Results from the Chesapeake Bay Program Scientific & Technical Advisory Committee Workshop on Microplastics in the Chesapeake Bay and its Watershed

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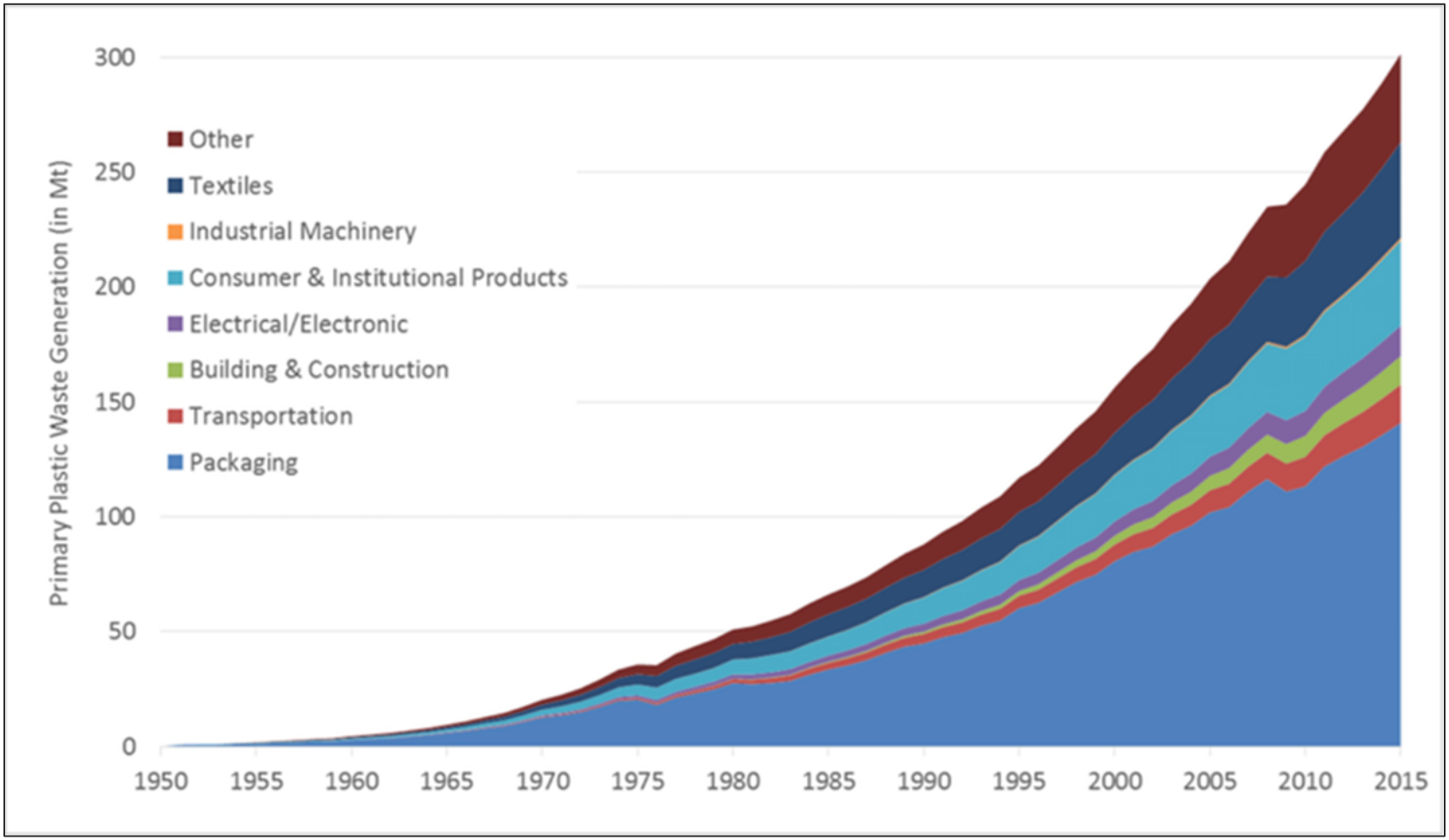
WE ARE WASHINGTON DC GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

SAV Workgroup
Chesapeake Bay Program

Plastics are a Global Problem



J. Geyer in Science Advances. 2017

Anacostia River Trash TMDL

- Established in 2010 and shared with DC and Maryland
- Assigns loads to local MS4, Combined Sewer Systems, and Non-Point Source (illegal dumping).
- District's total annual reduction obligation = 217,048 lbs
- Addresses trash ≥ 1 inch in length or diameter

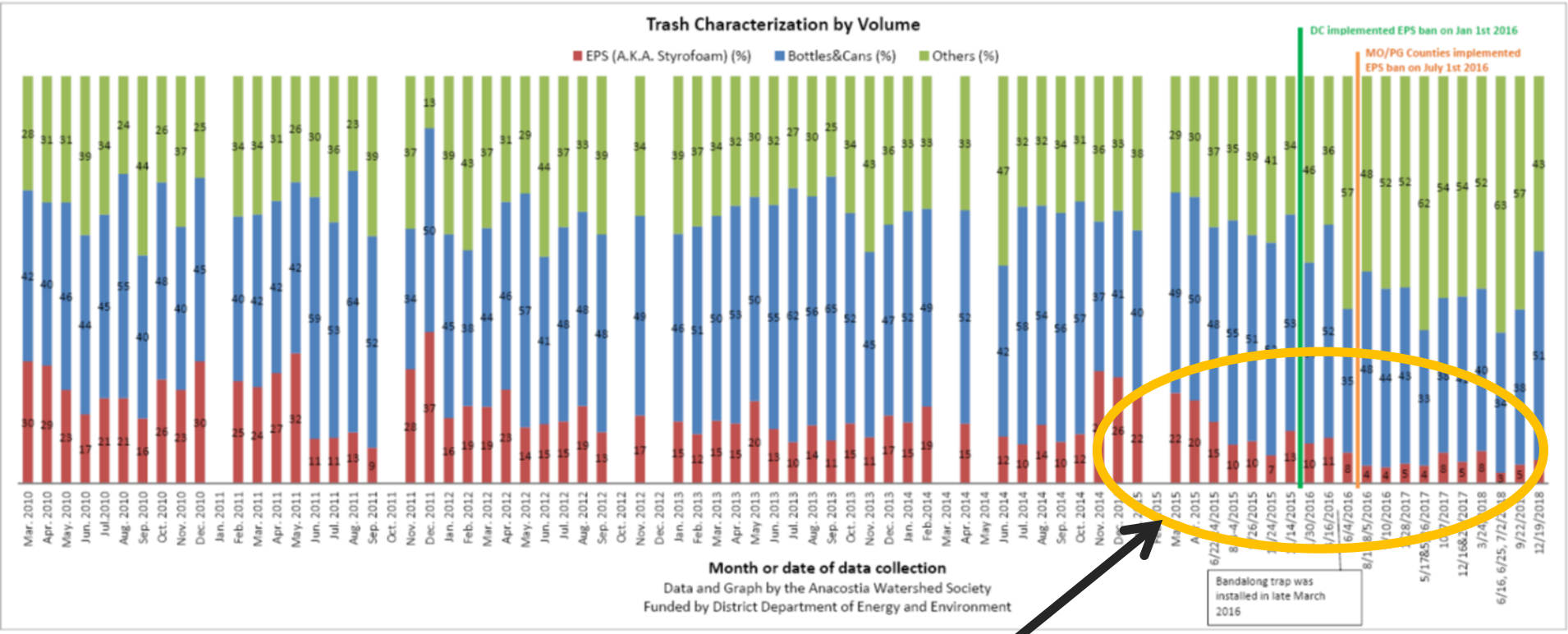
Implementation of the TMDL

- Use a variety of structural and non-structural controls

- Examples of Structural Controls:
  - Trash Traps
  - Skimmer Boats

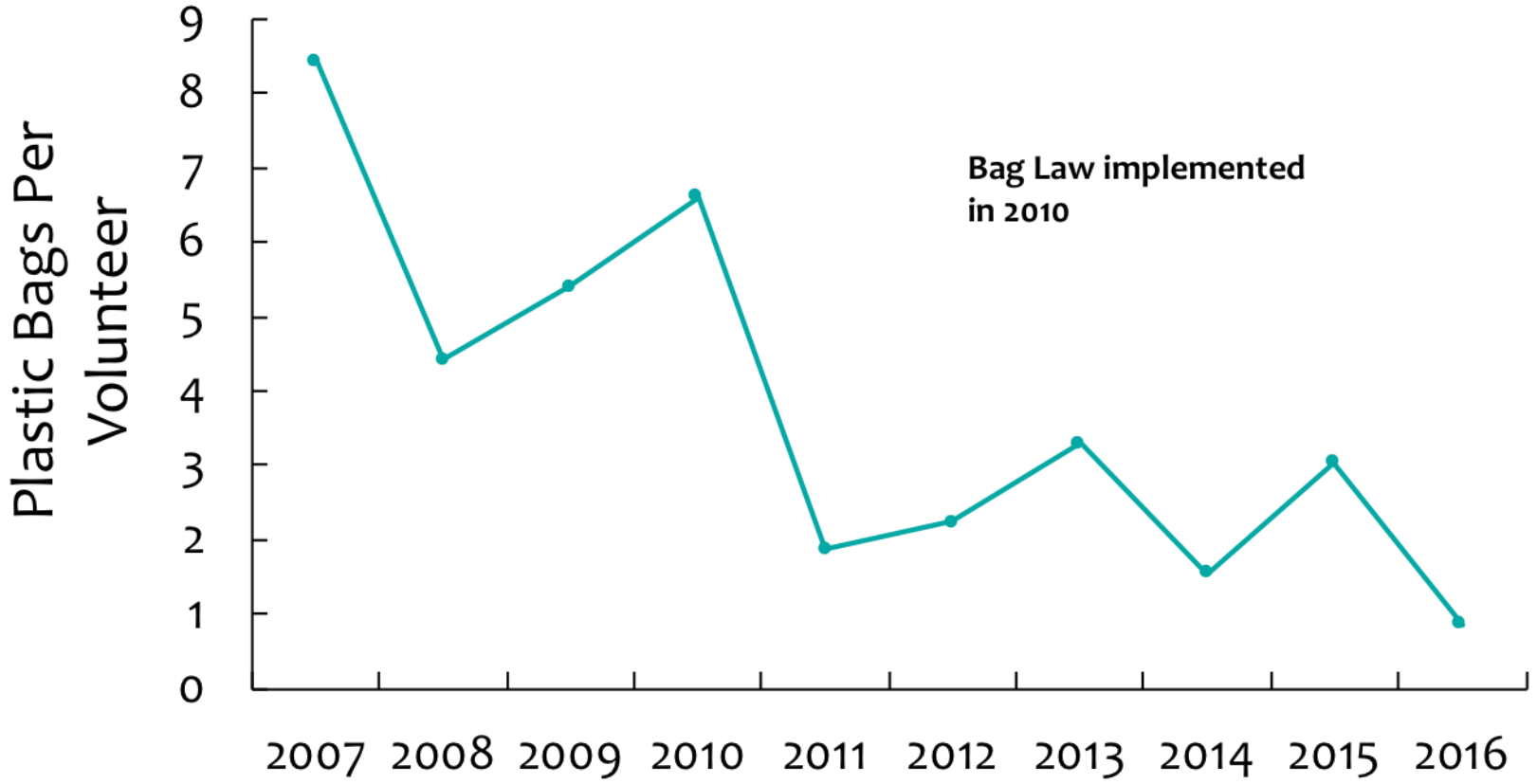
- Examples of non-structural controls:
  - Innovative Policies (e.g. Bag Law)
  - Enforcement
  - Clean Teams
  - Trash Free Potomac Watershed Anti-Littering Campaign
  - Street sweeping environmental hotspots

Evidence of Progress – Nash Run Trash Trap



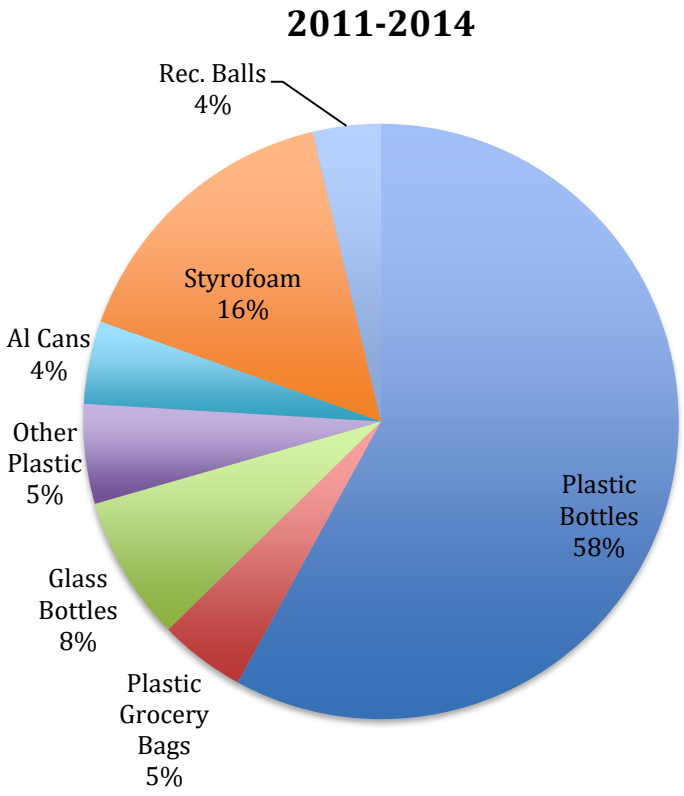
Evidence of declining trend in volume of foam found in Nash Run Trash Trap

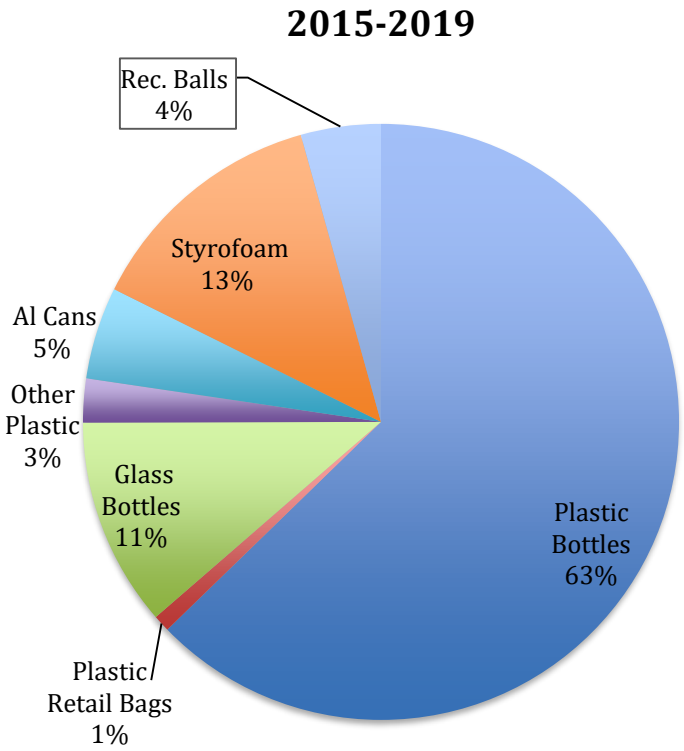
EVIDENCE OF PROGRESS



Number of plastic retail bags seen per volunteer at trash cleanups in DC since before and after passage of the Bag Law – Data courtesy of Alice Ferguson Foundation, 2017

EVIDENCE OF PROGRESS





Anacostia Riverkeeper observed decrease in total weight of foam and plastic bags during two grant periods: 2011-2014 and 2015-2019

What about the small stuff?
Evidence of Microplastics in the Anacostia River

Photos by Masaya Maeda, Anacostia Watershed Society, 2017

Microplastics

Small plastic fragments, fibers, and granules

How small? Usage of the term "microplastic" in the literature varies from 0.1 um to 10mm – a size range of five orders of magnitude!

- **Primary Microplastics** – manufactured products used in:
  -Facial cleansers and cosmetics (microbeads)
  -As vectors for drugs
  -As air-blasting media for removing rust (often contaminated with heavy metals, e.g. cadmium, chromium, lead)
  -Virgin plastic production pellets – Pellets are convenient to ship and are eventually melted down and molded into manufactured products

- **Secondary Microplastics** – pieces that have broken off larger plastic objects through physical, biological, or chemical processes

Why Do We Care about Plastics and Microplastics in Chesapeake Bay?

In March 2019, Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) estimated 95% of all seabird species will ingest some form of plastic by 2050

World Economic Forum projects more plastic in the ocean than fish by 2050

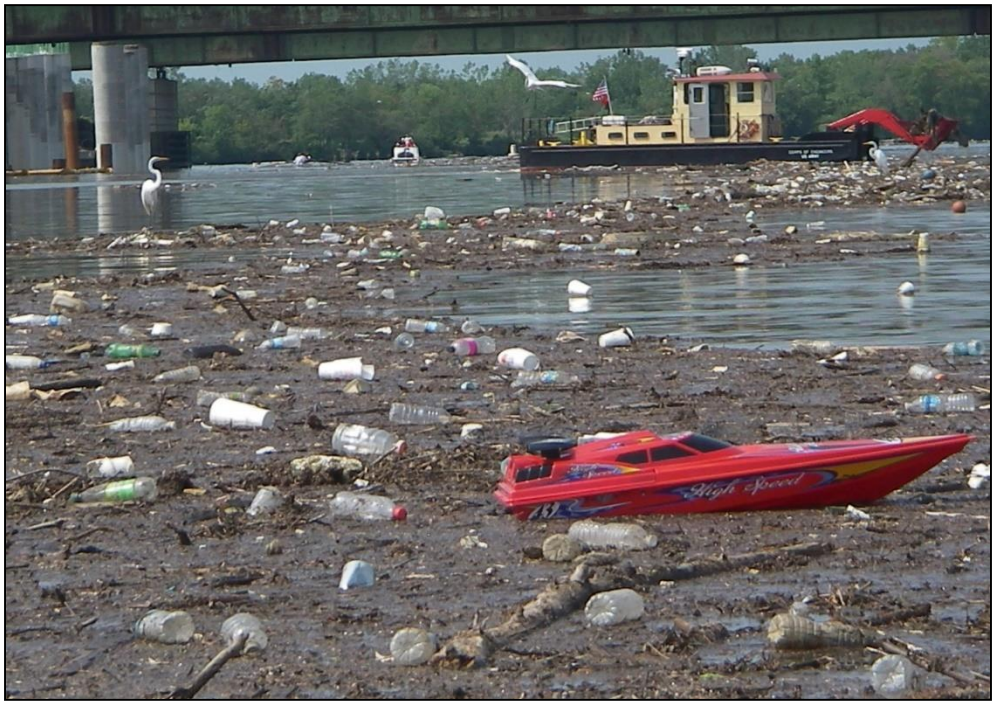
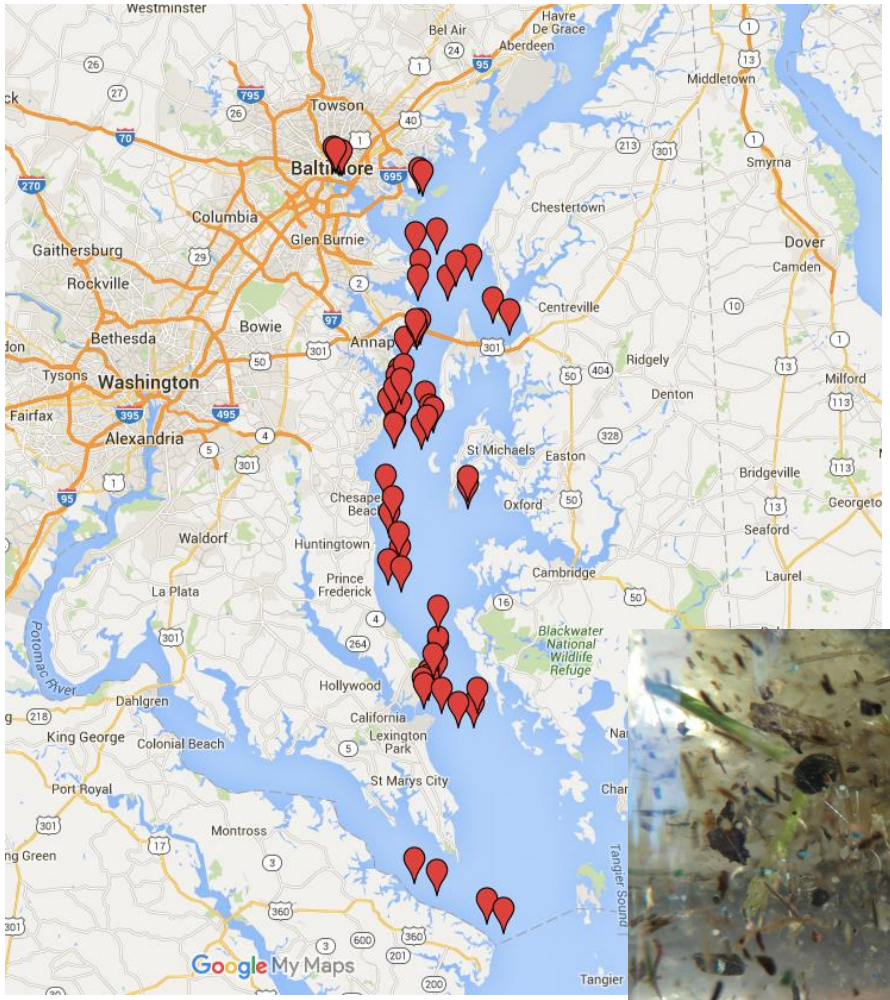
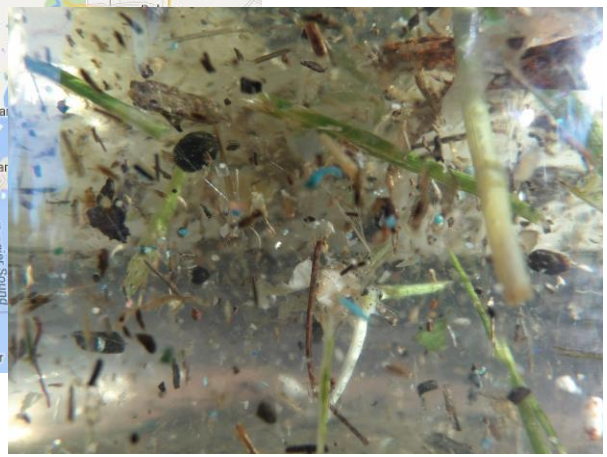


Photo by Masaya Maeda, Anacostia Watershed Society

Evidence of Microplastics in Chesapeake Bay



- 2014-2015 Bay Trash Trawl conducted by Trash Free Maryland surveyed 30 sites for microplastics in the Chesapeake Bay mainstem and tidal tributaries.
- 100% of samples contained microplastics.
- Highest concentrations found in urban and suburban tributaries.



Photos courtesy of Julie Lawson and Trash Free Maryland, 2015

- 2000% increase in SAV in DC between 2009 and 2017
- Surpassed Chesapeake Bay Program goals for SAV restoration
- SAV also habitat for larvae of DC state fish, American Shad (*A. sapidissima*)
- Question: could SAV beds be capturing microplastics?

Study of Microplastics in SAV Beds in DC

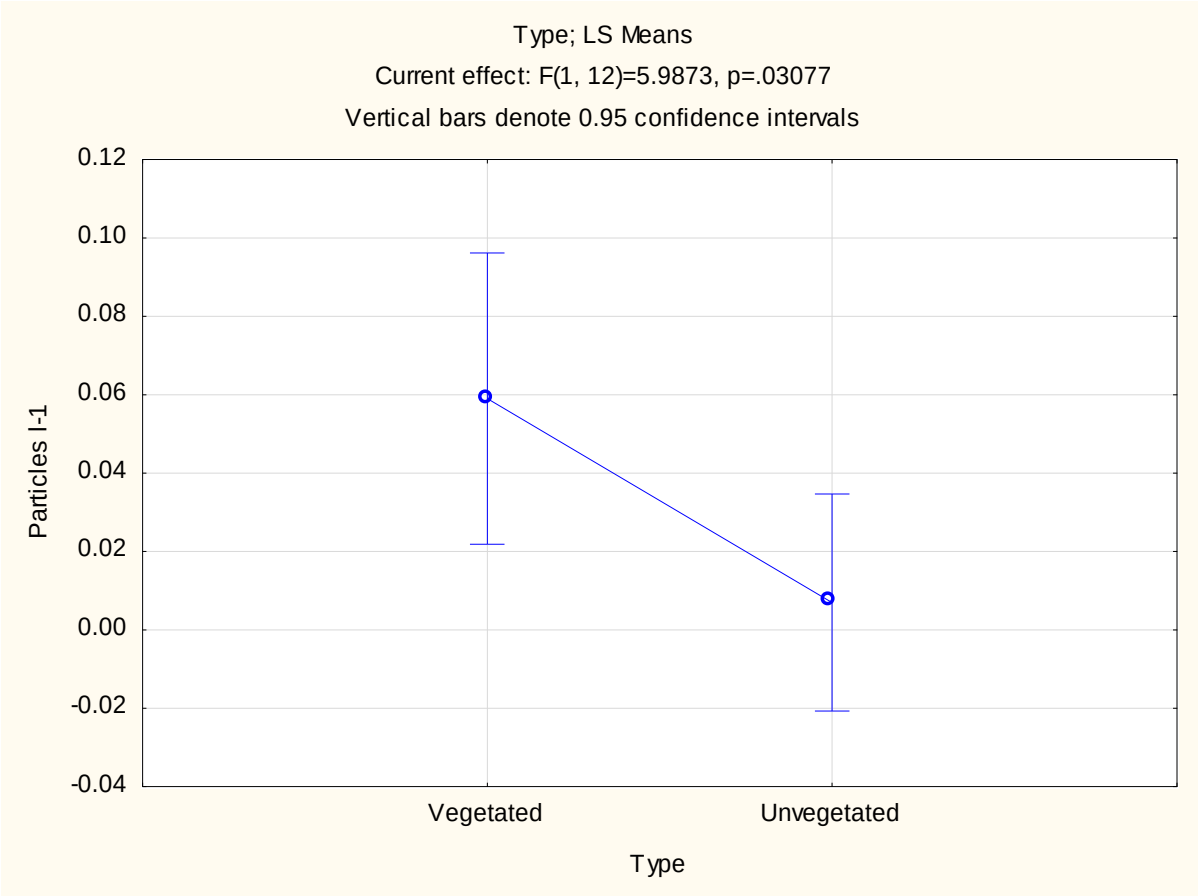
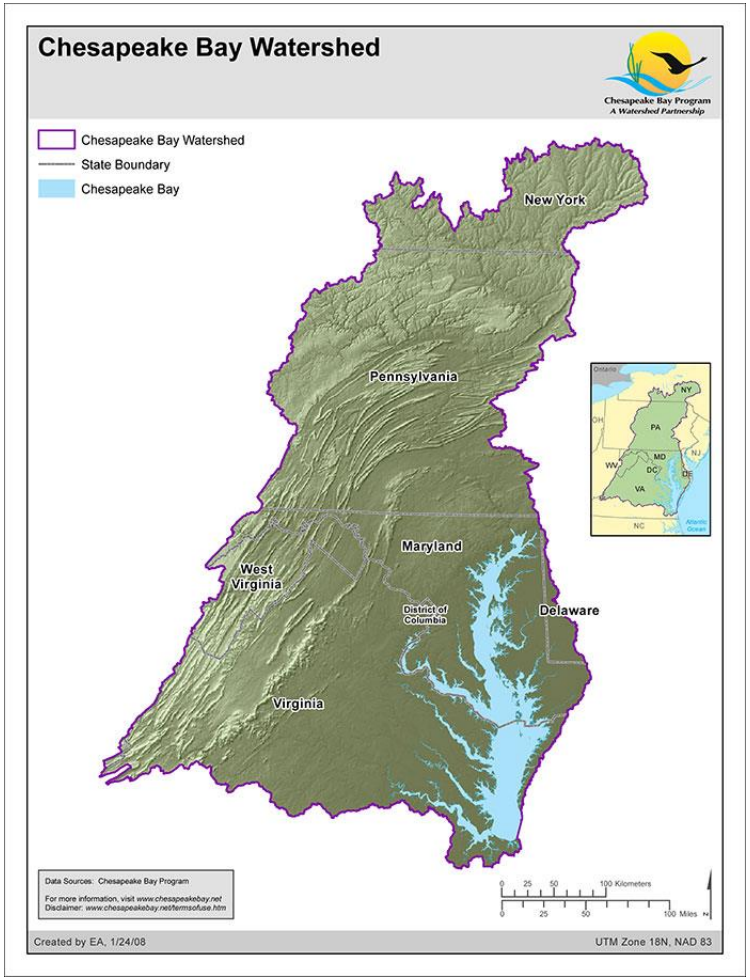


Figure 1 – Mean microplastic particle concentration (#of particles/volume of sample) in vegetated beds vs. unvegetated beds (n=14, 5 vegetated, 9 unvegetated)

Bringing the Issue to Light

- How can we bring more attention to this issue regionally?

- The CBP's SAV Workgroup applied for a Scientific & Technical Advisory Committee (STAC) funding to hold a workshop in 2019 about microplastics in the Bay and watershed



Workshop Goals

1. Assess the state of the knowledge on microplastic pollution in the Chesapeake Bay and its tributaries

2. Assess possible effects of microplastics on various habitats and associated living resources

3. Identify existing policy and management tools being used to address plastic pollution in the watershed and beyond, and their effectiveness

4. Identify research gaps moving forward, and develop recommendations for future studies or new tools

Workshop Format

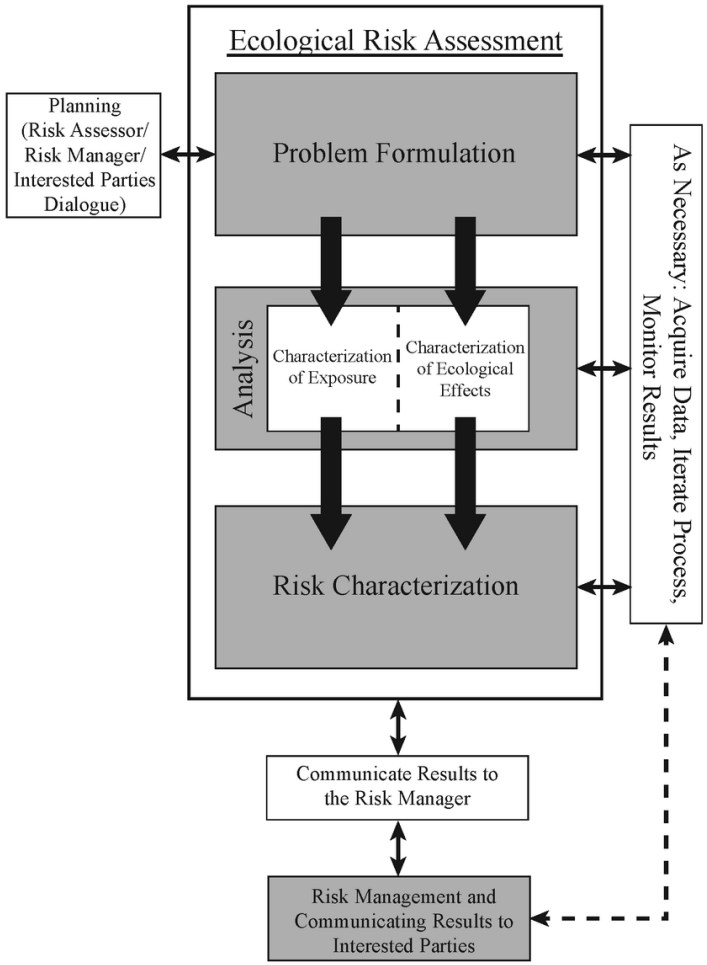
Steering committee decided early on that the workshop should be formatted around conducting an **ecological risk assessment (ERA)**

The Ecological Risk Framework consists of the following components:

1. **Problem Formulation**: Determine assessment endpoints and measurement endpoints

2. **Risk Analysis**: Identify testable linkages between sources, stressors and assessment endpoints

3. **Risk Characterization**: What are the risk and effects? Ex. LC50 – Lethal concentration to kill 50% of a population



Highlights

- Yonkos et al. (2014) found microplastics in 59 out of 60 samples in four tidal tributaries to the upper Chesapeake Bay. Concentrations highly correlated with urban/suburban landuse.

- USGS has found microplastics in every sample taken at five non-tidal stations in the Chesapeake Bay watershed (Fisher, 2019).

- In 2018, 95% of smallmouth bass (*M. dolomieu*) sampled in the central Susquehanna River had microplastics in their guts (Parks, 2019).

- Brander (2019) found that juvenile Black Seabass (*Centropristis striata*) fed with fish fed with pre-cleaned microplastics displayed increased oxygen consumption. Juveniles exposed to microfibers in the water column displayed increased oxygen consumption.

- Knauss (2019) found that Eastern Oyster (*C. virginica*) larvae that ingested polystyrene microbeads displayed a significant increase in algal clearance and an increase in carbon –assimilation in a dose dependent manner.

Conclusions

- Studies have shown microplastics are fairly ubiquitous throughout the bay and its tributaries. They have been found in both tidal (Yonkos, 2014; Rochman, 2019) and non-tidal waters (Fisher, 2019).

- There is general agreement that plastics represent a widespread, but largely unquantified, threat to the Chesapeake Bay ecosystem.

- Need standardization of terminology

- There are a number of piecemeal efforts to monitor plastics in the Bay, but no systematic effort and no organized effort directed at micro- and nano-plastics.

- **The MOST URGENT need is to identify assessment endpoints that represent areas of environmental and human health concern and to characterize the severity of those risks.**

Recommendations

1. The CBP should create a cross-GIT Plastic Pollution Action Team to address the growing threat of plastic pollution to the bay and watershed.

2. The Scientific, Technical Assessment and Reporting Team should incorporate development of ERAs of microplastics into the CBP strategic science and research framework, and the Plastic Pollution Action Team should oversee the development of the ERAs focused on assessment of microplastic pollution on multiple living resource endpoints.

3. STAC should undertake a technical review of terminology used in microplastic research, specifically size classification and concentration units, and recommend uniform terminology for the CBP partnership to utilize in monitoring and studies focused on plastic pollution in the bay and watershed.

4. The CBP should develop a source reduction strategy to assess and address plastic pollution emanating from point sources, non-point sources, and human behavior.

5. The CBP should direct the Plastic Pollution Action Team and STAR Team to collaborate on utilizing the existing bay and watershed monitoring networks to monitor for microplastic pollution.

URGENT

Next Steps

- Brief the Principals' Staff Committee at an upcoming meeting*.

- Work with STAR on the creation of a Plastic Pollution Action Team which will initially focus on determining the scope of work for conducting a microplastics ecological risk assessment*.

*Subject to approval of November Management Board Meeting Summary.

Take-Aways for LGAC

- DC has agreed to be a champion on the Management Board for addressing this issue.

- We welcome the opportunity to discuss our successes and failures with other jurisdictions
  who are as equally concerned about plastic pollution.

- CAC was briefed at their recent meeting on Nov. 11th. Trash/Plastic Pollution is a priority for the group.

Special Thanks

Matt Robinson, DC DOEE, Workshop co-chair

Brooke Landry (MD DNR), CBP SAV Workgroup Chair and workshop sponsor.

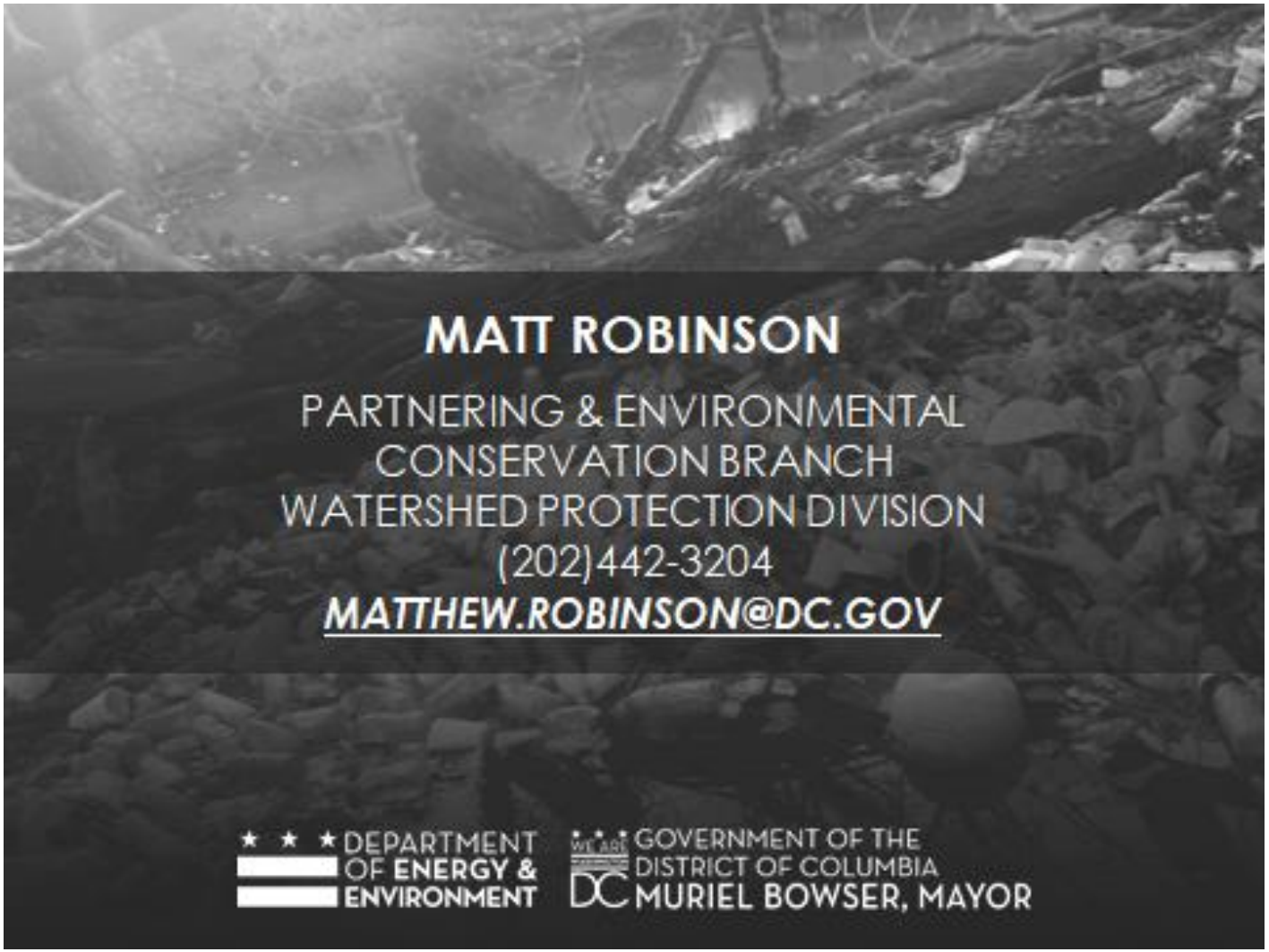
Rachel Dixon, former STAC Coordinator

Annabelle Harvey, STAC Coordinator

Our Host: Dann Sklarew, George Mason University Department of Environmental Science & Policy

Workshop Steering Committee:

- Mark Luckenbach, Virginia Institute of Marine Science
- Denice Wardrop, Penn State
- Lance Yonkos, University of Maryland
- Jason Rolfe, NOAA Marine Debris Program
- Kelly Somers, EPA Region III
- Greg Allen, EPA Chesapeake Bay Program Office
- Kim Grubert, MD DNR
- Phong Trieu, Metropolitan Washington Council of Governments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