Federal Ministry of Education and Research

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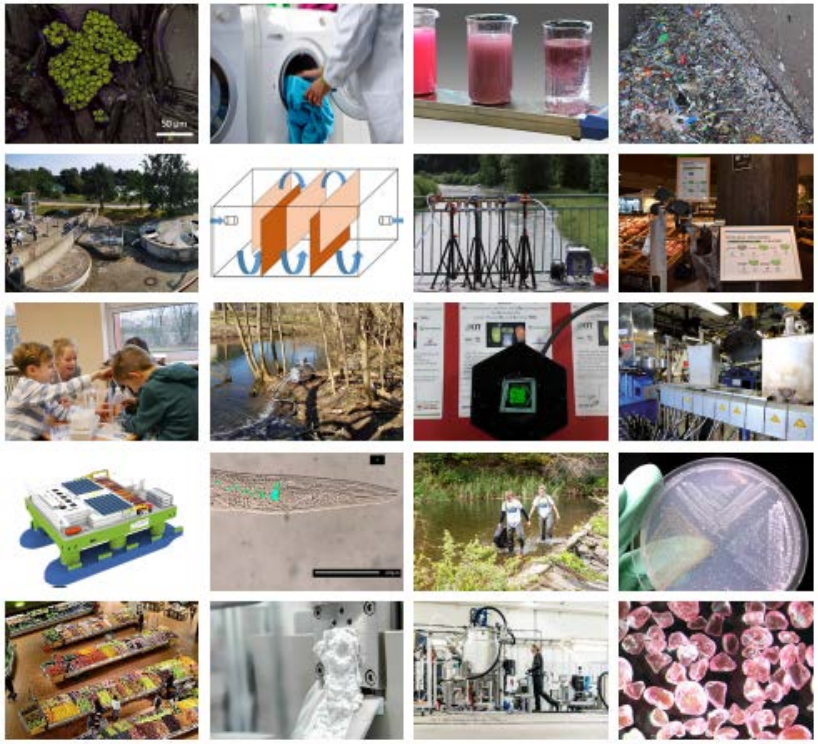
Plastics in the Environment
sources · sinks · solutions

FONA
Research for sustainability

Plastics in the Environment –
Key messages from five years of research



Tackling microplastics in the environment - evidence-based policy recommendations on textile fibres, tire abrasion, and pellet loss,

Brussels, 9 March 2023

Dr. Saskia Ziemann
Project Management Agency Karlsruhe

Timeline

Call published

Start of first projects

Closing event

EU-Event

2016 2017 2018 2019 2020 2021 2022 2023

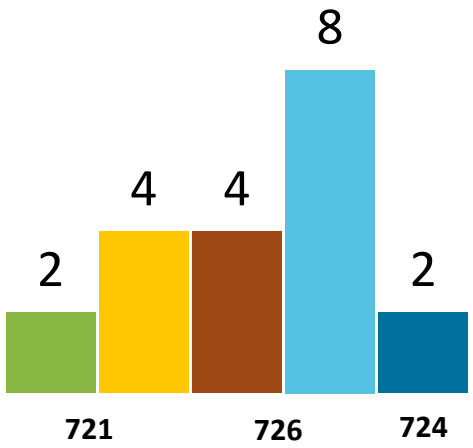
Funding Period

Overview

- 20 joint research projects with > 100 partners (≈ 40 Mio. € funding)
- Accompanying project PlastikNet
- Goals:
  - Analyze entry routes, mobility and effects of plastics in the environment along the whole plastic cycle
  - Identify and implement solutions for reducing the emission of plastics into the environment

Thematic areas

- **Green Economy**
- **Consumption**
- **Recycling**
- **Freshwater Ecosystems**
- **Saltwater Ecosystems**



Joint Research Projects

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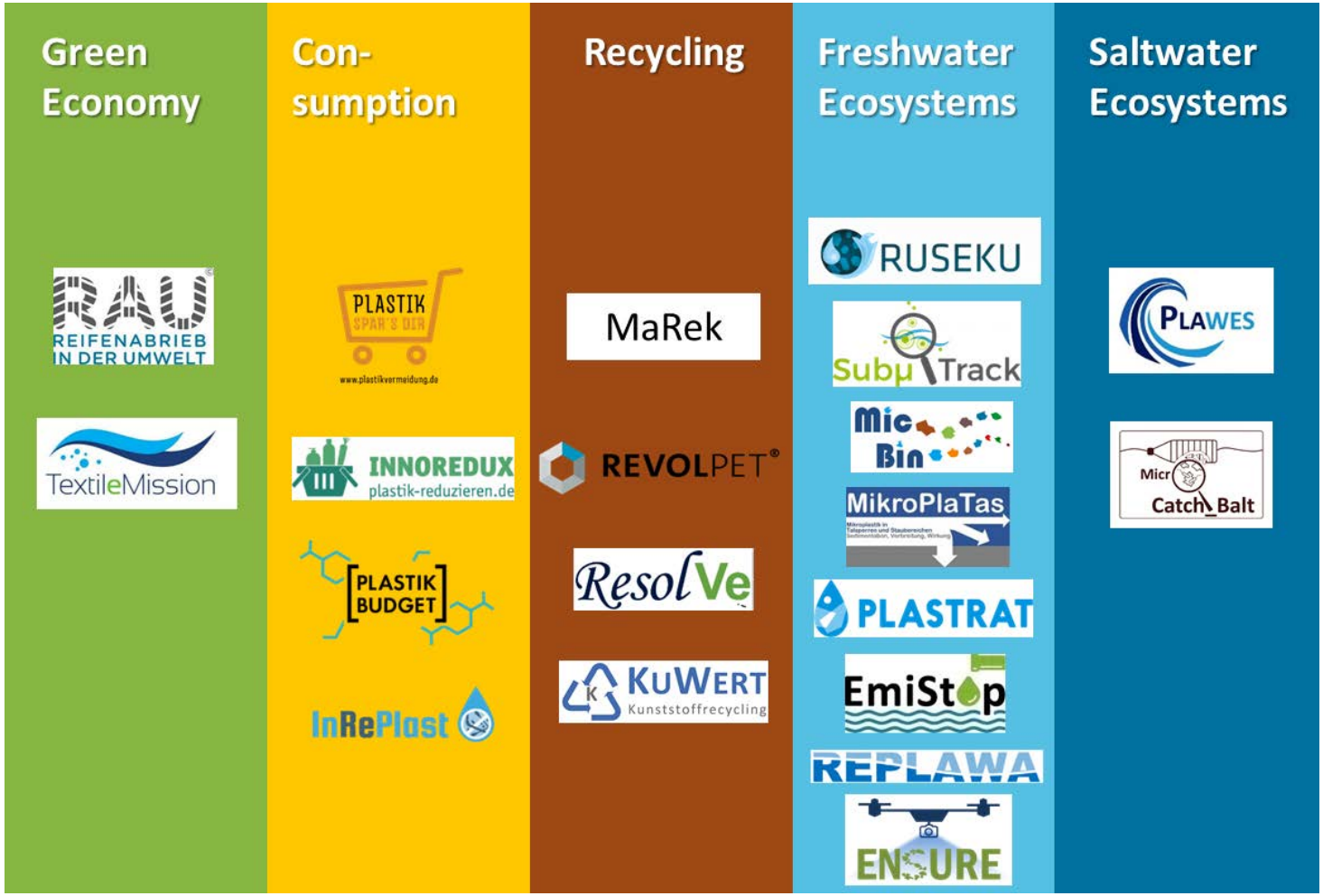

Cross-Cutting Working Groups

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Green Economy	Con-sumption	Recycling	Freshwater Ecosystems	Saltwater Ecosystems
1. Analytics and Reference Materials				
2. Evaluation Methods of Possible Effects of Plastics on the Environment				
3. Terms and Definitions				
4. Social and Political Dimension of Plastics in the Environment				
5. Modelling and Life Cycle Assessment				
6. Recycling and Product Design				
7. Biodegradability				

Key messages

Green Economy

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GOALS

- Examining inputs and losses of plastics along the entire value chain from production through the use phase in relevant sectors
- Developing measures to reduce plastic inputs.

RESULTS

- **Tire abrasion** is one of the largest sources of microplastics in the environment
  → Hotspots are bends, traffic lights and intersections
  → Reducing individual traffic, wear-resistant tires and a more defensive driving behaviour can decrease generation of tire abrasion
- **Textiles:** large amounts of fibrous microplastics are especially emitted when clothing is washed for the first time
  → Filling the washing machine to capacity and shortening the washing cycle reduce discharge of microplastics
  → Wearing clothing for a long time can also have a positive effect

Consumption and consumer behaviour

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GOALS

- Investigating meaningful and effective measures for a more sustainable consumer behaviour
- Developing solution strategies and recommendations

RESULTS

- Low prices of single-use solutions and primary plastics as well as higher costs for reusable products aggravate substitution and reduction of usage → stronger incentives for avoidance (e.g. subsidies) or restrictions needed
- Solutions based on quality seals, labels, etc. have limited effects since many products and packaging with too much information overstrain consumers → political measures often focus on private consumers, but their scope for action is limited due to lack of knowledge and practicable alternatives
- Products whose intended use leads to their contact with or retention in the environment should be replaced by products without plastics

Recycling

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GOALS

- Development of innovative processes to facilitate recycling and collection of end-of-life products
- Increase the proportion of high-quality recycling of plastic waste

RESULTS

- Current sorting technologies have deficiencies in distinguishing between e.g. food and non-food packaging as well as between single-layer and multi-layer films → innovative tracer-based sorting system was developed to improve sorting to enable high-quality recycling
- Chemical recycling processes can contribute to higher recycling rates
  - use of complex waste streams, that were only thermally processed before
  - developed processes **revolPET®** and **ResolVe** have ecological advantages

Freshwater ecosystems

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GOALS

- Reliable data on occurrence, impact, behaviour, and input pathways
- Harmonized analytical methods for assessment of potential hazards from microplastics and for solutions to reduce emissions

RESULTS

- Significant progress in analyzing microplastics - sample collection, sample preparation and detection
  - Quantification of particle numbers or polymer masses down to 10 µm in size
  - Analytical range extended to microplastic particles as small as 200 nm
  - Comparative test to demonstrate that both thermoanalytical and spectroscopic methods are suitable for identifying microplastics and quantifying them with sufficient accuracy

→ Findings are essential basis for standardization

Freshwater ecosystems

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GOALS

- Reliable data on occurrence, impact, behaviour, and input pathways
- Harmonized analytical methods for assessment of potential hazards from microplastics and for solutions to reduce emissions

RESULTS

- Effects of microplastics on plants and animals not yet comprehensively documented → acute toxicity not found, but effects on fitness and activity in some aquatic organisms
- For plastic particles < 10 µm sufficient data is not yet available
- Microplastics can release toxic additives → declaration obligation of the composition of plastics and additives

Freshwater ecosystems

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GOALS

- Reliable data on occurrence, impact, behaviour, and input pathways
- Harmonized analytical methods for assessment of potential hazards from microplastics and for solutions to reduce emissions

RESULTS

- Investigating sources of plastics and input pathways into the environment:
  - Littering as a significant source for localized high inputs of (micro-)plastics
  - Diffuse sources are sports grounds (artificial turf), construction sites, landfills
  - > 95% of micro- and macroplastics >10 µm removed in wastewater treatment
  - Further process technologies can increase microplastic retention to ~100%
  - Particles ultimately accumulate in screenings and grit traps (mainly macroplastics) or remain in sewage sludge (microplastics) → thermal treatment
- Indications of high emissions to soils and waters via combined sewer over-flows and untreated precipitation water → further investigation needed

Plastics in seas and oceans

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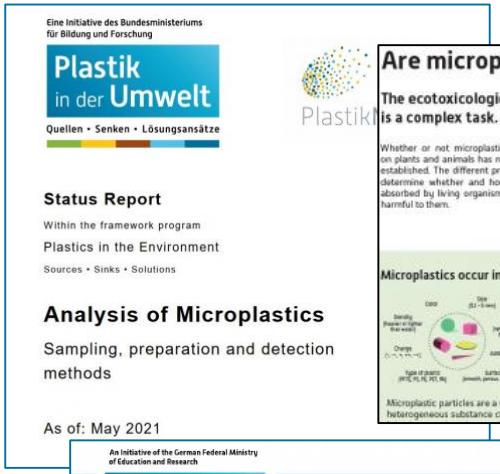
GOALS

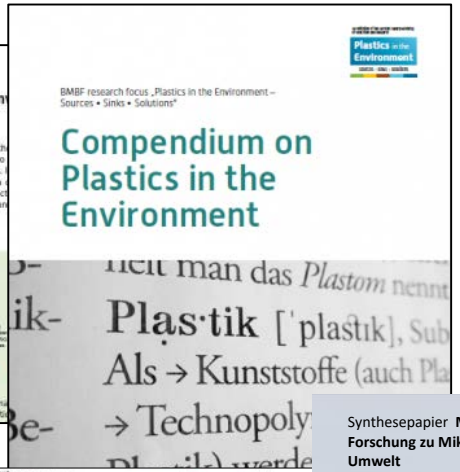
- Mapping spatial distribution and variability of microplastics from estuaries to coastal waters and into Baltic Sea and North Sea
- Identifying input pathways, transport routes and accumulation areas

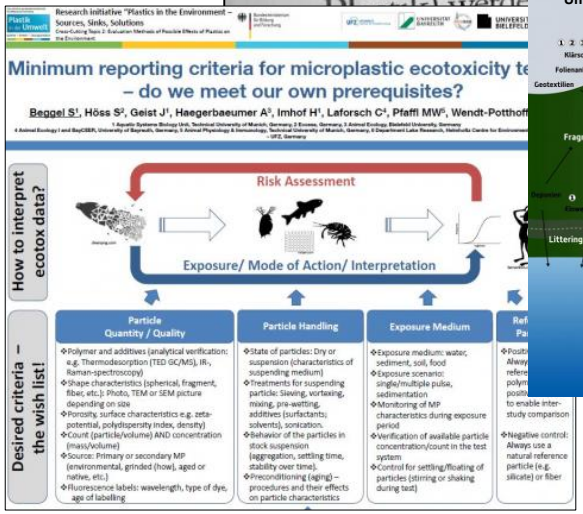
RESULTS

- Methods developed to detect microplastics down to 10 µm in marine environment → results transferred to Marine Plastics Database (MPDB)
- Entry pathways into estuarine areas identified through hydrologic and land use models → agricultural uses e.g. sewage sludge have major influence
- Transport and accumulation within coastal waters determined by current conditions, tides and runoff pattern → extreme weather events lead to growing inputs and remobilization of sedimented particles → biofilm effects
- Accumulation areas are beaches, sediments, harbor basins (dye particles)

Results from Cross-Cutting Topics







Science communication to the public

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Expert community

- Webinars *(16)*
- SciLogs – Blog posts *(20)*
- Factsheets *(26)*

General public

- Thementag *in Berlin*

Young people

- Plastic Pirates
- Lesemaus & Pixi-Books

Recommendations for action

- Measures to reduce plastic emissions in residential water management can only accompany strategies at production and use phase of plastic products
- Precautionary principle → environmental policy should aim to minimize input of plastics into environment since adverse effects cannot be excluded
- Current regulatory approaches (e.g., EU Single-Use Plastics Directive) do not cover all relevant plastic-containing products that are discharged wholly or partially and strongly targeted at private consumers, which is not sufficient
- Existing legal framework is insufficient and contains loopholes
  → consistent implementation of existing regulations (short term)
  → revise and adapt existing laws (medium to longer term)
- Coordinated, binding and comprehensive legal framework to reduce plastic inputs into the environment should be created going beyond regulation of individual products and input pathways

More Knowledge for less plastics in the Environment

Further information: www.bmbf-plastik.de