LOS ANGELES COUNTY SANITATION DISTRICTS

A Century of Service

All That Glitters Is Not Gold

Achieving Accurate Microplastics Measurements for Effective Management

Shelly Walther, Environmental Scientist, LACSD

Trash / Microplastics Breakout Session

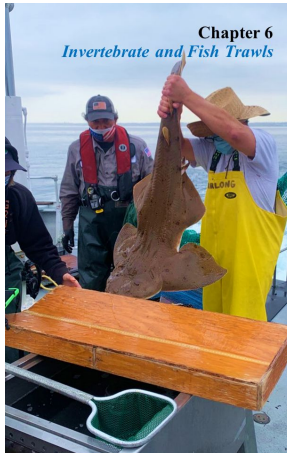
Council for Watershed Health: State of the LA River Watershed Symposium

September 19, 2023

My Areas of Focus

Supporting regulatory compliance by the wastewater sector

- Policy
  - CA Ocean Litter Strategy
  - SB 1263 – CA Microplastics Strategy
  - Microplastics Monitoring Playbook
- Environmental Monitoring
  - Ecological assessment of marine communities
  - Regional Kelp Forest monitoring
- Research
  - Microplastics: standardized methods (ASTM), study design, wastewater treatment, biosolids
  - Climate Change Issues: ocean acidification, ocean warming, shifting ecological baselines



California Senate Bill 1263 (2018): Statewide Microplastics Strategy

2022

- Initiate Statewide Microplastics Strategy

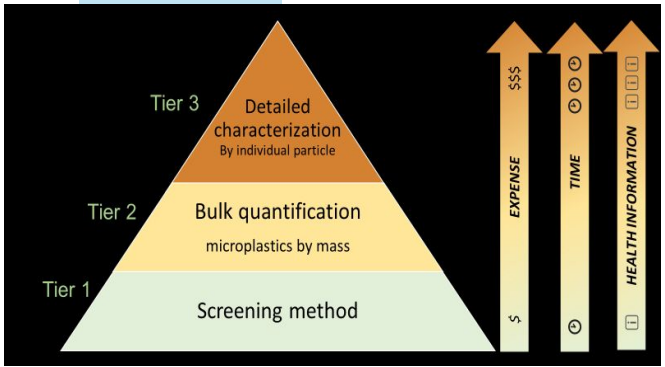
2026

- Develop **risk assessment** framework
- Develop standardized **methods**
- Establish baseline **occurrence** data
- Investigate **sources** and **pathways**
- Recommend **source reduction** strategies

Tiered Monitoring Framework

Tiered Regulatory Thresholds

Tiered Analyses



Increasing Microplastic Concentrations

Tier 5 - Highest Concern
Fish advisories, etc.

Threshold 4

Tier 4 - Elevated Concern
Mitigation strategies initiated

Threshold 3

Tier 3 - Moderate Concern
Investigate sources of

Threshold 2

Tier 2 - Low Concern
Increase monitoring frequency

Threshold 1

Tier 1 - No Concern
No action required

Why Do We Need A Microplastics Monitoring Playbook (MPMP)?

- New discoveries lead to growing interest
  - Media coverage
  - Academic response
  - Many methods, many results
- Regulatory response
  - SB 1422
  - SB 1263

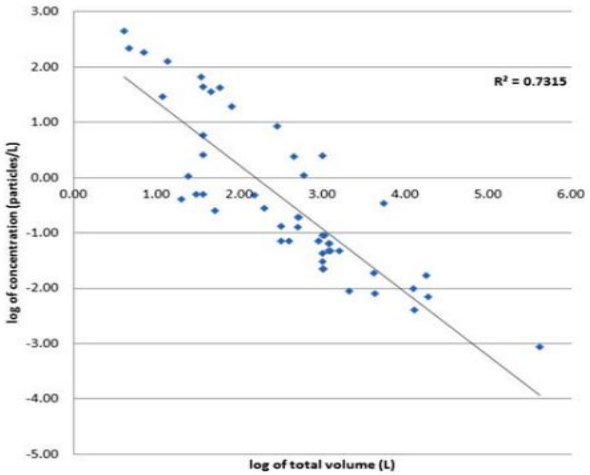


Figure 5.1 Logarithmic representation of total sample volume vs. calculated microplastic concentration, incorporating 51 secondary and tertiary final effluent samples pooled from 12 studies (Carr *et al.*, 2016; Dyachenko *et al.*, 2017; Gies *et al.*, 2018; Lares *et al.*, 2018; Mason *et al.*, 2016; Mintenig *et al.*, 2017; Murphy *et al.*, 2016; Simon *et al.*, 2018; Sutton *et al.*, 2016; Talvitie *et al.*, 2015, 2017; Ziajahromi *et al.*, 2017). Decreasing microplastic count trend as sampling volume increases with significant coefficient of correlation ($R^2 = 0.7315$).
From: Dyachenko et al. 2019

MPMP: Guidance on Microplastics Analyses

We need to:

- Be **confident** we're **accurately** quantifying and characterizing the microplastics in the sample
- **Quantify** plastics down to as low a size as possible
- Know the characteristics of each microplastic **particle**
- Avoid **false positive** and **false negative** identifications
- Avoid and quantify **contamination**
- Use a method that is **accurate**, **fast,** AND cost-effective

Orders of Magnitude Differences in Estimates of Microplastics in Water Bodies

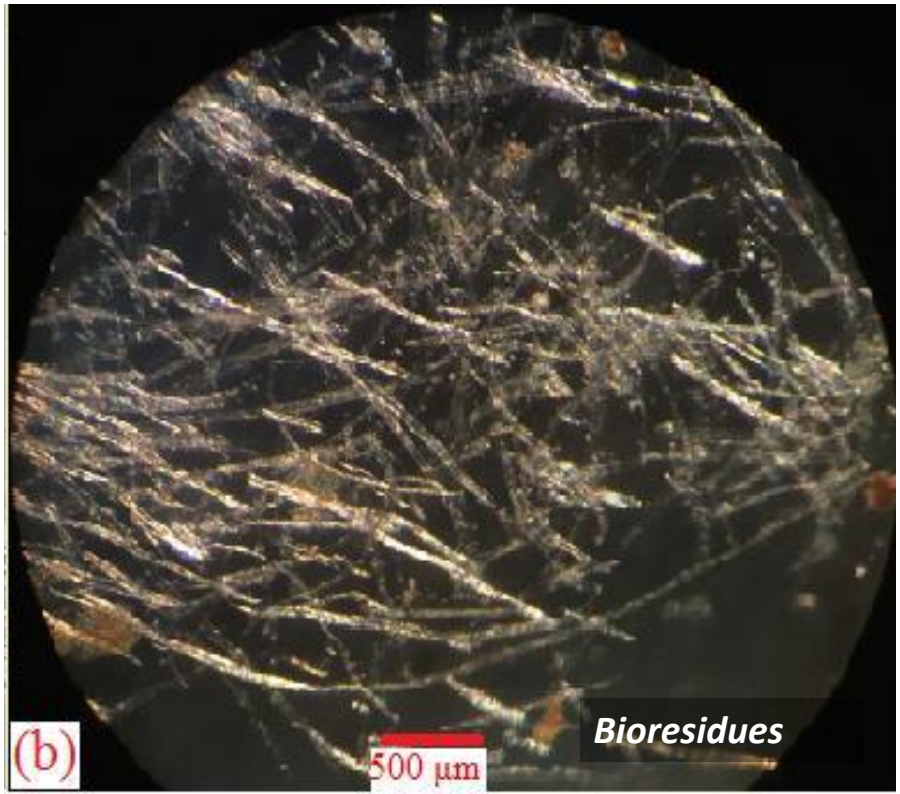
LA River/San Gabriel River (Wiggin & Holland 2019)	45,000-808,000 MP/m3	LB State, vast majority in the 20um-30um Range
Long Beach Harbor (Moore 2011)	12,932 MP/m3	Algalita 300um net
San Francisco Bay (Sutton 2016)	8 MP/m^{3*}	SFEI, 300um net
Great Lakes (Baldwin 2016)	8.69 MP/m^{3*}	USGS
World-wide (Hamid 2018)	1-102,000 MP/m^3	Various highest is Portugal (Noren 2007)

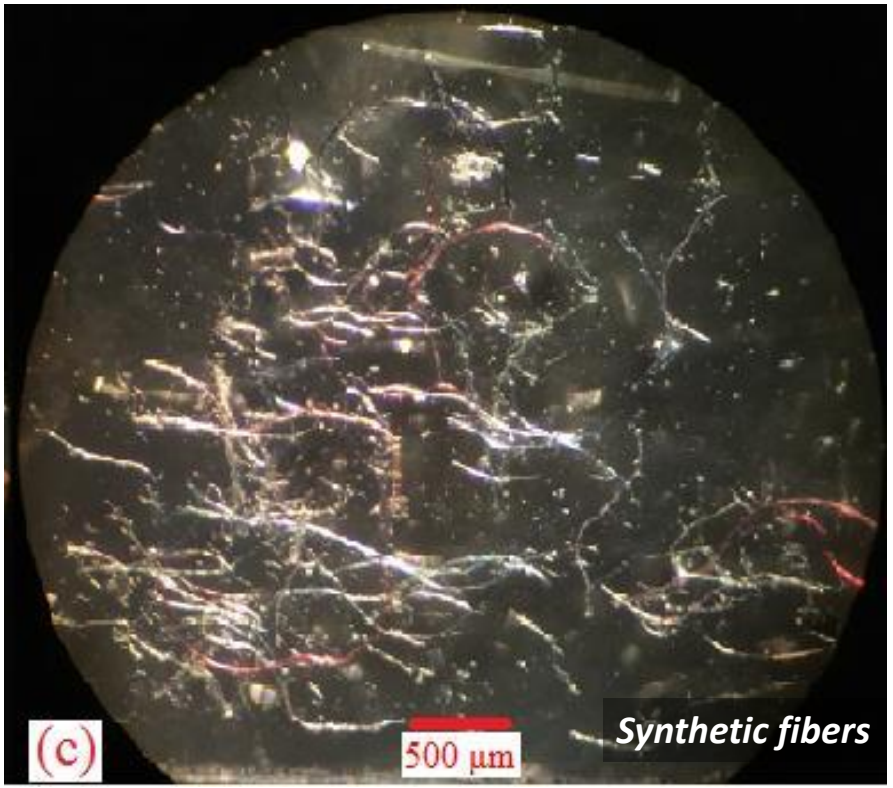
Table provided courtesy of Harry Allen, EPA R9

MYTH
DEBUNKED!
MYTH

Analysis: Microscope & Infrared Spectroscopy

Look-a-like Particles

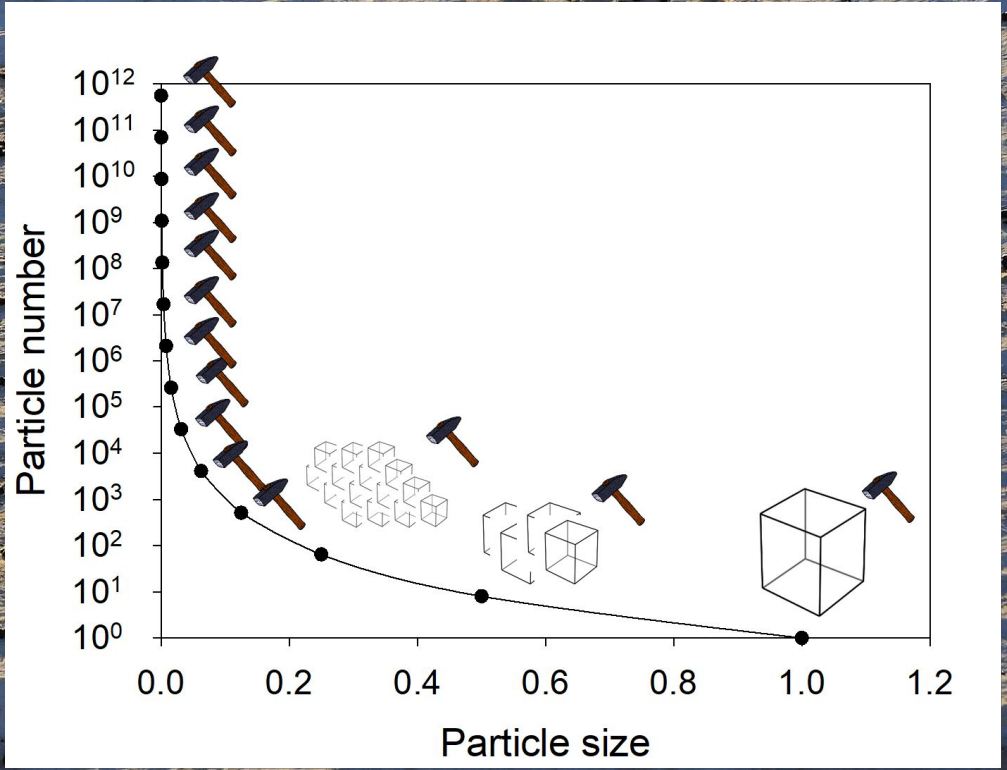




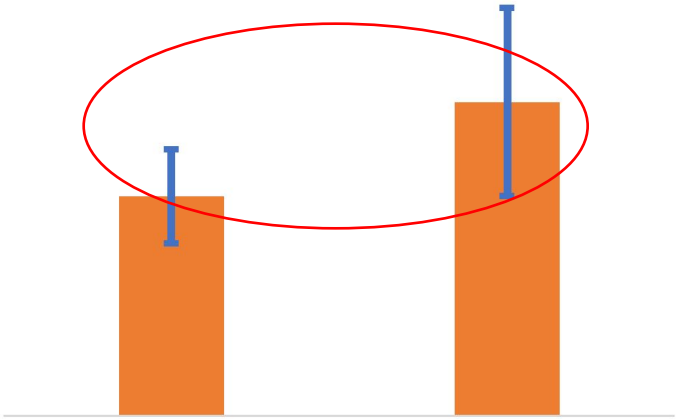
Regulatory Thresholds: What's in a Number?

What does this mean?

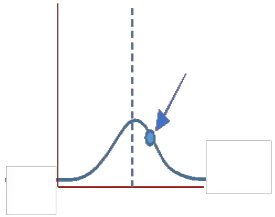
The smaller the particles you can see, the more you will find.



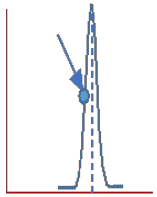
Measurement Uncertainty



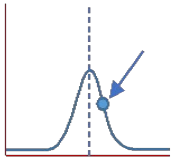
Sampling



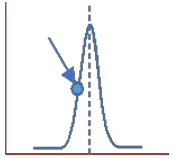
Sub-sampling



Sample Prep



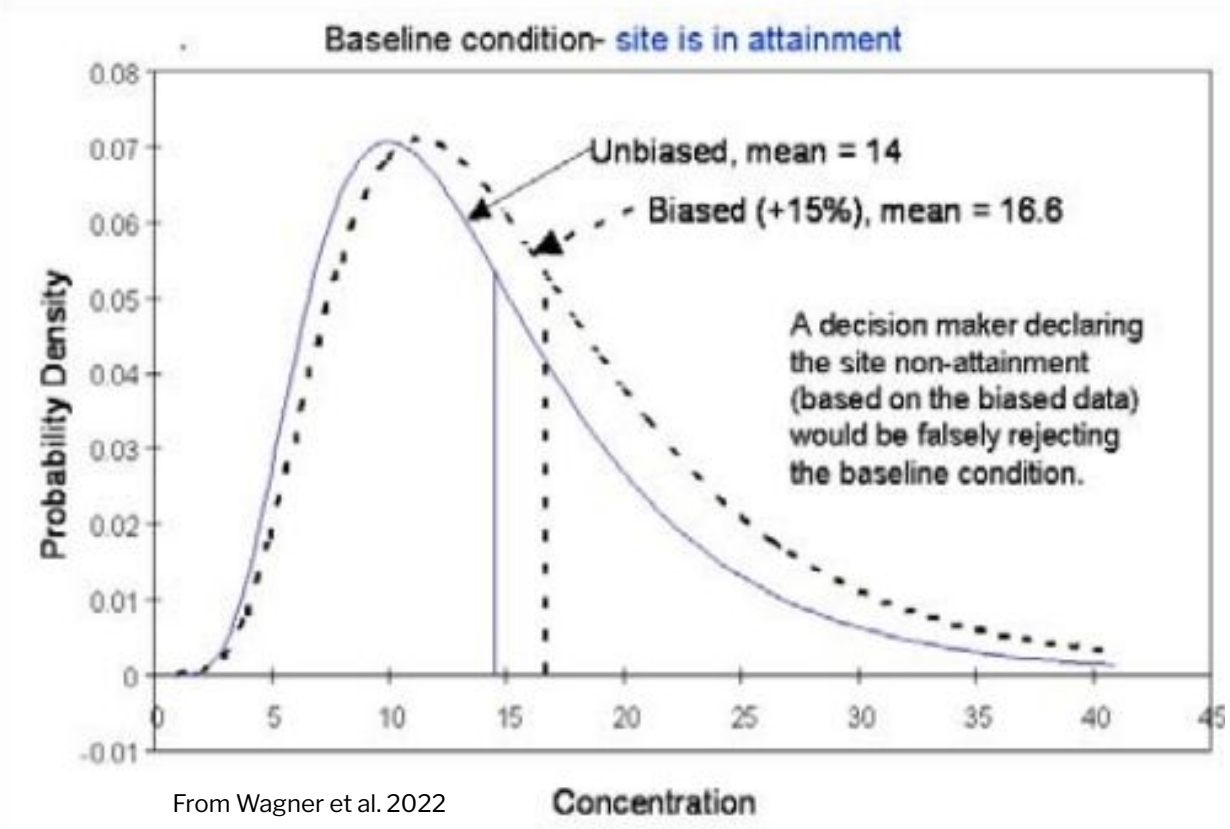
Analysis



There are many sources of variability in microplastics measurements

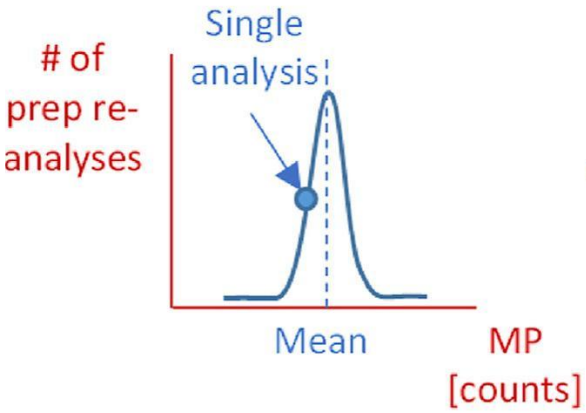
Data Reproducibility Is Critical

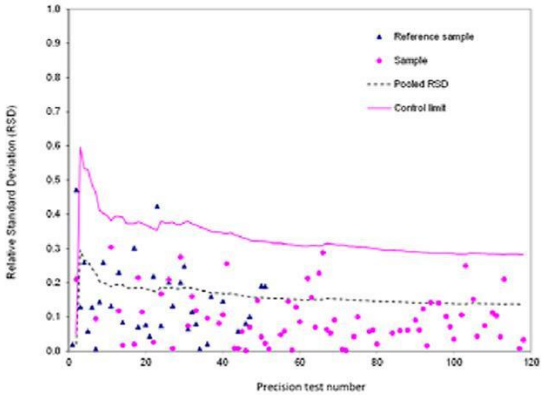
Quantifying Measurement Uncertainty

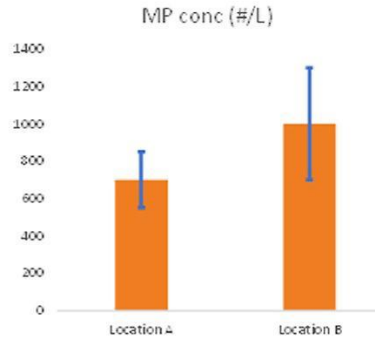


From Wagner et al. 2022

Microplastics Monitoring Playbook (MPMP): Putting Lessons Learned Into Practice







Recount precision

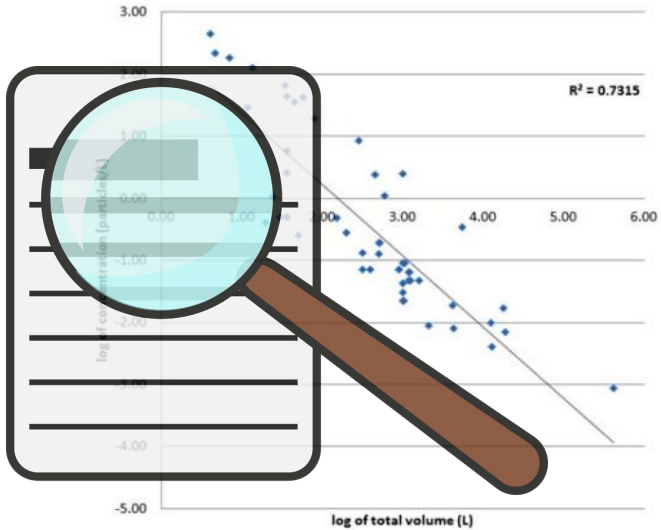
Control charts

Error bars

From Wagner et al. 2022

Microplastics Monitoring Playbook (MPMP): To Help Improve the Science

- Study design
- Sample collection & analysis
- Data analyses & reporting
- Reproducibility



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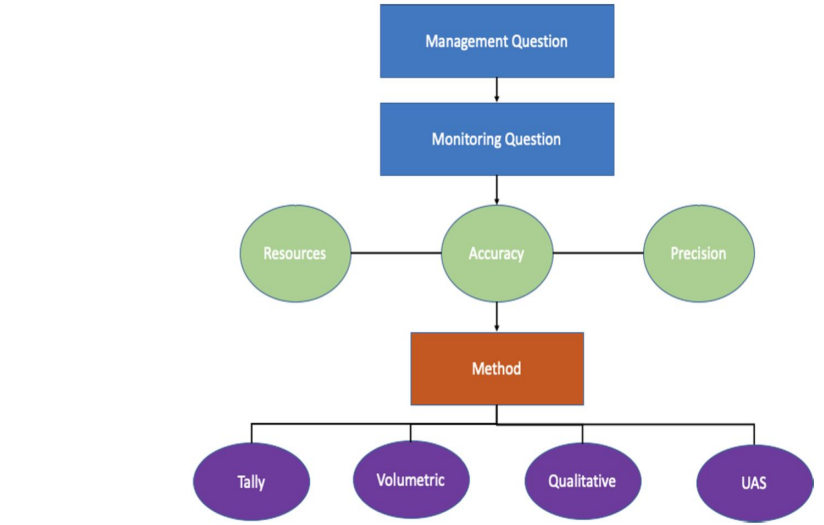
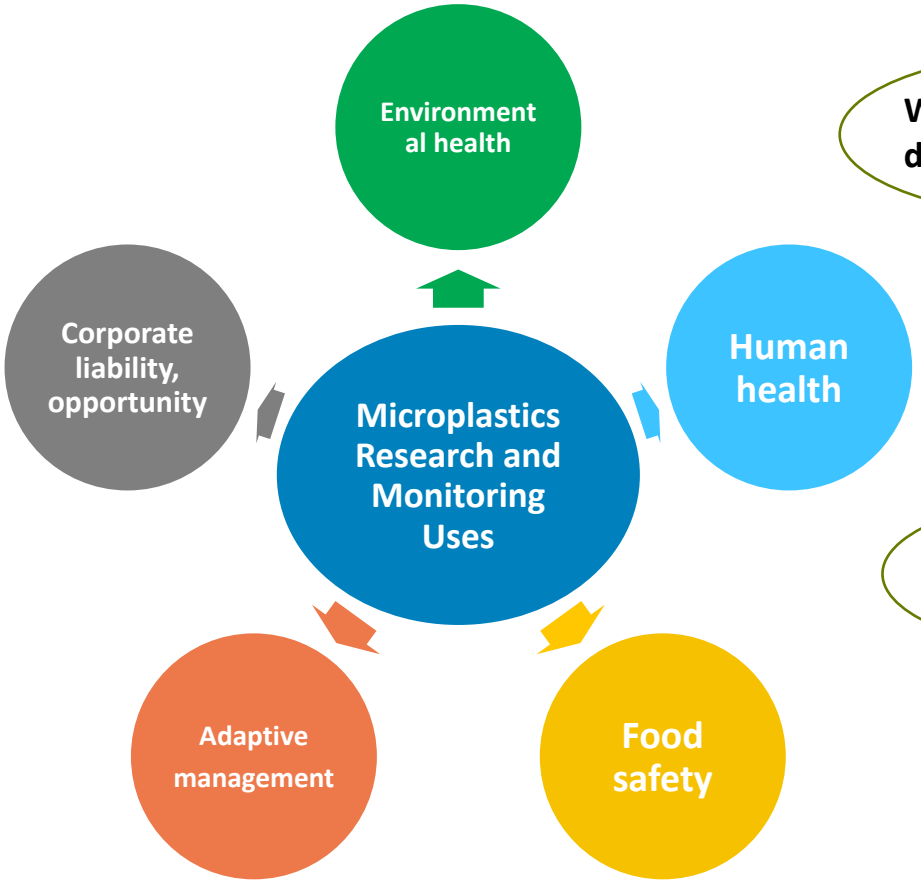
The Microplastics Monitoring Playbook will be Modeled on the CA Trash Monitoring Playbook



The Trash Monitoring Playbook Includes:

- Field Sampling Considerations
- QA Requirements
  - Training Materials
  - Field Audits
  - Data Record Review
- Consistency in Measurements for Comparability
  - Standard Operating Procedures
  - Tiered Method Approach
  - Training
  - Vocabulary
  - Recommendations of amount/unit area measurement
- Data Capture and Standardization
  - Forms and Data
  - Machine-learning algorithm
  - Mobile App for Field Stations

Study Design Depends on the Application



Where & when does my decision apply?

Monitoring vs. One-time?

Does size/shape matter?

Count vs. Mass?

What's my expected variability?

Adapted from Allen (*NEMC 2021*)

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The Quest Continues for Accurate Microplastics Measurements to Support Effective Management Solutions

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Thank you!

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Environmental Scientist

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swalther@lacsd.org