

# **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  
Resubmitted with Edits: February 16<sup>th</sup>, 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. While microplastics themselves could be directly harming the bay ecosystem, recent research has also shown that organic toxic contaminants (e.g. PAHs, PCBs) already known to pollute the bay adsorb to microplastic particles, which once consumed by bay species may be magnified up the food chain. Microplastics have also been found to leach "plasticizer" compounds that are known endocrine disruptors, such as Phthalate (Tueten et al. 2009). A 2014 survey showed microplastics to be present in four tidal tributaries to the bay, with 59 of the 60 samples collected showing presence of particles. This study also found concentrations of microplastics to be highly correlated with population density and presence of suburban and urban development (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 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. Lastly, recent research has shown that potential human pathogens, such as *Vibrio* spp., have also been found to colonize microplastics providing evidence that particles could help disperse disease (Kirstein et al. 2016)

The CBP Toxic Contaminants Workgroup to the Water Quality GIT identified microplastics as an emerging issue in their most recent management strategy. Their management strategy included a recommendation to propose a workshop to STAC on this issue. Other GITs, such as the Habitat and Sustainable Fisheries GITs, may also be highly interested in this subject given the possible effects microplastics may have on vital Chesapeake Bay habitats (e.g. SAV beds, oyster reefs) and fish species.

The prevalence of microplastics in the Chesapeake Bay, its watershed, and their potential effects on the entire ecosystem make this a highly urgent issue that needs to be addressed. Put simply, the extent of microplastic pollution and its ecological consequences have not been comprehensively assessed by the CBP partnership. Two major findings from the 2016 Wardrop et al. STAC Technical Review of Microbeads/Microplastics in the Chesapeake Bay (STAC Publication 16-002) included:

- 1) Data on microplastics in the bay and its watershed are extremely limited to date.
- 2) Studies measuring the abundance and ecological impact of microplastics in the bay are still in their infancy.

There has been only a modest amount of research conducted across the bay and its watershed since publication of the last STAC report, although pilot studies indicate microplastics may pose an acute ecological risk. This proposed workshop will strive to create a forum in which this research can be presented and discussed. In addition, new research questions will be entertained hopefully fostering new collaborations between workshop participants helping to advance our understanding of this issue.

### **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. 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. 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 on local research discussing the sources and impacts, or potential impacts, to regional riverine (i.e. non-tidal and tidal habitats) and estuarine habitats (e.g. pelagic, SAV, and oyster habitat). 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) with airport access would be ideal to hold the workshop. We anticipate 30-60 attendees given that this workshop would be of great interest to science and policy experts. 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. Most participants (see list below) are located in the DC Metro Region so we do not anticipate significant air travel costs. We will work to secure a venue that allows people to participate remotely if necessary. Our proposed schedule 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  
Kimberly Hernandez, Marine Debris Specialist, Maryland DNR  
Amy Uhrin, Chief Scientist Marine Debris Division, NOAA Office of Response and Restoration

### **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**

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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.

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Teuten, E.L., J. M. Saquing, D.R.U. Knappe, M.A. Barlaz, S. Jonsson, A. Bjorn, S.J. Rowland, R.C. Thompson, T.S. Galloway, R. Yamashita, D. Ochi, Y. Watanuki, C. Moore, P.H. Viet, T.S. Tana, M. Prudente, R. Boonyatumanond, M.P. Zakaria, K. Akkhavong, Y. Ogata, H. Hirai, S. Iwasa, K. Mizukawa, Y. Hagino, A. Imamura, M. Saha, & H. Takada. 2009. Transport and release of chemicals from plastics to the environment and to wildlife. *Philosophical Transactions of the Royal Society of Biological Sciences* 364: 2027-2045.

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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

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



**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,

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