EPA
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Environmental Protection
Agency

EPA Tools and Resources Webinar: Microplastics

Valerie Mitchell Hanley, PhD
CA Dept of Toxic Substances Control (DTSC)
ITRC Microplastics Team Co-Lead

Cheryl Hankins
US EPA Office of Research and Development

August 20, 2025

Who is CA DTSC?

DTSC's Mission is to protect California's people, communities, and environment from toxic substances, to enhance economic vitality by restoring contaminated land, and to compel manufacturers to make safer consumer products.

Department of Toxic Substances Control

Who is ITRC?

- State-led coalition
- State, federal, stakeholder, industry members
- Funded through federal grants/ industry membership fees
- Consensus Driven Process to develop Guidance Documents & Products https://itrcweb.org/guidance

ITRC is a state-led coalition comprised of state & federal governments, stakeholders, and industry members. ITRC is funded through federal grants/industry membership fees. ITRC operates under a consensus-driven process to develop guidance documents & products. https://itrcweb.org/guidance

ITRC Microplastics Team

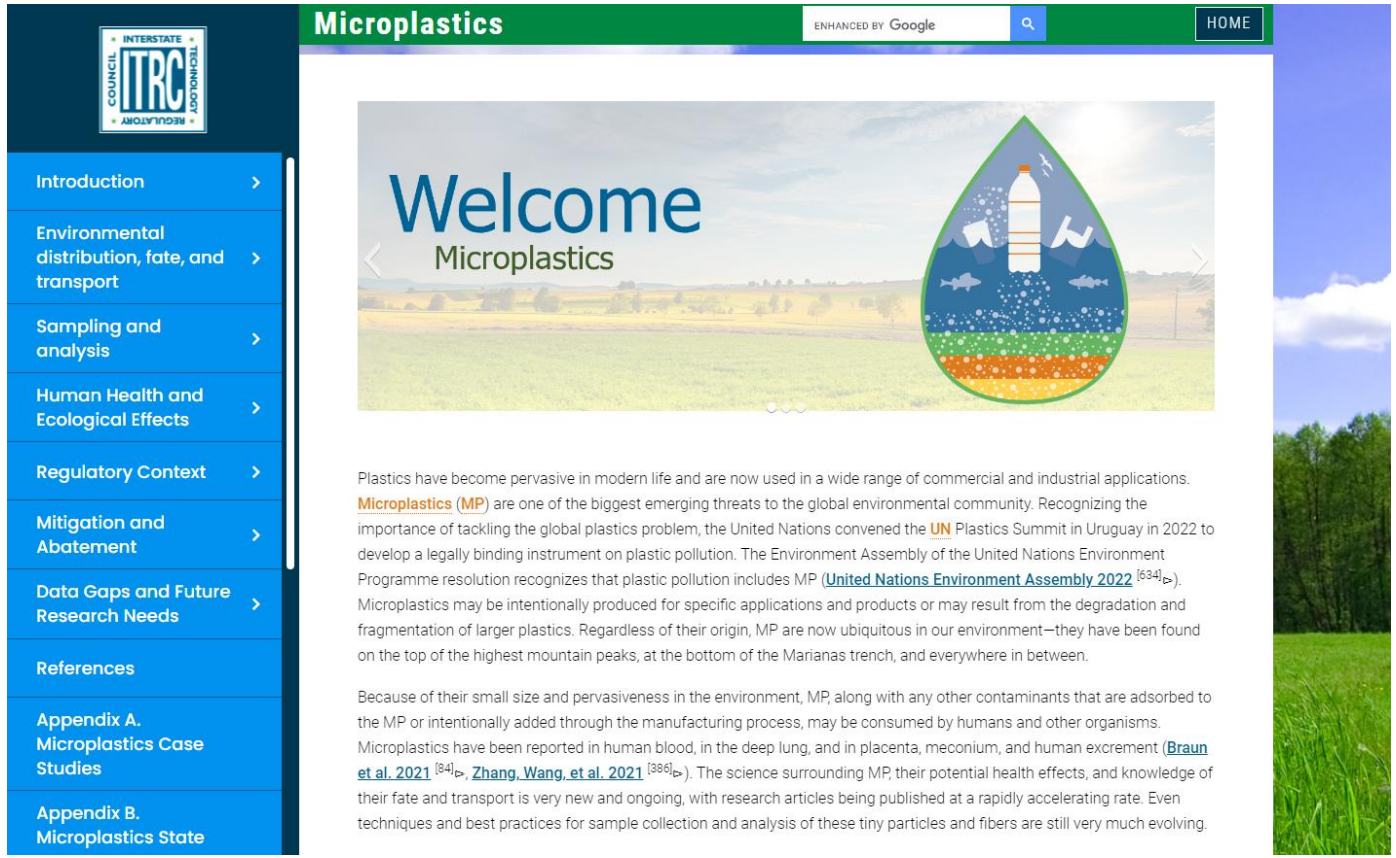
Technical Guidance

Co-Led by Kim Nimmer,
Orange Water and Sewer Authority
Carrboro-Chapel Hill, NC

Outreach Toolkit

Co-Led by Grace Anne Martin,
SC Department of Health &
Environmental Control

Technical Guidance
Web-based Document: https://mp-1.itrcweb.org



Training: https://www.clu-in.org/conf/itrc/Microplastics/

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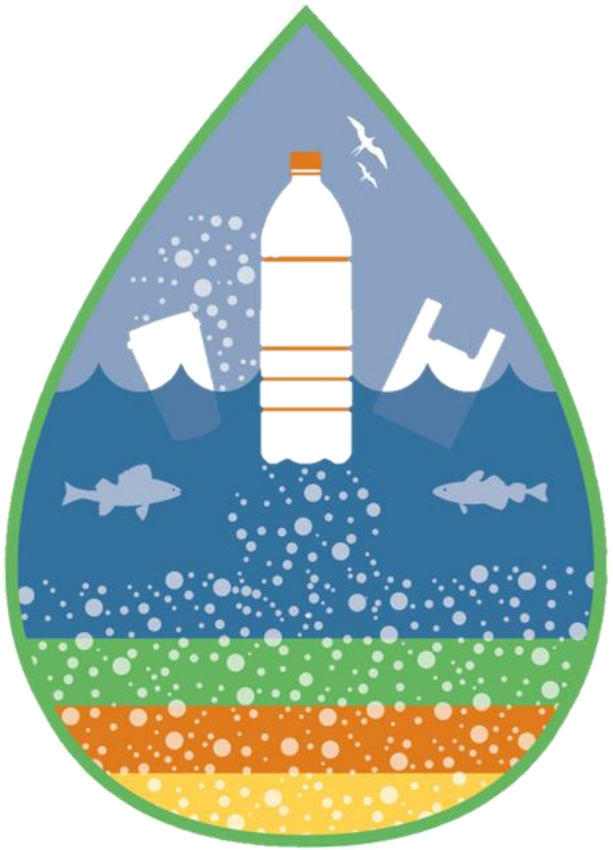
Microplastics (MP)

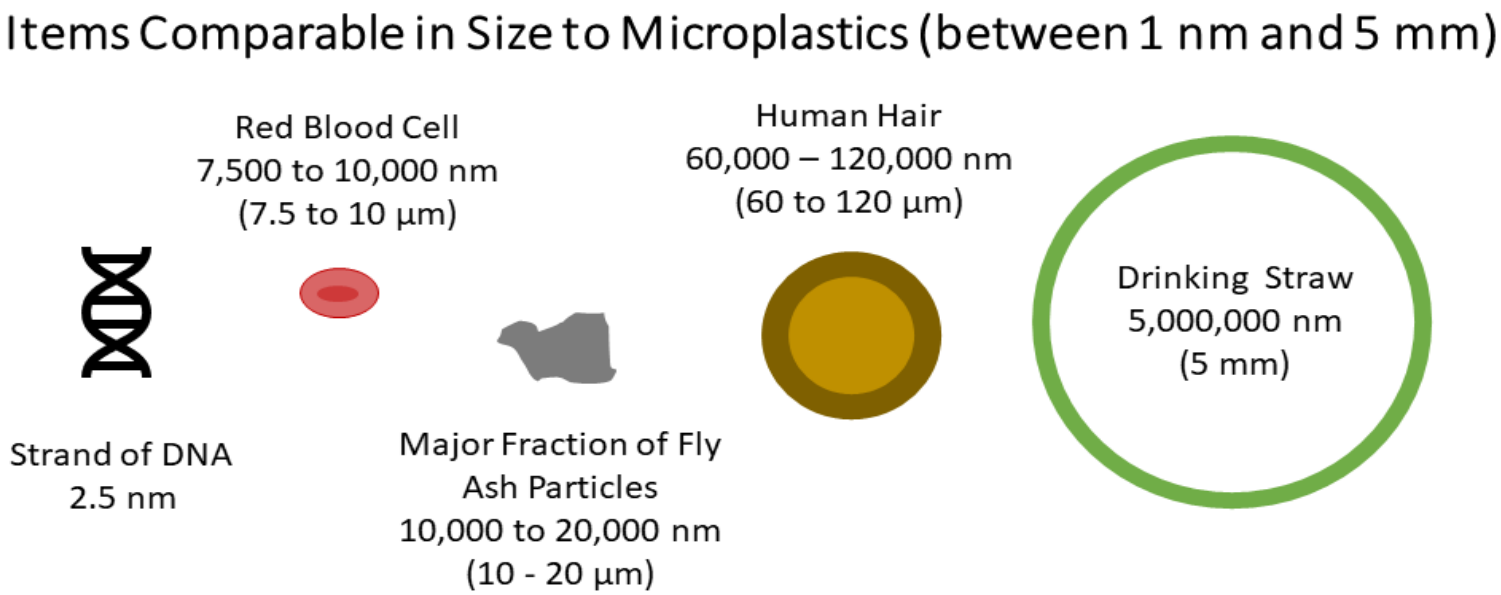


What are they?
Plastic particles ranging in size from 1 nanometer to 5 millimeters that contain chemical and/or other additives

Where do they come from?
Consumer products (primary and/or direct point source) and/or the breakdown of larger plastics (secondary and/or non-direct point source)

Where are they found?
Everywhere. MP have been found in drinking water, the human body, food, air, soil, and in water, to name a few places

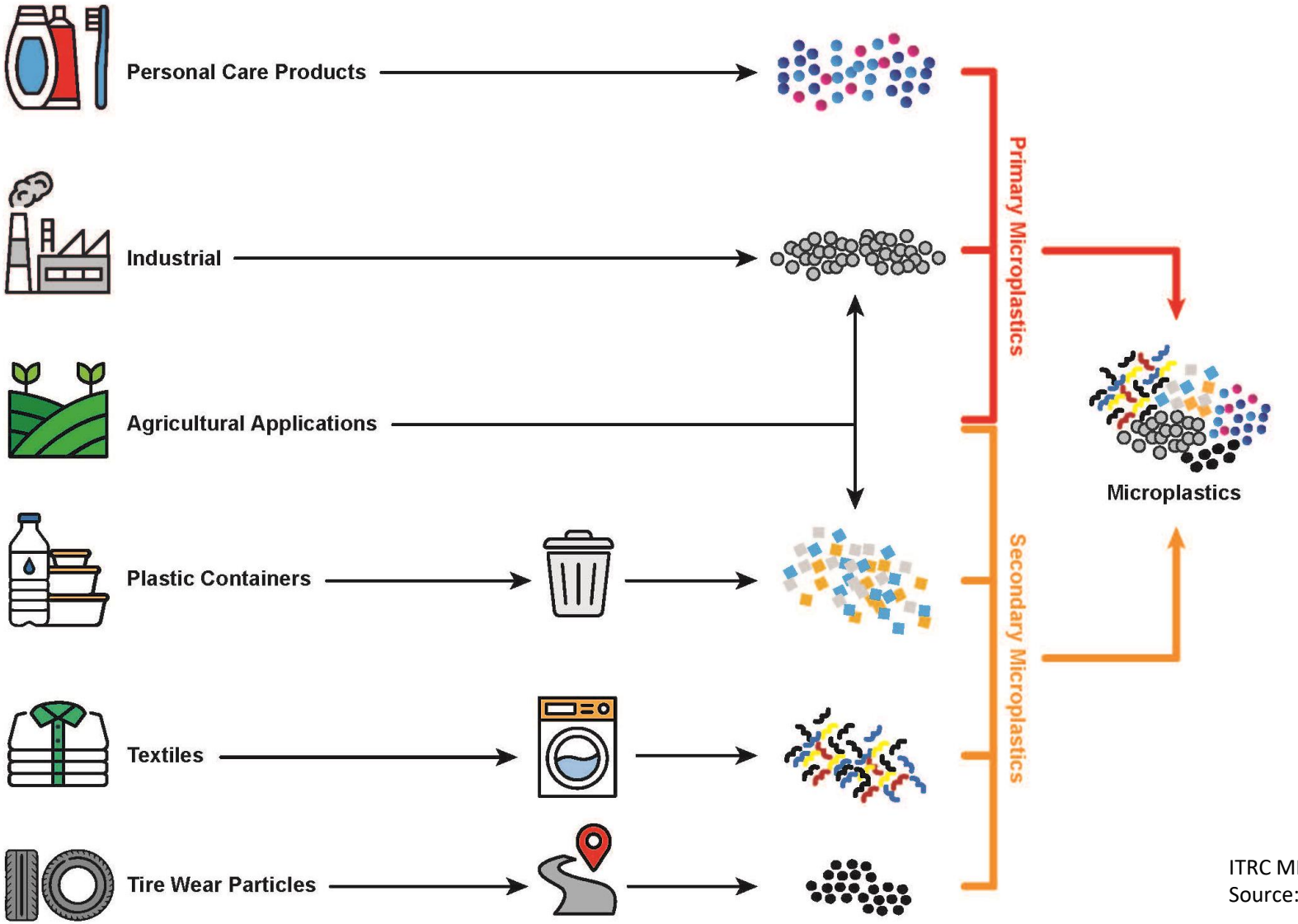
Microplastic Size



1,000 nm = 1µm
1,000,000 nm = 1 mm
1,000 µm = 1 mm

ITRC MP Figure 1-2
Source: V. Hanley

Primary vs. Secondary Microplastics



ITRC MP Figure 2-1
Source: J. McDonald

What We Know about Microplastics

- Ubiquitous in the environment
- Accumulate & persist in the environment
- Can contain harmful chemical contaminants & additives
- Consumed by humans and other organisms
- Cause adverse health impacts in organisms

Source Top: Flickr, Global Water Forum
Source Bottom: Oregon State University, CC-BY-SA-2.0

Where Are Microplastics Found?

- ITRC MP conceptual site model
- Multifunctional tool
  - Overview information
  - Document navigation

Figure 3-1. Conceptual model for sampling methods.
Source: Jonathan McDonald and the ITRC MP team.
https://mp-1.itrcweb.org/sampling-and-analysis/#figure_3_1

Conceptual Site Model: Point Sources

Marine Point Sources: Materials lost or discarded from vessels

Stormwater Outfalls

Industrial Smokestacks

Wastewater Outfalls

Figure 3-1. Conceptual model for sampling methods.
Source: Jonathan McDonald and the ITRC MP team.
https://mp-1.itrcweb.org/sampling-and-analysis/#figure_3_1

Conceptual Site Model : Nonpoint Sources

MPs transported through atmosphere and deposited far away from the source

(Macro)plastic trash washes into the ocean, then breaks down into smaller pieces, eventually becoming MPs

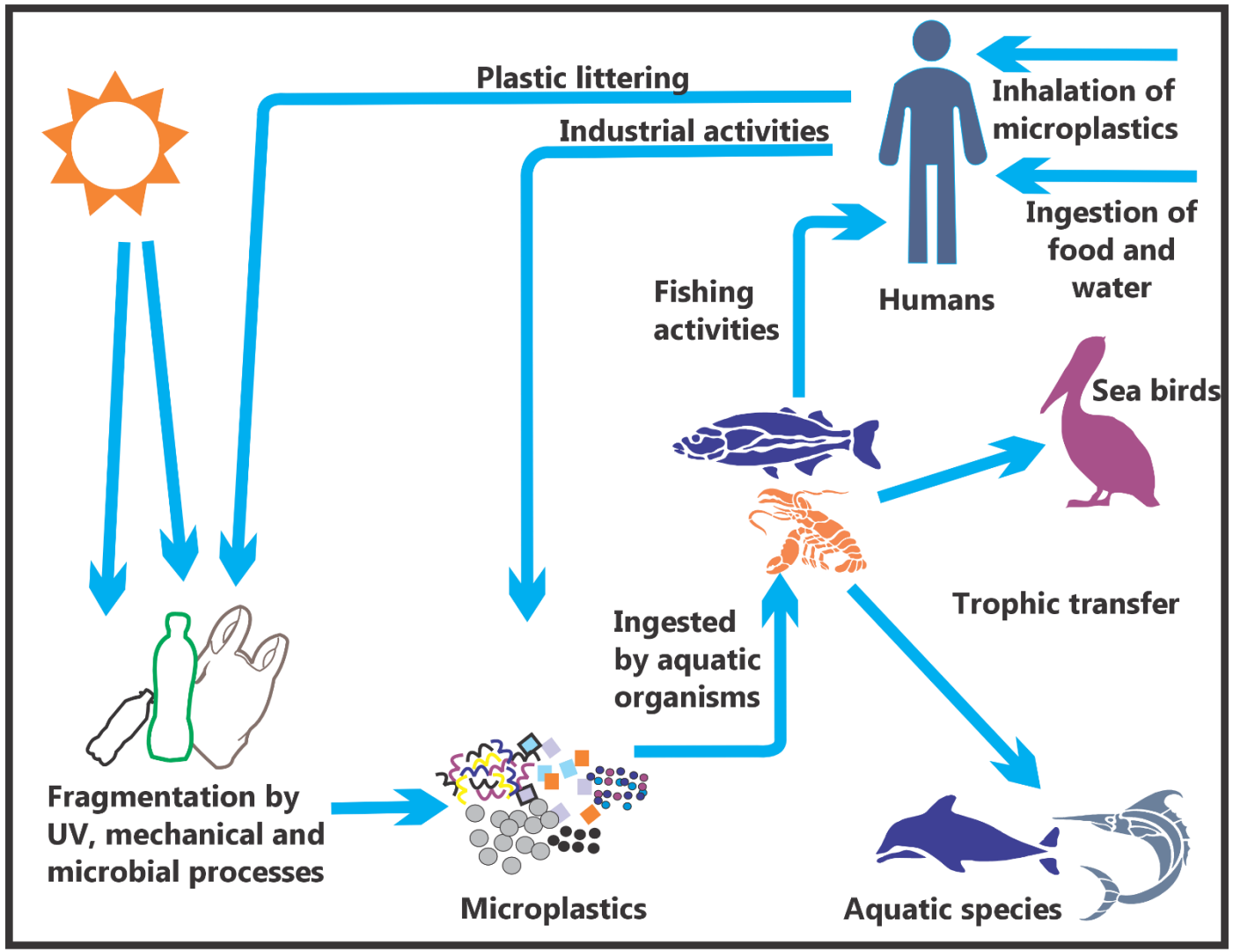
MPs generated through typical tire wear and breakdown of roadway materials

MPs present in household products such as toothpaste or facial cleaners. MPs generated through household activities such as laundering of clothing

MPs present in agricultural lands due to direct application of fertilizer pellets, biosolids from wastewater treatment plants, or breakdown of plastic sheeting

Figure 3-1. Conceptual model for sampling methods.
Source: Jonathan McDonald and the ITRC MP team.
https://mp-1.itrcweb.org/sampling-and-analysis/#figure_3_1

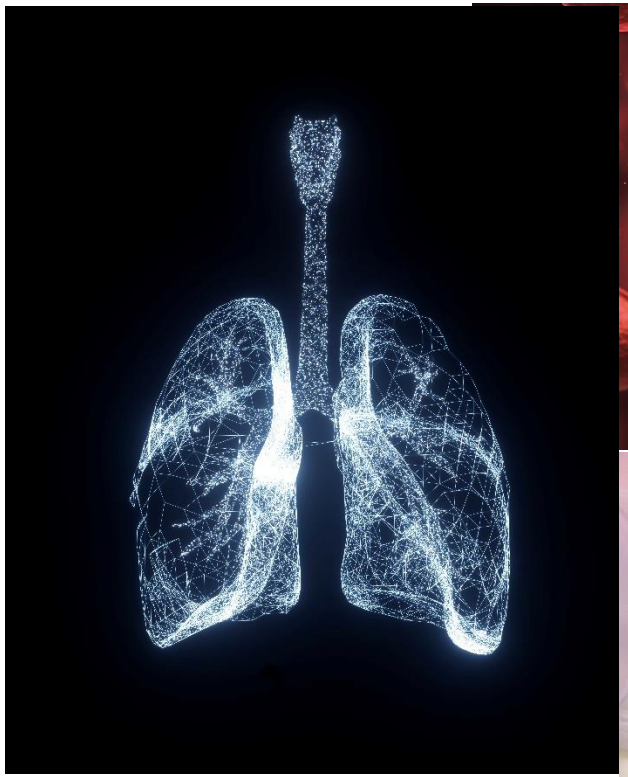
Why Should We Care?

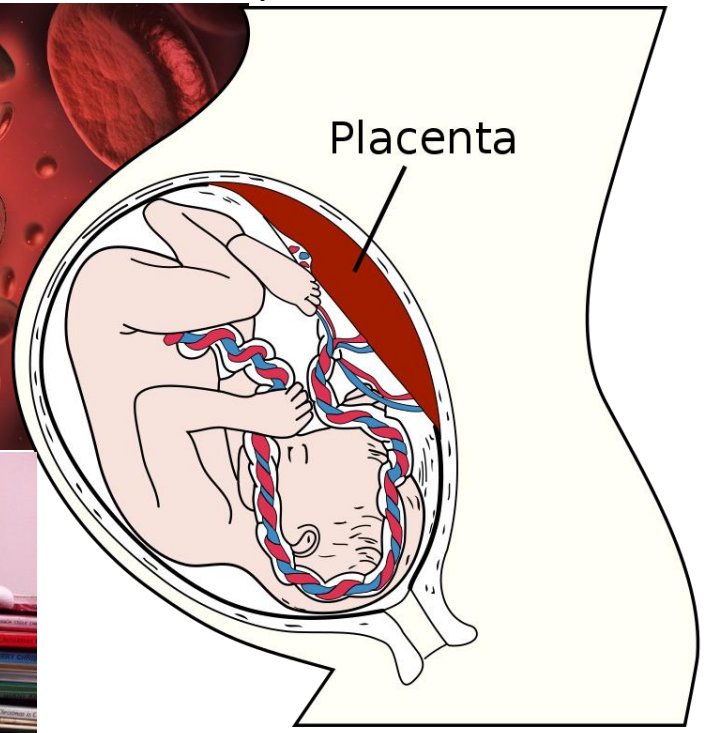


ITRC MP Figure 4-2

Microplastics Detected in Human Lungs[1], Blood[2], Placenta[3] and Breast Milk[4]

Slide adapted from S. Coffin 2023





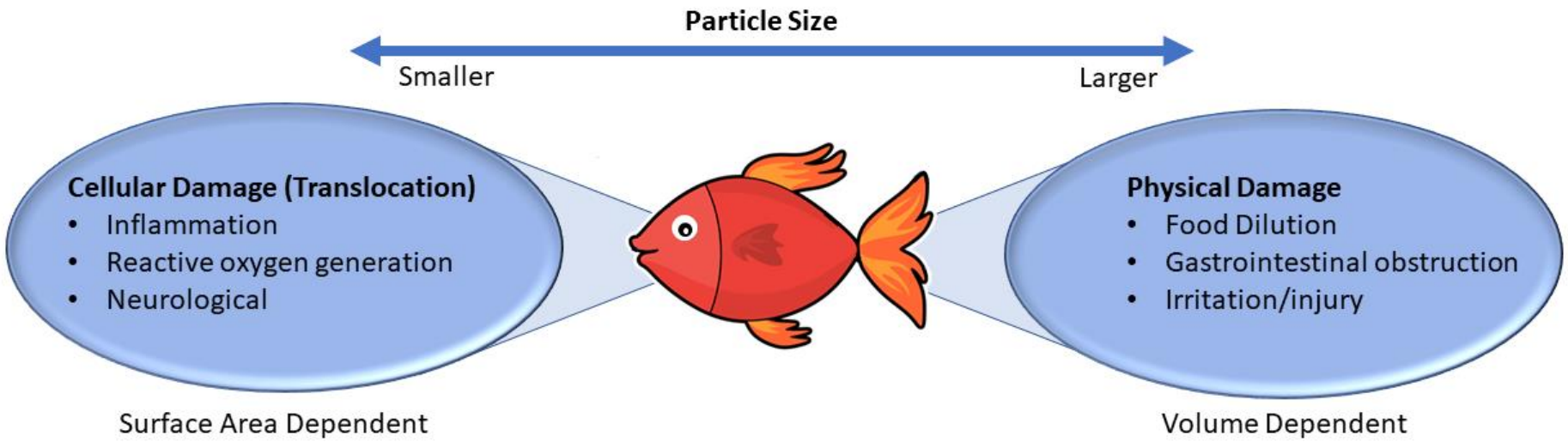
1. Jenner et al. (2022), *Science of the Total Environment*
2. Lesie *et al.* (2022), *Environment International*
3. Ragusa *et al.* (2021). *Environment International*
4. Ragusa *et al.* (2022). *Polymers.*

Challenges in Toxicity Research

- Exposure ≠ Adverse health effect
- Numerous non-human mammalian studies available but usability varies
- Uncertainties due to study design, exposure concentration, data quality, reporting, data gaps
- Not enough information to establish toxicity criteria to use in human health risk assessment

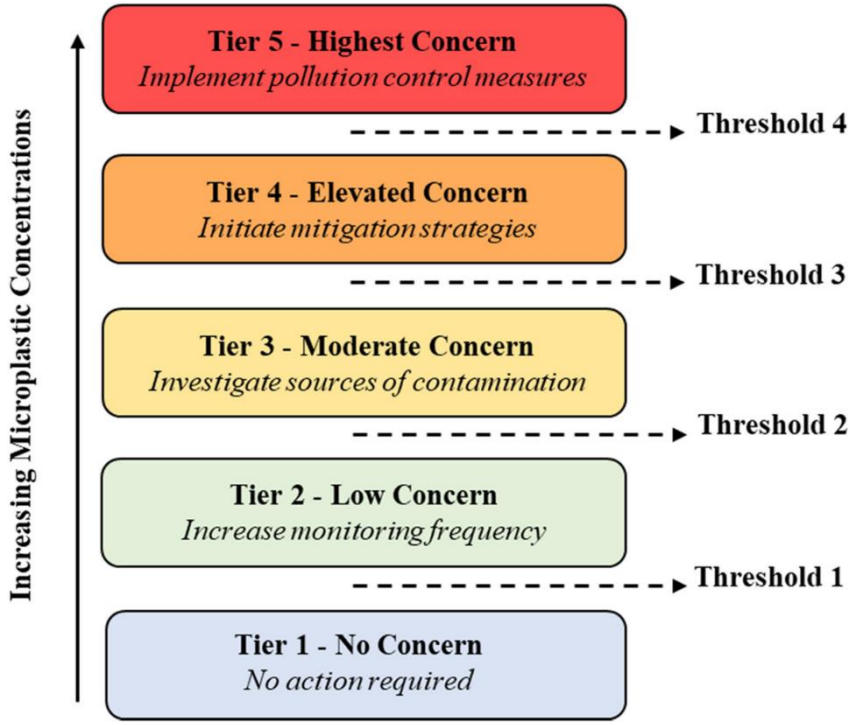
Source: Thornton Hampton et al. 2022

Factors Affecting Aquatic Toxicity

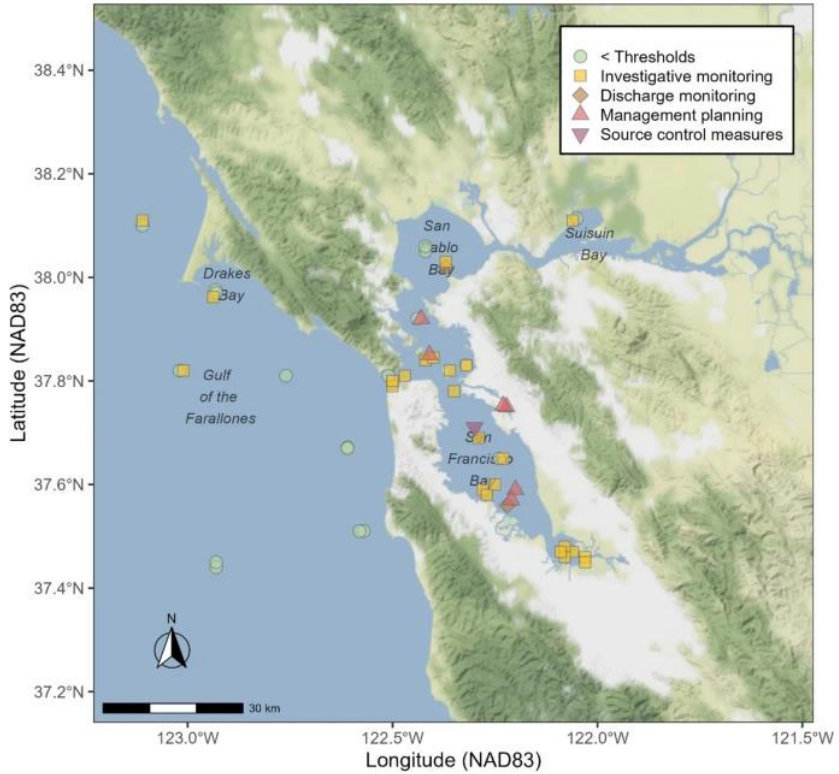


ITRC MP Figure 4-3
Source: Microplastics Team, created using concepts described in Mehinto et al. (2022)

Application of Aquatic Risk Threshold to San Francisco Bay, CA



ITRC MP Figure A.1- 5 Source: Mehinto et al. 2022



ITRC MP Figure A.1- 6 Source: Coffin et al. 2022

What Is Being Done?

- Local actions
- State actions
- Federal actions
- International actions

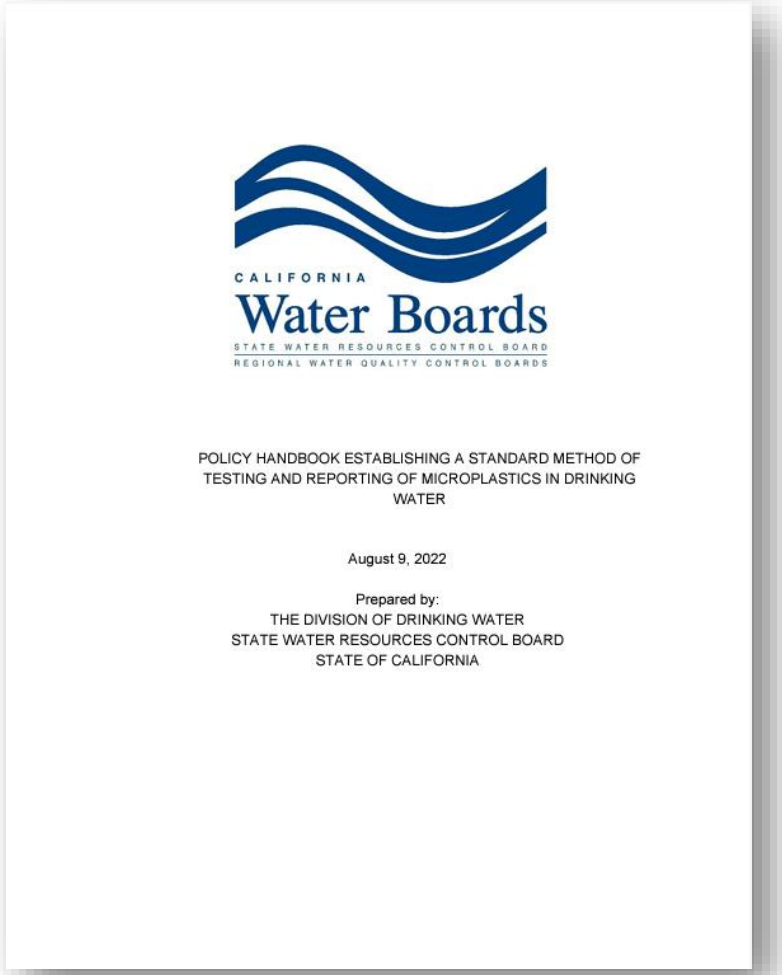
Local Actions

Single-Use Plastic Bans

Photo credit: Rob Barnes, Grid Arendal

State Actions - California Safe Drinking Water Act: Microplastics

- Adopt a definition of microplastics in drinking water
- Adopt a standard methodology to test drinking water for microplastics
- Establish requirements for four years of testing and reporting microplastics in water



[CA Health and Safety Code 116376]

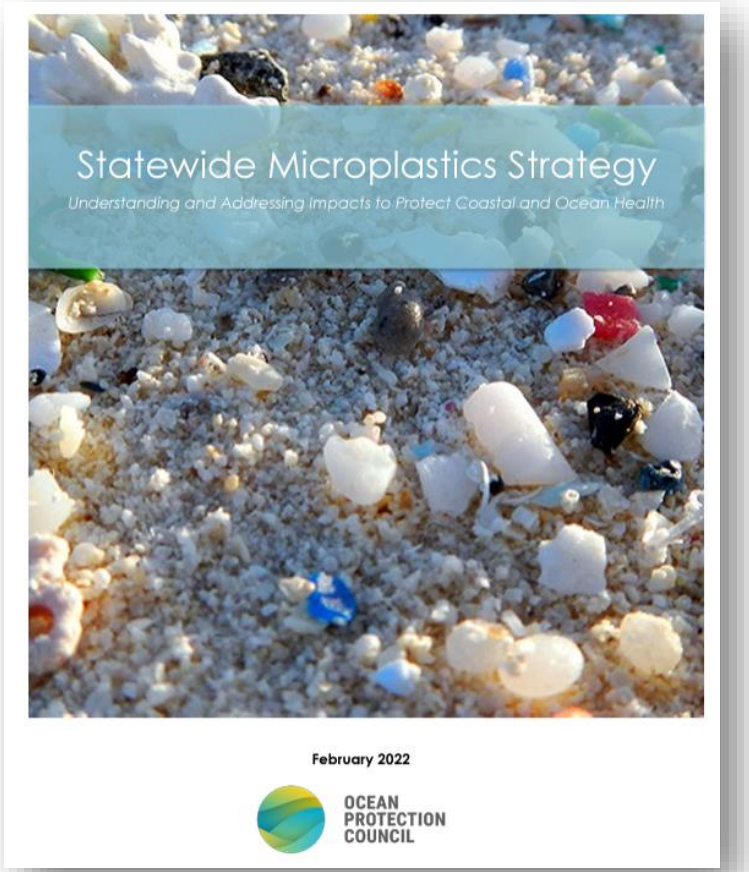
State Actions
Statewide Microplastics Strategy - 2 Track Approach

Track 1: Solutions

- Pollution prevention
- Pathway interventions
- Outreach & education

Track 2: Science to inform future action

- Monitoring
- Risk thresholds & assessments
- Sources & pathways prioritization
- Evaluating new solutions



CA Public Resources Code, Division 26.5, Chapter 3.2

State Actions
CA DTSC Safer Consumer Products Program

SAFER CONSUMER PRODUCTS

Proposal to Add Microplastics to the Candidate Chemicals List

June 27, 2023

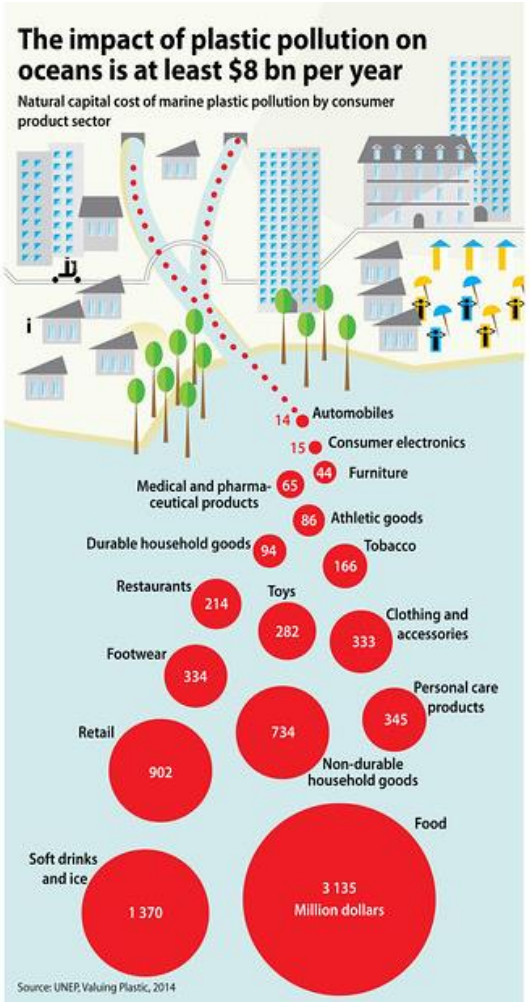
Candidate Chemical List	Chemicals listed as a concern by authoritative bodies
Priority Products	Product-Chemical combinations that may cause harm
Alternatives Analysis	Manufacturer evaluation of safer alternatives
Regulatory Response	Wide range of possible actions to protect human health and the environment

Federal Actions
Save Our Seas 2.0 Act

(Public Law 116-224)

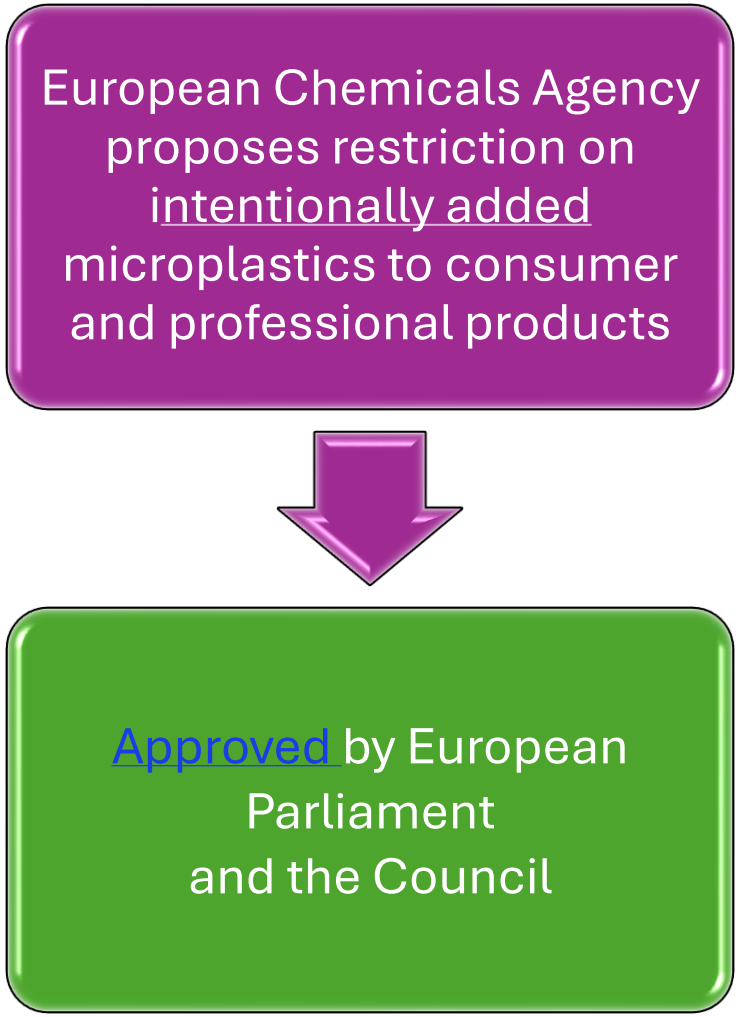
3 main goals of Act

- Combat marine debris
- Enhance global engagement
- Improve domestic infrastructure



Source: https://www.grida.no/resources/6912 (Maphoto/Riccardo Pravettoni)

International Actions: European Union



International Actions: UN Plastics Report

Purpose of report

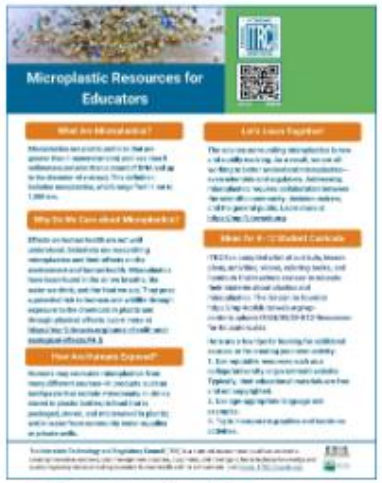
- Designed for decision makers & stakeholders
- Explains the changes surrounding plastics
  - Market shifts
  - Policies
- Goal is to end plastic pollution

Examples from Outreach Toolkit: General

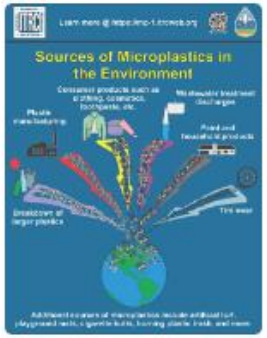
Microplastics: The Basics You Need to Know Fact

Sources of Microplastics Fact Sheet

How You Can Help Reduce Microplastics Fact Sheet



Microplastics Resources for Educators Fact Sheet



Sources of Microplastics Graphic

Microplastics are Everywhere Graphic

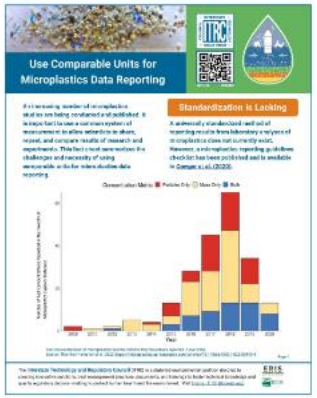
Today's Plastics are Tomorrow's Microplastics

Tired of Plastics Graphic

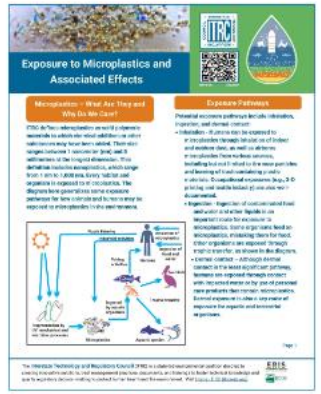
Help Keep Microplastics Out of Your Body Graphic

Examples from Outreach Toolkit: Scientific

Microplastics Sampling and Analysis Fact Sheet

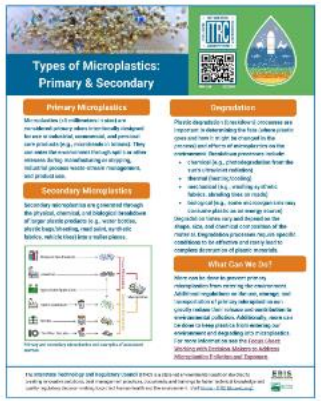


Use Comparable Units for Microplastics Data Reporting Fact sheet



Exposure to Microplastics and Associated Effects Fact Sheet

Data Gaps and Future Research Needs Fact Sheet



Types of Microplastics – Primary vs Secondary Fact Sheet

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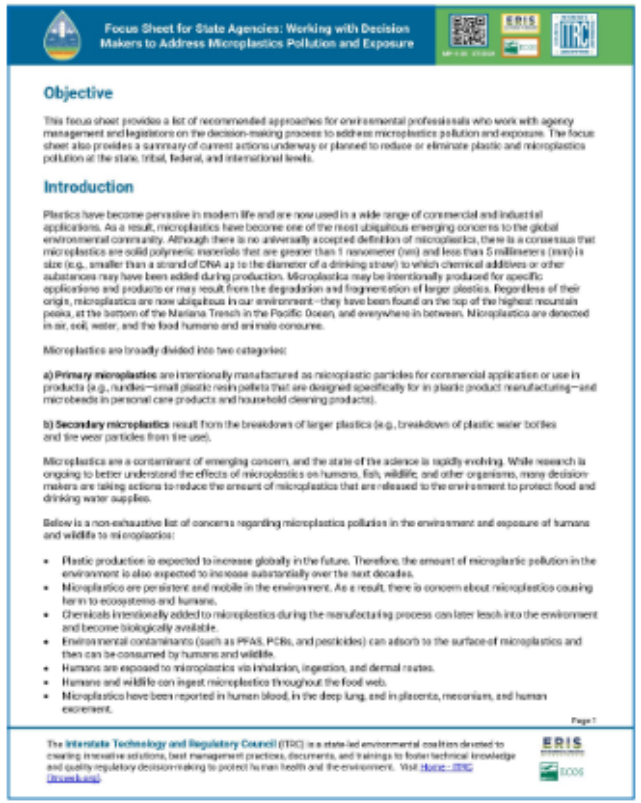
Examples from Outreach Toolkit : Decision Makers



Focus Sheet for State Agencies: Working with Decision Makers to Address Microplastics Pollution and Exposure

Objective

This focus sheet provides a list of recommended approaches for environmental professionals who work with agency management and legislators on the decision-making process to address microplastics pollution and exposure. The focus sheet also provides a summary of current actions underway or planned to reduce or eliminate plastic and microplastics pollution at the state, tribal, federal, and international levels.

Introduction

Plastics have become pervasive in modern life and are now used in a wide range of commercial and industrial applications. As a result, microplastics have become one of the most ubiquitous emerging concerns to the global environmental community. Although there is no universally accepted definition of microplastics, there is a consensus that microplastics are solid polymeric materials that are greater than 1 nanometer (nm) and less than 5 millimeters (mm) in size (e.g., smaller than a strand of DNA or to the diameter of a drinking straw) to which chemical additives or other substances may have been added during production. Microplastics may be intentionally produced for specific applications and products or may result from the degradation and fragmentation of larger plastics. Regardless of their origin, microplastics are now ubiquitous in our environment—they have been found on the top of the highest mountain peaks, at the bottom of the Mariana Trench in the Pacific Ocean, and everywhere in between. Microplastics are detected in air, soil, water, and the food humans and animals consume.

Microplastics are broadly divided into two categories:

a) **Primary microplastics** are intentionally manufactured as microplastic particles for commercial application or use in products (e.g., nurdles—small plastic resin pellets that are designed specifically for in plastic product manufacturing—and microbeads in personal care products and household cleaning products).

b) **Secondary microplastics** result from the breakdown of larger plastics (e.g., breakdown of plastic water bottles and tire wear particles from tire use).

Microplastics are a contaminant of emerging concern, and the state of the science is rapidly evolving. While research is ongoing to better understand the effects of microplastics on humans, fish, wildlife, and other organisms, many decision-makers are taking actions to reduce the amount of microplastics that are released to the environment to protect food and drinking water supplies.

Below is a non-exhaustive list of concerns regarding microplastics pollution in the environment and exposure of humans and wildlife to microplastics:

- Plastic production is expected to increase globally in the future. Therefore, the amount of microplastic pollution in the environment is also expected to increase substantially over the next decades.
- Microplastics are persistent and mobile in the environment. As a result, there is concern about microplastics causing harm to ecosystems and humans.
- Chemicals intentionally added to microplastics during the manufacturing process can later leach into the environment and become biologically available.
- Environmental contaminants (such as PFAS, PCBs, and pesticides) can adsorb to the surface of microplastics and then can be consumed by humans and wildlife.
- Humans are exposed to microplastics via inhalation, ingestion, and dermal routes.
- Humans and wildlife can ingest microplastics throughout the food web.
- Microplastics have been reported in human blood, in the deep lung, and in placenta, meconium, and human excrement.

Page 1

The Interstate Technology and Regulatory Council (ITRC) is a state-led environmental coalition devoted to creating innovative solutions, best management practices, documents, and trainings to foster technical knowledge and quality regulatory decision-making to protect human health and the environment. Visit Home - ITRC (itrcweb.org)

ERIS ECOS

[Focus Sheet: Working with Decision-Makers to Address Microplastics Pollution and Exposure]

Microplastics (MP)

This presentation has been developed by the Interstate Technology and Regulatory Council (ITRC) Microplastics Outreach Team. You may modify the slide deck as appropriate for your audience. We ask that you acknowledge the products of ITRC in your presentation. Thank you!

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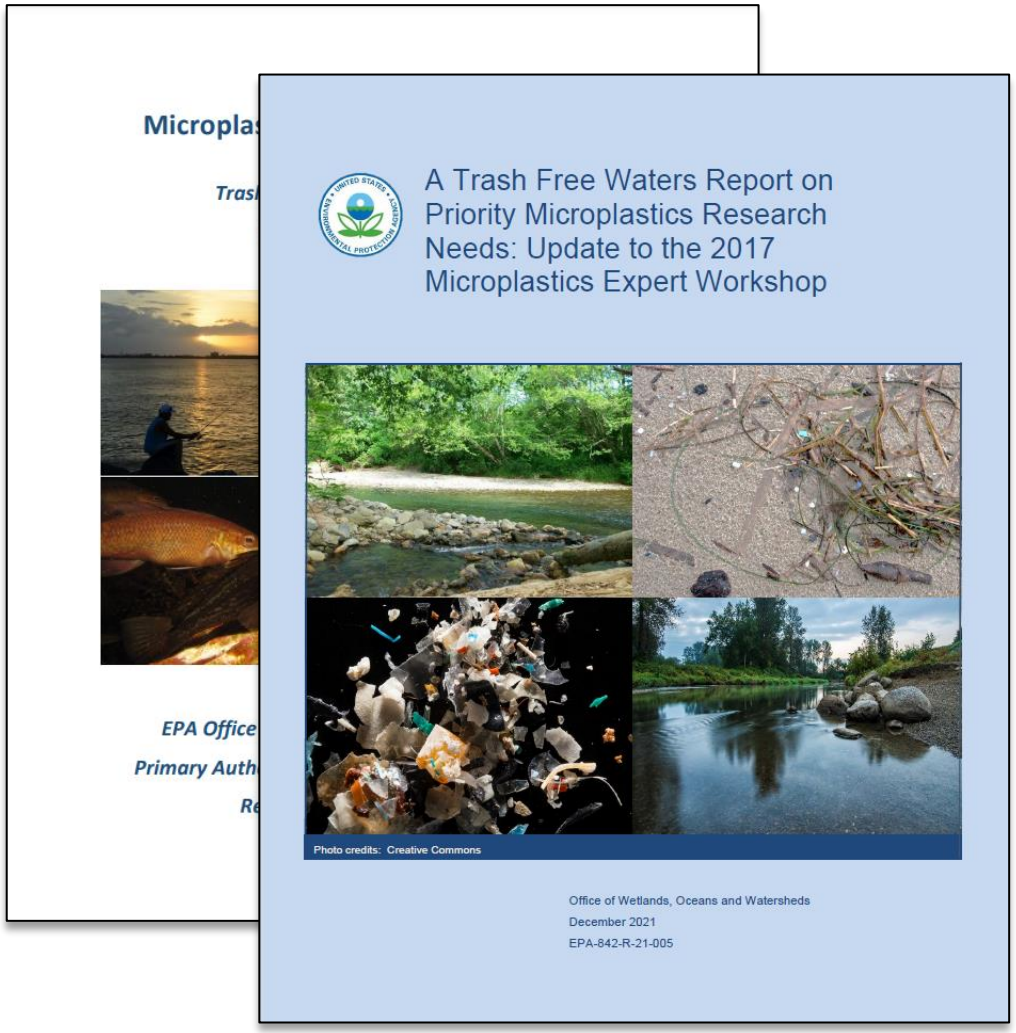
Microplastics Presentation

(PDF)

(PPT)

Microplastics Research at EPA



Research Topic Areas

- Analytical methods
- Sources, transport & fate
- Ecological assessments
- Human health assessments

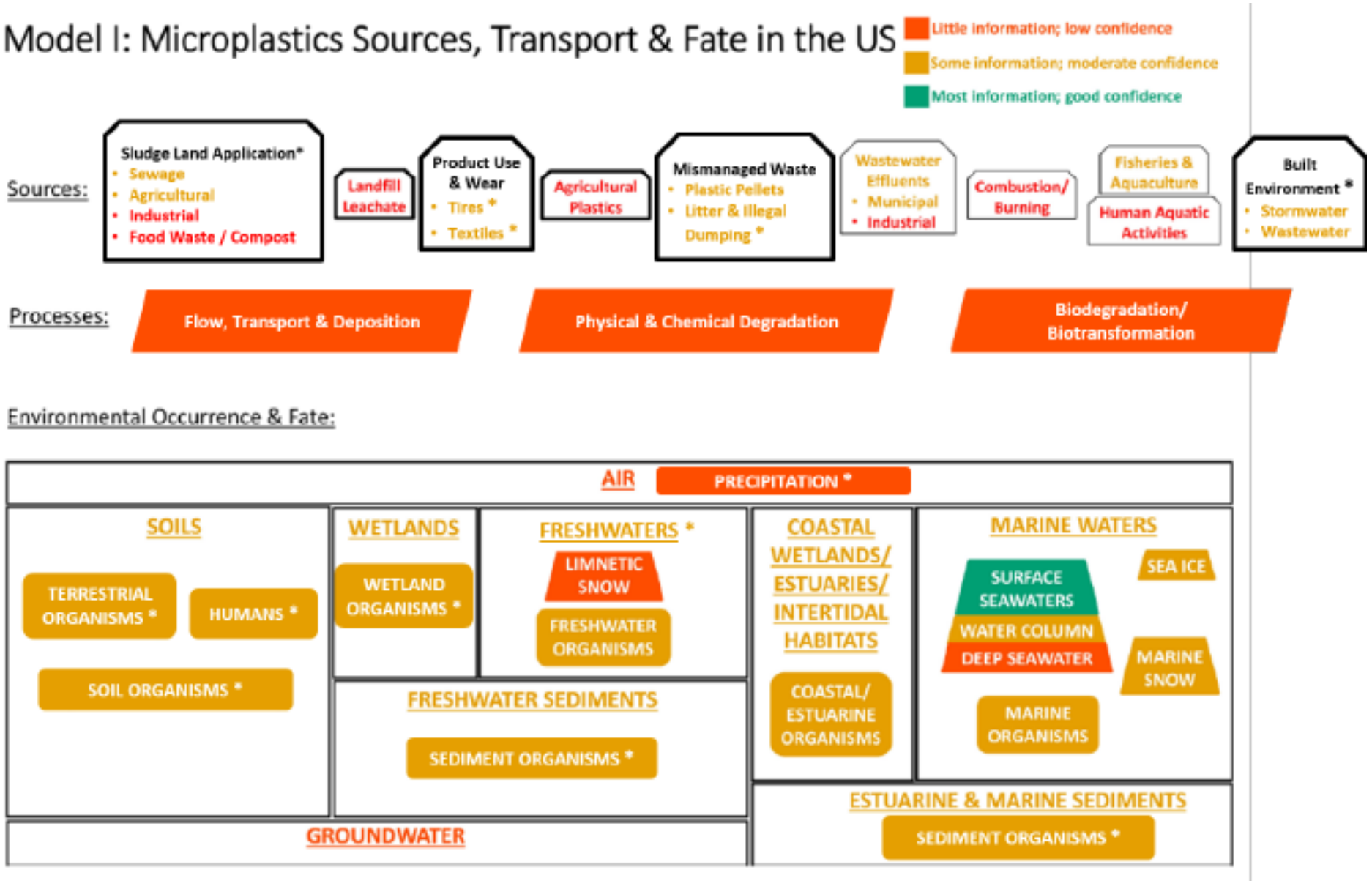
Analytical Methods

Considerations when planning sampling and analysis

Reproduced Table 1, EPA 2017

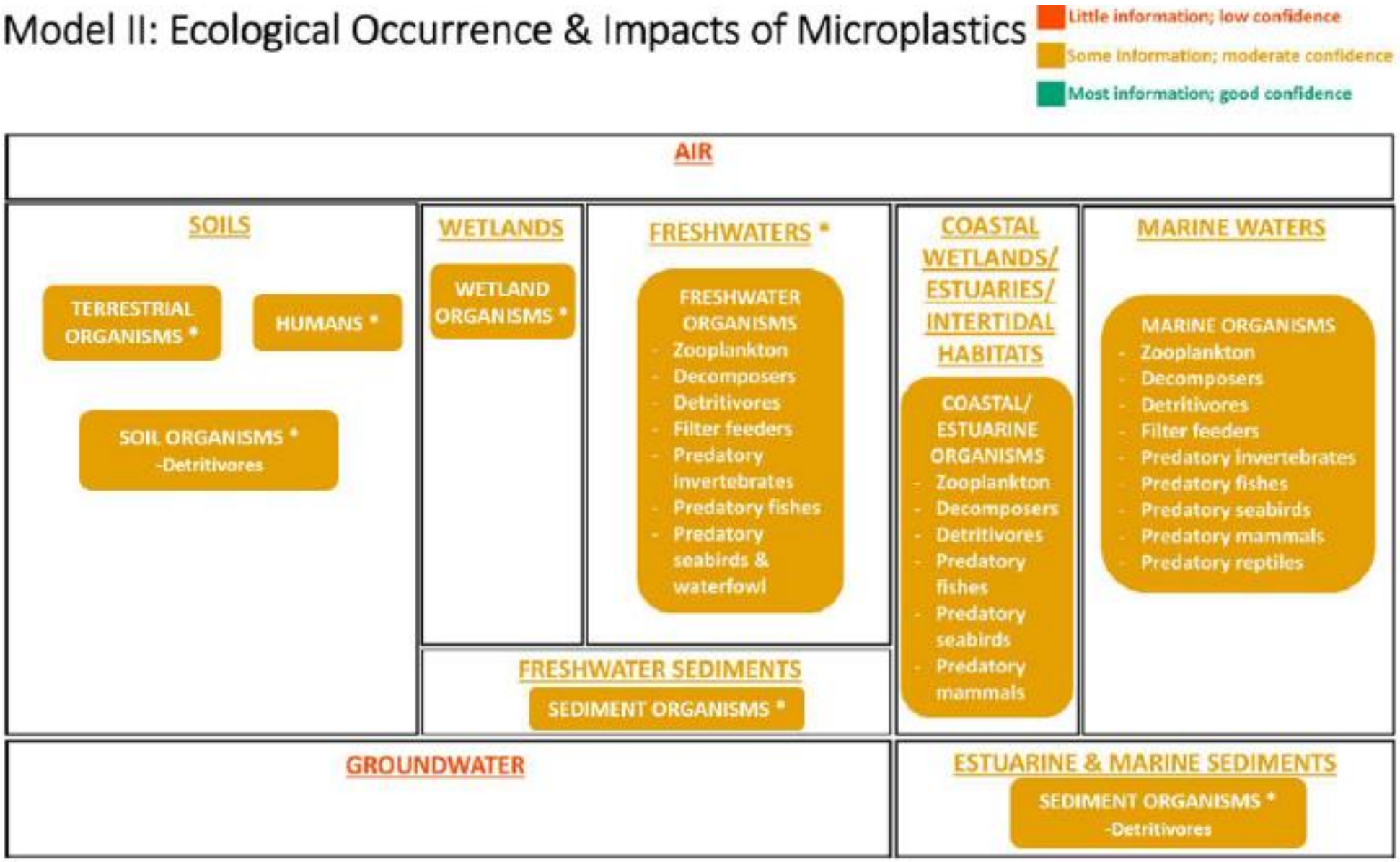
Microplastics Field Sampling	Microplastics Extraction, Separation and Cleanup	Microplastics Quantification and Characterization
▪ Which sample type/matrix is relevant? ▪ What size range is relevant? ▪ Which particle/polymer types are relevant? ▪ How many samples are needed? ▪ Will samples be kept discrete, homogenized or pooled for analysis, and what does this mean for interpretation of the results? ▪ Which sampling method is appropriate? ▪ What sample volume is needed to get a representative sample? ▪ What quality assurance/ quality control (QA/QC) methods are needed? ▪ Which units will be used for the final results and what does that mean for the comparability of data? ▪ What are the detection limits of the methods used?	▪ What QA/QC methods can be used (e.g., to determine procedural recoveries or to prevent background contamination)? ▪ What are the impacts of the chosen method on the final result? Will artifacts be introduced? ▪ How can sorbed contaminants and microbes be accounted for? ▪ Which polymers/particle types are accounted for, recognizing that some particle types such as microfibers can be challenging to extract and may be lost? ▪ What are the detection limits of the methods used?	▪ What are the limitations of the methods used? ▪ Which polymers/particle types are accounted for? ▪ What are the detection limits of the methods used?

Sources, Transport & Fate



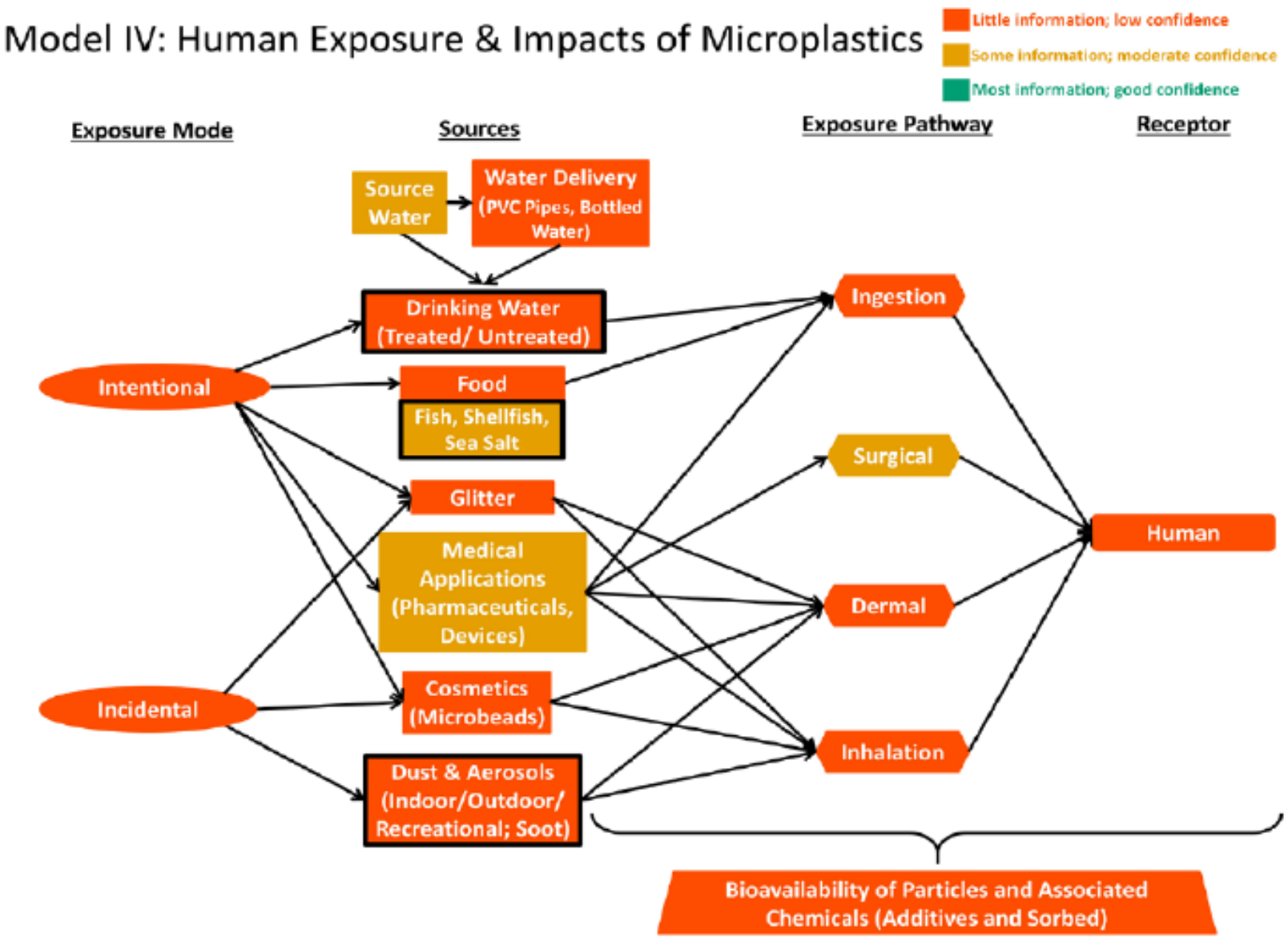
EPA 2021, Exhibit 3-1

Ecological Assessments



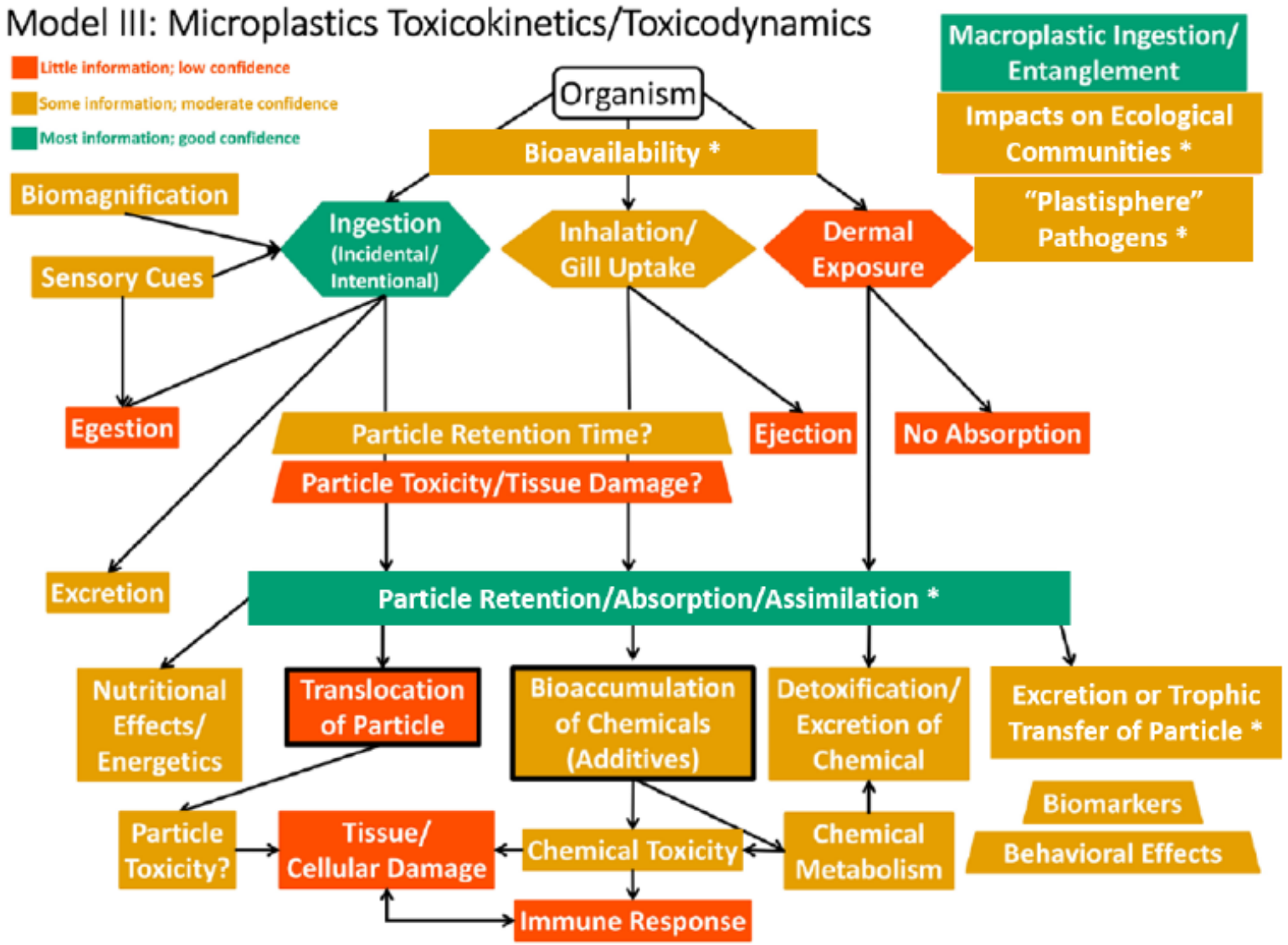
EPA 2021, Exhibit 4-1

Human Health Assessments



EPA 2021, Exhibit 5-1

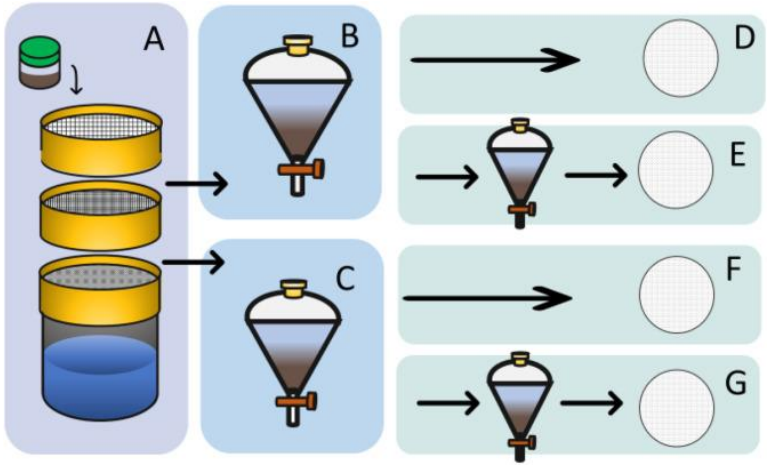
Ecological and Human Health Assessments



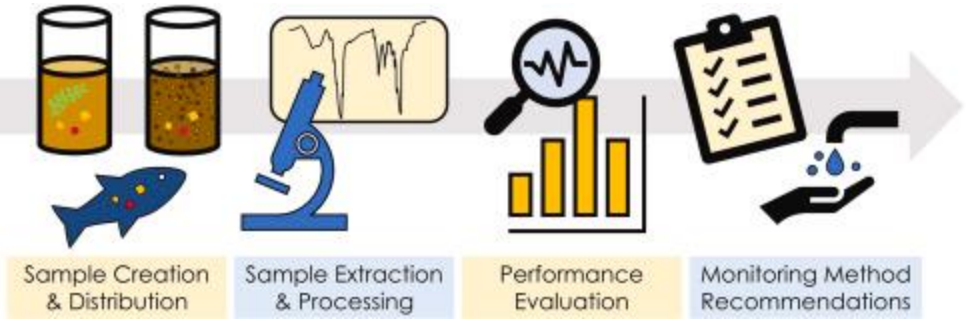
EPA 2021, Exhibit 4-2

Analytical Methods: Past Research Examples

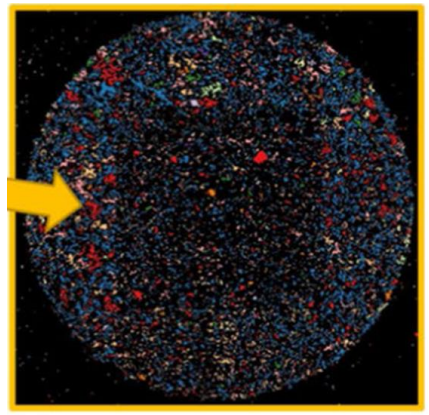
- Comparison MP extraction procedures from marine sediment
- Hybrid method of MP extraction from marine sediment for Raman spectroscopy
- Diagnostic of how/when to utilize laboratory/field blanks
- Evaluation of processing times for different matrices and accuracy of recovery
- Validation of new instrumentation for polymer identification



Cashman et al. 2022 Graphic of hybrid method extraction



Hampton et al. 2023 Processing different matrices



Whiting et al. 2022 LDIR output

Analytical Methods: Current Research

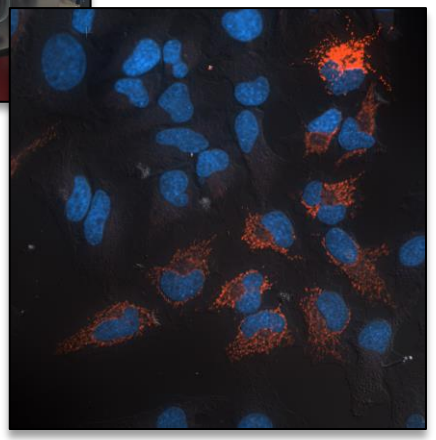
A low-tech, mass-based community-scientist-oriented method for routine microplastics monitoring in coastal systems

Flow cytometry and fluorescent microscopy

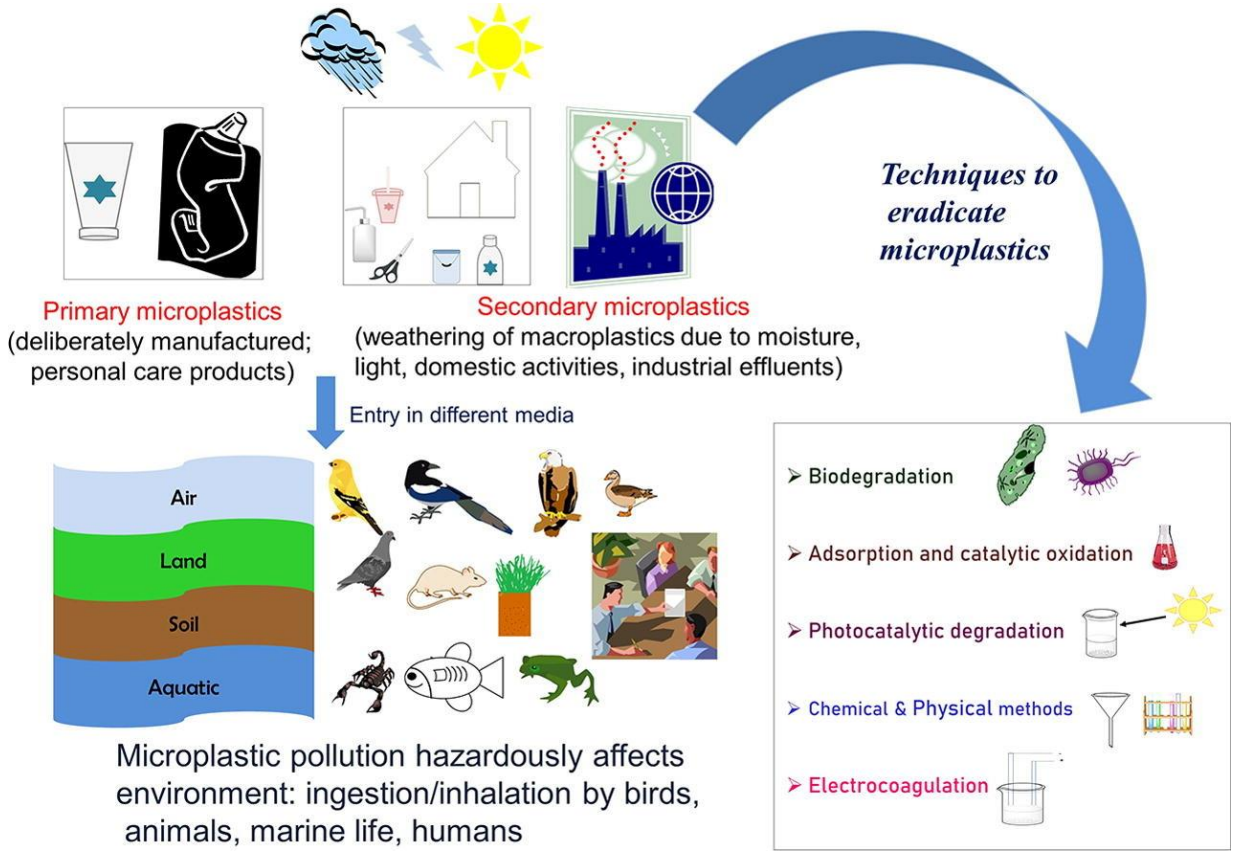
Using elemental fingerprint as potential tool for tracking fate of real-life model nanoplastics generated from plastic consumer in environmental systems

Validating extraction/digestion method for mass-based assessment from dryer lint

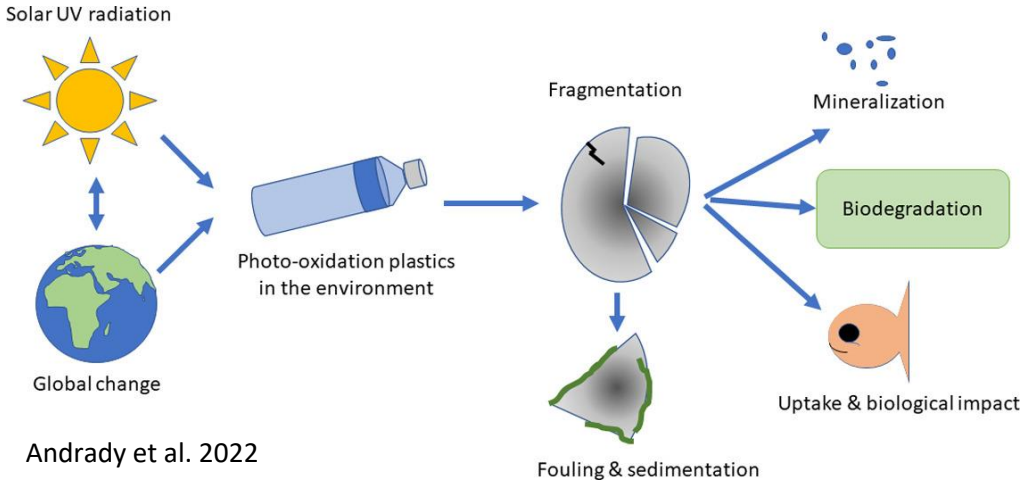
Developing method to extract nanoplastics from sediment using pyrolysis GC/MS analysis



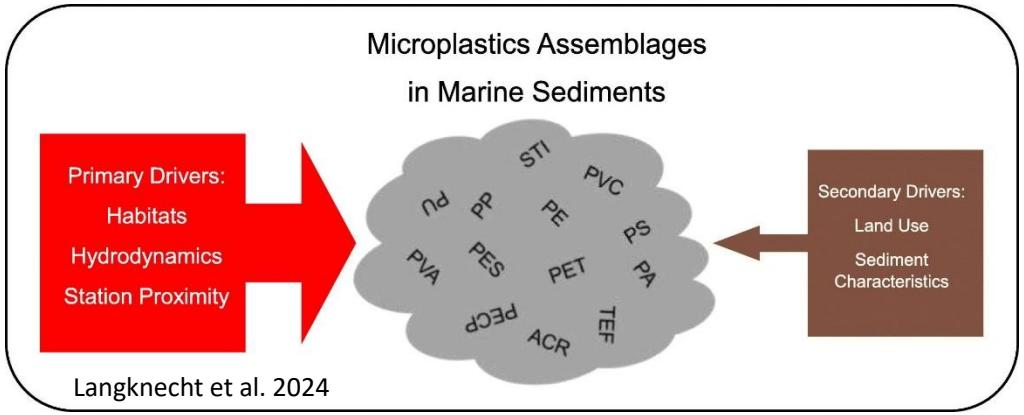
Sources, Transport & Fate: Past Research Examples



Sharma et al. 2021



Andrady et al. 2022



Langknecht et al. 2024

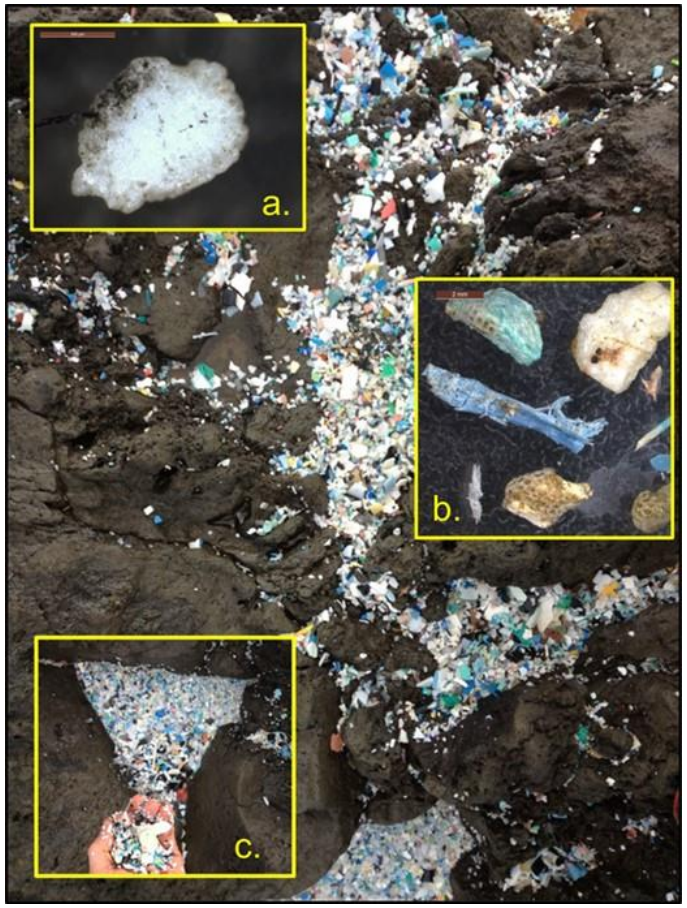
Sources, Transport & Fate: Current Research

Detecting and characterizing MPs in wastewater effluents from urban and semi-urban wastewater treatment plants

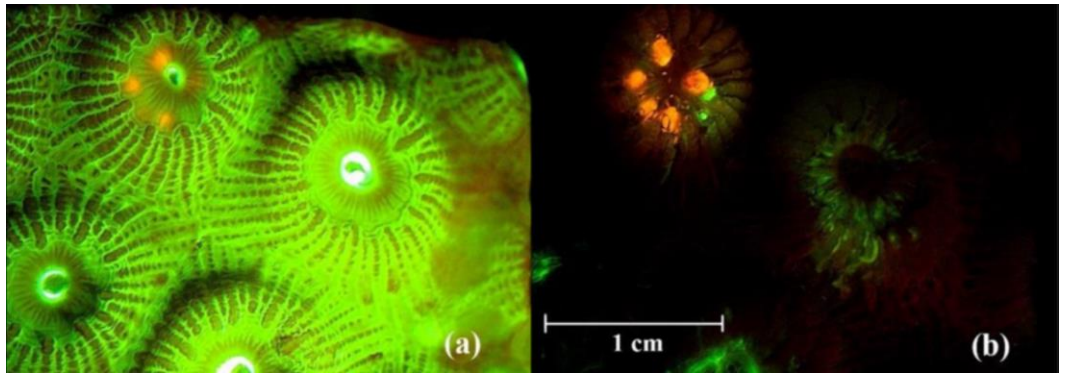
Monitoring how the environment effects UV-Chemical aging of MPs

Following MPs from source to environment: detection and characterization in urban watersheds

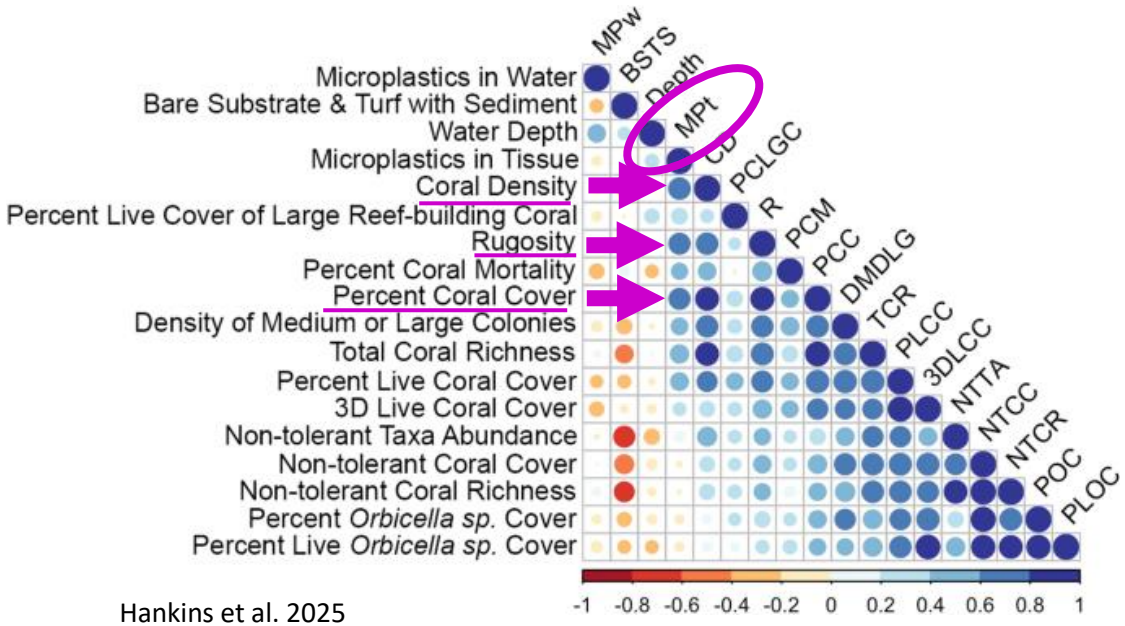
Ecological Assessments: Past Research



Burgess et al. 2017



Hankins et al. 2018



Hankins et al. 2025

Ecological Assessments: Current Research

Ecological effects on marine benthic communities of bioplastics (including analytical methods)

(1) MP fate in experimental streams facility

(2) Evaluation of ecotoxicological, molecular, and behavioral effects of nano- and MP exposure on aquatic life in freshwater environments

Regional-ORD Applied Research (ROAR) with Region 3: MP source tracking in Chesapeake Bay, MD

Quantification & identification of MPs in sediment from coral reef habitats

Cumulative effects of environmentally relevant MP concentrations and elevated temperature on stony coral growth

Growth effects of bioplastics on coral

Ecological Assessments: Research Highlight

- EPA ORD's Atlantic Coastal Environmental Sciences Division is partnering with Chesapeake Bay Program Plastic Pollution Team
- Conceptual Ecological Risk Assessment (ERA) by Chesapeake Bay Program found lack of data identifying types of plastics and potential sources
- Data will be used to support ERA of striped bass which have been experiencing population decline

Regional-ORD Applied Research (ROAR) with Region 3: MP source tracking in Chesapeake Bay, MD

Human Health Assessments: Past Research

Organization	Definition (by size)
National Oceanic & Atmospheric Administration	<5 mm
Environmental Protection Agency	5 mm – 1 nm
United States Geological Survey	5 mm – 1 µm
Food & Drug Administration	MP = 5 mm – 1 µm NP = 1000 nm – 1 nm
National Institute for Standards & Technology	No definition
ASTM International	<5 mm
International Technology & Regulatory Council	5 mm – 1 nm

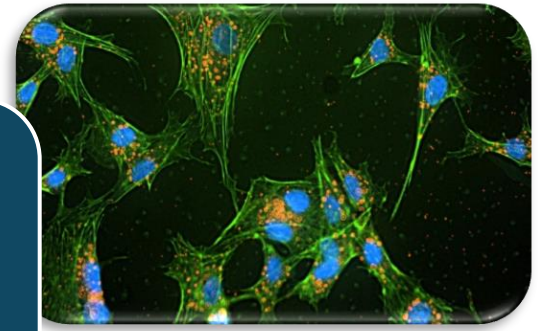
Comparing the definitions of microplastics based on size range: Scientific and policy implications (Ho et al. 2024)

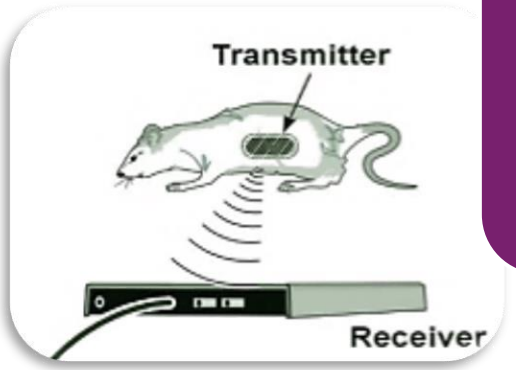
Antibiotic resistance in plastisphere (Joo et al. 2025)

Human Health Assessments: Current Research

Measurement, characterization, effects and impacts from products through the environment to organisms

Cellular distribution and toxicity of nano- and MPs in mammalian cells





Integration of in vitro, in vivo, and human health effects of MPs

Human exposure, human health: Plastic-associated compounds and biomarkers of health in human biological samples

CDC nhanes™

EPA's Trash Free Waters Program

- Interagency Marine Debris Coordination Committee Report on Microfiber Pollution (Save Our Seas 2.0 Act) (2024)
- National Strategy to Prevent Plastic Pollution: Part Three of a Series on Building Circular Economy for All (2024)
- Escaped Trash Risk Map (2024)

Learn more at epa.gov/trash-free-waters

EPA Research Summary & Impacts

Analytical Methods: provide faster methods with better confidence

- Development of hybrid method for MP extraction from marine sediment
- Validation of new technology for polymer identification
- Enhanced quality assurance by blank collection during processing

Sources, Transport, & Fate: inform when/where/how MPs may be of the largest threat and largest impact for mitigation efforts

- Urbanized areas are sources of high freshwater and air MP pollution
- UV radiation increases fragmentation
- Habitat and hydrodynamics important drivers of marine MP assemblages

Ecological and Human Health Assessments: inform Agency decisions for potential threats

- Laboratory studies that MP in high concentrations can reduce coral growth

Notable Impacts

- Advancing the science of methods development
- Addressing data gaps
- Identifying emerging contaminants/pathogens
- Providing expertise in policy documents

Summary

- Science of processing and polymer identification is evolving
- As data gaps are filled, better understanding of:
  - Impacts
  - Mitigation
- Outreach and education intended to help inform stakeholders (ITRC Microplastic Guidance Document and Toolkit)

Contacts

Valerie Hanley, PhD
Senior Toxicologist
Human and Ecological Risk Office
Department of Toxic Substances Control
Valerie.Hanley@dtsc.ca.gov
916-255-6440

Cheryl Hankins
Research Biologist
US EPA Office of Research and Development
Hankins.Cheryl@epa.gov
850-934-9340

Additional information/resources

EPA Science Inventory (https://cfpub.epa.gov/si/)
EPA Microplastic Research (https://www.epa.gov/water-research/microplastics-research)
EPA Trash Free Waters (https://www.epa.gov/trash-free-waters)
ITRC Microplastics Guidance Document (https://mp-1.itrcweb.org/)