Sampling for microplastics in natural waters of the Northeast

Urban Landscapes

Chesapeake Bay Toxic Contaminants Workgroup

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NY Water Science Center—Coram

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Microplastics

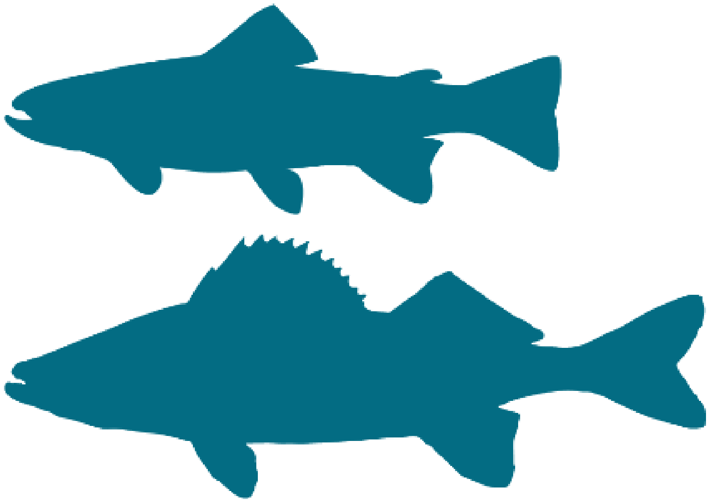
- Where do they come from?
  - Breakdown of plastic litter (foam, bottles, balloons)
  - Introduced through runoff from streets (cigarette butts)
  - Discharge from wastewater treatment plants and residential washing machines/dryers

- Why are they important?
  - They are small – defined as less than 5 mm
  - Found in most natural surface waters
  - Can sorb and transport contaminants
  - Are being ingested by fish and shellfish
  - Humans can be exposed through eating fish and inhaling microfibers

Studies have found particles in

12%

of **freshwater fish**[1]



50

particles per serving of
commercially-cultured **oysters**

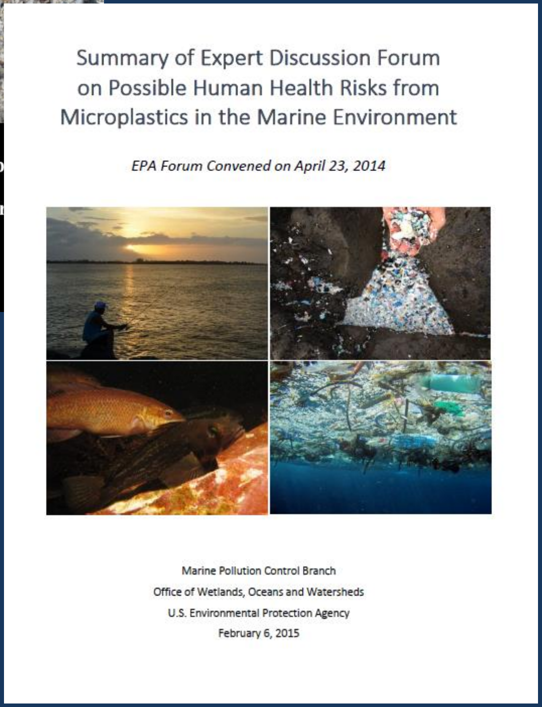
90

particles per serving of
commercially-cultured **mussels**[2]

https://owi.usgs.gov/vizlab/microplastics/

Who cares about microplastics?

- NOAA – Marine Debris Program
- EPA – Trash Free Waters
- USGS – Cooperative studies ongoing
- NPS – Studies on Park lands ongoing
- States, Tribes, local governments and academics…



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BACKGROUND

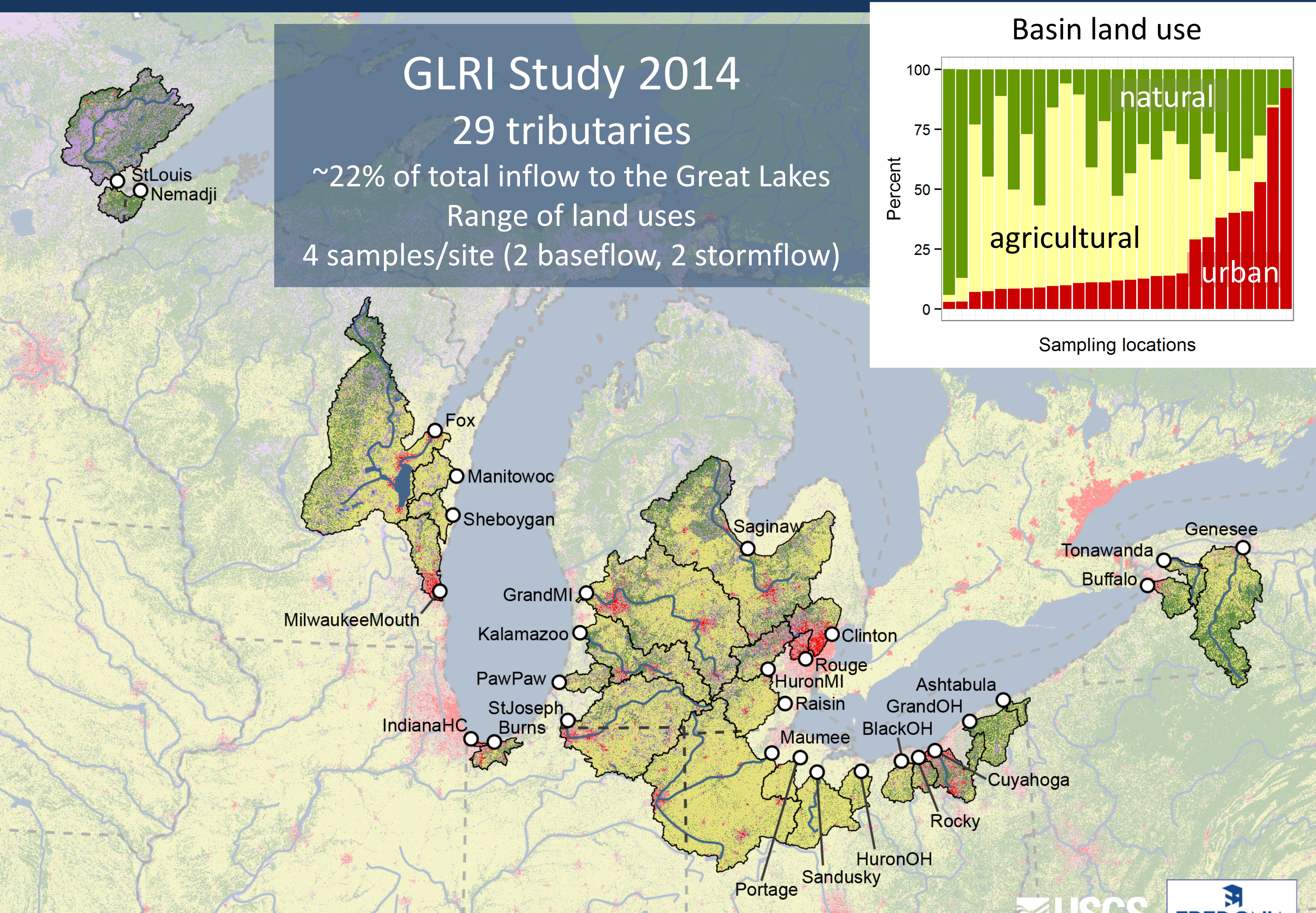
GLRI Study 2014

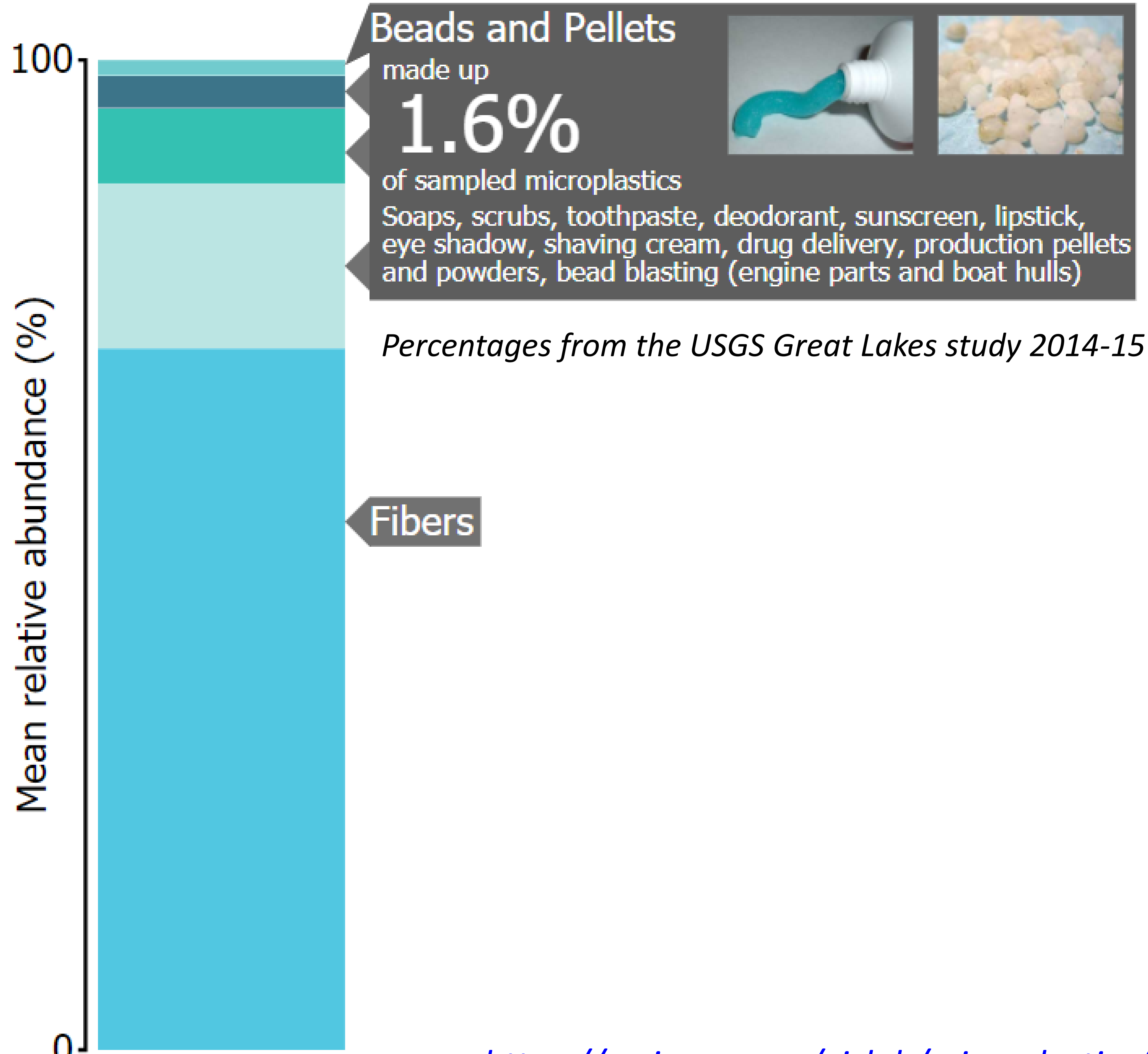
29 tributaries

~22% of total inflow to the Great Lakes

Range of land uses

4 samples/site (2 baseflow, 2 stormflow)





Percentages from the USGS Great Lakes study 2014-15

https://owi.usgs.gov/vizlab/microplastics/

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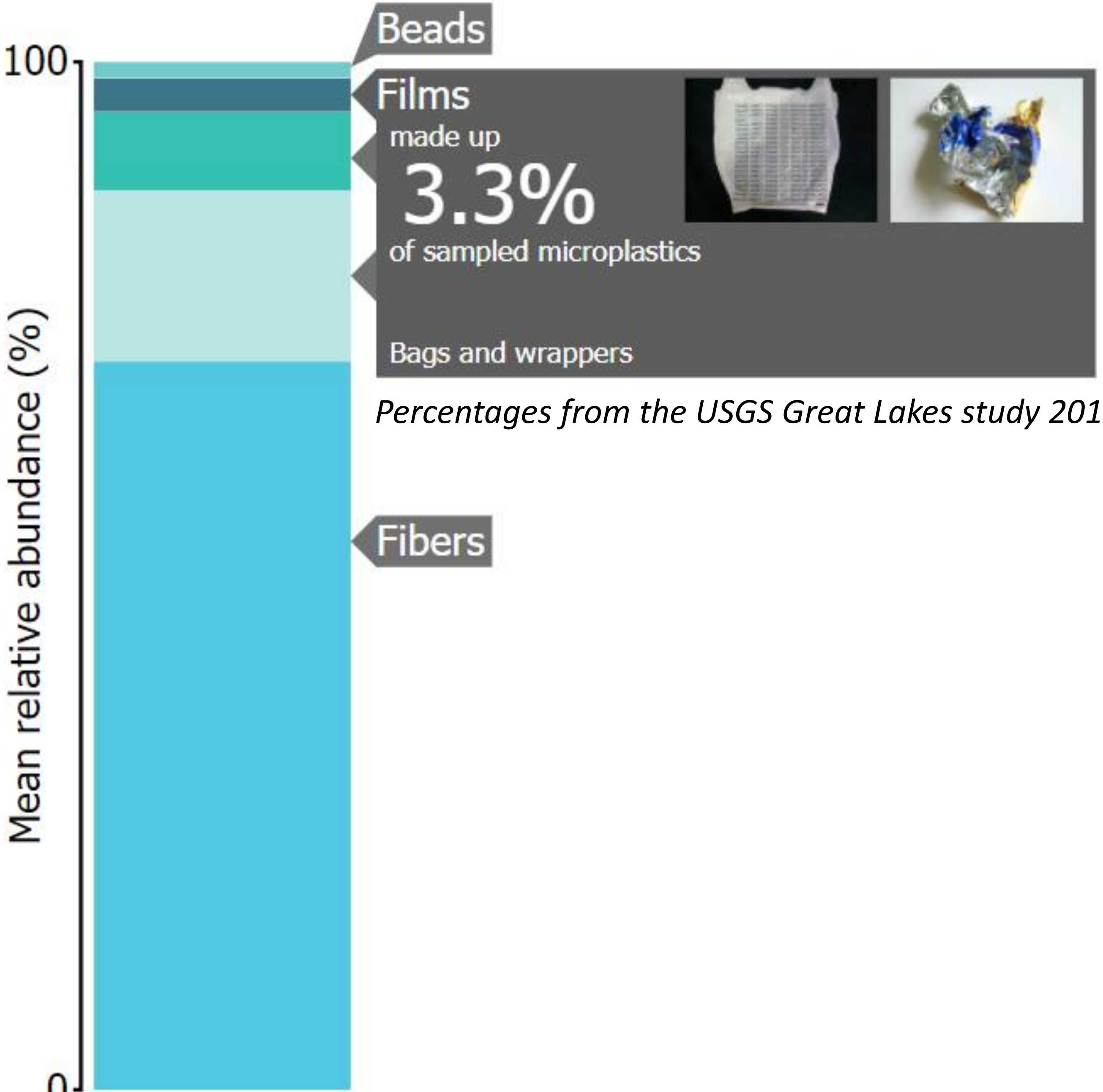

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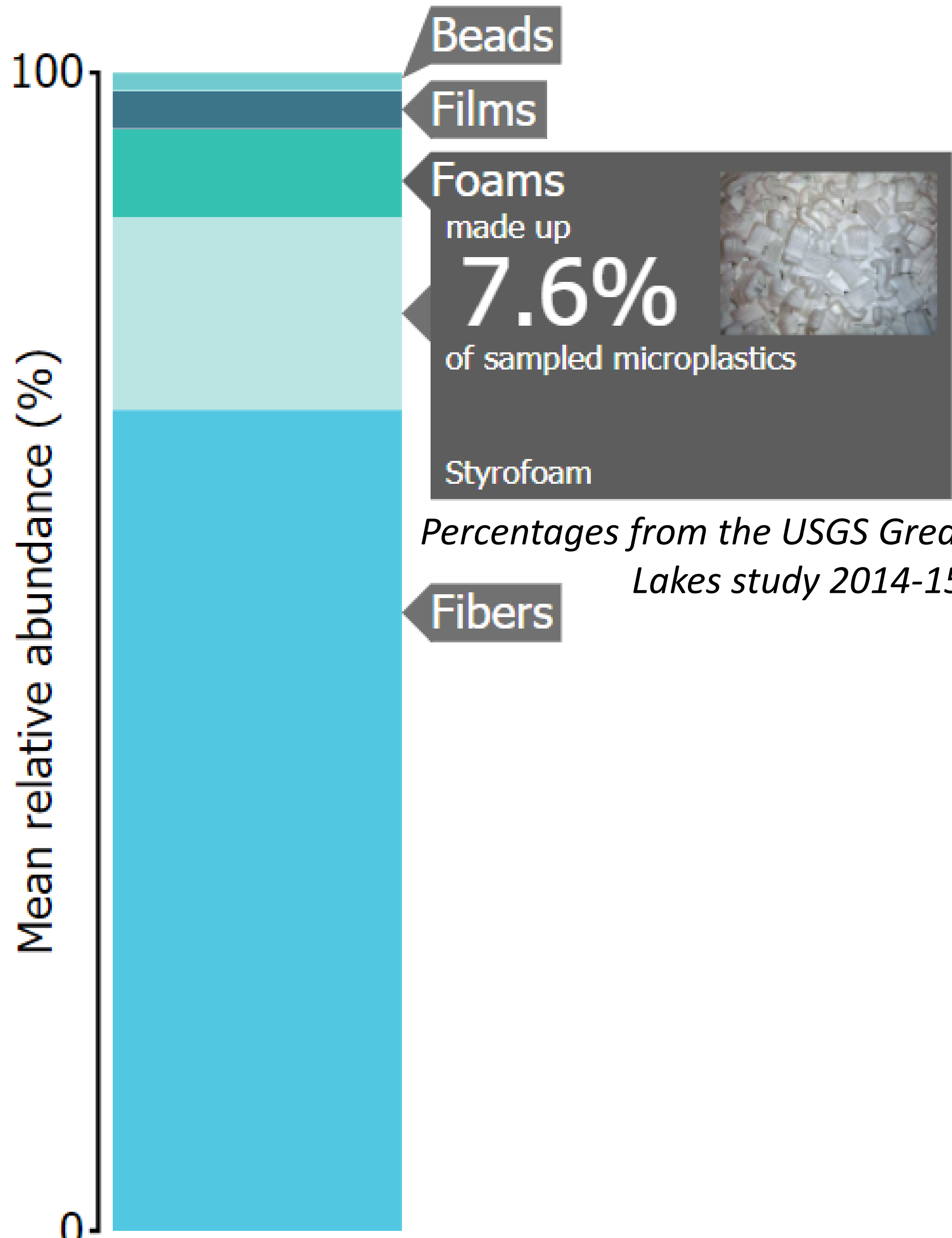

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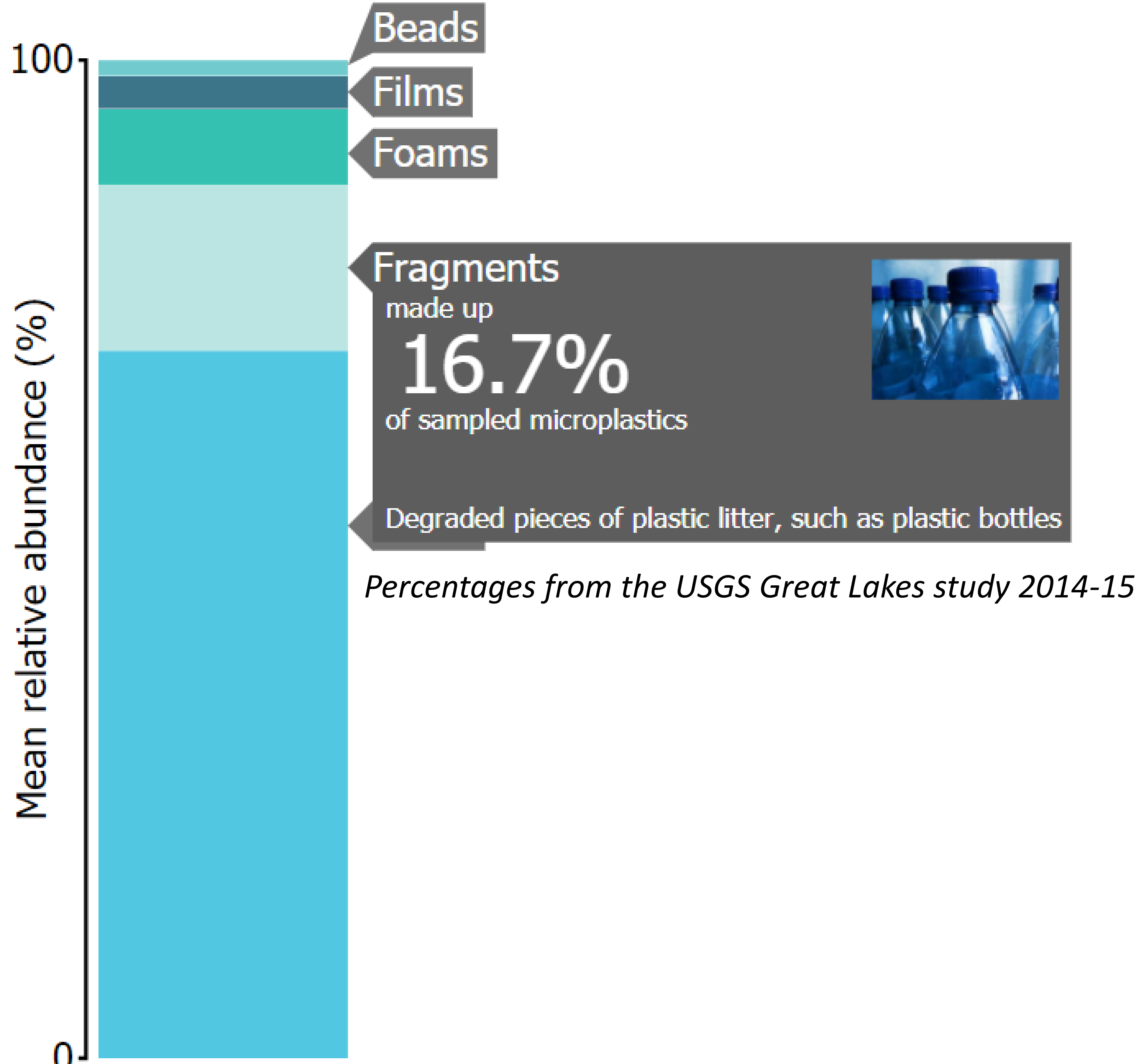

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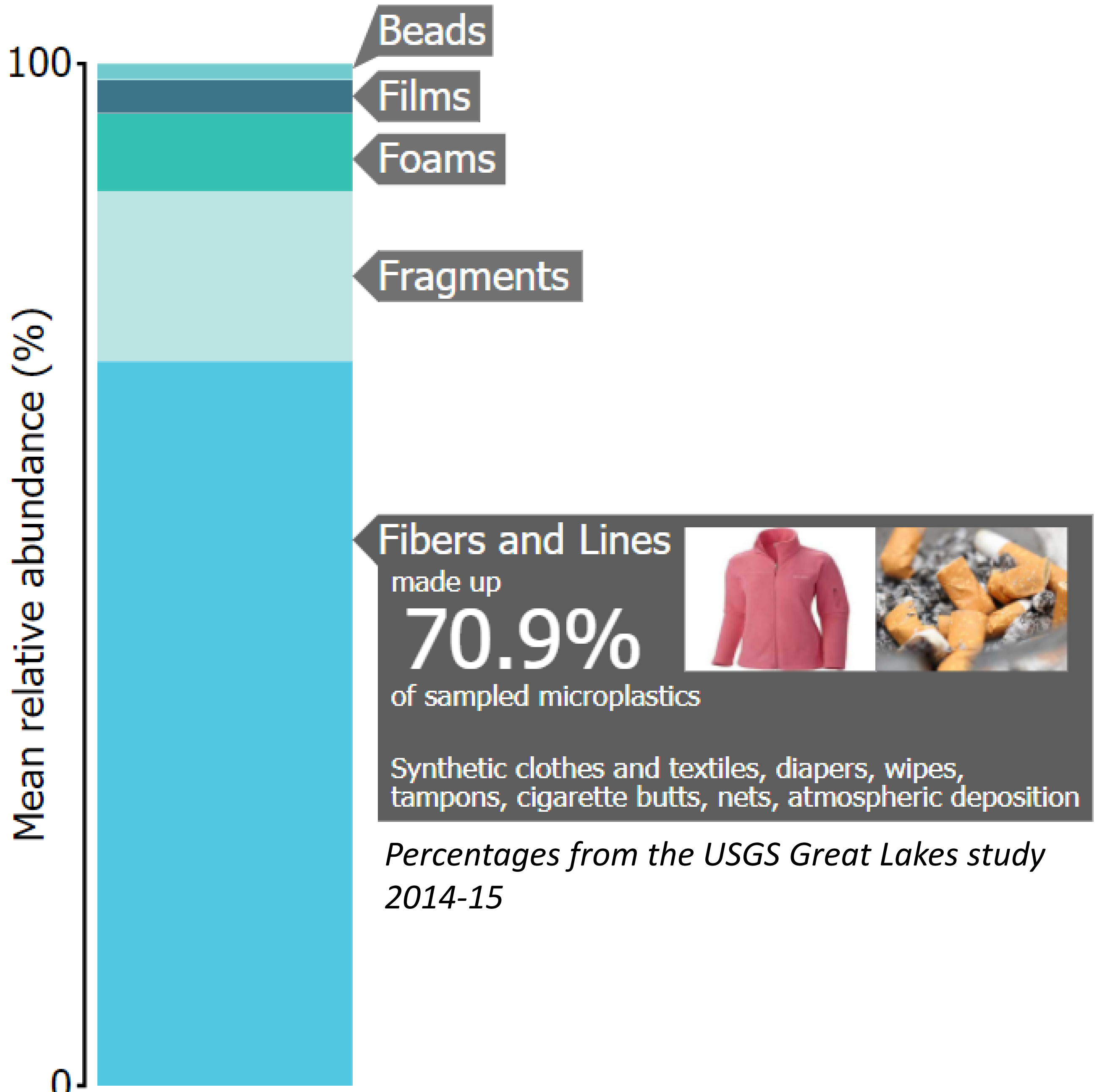

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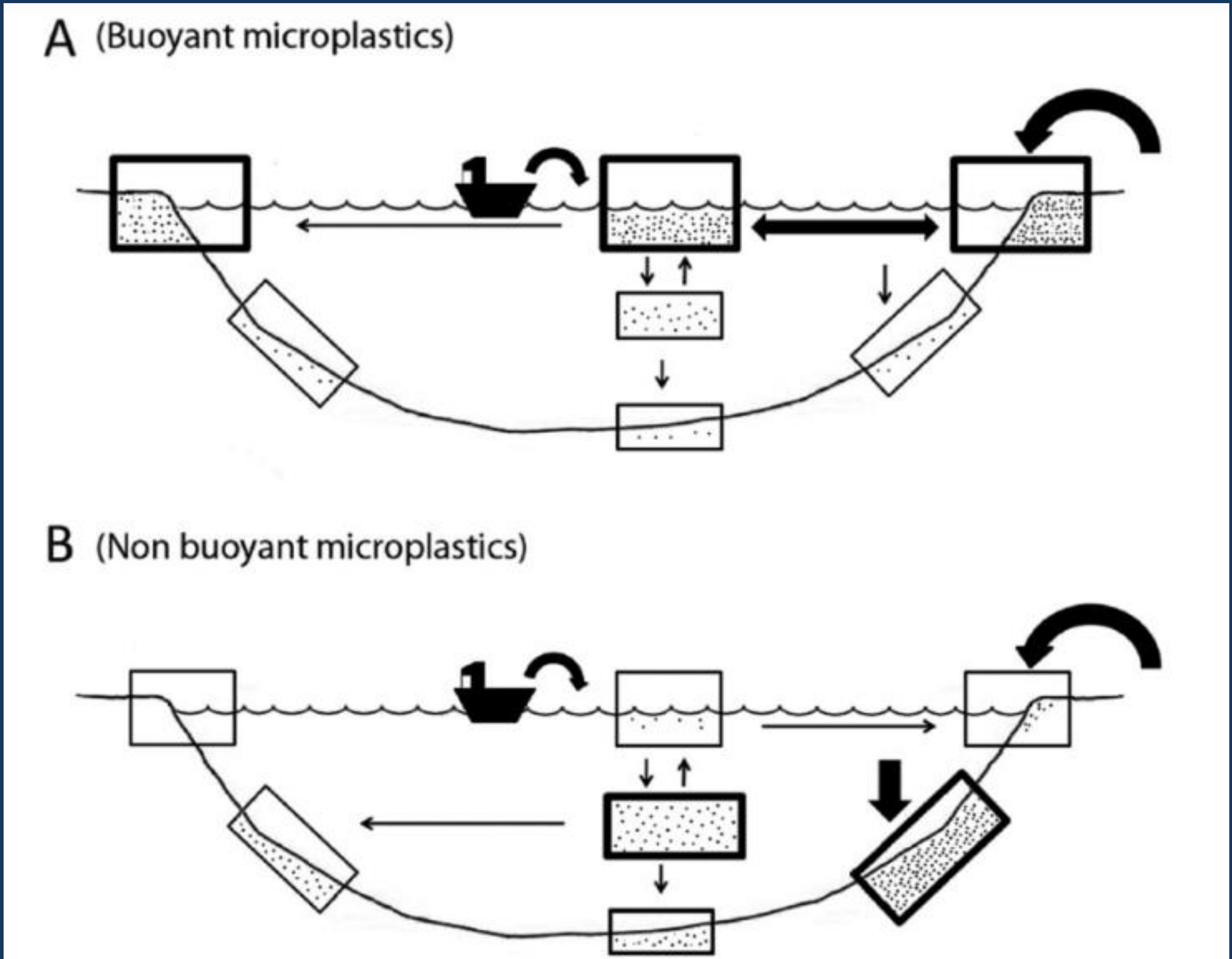
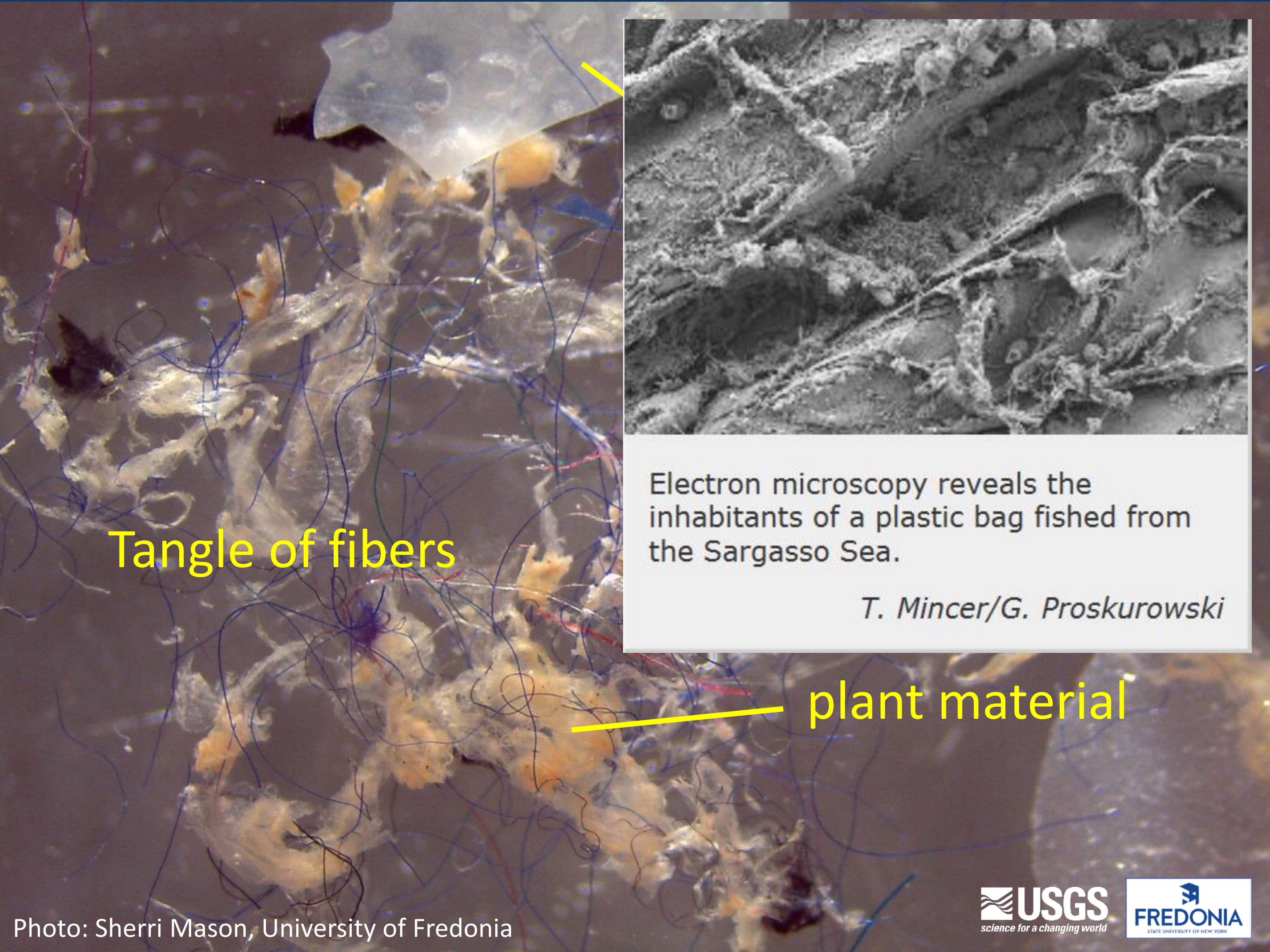
Microplastics characteristics



(Hidalgo-Ruz and others, 2012)



Electron microscopy reveals the inhabitants of a plastic bag fished from the Sargasso Sea.

T. Mincer/G. Proskurowski

Photo: Sherri Mason, University of Fredonia

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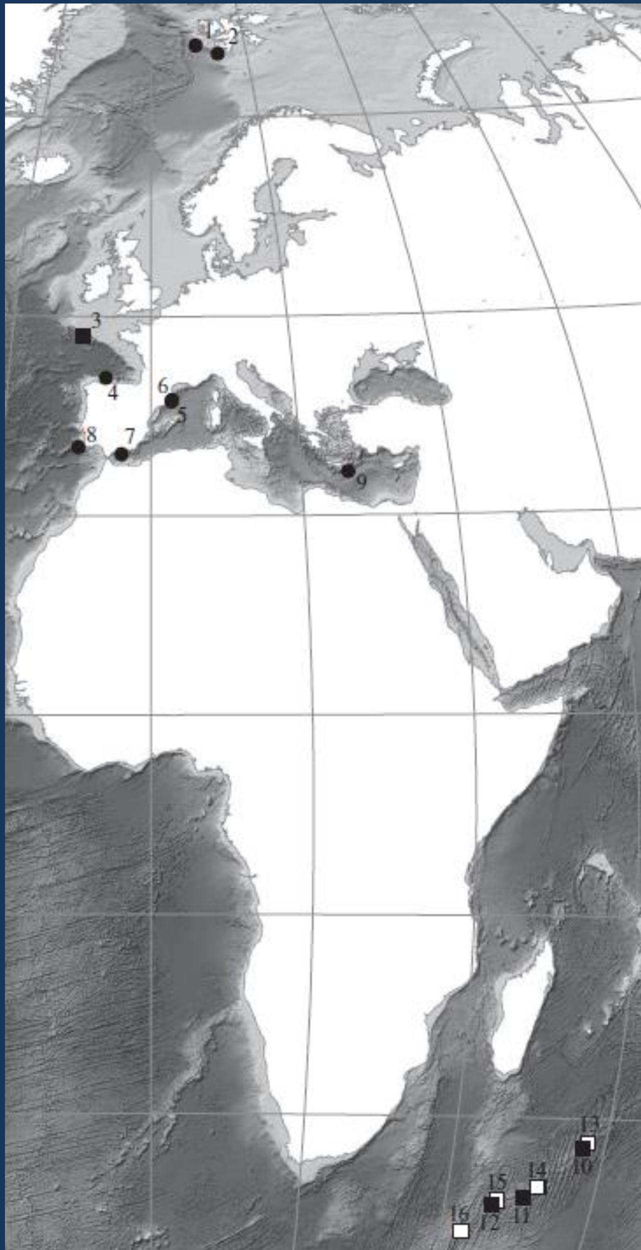
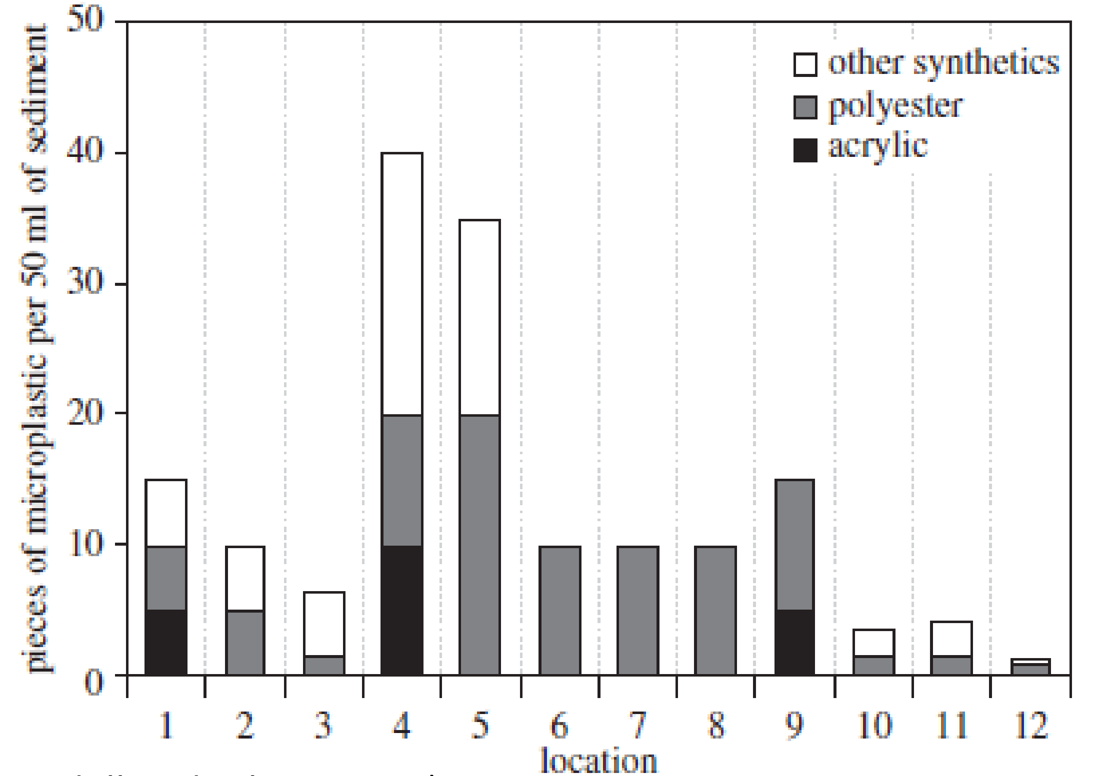


Fibers in deep-sea sediment



(Woodall and others, 2014)

- Concentrations in sediment 4 orders of magnitude greater than at ocean surface
- Average of 13 fibers/50 mL sediment

Chesapeake Bay


NOAA Marine Debris Program OFFICE OF RESPONSE AND RESTORATION

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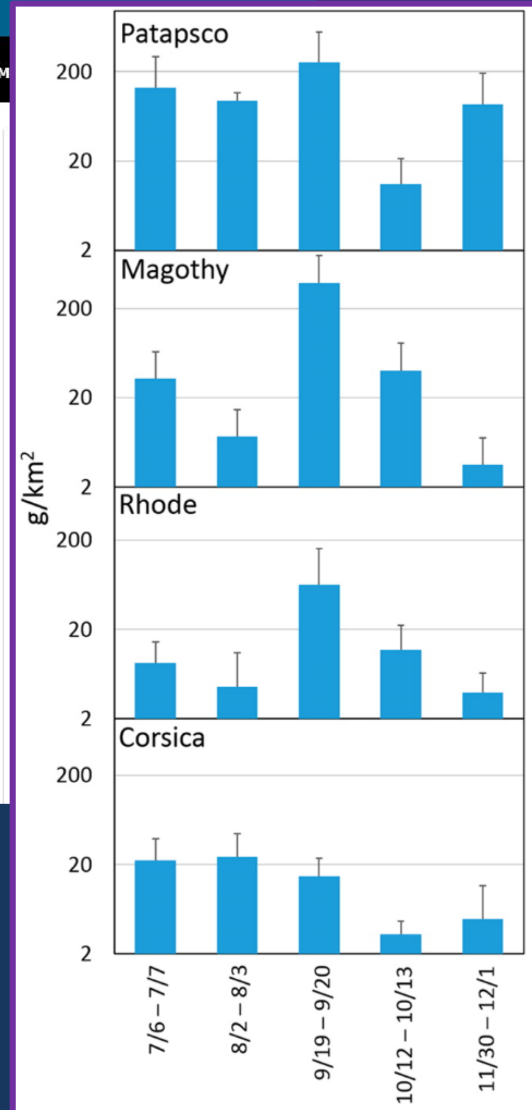
Analysis of Microplastics in Chesapeake Bay and Coastal Mid-Atlantic Water Samples

Microplastics sample from the Rhode River. (Photo Credit: Will Parson, courtesy of the Chesapeake Bay Program)

The University of Maryland's Wye Research and Education Center Aquatic Toxicology Group, by request of the NOAA Marine Debris Program, analyzed archived surface-water samples from four Chesapeake Bay tributaries for microplastic debris. The project found that microplastic concentrations increased near urban areas and peaked after major rains, providing important baseline data for the area and supporting the prioritization of upstream prevention efforts in urban locations.

Project Dates: April 2012 - June 2013



- Microplastic studies in Chesapeake Bay and its tributaries appear limited
- A Technical Review was generated for Chesapeake Bay by STAC by Wardrop and others (2016, STAC Pub. 16-002, 27 pp.)

(Yonkos and others, 2014, ES&T v. 48 [24], p. 14195-14202)

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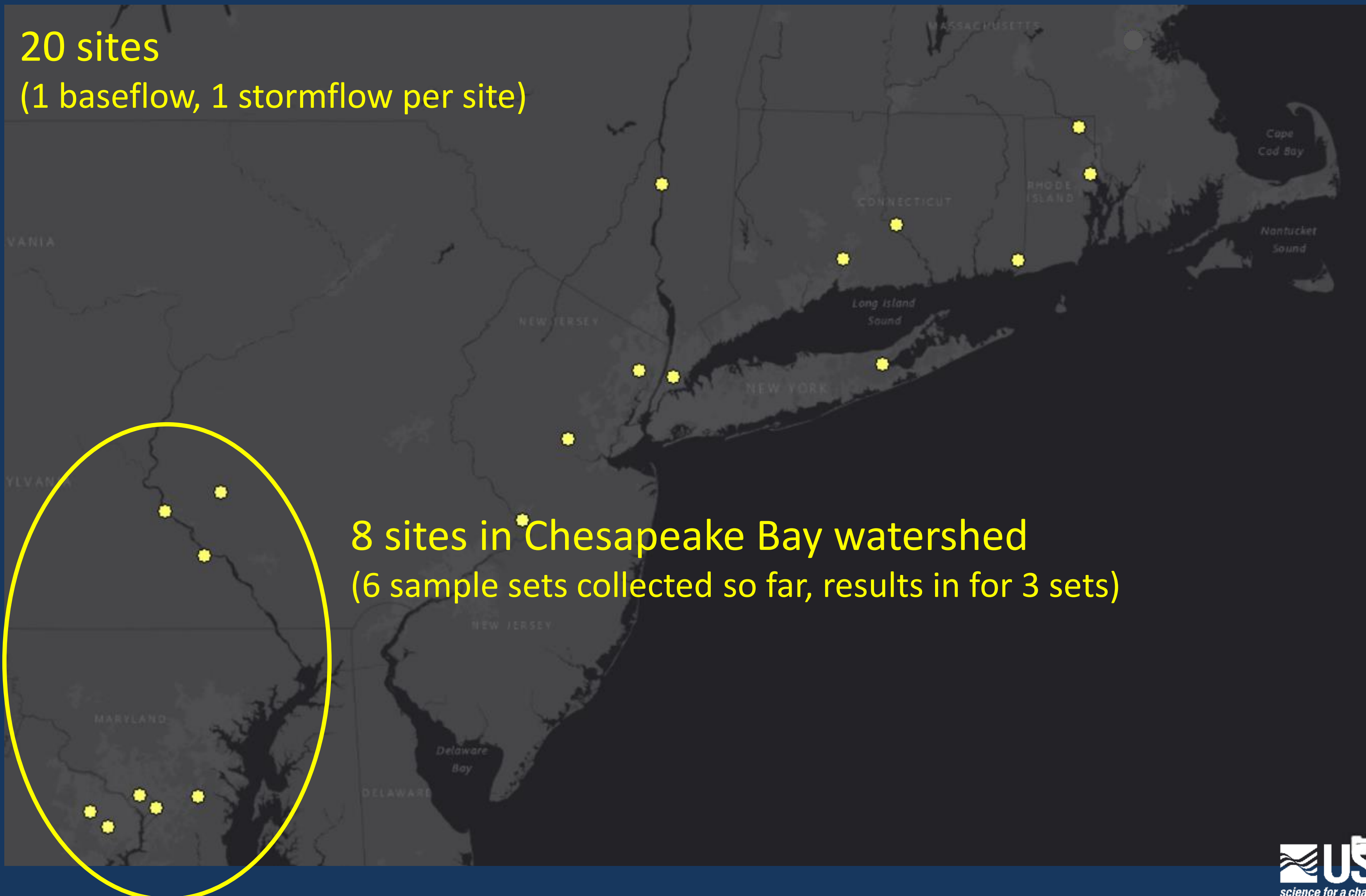
REGIONAL ASSESSMENT

Microplastics in the urban environment—Northeast Region

2017-19



20 sites
(1 baseflow, 1 stormflow per site)

8 sites in Chesapeake Bay watershed
(6 sample sets collected so far, results in for 3 sets)

Regional study objectives

- Get a snapshot of microplastics during storm and baseflow conditions in urban streams and estuarine waters
- Determine what is needed to leverage existing program to assess microplastics at sites chemistry data are routinely collected
- Evaluate potential sources based on upstream and adjacent watersheds land-use
- Improve USGS capabilities

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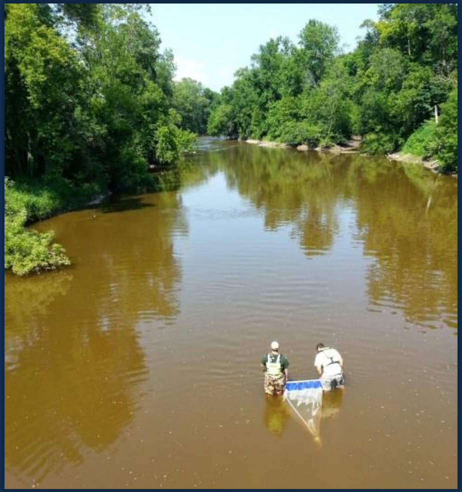
Sample collection



Sample processing

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Samples for analysis

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Analytical Methods

(photos of Sherri Mason's lab at SUNY Fredonia; similar to the USGS WA microplastics lab)

Sieved into three size classes:

- 0.355-0.999 mm
- 1.00-4.749 mm
- >4.75 mm

Digestion of organic matter using wet peroxide oxidation

Floatation in salt water to separate plastic particles

Photos courtesy of Tim Hoellein

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Particles counted & categorized using light microscope

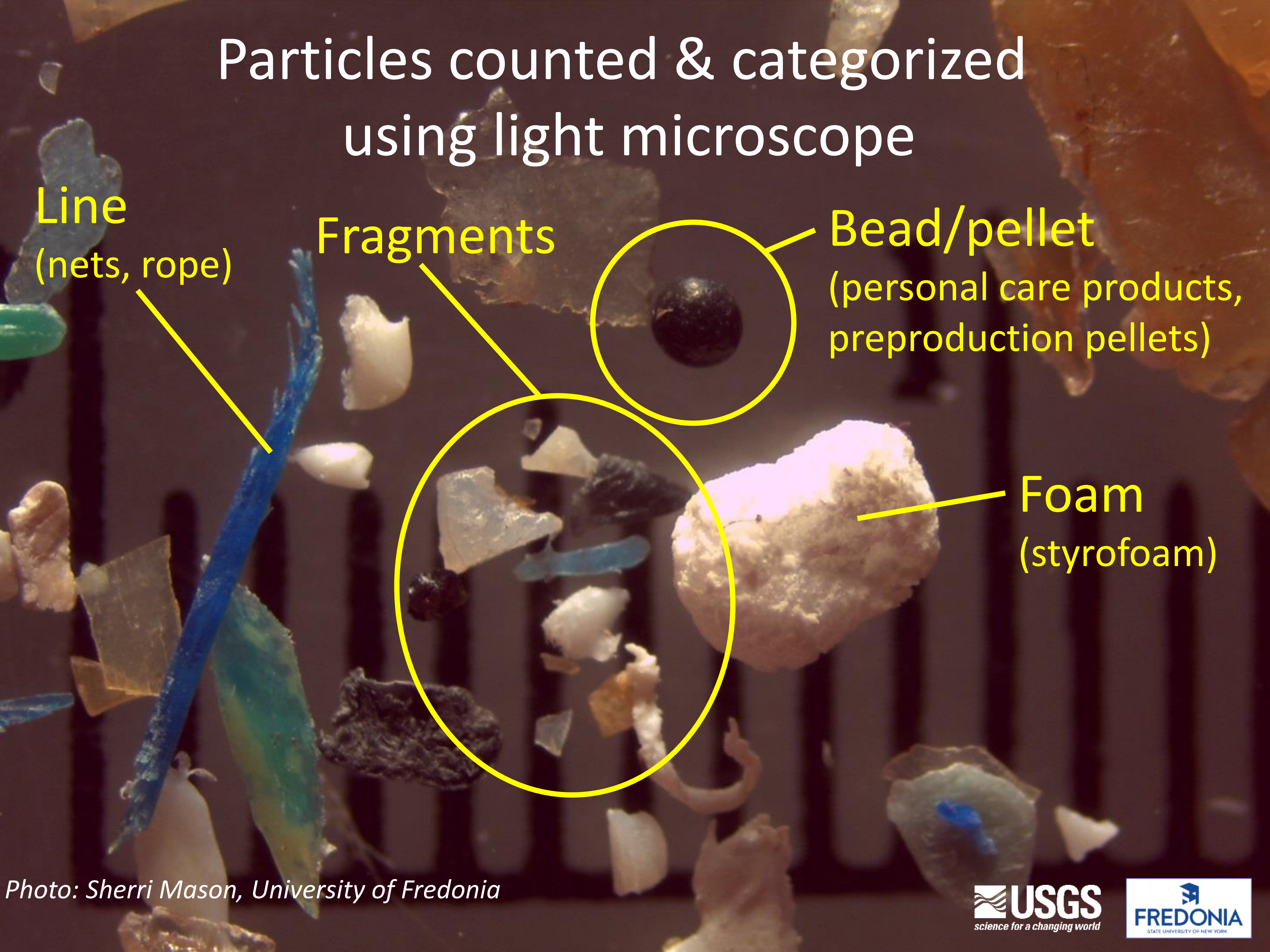

Photo: Sherri Mason, University of Fredonia

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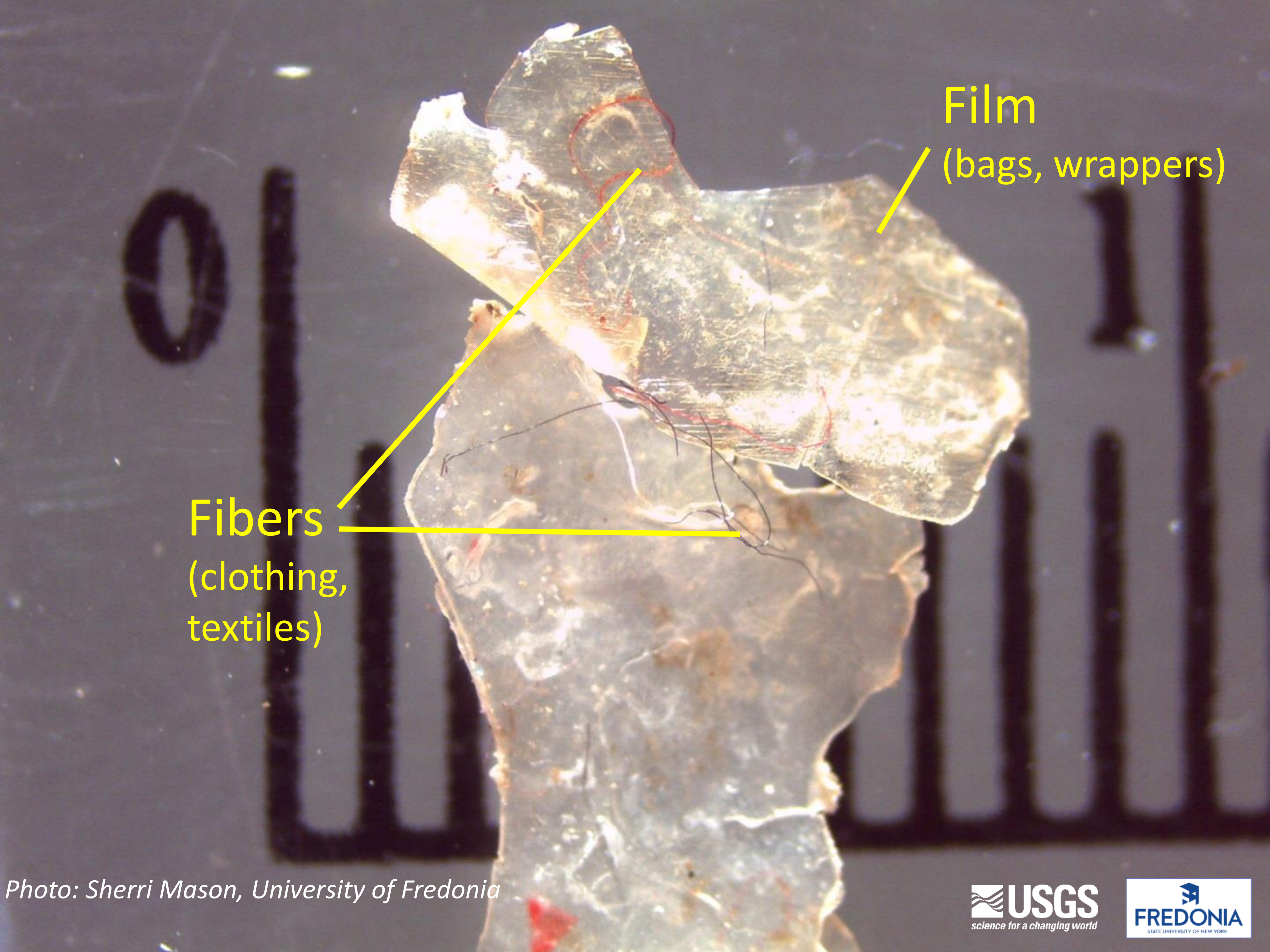


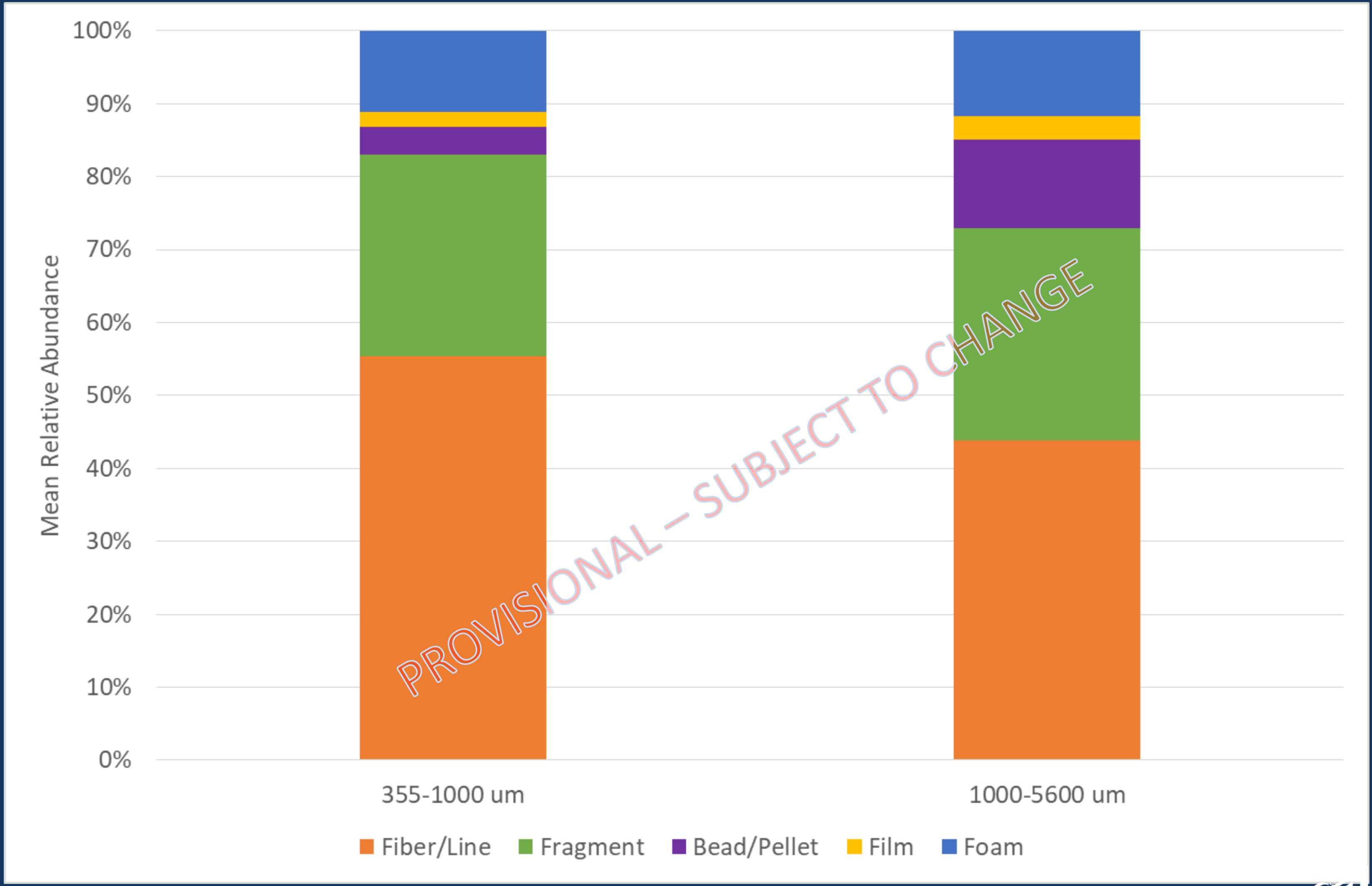
Photo: Sherri Mason, University of Fredonia

PROVISIONAL RESULTS

Relative Abundance

by size

2017 data



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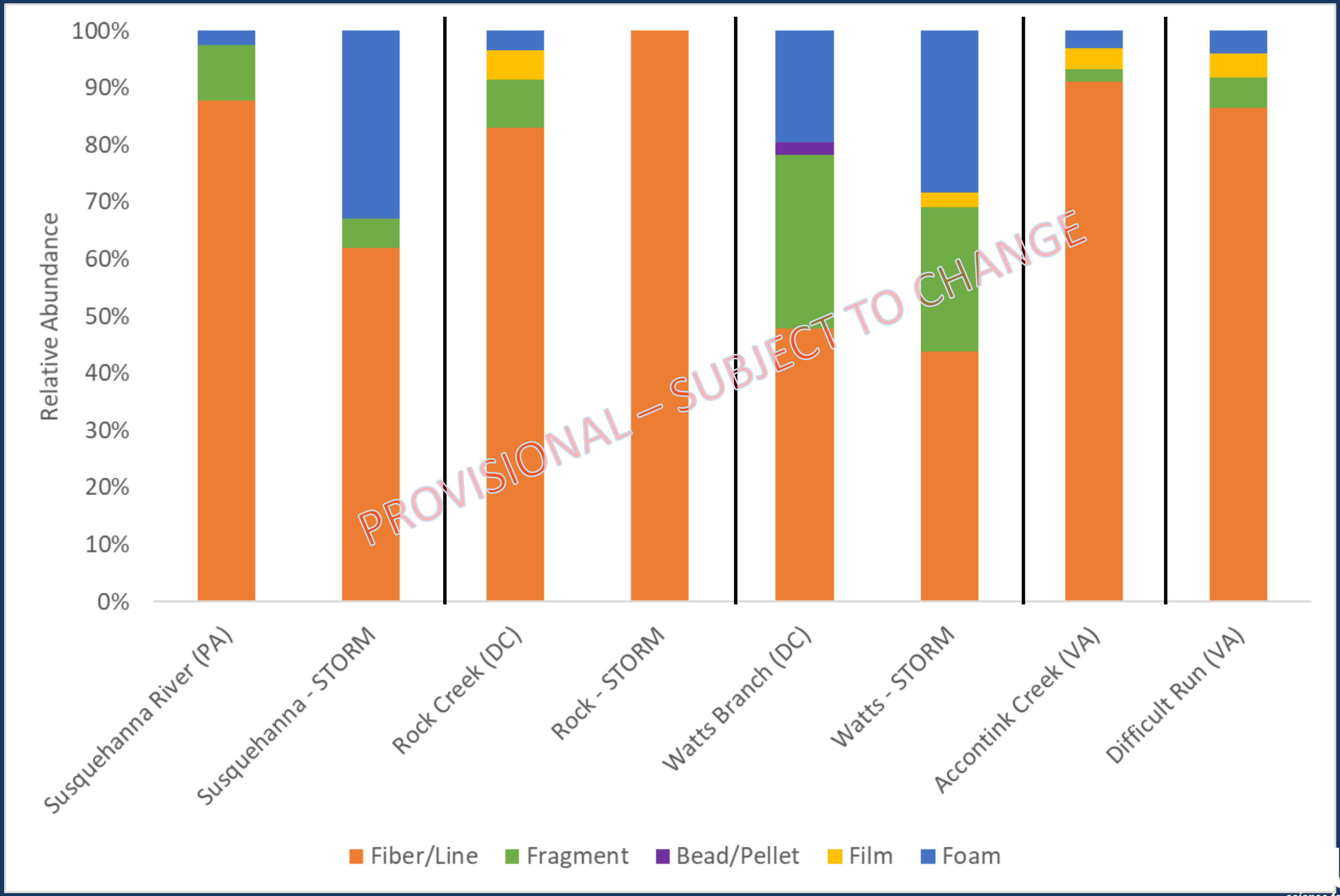
Relative Abundance

by site; condition (355-5600 µm)

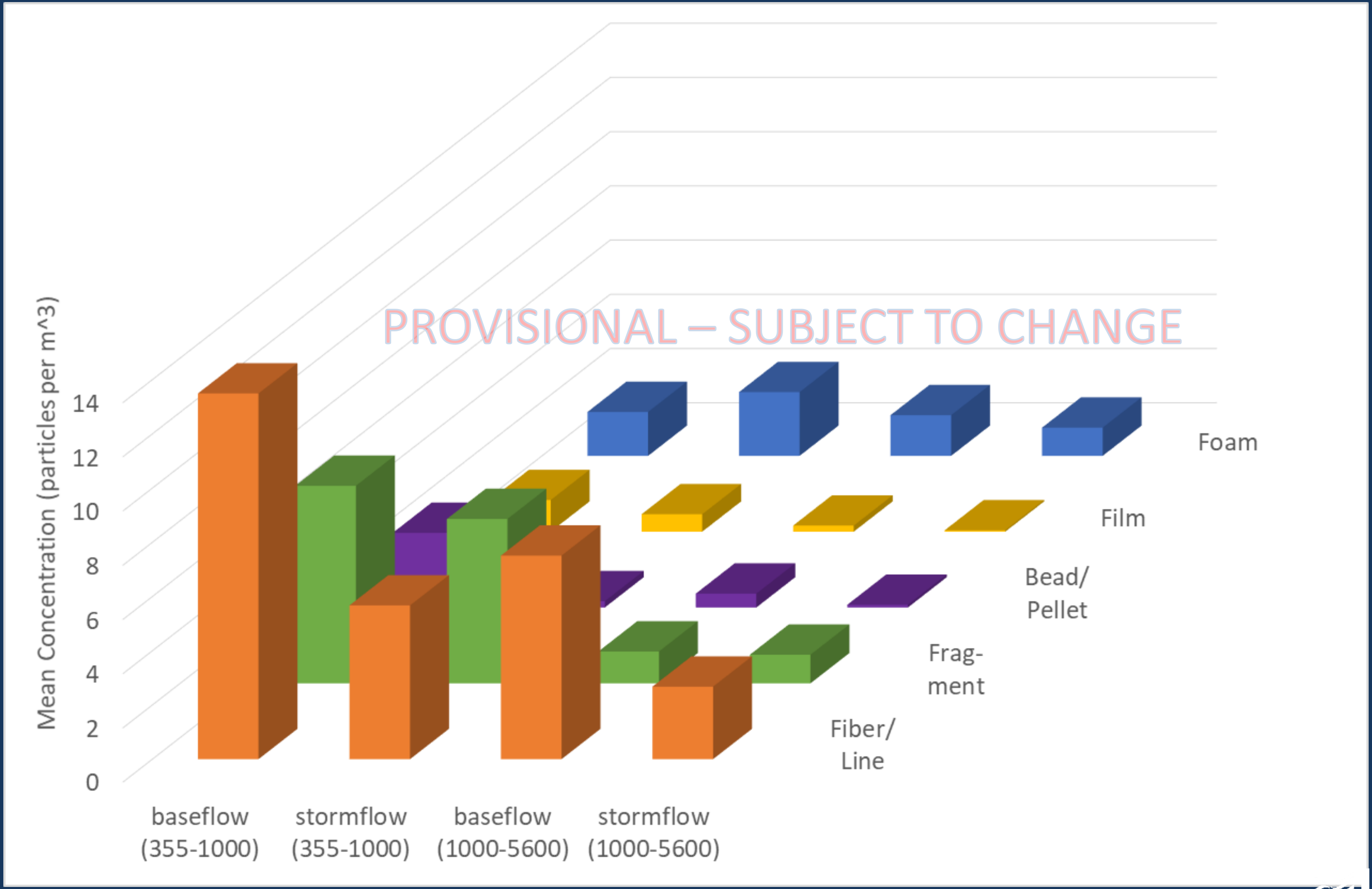
2017 data



Average Concentration

by condition; size

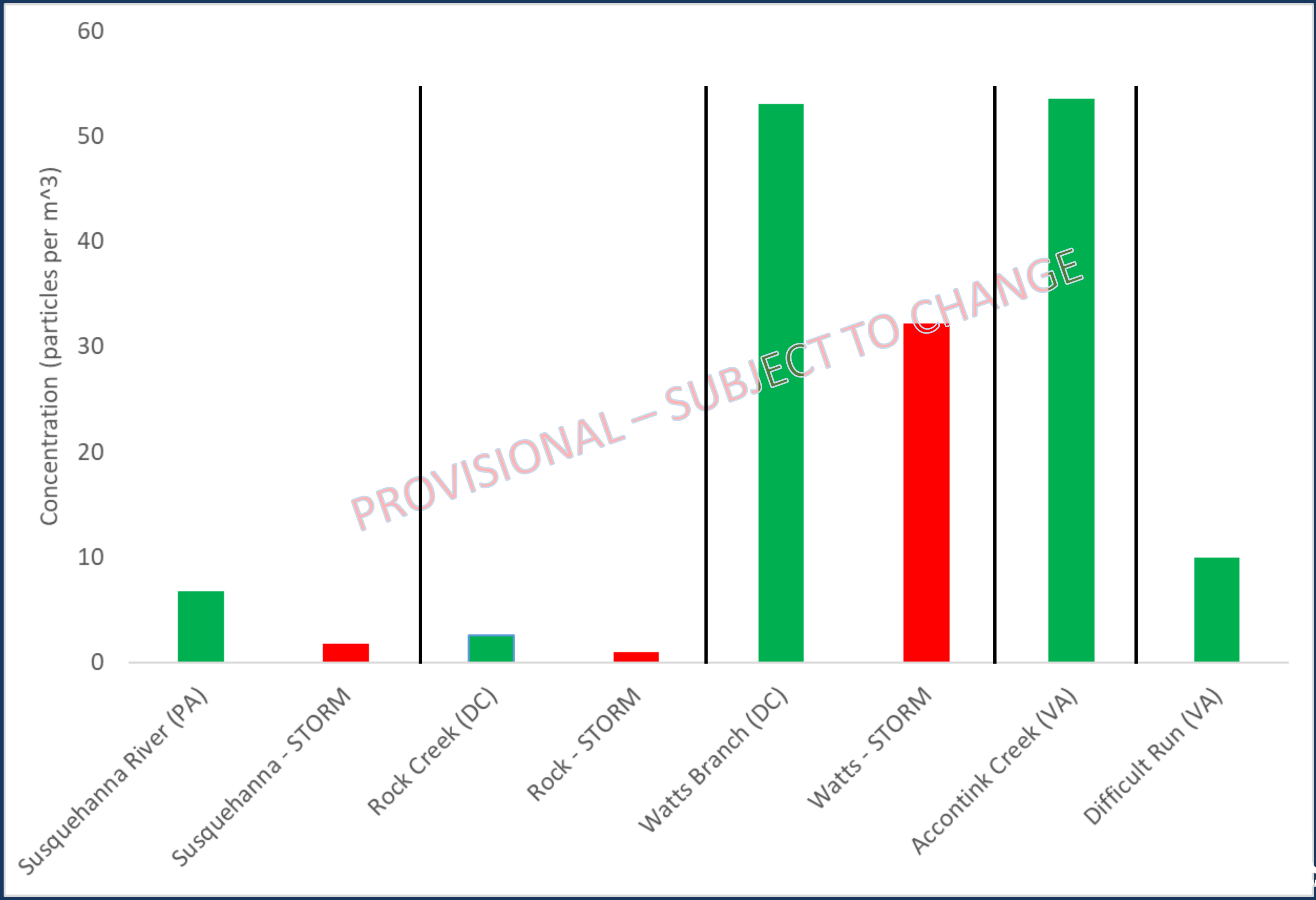
2017 data



Concentration

by site; condition

2017 data



Data Summary

- Microplastics present in every sample collected by USGS to date and could impact human and ecological health
- Relations with flow condition, land use, and wastewater effluent require additional analyses and likely additional monitoring
- Fibers dominate over other particle types in most tributaries
  - May be settling out
  - Sources beyond WWTP effluent
    - Atmospheric deposition
    - Overland sludge application
- More data are needed to better understand relative changes in microplastics concentrations during a storm

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Monitoring to inform resource management

- Identify major contributors
  - STP outfalls
  - Direct discharge
  - Road runoff
  - Atmospheric deposition
- Understand impacts of BMPs designed to reduce the number of microplastics reaching environment
- Determine impact to local ecology (and economy) and food chain effects
- Classify type/size/shape/composition to better understand sources, fate, and transport

QUESTIONS?

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