



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

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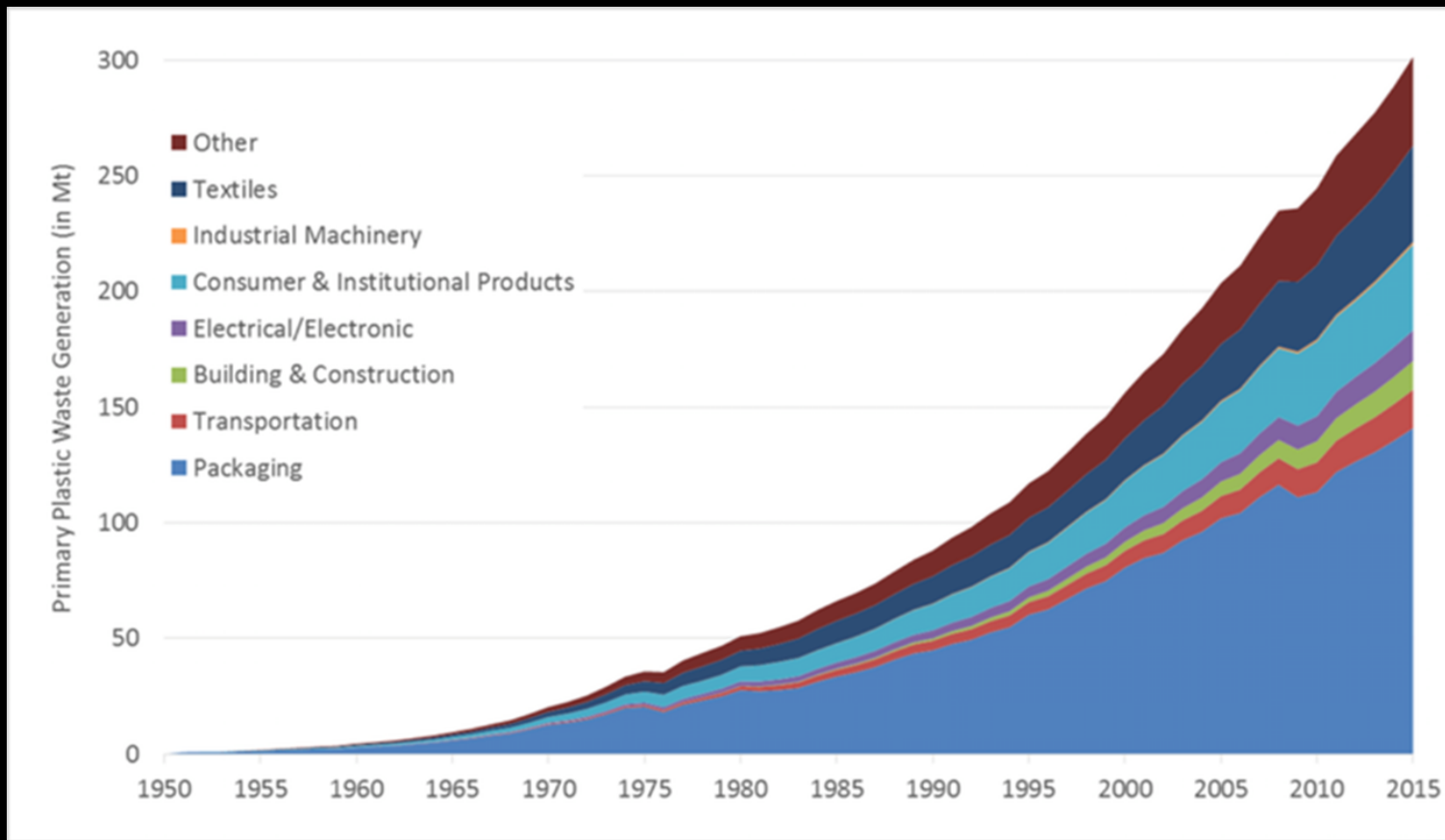
PARTNERING AND ENVIRONMENTAL
CONSERVATION BRANCH
WATERSHED PROTECTION DIVISION
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CHAIR, CBP's SAV WORKGROUP



Plastics are a Global Problem



J. Geyer in Science Advances. 2017

Microplastics



Small plastic fragments, fibers, and granules

How small? Usage of the term “microplastic” in the literature varies from 0.1 μm 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 Organisation (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 the Bay



Photos by Masaya Maeda, Anacostia Watershed Society, 2017

Where are those microplastics likely to accumulate?

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Logical
response:
SAV beds



Where are those Microplastics likely to accumulate?

- 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

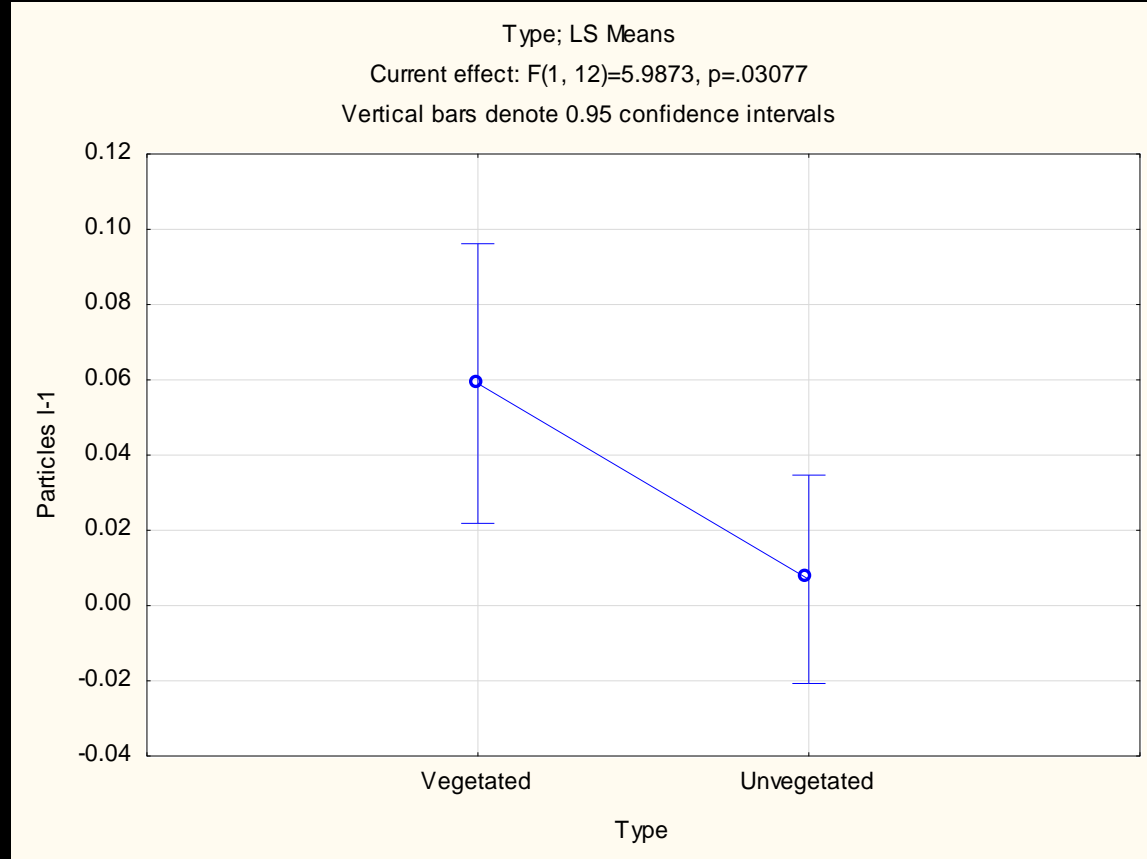
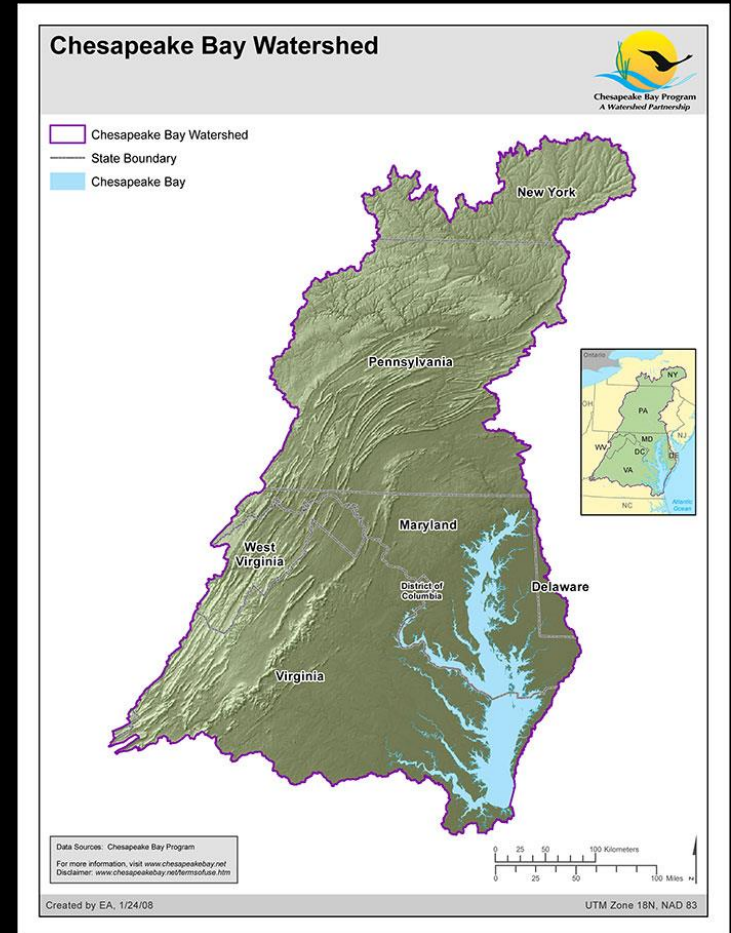


Figure 1 – Mean microplastic particle concentration (#of particles/volume of sample) in SAV beds vs. unvegetated bottom (n=14, 5 vegetated, 9 unvegetated)

Bringing the Issue to Light

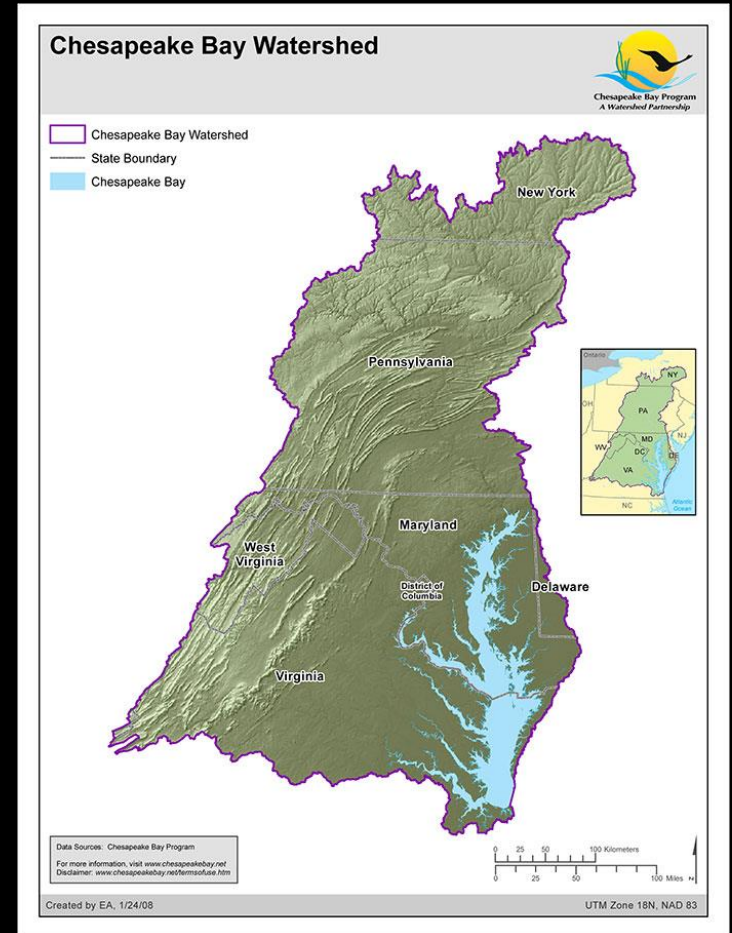
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Bringing the Issue to Light

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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



Scientific & Technical Advisory Committee Workshop



Chesapeake Bay Program's

Scientific and Technical Advisory Committee

“Microplastics in the Chesapeake Bay: State of the Knowledge, Data Gaps, and Relationship to Management”

- SAV Workgroup Sponsored
 - ❖ Brooke Landry (MD DNR, SAV WG Chair)
 - ❖ Bob Murphy (TetraTech, SAV Workgroup; Workshop Co-Chair)
 - ❖ Matt Robinson (DC DOEE, SAV Workgroup; Workshop Co-Chair)
- **Emerging Issues of Concern**

Workshop Goals

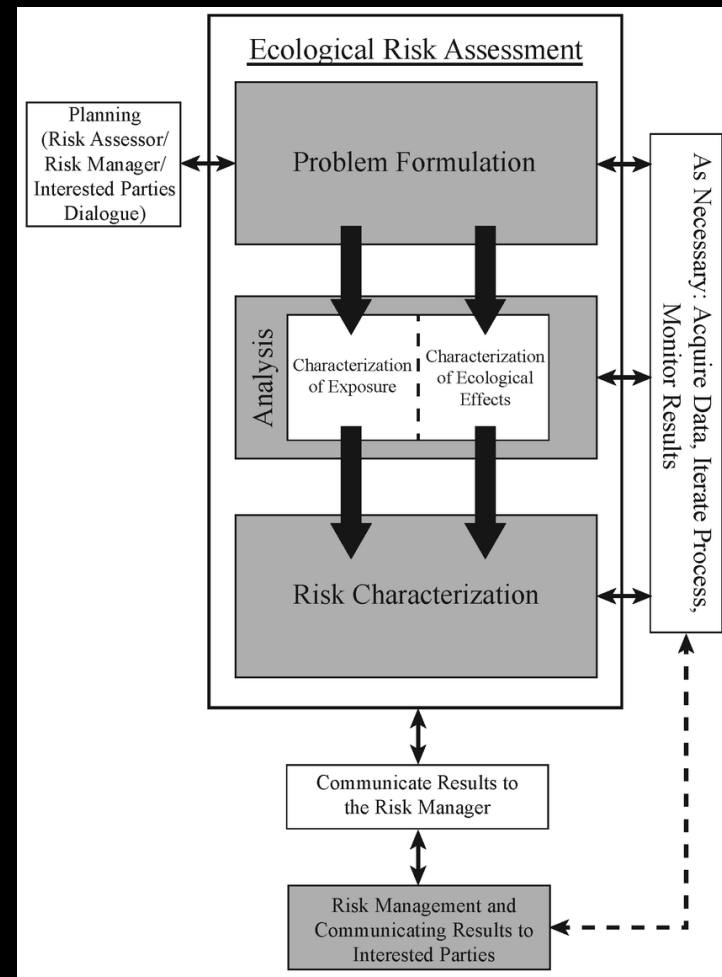
1. Assess the state of the knowledge on microplastic pollution in the Chesapeake Bay and its tributaries
2. Assess possible effects of microplastics on various habitats and associated living resources
3. Identify existing policy and management tools being used to address plastic pollution in the watershed 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



Ecological Risk Framework (EPA, 1992)

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.
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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.**

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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.

Special Thanks

Matt Robinson, DC DOEE, Workshop co-chair

Bob Murphy, Tetra Tech, 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



Questions?



Microplastics from the Magothy River at the laboratory of Dr. Lance Yonkos, University of Maryland, College Park