



Microplastics Health Effects Workshop

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Commission meeting, June 11, 2021



Background and Rationale

- Analytical methods will soon be available to measure microplastics in various matrices
- Next challenge is understanding the implications of occurrence data
 - i.e., what are the levels of concern for aquatic health?
- Over the last year, we have been working with world experts to develop these critical thresholds
 - Started with a webinar series on the state of the science
 - Since the experts have met monthly to provide ecotoxicological context

Workshop goals

- Identify relevant health effects in aquatic organisms and humans
- Prioritize microplastics characteristics that should be monitored
- Propose critical thresholds for ambient and drinking waters

Developing ambient thresholds

- Meta-analyses of microplastics toxicity data
- Selection of appropriate decision framework
- Development of the approach to calculate thresholds

Meta-analyses of toxicity data

- Database created to summarize effect concentrations for 160+ studies



167 manuscripts

6,051 data points

165 in vivo studies, **2** in vitro studies

3 shapes, **14** polymers

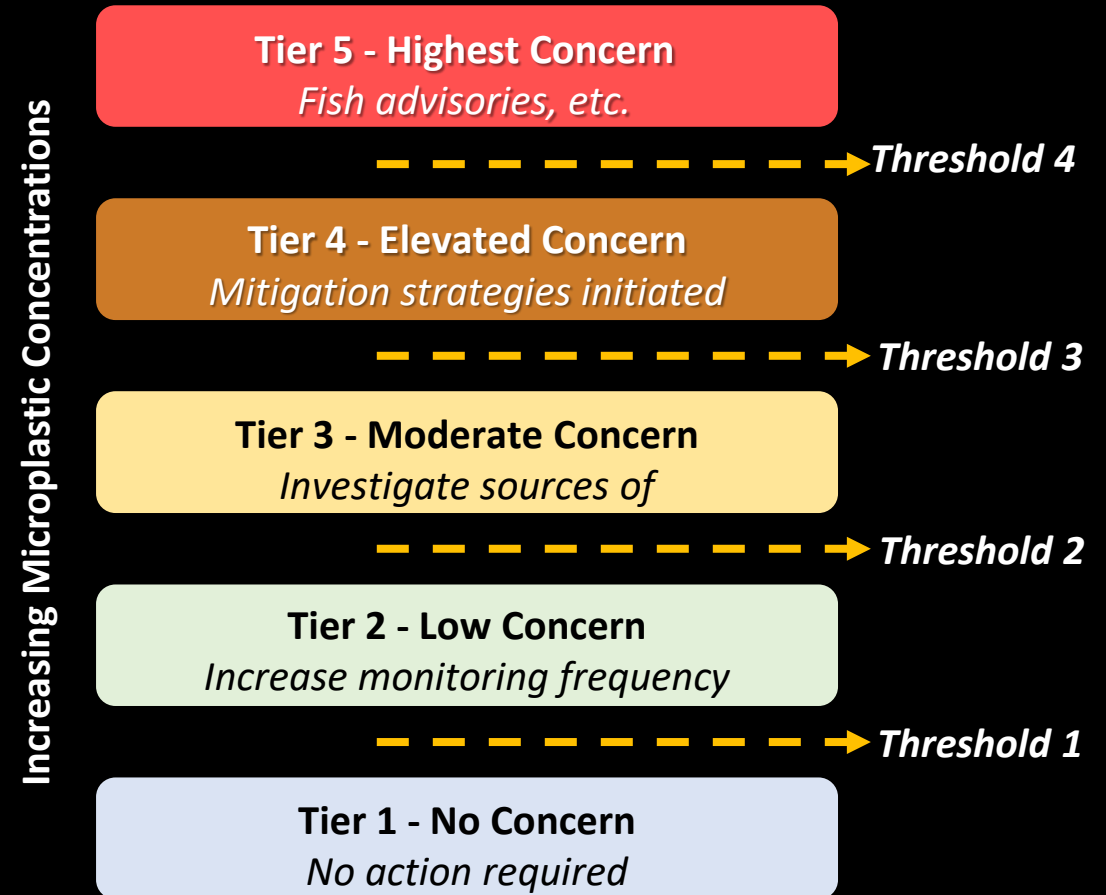
Particle sizes from **20 nm** to **5 mm**

117 Species

- Quality criteria established to filter the data based on:
 - *Minimum reporting requirements*
 - *Minimum dose tested*
 - *Biological significance of endpoints measured*
- 22** studies selected for threshold development

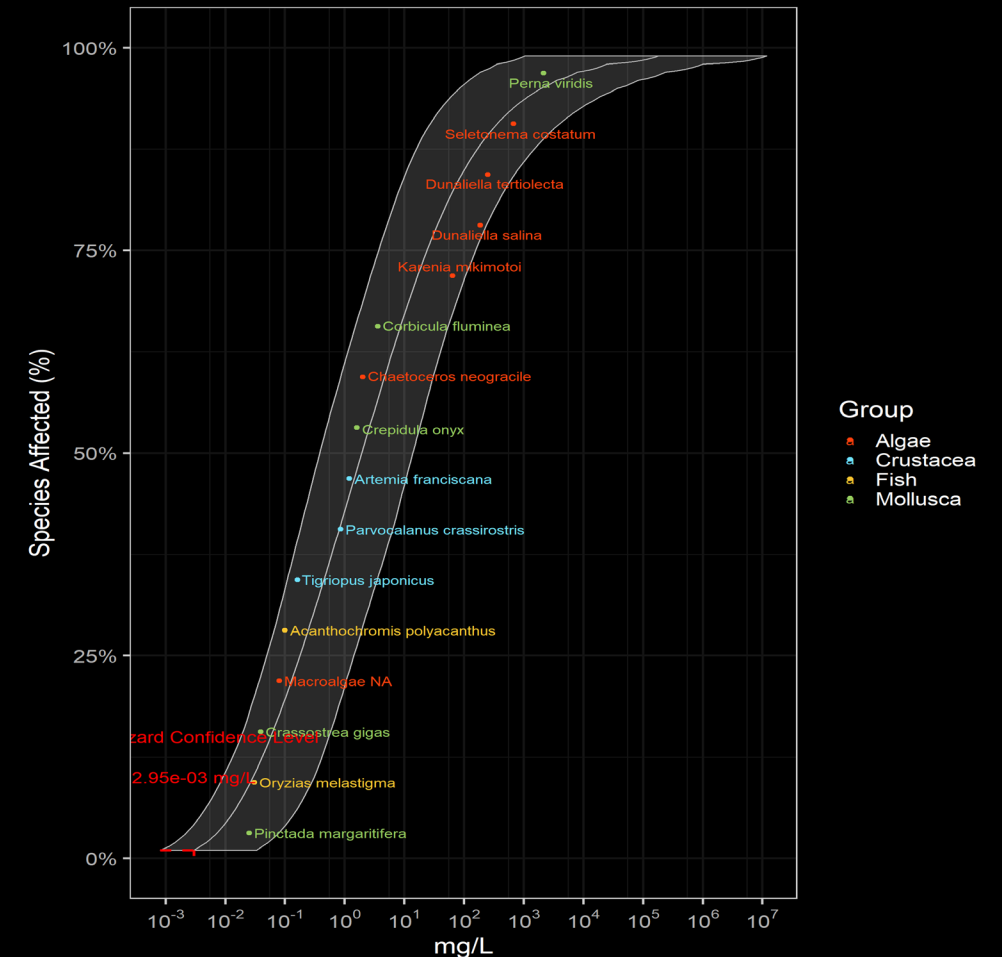
Developing the framework to apply microplastics thresholds

- Key questions addressed:
 - How many thresholds are needed?
 - What are their implications?
- We agreed on a tiered decision framework similar to the model used by the State Water Board



Deriving microplastics thresholds

- Species Sensitivity Distribution (SSD)
 - Method used to summarize the responses of different species to a specific stressor
 - Data are fitted on a curve to infer the concentration that will protect a desired percentage of population
- Method used widely to set safety limits
- We decided to set thresholds based on protection of 5 and 10% of the species



Monitoring for key particle characteristics

- We evaluated particle characteristics that drive toxicity
 - Chemical composition
 - Size
 - Shape
- Consensus is that size matters for the following reasons:
 - Food dilution (i.e., volume): Ingested particles can cause food dilution
 - Tissue translocation (i.e., surface area): Particles in the 1-80 μm range can translocate to tissues causing tissue inflammation and other toxic effects



Two sets of thresholds should be developed for food dilution and tissue translocation

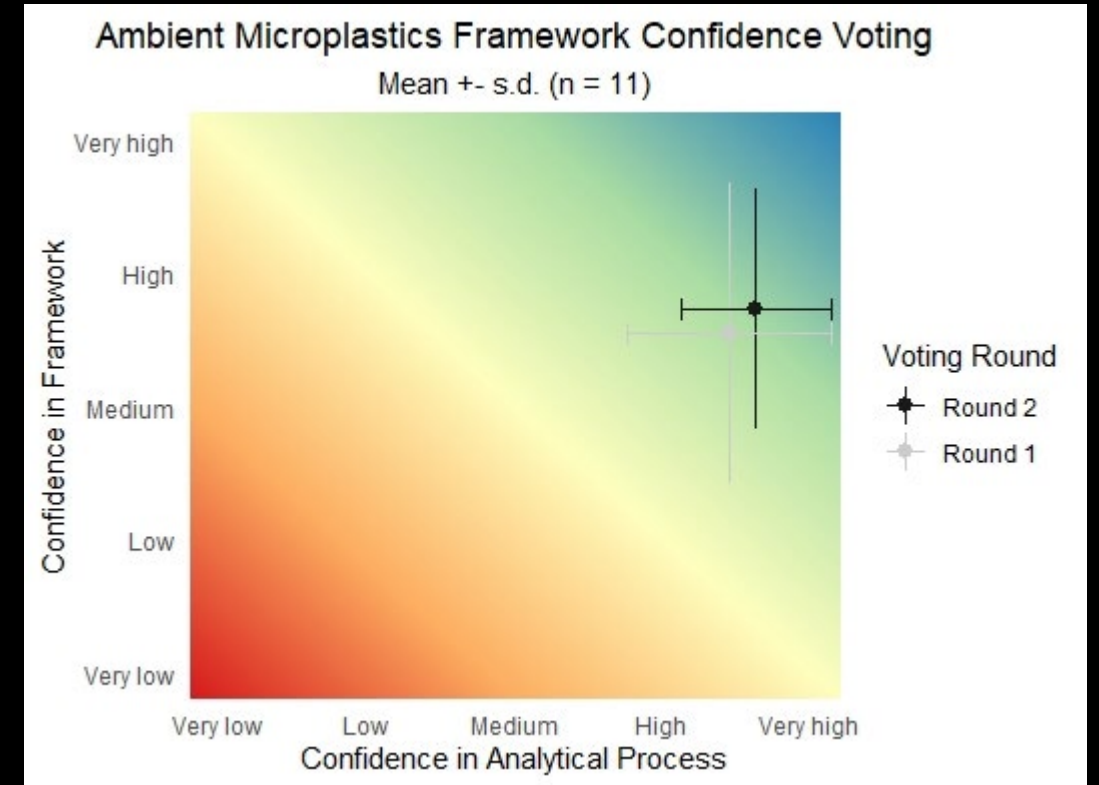
Tentative thresholds proposed

Threshold description	Food dilution (volume; $\mu\text{m}^2/\text{L}$)	Translocation (surface area; $\mu\text{m}^3/\text{L}$)
1- Invest in monitoring	NUMBERS SUBJECTED TO CHANGE	
2- Require discharge monitoring		
3- Listing as impaired waterbody		
4- Mandate pollution control measures		

All studies met pre-defined quality criteria

Evaluating confidence level

- Experts were asked to rate their level of confidence in the entire process
- Confidence scores were based on:
 - Amount and quality of data available
 - Consistency of findings among studies
- Overall, confidence level was medium to high



Next steps

- Workshop products will be publicly available
 - Series of manuscripts will be published in a Special Issue
 - Microplastics Toxicity Database will be released as an interactive web-app
- Risk assessment to assess relative impact of different plastics types & shapes on aquatic health
 - First step will be to expand the database to include occurrence data
 - And quantify the likelihood of adverse impacts in CA habitats relative to other stressors