Introduction to the Toxic Contaminant Inventory

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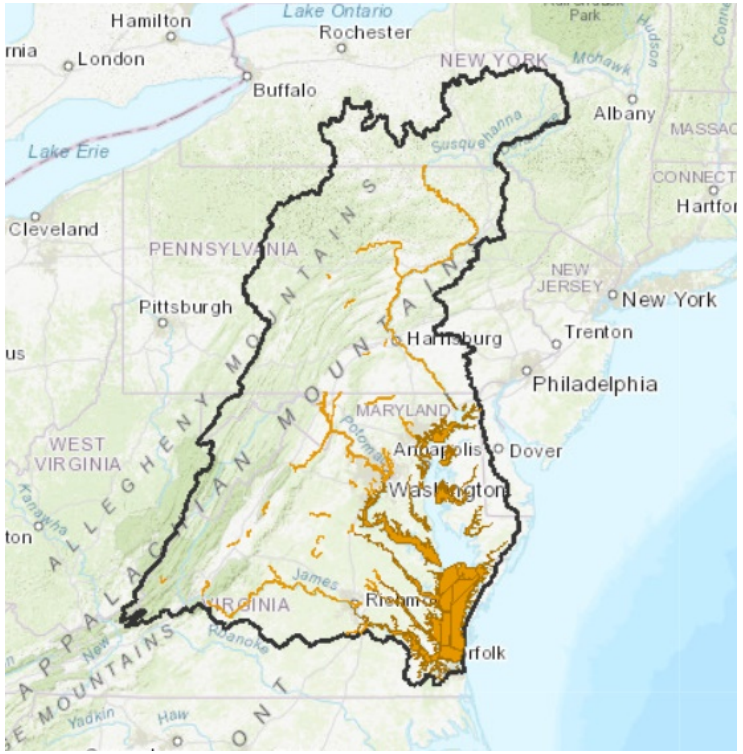
USGS MD-DE-DC Water Science Center

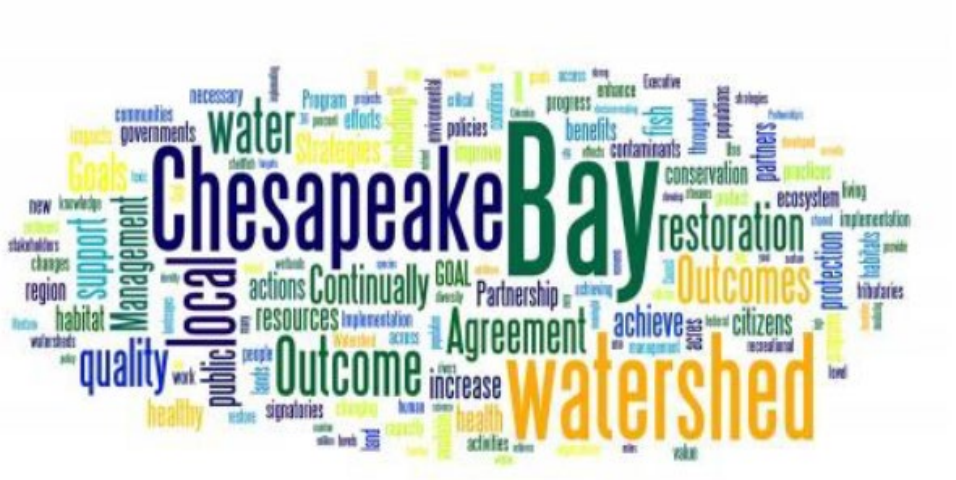
Summary

- Purpose of task as part of new USGS Science Strategy
- Summary of inventory compilation approach
- A few highlights of the inventory
  - Data distribution
  - Spatial extent
- How to use?
  - Example w/ power analysis to examine temporal trends



Toxic Contaminant Inventory

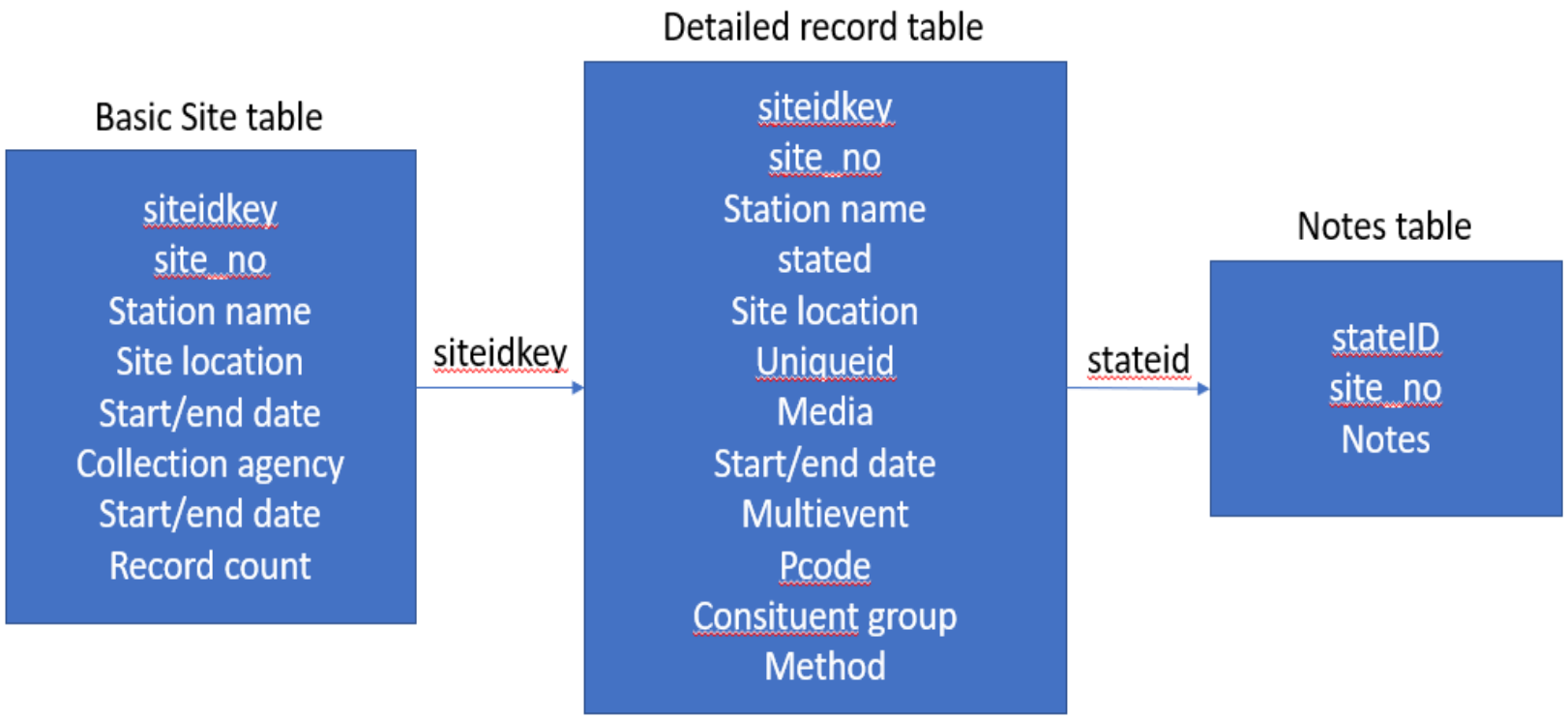
- Inventory of **phase 1 targeted, priority** toxic contaminants that includes:
  - A database containing records for available sites where specific analyte groups have been collected with appropriate supplemental metadata including media, method, timeframe and frequency.
  - These metadata have been combined into GIS layer(s) of location of data source for targeted, priority toxic contaminants with metadata of inventory details
  - Examination of data density, distribution



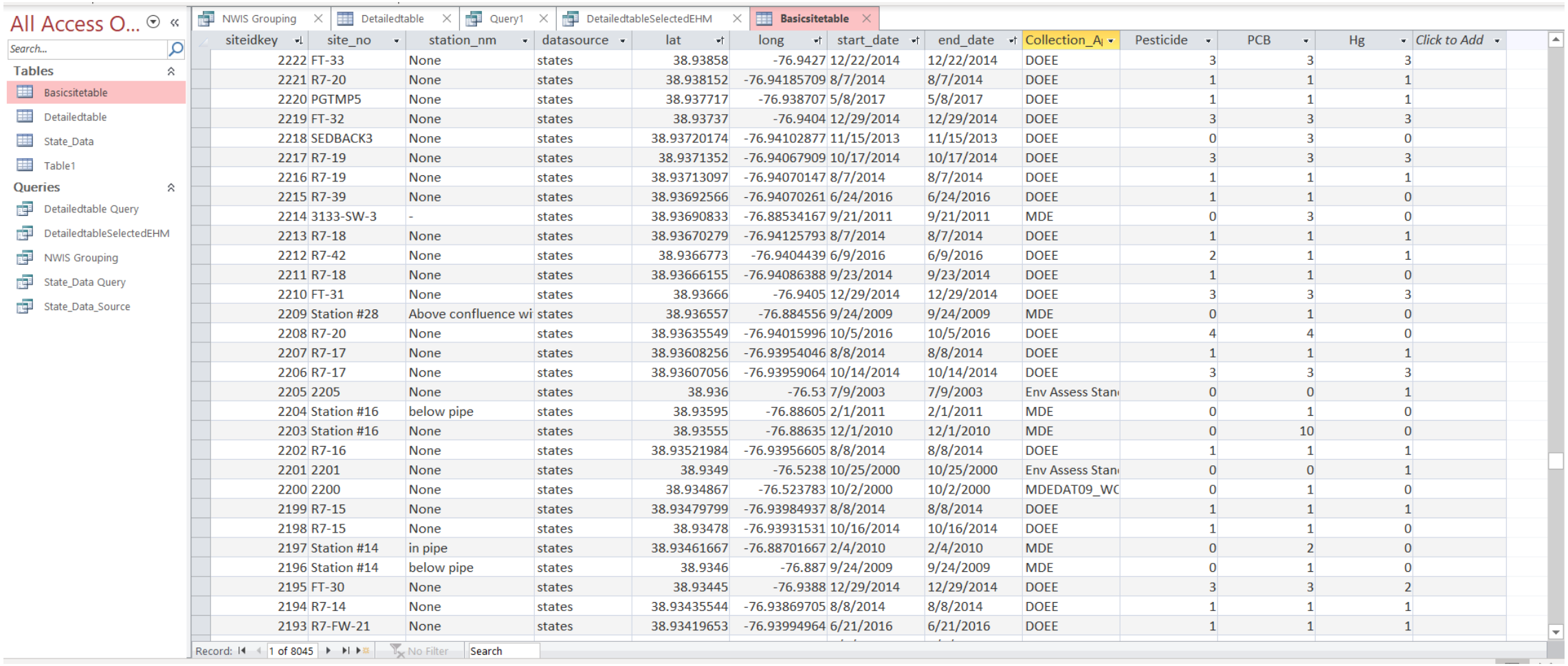
Toxic Contaminant Inventory- Summary of Activities

- Tiered prioritization for toxic contaminants based on stakeholder priorities (TCW) and findings from USGS studies: PCBs, mercury, pesticides (state data limited to OCP)
- Identified and contacted researchers, states, and internal USGS scientists to request data, developed R-script to query relevant NWIS data: DC (incl FWS), PA, DE, MD (NWQD), WV, VA, NWIS p-codes, EDC
- Developed metadata for these prioritized toxic contaminants in water, sediment, and fish tissue (biological media)
- Merged state and USGS databases, excluded state data outside the watershed, removed duplicates, populated blank cells
- Integrating values for PCBs (ongoing)

Database Structure



Database Metadata – Basic Table



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2221	R7-20	None	states	38.938152	-76.94185709	8/7/2014	8/7/2014	DOEE	1	1	1	
2220	PGTMP5	None	states	38.937717	-76.938707	5/8/2017	5/8/2017	DOEE	1	1	1	
2219	FT-32	None	states	38.93737	-76.9404	12/29/2014	12/29/2014	DOEE	3	3	3	
2218	SEDBACK3	None	states	38.93720174	-76.94102877	11/15/2013	11/15/2013	DOEE	0	3	0	
2217	R7-19	None	states	38.9371352	-76.94067909	10/17/2014	10/17/2014	DOEE	3	3	3	
2216	R7-19	None	states	38.93713097	-76.94070147	8/7/2014	8/7/2014	DOEE	1	1	1	
2215	R7-39	None	states	38.93692566	-76.94070261	6/24/2016	6/24/2016	DOEE	1	1	0	
2214	3133-SW-3	-	states	38.93690833	-76.88534167	9/21/2011	9/21/2011	MDE	0	3	0	
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2212	R7-42	None	states	38.9366773	-76.9404439	6/9/2016	6/9/2016	DOEE	2	1	1	
2211	R7-18	None	states	38.93666155	-76.94086388	9/23/2014	9/23/2014	DOEE	1	1	0	
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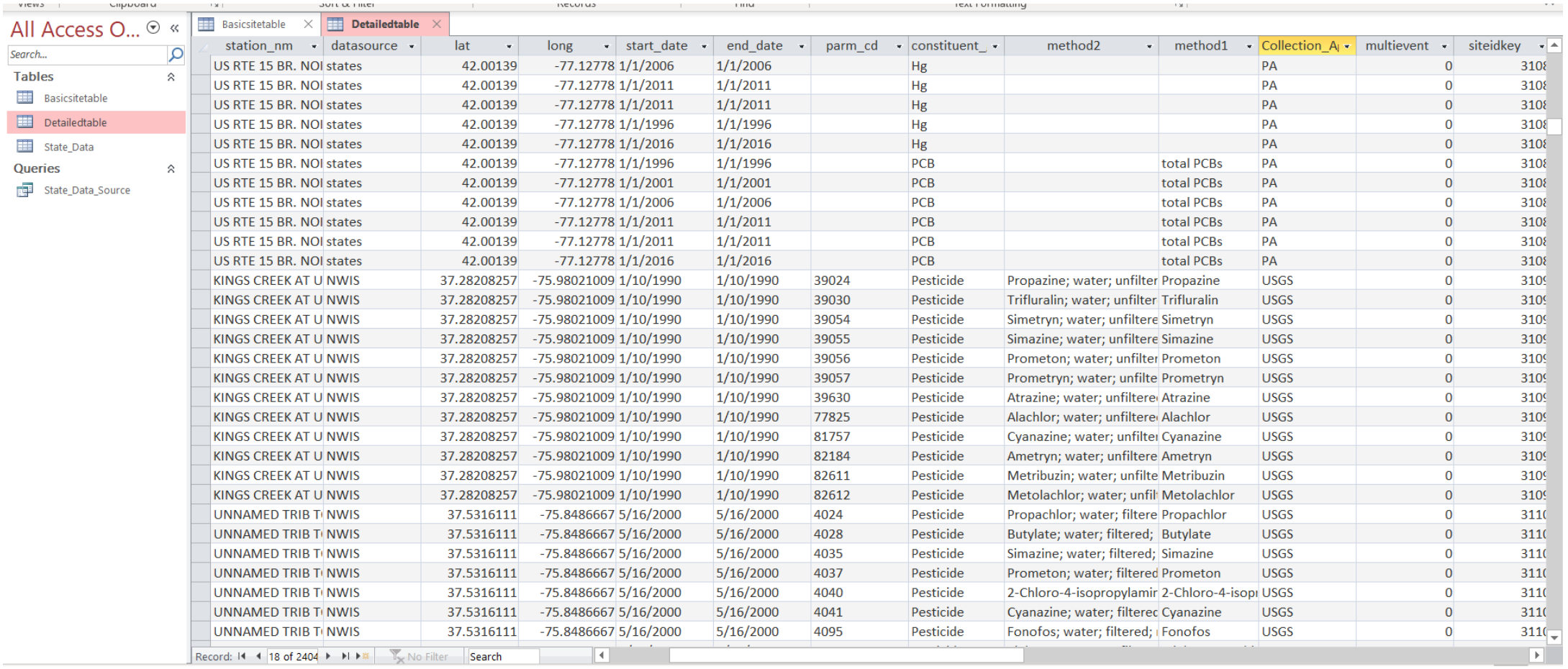
Database Metadata – Detailed Table



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US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/2011	1/1/2011		Hg			PA	0	310
US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/2011	1/1/2011		Hg			PA	0	310
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US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/1996	1/1/1996		PCB		total PCBs	PA	0	310
US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/2001	1/1/2001		PCB		total PCBs	PA	0	310
US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/2006	1/1/2006		PCB		total PCBs	PA	0	310
US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/2011	1/1/2011		PCB		total PCBs	PA	0	310
US RTE 15 BR. NOI	states	42.00139	-77.12778	1/1/2011	1/1/2011		PCB		total PCBs	PA	0	310
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KINGS CREEK AT U	NWIS	37.28208257	-75.98021009	1/10/1990	1/10/1990	39024	Pesticide	Propazine; water; unfilter	Propazine	USGS	0	310
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KINGS CREEK AT U	NWIS	37.28208257	-75.98021009	1/10/1990	1/10/1990	39054	Pesticide	Simetryn; water; unfiltere	Simetryn	USGS	0	310
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KINGS CREEK AT U	NWIS	37.28208257	-75.98021009	1/10/1990	1/10/1990	39056	Pesticide	Prometon; water; unfilter	Prometon	USGS	0	310
KINGS CREEK AT U	NWIS	37.28208257	-75.98021009	1/10/1990	1/10/1990	39057	Pesticide	Prometryn; water; unfilte	Prometryn	USGS	0	310
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KINGS CREEK AT U	NWIS	37.28208257	-75.98021009	1/10/1990	1/10/1990	81757	Pesticide	Cyanazine; water; unfilter	Cyanazine	USGS	0	310
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Database Metadata – Detailed Table (cont.)

All Access O...

Search...

Tables

- Basicsitetable
- Detailedtable
- State_Data

Queries

- State_Data_Source

Basicsitetable | State_Data | Detailedtable

Location	Object ID	Site ID	Sample ID	Source data filename	Notes
			1TF188	fishmetals2001	Data for As Cd Cr Hg Pb Se
			1TF187	2001pcbsfish	incomplete list contains other halogenated organics data
			1TF186	2001pcbsfish	incomplete list contains other halogenated organics data
			1TF187	2001pcbsfish	incomplete list contains other halogenated organics data
			1TF188	2001pcbsfish	incomplete list contains other halogenated organics data
			4TF017	2004fishmetals8	Data for As Cd Cr Hg Pb Se
			4TF018	2004fishmetals9	Data for As Cd Cr Hg Pb Se
			4TF019	2004fishmetals10	Data for As Cd Cr Hg Pb Se
			4TF019	2004fish-pesticides	just the pesticides incomplete list
			1TF186	2001pcbsfish	incomplete list contains other halogenated organics data
			15PF005	2015_Fish_PCBs_data_111	PCBs only
			4PF008	2004fishpcbs	just the pcbs
			4TF018	2004fish-pesticides	just the pesticides incomplete list
			4TF017	2004fish-pesticides	just the pesticides incomplete list
			4TF019	2004fishpcbs	just the pcbs
			4TF018	2004fishpcbs	just the pcbs
			4TF017	2004fishpcbs	just the pcbs
			4PF010	2004fishpcbs	just the pcbs
			4PF009	2004fishpcbs	just the pcbs
		NEB2	P2-NEB-011-GT	Anacostia RI Fish Tissue from A	What is in Sample ID is Field_Sample_ID . What is in Site ID is Station_ID .
		NEB2	P2-NEB-011-GT	Anacostia RI Fish Tissue from A	What is in Sample ID is Field_Sample_ID . What is in Site ID is Station_ID .
		NEB2	P2-NEB-011-GT.	Anacostia RI Fish Tissue from A	What is in Sample ID is Field_Sample_ID . What is in Site ID is Station_ID .
		NEB2	P2-NEB-011-GT	Anacostia RI Fish Tissue from A	What is in Sample ID is Field_Sample_ID . What is in Site ID is Station_ID .
		NEB2	P2-NEB-012-GT	Anacostia RI Fish Tissue from A	What is in Sample ID is Field_Sample_ID . What is in Site ID is Station_ID .
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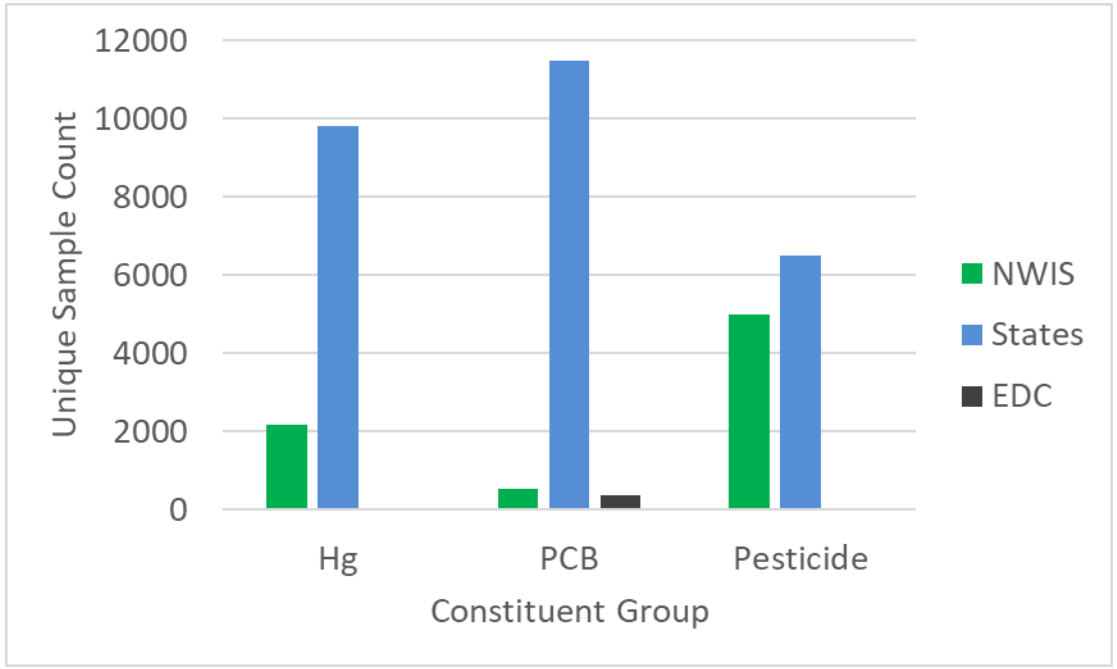
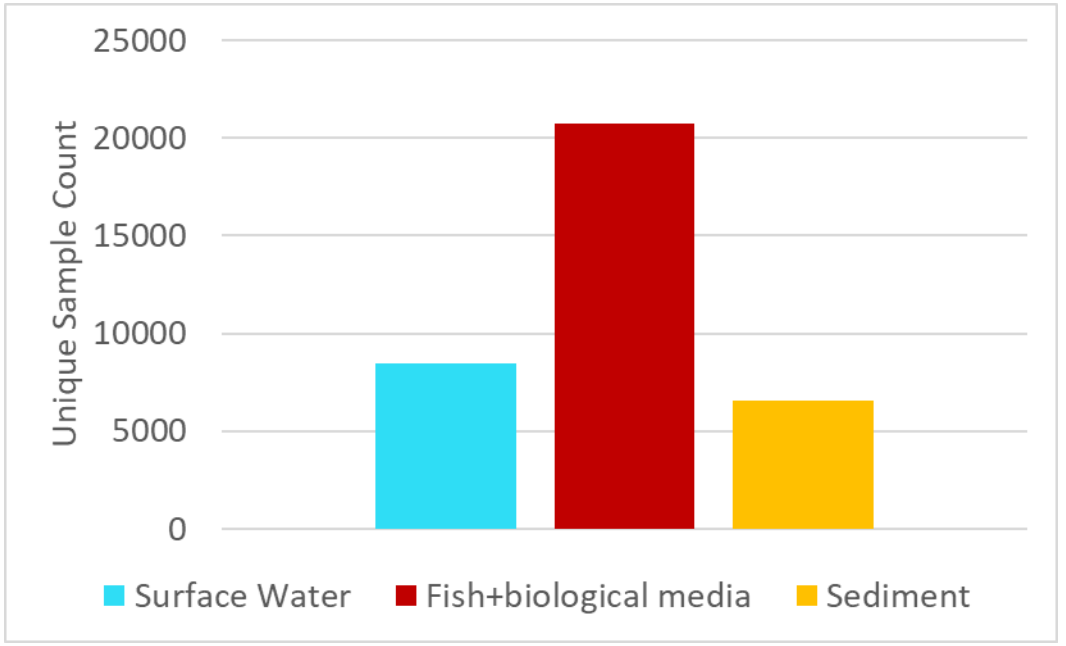
Record: 11850 of 36081 Unfiltered Search

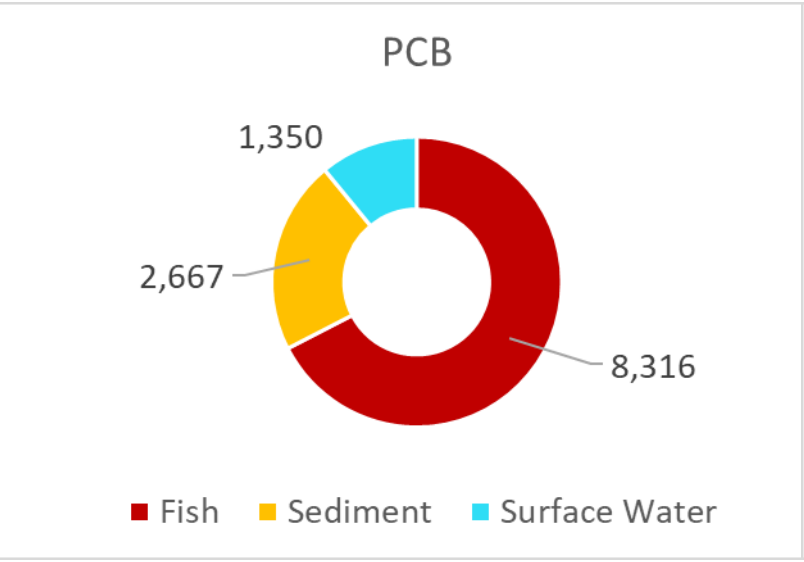
Datasheet View Num Lock

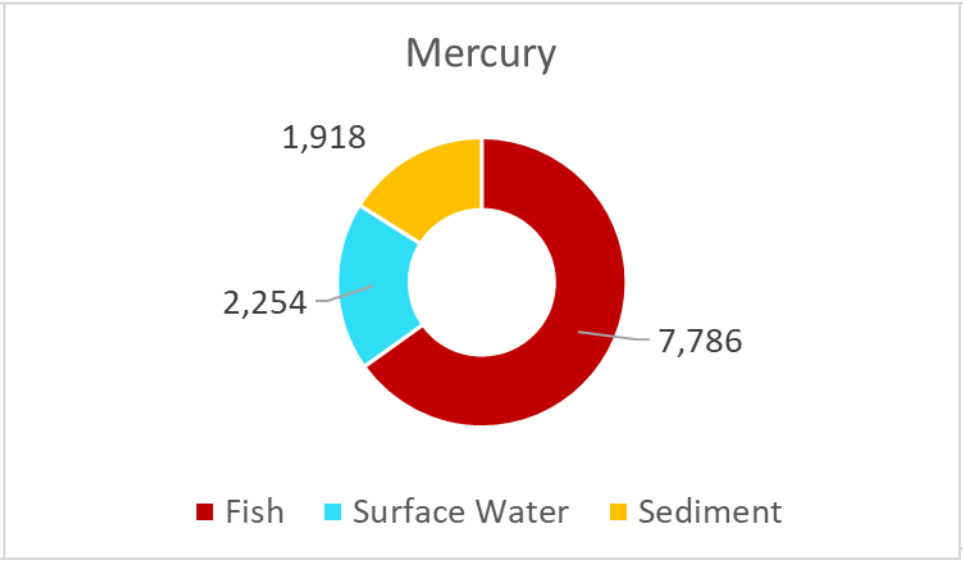
What does inventory tell us? Initial Impressions

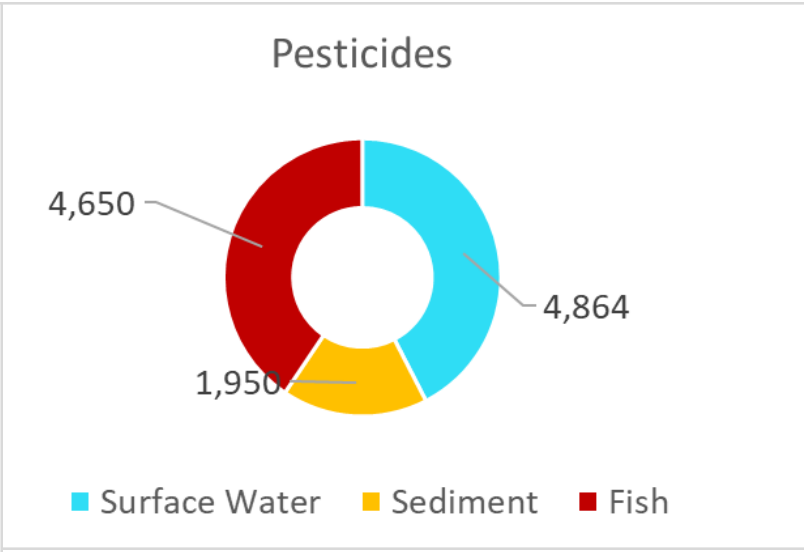




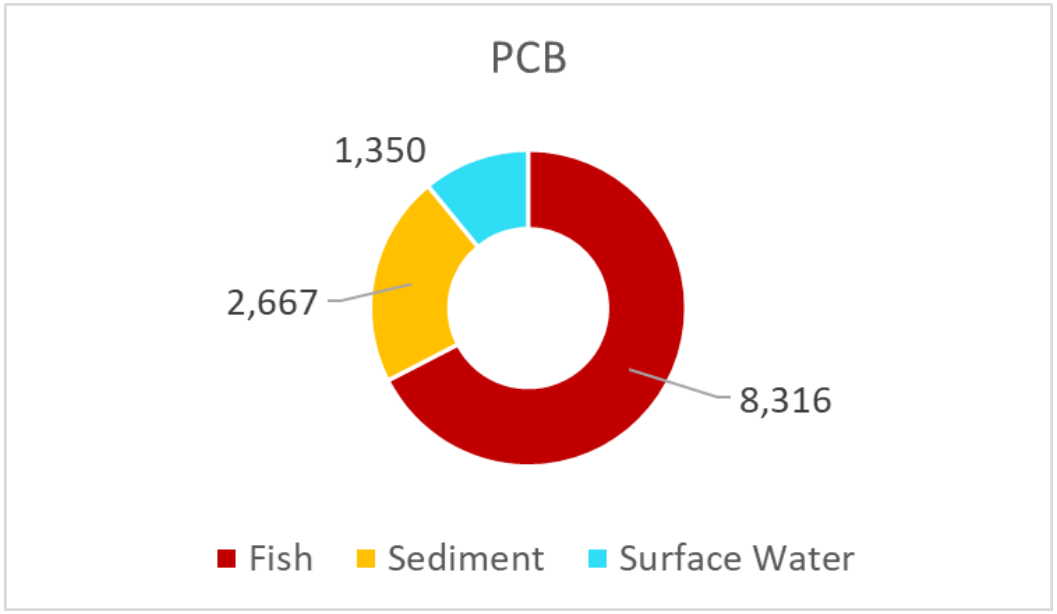
What does inventory tell us?

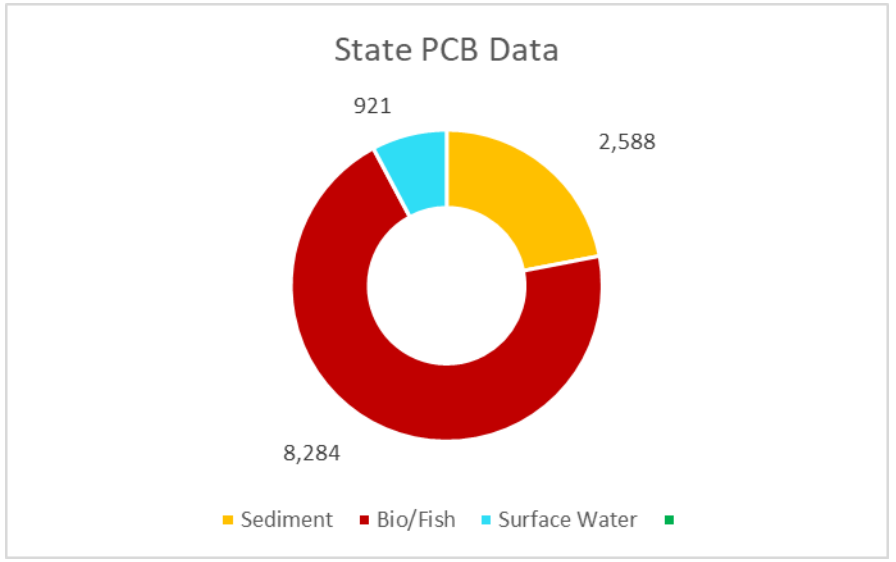


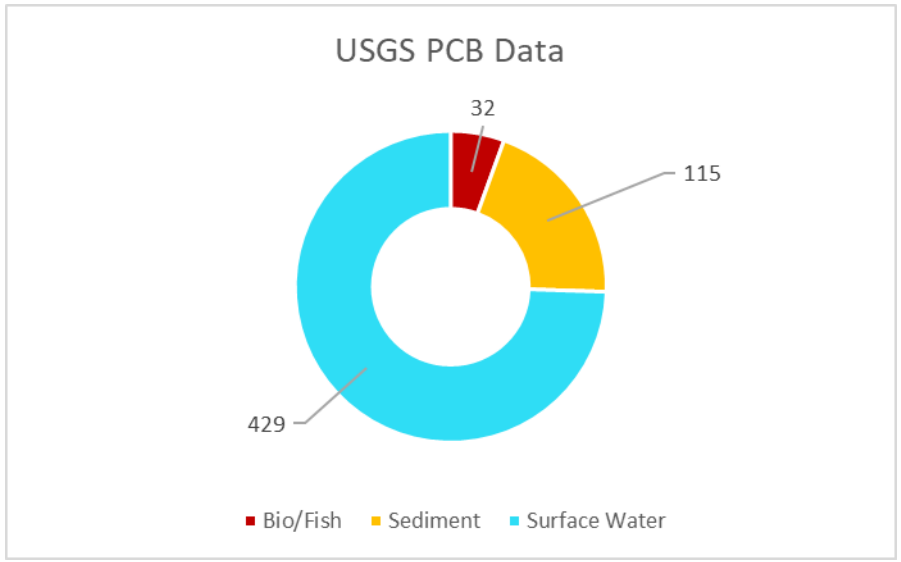




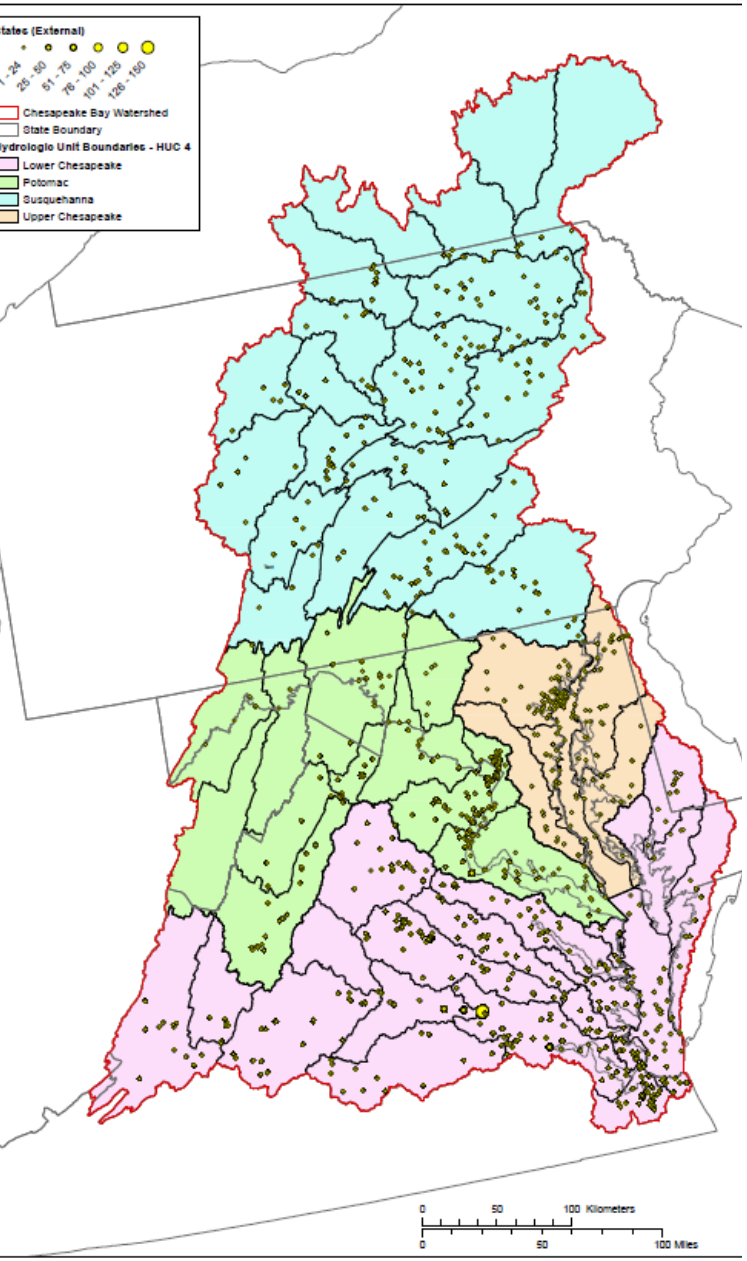
What does inventory tell us?



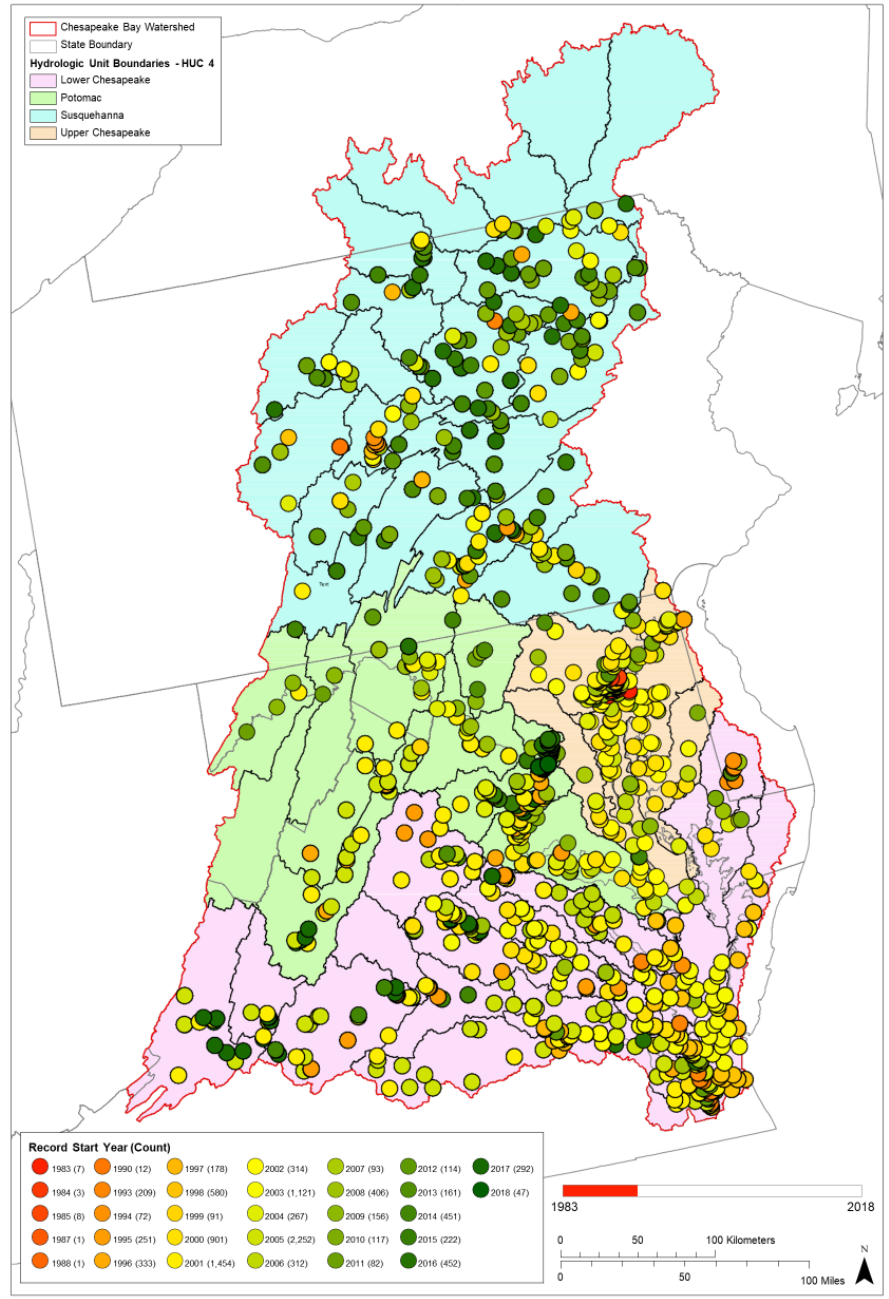




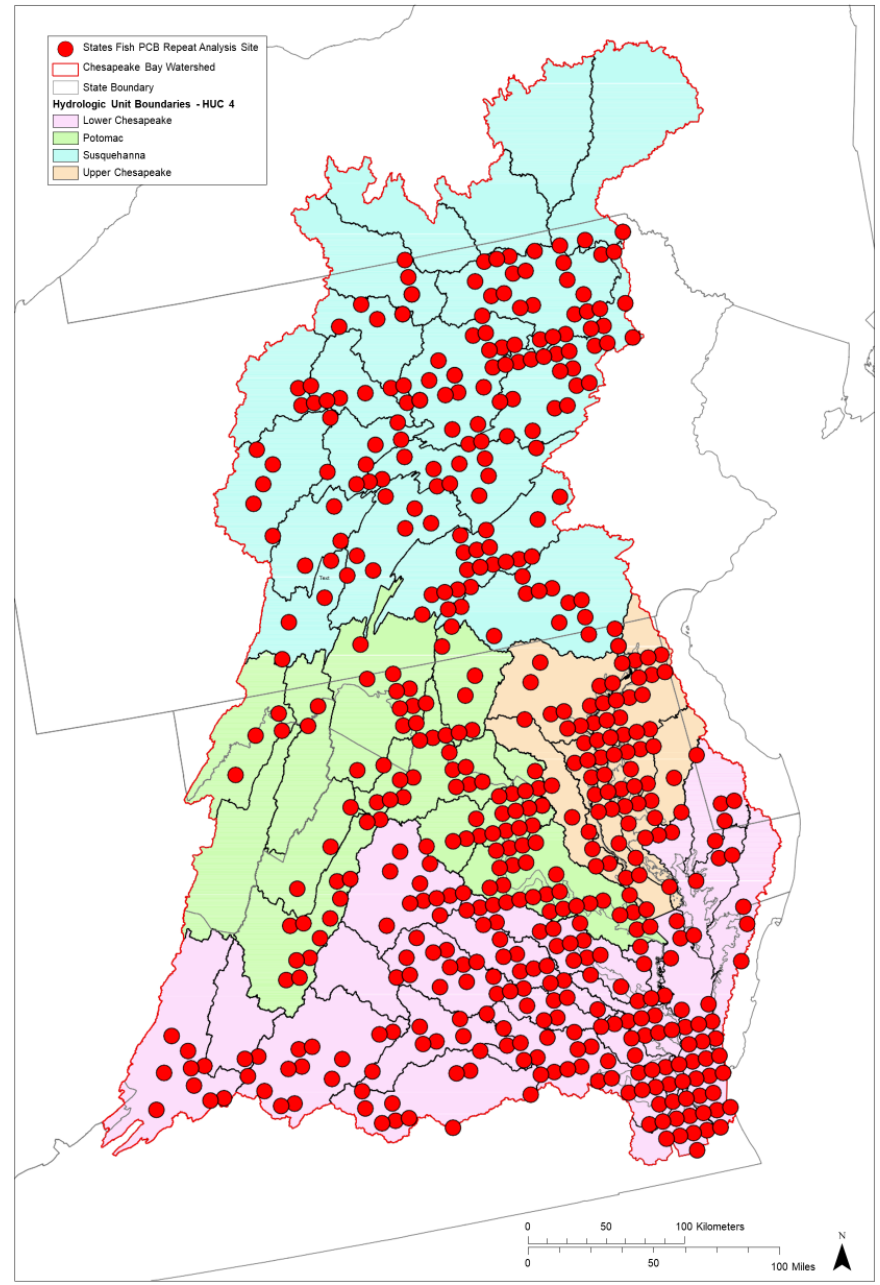
l Inclusive Fish PCB (States External USGS) Number of Fish PCB Records (1/1/1972 - 1/1/
Chesapeake Bay Watershed

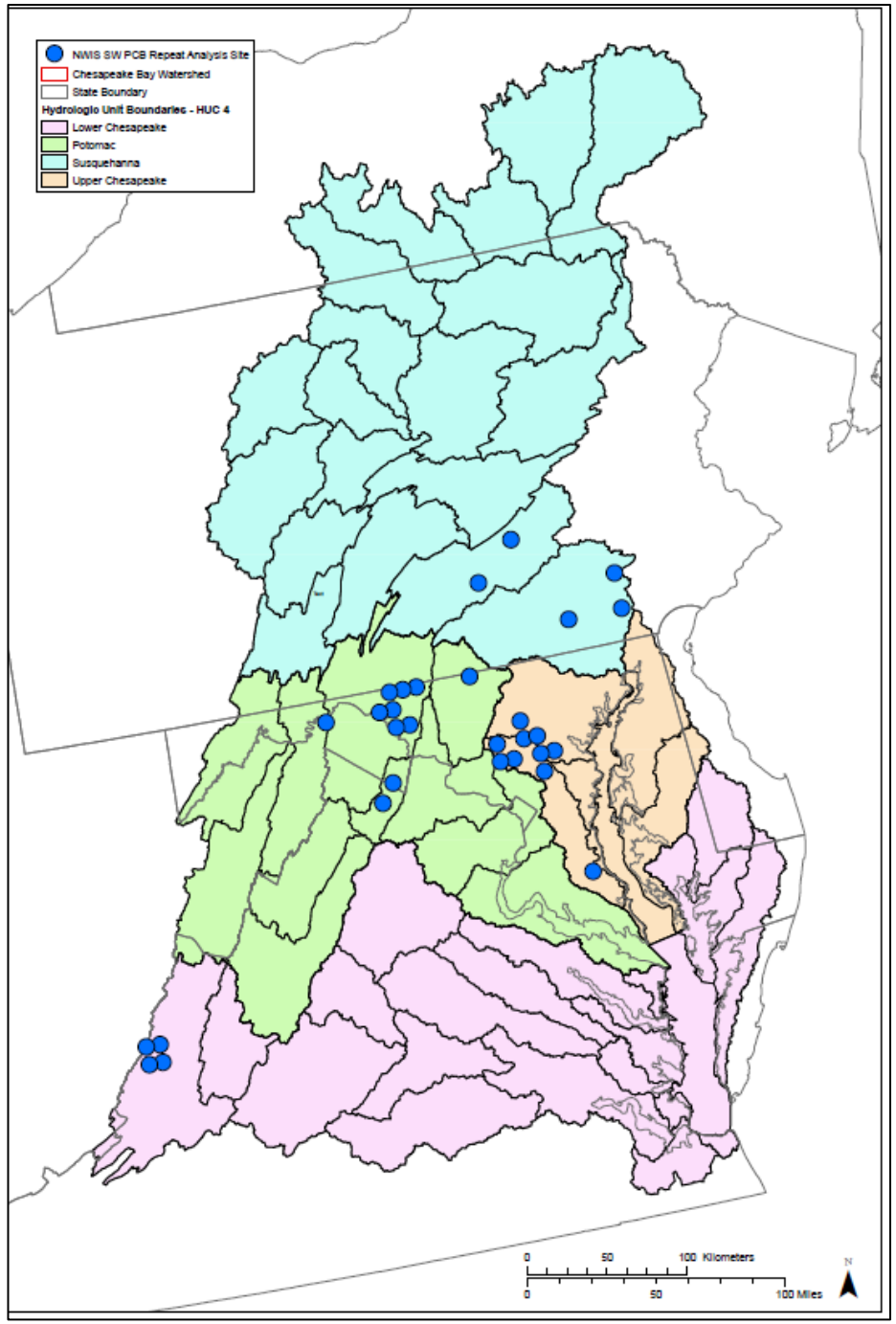


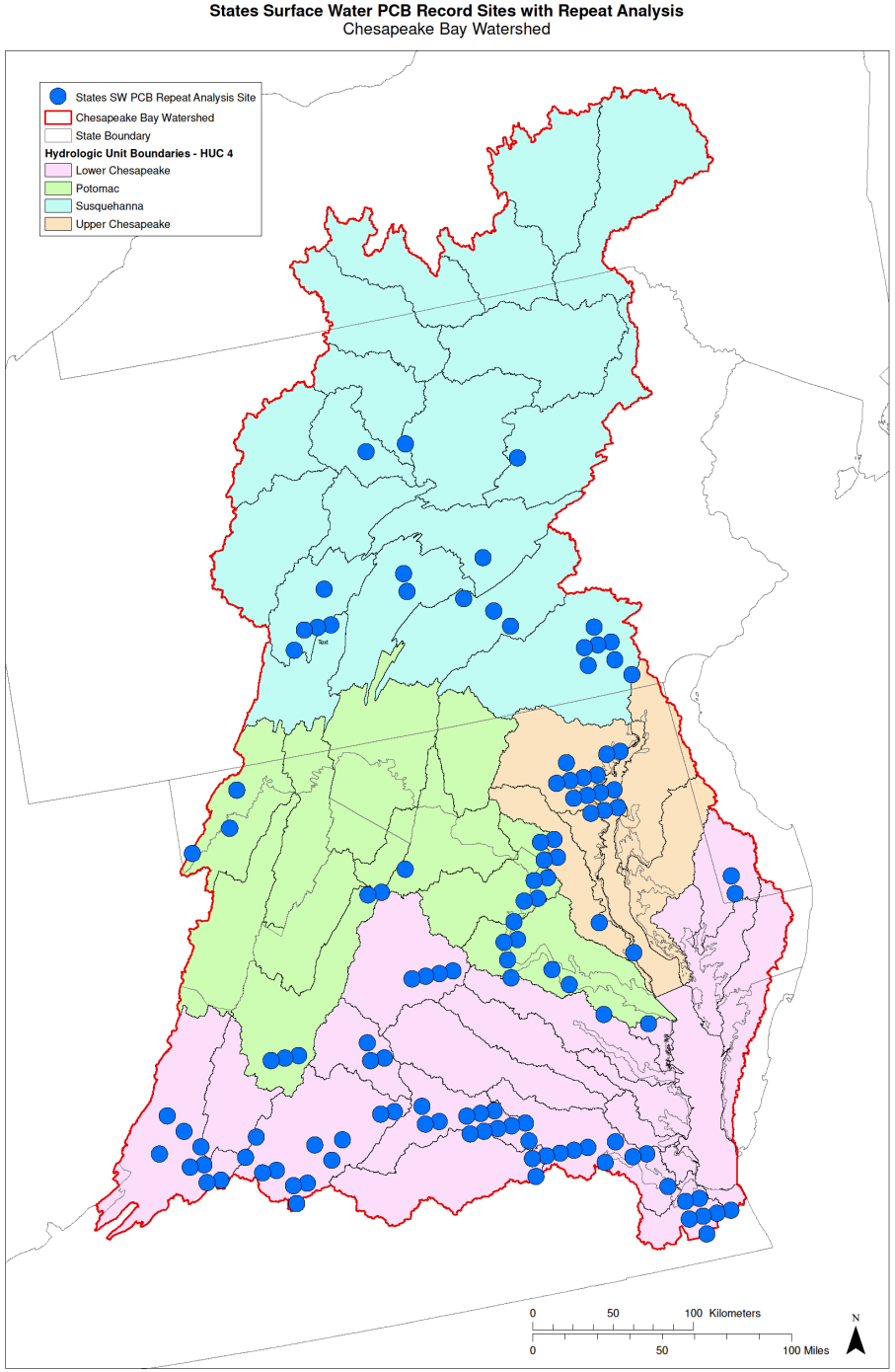
Fish PCB Records by Start Year since start of Bay Program (1983 - Present)
Chesapeake Bay Watershed



States Fish PCB Record Sites with Repeat Analysis
Chesapeake Bay Watershed

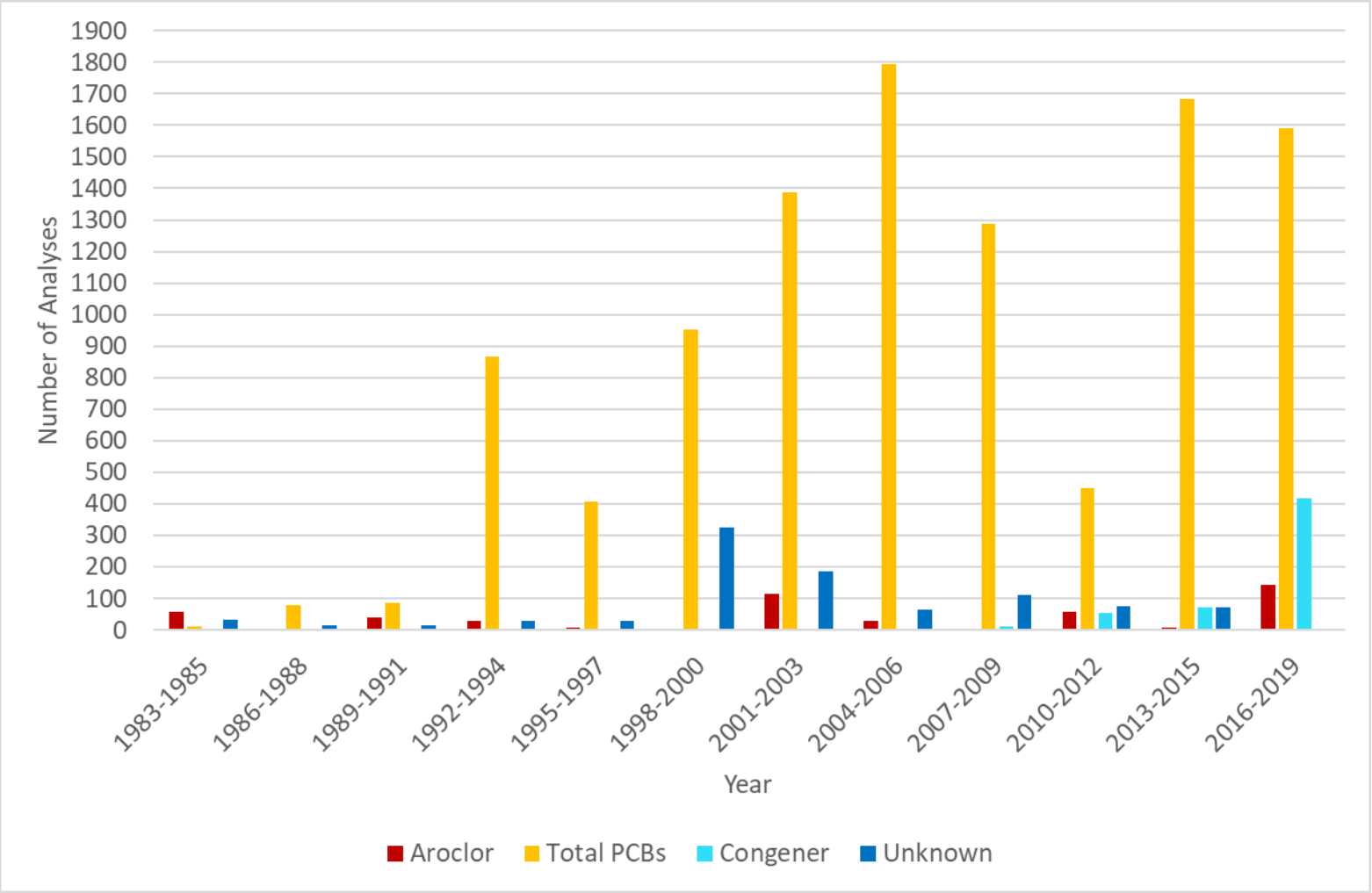


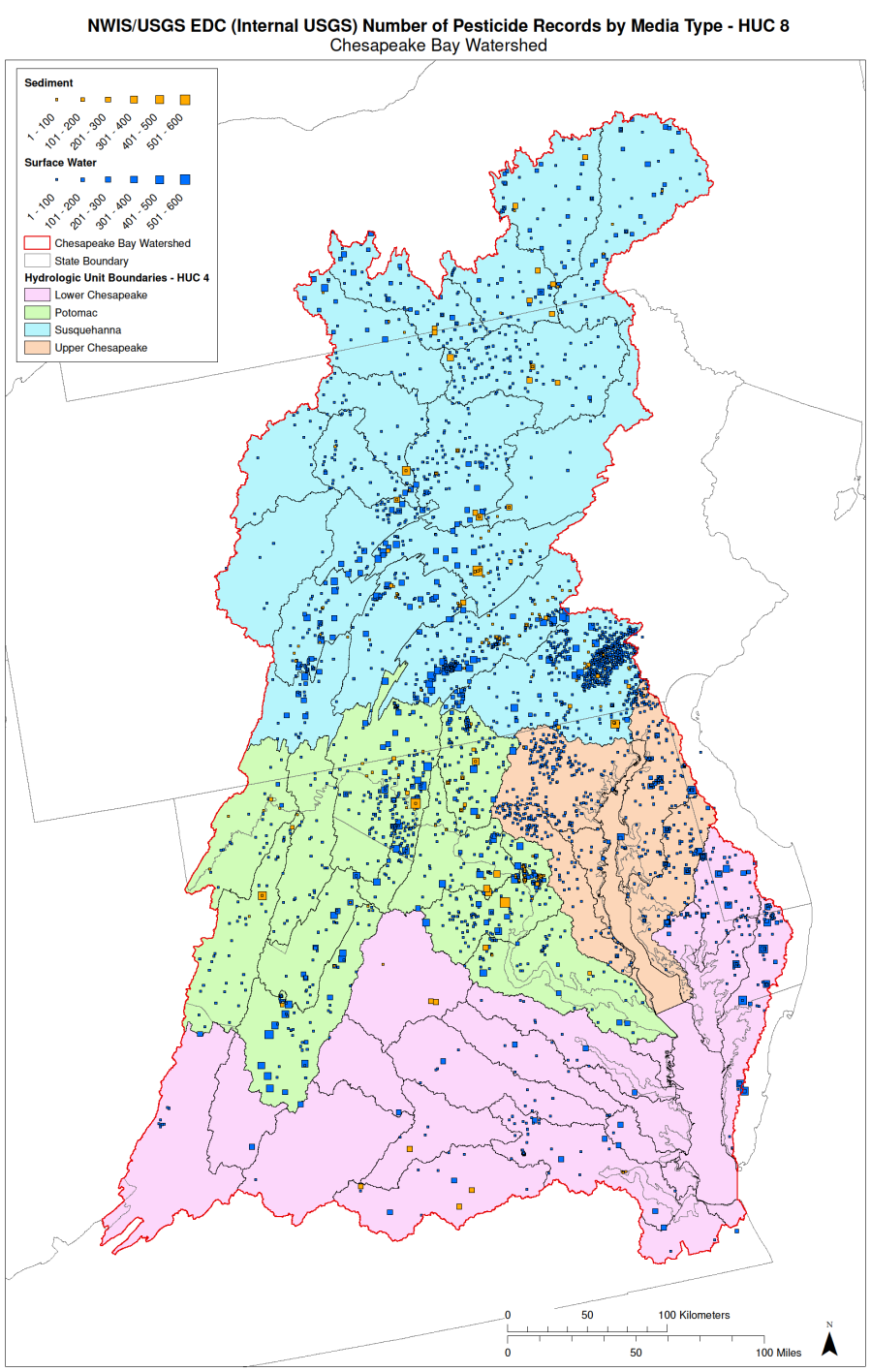


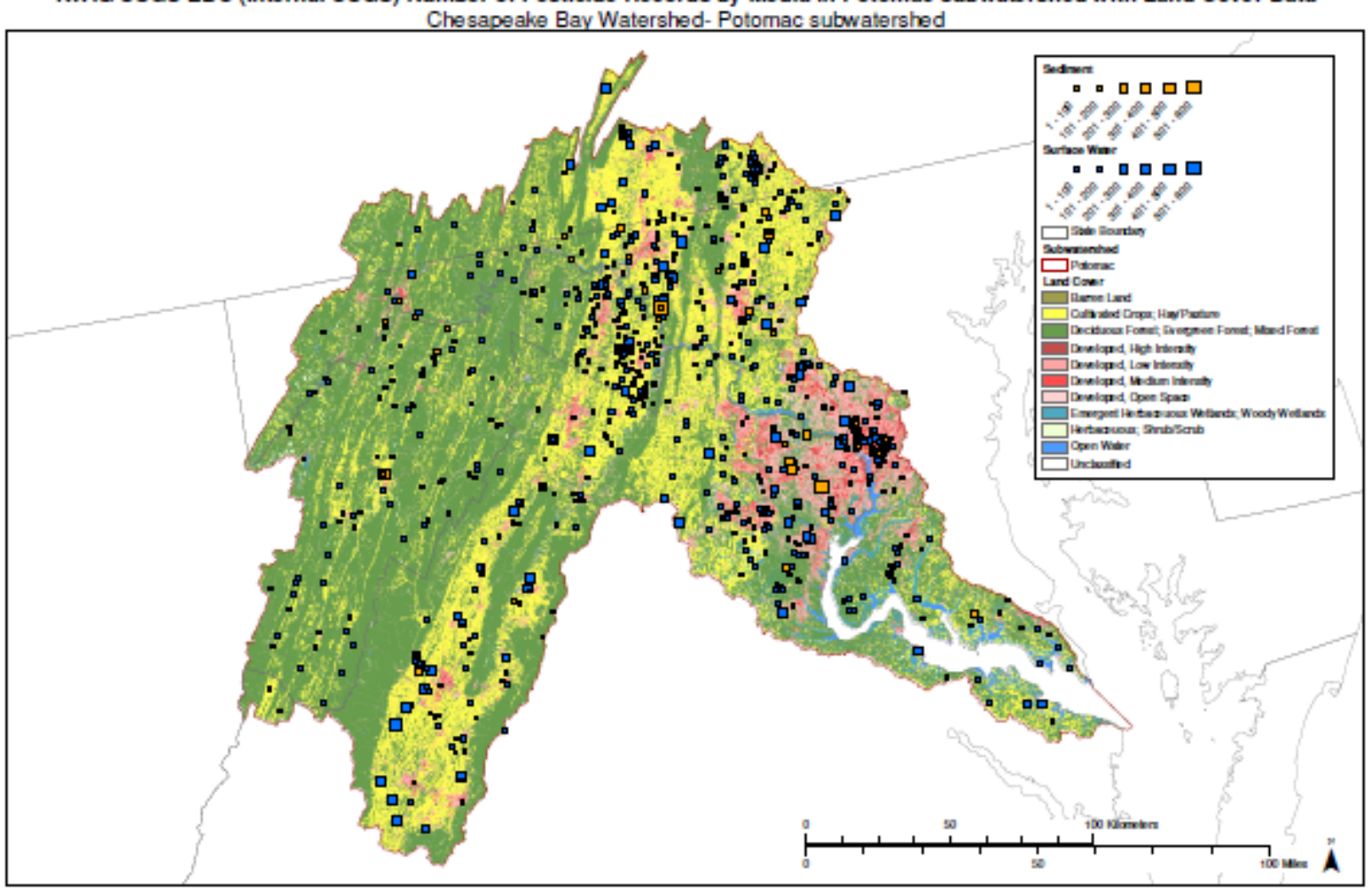


What does inventory tell us? Locations with repeat analyses (Internal, external sw PCBs)

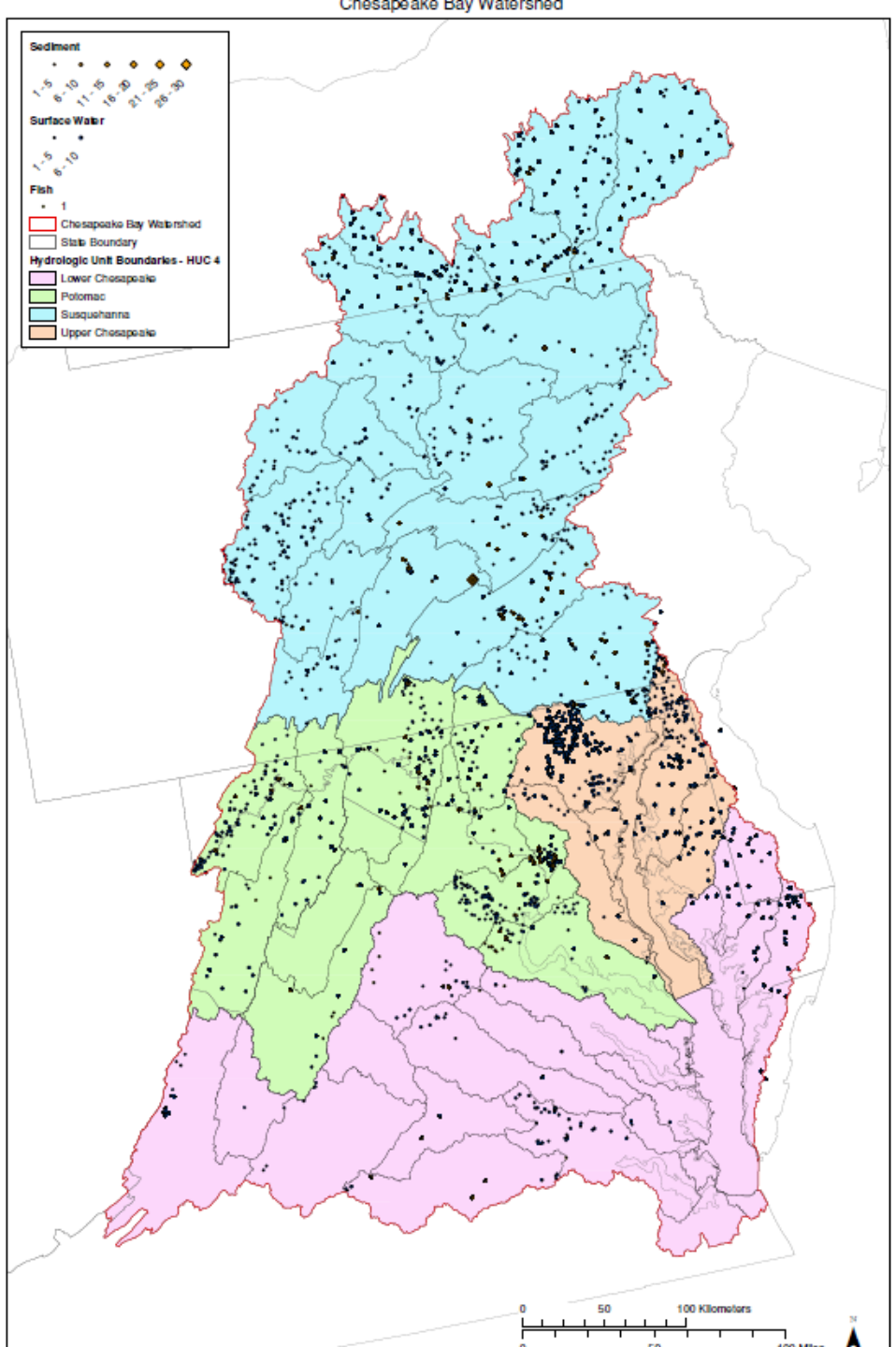
What does inventory tell us? Comparison of Methods- PCBs







USGS Pesticides by media, with land use



Mercury, Internal sw and sediment

Bioaccumulation of Mercury in Fish Varied by Species and Location in the Chesapeake Bay Watershed—Summary of Existing Data and a Roadmap for Integrated Monitoring

Paper: Willacker Jr., J.J., Eagles-Smith, C.A., Blazer, V.S., 2020, Mercury bioaccumulation in freshwater fishes of the Chesapeake Bay watershed: Ecotoxicology, v. 29, pp. 459-484, https://doi.org/10.1007/s10646-020-02193-5.

Challenges and Next Steps

- Inconsistencies between external and internal data sets
- Method differences across time, collection agency
- QC of data is difficult
- Breadth of the contaminant groups – PCBs (1-209 compounds), pesticides (200,000 individual analysis records)
- Deeper dive into repeat analysis sites needed- for example, how many sites >5 events?

- Merging of data values ongoing (PCBs, others?)
- Updates and/or expansion for other constituents

General Takeaways

- Inventory is useful for visualizing and assessing disparate monitoring efforts watershed-wide.
- Additional refinement is needed, but appear to be some geographically focused areas of high density, repeat sampling for priority contaminants that may be useful.
- State data sets are robust especially when combined. Streamlining methods (analytical, frequency, etc) may provide even more benefits.
- Worthwhile to explore opportunities to enhance or link together the state / CBP ongoing monitoring efforts (through the PSC effort or otherwise) to achieve TCW objectives.

Developing expectations for detecting temporal changes in river contaminant concentrations in the Chesapeake Bay Watershed

Ty Wagner, Paul McLaughlin, Sara Breitmeyer, Stephanie Gordon, Greg Noe, and Kelly Smalling

Research goal and question

- **Goal:** To utilize statistical power analysis to help develop expectations for detecting regional temporal declines for *select surface water* contaminants in the Chesapeake Bay Watershed under different monitoring scenarios (e.g., frequency, number of samples)

Question: What is the statistical power to detect **regional** temporal trends in river contaminant concentrations within the Chesapeake Bay Watershed as a result of BMPs?

Objectives

1. Quantify existing temporal trends in concentrations of select contaminants and total estrogenicity and estimate components of spatio-temporal variation

2. Using estimated parameters from objective 1, perform simulated power analyses to determine the statistical power to detect *regional* temporal trends under different monitoring scenarios

Contaminants of Focus

- Atrazine
- Metolachlor
- Total estrogenicity (a measure of estrogenic activity in the water column)
- Total PCBs

Stay tuned for results from Ty and others