Update to CBP Management Board

Report from the Plastic Pollution Action Team

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Review of Progress

- In Fall 2019, the Management Board created the Plastic Pollution Action Team for two years.
- The Management Board assigned the Plastic Pollution Action Team the following tasks:

1. Provide oversight of the development of preliminary ecological risk assessments of microplastics for one or more subwatersheds to the Chesapeake Bay (e.g. Potomac River).

2. Use the components and results of the preliminary ecological risk assessments to develop a strategy that identifies and if possible, prioritizes gaps in information concerning the effects of microplastic pollution on the Chesapeake Bay ecosystem, and highlights future research questions that need to be answered.

3. Present results from ecological risk assessments to the Management Board in order to guide future action on addressing plastic pollution.

4. Monitor policy advances at the state and federal level that could potentially impact, advance or complement this work to inform the science strategy and to identify potential policy or management options that could be utilized for source reduction strategies.

Review of Progress

- In Fall 2021, Plastic Pollution Action Team briefed the Principals Staff Committee on work completed.
- The Principals Staff Committee directed the CBP to do the following (tasks assigned to Plastic Pollution Action Team) :

1. The CBP should make a very strategic investment in science.
2. The CBP should send science needs signals out to academic institutions.
3. The Plastic Pollution Action Team should work on a plastic pollution source assessment and reduction strategy.

Major Tasks Completed to Date

- ✓ Plastic Pollution Action Team convened.
- ✓ Standardization of Terminology Document completed.
- ✓ Two iterations of an Ecological Risk Assessment looking at impacts of microplastics on Striped Bass in the Potomac River completed.
- ✓ Microplastic Monitoring and Science Strategy for the Chesapeake Bay completed.
- o Plastic Pollution Action Team Monitoring Workgroup is working to flesh out a monitoring plan
- o Plastic Pollution Action Team has begun efforts to develop a reduction strategy for the Chesapeake Bay and watershed.

Review of Progress

- Plastic Pollution Action Team convened in Spring of 2020, with members from federal agencies, state agencies, and academia.

- Chaired by Matt Robinson, DC Department of Energy and Environment, and Vice-Chaired by Kelly Somers, EPA Region III

- EPA Region III Trash Free Waters Program secured funding in 2019 and 2021 to contract Tetra Tech to work with the Plastic Pollution Action Team on implementing three Tasks:
    1. Development of a Standardization of Terminology document for conducting microplastic research in the Chesapeake Bay and watershed.
    2. Development of a preliminary Ecological Risk Assessment for Striped Bass in the Potomac River.
    3. Development of a microplastic monitoring and science strategy for the Chesapeake Bay.

- Plastic Pollution Action Team has met nine times between June 2020 and September 2022, and all three tasks listed above were completed by Tetra Tech.

- STAC reviewed both the standardization of terminology document and ecological risk assessment.

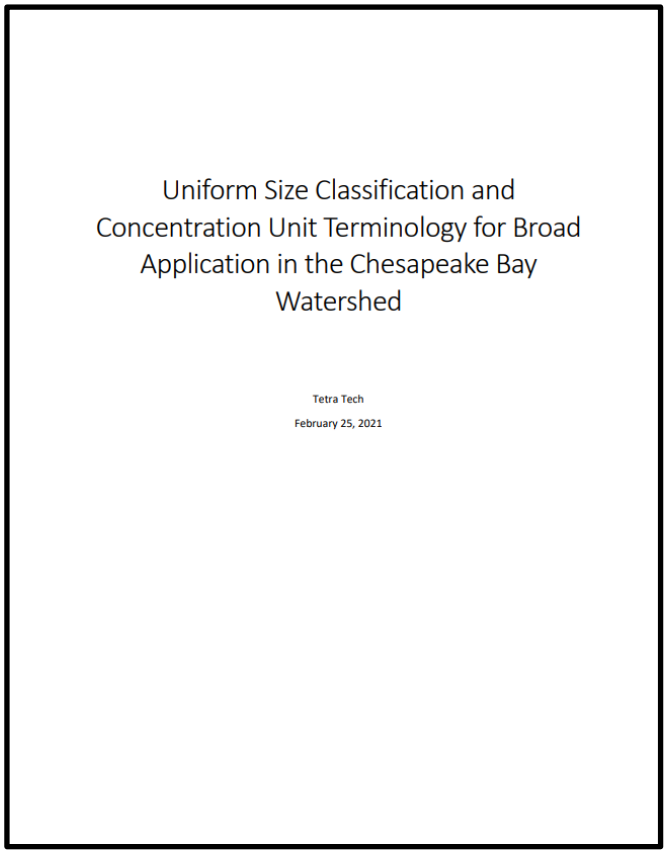
- STAR reviewed the monitoring and science strategy.

Standardization of Terminology Document

- Recommendation from 2019 STAC Workshop Report: *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 partners to utilize in monitoring and studies focused on plastic pollution in the bay and watershed.*

- Document (developed by Tetra Tech) describes and recommends a uniform size classification and concentration unit terminology for plastics for use in development of ecological risk assessments and development of a monitoring and science strategy.

- STAC conducted a technical review in Fall 2021 and this document was later approved by the Plastic Pollution Action Team.


Uniform Size Classification and Concentration Unit Terminology for Broad Application in the Chesapeake Bay Watershed

Tetra Tech

February 25, 2021

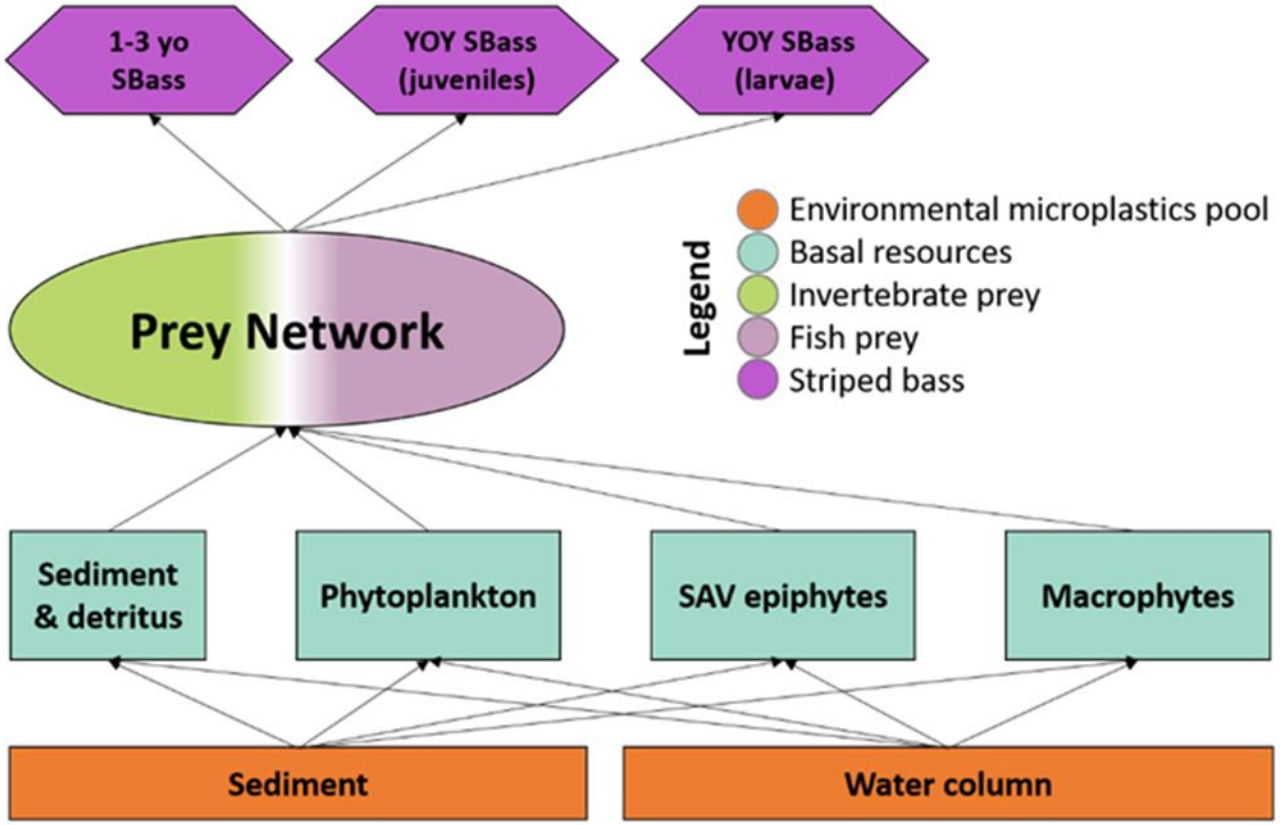
Access here: tinyurl.com/msbkxmk7

Ecological Risk Assessment Ver. 1.0

- Ecosystem Endpoint: Striped Bass (*M. saxatilis*) ages 1 month – 1 year old. Why?
  1. Apex predator and Iconic Bay Species - Food chain analysis for this species encompasses a multitude of trophic levels and other species.
  2. Wealth of knowledge on this age class based on state juvenile index surveys and diet studies (Boynton et al, 1981; Idhe et al, 2014).

- Geographic Location: Potomac River. Why?
  1. Appropriate scale waterbody given the current funding.
  2. Contains species and habitats prevalent throughout the entire bay.
  3. The second most important nursery for Striped Bass along the east coast.

The Conceptual Model



Potential Assessment Endpoints

Individual Assessment Endpoints

- Growth rates
- Fecundity
- Predator susceptibility
- Direct mortality
- Physiological condition
- Behavior change

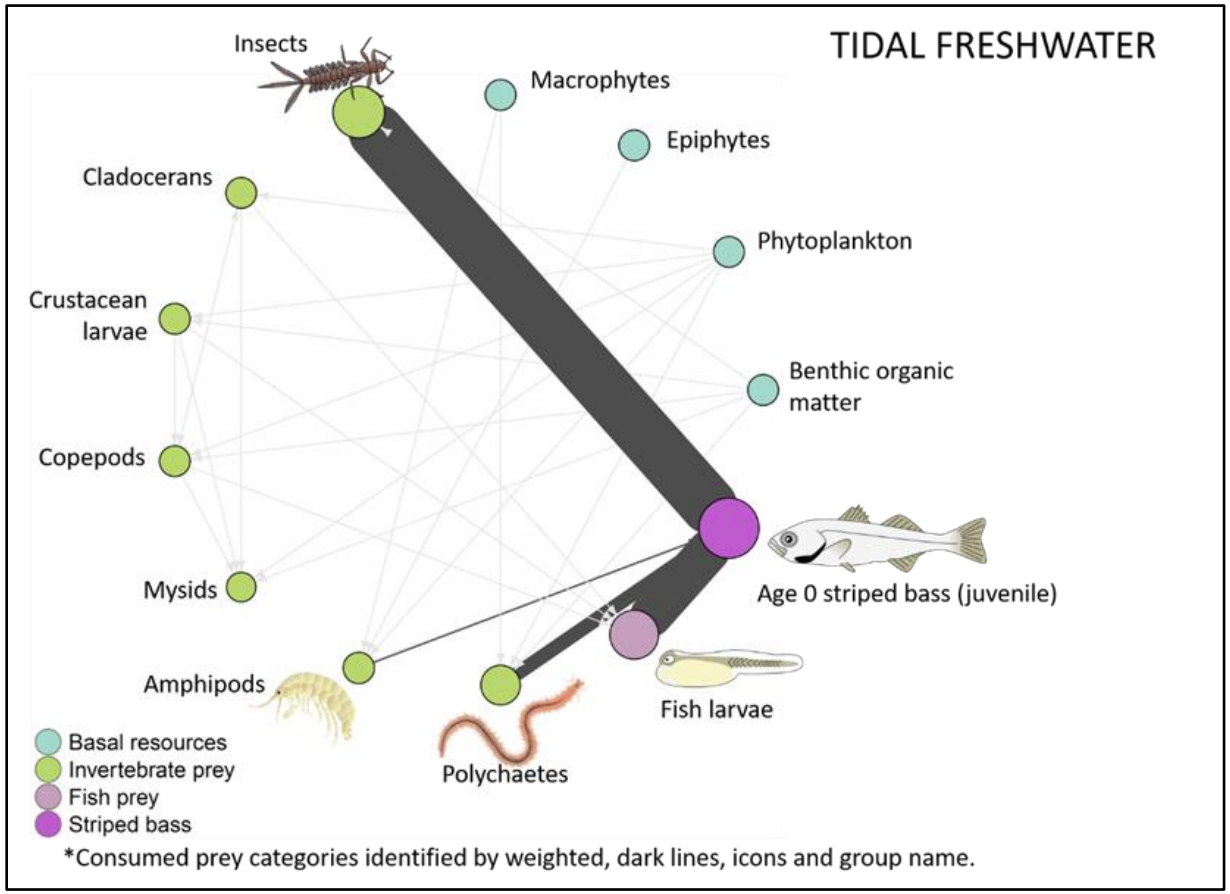
Population Assessment Endpoints

- Catch-per-unit-effort
- Size-at-age
- Age-structure
- Mortality
- Spawning stock biomass

ERA Model Development

- Existing information was gathered by conducting a literature review.
- Qualitative food web models were developed to identify microplastic pathways to Striped Bass ages 1 month – 1 year old.
- Using this analysis, semi-quantitative food web interaction scenarios were developed for Striped Bass living in different salinity regimes (e.g. tidal freshwater, oligohaline).

Example Semi-quantitative food web interaction



Models completed for tidal freshwater, oligohaline, mesohaline, and bay mainstem.

Microplastic pathways

- Literature review conducted on studies looking at presence of microplastics in Striped Bass prey taxa.
- Studies conducted outside of the Chesapeake Bay and its watershed were included in the literature review.
- 14 different taxa were identified as potential vectors for microplastics to Striped Bass.
- These taxa were given high priority for future research on Striped Bass.
- Additional information gaps were also identified and included in the science strategy.
- STAC conducted a merit review of ver. 1.0 in March 2021.
- Approved by Plastic Pollution Action Team in April 2021.

Major Taxa	Confirmed MP presence or consumption? (Y/N)	Location	Citation	Notes
Amphipods	Y	Laboratory	(Jeong et al. 2017, Mateos Cárdenas et al. 2019)	Jeong et al proposed an adverse outcome pathway for microplastic exposure that covers molecular and individual levels.
Mysids	Y	Laboratory	(Setälä et al. 2014, Lehtiniemi et al. 2018, Wang et al. 2020)	Hasegawa et al (2021) demonstrated trophic transfer of microplastics between mysids and fish predator
Polychaetes	Y	Newfoundland; laboratory; Norway	(Mathalon and Hill 2014, Setälä et al. 2014, Knutsen et al. 2020)	
Blue crab	Y	Murderkill and St. Jones Rivers, DE; Texas;	(Santana et al. 2017, Cohen 2020, Waddell et al. 2020)	Santana et al found little trophic cascade; Cohen's work in similar systems to tidal Potomac;
Crustacea (other)	Y	Florida; North Sea	(Devriese et al. 2015, Waite et al. 2018)	Waite et al found MPs in *Panopeus*, a known prey item for striped bass;

Example table showing literature date on microplastic presence in Striped Bass prey taxa

Ecological Risk Assessment Ver. 2.0

- New contract issued by EPA Region III to Tetra Tech in 2021.
- Using findings from Ver 1.0 literature review, Tetra Tech identified three prey taxa of greatest importance to Striped Bass ages 0-3 years that have also been found to be contain the highest concentrations of microplastics.
- The importance of these prey items is confirmed by a recent Striped Bass diet study conducted in the Chesapeake Bay by Matt Ogburn and colleagues at the Smithsonian Environmental Research Center (data unpublished).
- Prey taxa of focus include:
  - Mysid Shrimp
  - Amphipods
  - Bay Anchovy

- Plastic Pollution Action Team provided input on the development of Ver 2.0.

Ecological Risk Assessment Ver. 2.0

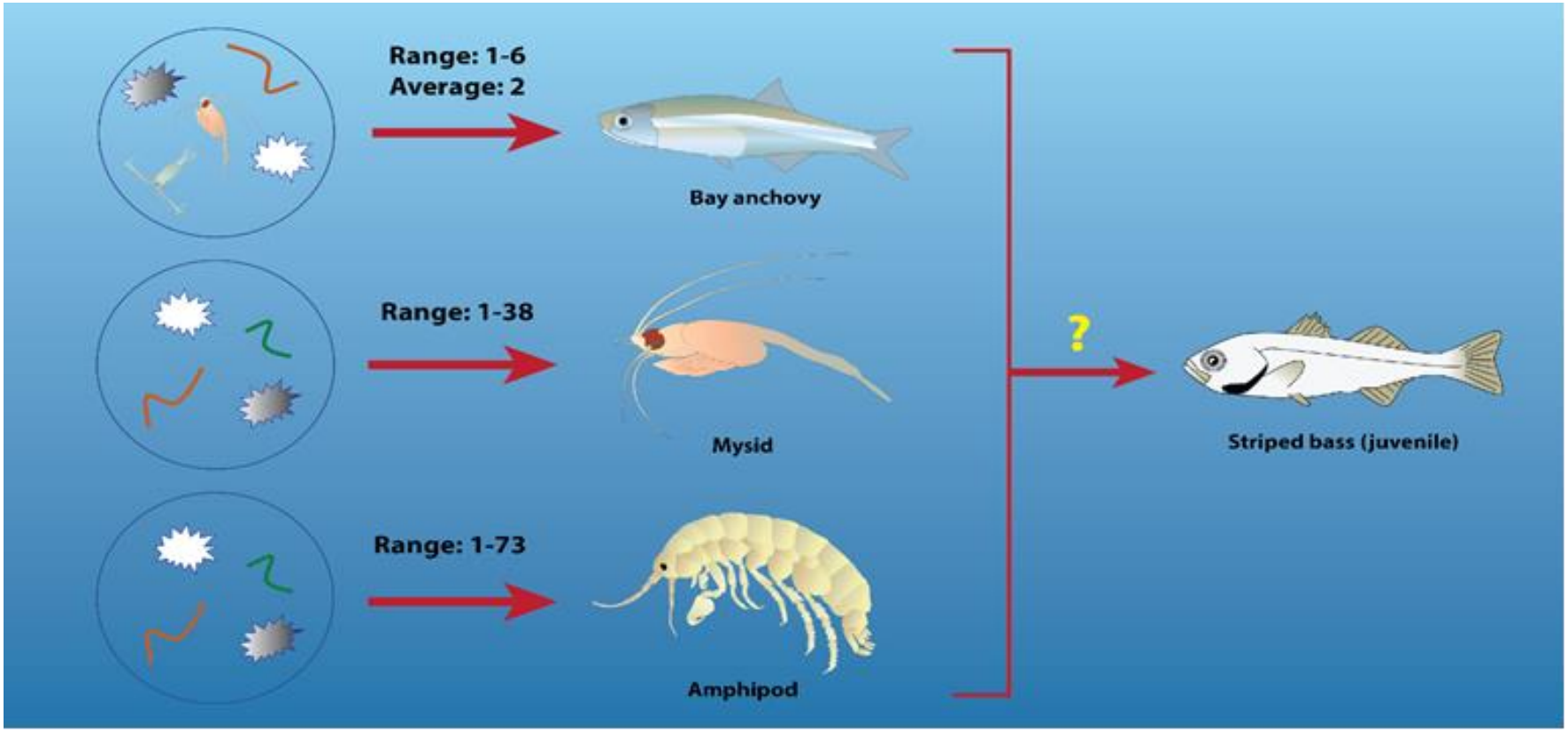


Figure 1. Estimated potential quantities of microplastic particles per individual for each of three common taxa (Bay Anchovy, Mysid, Amphipoda) reaching an individual feeding juvenile striped bass. Sources of microplastics for each taxa are displayed on the left, with most of it free-floating plastic particles, with the exception of mysid shrimp in bay anchovy diet (described in the text).

Next Steps

- Complete study: Microplastics in fish in the Anacostia and Potomac River, Washington, DC
  Project Leads: DOEE, WashCOG, Tetra Tech
  Funding from EPA Region III Trash Free Waters
  This study will provide data on presence of microplastics in Striped Bass

- Possible 2022 GIT Project: *Assessing Biological Effects of Plastic Pollution on Striped Bass*
  This project will sample mysid shrimp in Chesapeake Bay for microplastics and include an experimental study exposing Striped Bass to mysids contaminated with microplastics.

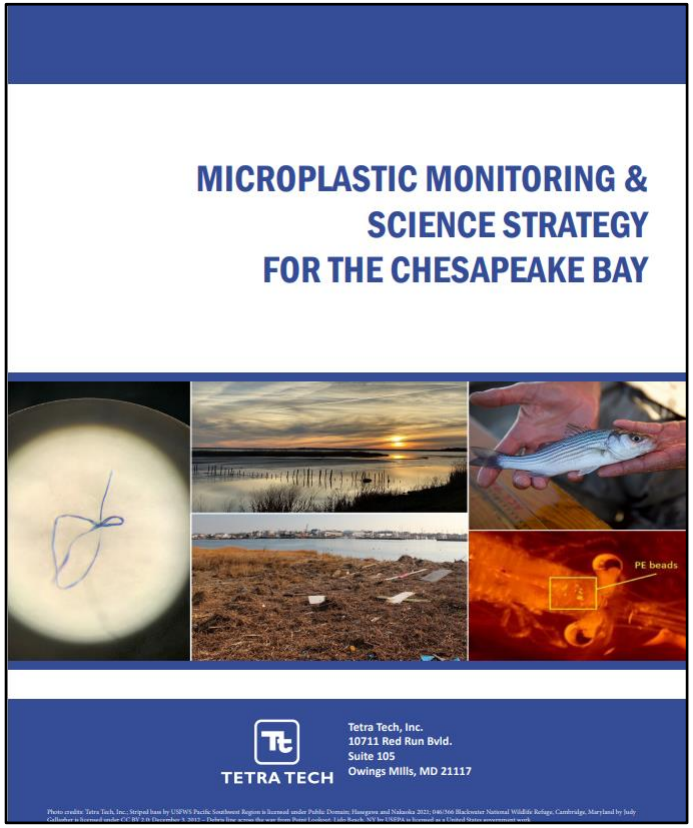
- Continue to work with our partners through the Plastic Pollution Action Team to collect scientific data on presence of plastic pollution in living resources in Chesapeake Bay and other mid-Atlantic coastal ecosystems.

Development of the Science Strategy

- Charge from Management Board: "*Use the components and results of the preliminary ERAs* [ver 1.0] *to develop a strategy that identifies and if possible, prioritizes gaps in information concerning the effects of microplastic pollution on the Chesapeake Bay ecosystem, and highlights future research questions that need to be answered.*"

- The Plastic Pollution Action Team organized the science strategy around four management questions.

- The Plastic Pollution Action Team made science/research recommendations for answering these management questions.



Management Questions

1. What health risks are posed by microplastics?

2. What are the sources, pathways, composition, and fate of microplastic loadings into the Chesapeake Bay?

3. What management actions or policies may be effective in reducing microplastic pollution?

4. How can government and resource managers develop sound policies to reduce [micro]plastic pollution and assess the economic impacts?

Recommendations

1. Design and implement a microplastic monitoring program, integrated into the existing Chesapeake Bay watershed monitoring framework.

2. Support research to understand microplastic pathways in the Bay, including trophic pathways that may affect living resources such as Striped Bass, Blue Crabs, Oysters, and other species critical to the Bay ecosystem.

3. Ensure adequate infrastructure resources are available to process microplastic samples, including analytical equipment.

4. Continue to support the Plastic Pollution Action Team in order to direct research, management, and policy development.

Monitoring Plan Development

- Beginning in 2022, the Plastic Pollution Action Team convened a workgroup of its members to discuss development of a monitoring plan plastic pollution.
- The plan was developed around the following questions:

  1. What is the current status (i.e., concentrations) of plastic pollution in tidal and nontidal waters of Chesapeake Bay and its watershed?
  2. What is the spatial distribution of plastic pollution in the Chesapeake Bay and watershed?
  3. What are the sources (i.e. plastic product) of plastics found in the bay and watershed?
  4. What are the pathways (i.e. stormwater, wastewater, non-point source) of plastics for the bay and its watershed?
  5. What is the range of concentrations for plastic pollution within the food web, focusing on species identified in the Chesapeake Bay 2014 Watershed Agreement Goals and Outcomes (e.g. blue crabs, oysters, brook trout) as well as other species of commercial and/or recreational importance (e.g. striped bass)?

- The group identified goals, objectives, and needs for each of these questions.
- All of this was compiled into a planning matrix which can be viewed by going here: https://tinyurl.com/3ke36d5h

Next Steps

- The workgroup will be sending out a questionnaire to researchers in the region to see if their existing projects/programs meet any of the needs identified in the monitoring plan.

- Following that exercise, the workgroup will conduct a needs assessment to try and prioritize gaps in monitoring and make recommendations to the CBP.

Source Reduction Strategy

- 2021 directive from the Principals Staff Committee: *"The Plastic Pollution Action Team should work on a plastic pollution source assessment and reduction strategy."*

- Source assessment will be addressed through the monitoring plan (see Monitoring Plan Questions 3&4):
  3. What are the sources (i.e. plastic product) of plastics found in the bay and watershed?

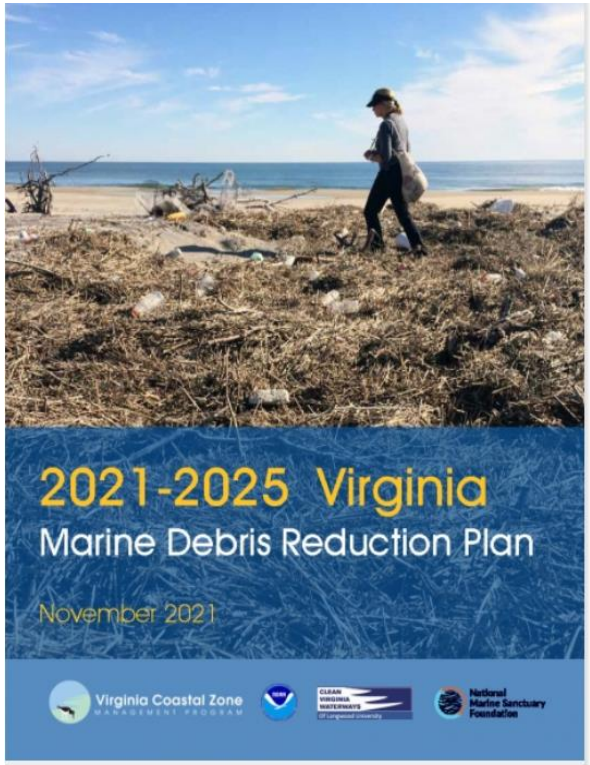
  4. What are the pathways (i.e. stormwater, wastewater, non-point source) of plastics for the bay and its watershed?

- The PPAT decided at its Spring 2022 meeting to pursue development of a reduction strategy that can focus on voluntary, "no regret" actions.

- It would be up to jurisdictional partners to decide what actions they would like to propose and include in the source reduction strategy.

Source Reduction Strategy

- During the September 23, 2022 meeting, the Plastic Pollution Action Team discussed principals that the plan should be based on.
- This is following the example of Virginia DEQ Marine Debris Reduction Plan.
- These principals will serve as a foundation on which to develop actions to include in the plan.
- Examples of principals from the Virginia Marine Debris Reduction Plan:
  - ❖ Identify actions that are politically, socially and economically feasible in Virginia
  - ❖ Evaluating progress as a key to success
  - ❖ Utilizing multiple approaches
  - ❖ Promote Justice, Equity, Diversity, and Inclusion



Access here:
https://tinyurl.com/aj3sv5wc

Next Steps

- We will compile all principals proposed and allow Plastic Pollution Action Team members to vote.

- The team is considering a 1-2 day workshop later this fall or early next year to develop the strategy.

- Before the workshop, Team leadership will likely be reaching out to all jurisdictional leads over the next few months to discuss the strategy and the feasibility of proposing actions.

Acknowledgements

- Justin Shapiro, Chesapeake Research Consortium
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- Brooke Landry (MD DNR/SAV Workgroup Chair)
- Technical Team: Bob Murphy (Tetra Tech) and Ryan Woodland (UMCES Chesapeake Biological Lab)
- All the members of the Plastic Pollution Action Team!!!

Questions?

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