

Microplastics in the Chesapeake Bay and its Watershed: State of the Knowledge, Data Gaps, and Relationship to Management Goals

Proposal for a STAC Responsive Workshop
Submitted by the CBP's SAV Workgroup
February 5th, 2018

Background

The global production and disposal of plastics has increased by orders of magnitude over the past 60 years (Li et al. 2016; Rochman and Browne 2013) and a large proportion of plastic waste makes its way into waterways and coastal systems (Andrady 2011). Aside from the deleterious impacts on the aesthetics of the environment, there are concerns about the ecological harms posed by plastics. It is well-documented that larger plastic debris has significant and negative impacts on a variety of wildlife (Li et al. 2016), ranging from entanglement to increased mortality through ingestion. An emerging concern, however, has shifted focus from large, visible plastic debris to the largely unseen microplastic contamination of the aquatic environment.

Recent research has shown microplastics to be ubiquitous in habitats around the world (Anderson et al. 2016; Castaneda et al. 2014; Jabeen et al. 2016), posing an emerging concern for aquatic life. Despite filtration methods, wastewater effluent is estimated to release, on average, 4 million microparticles per facility per day (Mason et al. 2016). With multiple Wastewater Treatment Plants discharging wastewater effluent into the Bay's streams and rivers, this is a significant concern for the Bay ecosystem. Additionally, the Chesapeake Bay watershed contains numerous urban and suburban areas that, via storm drains, are sources of plastic waste to the Bay (Peters and Bratton 2016). These larger, visible plastic items degrade into smaller microplastics over time and are hypothesized to affect the Bay's ecosystem in a variety of ways, both physiologically and toxicologically. A recent survey of tidal tributaries to Chesapeake Bay showed concentrations of microplastics to be highly correlated with population density and proportion of urban and suburban development in contributing watersheds (Yonkos et al. 2014). In addition, there is currently a preliminary study investigating the rates of microplastic accumulation in beds of submerged aquatic vegetation (SAV) (Murphy, pers. comm.). SAV is one of the Bay's most important habitats and provides the food and refuge for some of the region's most commercially and ecologically significant fisheries. Microplastic contamination to this habitat could potentially disrupt those fisheries but watershed-wide data for microplastic accumulation is non-existent. Additional research is urgently needed to identify the sources, prevalence, and fates of microplastics in the Chesapeake Bay.

Objectives and Workshop Format

We propose a 2-day responsive workshop with technical, management, and policy experts to determine the state of the research, data needs, field and laboratory research methodologies, and associated needs from the management community. This workshop will build on the 2016 Wardrop et al. STAC Technical Review of Microbeads/Microplastics in the Chesapeake Bay (STAC Publication 16-002) which indicated that significant additional research is needed to understand the threat posed by microplastics to the Chesapeake Bay. We anticipate a large interest in this emerging issue from a variety of scientific disciplines, as well as from the management community given recent efforts that have been undertaken by Chesapeake Bay watershed jurisdictions to reduce trash and marine debris. Examples include total maximum daily loads for trash in the Patapsco and Anacostia Rivers, and the Virginia Marine Debris Management Plan. During the workshop, we hope to clearly identify gaps in the scientific understanding of microplastic sources, their prevalence, and their

impacts to the environment with focus on the Chesapeake Bay ecosystem. Additionally, we hope to elucidate to what extent filling those gaps will inform management and policy decisions. Given the most recent research demonstrating the ubiquity of microplastics in the environment, this workshop is timely and urgent. Although a concrete agenda for the workshop has not been established, we envision a generalized format as follows:

Day 1: Review of the state of the knowledge.

Morning: Intro to microplastics, an emerging global issue. A series of presentations from experts in the field. Not Chesapeake Bay specific. Followed by discussion.

Afternoon: Microplastics in the Chesapeake Bay and its watershed. A series of presentations from local research discussing the sources and impacts or potential impacts to SAV and other bay habitats (oysters). Followed by discussion.

Day 2: Data gaps, research prioritization, and management implications

Morning: Science and Methods. What else do we need to know? What's a priority? How do we figure it out? Followed by discussion.

Afternoon: Policy and Management. What policies are in place to control microplastics? What info do managers have and need? Followed by discussion.

The final goal of the workshop will be to incorporate the presentations into a report that will define our state of the knowledge, link this understanding to data gaps, and subsequently to decision-making. Ultimately the workshop report will provide recommendations on research goals that are prioritized by workshop participants.

Logistics and Funding

The proposed steering committee anticipates that a watershed-central location (e.g. Annapolis, MD) would be ideal to hold the workshop. In addition to being centrally located in the Bay watershed, the region is served by a multitude of convenient airports which will simplify travel for out-of-region participants. We expect this workshop to be of great interest to a large and diverse audience, from scientists, to natural resource managers and policy-makers. We anticipate 30-60 attendees. If STAC approves this workshop request, we would tentatively plan for a meeting to be held in winter, 2018/2019, allowing time for out-of-region presenters to make travel arrangements, as well as to reduce the chance of conflicts with other seasonal research that takes place in the Chesapeake watershed. This would allow three to four months of planning and three to four months to complete the workshop report. Timing of this workshop is, however, flexible.

Venue: All attempts would be made to secure a meeting venue free-of-charge, but if that is not possible, we would work with the STAC Coordinator and staff to identify a location for a reasonable price. Max \$2000

Food: Coffee service and lunch for 60 participants for 2 days – max \$3000

Travel: Flights and lodging for out-of-town participants – max \$5000

Total: Not to exceed \$10,000

Potential Speakers/Moderators

Chelsea Rochman, PhD; Department of Ecology and Evolutionary Biology, Univ. of Toronto
Bob Murphy, Fisheries Ecologist, Tetra Tech Center for Environmental Sciences

Bill Dennison, PhD, University of Maryland Center for Environmental Science
Randy Larsen, PhD, Dept. of Chemistry and Biochemistry, St. Mary's College of Maryland
Mark Luckenbach, PhD, Virginia Institute of Marine Science
Lance Yonkos, PhD, University of Maryland
Charles Walker, PhD, U.S. Geological Survey
Jesse Meiller, PhD, American University
Fred Pinkney, PhD, US Fish and Wildlife Service
Amy Uhrin, PhD, Chief Scientists Marine Debris Program, NOAA Silver Spring
Kimberly Hernandez, Marine Debris Specialist, Maryland DNR

Proposed Steering Committee

Bob Murphy, Fisheries Ecologist, Tetra Tech Center for Ecological Sciences **(Co-Chair)**
Matt Robinson, Watershed Protection Division, D.C. Dept. of Environment **(Co-Chair)**
Brooke Landry, Chair, Chesapeake Bay Program SAV Workgroup, MD DNR
Mark Luckenbach, PhD, Virginia Institute of Marine Science, STAC member
Lance Yonkos, PhD, University of Maryland
Greg Allen, PhD, EPA Chesapeake Bay Program Office
Kelly Somers, US EPA, Region 3
Phong Trieu, Metropolitan Washington Council of Governments
Jason Rolfe, NOAA Marine Debris Program

Literature Cited

1. Anderson, J.C., B.J. Park, and V.P. Palace. 2016. Microplastics in aquatic environments: Implications for Canadian ecosystems. *Environmental Pollution* 218: 269-280.
2. Andrady, A.L. 2011. Microplastics in the marine environment. *Marine Pollution Bulletin* 62: 1596-1605.
3. Castaneda, R.A., S. Avlijas, M.A. Simard, and A. Ricciardi. 2014. Microplastic pollution in St. Lawrence River sediments. *Canadian Journal of Fisheries and Aquatic Sciences* 71: 1-5.
4. Jabeen, K., L. Su, D. Yang, C. Tong, J. Mu, and H. Shi. 2016. Microplastics and mesoplastics in fish from coastal and fresh waters of China. *Environmental Pollution* 221: 141-149.
5. Li, W.C., H.F. Tse, and L. Fok. 2016. Plastic waste in the marine environment: A review of sources, occurrence and effects. *Science of the Total Environment* 566: 333-349.
6. Mason, S., Garneau, D., Sutton, R., Chu, Y., Ehmann, K., Barnes, J., Fink, P., Papazissimos, D., and D. Rogers. 2016. Microplastic pollution is widely detected in US municipal wastewater treatment plant effluent. *Environmental Pollution* 218: 1045-1054
7. Peters, C.A., and S.P. Bratton. 2016. Urbanization is a major influence on microplastic ingestion by sunfish in the Brazos River Basin, Central Texas, USA. *Environmental Pollution* 210: 380-387.
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9. Wardrop, D., C. Bott, C. Criddle, R. Hale, J. McDevitt, M. Morse, C. Rochman. 2016. Technical Review of Microbeads/Microplastics in the Chesapeake Bay. STAC Publication Number 16-002, Edgewater, MD. 27 pp.
10. Yonkos, L.T., E.A. Friedel, A.C. Perez-Reyes, S. Ghosal, and C.D. Arthur. 2014. Microplastics in four estuarine rivers in the Chesapeake Bay, U.S.A. *Environ. Sci. Technol.* 48: 14195-14202.

February 4, 2018

Dr. Brian Benham
Chair, Scientific and Technical Advisory Committee
Chesapeake Research Consortium
645 Contees Wharf Rd.
Edgewater, MD 21037

Dear Dr. Benham,

I write to voice my support for the STAC Workshop proposal *Microplastics in the Chesapeake Bay Watershed: State of the Knowledge, Data Gaps, and Relationship to Management Goals*. This workshop would build on the *2016 STAC Technical Review of Microbeads/Microplastics in the Chesapeake Bay* by Wardrop et al., with a goal of determining the state of current research and data needs for meeting management goals. I have agreed to serve on the steering committee for this workshop, should it be selected for funding.

Sincerely,



Mark W. Luckenbach
Associate Dean for Research & Advisory Services
Professor of Marine Science



Larry Hogan, Governor
Boyd Rutherford, Lt. Governor
Mark Belton, Secretary
Joanne Throwe, Deputy Secretary

Bob Murphy
Center for Ecological Sciences
Tetra Tech
10711 Red Run Blvd. Suite 105
Owings Mills, MD 21117

Dear Mr. Murphy,

February 2, 2018

I'm writing this letter to express my support of your proposal to conduct a STAC Workshop on the topic of microplastics in the Chesapeake Bay and their impact on the Bay ecosystem. STAC Workshops are a proven and effective way to convene subject matter experts and I believe this topic will prove to be of interest to a broad range of individuals from all levels of government and research institutions. Microplastics plague most of the world's waterways but their impact to the Chesapeake is by and large unknown at this time; therefore, a workshop to gather experts in the fields of SAV research, Fisheries Ecology, and Marine Debris, as well as Environmental Policy and Management, is timely and urgently needed.

As Chair of the Chesapeake Bay Program's SAV Workgroup, I fully support this endeavor and agree to participate on the steering committee if funded. Preliminary research indicates that microplastics accumulate in beds of submerged aquatic vegetation (SAV) and have the potential to affect the associated food web at all trophic levels. This workshop would be of specific interest to the SAV Workgroup as it is our goal to restore SAV baywide for the purpose of restoring those ecosystem services that SAV provides. One of the most significant services SAV provides to the Bay is habitat for blue crabs. Because blue crabs are voracious predators and scavengers, accumulating microplastics have the potential to significantly impact their diet and consequently their overall health and abundance. One can assume similar scenarios in other Bay habitats, but there is a resounding lack of data and knowledge on the topic – this workshop will allow for a review of what we know and what we still need to find out in order to manage this potential threat successfully.

Thank you for highlighting this important topic and bringing attention to the knowledge gap surrounding it. I look forward to a rewarding and educational workshop, and to the development of a report that will guide research, policy, and management decisions regarding microplastics in the Chesapeake Bay, its watershed, and nationally.

Sincerely,

A handwritten signature in blue ink that reads "J. Brooke Landry". The signature is fluid and cursive.

J. Brooke Landry
Chair, SAV Workgroup
Fisheries Habitat Assessment Specialist, MD DNR

GOVERNMENT OF THE DISTRICT OF COLUMBIA
Department of Energy and Environment

Mr. Bob Murphy
Center for Ecological Sciences
Tetra Tech
10711 Red Run Blvd. Suite 105
Owings Mills, MD 21117

February 2, 2018

Dear Mr. Murphy,

I'm writing this letter in support of your proposal to conduct a Chesapeake Bay Program Scientific and Technical Advisory Committee (STAC) Workshop on the topic of microplastics in the Chesapeake Bay and their impact on the bay ecosystem. Microplastics plague most of the world's waterways but their impact to the Chesapeake and its tributaries is largely unknown at this time. A workshop to gather experts in the fields of water quality monitoring, toxicology, and fisheries ecology would serve as a starting point for diving into the issue and prioritizing both research and management needs.

The District has been at the forefront of addressing the problem of trash, especially plastics, in urban waterways. We established one of the first TMDLs for trash for a waterbody in the nation; promulgated aggressive laws for combatting litter from plastic bags and polystyrene foam; and installed some of the most innovative trash reduction technologies in the nation. As one of the District's representative to STAC, I fully support this endeavor.

Thank you for highlighting this important topic and bringing to attention the knowledge gap surrounding it. I look forward to a rewarding and educational workshop.

Sincerely,



Hamid Karimi, PhD
Deputy Director
Natural Resources Administration
Department of Energy and Environment