RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

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Microplastic Monitoring in Wastewater and Stormwater

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Chelsea Rochman Laboratory (University of Toronoto)

EU determines MP present a risk

- Microplastic is a non-threshold substance for which no safe level exists
  - *"there is currently insufficient information to derive a robust predicted no effect concentrations (PNECs) for microplastics, that could be used to justify a conclusion that risks are adequately controlled"*
- As part of decision considered:
  - Persistence
  - Fragmentation
  - Bioaccumulation
  - "Practically impossible" to remove

Microplastic Timeline

Sampling and Analysis Plan

Bakelite invented

GORDON AND BETTY MOORE FOUNDATION

Manuscripts

Factsheet, Policy Report

We are here

1907

2015

Oct 2016

Mar 2017

Summer

Sept 2019

Symposium Oct 2, 2019

2015 Study

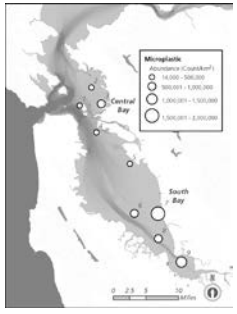
2016 Workshop

Jan 2017 MP Strategy

Finish lab analysis

Summer 2019 Film

August 1 2019 Draft Report to RMP; Sept 1 Final to Moore

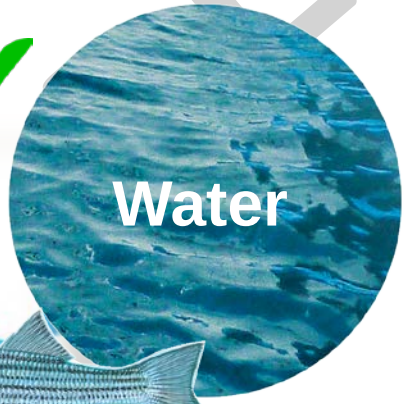


Microplastics Monitoring

Pollution Pathways

Wastewater (BACWA)

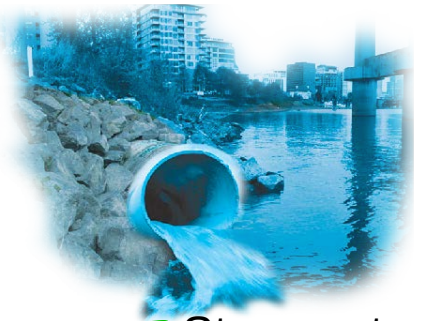
Bay Monitoring



Marine Monitoring & Science

Fish

Mussel*

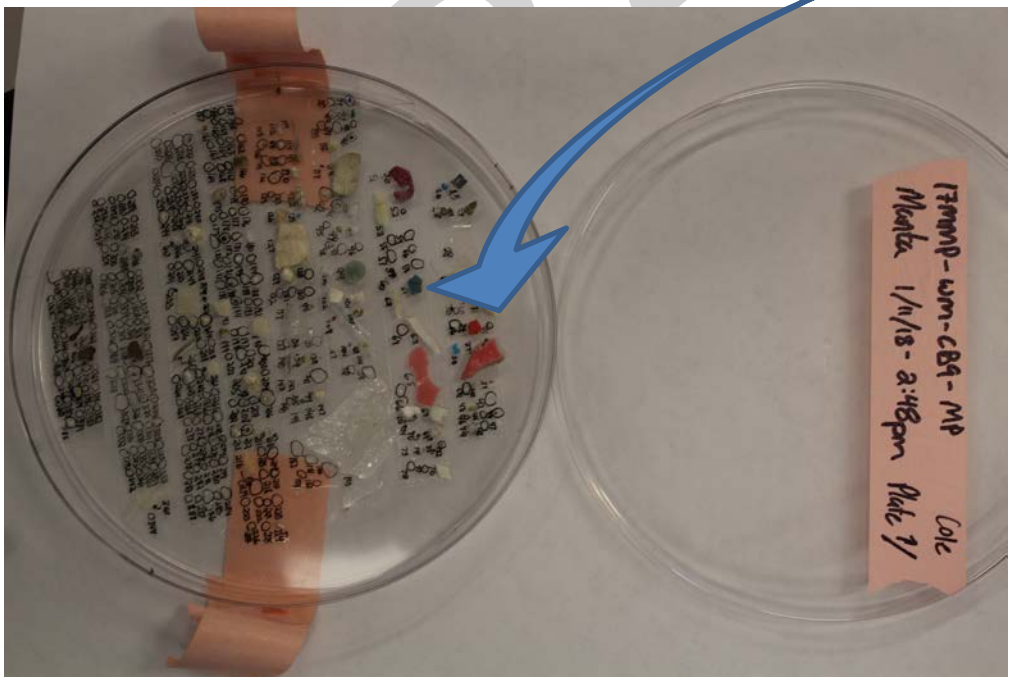


Stormwater (BASMAA)

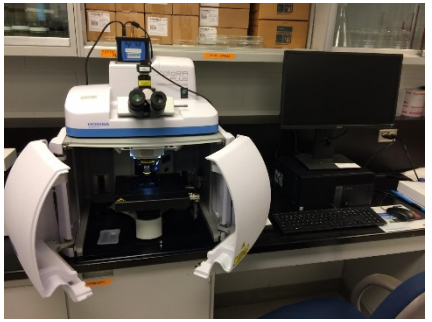
Tra[illegible]port M[illegible]del

Nomenclature

- Microplastic vs microparticle
  - What is the difference? Both < 5 mm. Microplastics are a subset of microparticles for which a secondary technique has been used to confirm they are plastic.



Microplastic



San Francisco Bay Microplastics Project: Microparticles in Effluent

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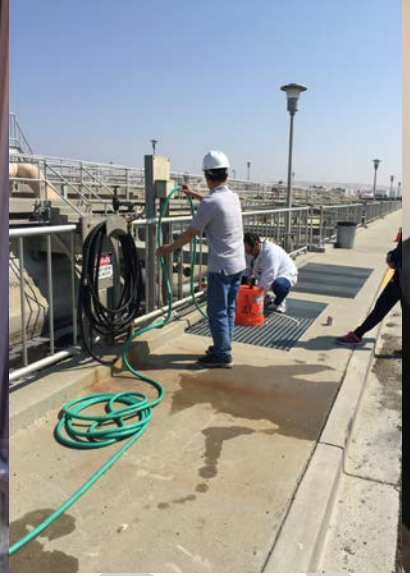
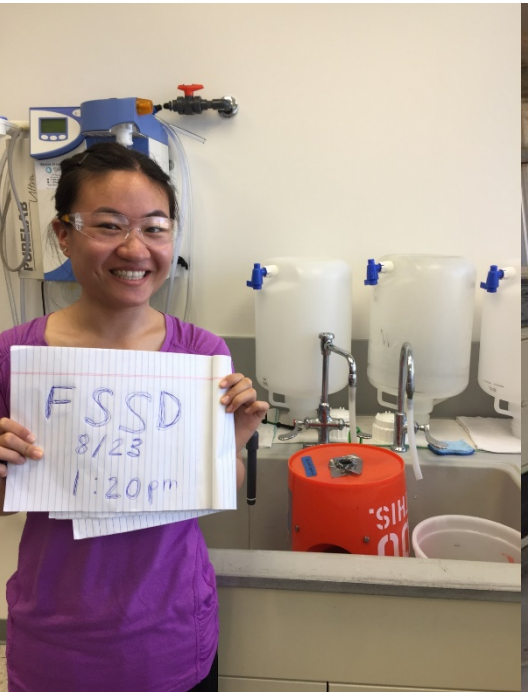
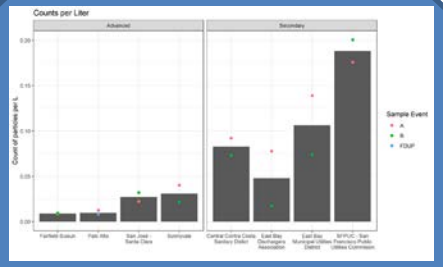


Many thanks to all the WWTPs!



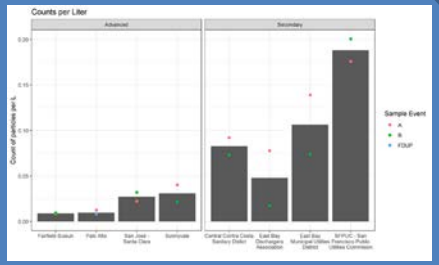
Study Objectives

Characterize Composition



Quantify Abundance

Estimate Loads



Evaluate Treatment

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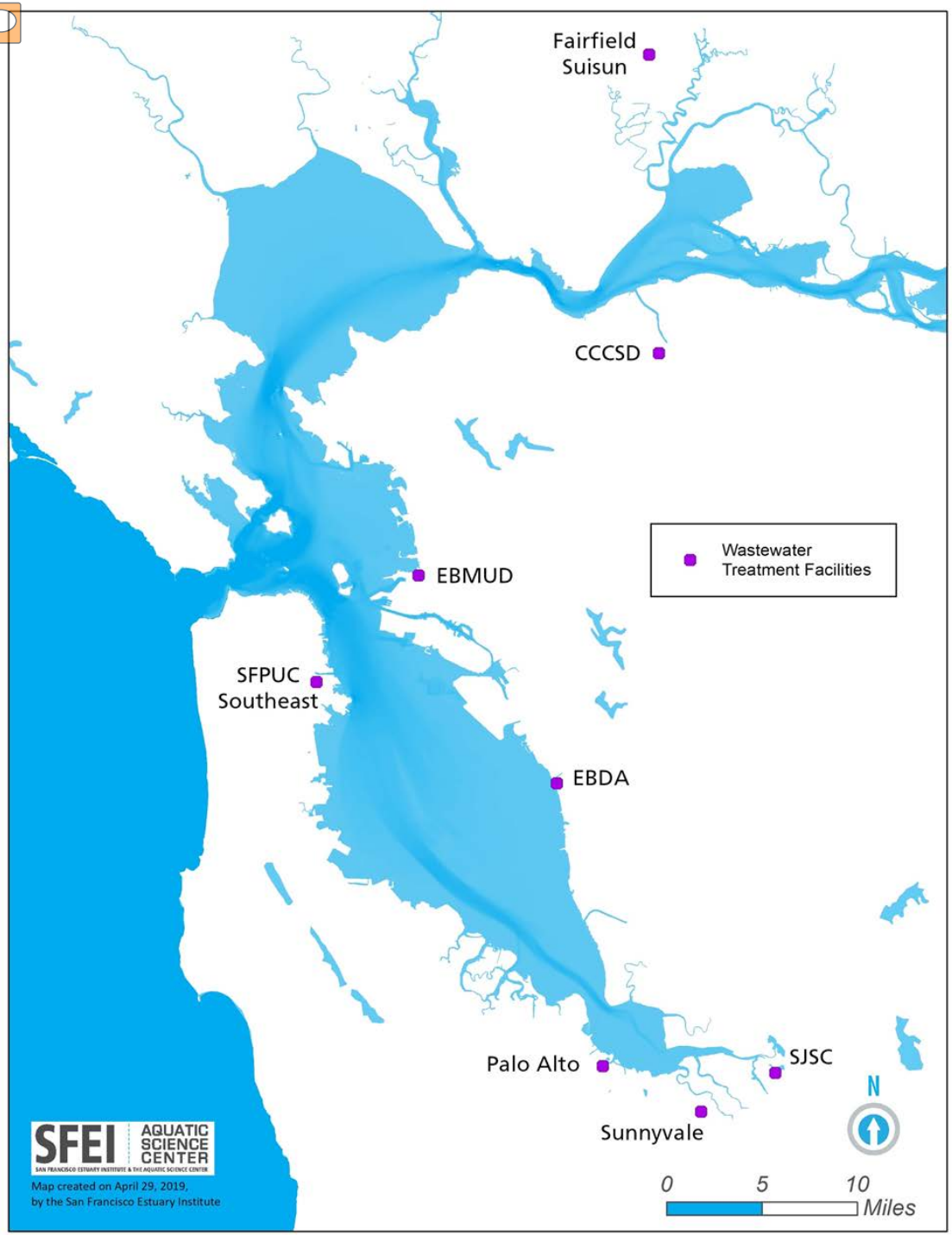


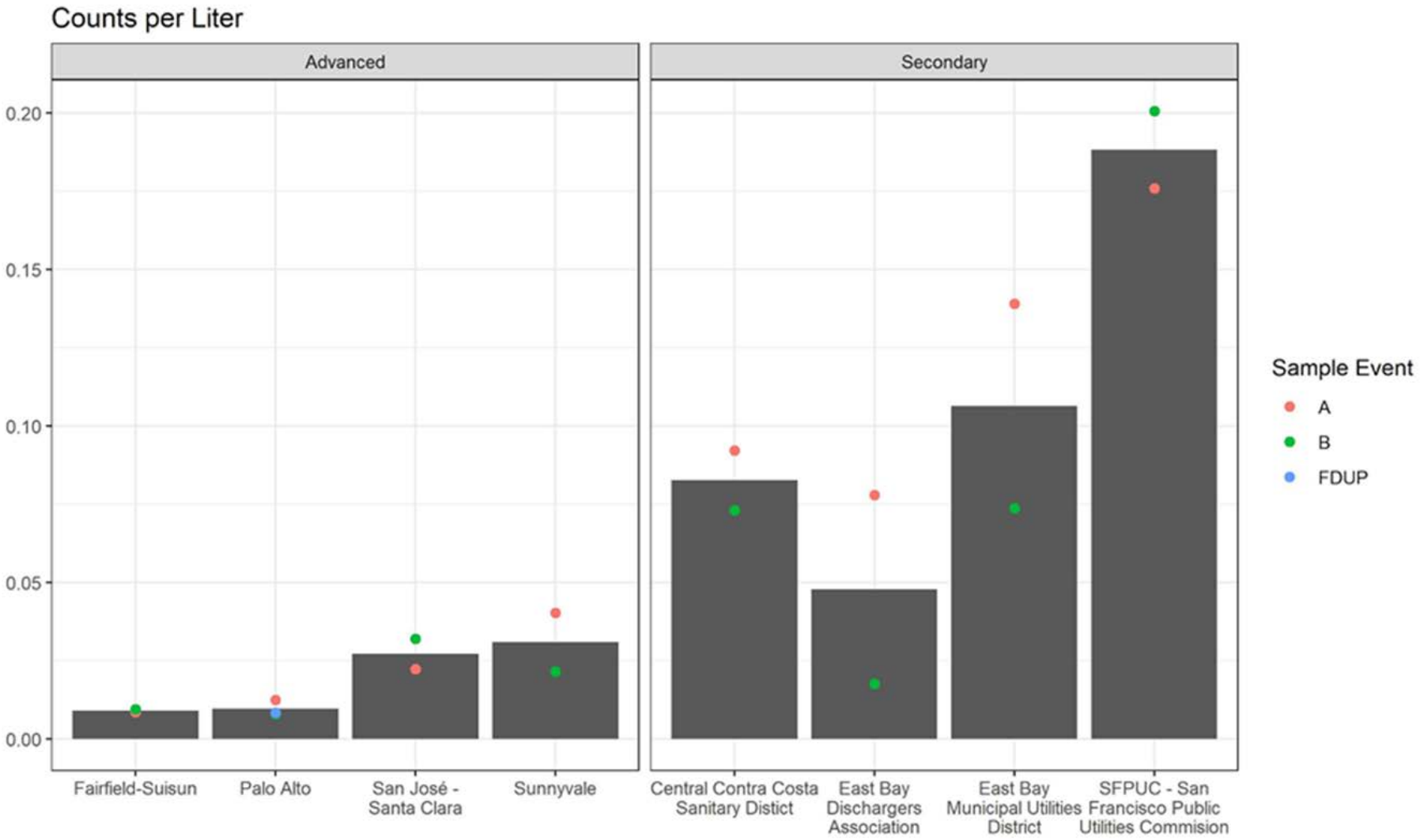
Background

- Flow: 24 to 160 MGD
- Secondary and tertiary treatment

Collection Methods

- Final effluent, two events
- 355 and 125 µm mesh screens
  - Consistent with stormwater
- Total volume (24 hrs)
  - 900 to 12,300 liters

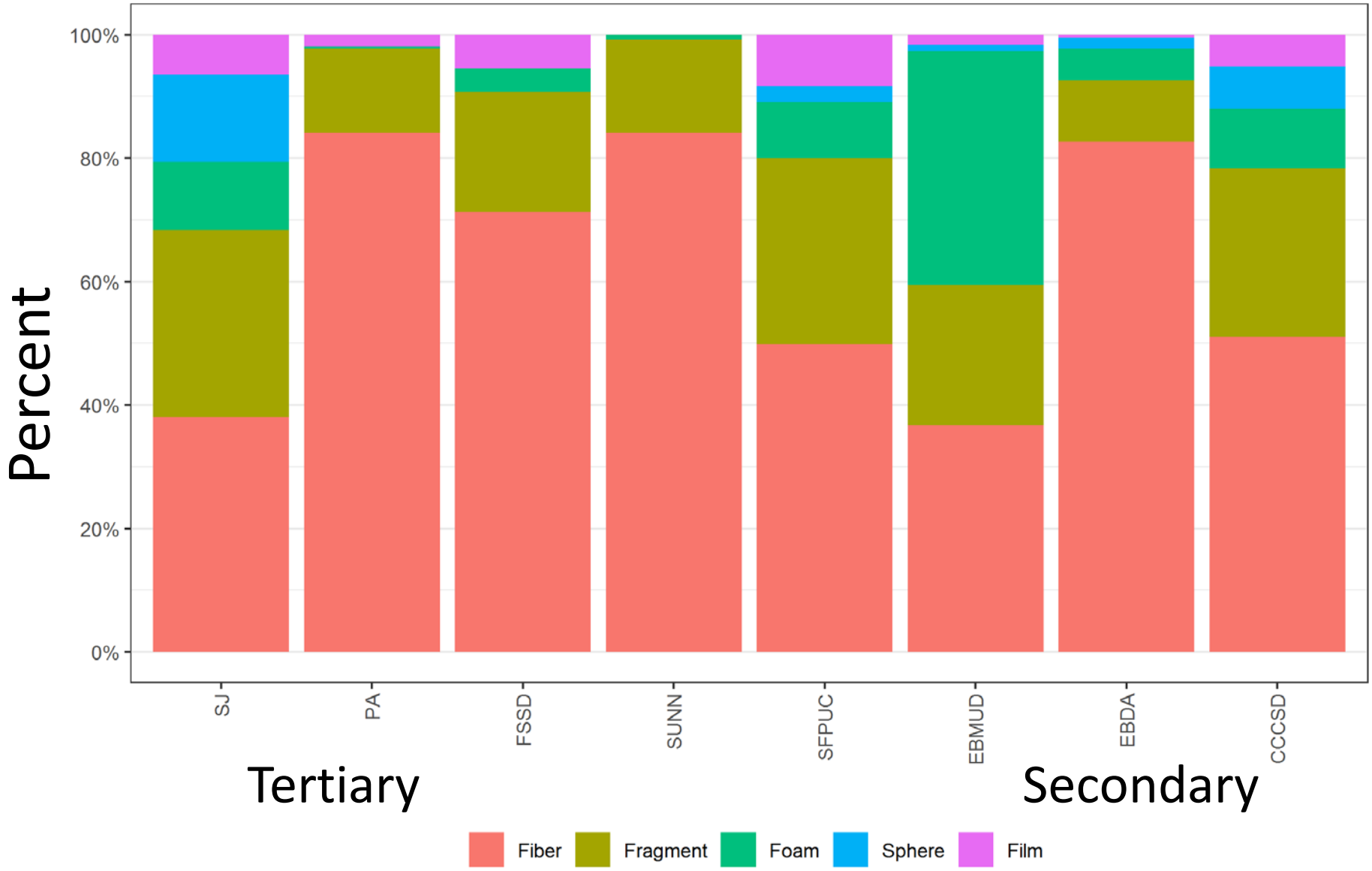
Microparticle Abundance

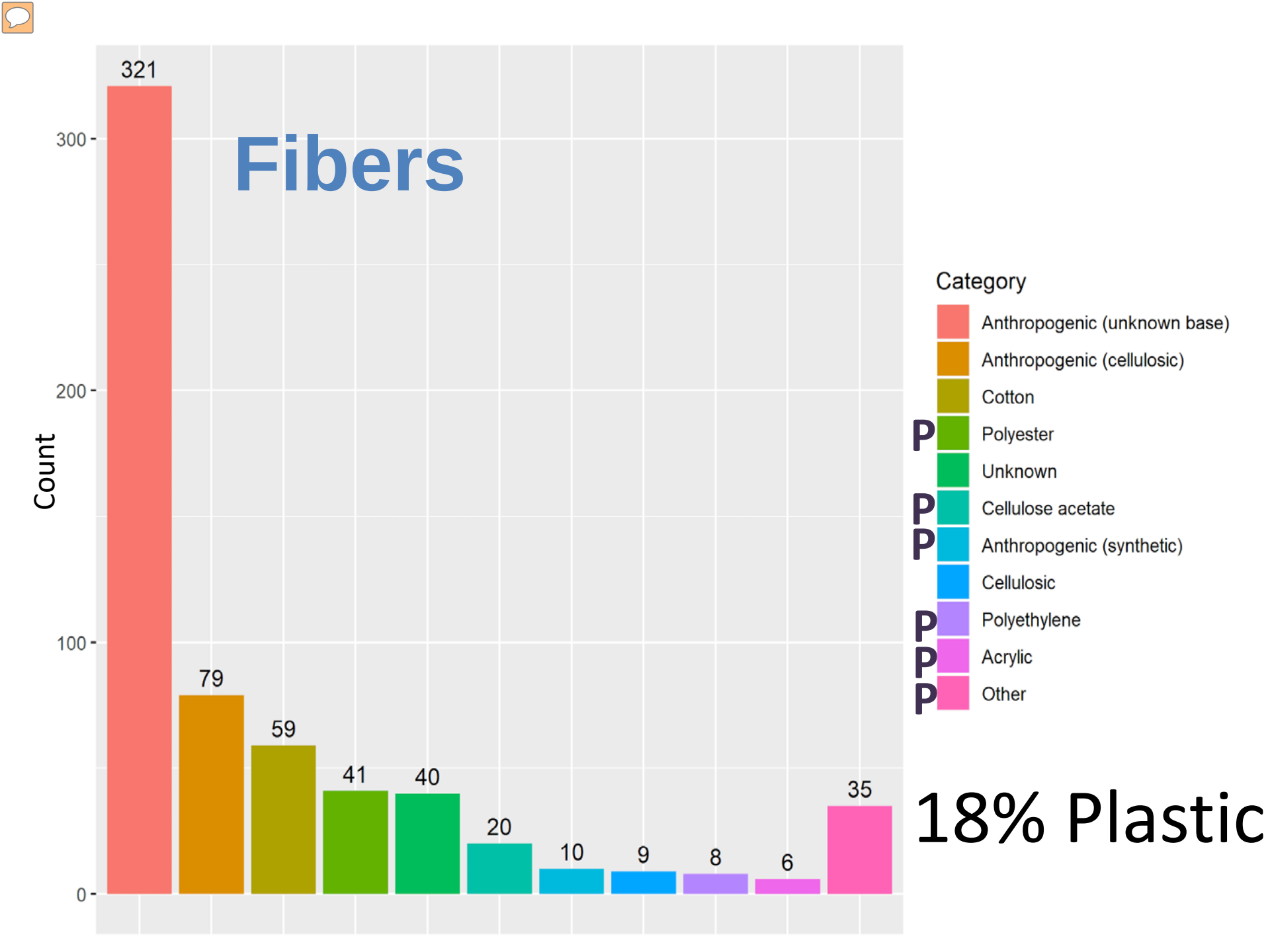


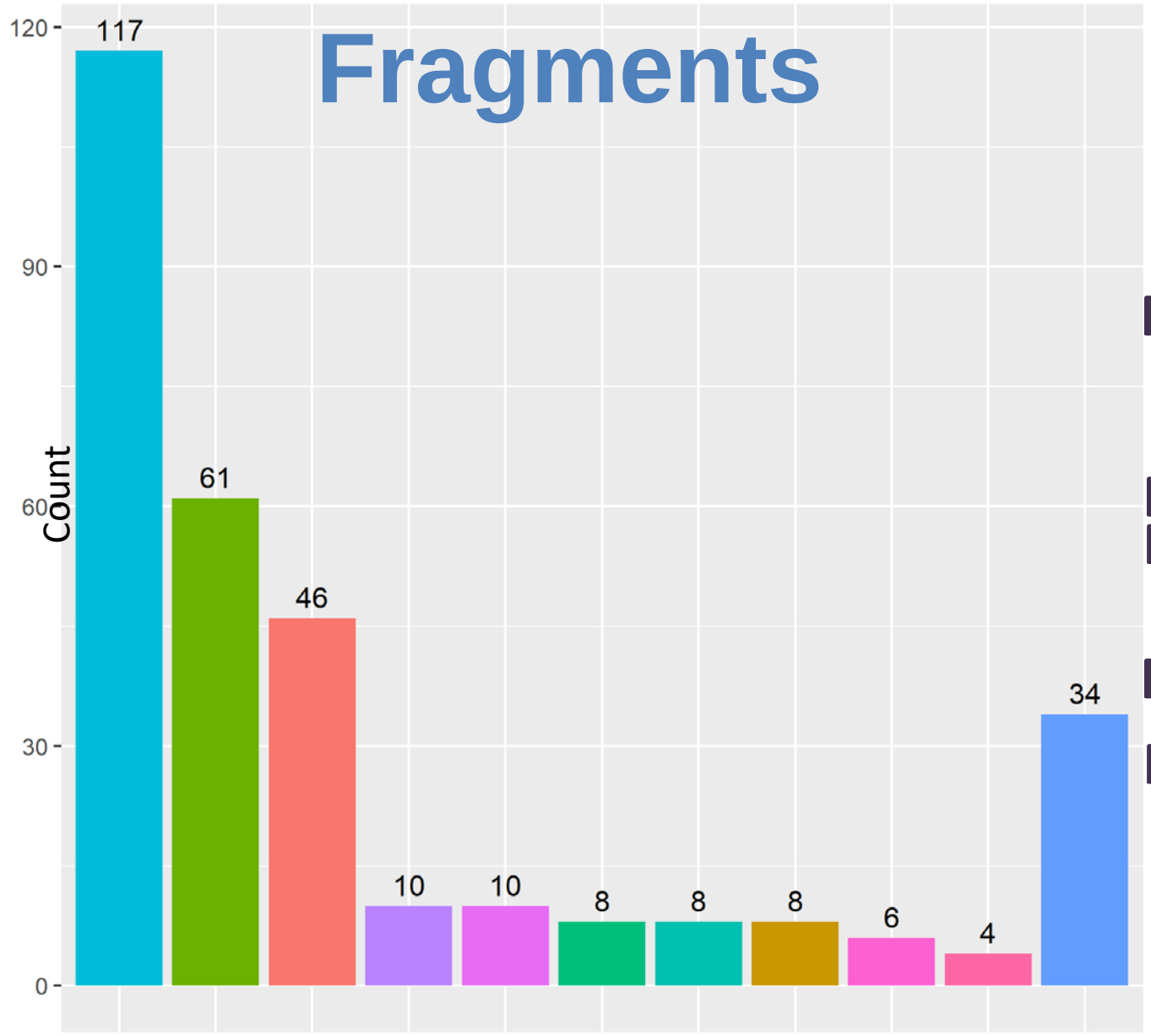
Tertiary

Secondary

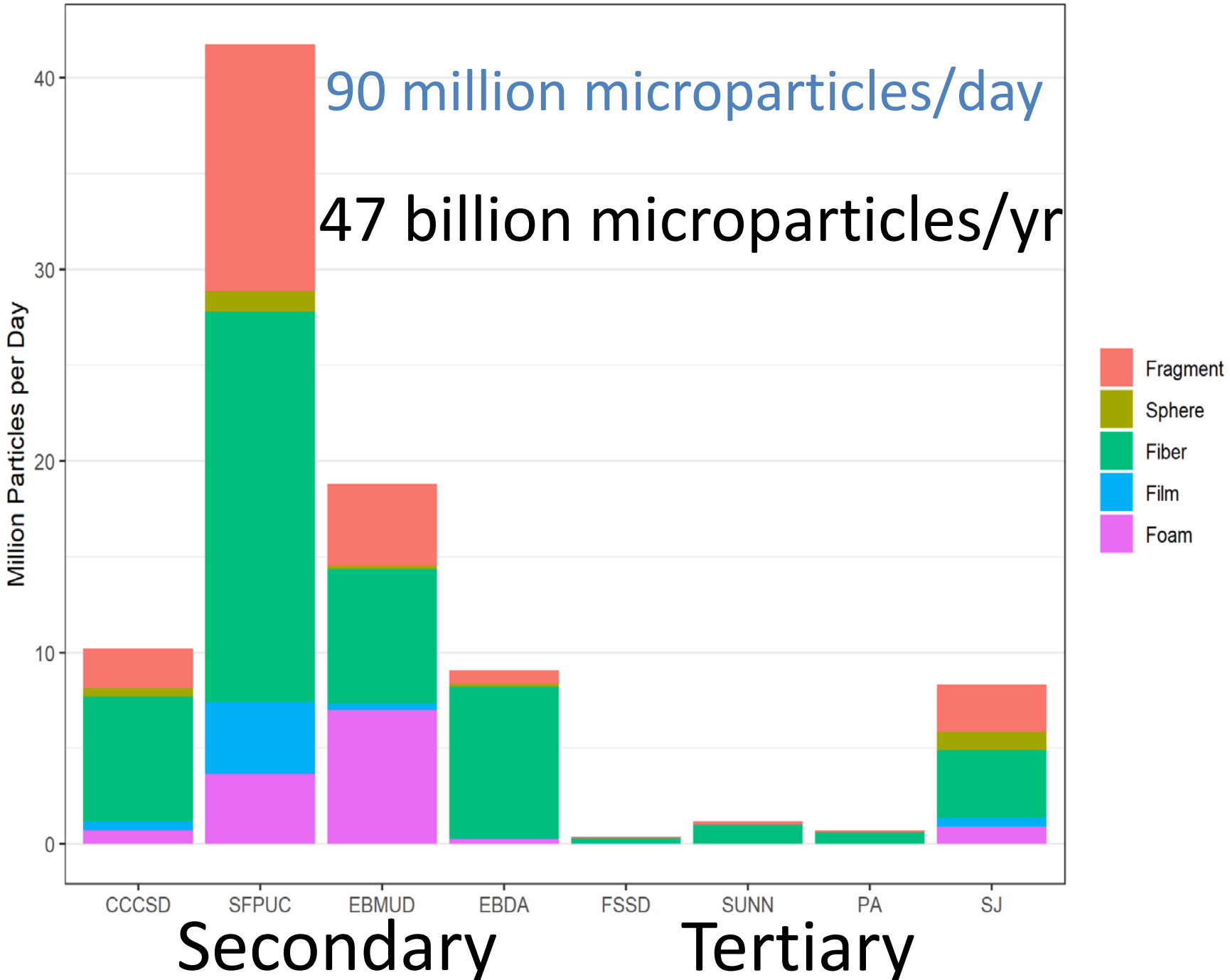
Composition: Fibers and Fragments




Fibers
Count
300
200
100
0
321
79
59
41
40
20
10
9
8
6
35
Category
Anthropogenic (unknown base)
Anthropogenic (cellulosic)
Cotton
Polyester
Unknown
Cellulose acetate
Anthropogenic (synthetic)
Cellulosic
Polyethylene
Acrylic
Other
P
P
P
P
P
P
18% Plastic


Fragments
Count
120
90
60
30
0
117
61
46
10
10
8
8
8
6
4
34
Category
Polyethylene
Unknown
Anthropogenic (unknown base)
Inorganic natural material
Polypropylene
Anthropogenic (synthetic)
Cellulosic
Cotton
Polyethylene co-vinyl acetate
Organic natural material
Other

55% Plastic


90 million microparticles/day
47 billion microparticles/yr
Million Particles per Day
40
30
20
10
0
CCCSD
SFPUC
EBMUD
EBDA
FSSD
SUNN
PA
SJ
Fragment
Sphere
Fiber
Film
Foam
Secondary
Tertiary

Summary

- Abundance: microparticles were identified in effluent from all plants
  - Fibers (55%) > fragments (23%) > all other morphologies
- Treatment: Secondary > tertiary facilities
- Composition: Fibers
  - Top category - Anthropogenic unknown (55%)
  - Overall, 18% were identified as plastic
- Composition: Fragments
  - Top category - Polyethylene (38%)
  - Overall, 55% were identified as plastic
- Loads: In aggregate, 47 billion microparticles are discharged annually of which 21 billion are estimated to be plastic.

San Francisco Bay Microplastics Project: Microparticles in Stormwater

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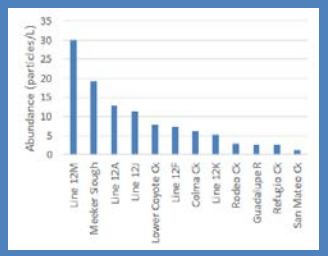
Thank you to BASMAA/STLS for making the microplastics stormwater sampling possible!

Study Objectives



Quantify Abundance

Characterize Composition

Develop Methods

Estimate Loads

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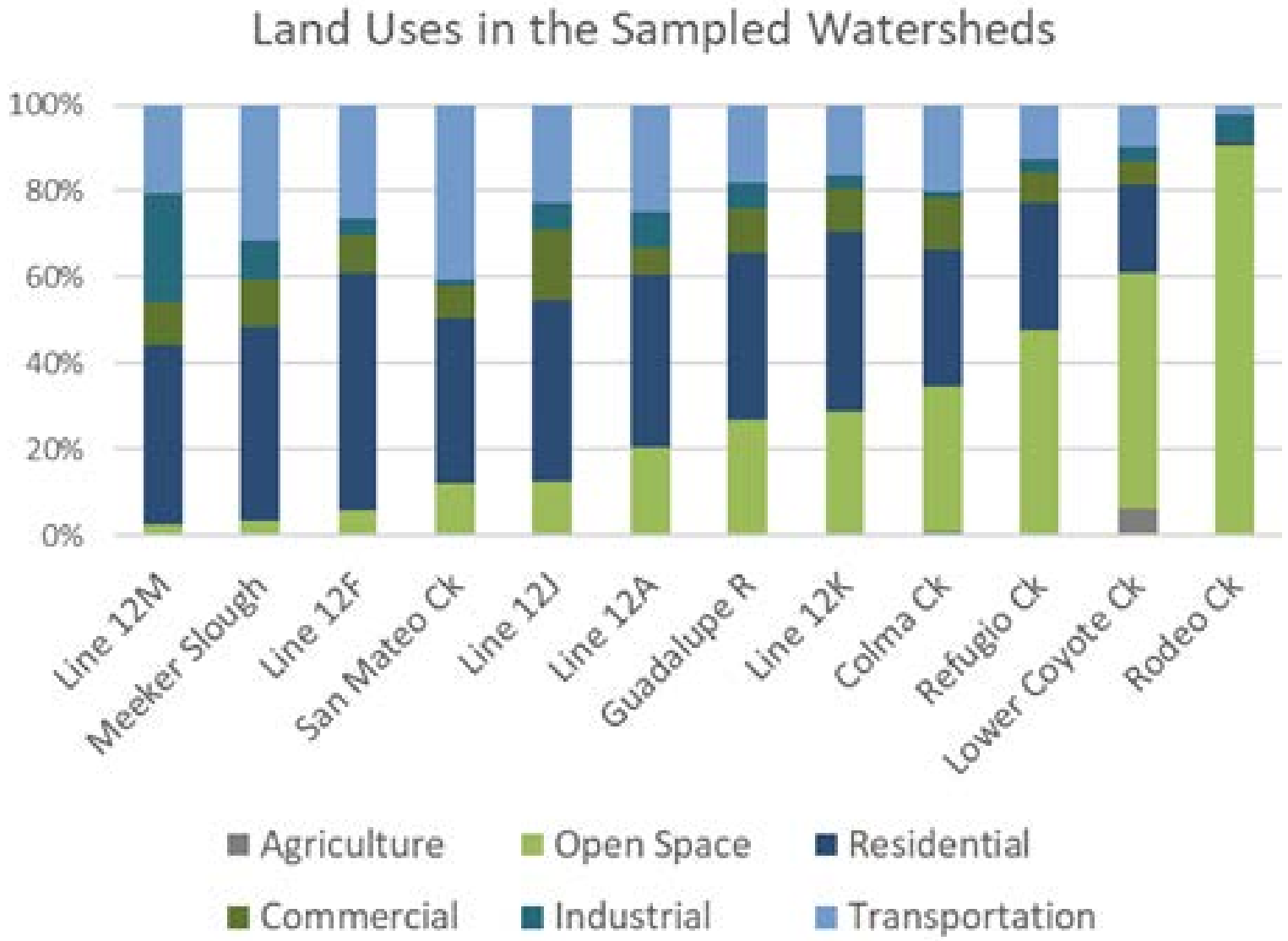
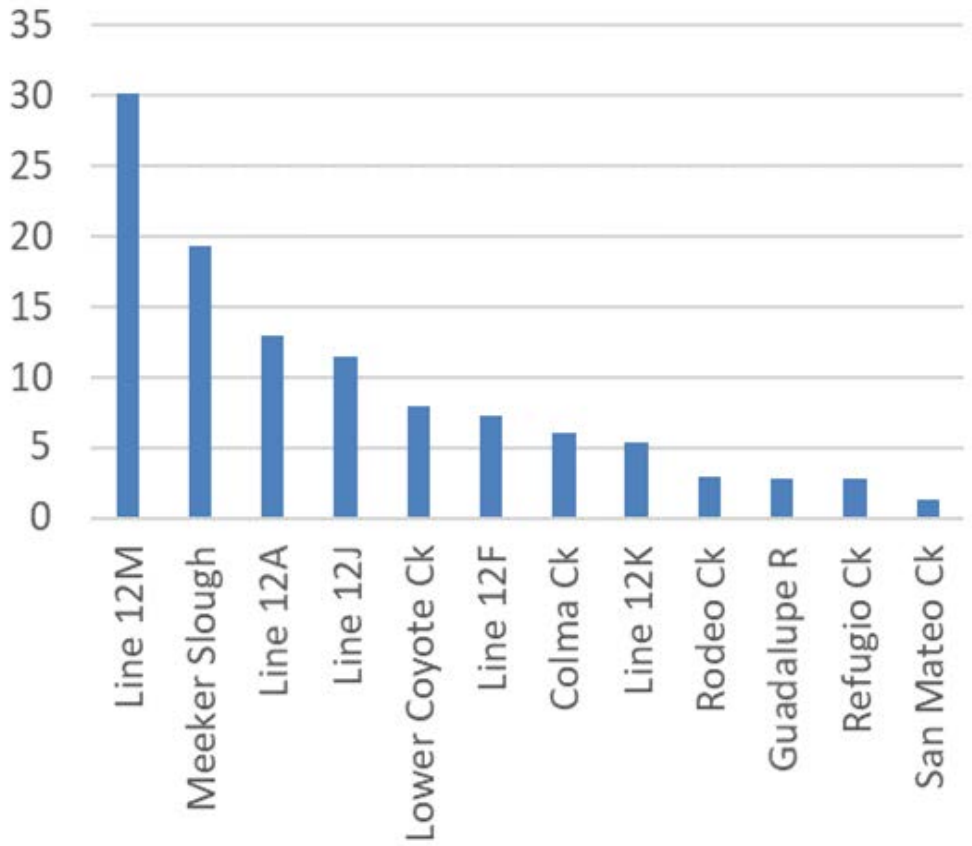
Sampling Sites



Microparticle abundance (microparticles/L)



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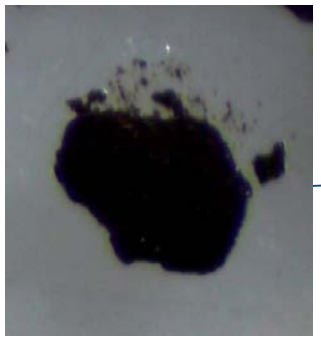
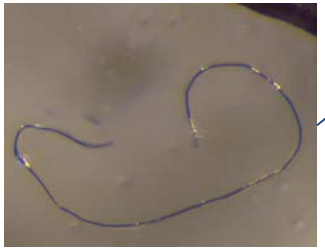
Fragments and fibers dominate shape distribution

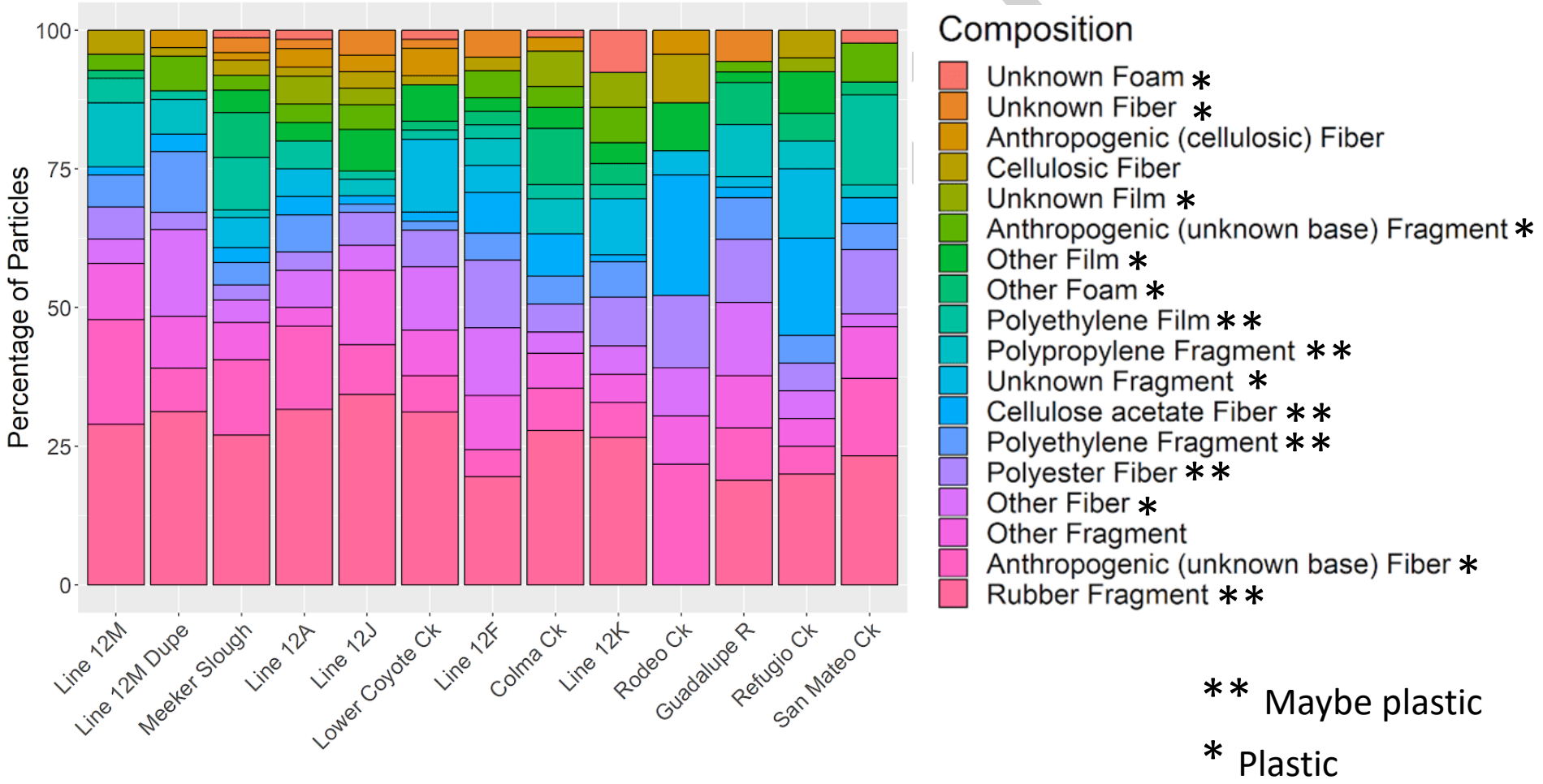


Fragment



Fiber

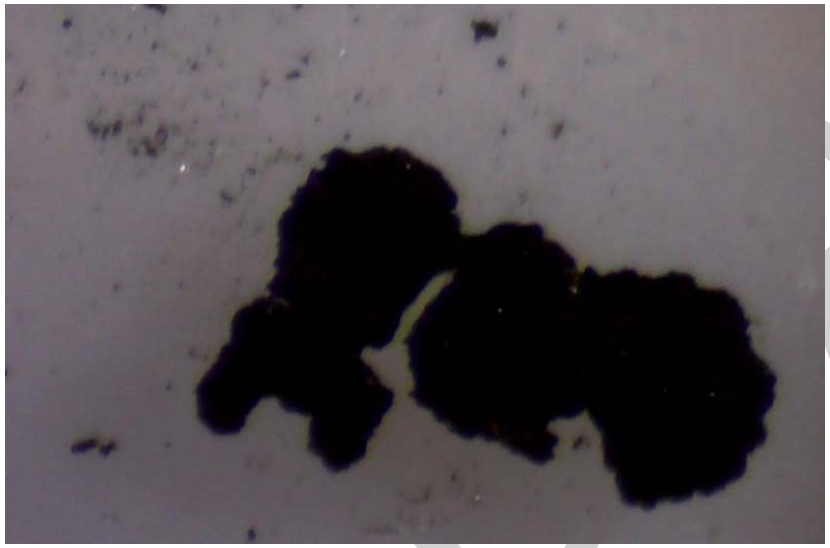
63 - 90% of microparticles spectroscopied were plastic

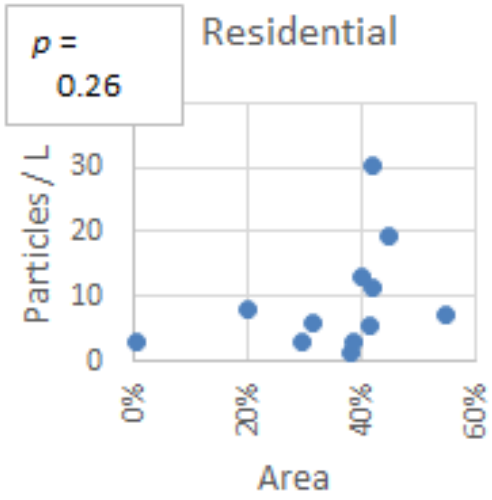


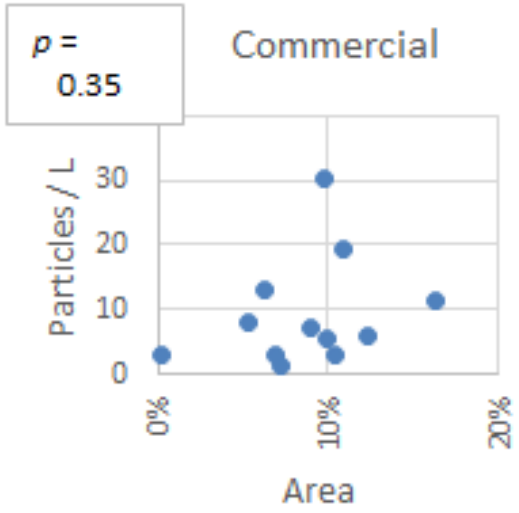
** Maybe plastic

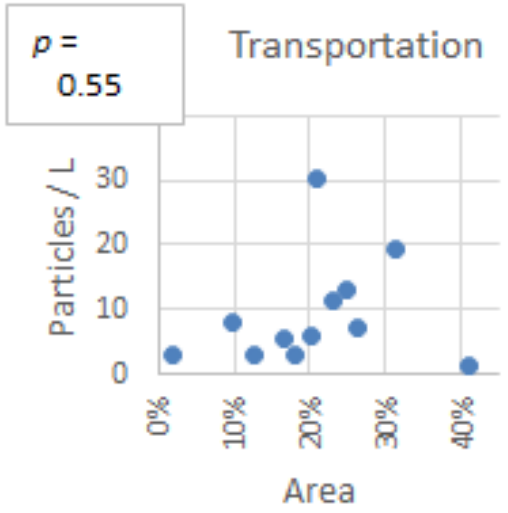
* Plastic

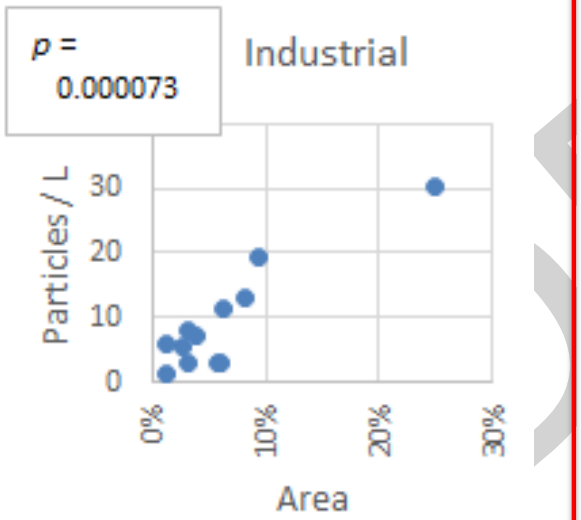
47% of microparticles collected were rubber fragments

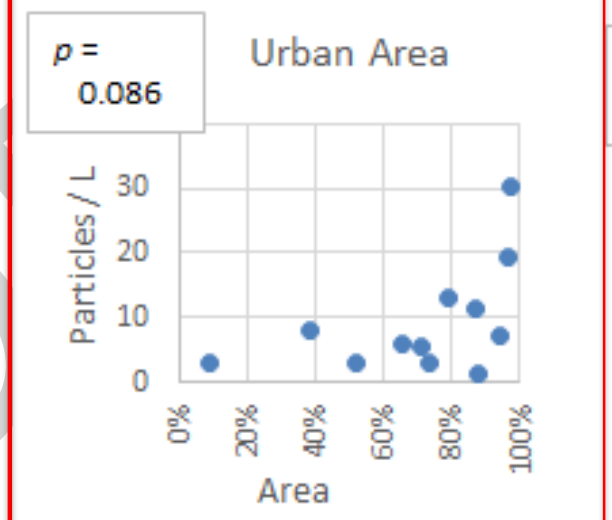


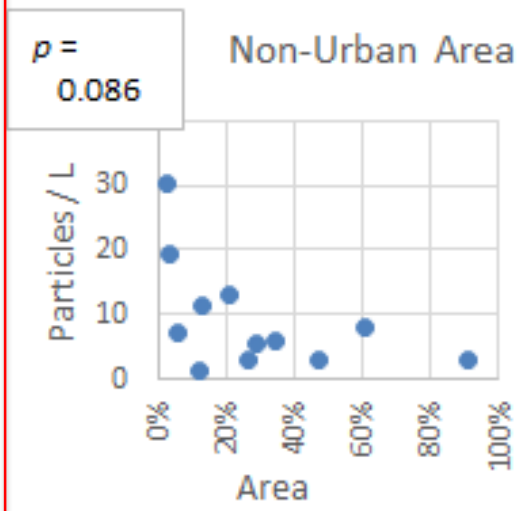












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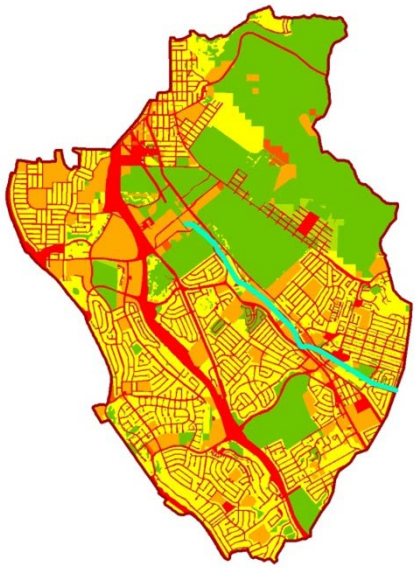
Regional Watershed Spreadsheet Model used to estimate loads

Annual Flow	x	Loading Coefficient	=	Microparticle load



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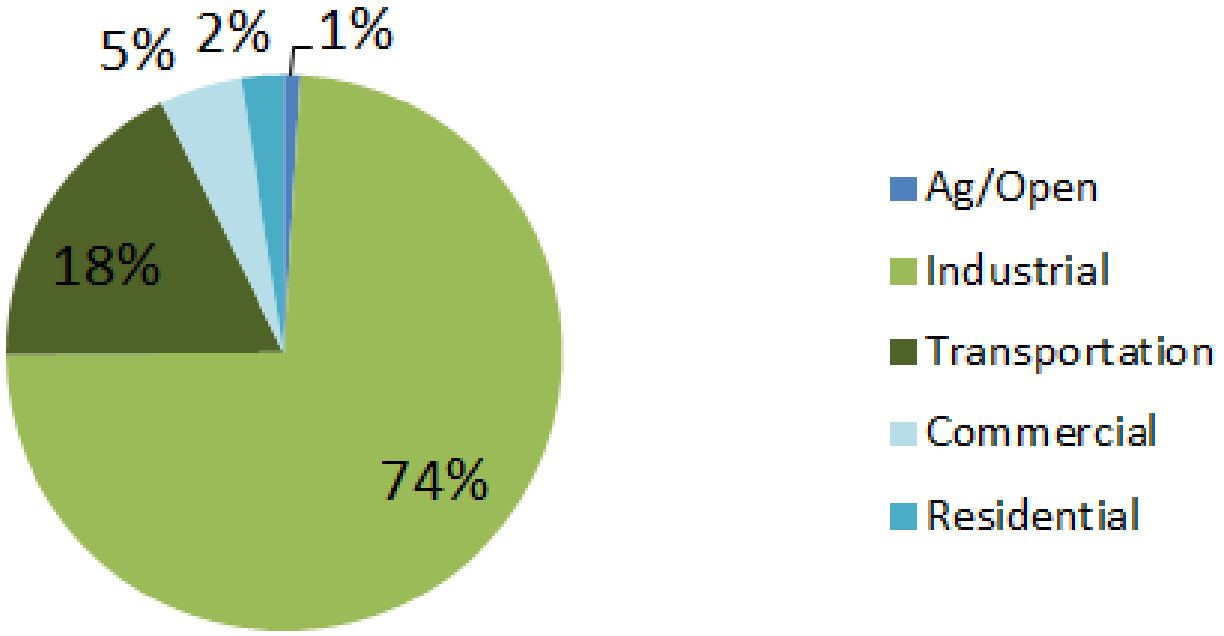
10.9 trillion microparticles to SF Bay annually; 63-90% of that is plastic



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Summary

- Abundance:
  - Higher concentrations than wastewater
- Composition:
  - Fragments and fibers dominate
  - Rubber fragments almost half the load
- Loads:
  - Industrial areas = disproportionate loading
  - Stormwater loads >200x wastewater loads

Any questions?