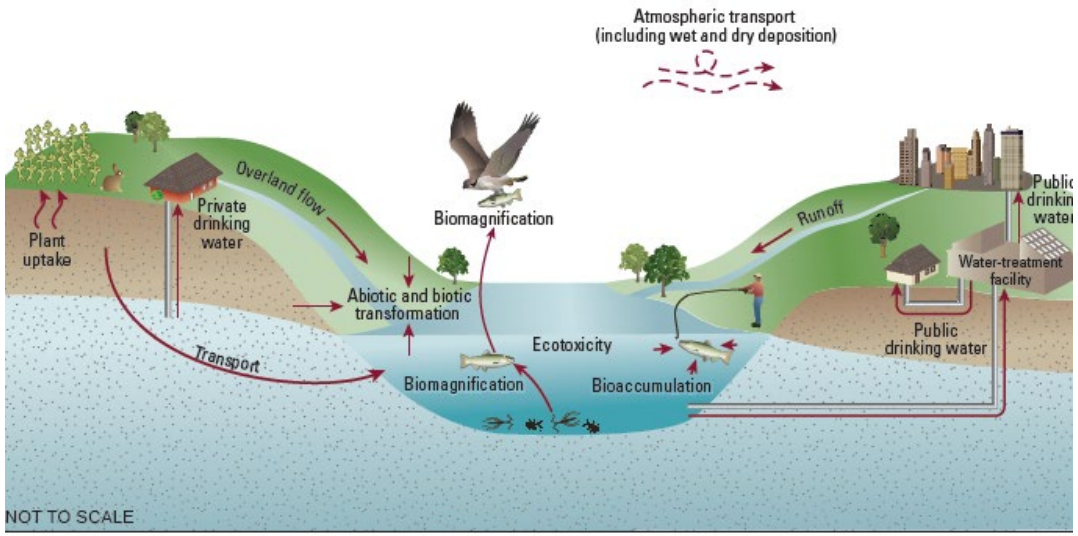


Improving Understanding and Coordination of Science Activities for Per- and Polyfluoroalkyl Substances (PFAS) in the Chesapeake Bay Watershed

Kelly Smalling

STAC Workshop Steering Committee Co-Chair

US Geological Survey, New Jersey Water Science Center

USGS science for a changing world

Michelle Lorah, U.S. Geological Survey (Workshop co-lead)

Greg Allen, U.S. Environmental Protection Agency, Chair of CBP Toxic Contaminant Workgroup

Lee Blaney*, University of Maryland, Baltimore County

Mark Cantwell, U.S. Environmental Protection Agency

Lara Fowler*, Pennsylvania State University

Tom Ihde*, Morgan State University

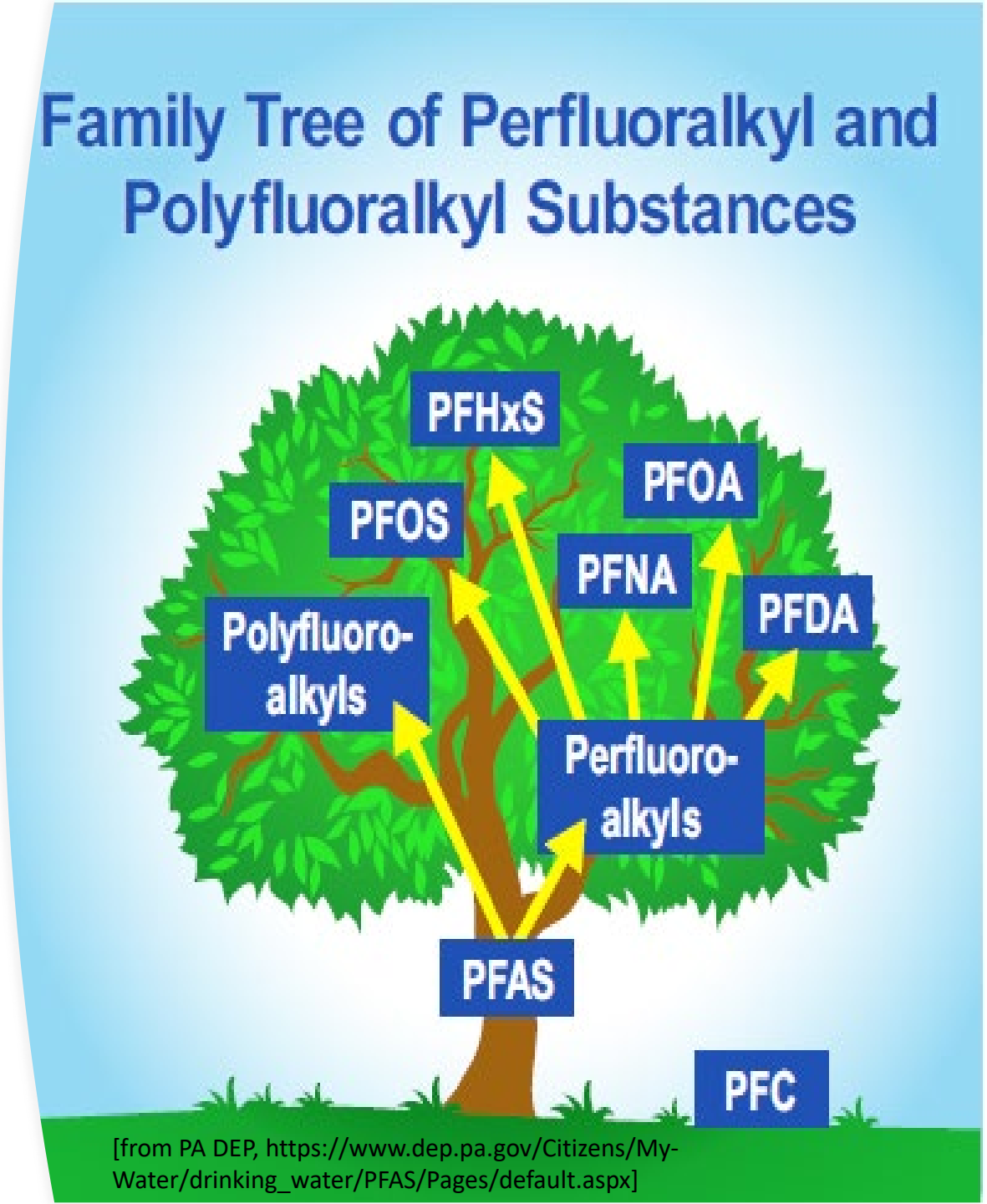
Mark Mank, Maryland Department of the Environment

Emily Majcher, U.S. Geological Survey, Chair of CBP Toxic Contaminant Workgroup

George Onyullo, District of Columbia, Department of Energy and Environment

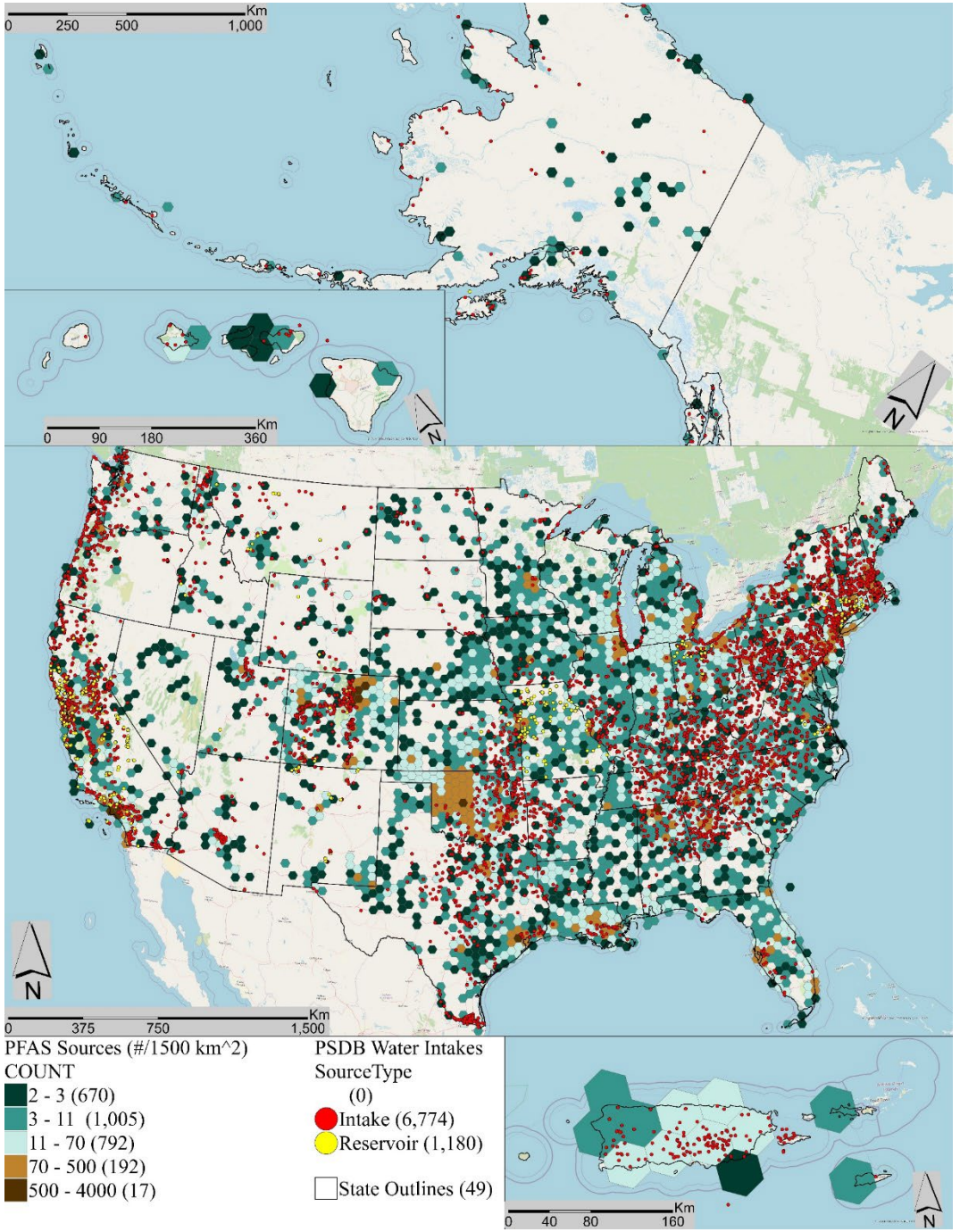
Scott Phillips, U.S. Geological Survey

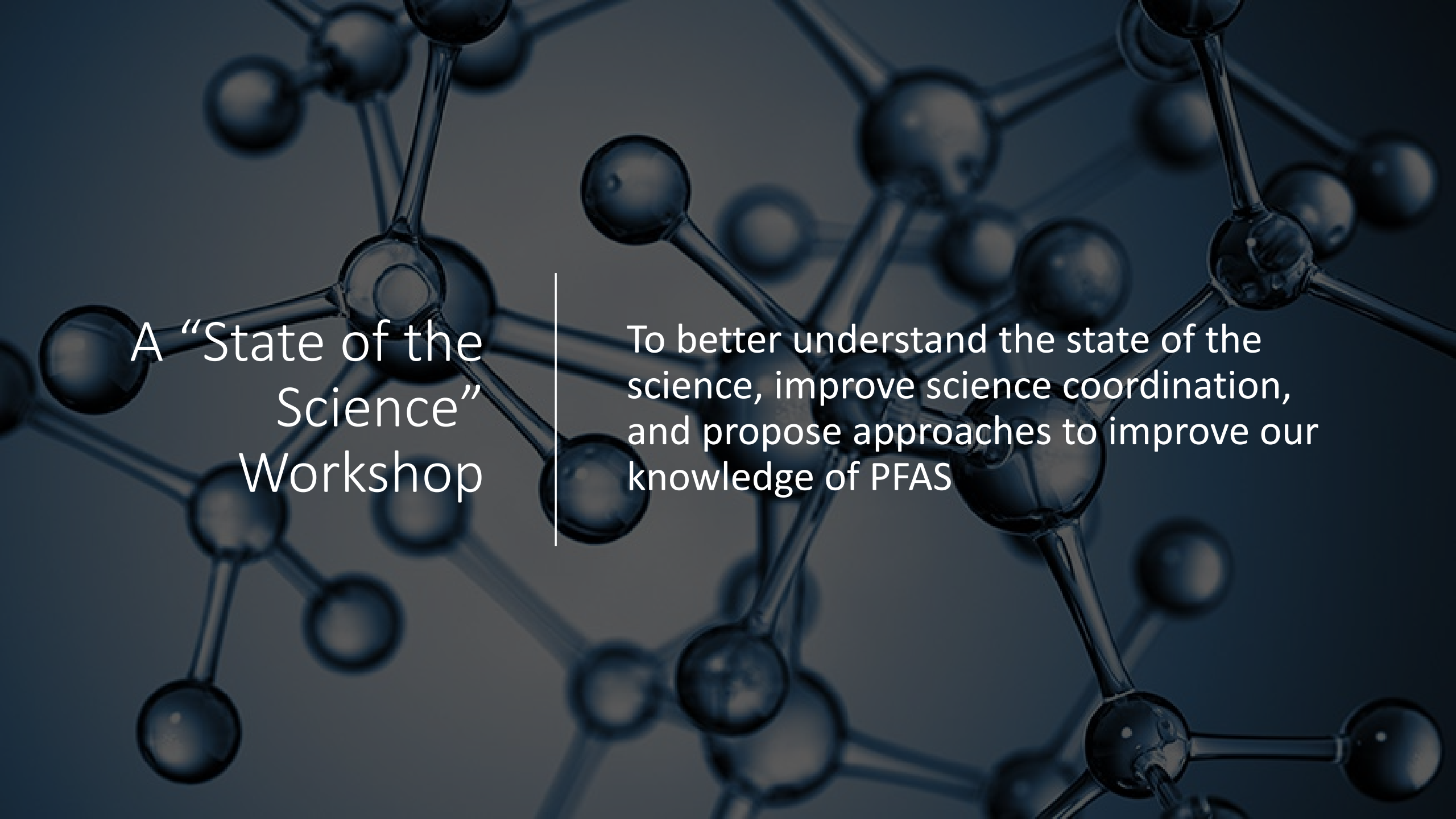
Meg Cole, STAC Coordinator



[from PA DEP, https://www.dep.pa.gov/Citizens/My-Water/drinking_water/PFAS/Pages/default.aspx]


PFAS
SOURCES
PHOTOGRAPHY
SHAMPOO
FIREFIGHTING FOAMS
PESTICIDES
STAIN RESISTANT PRODUCT
PAINTS
FAST FOOD PACKAGING
NON-STICK COOKWARE


Km
0 250 500 1,000
0 90 180 360
0 375 750 1,500
0 40 80 160
N
PFAS Sources (#/1500 km^2)
COUNT
2 - 3 (670)
3 - 11 (1,005)
11 - 70 (792)
70 - 500 (192)
500 - 4000 (17)
PSDB Water Intakes
SourceType
(0)
Intake (6,774)
Reservoir (1,180)
State Outlines (49)



A “State of the Science” Workshop

To better understand the state of the science, improve science coordination, and propose approaches to improve our knowledge of PFAS

Workshop Objectives

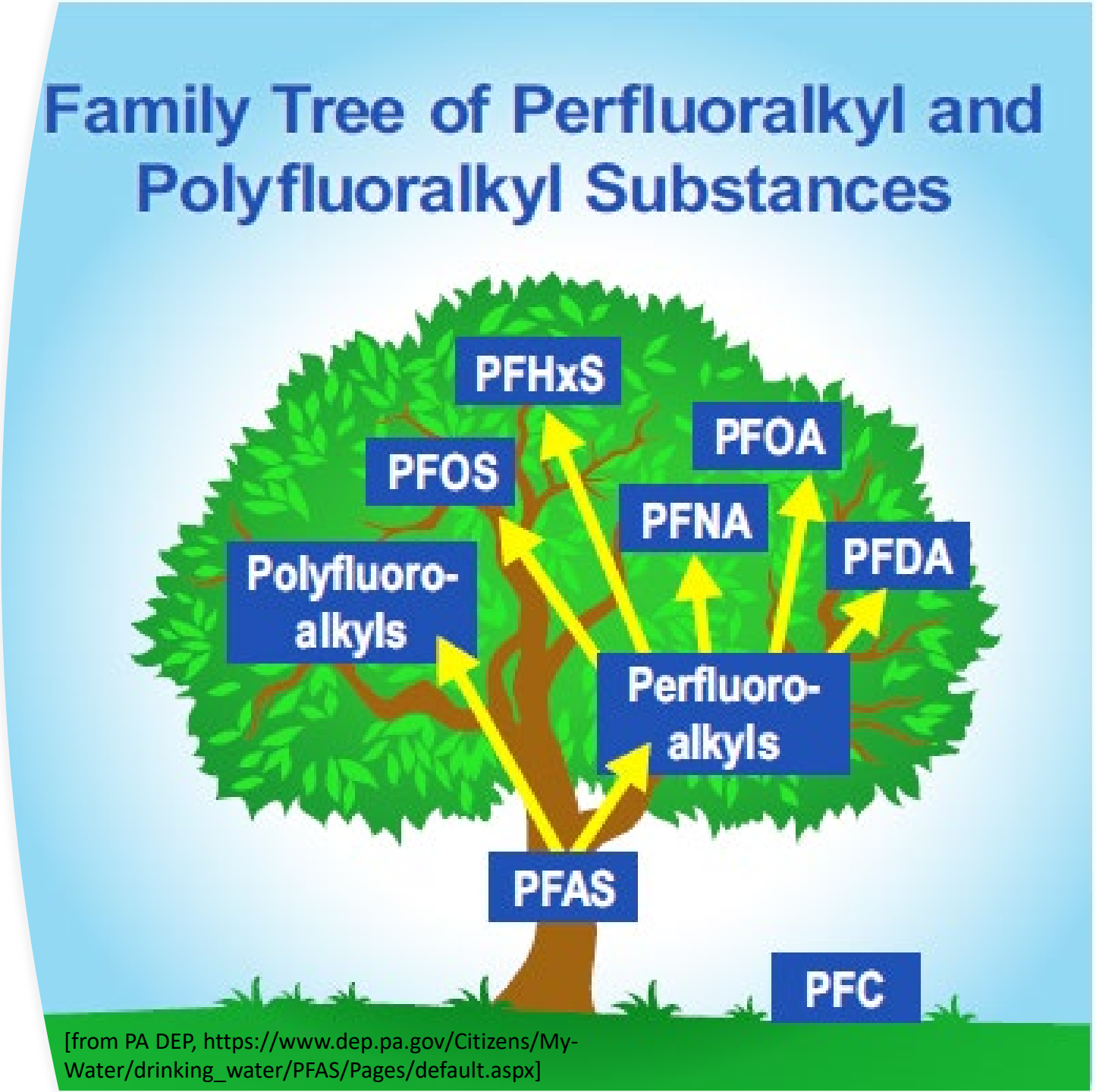
- Summarize current understanding of sources, occurrence, and fate of PFAS
- Identify current efforts and approaches to inform the potential effects on fish and wildlife and their consumption by humans
- Consider study designs and comparable sampling and analysis methods for a more coordinated science effort
- Identify key research needs/data gaps and actionable recommendations associated with better understanding potential effects on fish, wildlife and their consumption as an impact on human health

Workshop Statistics

- Hybrid, in person and online format held in May 2022
- 32 in-person and 44 virtual attendees
- Varied organizations including:
  - jurisdictions and interstate partnerships (MD, DE, PA, DC, NJ, DRBC, ICBPRB),
  - federal (EPA Region 3 and GLRI, USGS, NOAA, FWS, DoD),
  - academic (UMBC, Johns Hopkins, Morgan State, Mount Sinai Medical School),
  - private (EA Engineering)

Workshop Agenda – Day 1

- Session 1: Current Understanding and Efforts to Address PFAS
- Session 2: Considerations for Establishing PFAS Targets for Fisheries- Consumption Advisories and Identifying Potential Effects on Fisheries
- Breakouts to discuss gaps and needs



[from PA DEP, https://www.dep.pa.gov/Citizens/My-Water/drinking_water/PFAS/Pages/default.aspx]

Ongoing Efforts to Address PFAS in the Chesapeake Bay Watershed

- responses to STAC inventory questions distributed prior to the workshop to regulators and researchers at federal and jurisdiction agencies, an interstate commission, non-government organizations (NGOs), and academic institutions in the Chesapeake Bay area
- public sources available on web pages
- a literature review of relevant published research

Inventory Questions

Have potential sources been summarized or categorized in your jurisdiction?

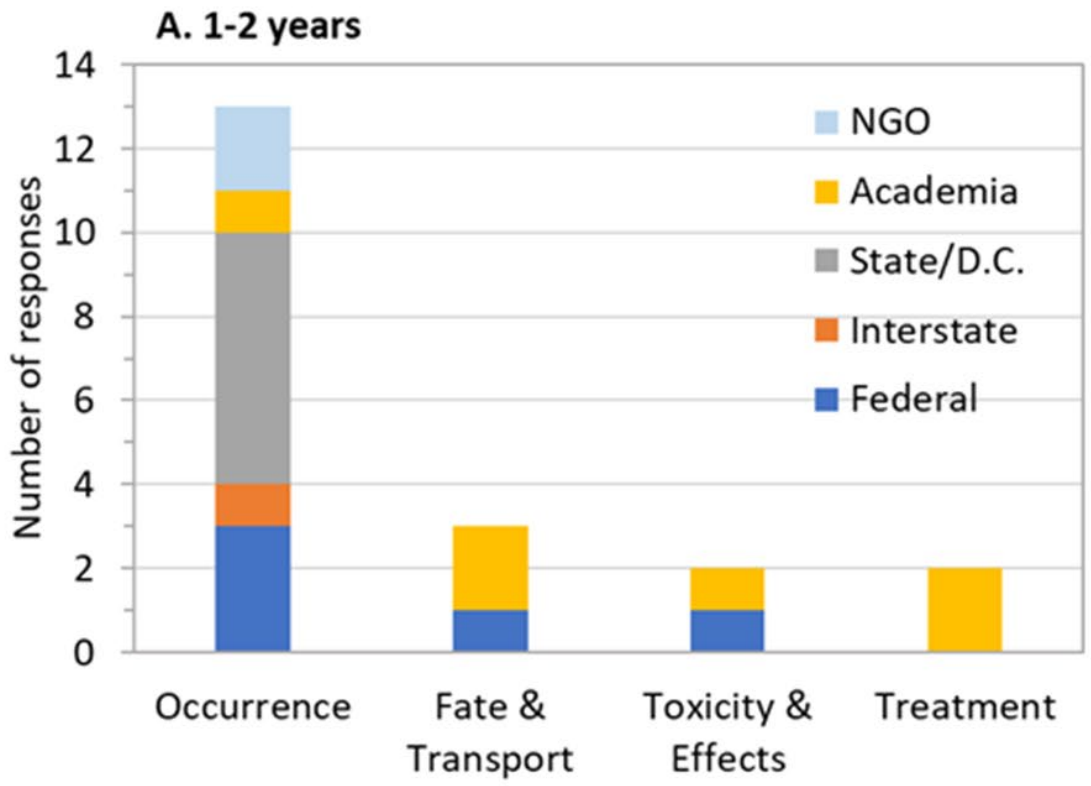
What are the goals of any ongoing or planned PFAS studies in the next 1-2 years?

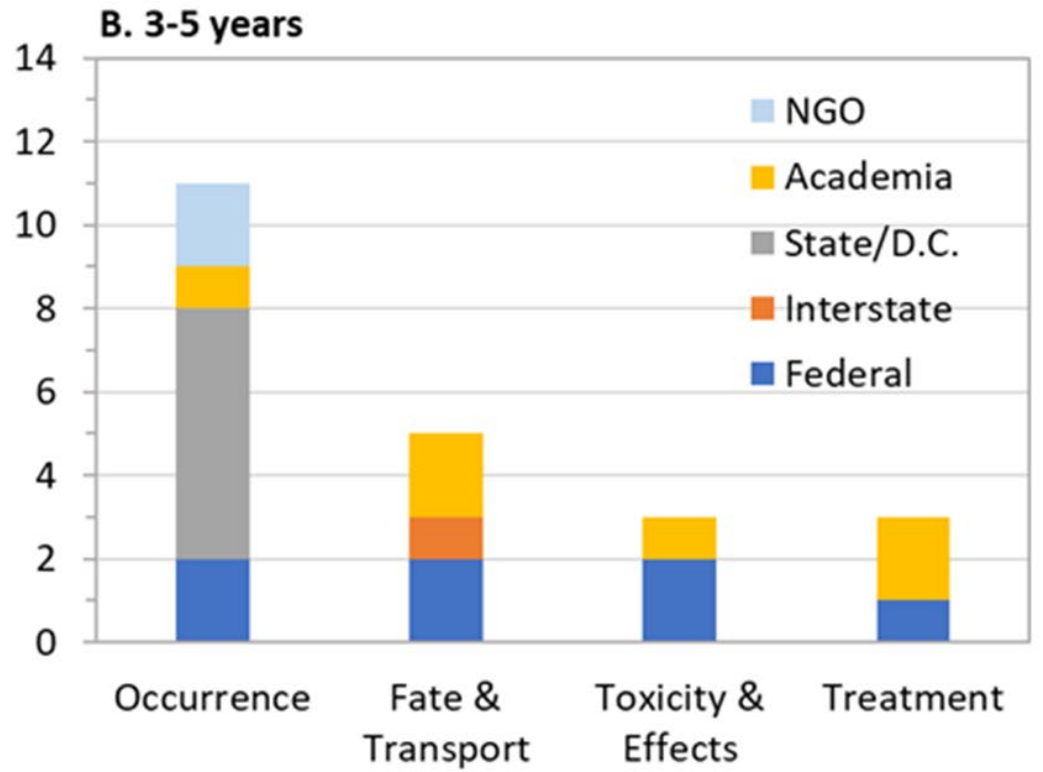
Are there current PFAS recommended action levels (health/consumption advisories) in your jurisdiction, or work underway to establish?

Have any studies indicated ecological effects from PFAS?

What types of PFAS studies would you like to initiate in the next 3-5 years?

What types of PFAS studies would you like to initiate in the next 3-5 years?





Potential PFAS sources that are priorities for current studies

Point Sources

- Industrial sites that used or manufactured PFAS
- Military fire training areas, fire suppression, and storage areas
- Civilian fire training areas, fire suppression, and storage areas
- Wastewater treatment plant effluent
- Landfills

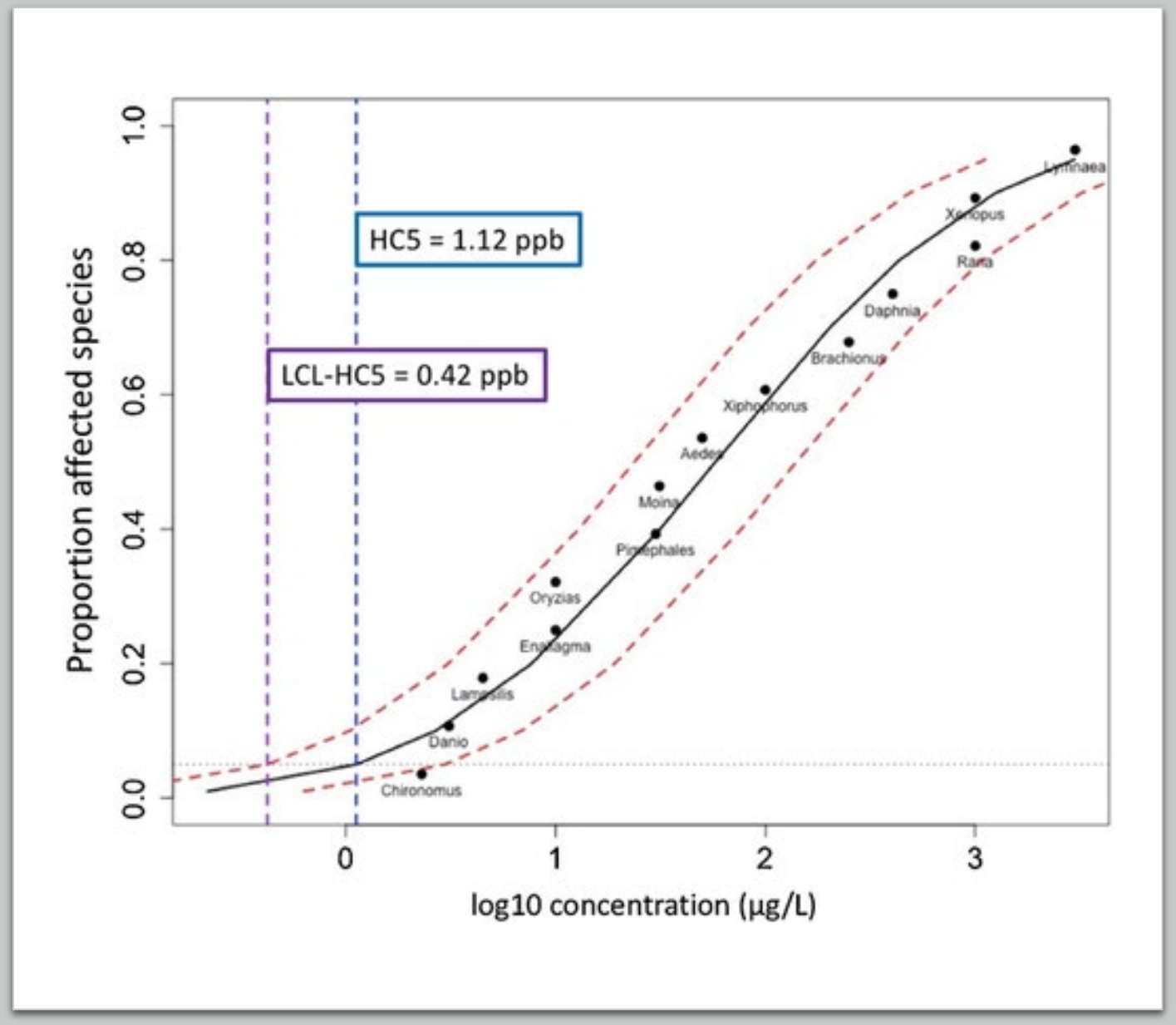
Nonpoint Sources

- Biosolids land application
- Stormwater runoff
- Septic systems
- Atmospheric deposition

Federal and academia responses only.

Effects on fish and wildlife, and their consumption by humans.

- Primary knowledge gaps identified in the STAC workshop proposal was better understanding of the occurrence of PFAS in fish and wildlife.

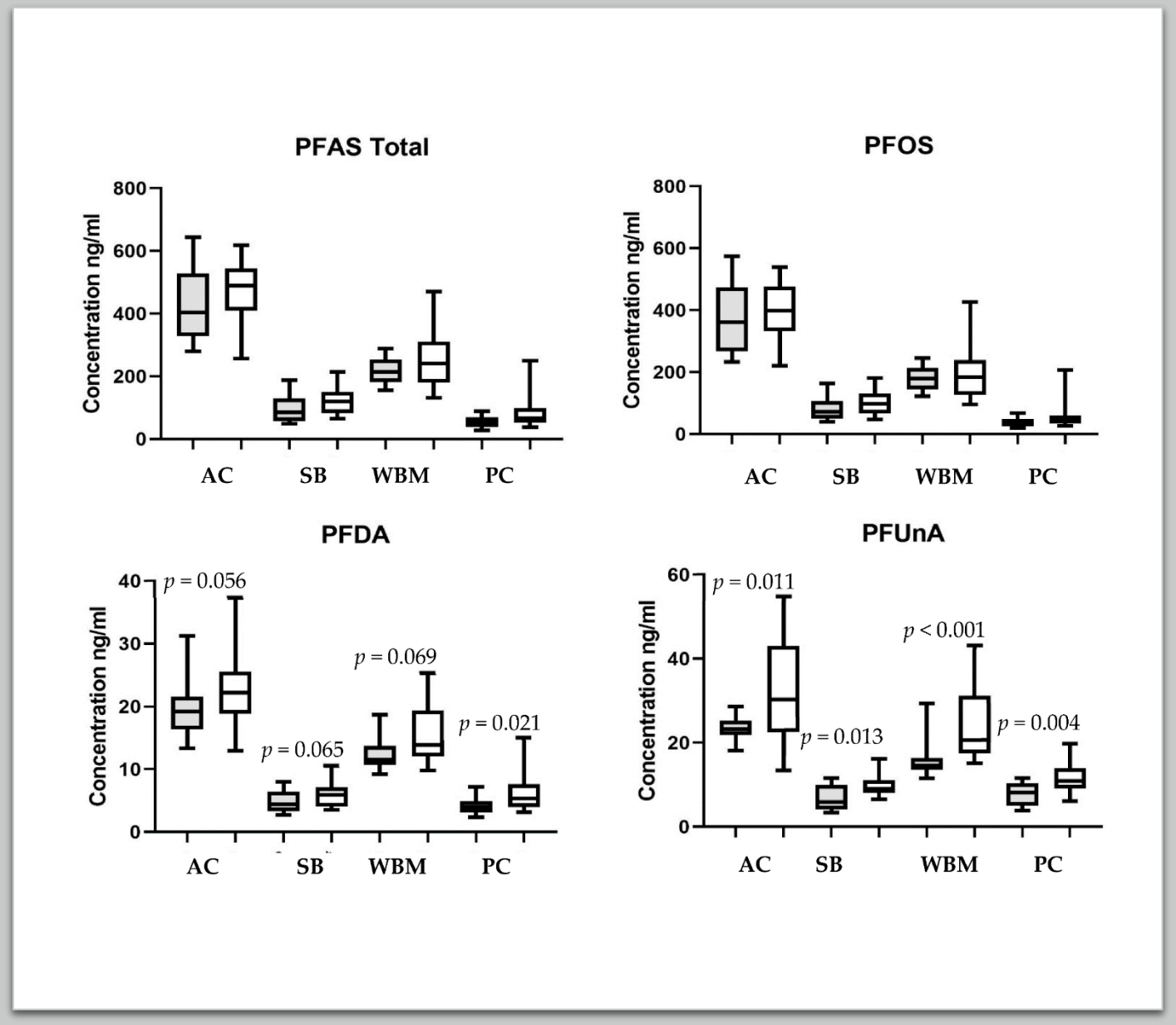


Human health/fish consumption

- PFOS concentrations in fish tissue currently driving risk.
- In MD, consumption screening concentrations have been developed based on 2016 reference doses.
- Measured concentrations below screening levels in most waterbodies
- More information is needed more broadly to assess risk especially as reference doses change

Understanding Potential Effects on Aquatic Organisms

- Much of the current effects research is funded by DoD through SERDP with an emphasis on PFOS
- Limited information is available on PFAS in marine environment and the effects on marine organisms
- Recent work with plasma in small mouth bass shows 4 PFAS were ubiquitous: PFOS, PFUnA, PFDoA, PFDA.



Workshop Agenda – Day 2

- Session 3: Considerations for Developing a Coordinated Monitoring Effort for PFAS in the Chesapeake Bay – Sampling and Analysis
- Break-out to discuss knowledge gaps and answer a series of questions
- Develop Recommendations to Address Science Gaps for a More Coordinated Research and Monitoring Effort for PFAS in the Chesapeake Watershed

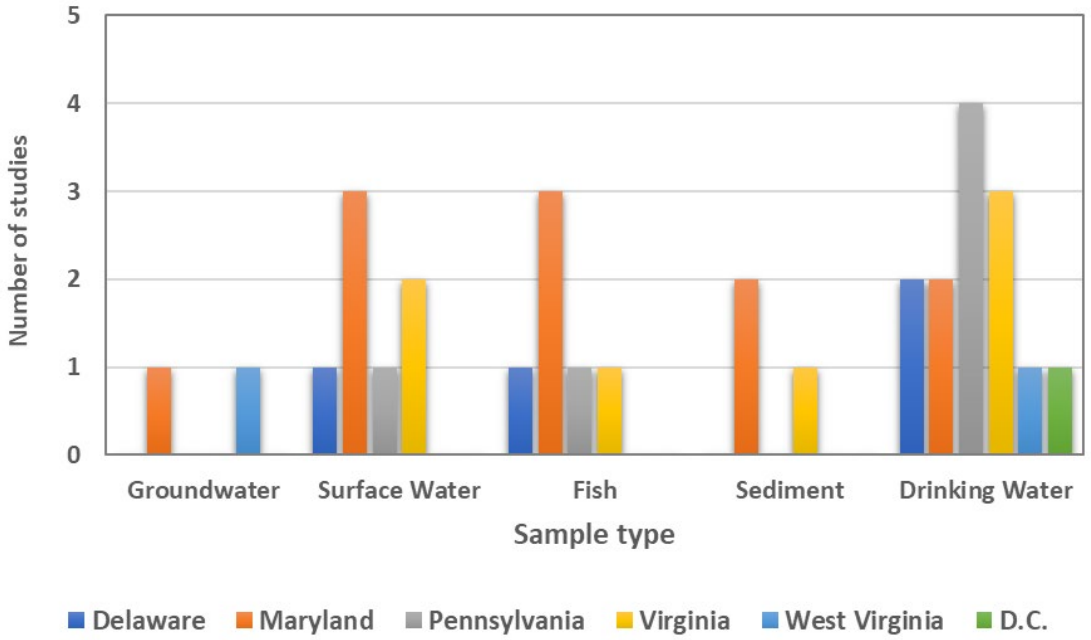
Sampling and Analysis

Analysis Method

- Water: EPA 537.1 (dw), EPA 533 (dw, sw) by various state/contract labs
- Fish: SGS Axys method

Sample Method

- Grab (dw, sw, sediment), POCIS (sw passive)
- Fish: composite fish fillets (5 each by species, or tidal, non-tidal specific species), oysters (12 each), plasma



Monitoring Takeaways

- Drinking water and surface water sampling are the primary focus
- Sample collection, preparation and analytical methods are not standardized
- For tissue analysis, blood and liver and edible portions that approximate potential human exposure.
- Communication and transparency among partners wishing to compare and share data is extremely important.

Gaps Related to Coordinated Efforts for PFAS

- *Which analytical methods to choose?*
  - Regulatory: Consensus around EPA 1633
  - Fate/transport: targeted, non-targeted, total oxidizable precursors should be considered based on objectives
- *Which chemicals or bulk groupings should be analyzed?*
  - Regulatory: Targeted list, with emphasis on legacy PFAS
  - Tiered approach, screening, then targeted could be cost-effective initial step
- *What tissues should be analyzed and how?*
  - Fish consumption: skin off fillet and/or whole fish
  - Fish health: blood and organs (due to protein binding)
  - Bioaccumulation/biomagnification: whole animal

Develop Recommendations to Address Science Gaps for a More Coordinated Research & Monitoring Effort for PFAS in the Chesapeake

- Identify and rank the high priority **science gaps** related to the sources, occurrence, fate and ecological effects of PFAS and
- develop **actionable recommendations** for more **coordinated research and monitoring** of PFAS

High Priority Science Needs

Urgent, short-term

- Temporal and spatial assessment of PFAS occurrence in tributaries
- Coupled fish and surface water sampling to develop species specific bioaccumulation factors (“early warning system”)

High Priority Science Needs

Near-term

- Development of a regionally uniform bioconcentration factor approach to drive fish consumption advisories
- Information on effects of PFAS on different life stages of fisheries in estuarine and freshwater systems

High Priority Science Needs

Near- to mid-term

- Inform what land-uses are most likely to contribute to predict occurrence, delivery, and load
- Investigate the biological effects of PFAS at lower concentrations
- Expand studies directly designed to address biomagnification of PFAS

High Priority Science Needs

Long-term

- Assess cumulative effects of PFAS and other contaminant and biological stressors on aquatic species and synergistic effects that have the potential to enhance the risk of PFAS
- Assess chronic toxicity for larval oysters and blue crabs with an emphasis on long-term exposures
- Emphasize/prioritize more studies directly assessing the interface between the aquatic and terrestrial environments

Actionable Recommendations: Study Design and Approaches

- **Design a monitoring network and specific approaches to directly address PFAS.**
  - Widespread tributary monitoring in multiple media to identify targeted PFAS mixtures in regions or areas associated with specific sources.
  - Development of test bed sites that require active sampling to address a broad range of priority science gaps through integration and collaboration.
- **Design studies that relate PFAS occurrence and effects in different land-use settings.**
  - Rural lands where biosolids application, septic systems, and other non-point sources, may potentially introduce PFAS to groundwater, soil, and food crops.

Actionable Recommendations: Consistency in Data collection

- **Develop and adopt similar field collection and analytical approaches and methodologies to better compare data among studies.**
  - EPA 1633
  - Consistent study designs and sampling methods
  - Identify at least one sentinel species
  - Identify a set of common approaches to build food web models
- **Collect standardized data to develop ecological risk assessments across a range of species for the protection of aquatic resources.**
  - Studies to address sublethal effects
  - Acute and chronic toxicity testing
  - Development of aquatic life criteria
  - Develop studies to address synergistic responses with other contaminants.

Actionable Recommendations: Communicate and Collaborate

- **Enhance interaction between management agencies and scientists to facilitate broad coordination across the Bay watershed.**
  - Capacity for coordination
  - Database and web page development (e.g., PFAS portal)
- **Collaborate amongst jurisdictions to develop data needs for fish consumption advisories.**
  - Science and managers working together to identify tissue concentrations in support of assessing important thresholds for human health and health of aquatic communities. This would involve coordination of sampling designs and analytical methods and the types of tissues collected for analysis.

Responses to Comments Received

- 1 workshop participant commented on the draft report sent out for review
- 2 STAC members commented on the draft report
- Executive summary was substantially revised based on STAC feedback
- References were added to report focused on sources and WWTPs
- Inconsistencies identified were either clarified or revised
- Where editorial clarifications were suggested, changes were accepted
- No changes were made in the science gaps, and no recommendations were added or deleted
- Responses to any comments and changes were documented and are available for review

USGS Approval Process

- The State of the Science report was tentatively approved by the USGS on January 18, 2023
  - Peer review comments were minor and all editorial

- USGS proposed a change to the disclaimer during the approval:

NEW: “The enclosed material represents the professional and expert findings of individuals undertaking a workshop…”

CURRENT: “The enclosed material represents the professional recommendations and expert opinion of individuals undertaking a workshop”

Final Asks

- The steering committee were able to champion the workshop from proposal through delivery of the final report
- We ask STAC and others (e.g., TCW) to champion the follow through on identified recommendations for more coordinated PFAS monitoring and research throughout the watershed.
- I ask for STAC's approval to finalize and publish the STAC workshop report