991 due to concerns that Aboriginal people and Northerners in general were being exposed to high levels of contaminants through animals important to the traditional diets of Aboriginals. It was also determined that many of the substances and pollutants discovered weren’t originating in the North, or even in Canada.

As a result, the program’s key objective was determined:

To work towards reducing and, where possible, eliminating contaminants in traditional/country foods, while providing information that assists individuals and communities in making informed decisions about their food use.

The NCP provides funds for research and related activities through four main areas of focus that contribute to addressing health and safety issues arising from contaminants in traditionally harvested foods. They are:

- ▶ Human Health Research
- ▶ Environmental Monitoring and Research
- ▶ Education and Communications
- ▶ National/Regional Coordination and Aboriginal Partnerships



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