Plastic Pollution Action Team Meeting

June 2, 2020 1:00-4:00pm

Virtual Meeting

All meeting materials are available on the Chesapeake Bay Program's website, here

Linsay Haram (SERC)	Rob Hale (VIMS)	Kirk Havens (VIMS)
Meredith Seeley (VIMS)	Julianna Greenberg (CRC)	Denice Wardrop (CRC)
Alex Lopez (Penn State)	Phong Trieu (COG)	Claire Buchanan (ICPRB)
Michael Gonsior (UMCES)	Kristin Saunders (UMCES)	Jonathan Cohen (University of Delaware)
Donna Morrow (MD DNR)	Mark Trice (MD DNR)	Brooke Landry (MD DNR)
Anna Kasko (MDE)	Tish Robertson (VA DEQ)	Dann Sklarew (GMU)
Jennifer Starr (Alliance for the Ches Bay)	Marty Gary (PRFC)	Christy Kehoe (NOAA)
Amy Uhrin (NOAA)	Carlie Herring (NOAA)	Shawn Fisher (USGS)
Rebecca Whiteash (PA DEP)	Bill Jenkins (EPA)	Kelly Somers (EPA)
Emily Trentacoste (EPA)	Jennifer Flippin (Tetra Tech)	Bob Murphy (Tetra Tech)
Paige Hobaugh (Tetra Tech)	Julie Lawson (CAC)	Anthony Johnson (CRC)
Matt Robinson (DC DOEE)	Claire Svecik (DNREC)	

Introductions – Matt Robinson, Chair (DC DOEE)

- STAC Microplastics Workshop and recommendations
- Action Team created to advise EPA and the Chesapeake Bay Program (CBP) Management Board. The action team charge approved by the Management Board can be found here.
    - EPA Region III Water Division is funding the risk assessment
    - Final decisions on endpoints and reports will be made by the EPA Region III Water Division. However, Matt Robinson emphasized that the CBP wishes to make this a collaborative effort amongst CBP partners.

Ecological Risk Assessment (ERA) 101 – Jennifer Flippin (Tetra Tech)

- Four steps to an ERA
    - Planning
    - Problem Formulation
        - Identify ecological attribute you want to protect
        - How do you measure the end point?
    - Analysis
        - Identify sources of exposure and potential ecological responses
        - Identify risk hypotheses or testable linkages

    - Risk Characterization
        - Estimate risk and approximate uncertainties
        - Integrates exposure and effects

Discussion

- Dann Sklarew (GMU): Have you found specific things to be better end points, I.e. charismatic species or easy to measure?
    - Jennifer Flippin (Tetra Tech): When choosing an endpoint, considering one that is ecologically relevant and has importance to the public are both important. Flashier endpoints often have more public engagement
    - Matt Robinson (DC DOEE): The conceptual model developed as part of this preliminary ecological risk assessment will serve as important communications tool. The conceptual model will help illustrate the various pathways microplastic contamination takes through the ecosystem and how contamination may ultimately affect the endpoint.
- Matt Robinson (DC DOEE): Is it the intention of Tetra Tech to also include other stressors to choose how microplastics interact with them?
    - Jennifer Flippin (Tetra Tech): We will have to look at that as we move through the literature. Important to show where there is an additive effect.

Microplastics ecological risk assessment: Biological endpoint considerations – Bob Murphy (Tetra Tech)

- Logic in choosing an endpoint
- Biological endpoint identification criteria
    - Higher trophic level
        - One of the benefits of using a species from a higher trophic level is that it cancapture sepcies in lower trophic levels that can potentially be impacted my microplastics.
    - Represented in the 2014 Bay agreement, directly or indirectly
    - Data rich
        - Ideally already well understood ecologically
    - Common enough to be recognized by non-specialists
    - Wide distribution
        - Conceptual model is just for the Potomac, but we want bay-wide applicability
- Striped Bass (age class 0-2 years) is being strongly recommended
    - ERA with Striped Bass as an endpoint will capture several target species (e.g. Blue Crabs, American Shad, forage fish, oysters) and habitat (e.g. submerged aquatic vegetation, wetlands) featured in the 2014 agreement
    - Striped Bass are migratory

        - Reduced to first two years of life before they start their migration along the coast

Discussion item #1: Choosing an Ecological Endpoint for the Potomac river ERA

- Denise Wardrop (CRC) – I'm concerned that when we use a more motile organism, like Striped Bass, as an endpoint, we are disregarding potential spatially explicit distribution of microplastics.
    - Bob Murphy (Tetra Tech)–We might run in to that issue with any fin fish, because they areall motile. In that way, it would be nice to be able to use oysters. But I would counter that by saying that we know a lot about bass life history, so we have a good idea of where they spend their time.
    - Jon Cohen (University of Delaware) – Could serve as a spatial integrator. The motility of Striped Bass might make them a better endpoint since they are exposed to microplastics everywhere.
- Michael Gonsior (UMCES)– When you're looking at higher trophic levels, you're losing the direct signals of the microplastics, might be hard to distinguish from other stressors. We're picking the charismatic megafauna for attention so we want to make sure we can ID signals.
    - Bob Murphy–There might not be a biological effect at higher tropic levels, but there might be a reduction in population numbers and size at lower trophic levels which can reduce populations and biological health at higher trophic levels too
- Linsey Haram (SERC) - If we're looking for a "catch-all" species to build the conceptual model, couldn't we look to foundation species like oysters or sav to do that? Just from more of a bottom up approach
    - Amy Uhrin (NOAA) - Oysters are selective filter feeders - they selectively retain or reject (as pseudofeces) microplastics of diff types (i.e., fibers vs fragments/particles)
    - Bob Murphy (Tetra Tech) –These foundational species, like SAV and oysters, are incorporated in the pathways as we look at higher trophic levels.
    - Linsey Haram (SERC) – Not sure why we have to choose just one, it may be important to consider both.
    - Dann Sklarew (GMU) – Having multiple endpoints might be more ecologically beneficial.
    - Matt Robinson (DC DOEE) – The importance of this exercise is to develop a preliminary ecological risk assessment to guide future research. Our goal is to use the ecological risk assessment framework to develop a science strategy that will help us do that.

- Martin Gary (PRFC) - Potomac Striped Bass Spawning area is the second most productive on the eastern seaboard. Huge amount of management focus on Striped Bass right now

- Matt Robinson (DC DOEE) – There appears to be mixed opinions on using Striped Bass vs a lower trophic level species. What would be most compelling to the jurisdictions?
    - Martin Gray (PRFC) – Striped Bass checks a lot of the boxes we put forward. From management perspective, the lower trophic levels are important, but Striped Bass seems to be the right one. For the last five years, Striped Bass has struggled. We're trying to launch a new amendment to the fisheries management plan now. The species is in the collective mindset right now.
- Matt Robinson (DC DOEE) – Lets be sure to note dissenting opinions
    - Kristin Saunders (UMCES) – I am not see dissenting ideas so much as caveats and considerations we should ask Tetra Tech to consider and come back to us with a refined recommendation
- Matt Robinson (DC DOEE) – Tetra Tech is developing a conceptual model, a science strategy, and a narrative.
    - Bob Murphy (Tetra Tech) – We can incorporate this discussion and caveats into the narrative and will bring the narrative to the Action Team for Feedback.
    - Suggestion was embraced by the team.

Discussion Item #2: Which microplastic type should the Potomac river ERA be focused on? – Jennifer Flippin (Tetra Tech)

- Microplastics can be categorized by morphology
    - Examples include fragments, film, fiber, foam, sphere, fiber bundle
- Projects tasks for this microplastics ecological risk assessment include:
    - Develop uniform terminology for the Chesapeake Bay region to adopt for both microplastic size class (e.g. nanoplastic vs microplastic and units of concentration
    - Develop a preliminary ecological risk assessment model
- Challenges to applying ecological risk assessment to microplastics
    - Lots of different compounds that are different shapes and sizes
    - Sources of stressors are diffuse and heterogenous
    - Microplastic contaminationis still relatively new science
- What DO we know about microplastics in the Potomac and the Bay?
    - Looked at abundance bay-wide
        - Various studies performed in the Chesapeake Bay mainstem, the Potomac River, and Anacostia River show that fragment, films, and fibers are the most common
    - Microplastics in the Chesapeake Bay
        - Bikker et al. (2020) found fragments dominated the samples.
    - Microplastics in the SAV beds in the Anacostia

        - Mostly fibers here (75%) and fragments (24%)
        - Is there a difference in movement in different particles?
- Recommendations
    - Tetra Tech recommended that the ecological risk assessment focus on one of the three following options:

1) Fibers

- Majority of ingestions are fibers2) Fragments

3) All particles less than or equal to 150um since that is the upper size limit for particles that are biologically available.

Discussion

- Julie Lawson (CAC) – It's important to note the Anacostia survey was in SAV, and the Bay survey was surface water with a manta trawl
    - Bob Murphy (Tetra Tech) -The Anacostia data was from sediment samples, whereas bay-wide data was from surface waters
- Jennifer Flippin – We're just picking one type and shape of microplastic for simplicity, but this is an iterative process, so we'll see how much effort it takes to get through one. If time allows, or if there's enough compelling information, we could attempt more.
- Amy Uhrin (NOAA)- Have you documented ingestion specifically by Striped Bass and that fibers dominate gut contents versus other microplastic forms?
    - Matt Robinson (DC DOEE)– I don't think anyone has documented that yet. Don't know if anyone has looked. There has been evidence of microplastics being observed in the prey of Striped Bass.
    - Bob Murphy (Tetra Tech) – There is a 2020 paper showing ingestion of microplastics by Striped Bass in Lake Mead, CA.
- Michael Gonsior (UMCES) - Surface chemistry is also very important to how chemicals absorb to things. Recommend not excluding type of polymer. Fibers are also inherently difficult to count. Potential for a wide range of values that could seem like an "effect".
    - Julie Lawson (CAC) –Fibers are going to be a lot easier to manage because they have limited sources. If you're looking at a behavioral solution rather than a structural solution, fibers might be easier to measure
        - Amy Uhrin (NOAA) – Are fibers being significantly generated from fishing nets in the bay in addition to pollution from clothing?
        - Shawn Fisher (USGS) - Fibers are also in the air and deposit everywhere, which could potentially be significant when considering sources such as urban and agriculture (via applied biosolids) runoff, wastewater treatment plant effluent, and secondary breakdown in the water.
        - Meredith Seely (VIMS) - Fibers, although often more abundant, have far less research on their effects. If we were to pick just fibers, could data limitation become a problem?

        - Rob Hale (VIMS) – It may be more important to focus on a particle that has been found to have more harmful effects rather that the particle type that has been found to be most abundant.
- Alex Lopez (PSU) - Both fiber and fragment would be ideal from a surface area/volume perspective. Focusing on just fiber focuses too much on rivers and means the ERA won't lend itself later to an understanding of the Bay's mainstem.
    - Matt Robinson (DOEE) – This is a preliminary ERA and there are a lot of assumptions. That being said, the assumptions will feed into the science strategy that will guide future Bay Program research.
- Bob Murphy (Tetra Tech) –Maybe we shouldn't choose a polymer type or size yet. We don't need to account for gear bias or sampling. The data available might dictate what we need to investigate. We want to capture "microplastics".
    - Meredith Seeley (VIMS) – There is a paper that looks at the effects of composite samples of microplastics on species in the lab that are more representative of environmental samples.

Final Thoughts

- Kelly Somers (EPA)- Are there objections to Striped Bass and using fibers as a starting point and pursuing leads as they arise?
    - Dann Sklarew (GMU) and Michael Gonsior (UMCES) – Still on the fence about using Striped Bass vs oysters but not willing to advocate strongly against the group.
    - Bob Murphy (Tetra Tech) - Oysters will be captured in the pathway. DC doesn't have any oyster beds in its jurisdiction.
        - Martin Gary (PRFC) –Oysters in the Potomac have not been doing well. Only the lower river oyster bars have made it through the past few seasons due heavy rainfall.

Action Items

- Tetra Tech will write a narrative document that discusses ecosystem endpoints, highlighting the caveats discussed today. Striped Bass, aged 0-2 years will be used as biological endpoint for the conceptual model. The narrative will be circulated to the PPAT via email for comment.
- Tetra Tech will reassess if we can investigate multiple microplastics or if we should limit focus to one type (fibers and make changes to the options paper which will be circulated to the PPAT for comment.
- Matt Robinson (DC DOEE) will distribute the narrative provided by Tetra Tech to the Action Team for feedback within a few weeks.

Papers linked/referenced in meeting chat:

Microplastics in Lake Mead National Recreation Area, USA: Occurrence and biological uptake. Baldwin AK, Spanjer AR, Rosen MR, Thom T. PLoS ONE 15(5): e0228896. https://doi.org/10.1371/journal.pone.0228896

Microplastics and other anthropogenic particles in the surface waters of the Chesapeake Bay . J. Bikker, J. Lawson, S. Wilson, C.M. Rochman. Marine Pollution Bulletin 2020. 156 https://doi.org/10.1016/j.marpolbul.2020.111257

Multidecadal increase in plastic particles in coastal ocean sediments. Jennifer Brandon, William Jones, Mark D. Ohman. Science Advance*s* 04 Sep 2019. 5(9) DOI: 10.1126/sciadv.aax0587

Observations and Simulations of Microplastic Debris in a Tide, Wind, and Freshwater-Driven Estuarine Environment: the Delaware Bay. Jonathan H. Cohen, Anna M. Internicola, R. Alan Mason, and Tobias Kukulka. *Environmental Science & Technology* 2019, *53* (24), 14204-14211. DOI: 10.1021/acs.est.9b04814

Marine microplastic: Preparation of relevant test materials for laboratory assessment of ecosystem impacts. Susanne Kuhn, Albertvan Oven, Andy M. Booth, Andre Meijboom, Jan A van Franeker. Chemosphere 2018, 213(103-113) https://doi.org/10.1016/j.chemosphere.2018.09.032

Microplastics affect sedimentary microbial communities and nitrogen cycling. Seeley, M.E., Song, B., Passie, R. Hale, R. Nature Communications 2020, 11, 2372. https://doi.org/10.1038/s41467-020-16235-3

Microplastics affect oyster reproduction Rossana Sussarellu, Marc Suquet, Yoann Thomas, Christophe Lambert, Caroline Fabioux, Marie Eve Julie Pernet, Nelly Le, Virgile Quillien, Christian Mingant, Yanouk Epelboin, Charlotte Corporeau, Julien Guyomarch, Johan Robbens, Ika Paul-Pont, Philippe Soudant, Arnaud Huvet**.** Proceedings of the National Academy of Sciences Mar 2016, 113 (9) 2430-2435; DOI: 10.1073/pnas.1519019113

Selective Ingestion and Egestion of Plastic Particles by the Blue Mussel (Mytilus edulis) and Eastern Oyster (Crassostrea virginica): Implications for Using Bivalves as Bioindicators of Microplastic Pollution. J. Evan Ward, Shiye Zhao, Bridget A. Holohan, Kayla M. Mladinich, Tyler W. Griffin, Jennifer Wozniak, and Sandra E. Shumway. *Environmental Science & Technology* 2019, *53* (15), 8776-8784