Integrating Science and Developing Approaches to Inform Management for Contaminants of Concern in Agricultural and Urban Settings

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Final report summary of the STAC Workshop held May 2019

Watershed Agreement: *Toxic Contaminants Goal*

Policy and Prevention Outcome: focused on PCBs

Research Outcome

- Continually increase our understanding of the impacts and mitigation options for toxic contaminants.

- Develop a research agenda and further characterize the occurrence, concentrations, sources and effects of mercury, PCBs and other contaminants of emerging and widespread concern.

- In addition, identify which best management practices might provide multiple benefits of reducing nutrient and sediment pollution as well as toxic contaminants in waterways.

Contaminant Groups and Strategies

Widespread Severity and Occurrence

PCBs →

Mercury →

Policy/Prevention Strategies

Potential policy strategy: what else needed?.

Local Effects

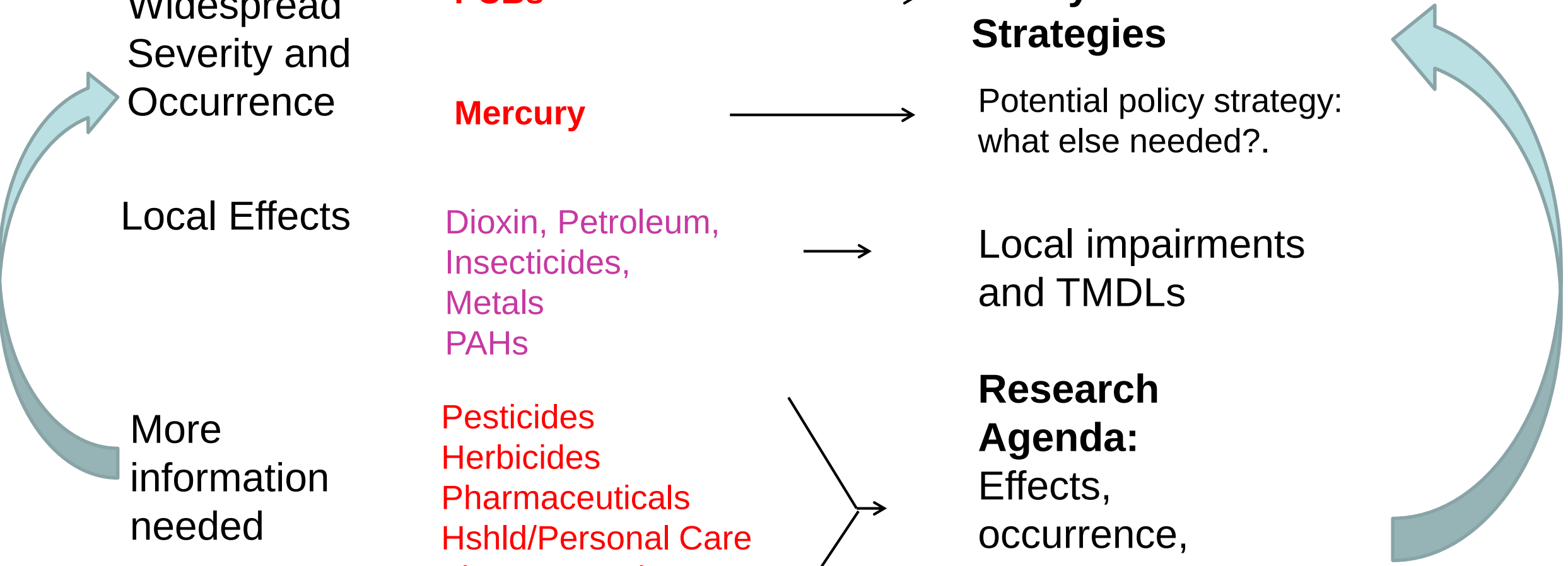
Dioxin, Petroleum, Insecticides, Metals PAHs →

Local impairments and TMDLs

More information needed

Pesticides
Herbicides
Pharmaceuticals
Hshld/Personal Care
Flame Retardants
Biogenic Hormones →

Research Agenda: Effects, occurrence, sources, Co-benefits



STAC Workshop Objectives

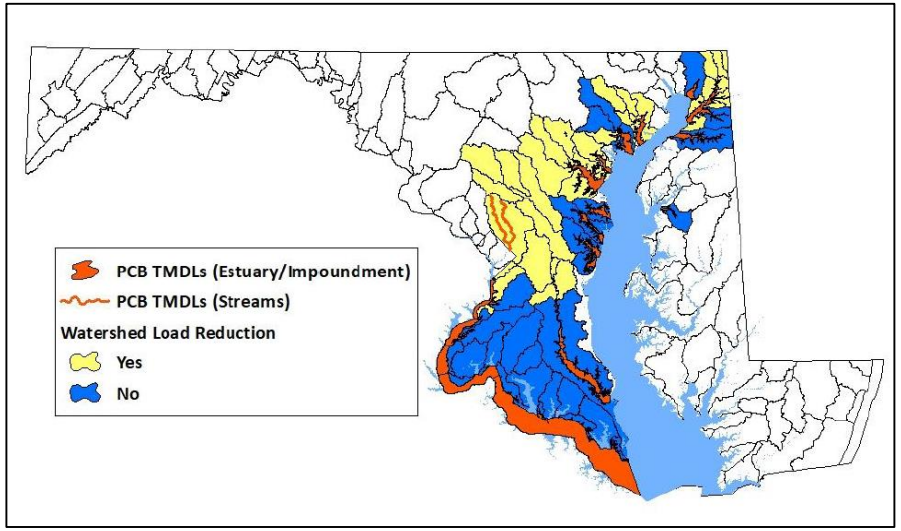
- Discuss contaminants related to fish consumption advisories, fish health, and emerging concern;
- Identify sources, occurrence, and transport of contaminants in agricultural and urban settings;
- Characterize opportunities to mitigate effects of contaminants in each setting by taking advantage of nutrient and sediment reductions, and other innovative approaches;
- Identify future needs for research and more integrated management approaches

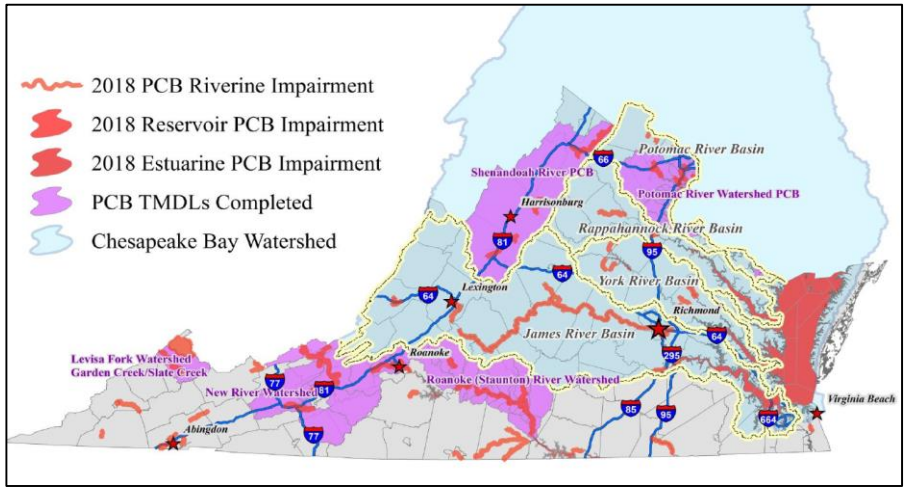
Workshop Agenda and Participants

- 50 participants: all CB jurisdictions, other National efforts
- Jurisdictional Panel: Overview of issues and mitigation efforts
- Session 1: Primary contaminants related to fish consumption advisories and fish health
- Session 2: Primary contaminant sources, fate, and transport
  - Breakouts: Urban and agricultural groups
- Session 3: Mitigation and potential of nutrient and sediment management actions for contaminant reductions
  - Breakouts: Urban and agricultural groups

Jurisdictional Panel Highlights

- Most jurisdictions using local TMDLs to address toxic contaminants
  - PCB dominated
- NPDES permits
  - MS4
  - Industrial
  - Individual
- Other
  - DC coal tar sealant ban (PAHs)
  - Anacostia sediment study (megasite)
  - DE integrated cleanup and TMDL (WATAR)

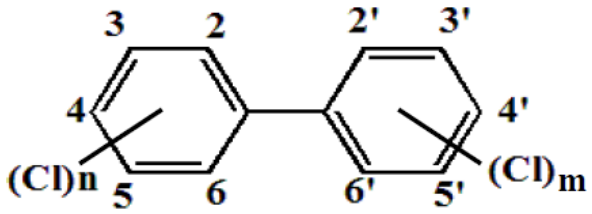




What are the chemicals contributing to fish consumption advisors?

- **PCBs & Mercury**: widespread fish consumption advisories
  - Range from “No consumption to 8 meals per month”
- **Organochlorine pesticides**: lesser extent

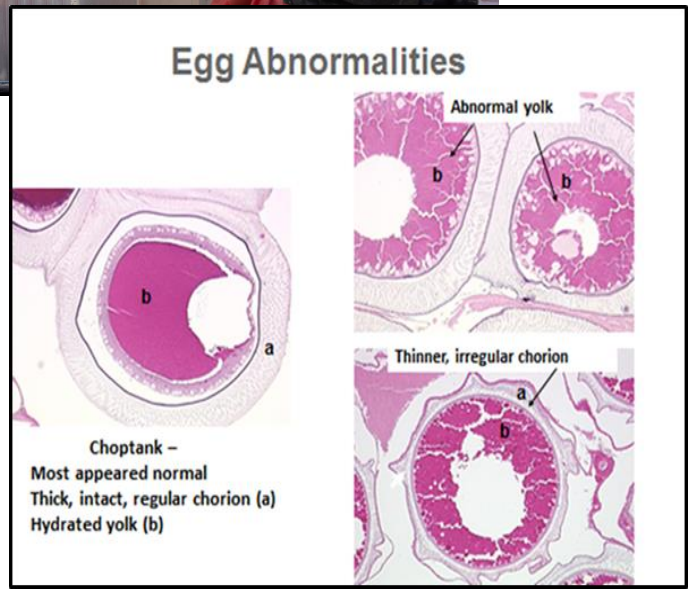
- **Emerging contaminants**: fish consumption advisories not established
  - Exception of PFAS in NJ



(Photo: Kjellerup, 2019)

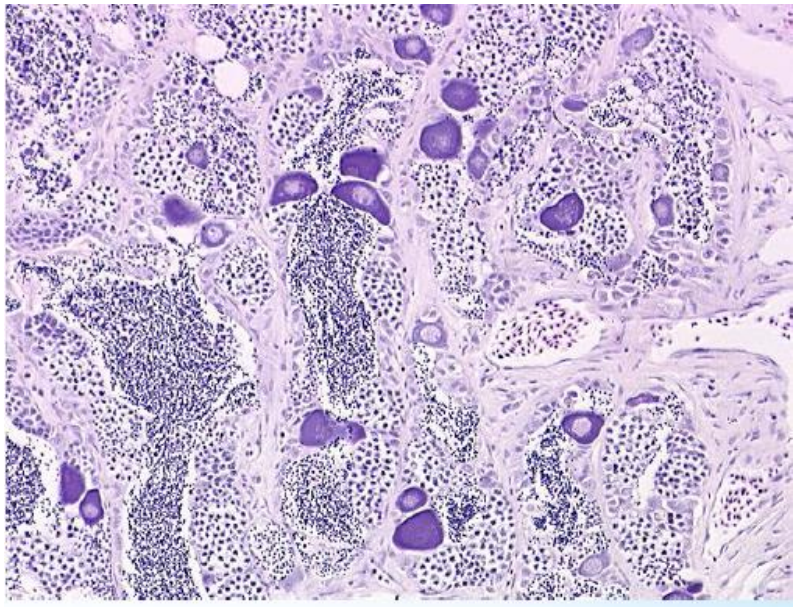
How are contaminants affecting fish health?

- **Urban settings**:
  - Neoplasia (abnormal tissue growth)
    - Tumors in Brown bullheads
    - DNA alteration
    - PAH exposure (PCBs and DDT)
  - Reduced reproductive success of yellow perch
    - Combined exposures to legacy (e.g., PCBs) and emerging contaminants



How are contaminants affecting fish health?

- **Agricultural settings**:
  - Fish kills, low chronic mortality, skin lesions, reproductive endocrine disruption observed
  - Increased susceptibility to infectious agents and disease susceptibility (ag land use and chemicals present)



Science needs and recommendations

- Fish health
  - Early indicators of sub-lethal effects
  - Risk factors contributing to skin tumors and skin lesion
  - Identify chemical concentration thresholds
- Management actions to reduce exposure
  - Sources of pollutants entering the food chain & causing consumption advisories
  - BMPs and effects on fish health
    - Monitoring in Potomac
    - Small mouth bass populations

Lesions decreasing

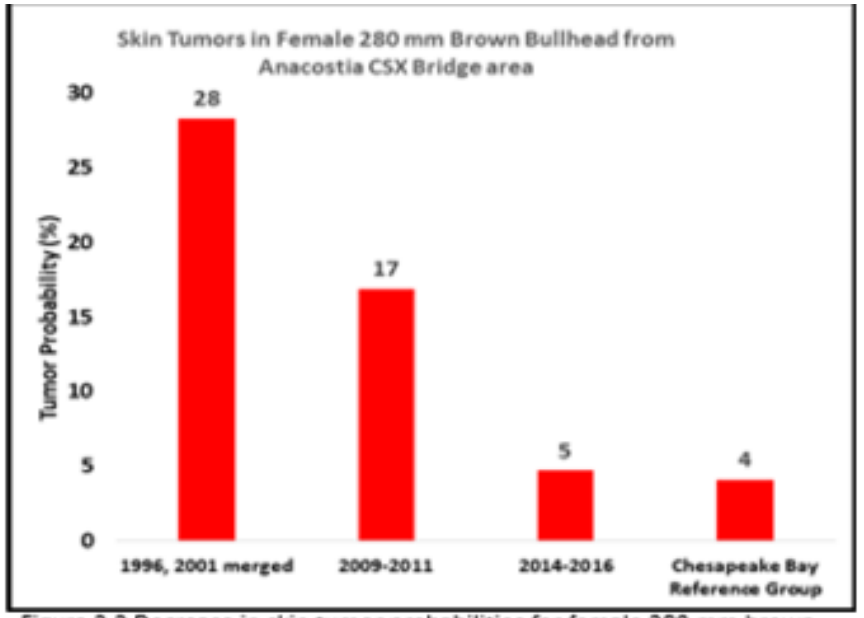
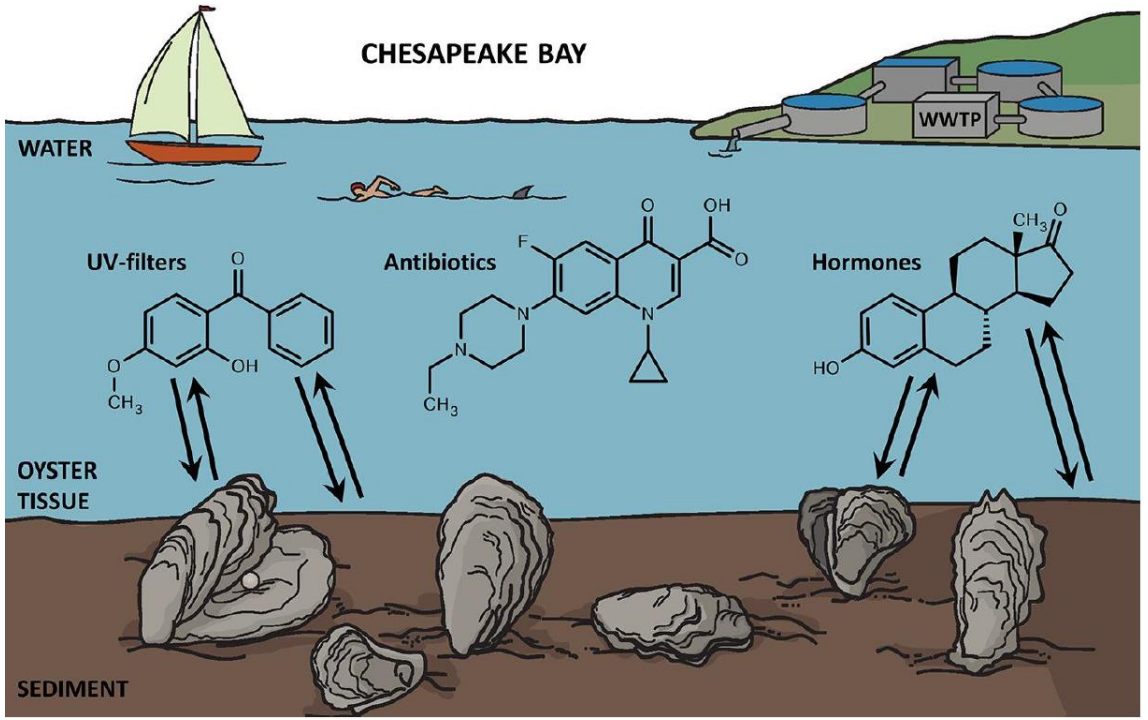
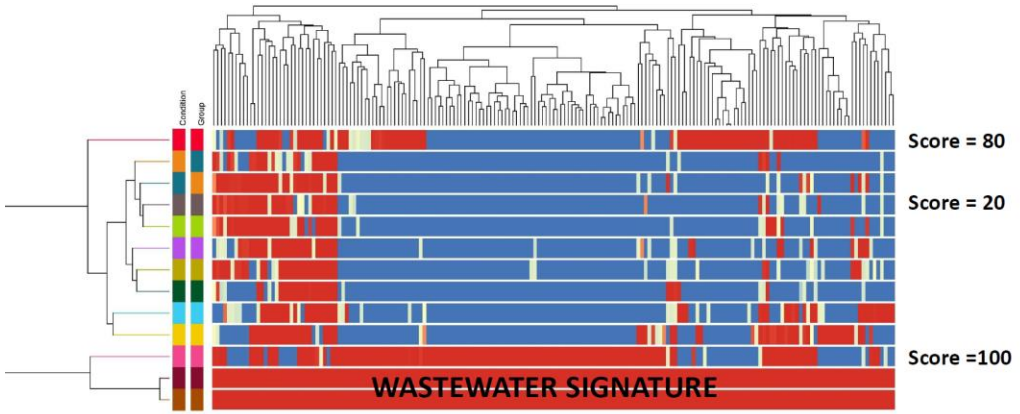


Figure 2.2 Decrease in skin tumor probabilities for female 280 mm brown bullhead from the Anacostia River (Pinkney et al. 2019)

Urban Areas: Contaminant Sources, Fate, Transport

- Fate and transport of CECs and transformation products are largely unknown
- While urban conveyance sources are well known (ww, stormwater, atm), complexity of urban systems complicates source definition and selection of appropriate management for habitat improvement
  - Puget Sound “fingerprinting” sources
  - Hudson R. sediment removal in upper portion has so far resulted in limited impacts to fish in lower portion ($1B effort)



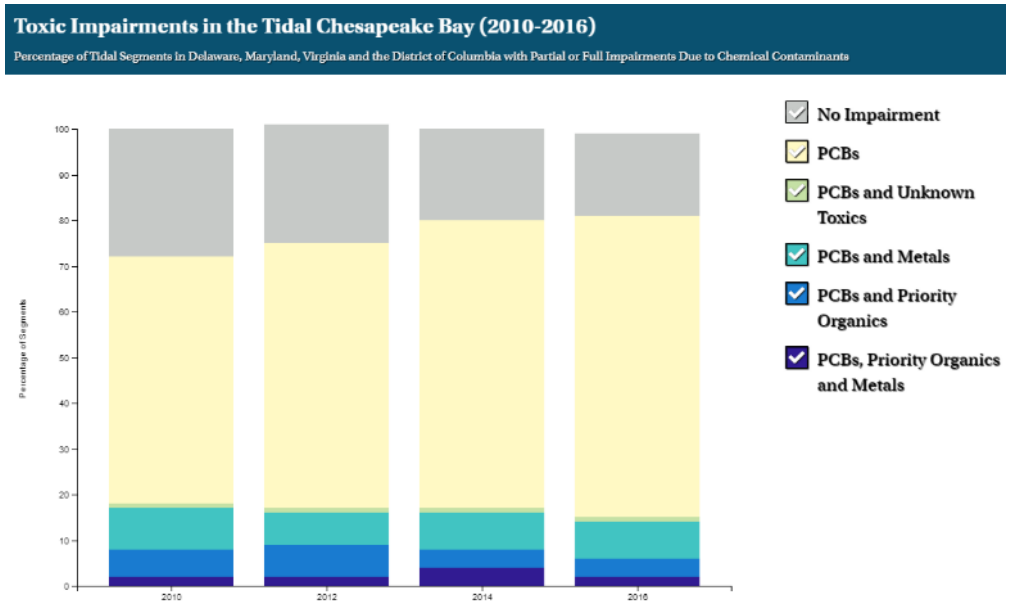


Urban Areas: Opportunities to Reduce Toxic Contaminants

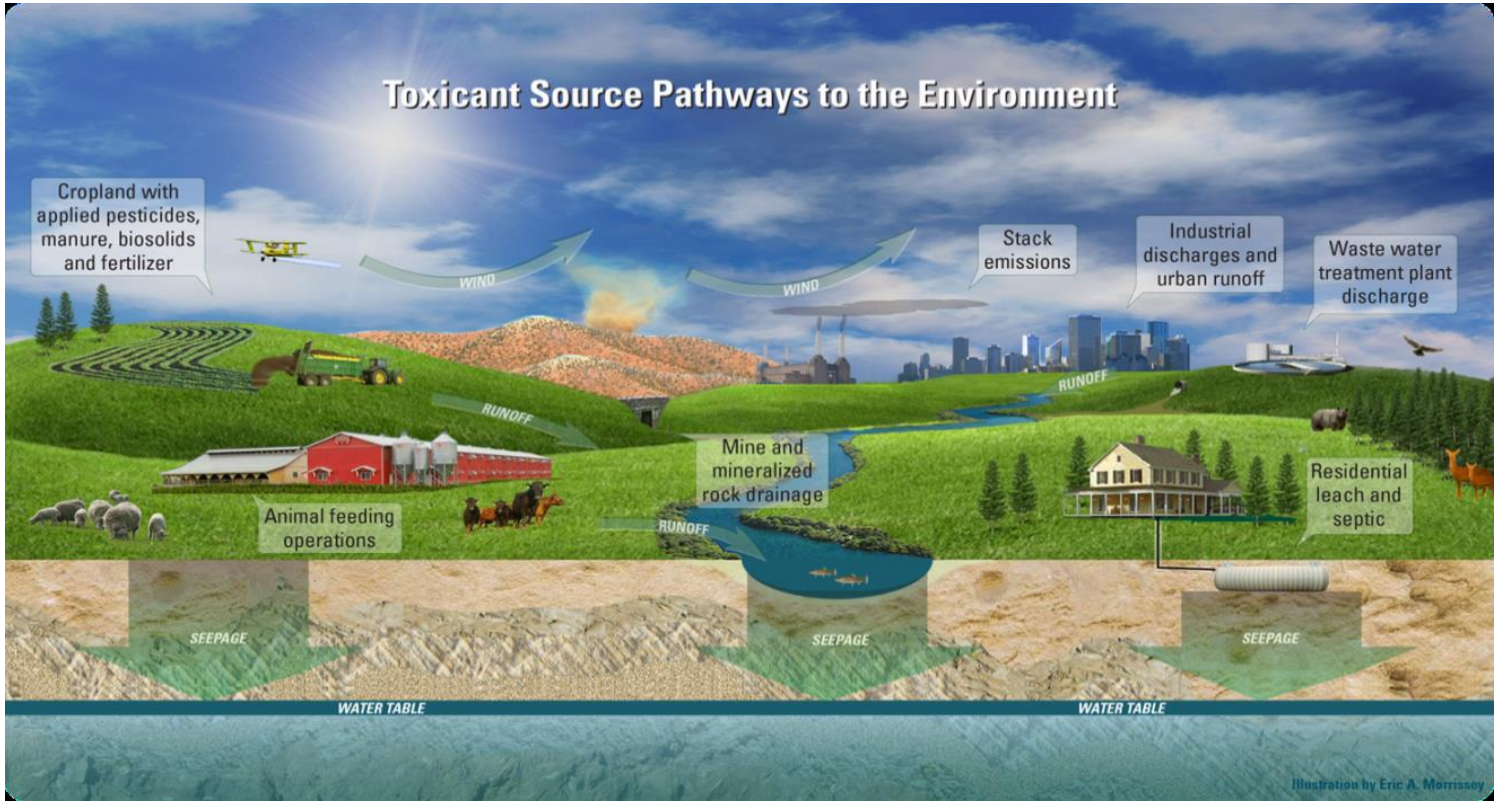
- Sediment capture and reactive filter BMPs reduce concentration and toxicity related to urban stormwater runoff
- Iron-enhanced sand filtration reduces concentrations of pesticides and wastewater indicators
- In stream innovative treatment using activated carbon with and without bioamendments immobilizes and degrades PCBs

Urban Areas: Science Needs and Recommendations

- Improve best practices for source evaluation and conceptual model improvement for management selection
  - Example Anacostia R sediment project
- Better define the fate and transport of toxic contaminants in different settings including stormwater control structures (effectiveness and OM knowledge gaps)
- Compile and communicate efficiencies and effectiveness of BMPs and in stream mitigation for concentration reduction and improvement of aquatic organism health



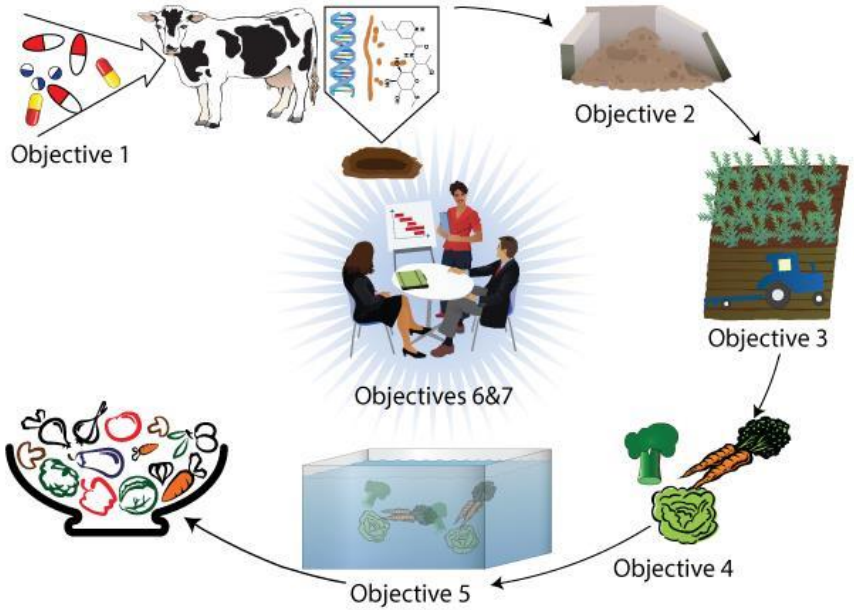
Agricultural Areas: Contaminant Sources, Fate, Transport



- Sources of contaminants are relatively well defined
  - Pesticide use
  - Manure storage/application
  - Biosolid application
  - Irrigation treated WW, septic
- Detailed information on many CECs is currently limited

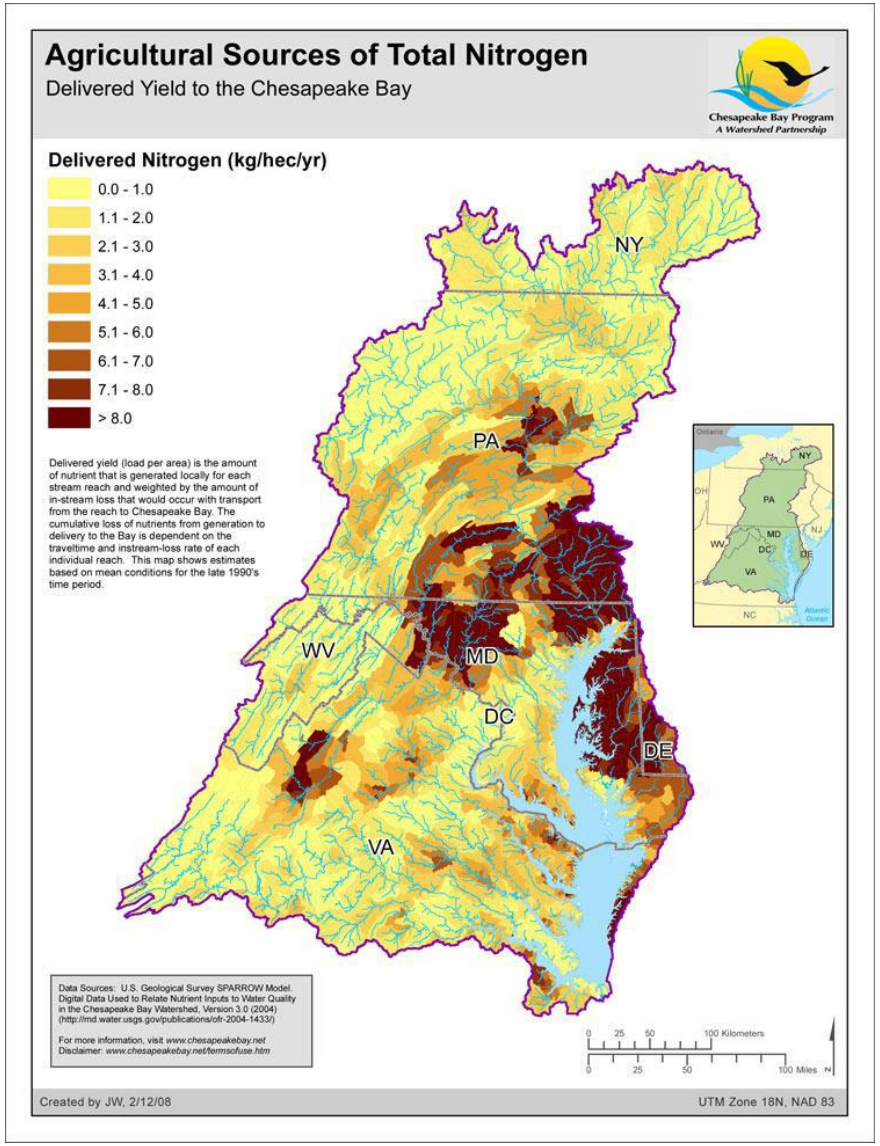
Agricultural Areas:Opportunities to Reduce Toxic Contaminants

- Activated carbon or biochar to established BMPs effectively reduces contaminant transport
- Retention ponds and vegetative treatment reduces pesticide loading
- Manure management including composting, subsurface application, buffer strips, etc. reduce antibiotics and antibiotic resistance



Agricultural Areas: Science Needs and Recommendations

- Help prioritize BMP implementation
  - Identify contaminants that require reduction (exposure)
  - Desired outcome (e.g., fish health)
  - Establish how the BMP functions in relation to this outcome
- Compile/communicate findings of nutrient and sediment BMPs effectiveness to reduce toxic contaminants
- Build qualitative frameworks to answer questions related to co-benefits for toxic contaminants



Products

STAC Report

- https://www.chesapeake.org/stac/document-library/integrating-science-and-developing-approaches-to-inform-management-for-contaminants-of-concern-in-agricultural-and-urban-settings/

Workshop materials

- https://www.chesapeake.org/stac/events/integrating-science-and-developing-approaches-to-inform-management-for-contaminants-of-concern-in-agricultural-and-urban-settings/

Next Steps: STAC Letter to CBP

- Gaps in compiling and communicating potential removal efficiencies for contaminants
  - Continued expansion and compilation of BMP studies
  - Examine known and emerging contaminants
  - Capitalize on possible co-benefits
- BMPs are necessary investment to reduce contaminant loads and improve water quality
  - Research investment to understand co-benefits or negative impacts
  - Close working relationship between researches and management community to develop tools

- Prepare CBP responses to STAC

Potential CBP Responses to STAC

STAC:

- Gaps in compiling and communicating removal efficiencies
- Close working relationship between researches and management community

CBP Action 1: Enhance Interaction with Audiences for Contaminant Information

- Jurisdictions:
  - Implementing Phase 3 WIPs
- Water Quality GIT & workgroups
  - Ag, Stormwater, WWTP
- Local TMDL implementation
  - States, DC, and local jurisdictions
- Science providers

Potential CBP Responses

STAC: Close working relationship between researches and management community

CBP Response 2: Take advantage of Phase 3 implementation

- Nutrient and sediment BMPs with contaminant benefits
- Jurisdictions consider BMP planning
- New findings provided 2 years
- Materials to inform decisions

2020	2021	2022	2023	2024	2025
Phase 3 WIPs	New findings		New findings		New findings

Potential CBP Responses

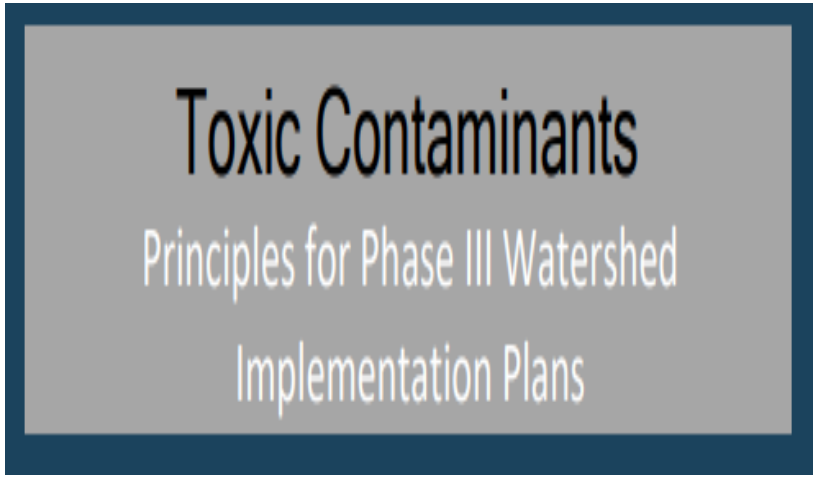
STAC: Gaps in compiling and communicating removal efficiencies; close working relationships

CBP 3: Enhance Communication Materials to Inform Decisions

- Stakeholder input on most useful topics
  - Ag, Urban, WWTP WGs

- Fact Sheets/

Briefing Materials



Best Management Practice	Urban Pollutants	Agricultural Pollutants
Ag Forest Buffer		4
Streamside Forest Buffers		3
Narrow Forest Buffer	3	3
Runoff Reduction	2.5	
Wet Ponds	2.5	
Urban Forest Buffers	2.5	
Filtering Practices	2	
Infiltration Practices	2	
Dry Ponds	2	
Bioretention	1.5	

Potential CBP Responses

STAC:

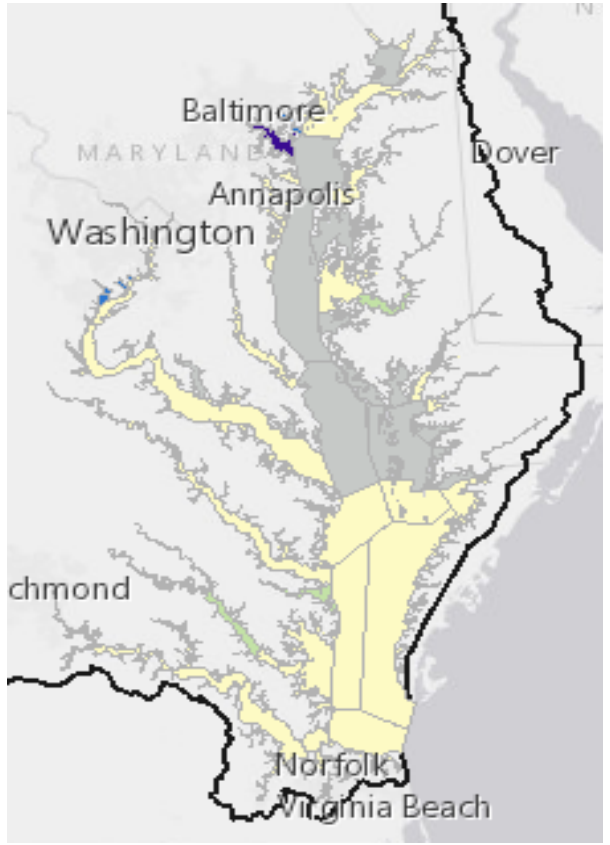
- Research investment to understand co-benefits or negative impacts;
- Gaps in compiling and communicating potential removal efficiencies for contaminants

CBP 4: Compile results and expand BMP studies

- Science needs updated
- Synthesis of BMPs from existing studies
- Expand studies for contaminants of most concern
- Ag, Urban, WWTP WGs

CBP 5: Selected BMP results into CBP tools

- Watershed Dashboard, modeling, and CAST



Next Steps and Questions

- Present findings and draft response to WQ GIT and WGs
- Response through CBP to STAC
- Progress on responses
- Build into TCW action plans

- Questions?
- Follow-up:
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