

# SF BAY MICROPLASTICS PROJECT



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OUR MISSION IS TO EMPOWER

**ACTION**

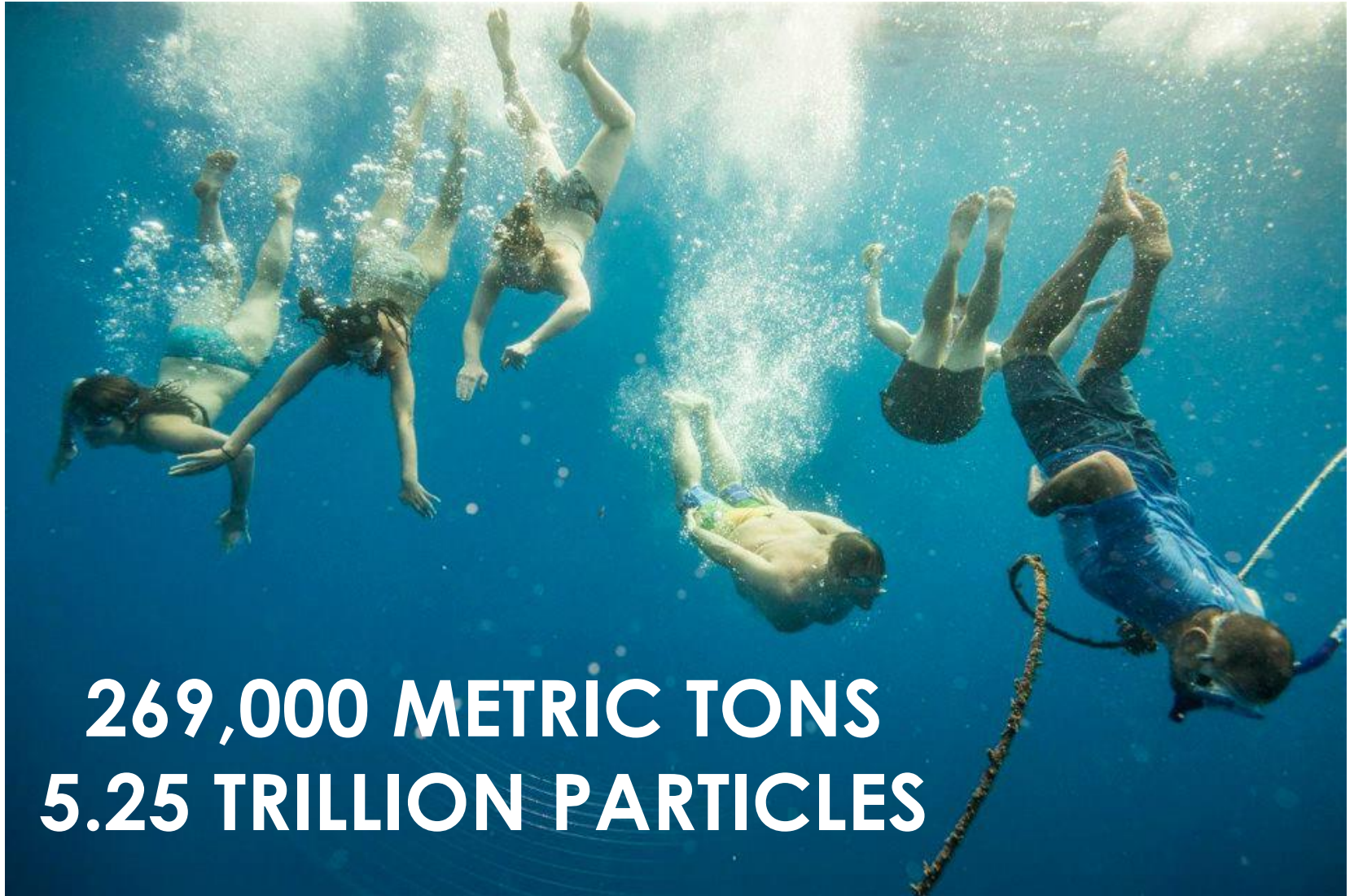
AGAINST THE GLOBAL HEALTH CRISIS OF

**PLASTIC POLLUTION**

THROUGH SCIENCE,  
EDUCATION AND ADVENTURE



**5 GYRES**  
SCIENCE TO SOLUTIONS



**269,000 METRIC TONS**  
**5.25 TRILLION PARTICLES**



**5 GYRES**  
SCIENCE TO SOLUTIONS

# SAN FRANCISCO BAY



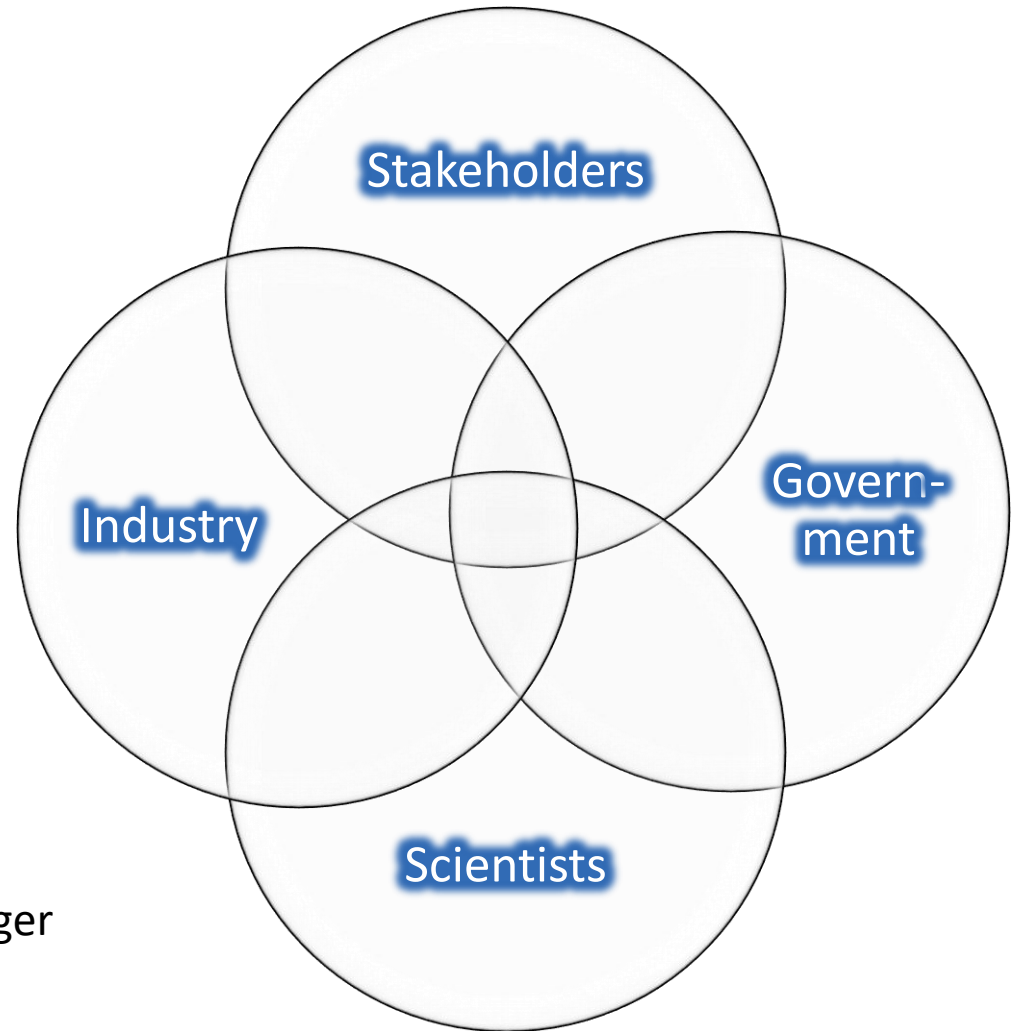
# Regional Monitoring Program

**Partnership** to understand the **health** of San Francisco Bay

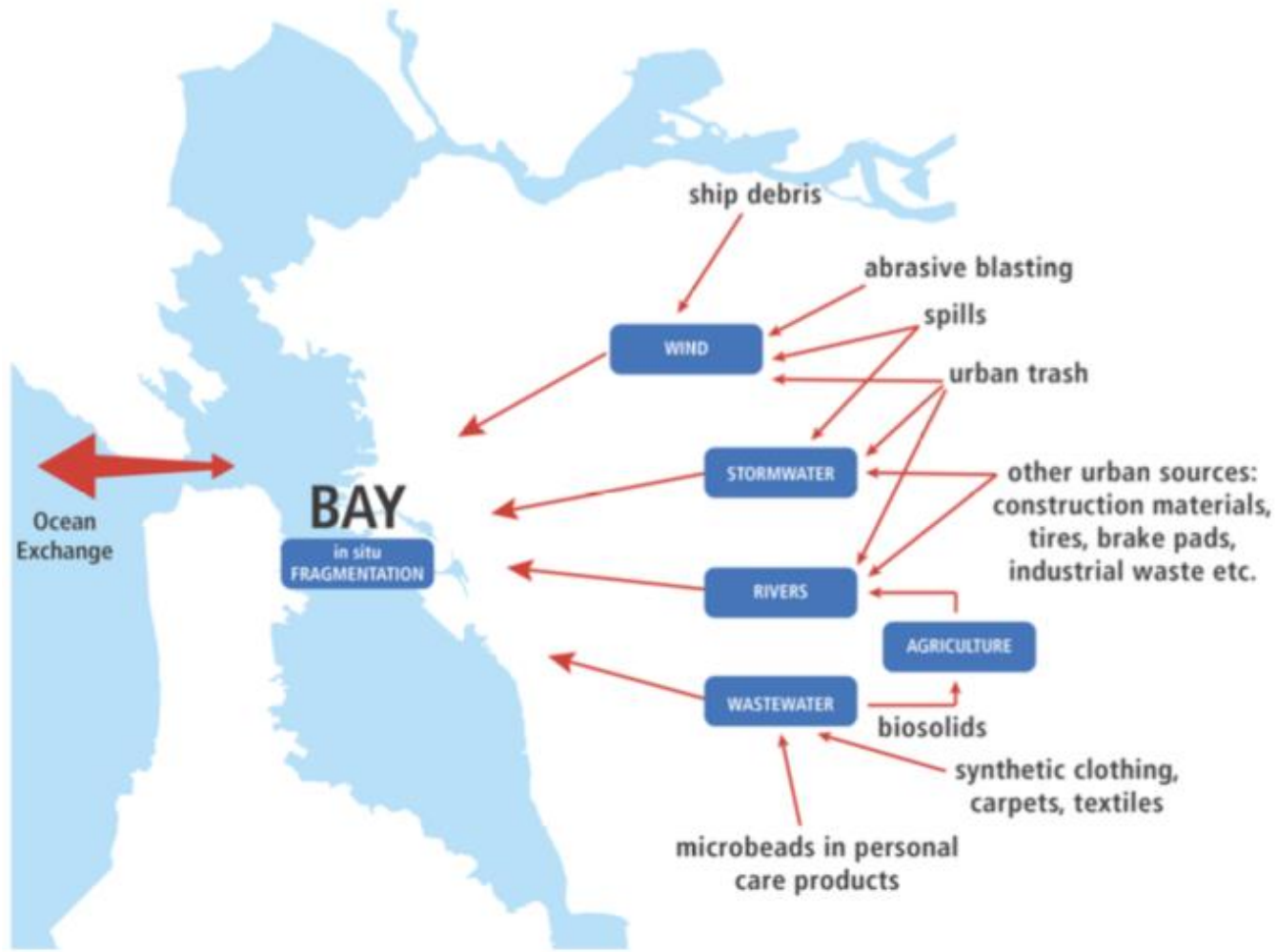
Implemented by



Melissa Foley  
SFEI, RMP Manager



# SF BAY: CONCEPTUAL MODEL



# MICROPLASTICS MONITORING TO INFORM MANAGEMENT ACTION

Pollution Pathways

Bay Monitoring



Wastewater  
(BACWA)

Marine  
Monitoring  
& Science

Sanctuary  
Samples

Transport  
Model



Water



Fish



Sediment



Mussels\*



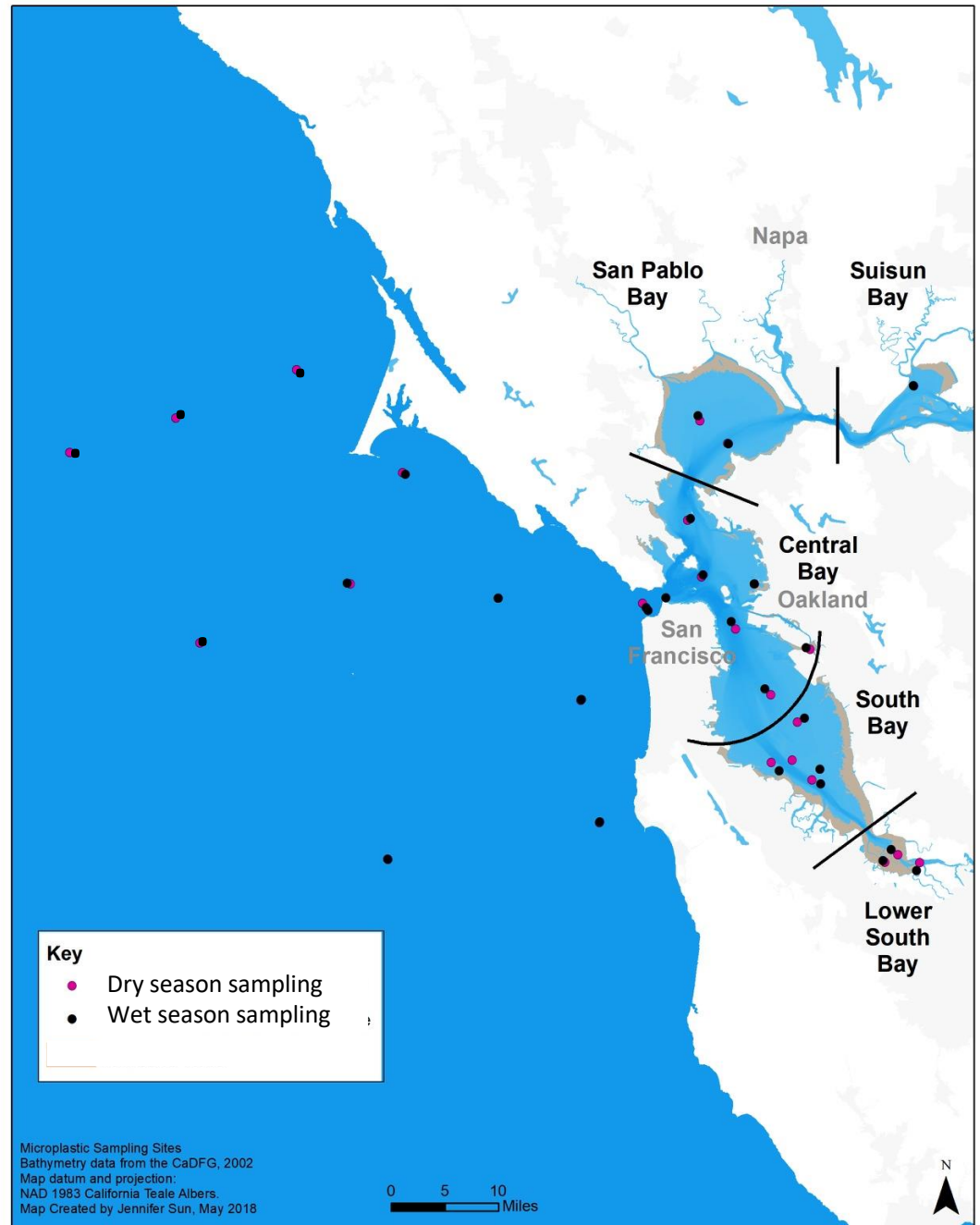
Stormwater  
(BASMAA)

# SAMPLE LOCATIONS

16 Bay sites  
11 Sanctuary sites

Exploring questions on:

- Ambient conditions
- Comparing Bay vs. Sanctuaries
- Bay comparisons
- Seasonality
- Baseline levels



# BAY AND SANCTUARY SURFACE WATERS

## Sample Collection:

- Manta trawl collection ( $>355\ \mu\text{m}$ )
- 1-Liter Grab ( $>20\ \mu\text{m}$ )
- Pump ( $>20\ \mu\text{m}$ ) [*Not Analyzed*]

## Field Work:

- 2 vessels: Derek M. Baylis sailboat and Bay Keeper boat
- Many days of field work

Field duplicates and blanks collected



# MANTA TRAWL SAMPLES



## SUMMARY – 65 Samples

- 39 Bay Samples
- 26 Sanctuary Samples

## FIELD METHODS

- Modified Neuston net
- 355 microns and larger
- 30 minute tows w/ flow meter
- Dry / Wet weather sampling

## QAQC

- Field blanks / Lab blanks

# 1-LITER SAMPLES



## SUMMARY – 56 Samples

- 32 Bay Samples
- 24 Sanctuary Samples

## FIELD METHODS

- 1-Liter grab samples collected with pole
- Surface water
- Dry / Wet weather sampling

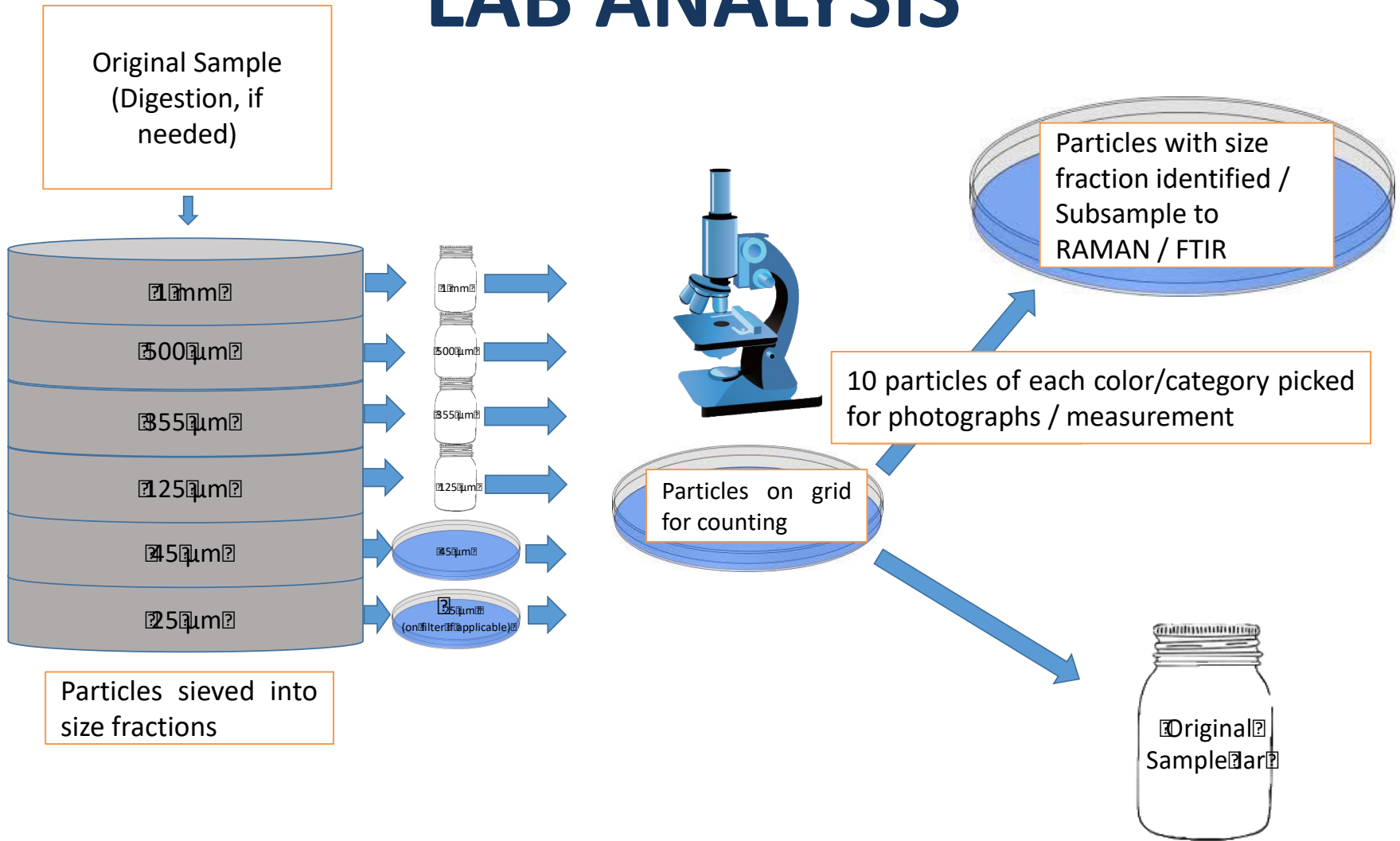
## QAQC

- Field Blanks / Lab Blanks

# LAB ANALYSIS



# LAB ANALYSIS



# SURFACE WATER SAMPLE OVERVIEW

## Manta Samples

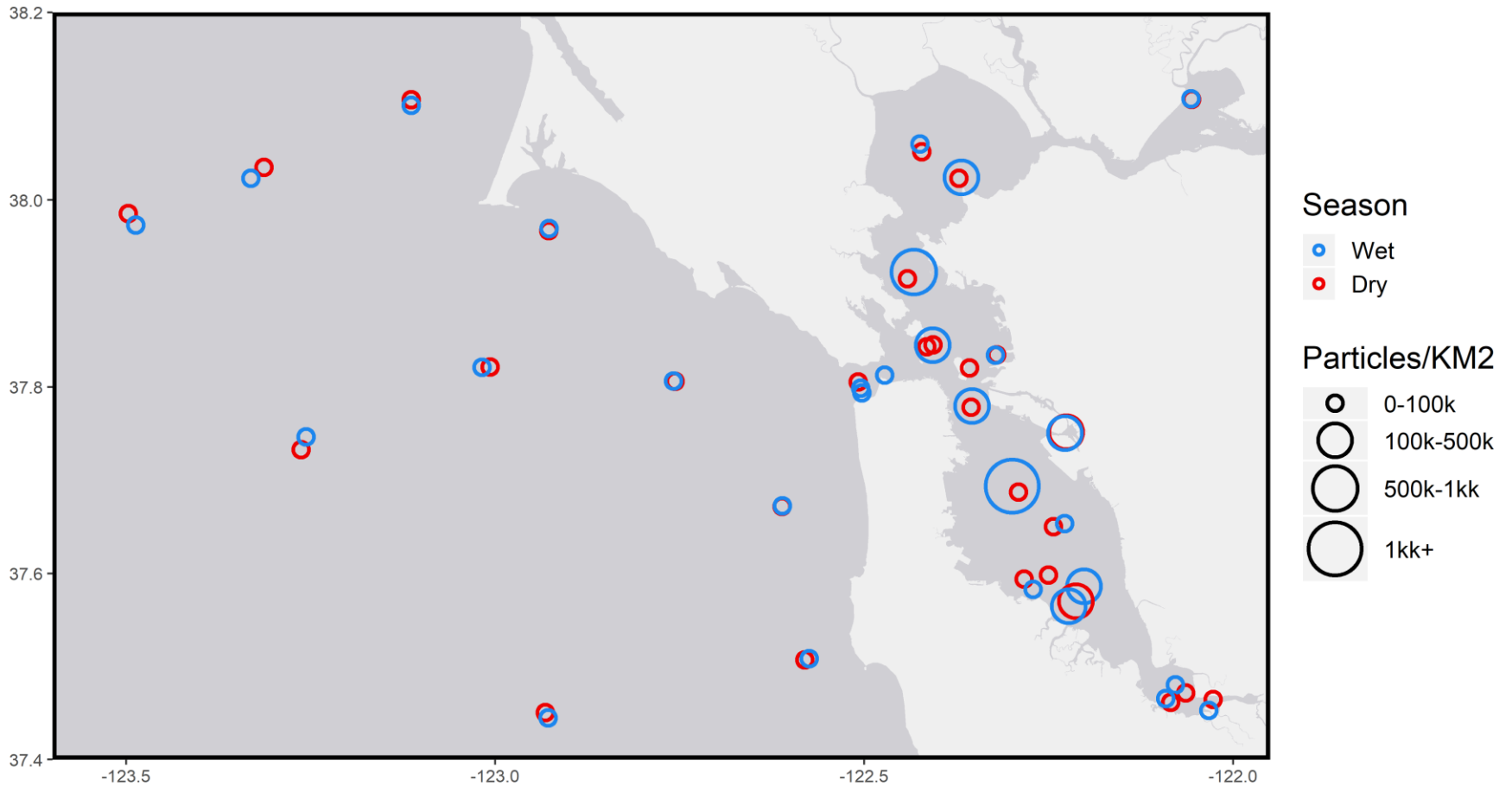
- 21,000++ microparticles
- 10% of particles were analyzed w/ spectroscopy
- Subsample fiber analysis

## 1-Liter Samples

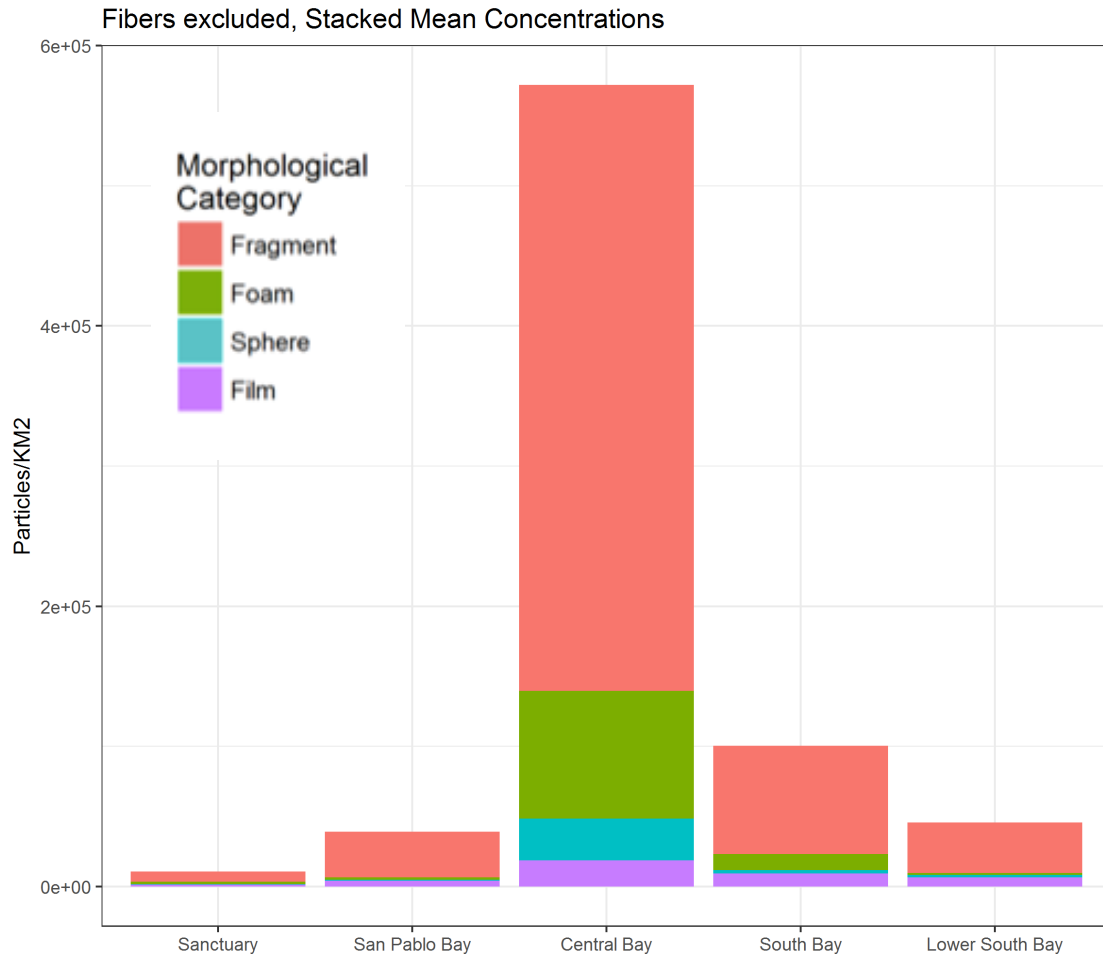
- Results coming soon!



# MANTA TRAWL: ABUNDANCE (Excluding fibers)



# MANTA TRAWL: ABUNDANCE (Excluding fibers)

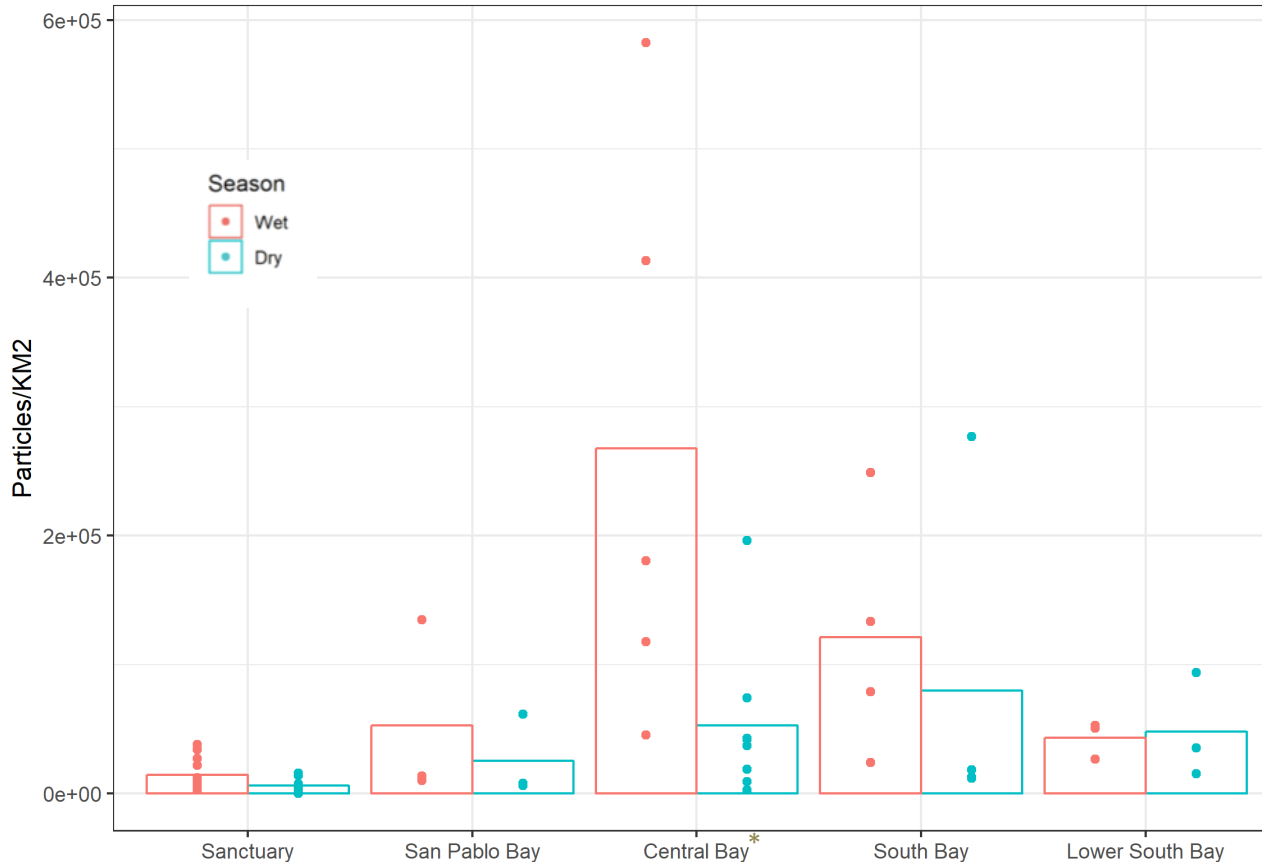


## Highlights:

- Central Bay has highest abundance
- 73% of microparticles are fragments; 17% foam
- Central Bay sample had 6.25 M particles / km<sup>2</sup>

# MANTA TRAWL: WET VS. DRY (Excluding fibers)

Fibers excluded, Total Particle Concentration, Individual Samples as Dots

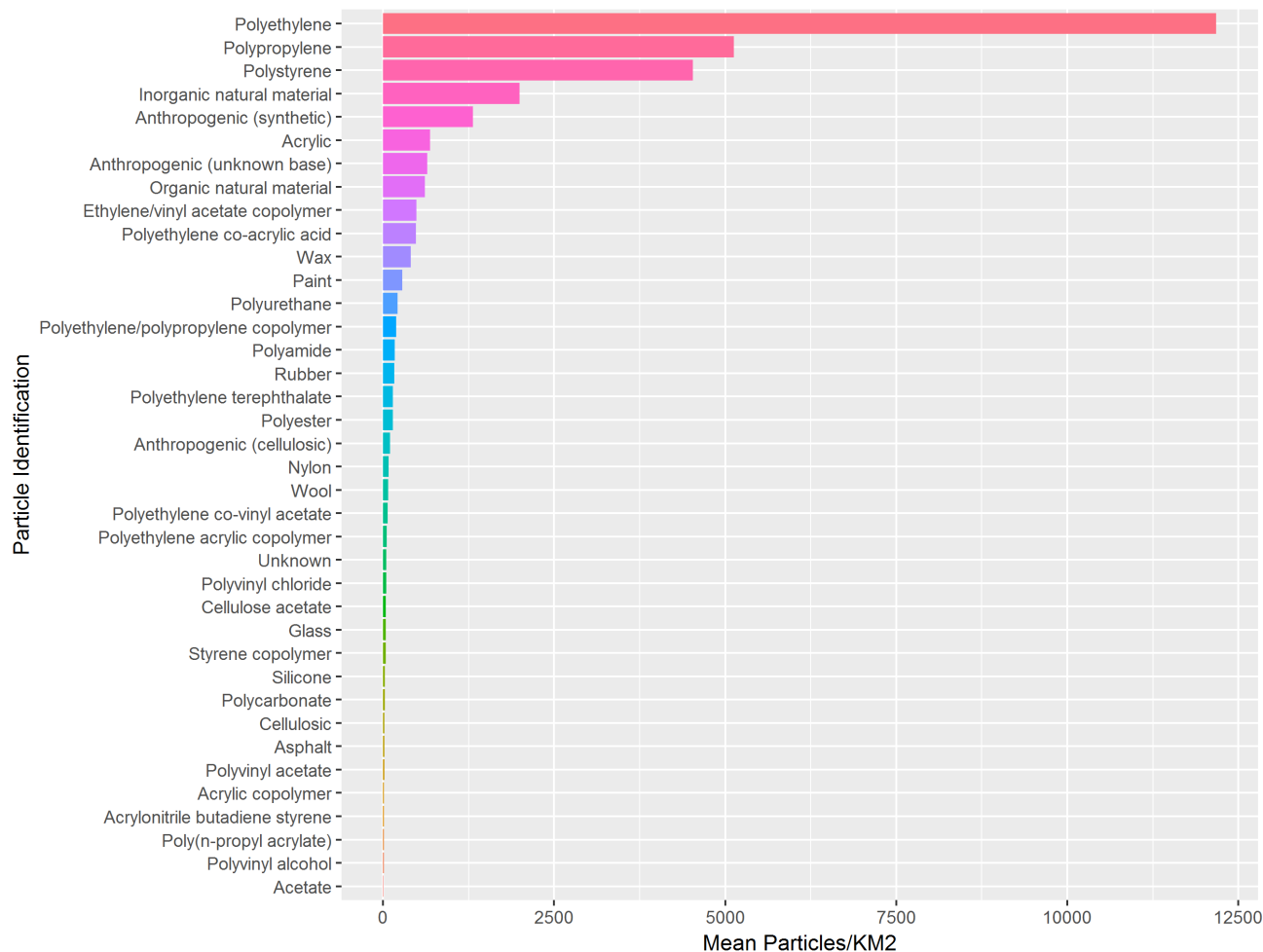


## Highlights:

- Concentrations generally higher in wet season
- Lower South Bay doesn't show much difference between seasons

\*CB-9 not included

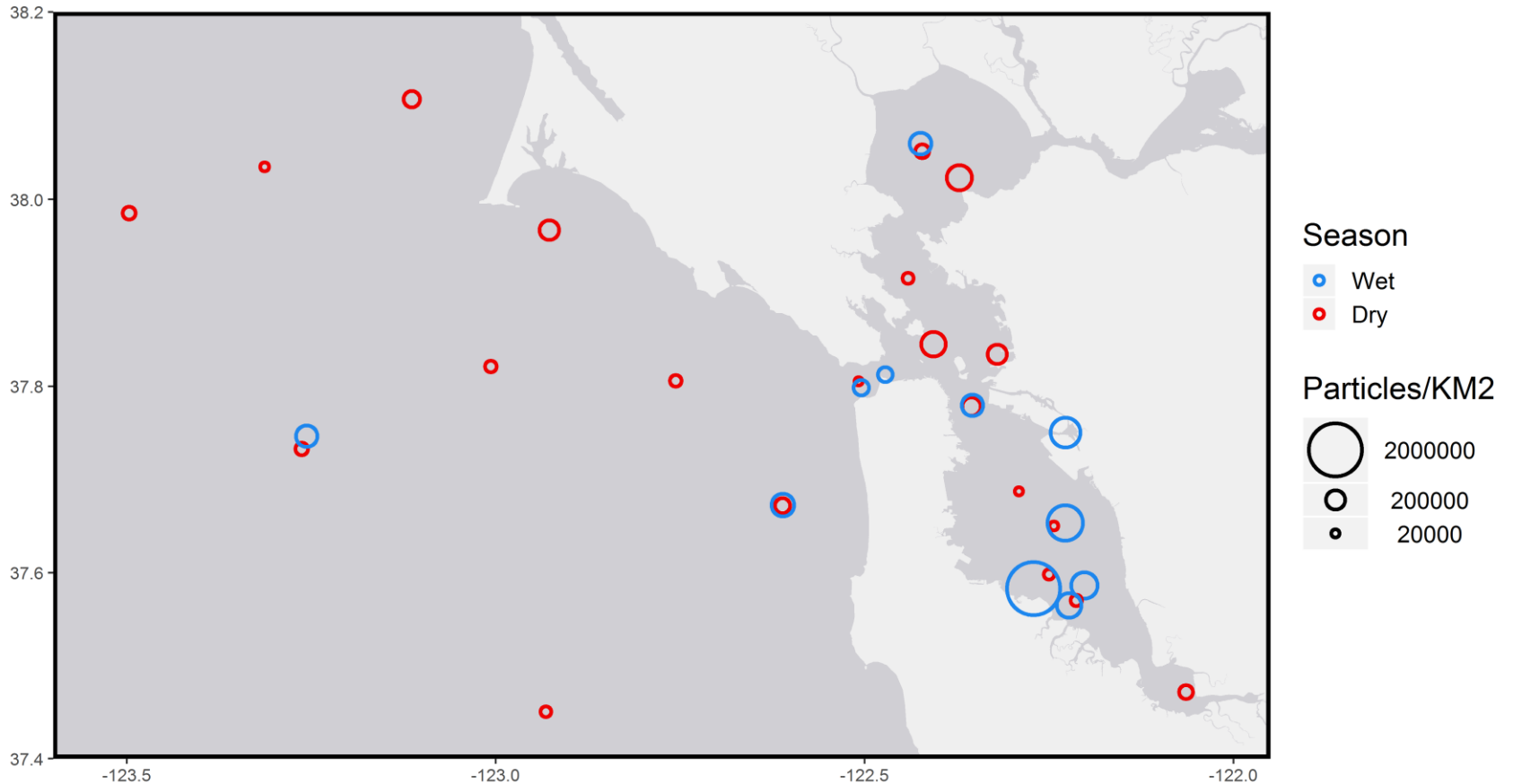
# MANTA TRAWL: POLYMER TYPE (Excluding fibers)



## Highlights:

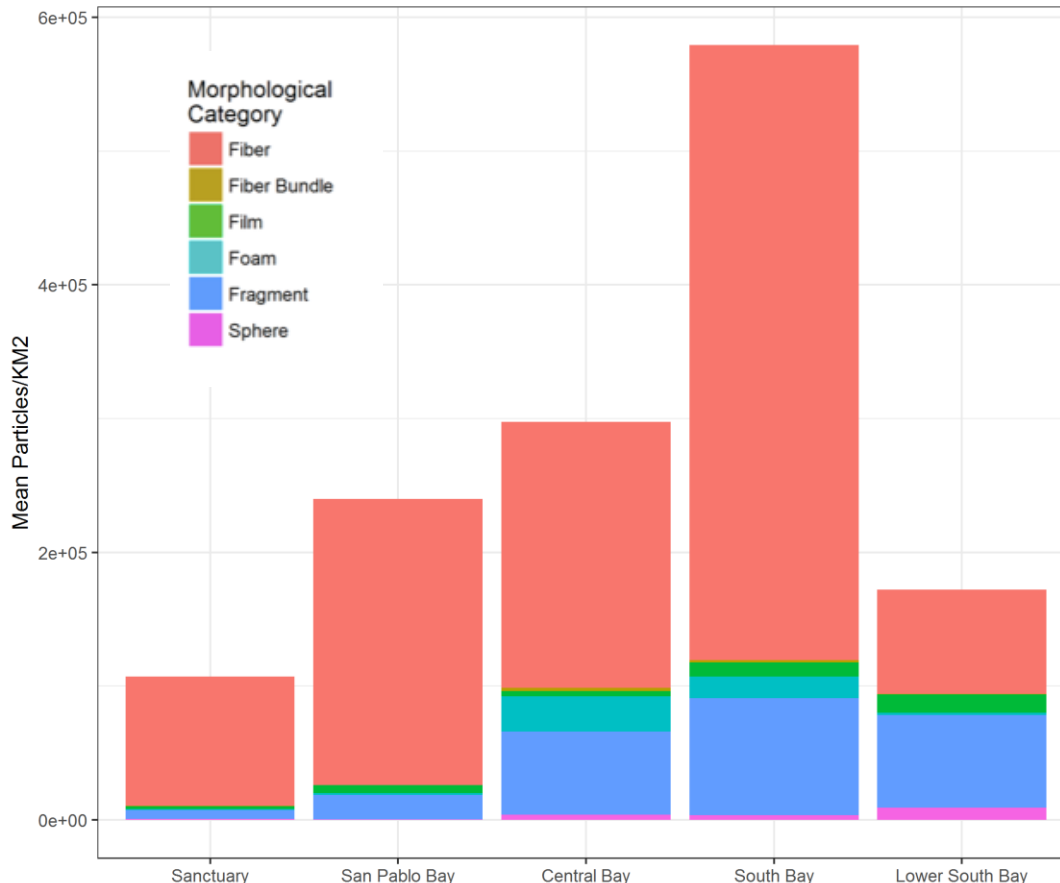
- Polyethylene and polypropylene
- Similar to ocean plastic top plastic type

# MANTA TRAWL: FIBER ABUNDANCE



# MANTA TRAWL: FIBER MEAN ABUNDANCE

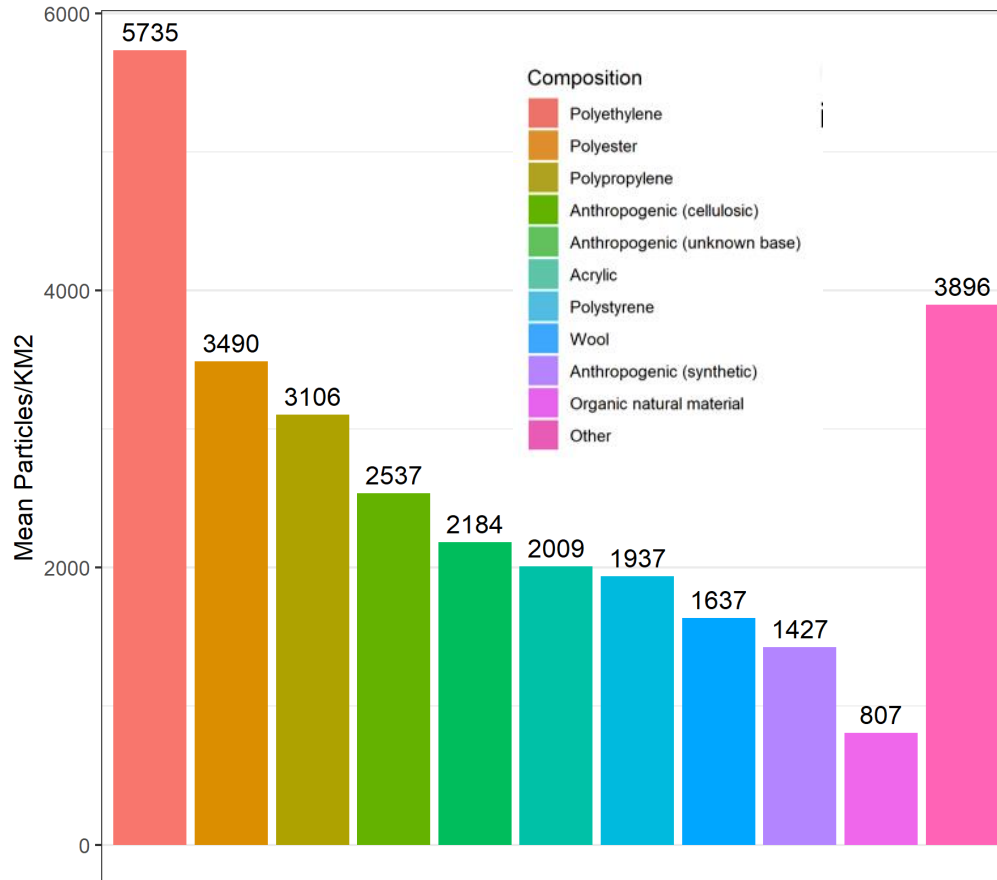
Samples with Fibers analysis only, Stacked Mean Concentrations



## Highlights

- 74% of all microparticles were fibers, 18% fragments
- Central and south Bay samples show fiber abundance over 1M fibers / km<sup>2</sup>
- Higher fiber abundance in South Bay

# MANTA TRAWL: FIBER COMPOSITION



## Highlights:

- At least 68% of the fibers were identified as plastic with spectroscopy
- Anthropogenic unknown makes up ~20%

# Surface Water Results Highlights

- High abundance of microparticles in Central and South Bay
- Subsample shows microfibers throughout project area
  - More than 68% of microfibers identified as plastic through spectroscopy
- Wet weather showed more microparticles in samples
- Higher levels in SF Bay vs. Sanctuaries
- 1L grab samples being analyzed

# SCIENCE TO SOLUTIONS

- Organize Policy Committee with experts
- Identify science-based recommendations
- Consider policy options, innovations, product design, research needs, and household interventions

SF BAY MICROPLASTICS  
POLICY RECOMMENDATIONS  
REPORT

SF BAY MICROPLASTICS  
POLICY BRIEF  
(PUBLISHED)

EDUCATIONAL  
MATERIALS

POLICY BRIEF  
FACTSHEET

# POLICY ADVISORY COMMITTEE

- 22 Partners (25+ participants)
- December 11, 2018 Meeting: Discussed large scale themes, brought together new stakeholders
- March 5, 2019: Reviewed *Draft* Recommendation Report; Identified needs / gaps

	Name	Affiliation
1	Miriam Gordon	Upstream
2	Chelsea Rochman	University of Toronto
3	Christopher Lester	San Francisco Department of the Environment
4	Sean Bothwell / Natalie Caulk	California CoastKeeper
5	Krystle Wood	Textile Consultant / Materevolve
6	Nick Lapis / Robert Nunez	Californians Against Waste
7	Elissa Foster	Patagonia
8	Karin North	City of Palo Alto, Treatment Plant
9	Trent Hodges / Shannon Waters	Surfrider Foundation
10	Genevieve Abedon	Eco Consult / Clean Seas
11	Leslie Tamminen	Clean Seas / 7th Generation Advisors
12	Chris Sommers	EOA, Inc.
13	Holly Wyer	Ocean Protection Council
14	Sherry Lippiatt	NOAA (National Oceanic and Atmospheric Administration)
15	Jacqueline Zipkin	EBDA (East Bay Dischargers Authority)
16	Nirmela Arsem	EBMUD (East Bay Municipal Utility District)
17	Allison Chan	Save the Bay
18	Kevin Messner	Association of Home Appliance Manufacturers (AHAM)
19	Tony Hale	SFEI
20	Michael Shen	Schmidt Marine Tech
21	Alexander Black	Microfiber Solution
22	Carolynn Box	5 Gyres
23	Anna Cummins	5 Gyres
24	Haley Haggerstone	5 Gyres
25	Ella McDougall	5 Gyres
26	Meg Sedlak	SFEI
27	Becky Sutton	SFEI
28	Diana Lin	SFEI
29	Cambria Bartlett / Emily Bartlett	Heirs to Our Oceans

# RECOMMENDATIONS #1, #2 & #9

## Standardization, filtration & education

### Project Results:

- Microfibers widely detected in samples
- Spectroscopy identified 18%-78% plastic

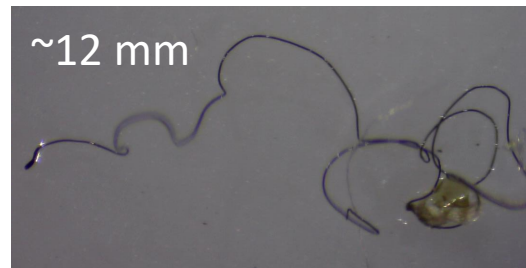
Recommendation #1: Fiber sheddability standardization

Recommendation #2: Prioritize various intervention points for microfibers around filtration

Recommendation #9: Education to consumers on ways to reduce microfibers from entering San Francisco Bay

### Key Suggestions:

- Filtration on Commercial vs. Industrial vs. Residential
- Work with new stakeholders (Carpet, Washing Machine/ Dryer trade associations)
- Provide resources / info to stakeholders and public



# RECOMMENDATIONS #3 & #5

## Stormwater pathways & green infrastructure

### Project Results:

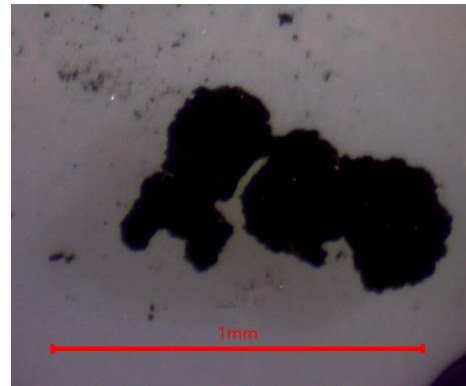
- Stormwater systems may be discharging more microparticles than wastewater
- Rubber particles = ~50%
- SFEI found rain gardens can eliminate ~90% microparticles

Recommendation #3: Further identify and quantify microplastics sources and pathways within stormwater systems

Recommendation #5: Explore green stormwater infrastructure management options to reduce microplastics from entering San Francisco Bay

### Key Suggestions:

- Develop stormwater conceptual model
- More research on green stormwater infrastructures



# RECOMMENDATIONS #4 & #6

## Policy & collaboration

### Project Results:

- Foam & plastic fragments in surface waters and stormwater



Recommendation #4: Support comprehensive packaging bill in Bay Area and statewide

Recommendation #6: Better collaboration between trash (>5mm) and microplastics (<5mm) efforts

### Key Suggestions:

- Statewide and regional comprehensive bans
- Open source data on plastic pollution
- Build collaborative campaigns to encourage reuse

# RECOMMENDATIONS #7, #8 & #10

## Advancing research, technology & management

### Project Results:

- Microbeads in samples
- Blank contamination
- Microplastics in fish

### Suggestions:

- Long-term monitoring to evaluate management actions
- Airborne microparticles
- Ecological impacts
- Local funding sources for innovation
- SF Bay Management Strategy

Recommendation #7: Support innovation to address microplastic pollution in San Francisco Bay

Recommendation #8: Address additional research needs

Recommendation #10: Support San Francisco Bay Microplastics Management Strategy to reduce microplastics



# Next Steps:

- Final Recommendations Report released to partners / public Fall 2019
- Discuss results at October 2, 2019 Symposium
- Factsheets for partners / educational resource
- Policy brief and resources



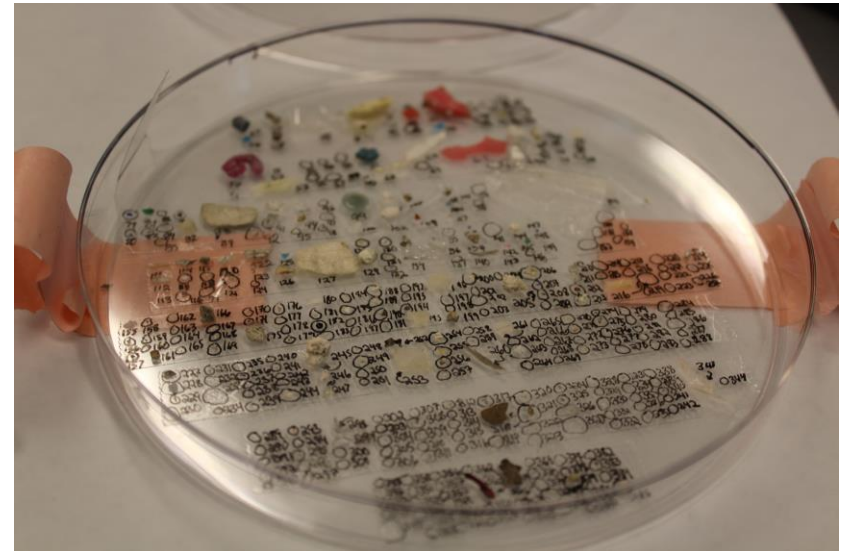
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# EXTRA SLIDES



# LAB ANALYSIS IS TEDIOUS



# SEDIMENT

30 samples

Exploring questions on:

- Ambient conditions
- Comparing mid-Bay sites vs nearshore (margin) sites
- Influence of pathways
- Spatial differences

Field duplicates and blanks collected



# SMALL FISH

8 sites; co-located with sediment

- Reference site included

20 individual fish

- Anchovy & Topsmelt

Exploring questions on:

- Influence of pathways
- Spatial differences
- Pelagic vs. benthic



# PATHWAYS: WASTEWATER

2 samples collected at 8 Facilities  
around SF Bay

- 24 hr composites
- 355 and 125  $\mu\text{m}$  sieves

Exploring questions on:

- Treatment (secondary vs tertiary)
- Location
- Flow (40 to 160 million gallons per day)

Field duplicates and blanks collected



Diana Lin and Palo Alto Staff

# PATHWAYS: STORMWATER

12 sites:

- Large watersheds for loads
- Potentially polluted areas

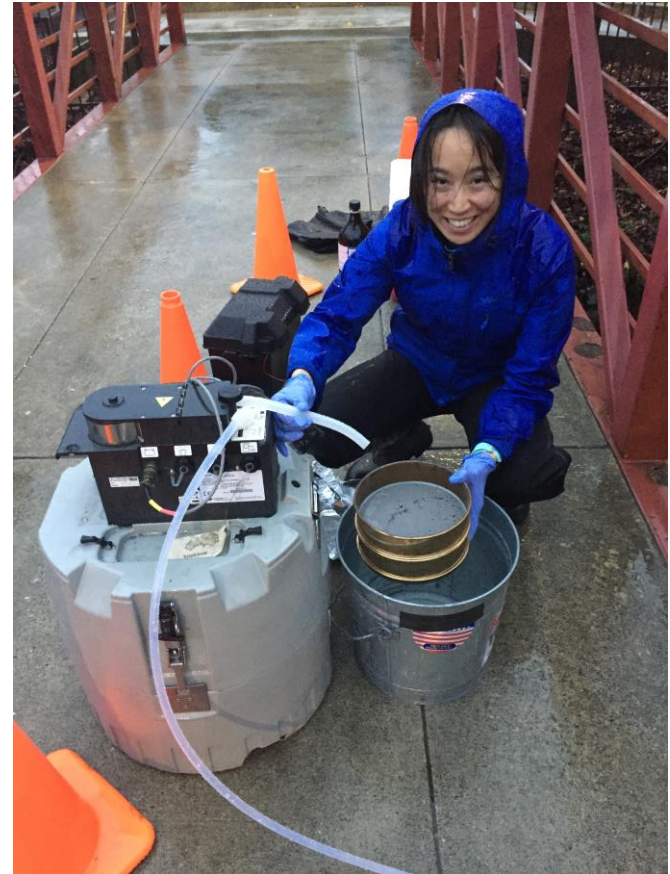
Composites of “sips” during storm

- 355 and 125  $\mu\text{m}$  sieves

Exploring questions on:

- Urban vs rural
- Watershed size
- Trash hot spots

Field duplicates and blanks collected



# MANAGEMENT QUESTIONS

MQ1) How much microplastic pollution is there in the Bay and in the surrounding ocean?

MQ2) What are the health risks?

MQ3) What are the sources, pathways, loadings, and processes leading to microplastic pollution in the Bay?

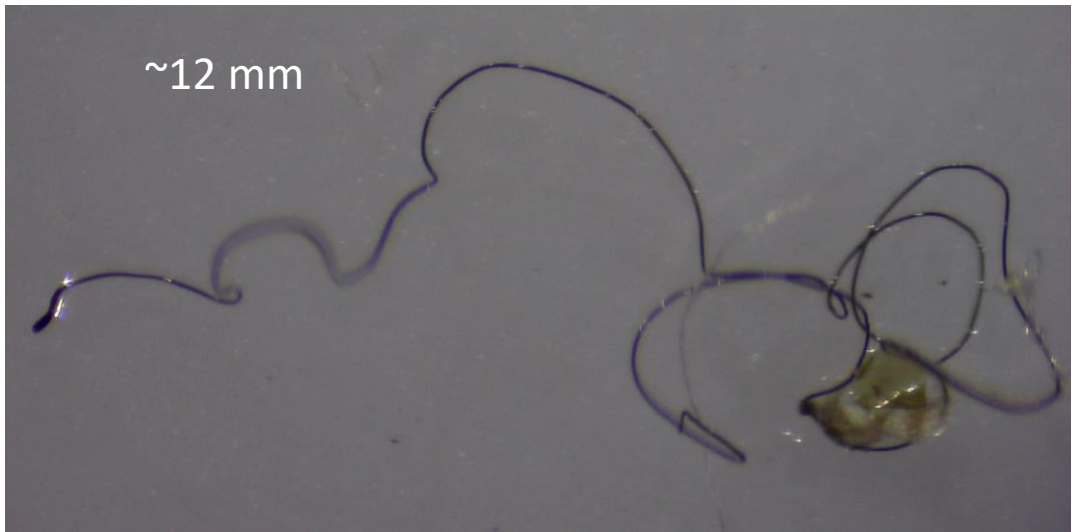
MQ4) Have the concentrations of microplastic in the Bay increased or decreased?

MQ5) Which management actions may be effective in reducing microplastic pollution?

# RECOMMENDATION #1: Develop microfiber sheddability standards

## Project Results:

- *Microfibers widely detected in samples*
- Spectroscopy identified 18%-78% plastic



## Suggestions:

- Collaborate with trade associations
- Standardize definitions
- Identify microfiber sources



# RECOMMENDATION #2: Prioritize various intervention points for microfibers around filtration

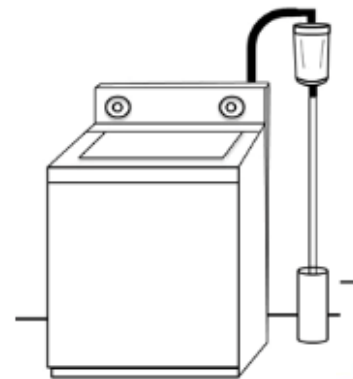
## Project Results:

- *Wastewater facilities discharge 50 billion microparticles annually (55% fibers)*
- Spectroscopy identified portion to be plastic



## Suggestions:

- Filtration on Commercial vs. Industrial vs. Residential
- Work with new stakeholders (Carpet, Washing Machine/ Dryer trade associations)



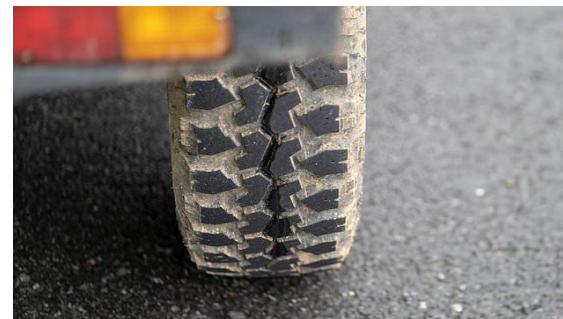
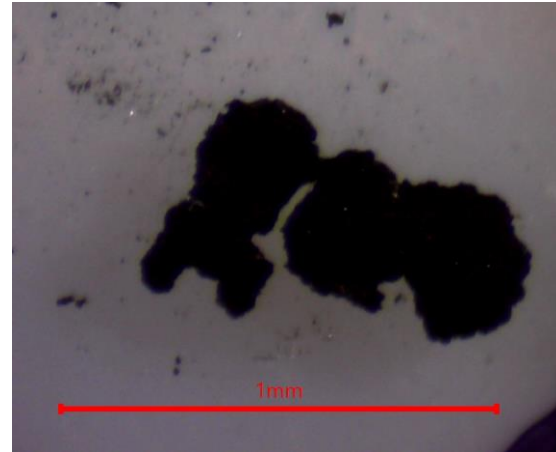
# RECOMMENDATION #3: Further identify and quantify microplastics sources and pathways within stormwater systems

## Project Results:

- Stormwater systems may be discharging more microparticles than wastewater
- Rubber particles make up ~50%

## Suggestions:

- More green stormwater infrastructures
- Stormwater conceptual model



# RECOMMENDATION #5: Explore green stormwater infrastructure management options to reduce microplastics from entering San Francisco Bay

## Project Results:

- Stormwater may contribute more than 10.9 trillion microparticles / yr
- SFEI found rain gardens can eliminate ~90% microparticles

## Suggestions:

- More green stormwater infrastructures
- Additional monitoring of other infrastructures



# RECOMMENDATION #4: Support comprehensive packaging bill in Bay Area and statewide

## Project Results:

- Foam + plastic fragments in surface waters and stormwater



## Suggestions:

- Statewide comprehensive ban
- Alternatives to expanded polystyrene
- Build campaigns to encourage reuse



# RECOMMENDATION #6: Better collaboration between trash (>5mm) and microplastics (<5mm) efforts

## Suggestions:

- Open source data on plastic pollution
- Regional coalition to bring upstream + ocean communities together
- Combine project results with upstream (beach / river / streets) data



# RECOMMENDATION #7: Support innovation to address microplastic pollution in San Francisco Bay



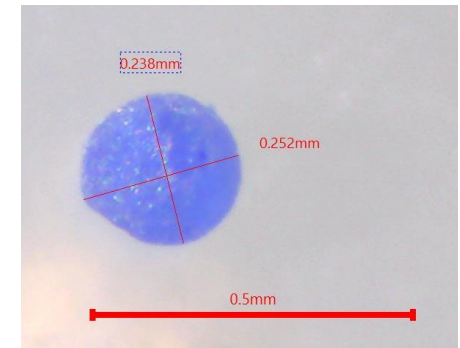
## Suggestions:

- Local funding sources for innovation
- Encourage new technologies (e.g. Microplastic sampling, new fabric options)

# RECOMMENDATION #8: Address additional research needs

## Project Results:

- Microbeads in samples
- Blank contamination
- Microplastics in fish



## Suggestions:

- Long-term monitoring to evaluate management actions
- Airborne microparticles
- Ecological impacts



# RECOMMENDATION #9: Educate consumers on ways individuals can reduce microfibers from entering San Francisco Bay

## Suggestions:

- Distribute educational materials on steps to reduce personal microplastic footprint
- Add results to environmental curriculum



# RECOMMENDATION #10: Support San Francisco Bay Microplastics Management Strategy to reduce microplastics



- Bay Area focused management strategy that compliments California Microplastic Management Strategy
- Share results and lessons learned with California Microplastic Management Strategy efforts