# Microplastics in natural waters of the Northeast

*Urban Landscapes*

Chesapeake Bay Program—STAC workshop

*April 24, 2019*

Shawn Fisher

*U.S. Geological Survey*

*NY Water Science Center—Coram (Long Island)*

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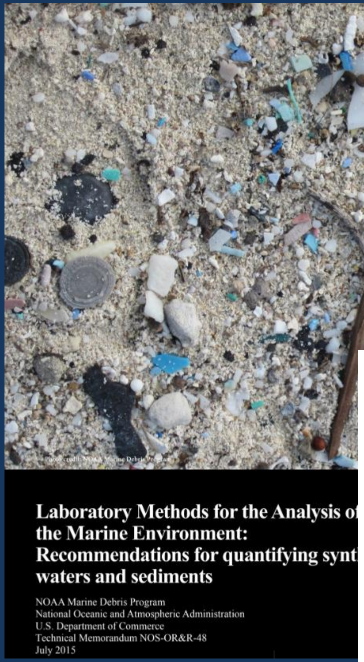
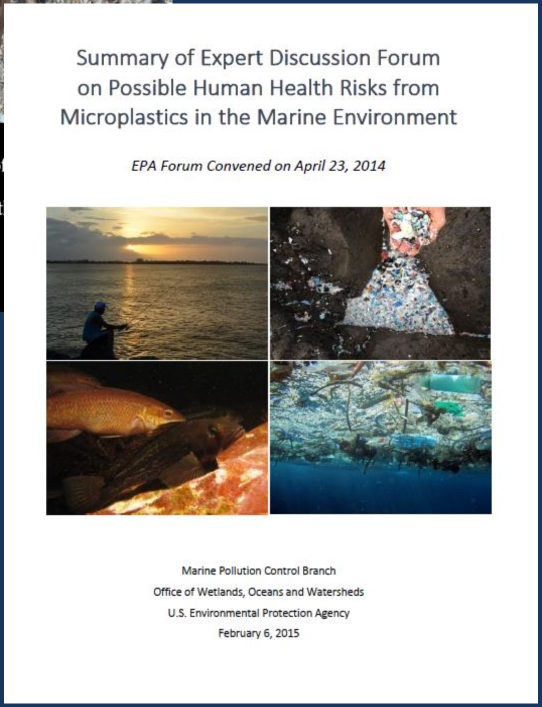
# Who cares about microplastics?

- International – recent G20 report
- NOAA – Marine Debris Program
- EPA – Trash Free Waters
- USGS – Cooperative studies ongoing
- NPS – Studies on Park lands ongoing
- States, Tribes, local governments, and academics



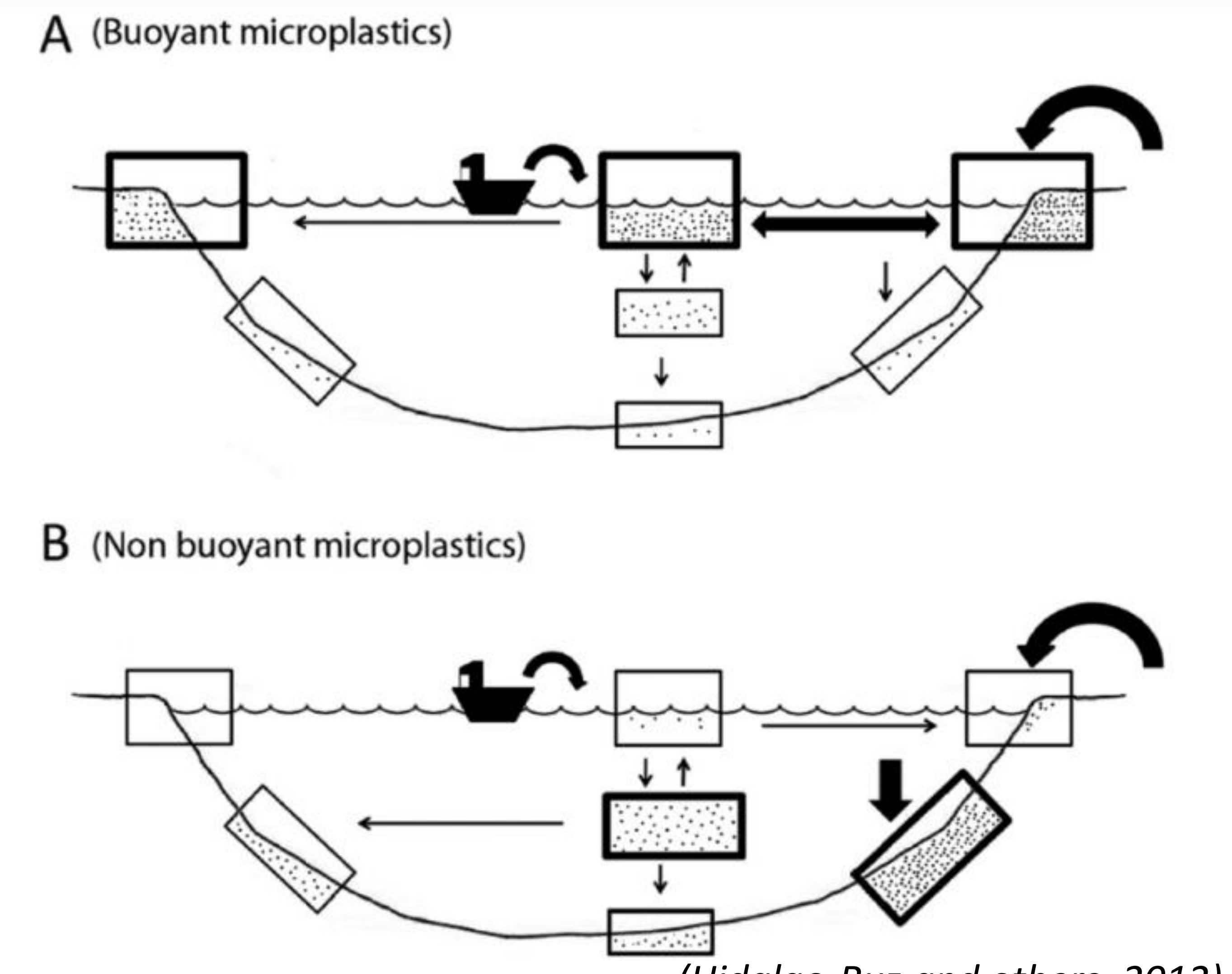
# BACKGROUND

# 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
  - Atmospheric deposition

- Why are they important?
  - They are small–defined as < 5 mm
  - Found in most natural surface waters
  - Can sorb and transport contaminants
  - Are being ingested by fish and shellfish
  - Routes of human exposure include shellfish consumption, inhalation (fibers), and various drinking water supplies

# Microplastics characteristics

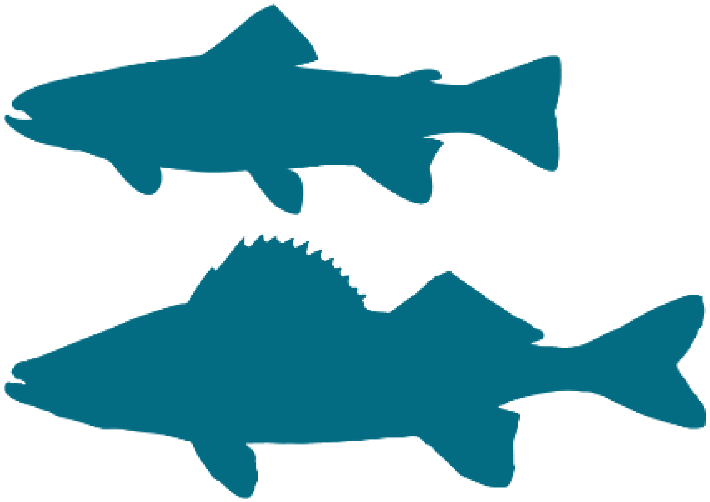



*(Hidalgo-Ruz and others, 2012)*

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/

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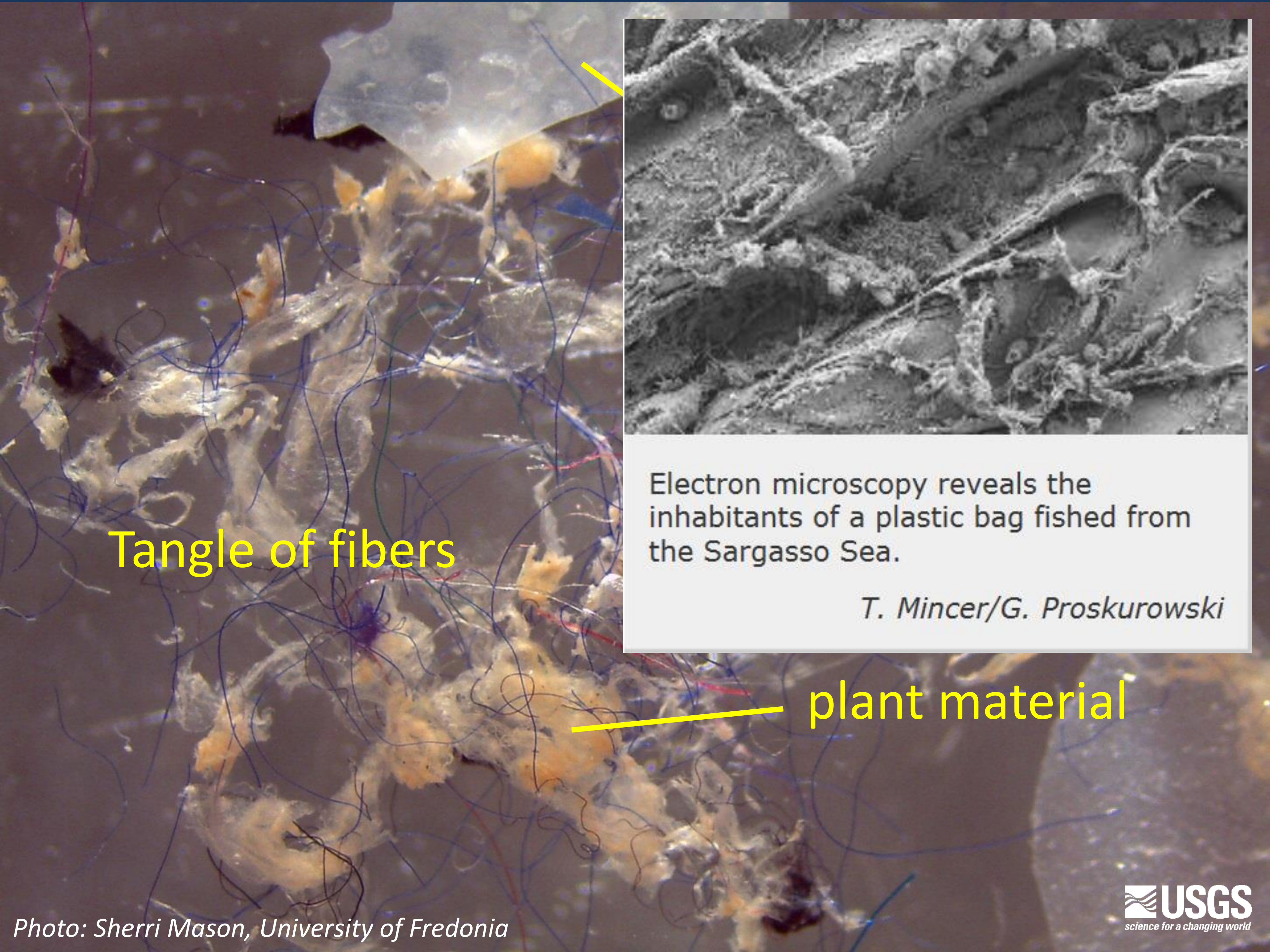



Electron microscopy reveals the inhabitants of a plastic bag fished from the Sargasso Sea.

*T. Mincer/G. Proskurowski*

*Photo: Sherri Mason, University of Fredonia*

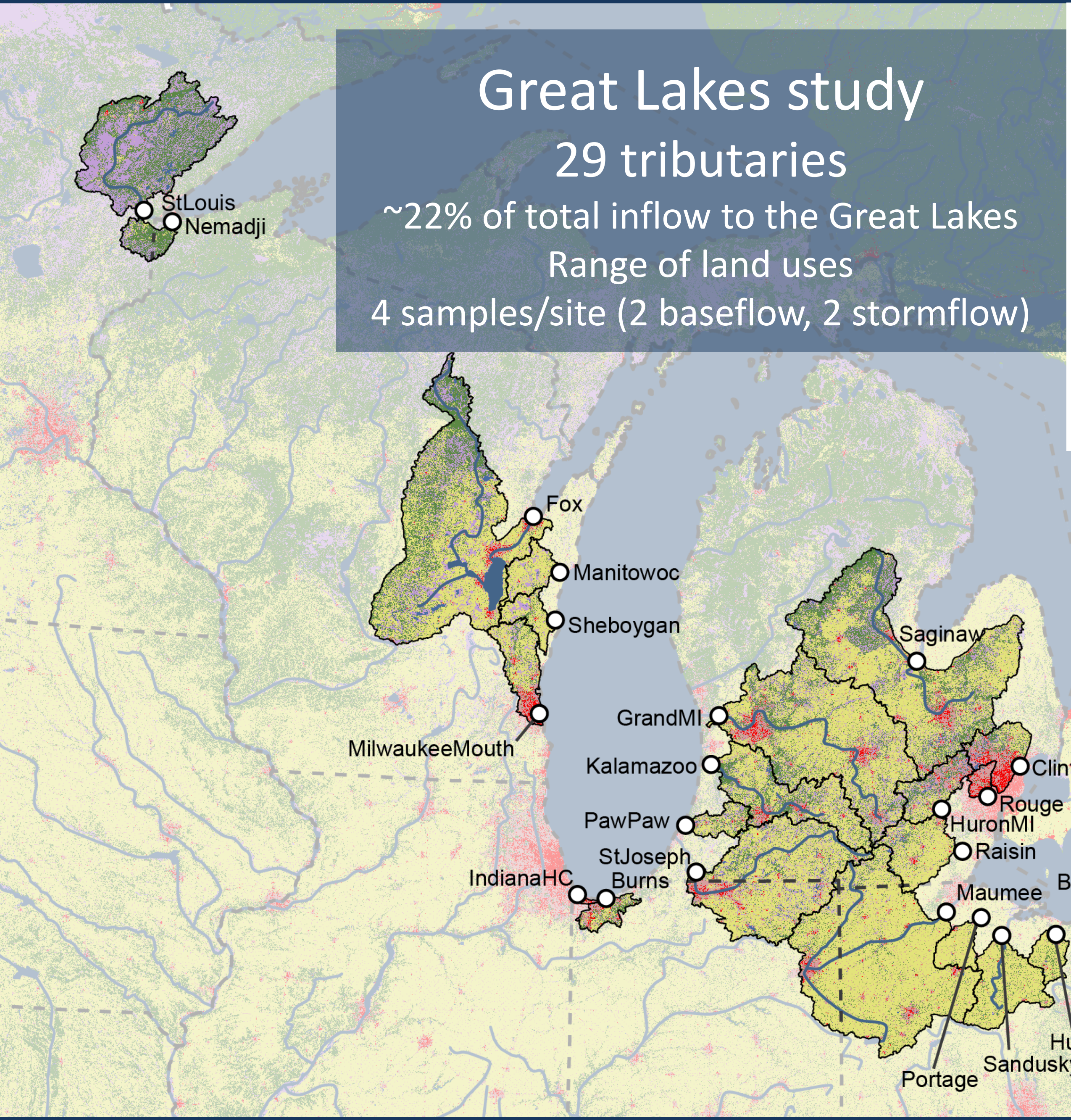
# Great Lakes study

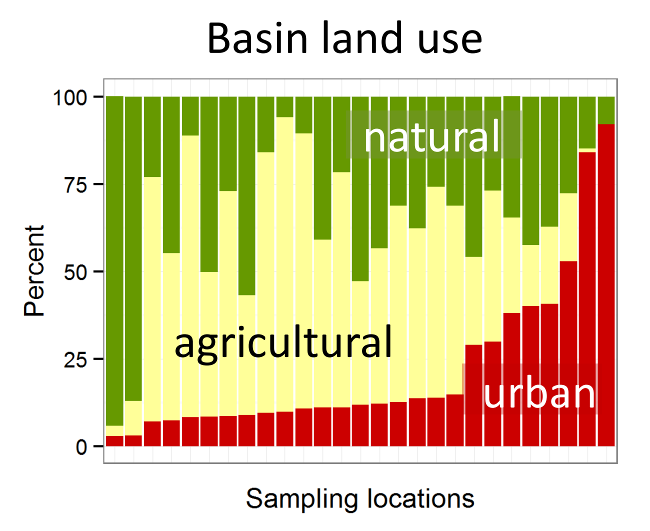
## 29 tributaries

~22% of total inflow to the Great Lakes

Range of land uses

4 samples/site (2 baseflow, 2 stormflow)




*Baldwin and others, 2016, ES&T, v. 50, p. 10377–10385*

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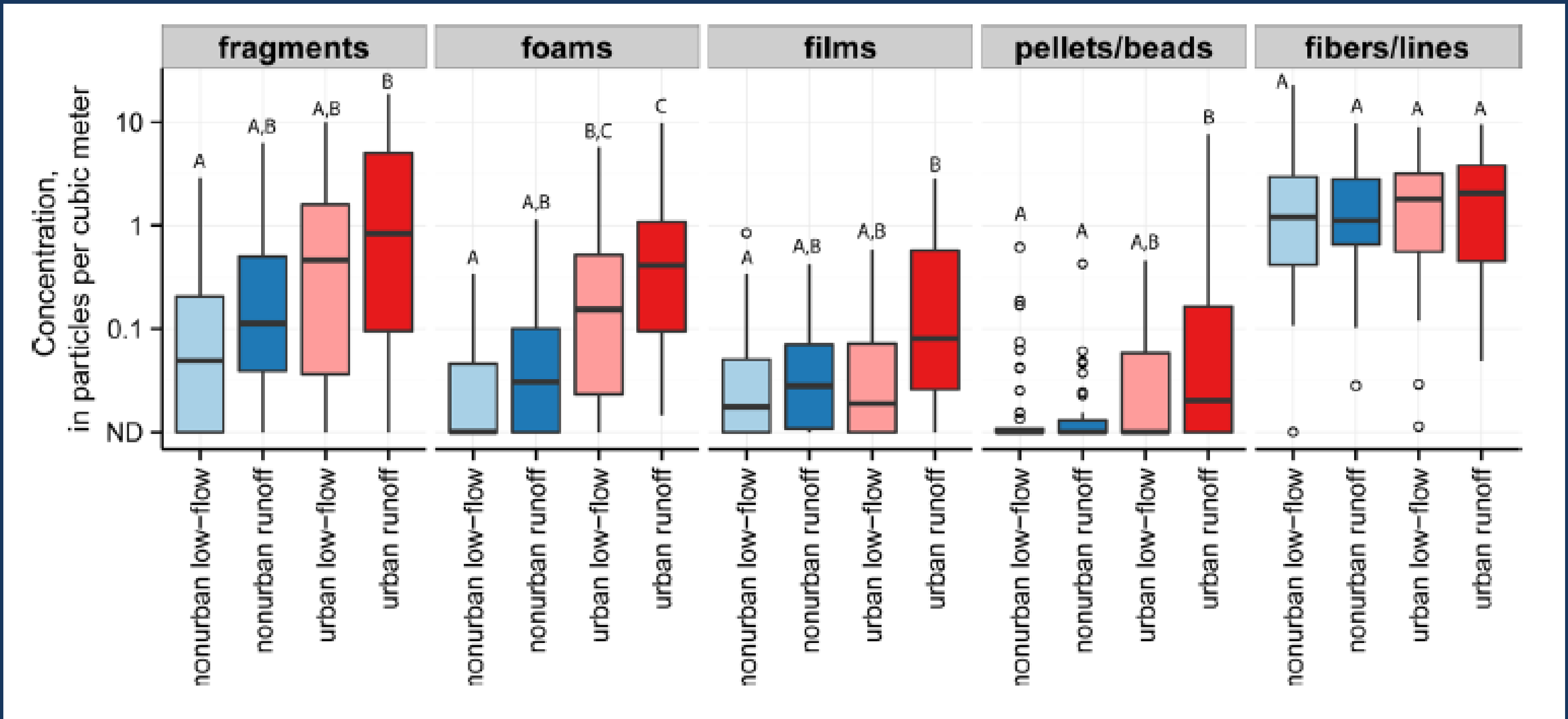
# Great Lakes study

## 29 tributaries




*Baldwin and others, 2016, ES&T, v. 50, p. 10377–10385*

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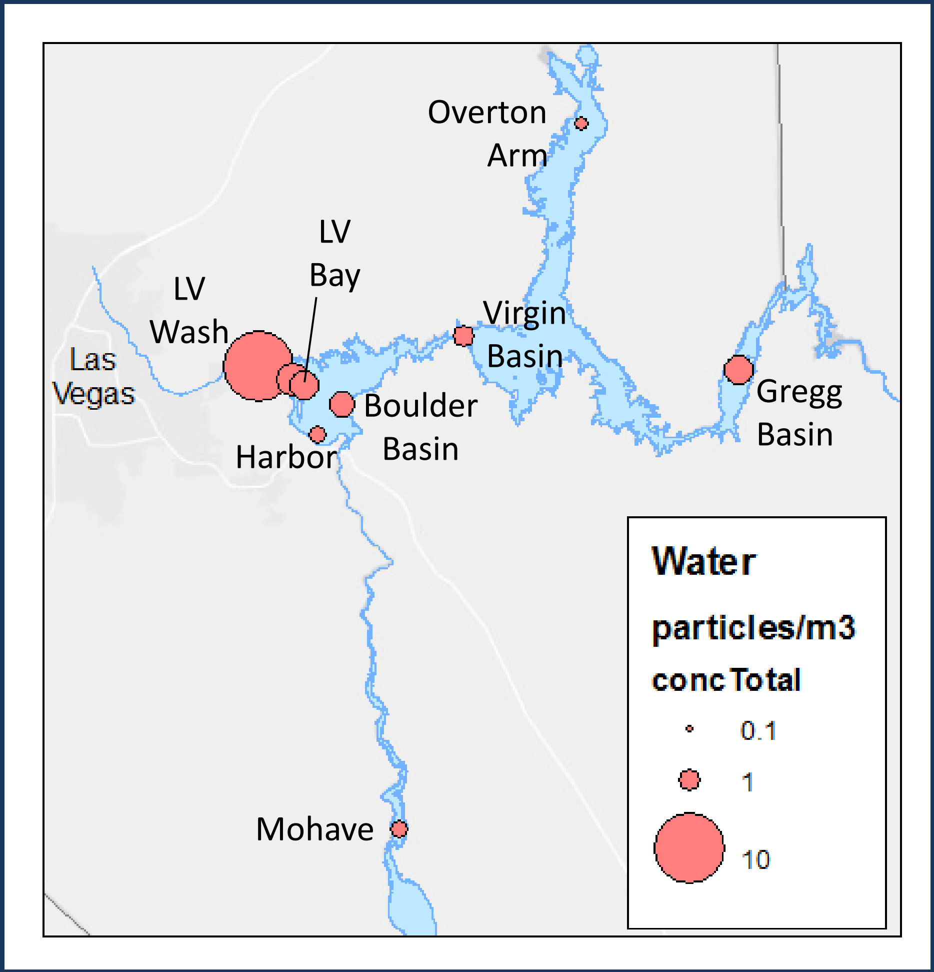
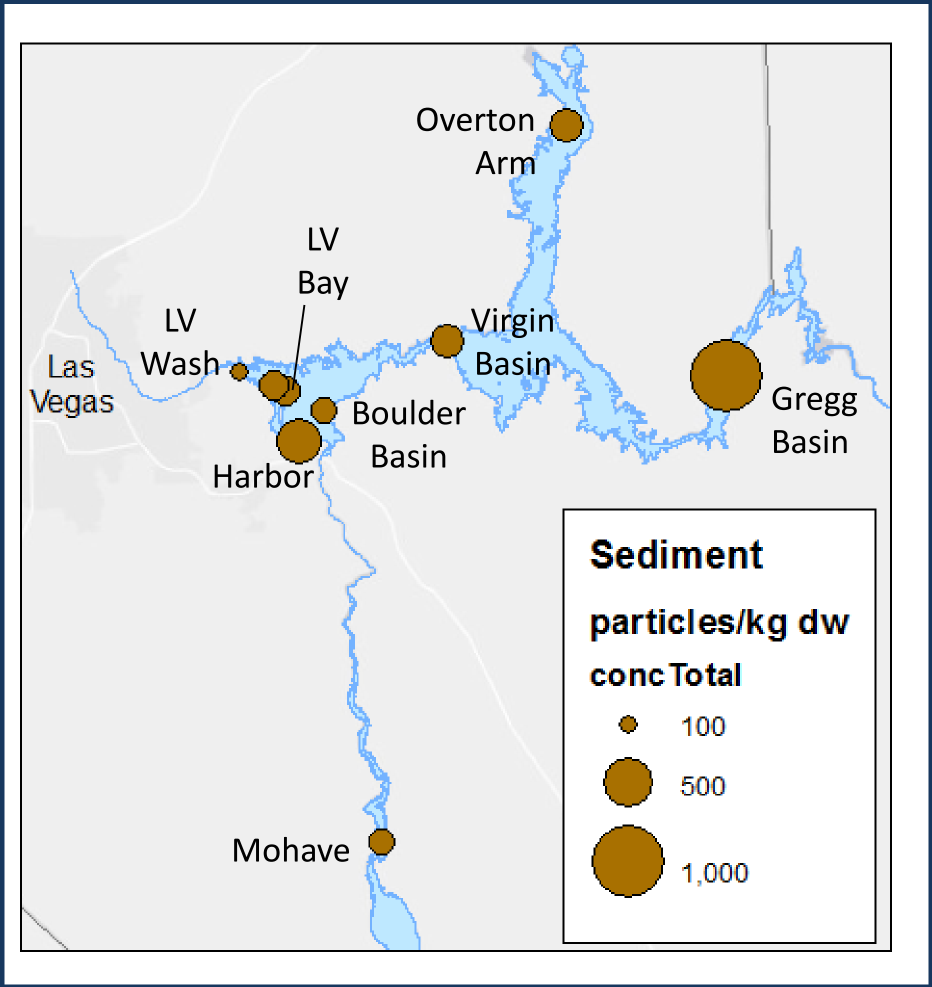
# Lake Mead, Nevada

*Austin Baldwin, Andrew Spanjer, Michael Rosen – USGS*
*Theresa Thom – NPS*

water



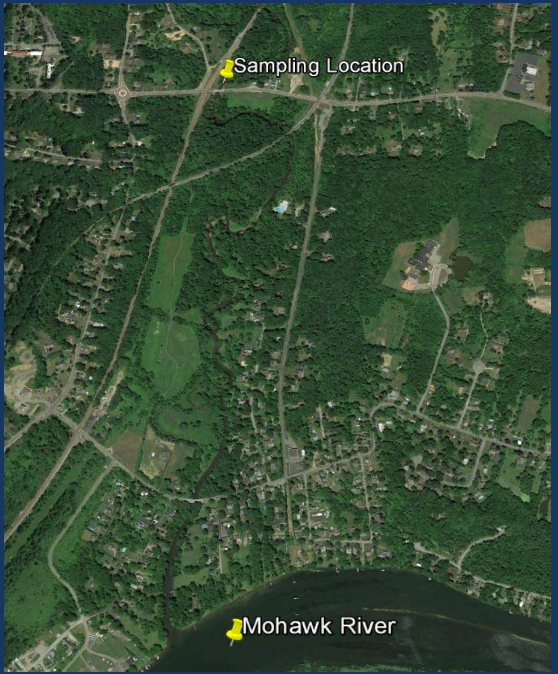

sediment



# Alplaus Kill, New York

## Mohawk River basin

*Michael Antidormi - USGS*




### Objectives

- Collaborate with a Union College study of microplastics in Mohawk River tributaries
- Collect high-frequency (every 2 weeks) data for a tributary to the Mohawk River throughout 2019
- Continue to expand sampling to monitor microplastics in New York's freshwater ecosystems

*In cooperation with:*

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

UNION COLLEGE FOUNDED 1795

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# Chesapeake Bay

**Marine Debris Program** OFFICE OF RESPONSE AND RESTORATION

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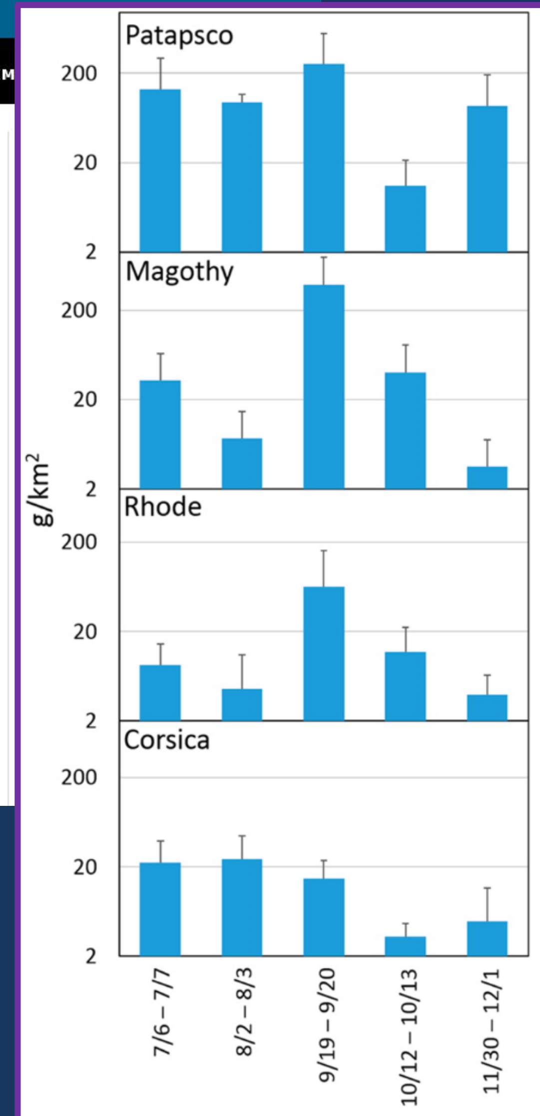
Home › Current Efforts › Research › Analysis of Microplastics in Chesapeake Bay and Coastal Mid-Atlantic Water Samples

## 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
- 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, p. 14195-14202*

# REGIONAL ASSESSMENT

## *WITH FOCUS ON THE CHESAPEAKE BAY WATERSHED*

# Study objectives

- Assess a variety of urban streams for microplastics under storm and non-storm conditions

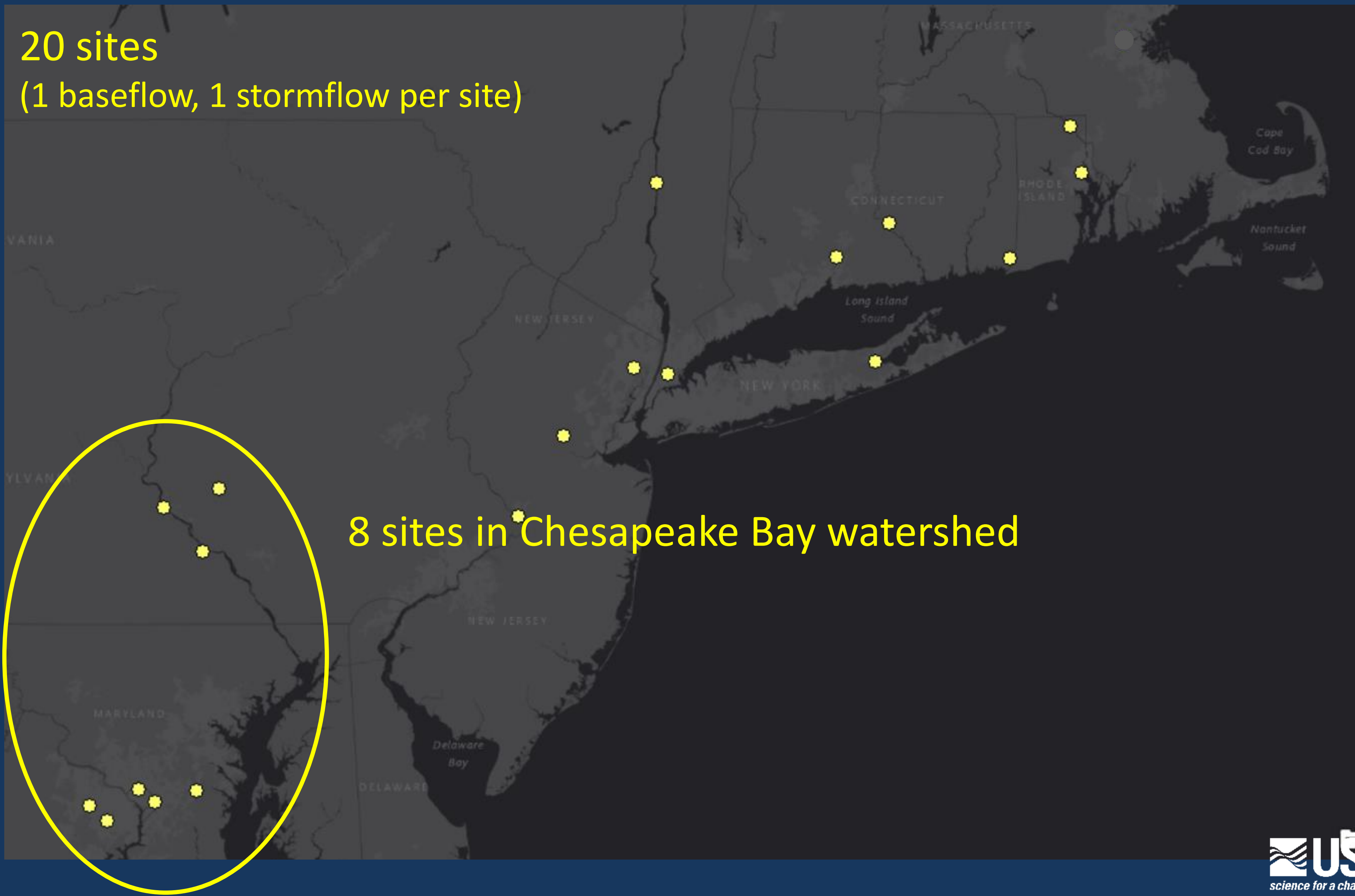
- Leverage existing projects collecting water-quality data

- Develop broader USGS capabilities within the Northeast Region for microplastics assessment

- Engage local cooperators and stakeholders by sharing results and providing context

# Microplastics in the urban environment—Northeast Region

2017-18

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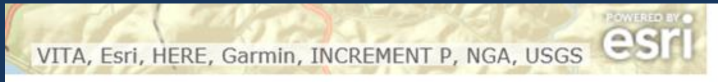
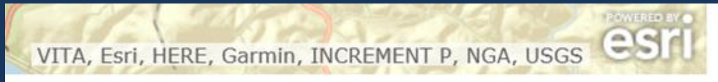
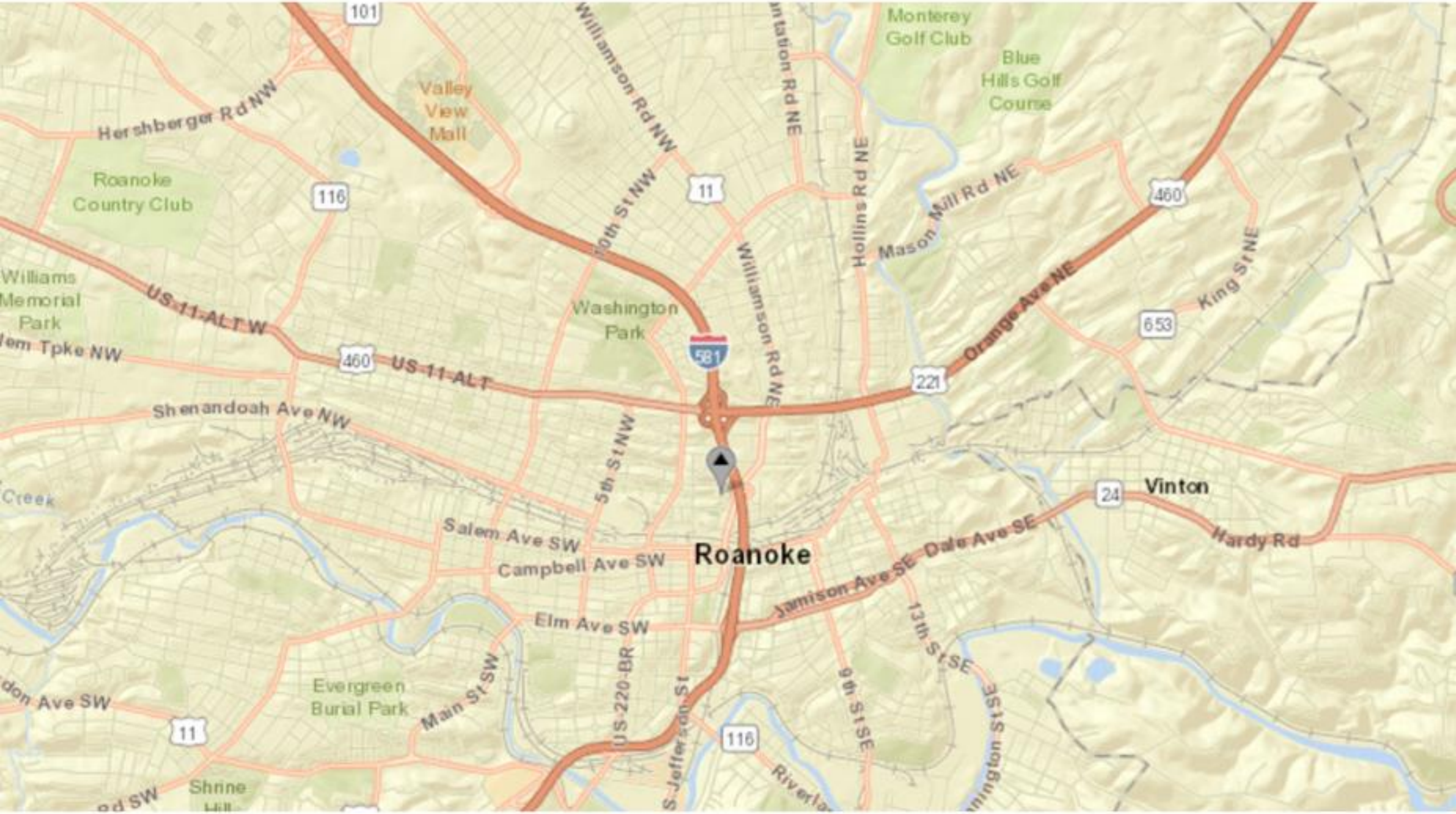
# Susquehanna River, PA

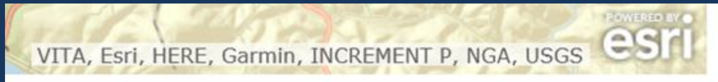
# Rock Creek, DC

# Lick Run, VA

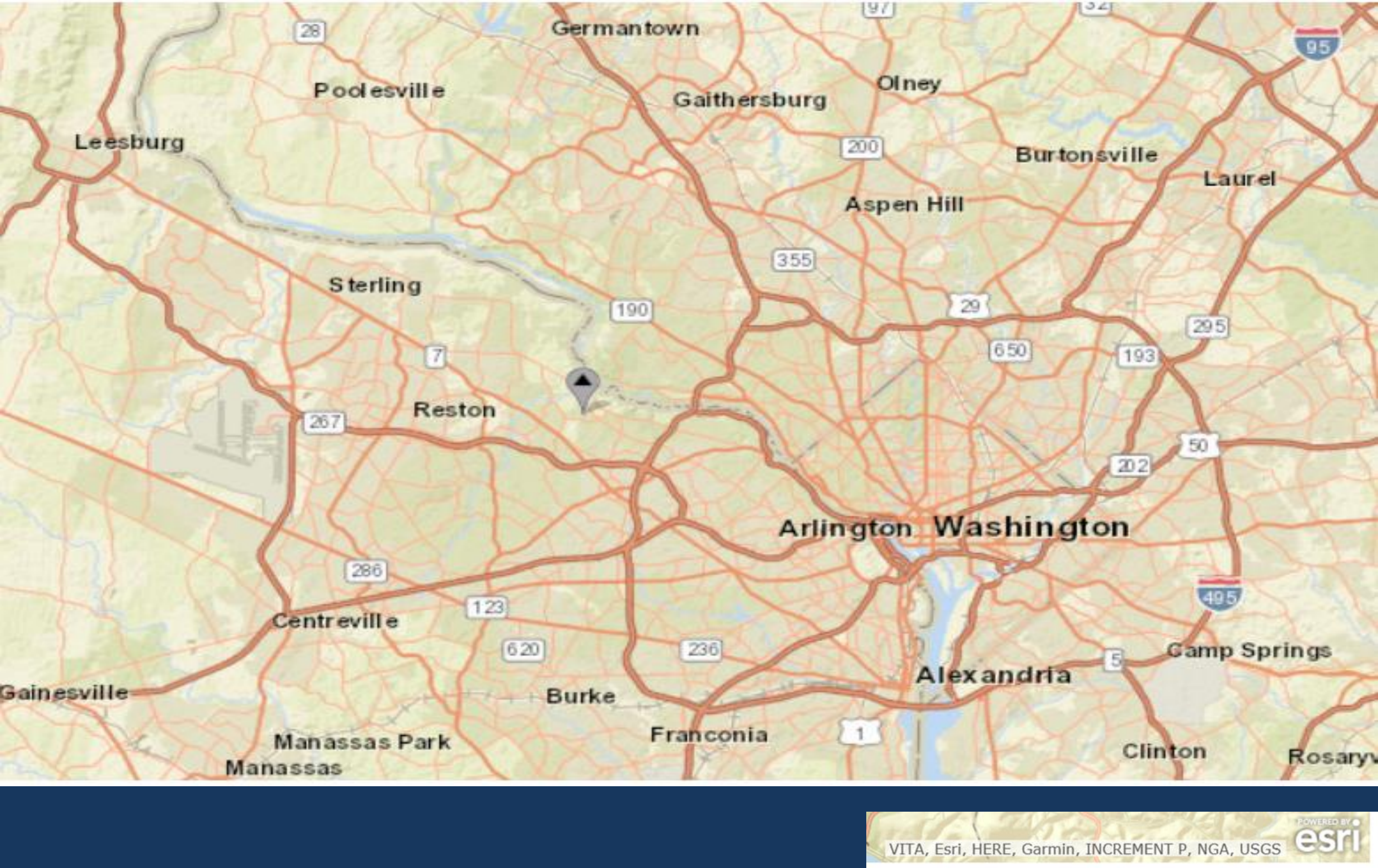


Hershberger Rd NW
Roanoke Country Club
Valley View Mall
Williamson Rd NW
Monterey Golf Club
Blue Hills Golf Course
Plantation Rd NE
Hollins Rd NE
Mason Mill Rd NE
10th St NW
Williamson Rd NE
Williams Memorial Park
US-11-ALT W
Salem Tpke NW
US 11-ALT
Washington Park
Orange Ave NE
King St NE
Shenandoah Ave NW
5th St NW
Creek
Salem Ave SW
Campbell Ave SW
Roanoke
Vinton
Hardy Rd
Dale Ave SE
Jamison Ave SE
13th St SE
Elm Ave SW
Evergreen Burial Park
Main St SW
US-220-BR
S Jefferson St
9th St SE
Washington St SE
Riverland
Shrine Hill
101
116
11
460
581
221
653
24

VITA, Esri, HERE, Garmin, INCREMENT P, NGA, USGS

# Difficult Run, VA



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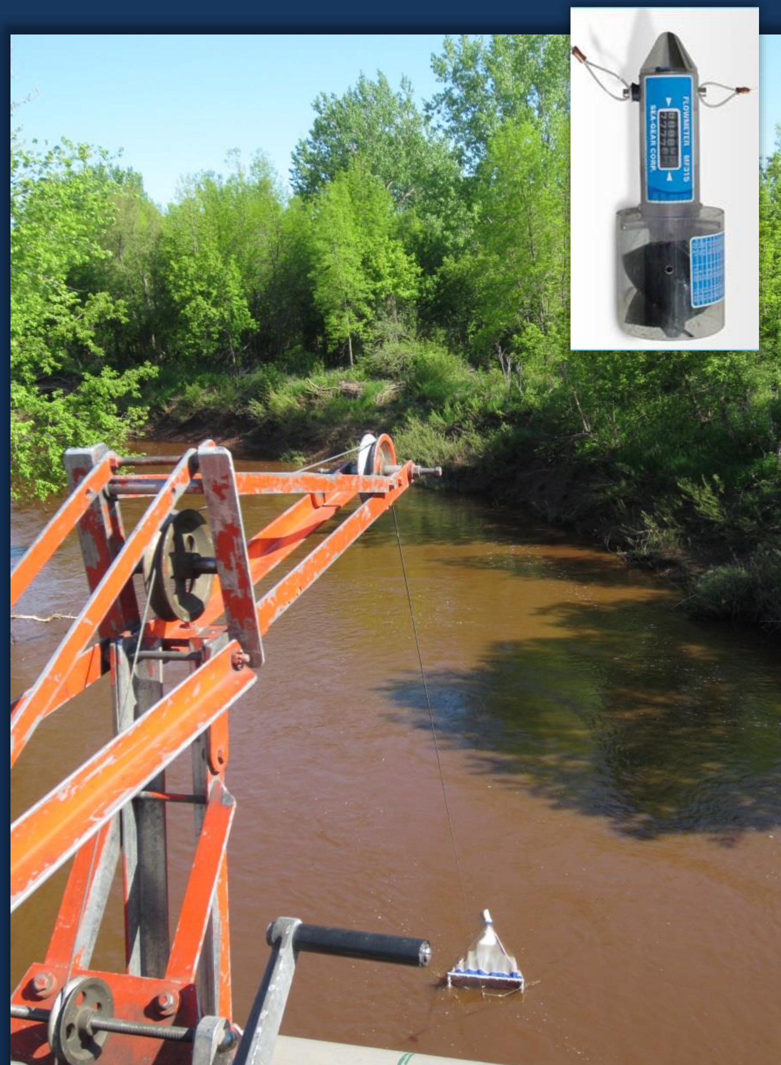
# Sample collection



*Images provided by Austin Baldwin, USGS IDWSC*

# Sample processing

*Images provided by Austin Baldwin, USGS IDWSC*

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# Samples for analysis

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*Images provided by Austin Baldwin, USGS IDWSC*

# Analytical Methods

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

Sieved into two size classes:

- 0.355-0.999 mm
- 1.00-5.60 mm

Digestion of organic matter using wet peroxide oxidation

Floatation in salt water to separate plastic particles

*Photos courtesy of Tim Hoellein*

# Particles counted & categorized using light microscope

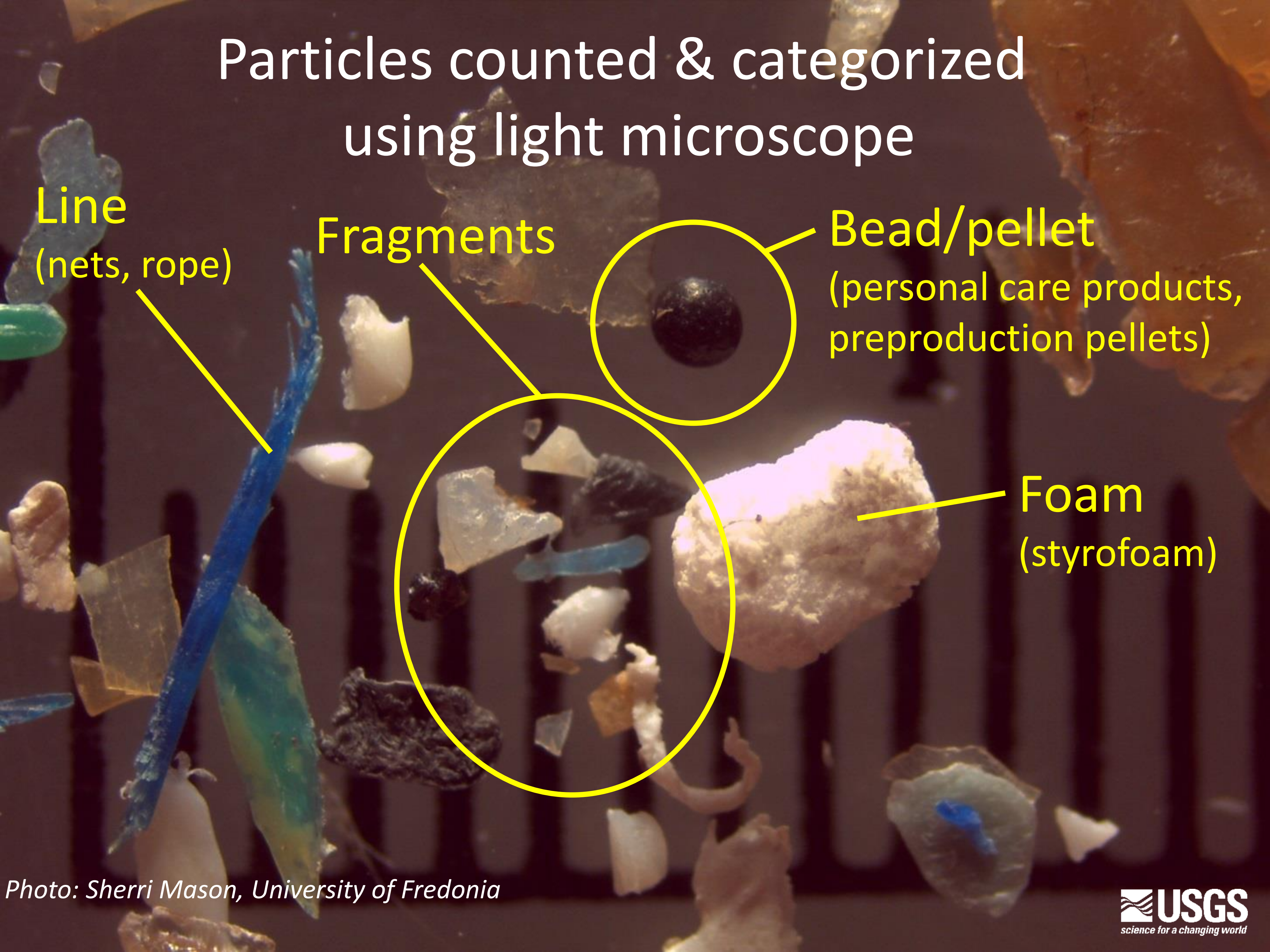
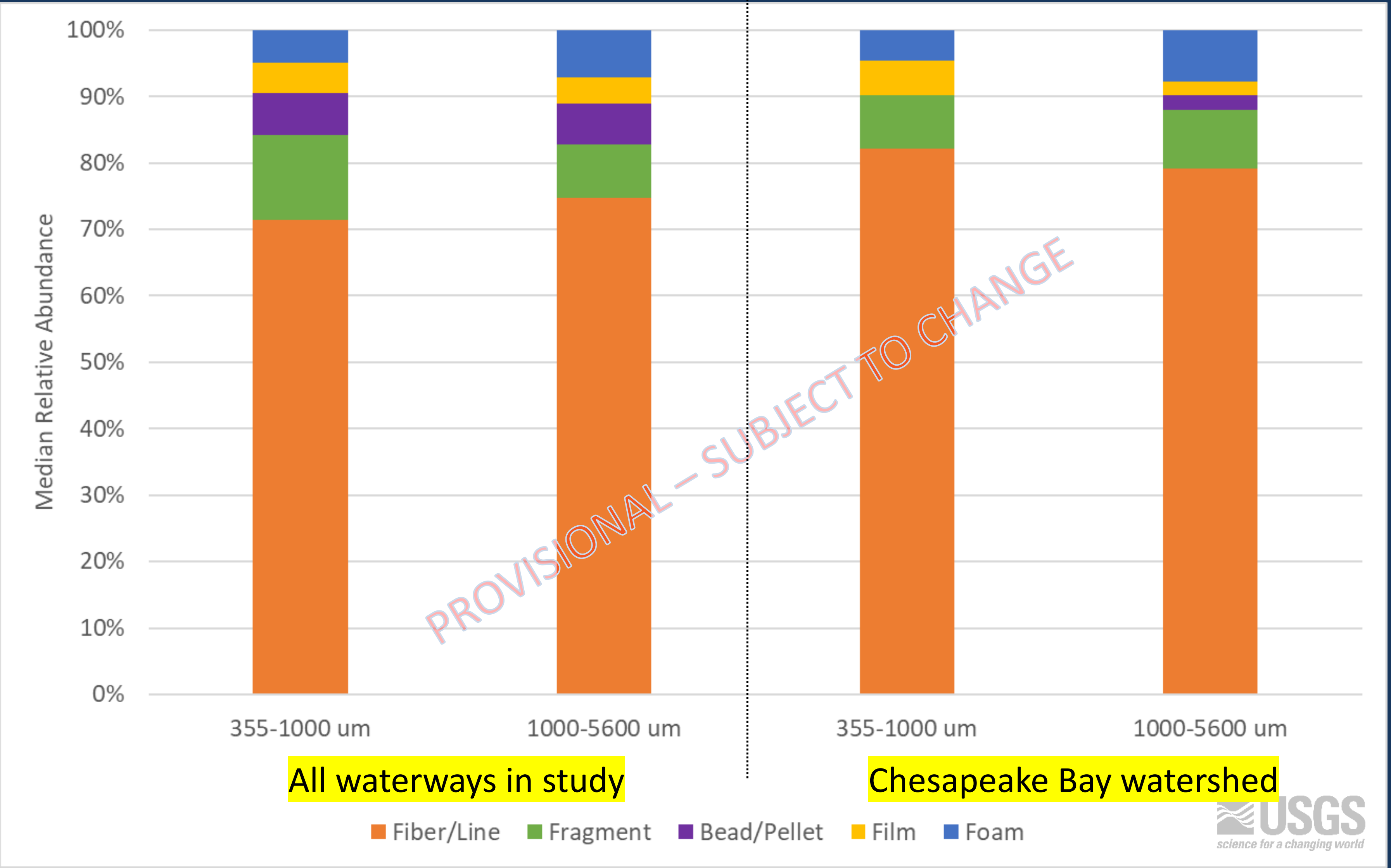



*Photo: Sherri Mason, University of Fredonia*

# Relative Abundance

## by size

2017-18 data



# Relative Abundance

## by site; condition (355-5600 µm)

2017-18 data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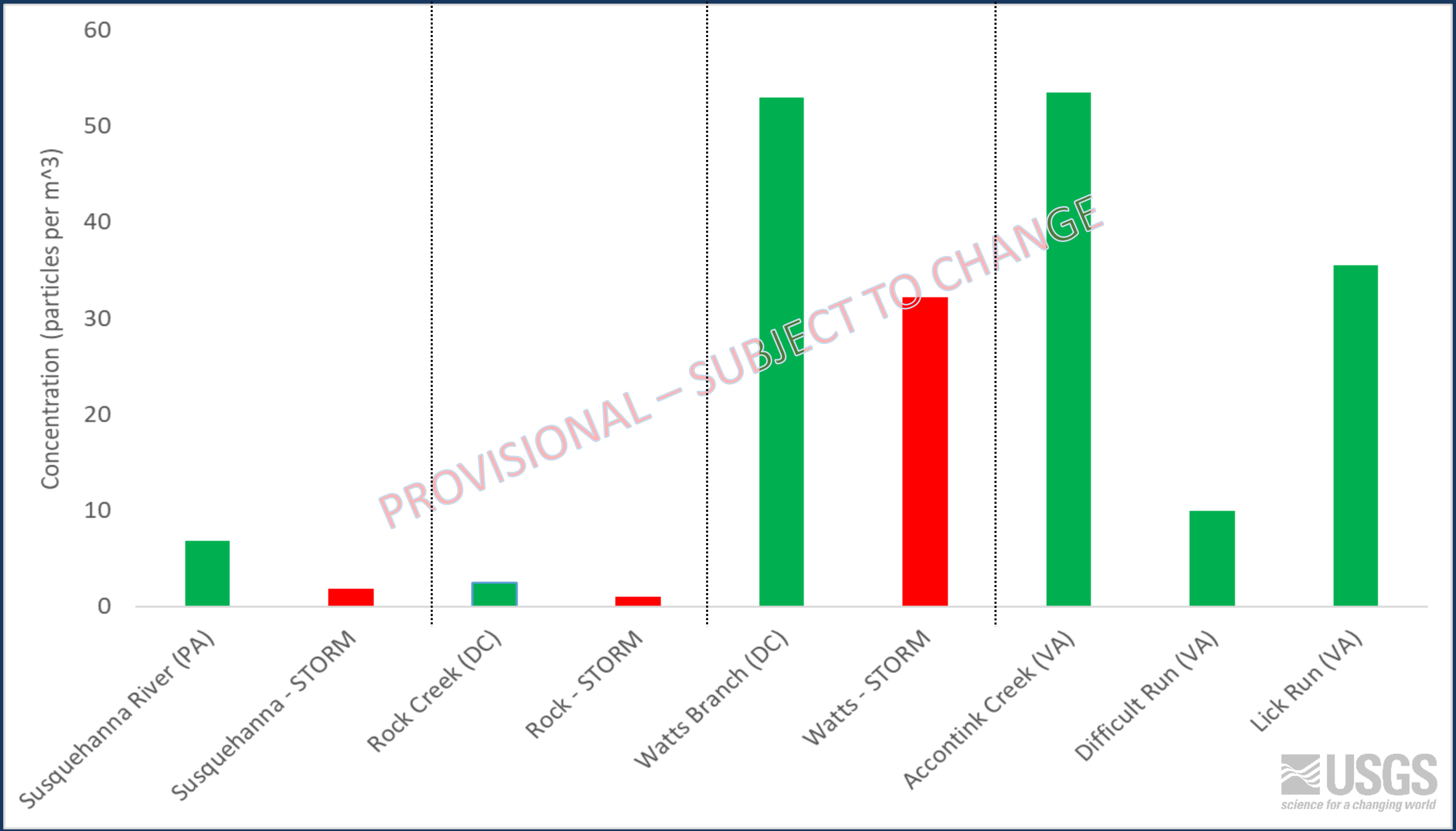
# Concentration

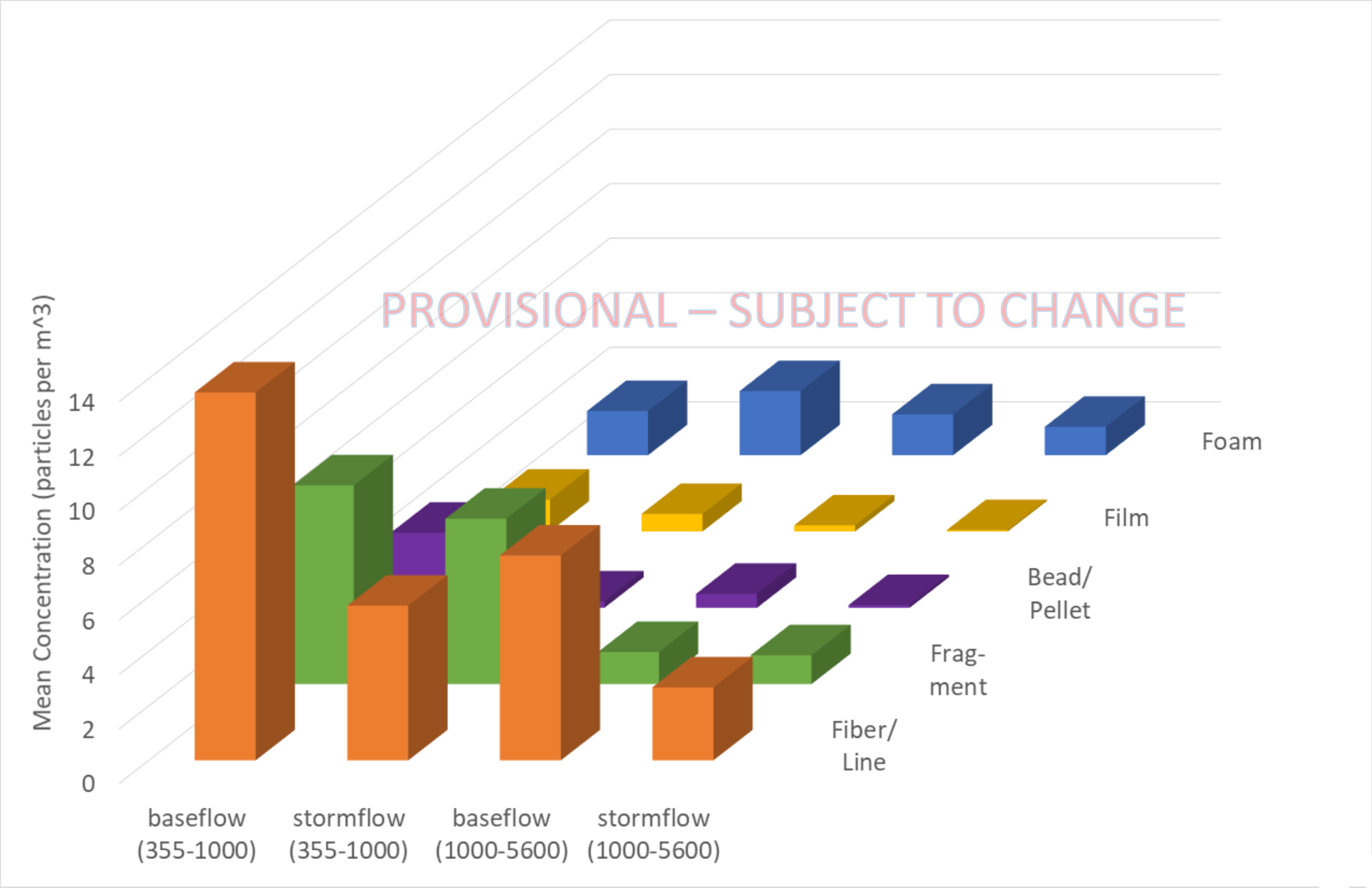
## by site; condition

2017-18 data



# Average Concentration
## by condition; size

2017-18 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?

Shawn Fisher – NY WSC – *Northeast Regional study* – scfisher@usgs.gov

<u>Local contacts</u>
Chuck Walker – MD-DE-DC WSC – cwwalker@usgs.gov
John Jastram – VA-WV WSC – jdjastra@usgs.gov

<u>National contacts</u>
Austin Baldwin – ID WSC – *National Park Service study* – akbaldwi@usgs.gov
Andrew Spanjer – WA WSC – *USGS Microplastics laboratory* – aspanjer@usgs.gov

**USGS Visual Lab – Microplastics – *https://owi.usgs.gov/vizlab/microplastics/***

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