

Analyzing Microplastics in the Environment: Striving to Better Assess Occurrence, Fate & Effects

Monitoring to Answer the “So What?” A Case for Risk Management

Anna-Marie Cook • August 5, 2021



Plastic Occurrence in Environmental Media



Occurrence:

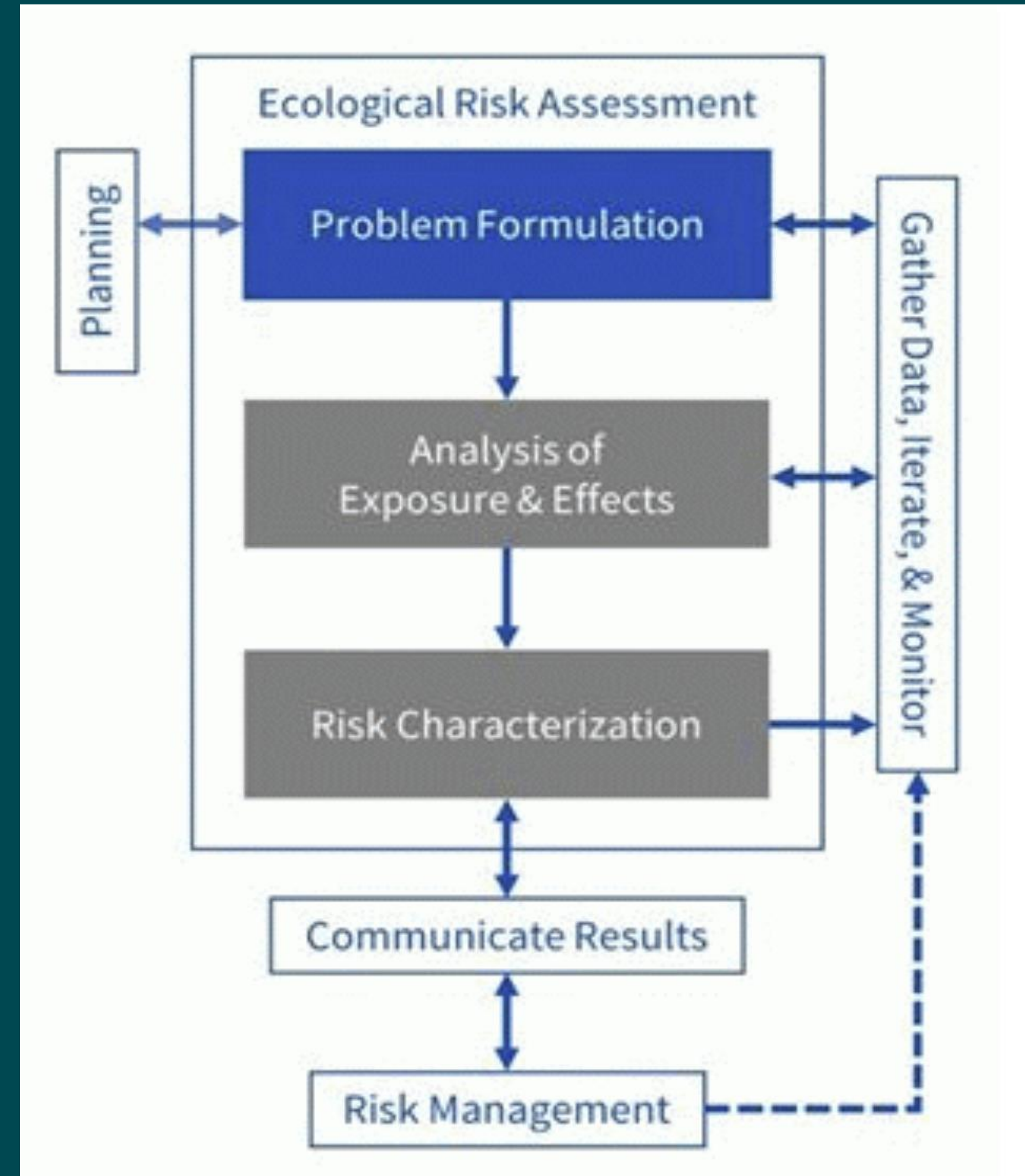
Currently mostly unknown

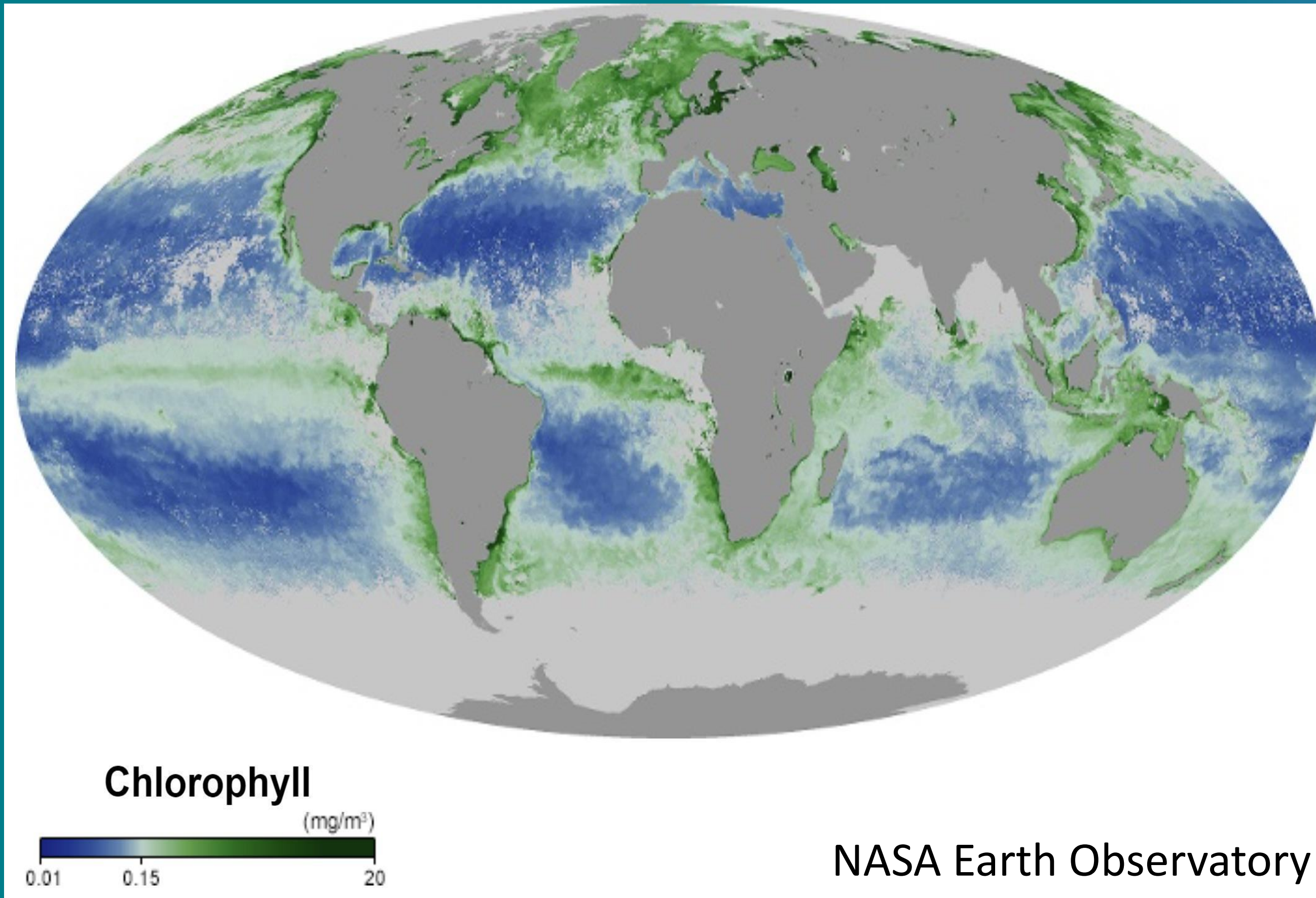
Fate:

Dependent on known occurrence/release. We know plastic particles get smaller and smaller and are likely to eventually end up on the floors of the oceans, lakes, rivers

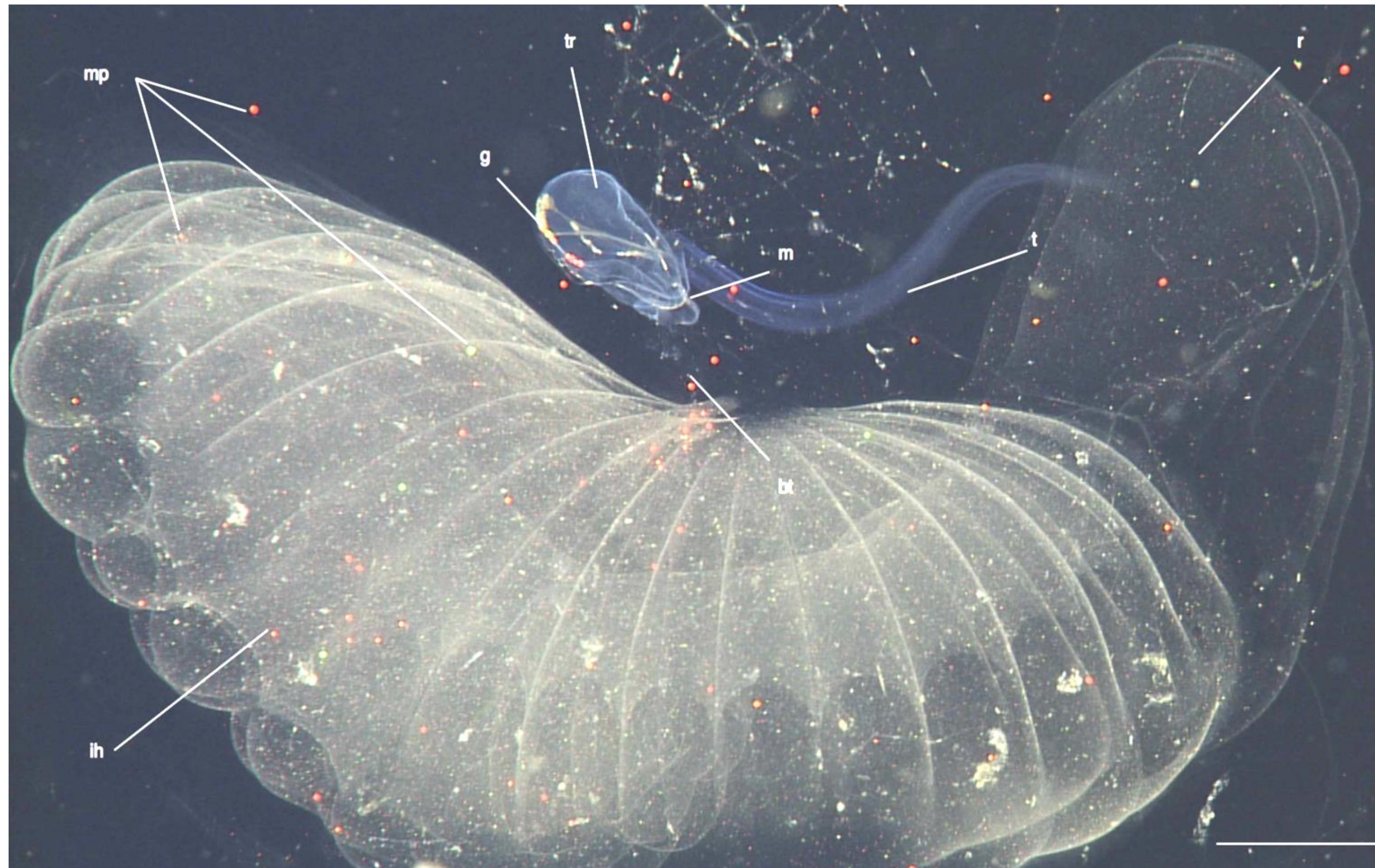
Effects:

Unknown. How to distinguish/differentiate impacts from a particle(s) consisting of a cocktail of chemicals and ranging orders of magnitude in size?





- Competition for sunlight may impact the health of phytoplankton in areas where micro/nanoplastics and phytoplankton conglomerate due to ocean currents and wind action.
- The ability of phytoplankton to sequester CO₂ may be compromised which would impact the planet's oxygen supply and increase GHG levels.



Zooplankton survival may be impacted from ingestion of plastic particles, creating a ripple effect up the food chain

From *Science Advances* publication by K. Katija, C. A. Choy, R. E. Sherlock, A. D. Sherman, B. H. Robison, From the surface to the seafloor: How giant larvaceans transport microplastics into the deep sea. *Sci. Adv.* 3,e1700715 (16 August 2017).

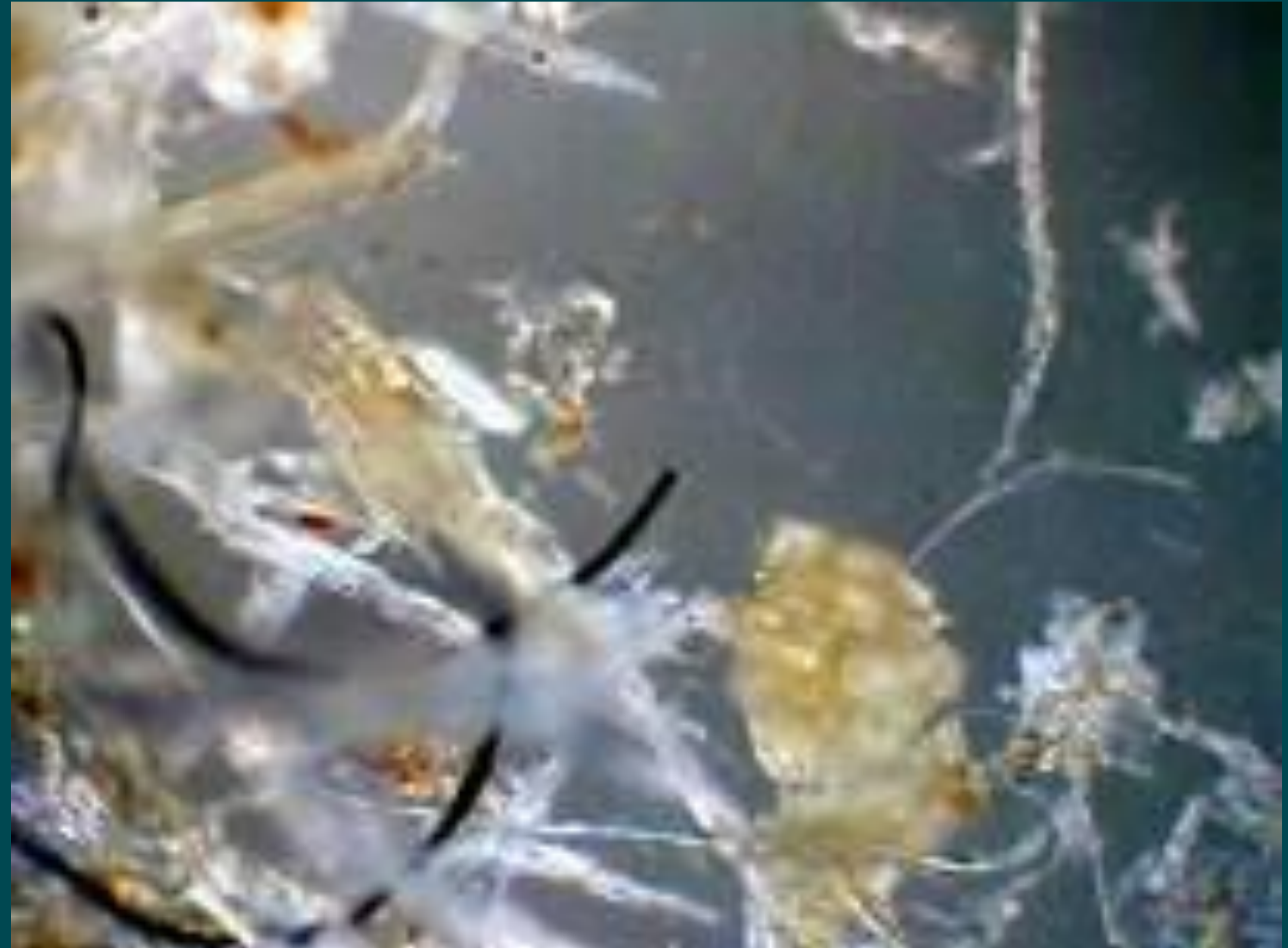
- The impacts of the very small micro and nano particles on organ health and endocrine systems for higher trophic level organisms are unknown
- We have not evaluated exposure over time frames that are environmentally relevant and through successive generations of species.



Discerning plastic polymers
from other materials is
challenging!

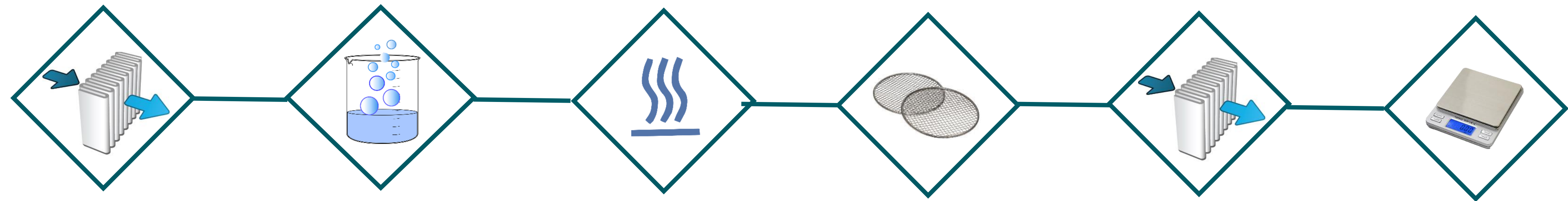
A slide from our own studies
on microplastic particles and
fibers in untreated wastewater

Multiple types of fibers and
particles are evident when
magnified, yet it is hard to tell
what type of material each
object is made of.



800 microns across.....

Sound Global Micro/Nano Plastics Monitoring Rests on the Use of Internationally Accepted Sample Collection, Preparation and Identification Standards



Procedures must:

- Be designed to prevent or reduce cross-contamination
- Account for interferences
- Be simple to follow and reproducible
- Produce accurate results
- Minimize loss of or damage to particles



Interactive Map of Air Quality

Current

Forecast

Loops

Archive

Info



Find address or place



Monitors

NowCast AQI



☐ Ozone and PM
(PM2.5 and PM10)

☐ Ozone

☒ PM (PM2.5 and PM10)

☐ PM2.5

☐ PM10

Contours

NowCast AQI



Boundaries



Basemaps



Legend



U.S. Air Quality Index

Good (0-50)

Moderate (51-100)

Unhealthy for
Sensitive Groups
(101-150)

Unhealthy (151-
200)

Very Unhealthy
(201-300)

Hazardous (301-
500)

No Data

Note: Values above 500 are considered

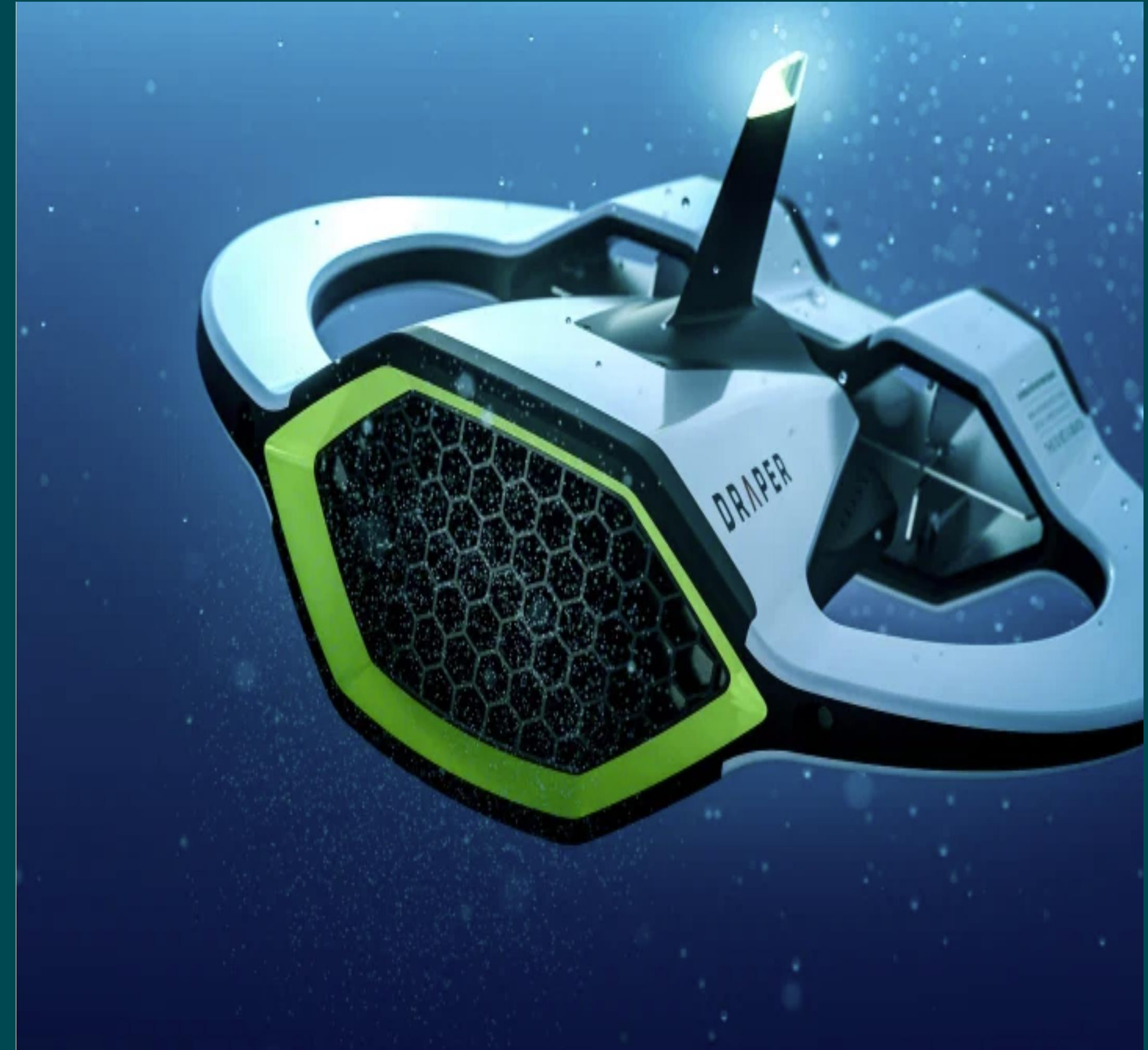
Data updated Sat July 17, 2021 at 03:00 PM PDT

*information on reducing exposure to
extremely high levels of particle pollution
is available [here](#).*

Esri, HERE, Garm

This concept ray-like drone is meant to swim around a body of water, collecting and analyzing samples for their microplastics content

TIME magazine listed it as one of the top 100 inventions of 2018





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- Unlike many other chemicals, we can't clean up these tiny plastic particles once they are in the environment.
 - Spending years of effort and resources determining "acceptable" levels of exposure to organisms/humans ultimately results in a "so what" response because whatever the exposure threshold is (perhaps zero?), we still need to manage the problem and stop the release of this pollutant.

Environmental plastic pollution in the United States...

- Reducing microplastic risk requires managing/eliminating upstream sources of pollution.
- The more intact & clean the plastic, the easier it is to manage.





Each year 10,000 lbs of plastic particles are estimated to be brought to the island by adult birds mistakenly feeding it to their chicks as food.




Midway Atoll is inundated with plastic pollution which washes up from the North Pacific Gyre



Plastics and the Circular Economy

The recycling of plastic is critical to the world's move away from a linear economy and toward a circular one. New and revised standards from ASTM International will support the transition.

A photograph of a beach covered in plastic pollution, including small pieces of plastic and larger debris, overlaid with a dark teal filter. The text is white and bold, positioned on the left side of the image.

We can all agree that plastic pollution has no place in our environment, in organisms and in ourselves

- **Environmental monitoring data** of micro/nano plastic is the way to measure the efficacy of our upstream management strategies and our prevention and mitigation actions.

This is the answer to “So What”



An underwater photograph showing a large amount of plastic waste floating in the water. The waste includes various pieces of plastic, including a large clear plastic bag, a green plastic bottle, and several smaller pieces of plastic debris. The water is dark blue and murky, with some green algae or seaweed visible in the background. The overall scene is one of environmental pollution.

Environmental monitoring is needed to understand efficacy of prevention & mitigation strategies

1. Baseline conditions must be established
2. Temporal and spatial trends must be monitored
3. All monitoring must answer the bottom line of "So What?"
4. "So What" is answered through development/adoption of sound Data Quality Objectives (DQOs)



Thank you.