234th Technical Committee Meeting

Scott Mandirola, Chair

Presiding

February 6-7, 2024

The meeting will begin at 1:00 P.M. (Eastern) on February 6.   Below are a few tips to effectively navigate the meeting:

- ***Confirm that your first and last name is entered correctly in the GoToMeeting software.***
- ***Mute your microphone at all times unless speaking.***
- ***Disable your camera unless you are a Technical Committee member.***
- ***The presenter will prompt participants for verbal questions, or use the Chat feature.***

Chair's Welcome & Roll Call

Commissioner Wilson for Scott Mandirola

Chair, Technical Committee

TEC Members Roll Call

- IL – Scott Twait *
- IN – Brad Gavin *
- KY – Katie McKone *
- NY – Damianos Skaros *
- OH – Melinda Harris *
- PA – Kevin Halloran *
- VA – Jeffrey Hurst *
- WV – Scott Mandirola*
- USACE – Erich Emery *
- USCG – Michael Franke-Rose*
- USEPA – David Pfeifer *
- USGS – Jeff Frey *
- CIAC – Kathy Beckett
- PIAC – Cheri Budzynski
- PIACO – Betsy Bialosky
- POTW – Reese Johnson
- WOAC – Heather Hulton VanTassel
- WUAC – Chris Bobay
- Chair – Scott Mandirola *
- Executive Director – Richard Harrison *

* Voting member

Agenda for the 234th Meeting of the Technical Committee

CHAIRMAN'S WELCOME AND ROLL CALL (February 6, 1:00 P.M.)

ACTION ITEMS AND REPORTS

1. Action on Minutes of 233rd Technical Committee Meeting – Chair Mandirola *
2. Chief Engineer's Report – Director Harrison
3. Great Lakes to Gulf: Tracking Nutrient Trends in the Mississippi River Basin – Dr. Alejandra Botero-Acosta, National Great Rivers Research and Education Center, and Maxwell Burnette, University of Illinois
4. An Assessment of the Influence of Reservoirs on Ohio River Low Flow & A Discussion of the Benefits and Costs – Dr. Patrick Ray, University of Cincinnati
5. Kentucky Communities Are Embracing Their Local Waterways and Basin Coordinators Have a Seat at the Table – Brian Storz, Kentucky Division of Water
6. 2024 Biennial Assessment of Ohio River Water Quality Conditions (2018-2022) – Ryan Argo, ORSANCO
7. PCBs Trends in Fish Tissue – Daniel Cleves, ORSANCO
8. Broad Scan Survey Interim Results – Lila Ziolkowski, ORSANCO
9. ORSANCO's Contact Recreation/Bacteria Monitoring and Trends Analyses – Stacey Cochran, ORSANCO

ADJOURN/RECONVENE WEDNESDAY MORNING (February 7, 8:30 A.M.)

10. Waterbody Impairment Compilation Maps for the Ohio River Basin – Bridget Taylor, ORSANCO
11. ORSANCO's Response to the East Palestine Derailment Using EPA's River Spill Model – Sam Dinkins, ORSANCO
12. Source Water Protection Programs Update – Sam Dinkins, ORSANCO
13. ORSANCO Biological Programs Update – Ryan Argo, ORSANCO
14. Monitoring Strategy Update – Jason Heath, ORSANCO
15. TEC Member Roundtable Reports

OTHER BUSINESS

- Comments by Guests
- Announcement of Upcoming Meetings

ADJOURNMENT (NOON)

Agenda Item 1:

Request for action on minutes of the 233rd Technical Committee Meeting

Commissioner Wilson for Chair Mandirola

The minutes were emailed with the agenda package on January 18 , 2024

Agenda Item 2:
Chief Engineer’s Report

Executive Director Richard Harrison

Agenda Item 3:
Great Lakes to Gulf: Tracking Nutrient Trends in the Mississippi River Basin

Dr. Alejandra Botero-Acosta, National Great Rivers Research and Education Center

Maxwell Burnette, University of Illinois

ORSANCO
February 6, 2024

Great Lakes to Gulf:

Tracking Nutrient Trends in the Mississippi River Basin

Maxwell Burnette
Senior Research Software Engineer
National Center for Supercomputing Applications
University of Illinois

Alejandra Botero-Acosta, Ph.D.
Research Scientist, WATER Institute,
Saint Louis University and Associate at
National Great Rivers Research & Education Center

What Is the Great Lakes to Gulf Virtual Observatory?

Geospatial Application

An interactive tool that integrates water quality data and analytical tools from multiple trusted sources such as USGS, NOAA, EPA, National Water Quality Monitoring Council and others.

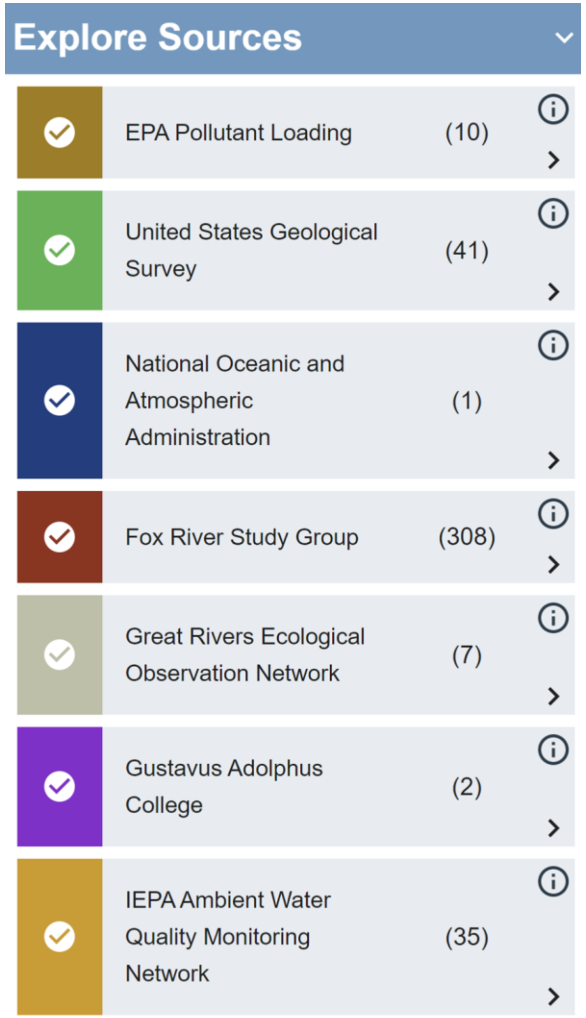
Visualization Map

GLTG has map layers that show what is happening across the Mississippi River Basin, allowing researchers and decision makers to better understand nutrient pollution and its causes.

Data Exploration

Currently, GLTG℠ includes sites with five or more years of discreet nutrient data in the main stem of the Mississippi River watershed along with nutrient data for selected small watersheds (HUC-8 or smaller) in all the mainstem states.

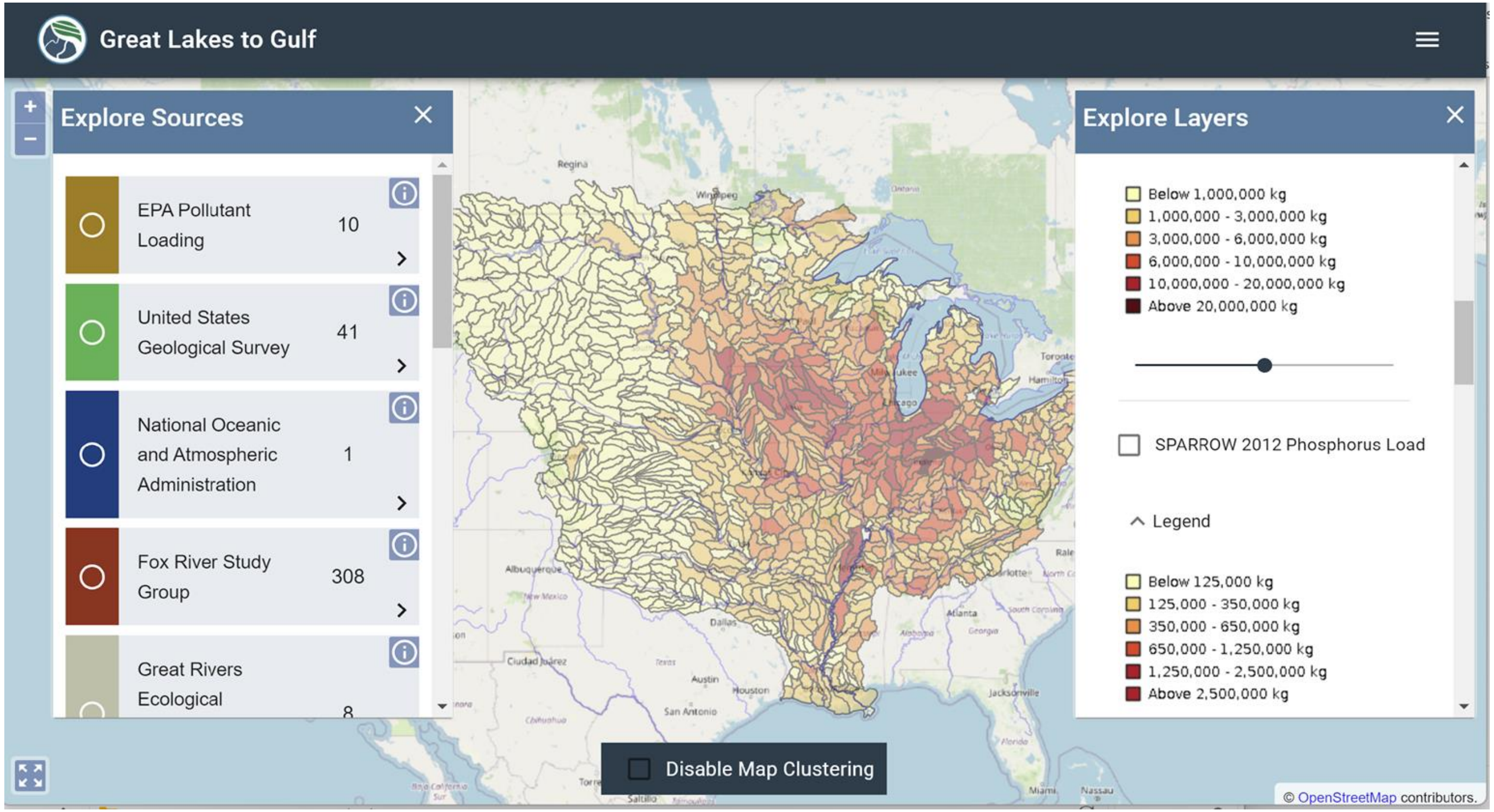
Data Sources



- **US Geological Survey** – NWIS ‘Super Gages’, ambient monitoring
- **US EPA and State WQ Agencies** –STORET/WQX
- **National Oceanic and Atmospheric Administration (NOAA)**
- **UMRR LTRM** – Upper Mississippi River Restoration Long Term Resource Monitoring Program
- **NGRREC – GREON** (Great Rivers Ecological Observatory Network)
- **Metropolitan Council, Minneapolis/St. Paul, MN**
- **Fox River (Illinois) Study Group**
- **Iowa Water Quality Information System / University of Iowa**

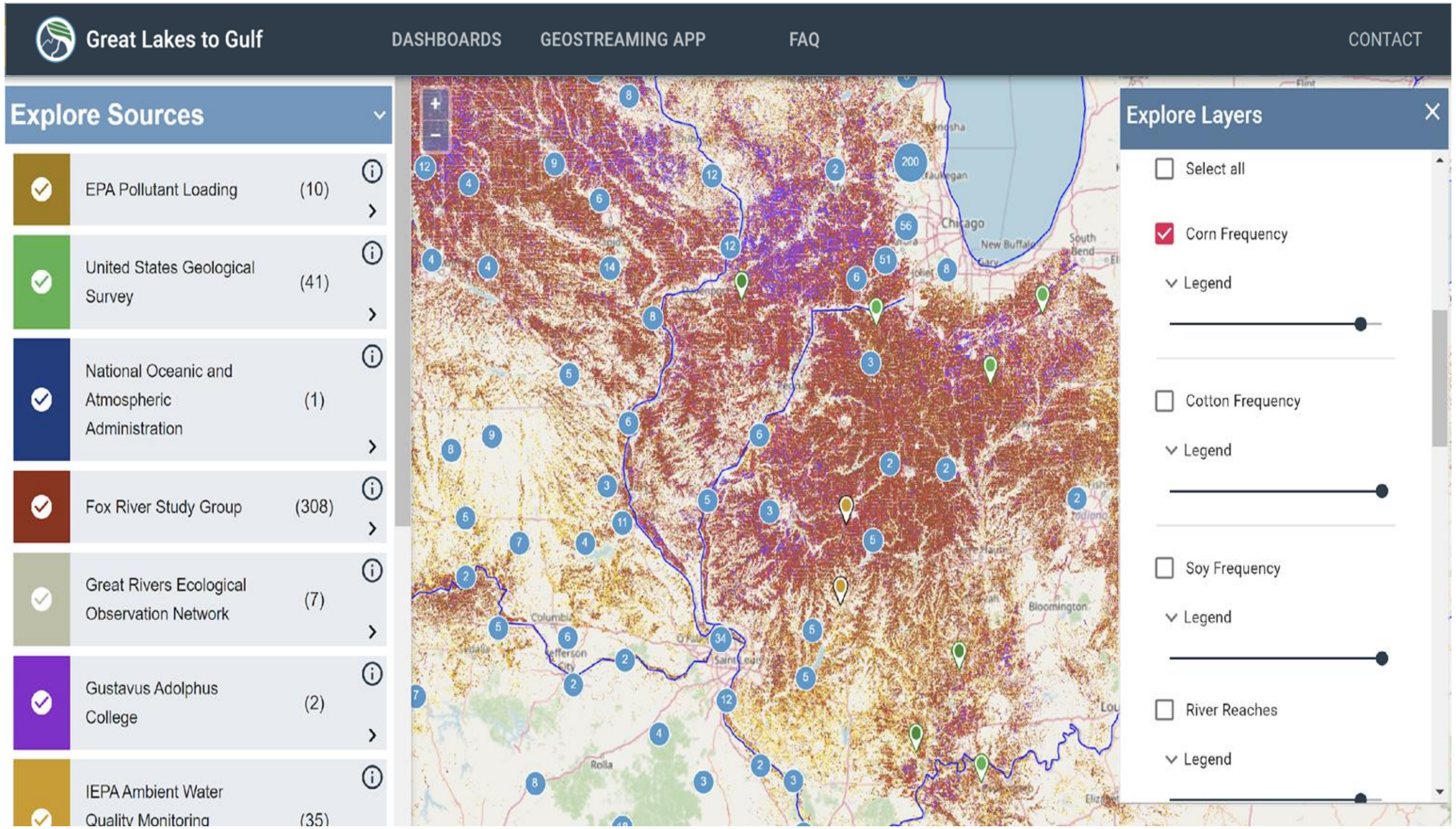
Geospatial Contextual Layers

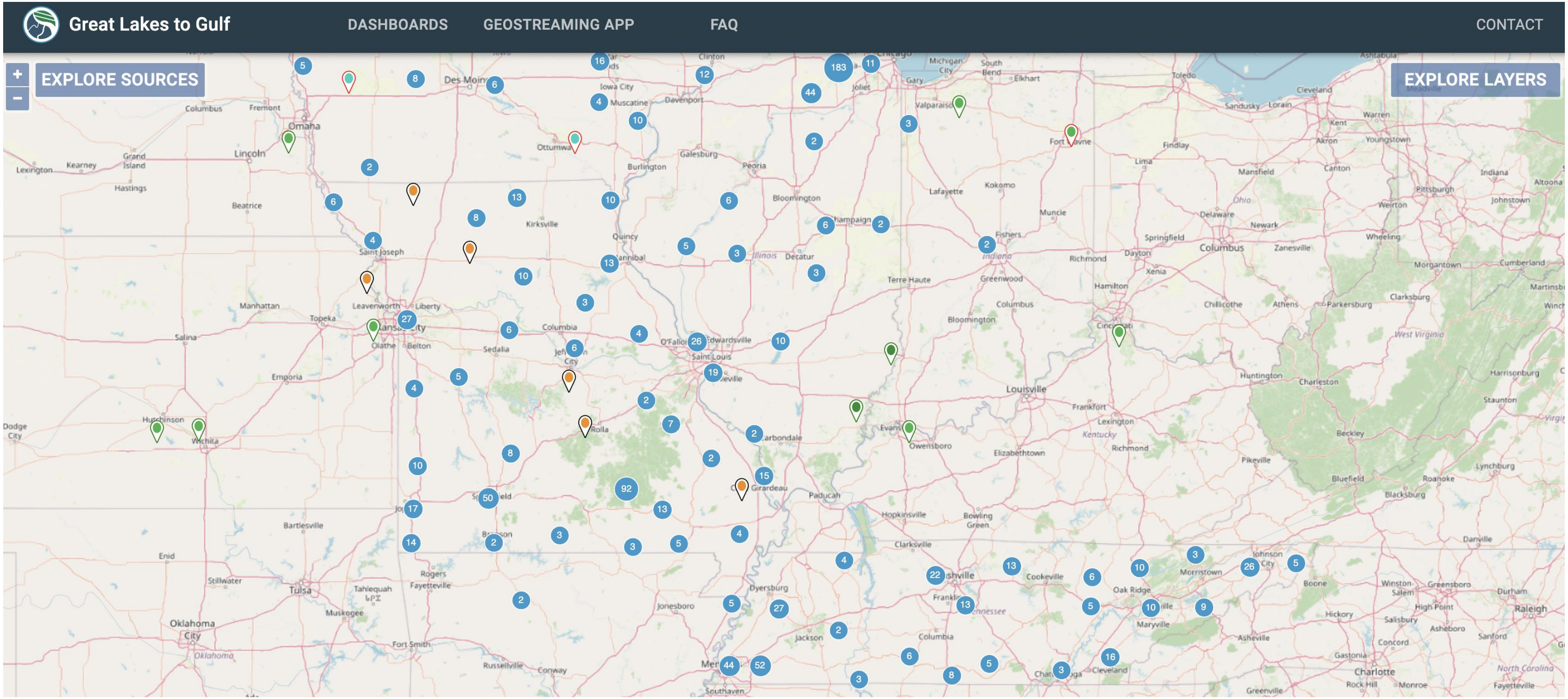
- SPARROW 2002 and 2012 Models
- Hypoxia extent 2005- 2017
- State legislative district – lower and upper chamber layers
- Congressional district layer
- Watershed boundaries
- River reaches layer and large river layer



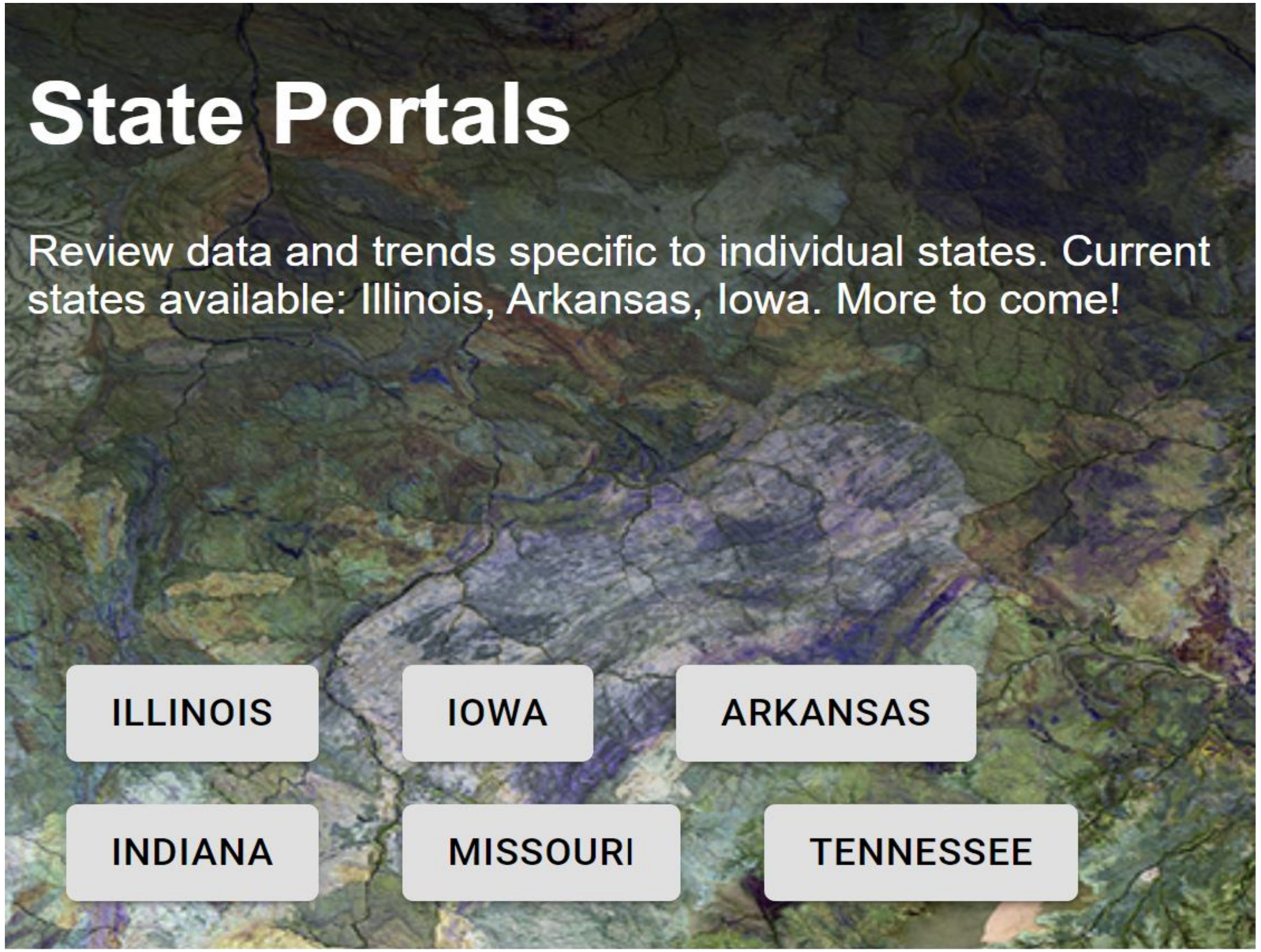
More Geospatial Layers

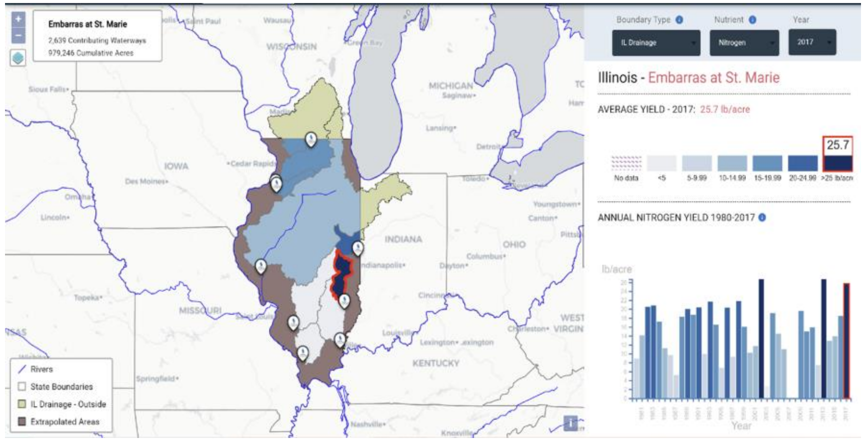
- USDA CropScape frequency layer
- NOAA precipitation layer
- State impaired waters layer
- Total annual Nitrogen from point sources by HUC8 (average from 2008 to 2014) layer
- Average annual Nitrogen fertilizer inputs for 1997 to 2006 layer



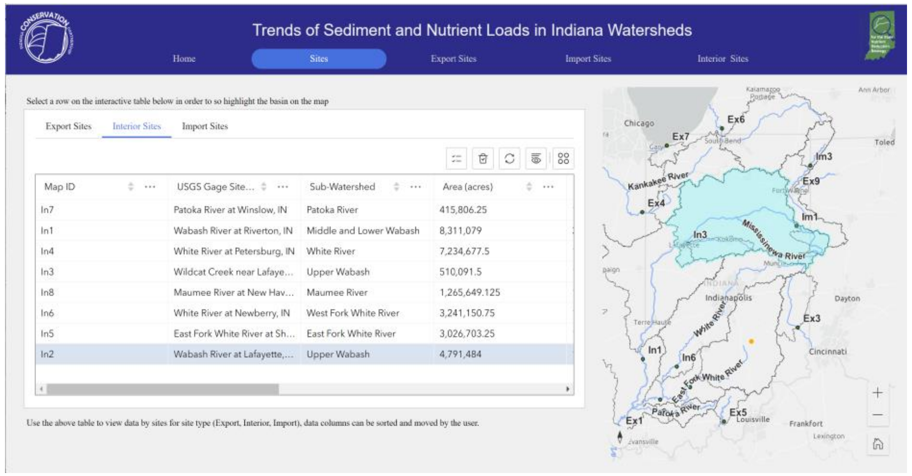

Great Lakes to Gulf
DASHBOARDS
GEOSTREAMING APP
FAQ
CONTACT
EXPLORE SOURCES
EXPLORE LAYERS

State Data Portals





Illinois



Indiana

Mississippi River Nutrient Trends Analysis

- Selected a network of existing long-term water quality monitoring stations as trends sites; data found in the Water Quality Portal https://www.waterqualitydata.us/ from USGS, EPA, and state, federal, tribal, and local agencies.
- Harmonized data to create a consistent and quality-controlled dataset unifying parameter names, units, type of measurement, etc.
- Flow data from USGS National Water Information System (NWIS).
- Used a unified analysis method (WRTDS) to explore nutrient trends across states and watersheds.
- Used the longest consistent record available; we can use 1990-2020 but get more stations for trends with 2000-2020).

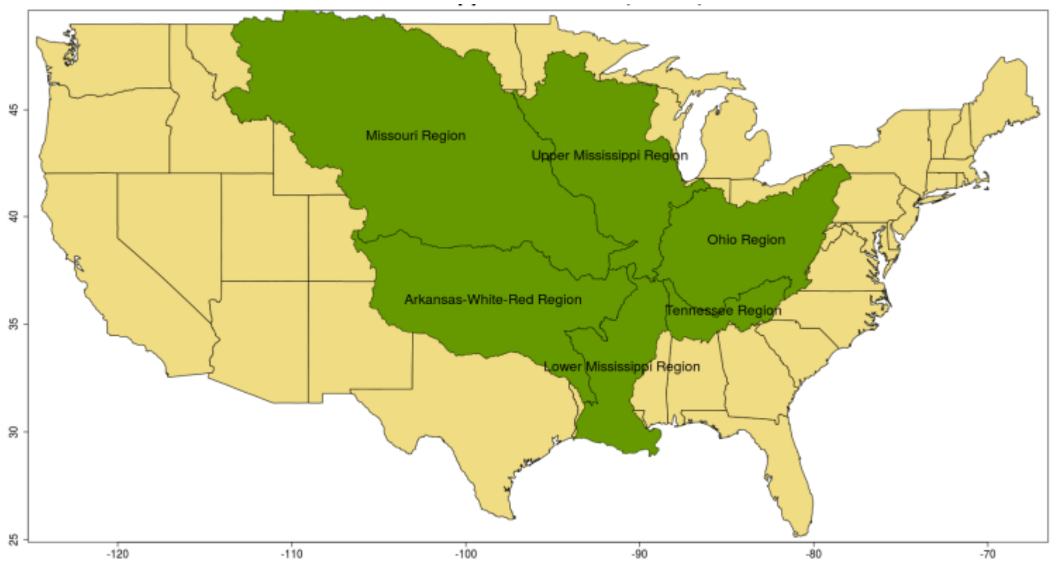


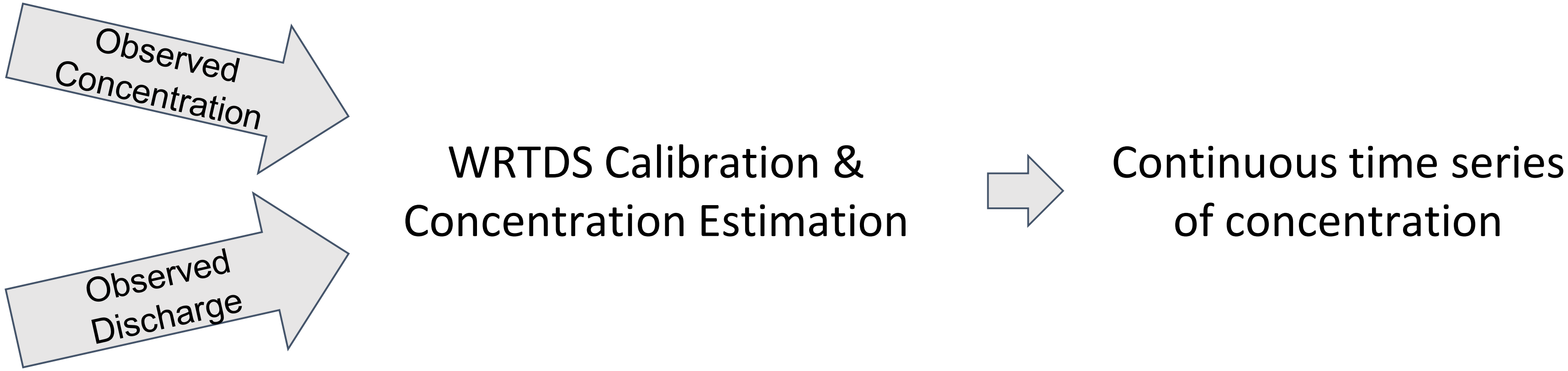
Image from KOPPA, A. 2019.

Weighted Regression on Time, Discharge, and Season - WRTDS

Concentration, Time, Discharge, Residual

$$\ln(c) = \beta_0 + \beta_1 t + \beta_2 \ln(Q) + \beta_3 \sin(2\pi t) + \beta_4 \cos(2\pi t) + \varepsilon$$

Fitted coefficients: Weighted regression based on proximity to simulated day and discharge.



Observed Concentration - Water Quality Portal

Water-quality data from the United States Geological Survey (USGS), the Environmental Protection Agency (EPA), and over 400 state, federal, tribal, and local agencies.

- Sampling, laboratory and reporting methods.
  - Reporting parameter
  - Units
  - Chemical form (elemental vs molecular)
  - Media (water, sediments)
- Data quality
  - Duplicates
  - Censored data
  - Negative, zero, missing (NA) values

Observed Discharge - USGS NWIS

Discharge date of over 1.5 million sites contained in the USGS National Water Information System (NWIS)

- Data quality
  - Missing, negative and zero records
  - WRTDS estimation requires a continuous time series of daily discharge
  - Co-location of discharge and water quality sites (basin areas)

Data Harmonization

- Create a consistent and quality-controlled dataset to be used for analysis and modelling.

- Requires making high-level decisions to process and screen data from multiple sources and sites to allow for regional and national trends analysis (Oelsner et al., 2017).

- Selected fields in the database are used to harmonize records with heterogeneous format on its metadata. The harmonization process includes:
    - Unifying collection organization name
    - Unifying parameter's names
    - Unifying units
    - Identify proper fractionations
    - Synthetizing remark codes and comments

- Columns containing updated, reformatted, or cleaned data and metadata are added to the original database. The end user can decide which data to use.

1. Select time period

↓

2. Water quality (WQ) data pre-processing

WQ1. Download WQ data

WQ2. Extract unique values for field: CharacteristicName (parameter name)

WQ3. Select target parameters for the trend analysis

WQ4. Filter target parameters from dataset (new baseline dataset)

WQ5. Select harmonization parameters

WQ6. Conduct dataset harmonization

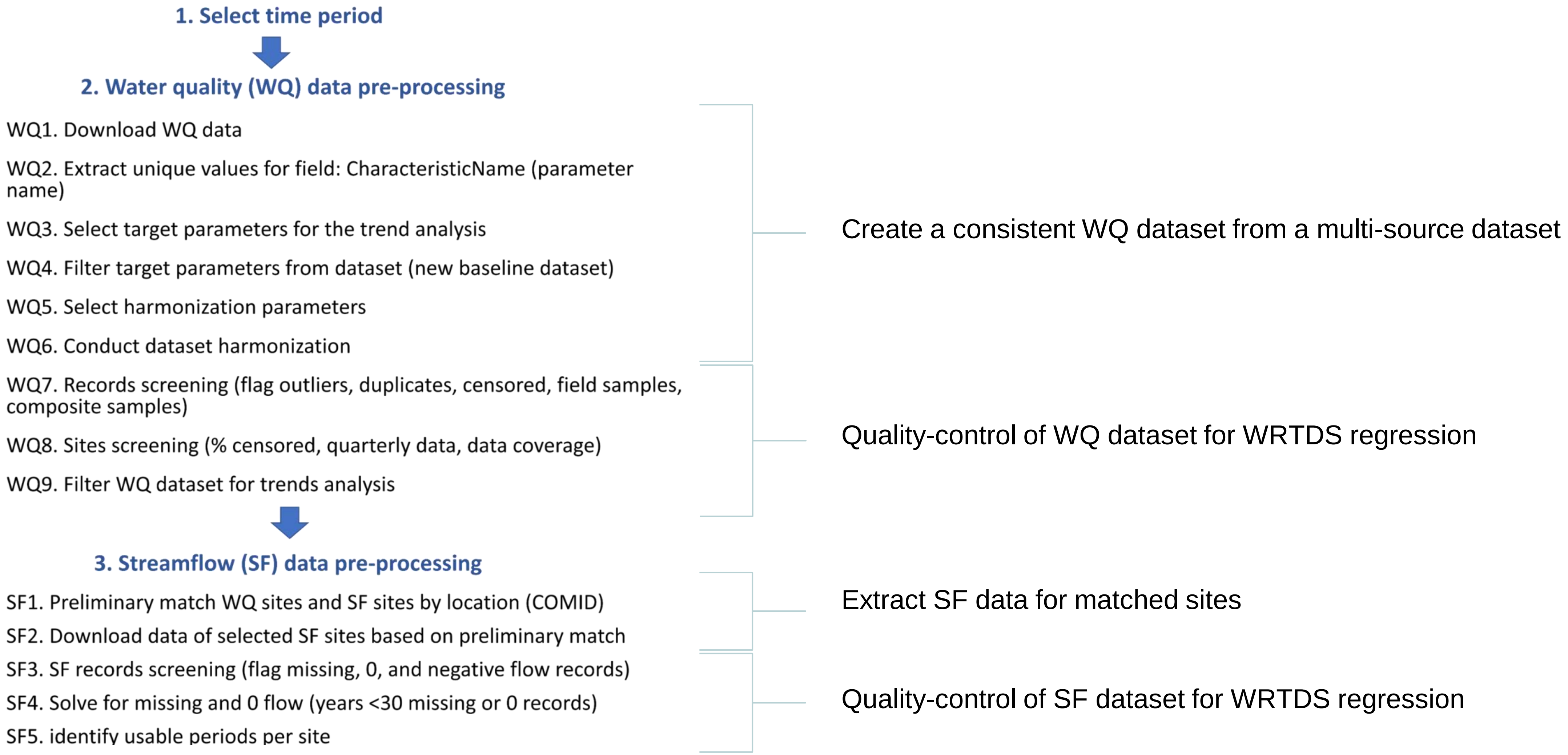
Create a consistent WQ dataset from a multi-source dataset

WQ7. Records screening (flag outliers, duplicates, censored, field samples, composite samples)

WQ8. Sites screening (% censored, quarterly data, data coverage)

WQ9. Filter WQ dataset for trends analysis

Quality-control of WQ dataset for WRTDS regression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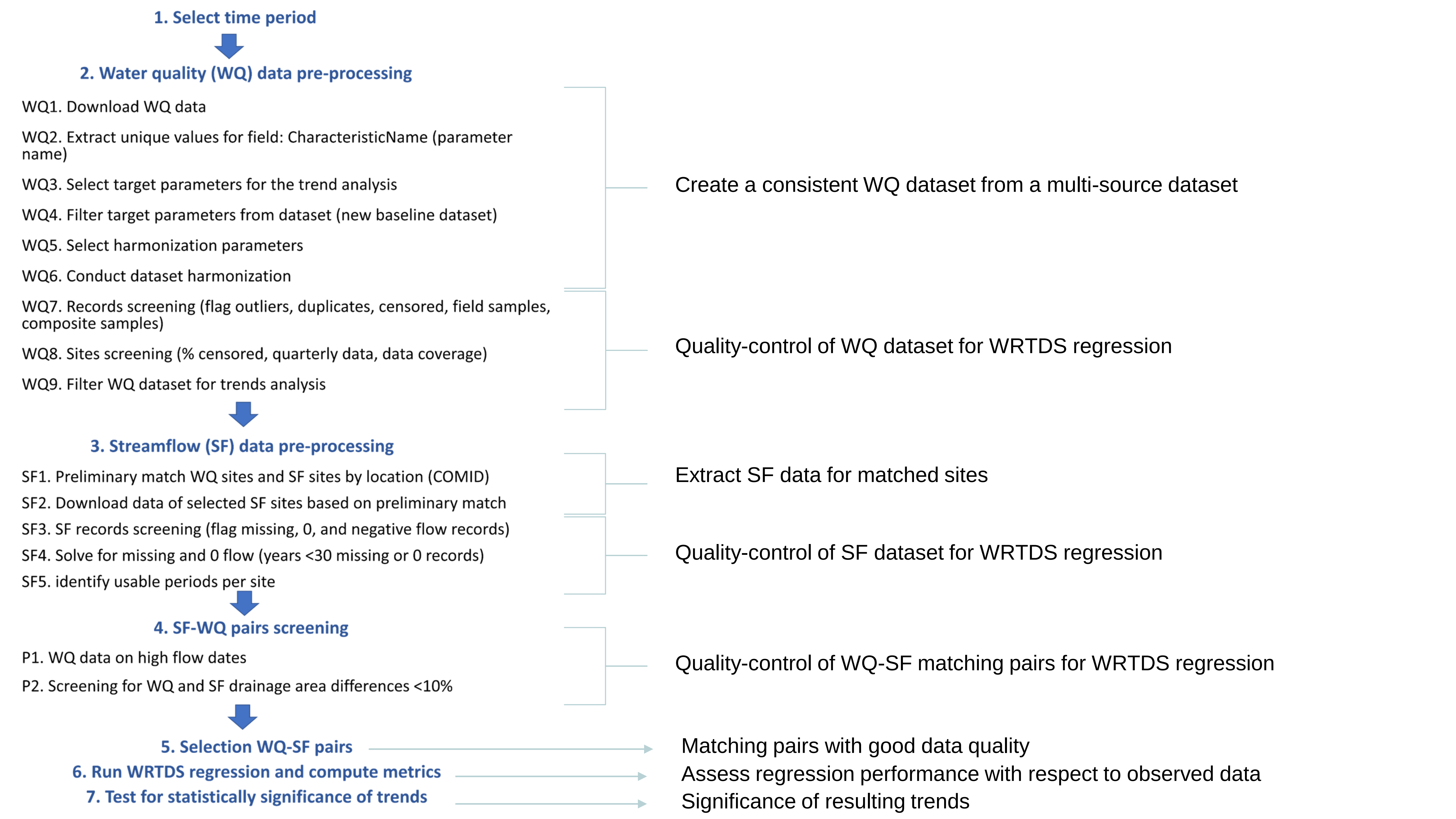
WQ9. Filter WQ dataset for trends analysis
Quality-control of WQ dataset for WRTDS regression
3. Streamflow (SF) data pre-processing
SF1. Preliminary match WQ sites and SF sites by location (COMID)
SF2. Download data of selected SF sites based on preliminary match
Extract SF data for matched sites
SF3. SF records screening (flag missing, 0, and negative flow records)
SF4. Solve for missing and 0 flow (years <30 missing or 0 records)
SF5. identify usable periods per site
Quality-control of SF dataset for WRTDS regression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SF4. Solve for missing and 0 flow (years <30 missing or 0 records)
SF5. identify usable periods per site
Extract SF data for matched sites
Quality-control of SF dataset for WRTDS regression
4. SF-WQ pairs screening
P1. WQ data on high flow dates
P2. Screening for WQ and SF drainage area differences <10%
Quality-control of WQ-SF matching pairs for WRTDS regression
5. Selection WQ-SF pairs
Matching pairs with good data quality
6. Run WRTDS regression and compute metrics
Assess regression performance with respect to observed data
7. Test for statistically significance of trends
Significance of resulting trends

Trend Sites Selection Criteria

Data Criteria for "ideal" sites selection to run WRTDS:

- WQ sites with less than 50% left-censored data
- Quarterly sampling for at least 70% of the trend analysis period.
- Water quality samples available for at least 10% of days in high flow regime per decade (>85 percentile of monthly flow values for the site).
- Co-located WQ and SF sites.
- Composite and field analyzed records were not used to avoid inconsistencies with discrete and lab analyzed records.

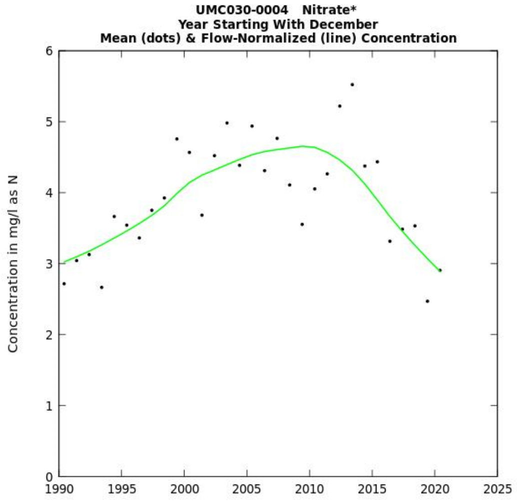
Model Performance Criteria for final selection of sites:

- Metrics (Pearson, Flux-bias, Extrapolation metric).
- Inspection of residuals.

Flow Normalized Concentration and Flux

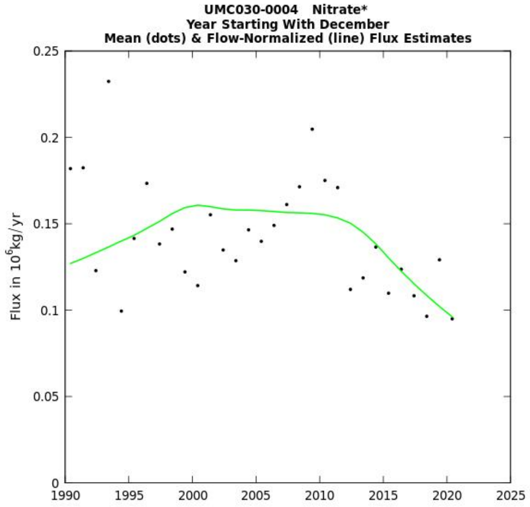
$$E[C^*(t)] = \int_0^\infty w(Q,t) \cdot f_t(Q)\, dQ$$

- Removes the “noise” introduced by random SF variability.
- Smoother nature than non-normalized time series.



Yearly average concentrations:

- ● Original values
- — Flow-normalized values



Yearly average concentrations:

- ● Original values
- — Flow-normalized values

Statistical Significance of Trends

- The block bootstrap method re-uses the data many times, randomly sampling a block of records estimating the change in concentration or flux during the period.
- Fraction of records with a positive change → likelihood of increasing trend.

Probability of Having an Upward Trend	Significance Labels
≥ 90%	Highly Likely Upward
≥ 66% and ≤ 90%	Likely Upward
≥ 33% and ≤ 66%	No Significant Trend
≥ 10% and ≤ 33%	Likely Downward
<10%	Highly Likely Downward

What about the Effects of Time Periods on Trends?

- We did a preliminary analysis using different time periods at trial sites.
    - 1990-2020
    - 2000-2020
    - 2010-2020

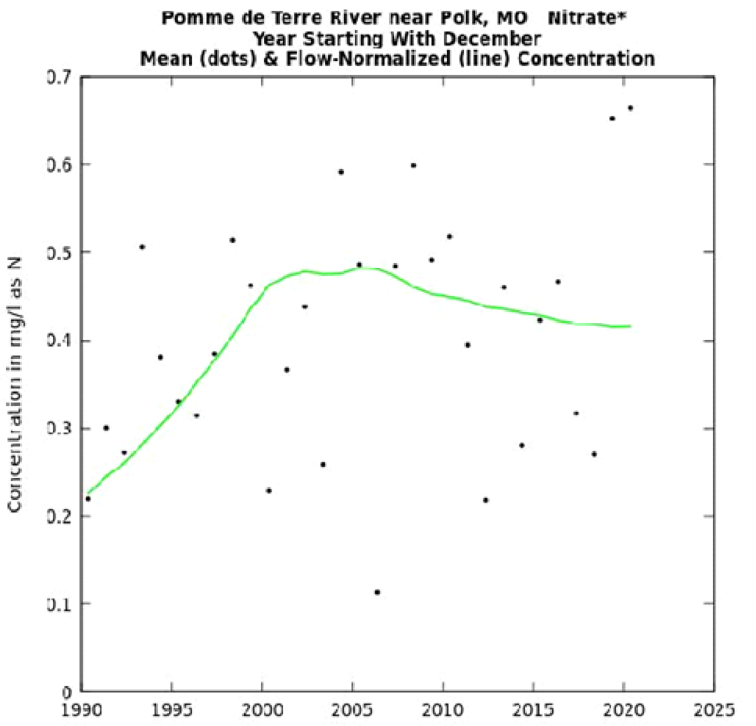
- Different significant trends at same site depending on time period used.
- Number of sites included in the analysis.

Nitrate –N Trends for Multiple Time Periods

Yearly average concentrations:
- ● Original values
- — Flow-normalized values

Site example 1: Pomme de Terre River near Polk, MO

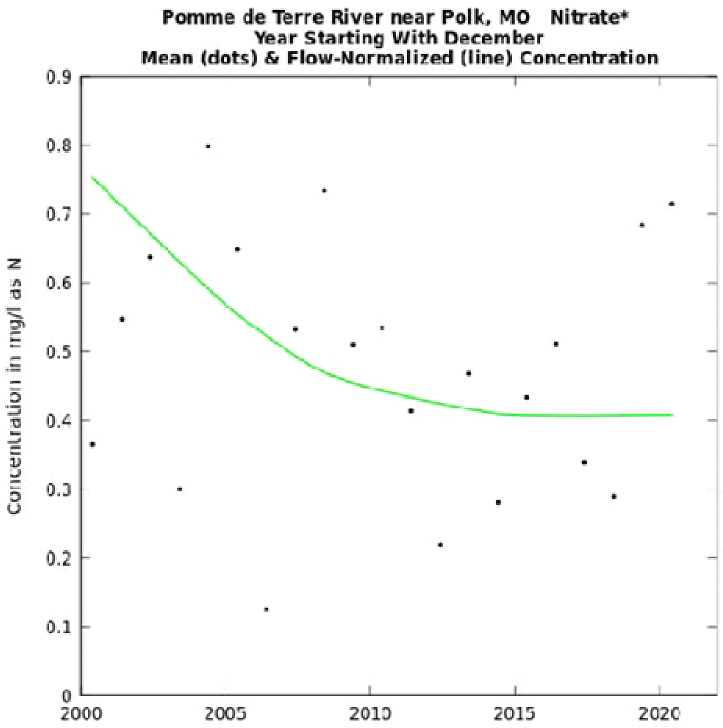
1990-2020



Upward trend in concentration is highly likely

Number of records=213

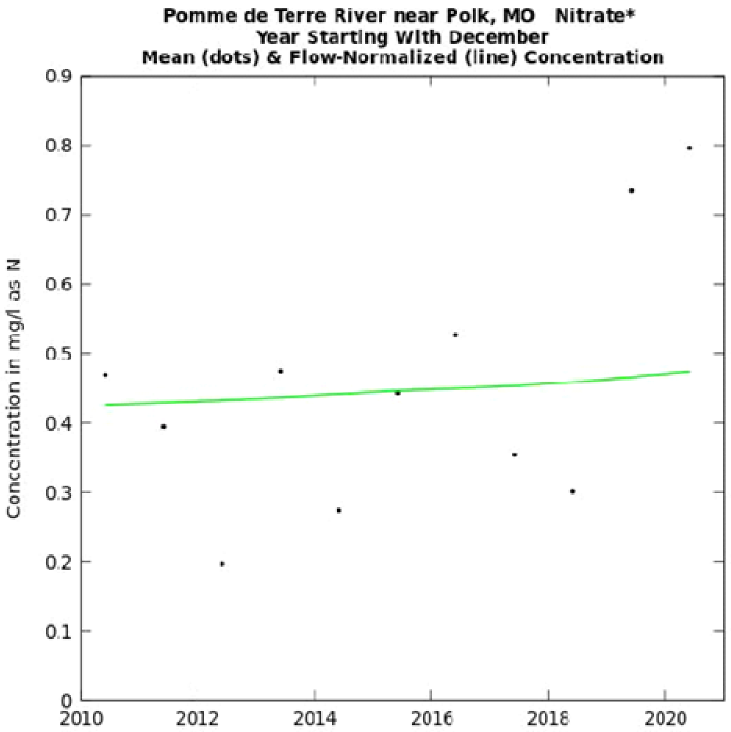
2000-2020



Downward trend in concentration is likely

Number of records=145

2010-2020



Upward trend in concentration is likely

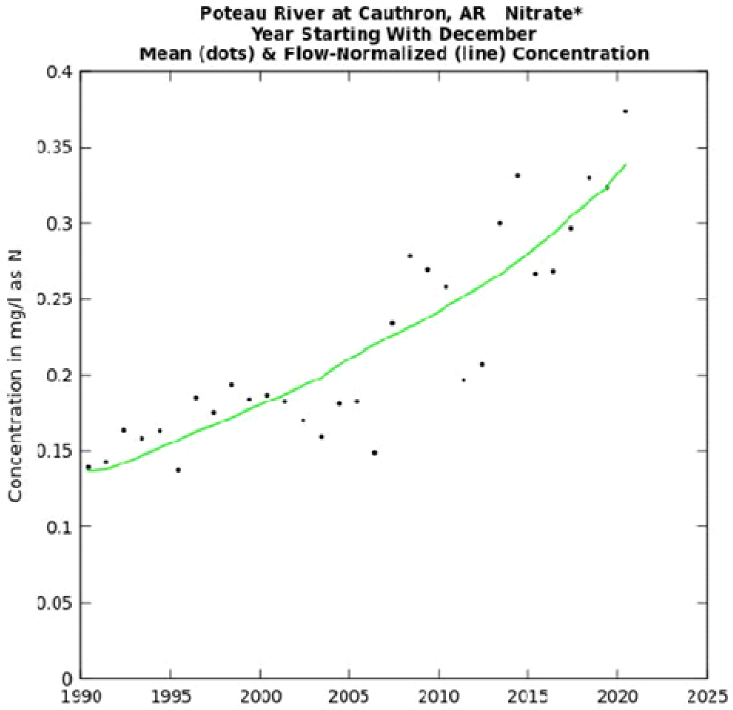
Number of records=82

Nitrate-N Trends for Multiple Time Periods

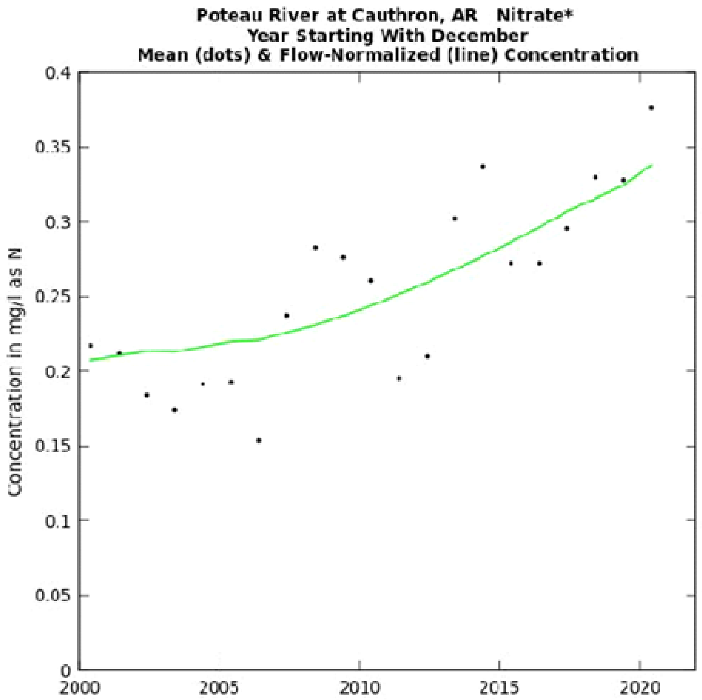
Yearly average concentrations:
- Original values
- Flow-normalized values

Site example 2: Poteau River at Cauthron, AR

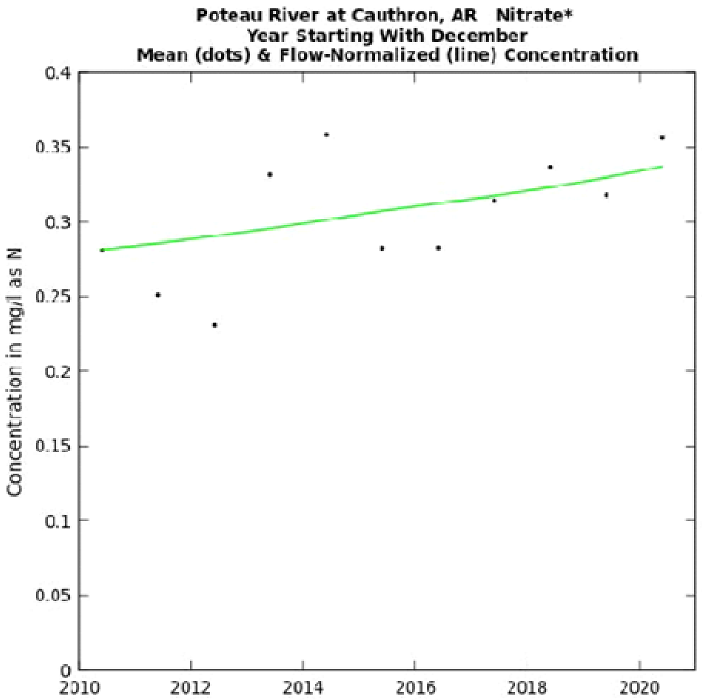
1990-2020



2000-2020



2010-2020



Upward trend in concentration is very likely

Number of records=134

Upward trend in concentration is likely

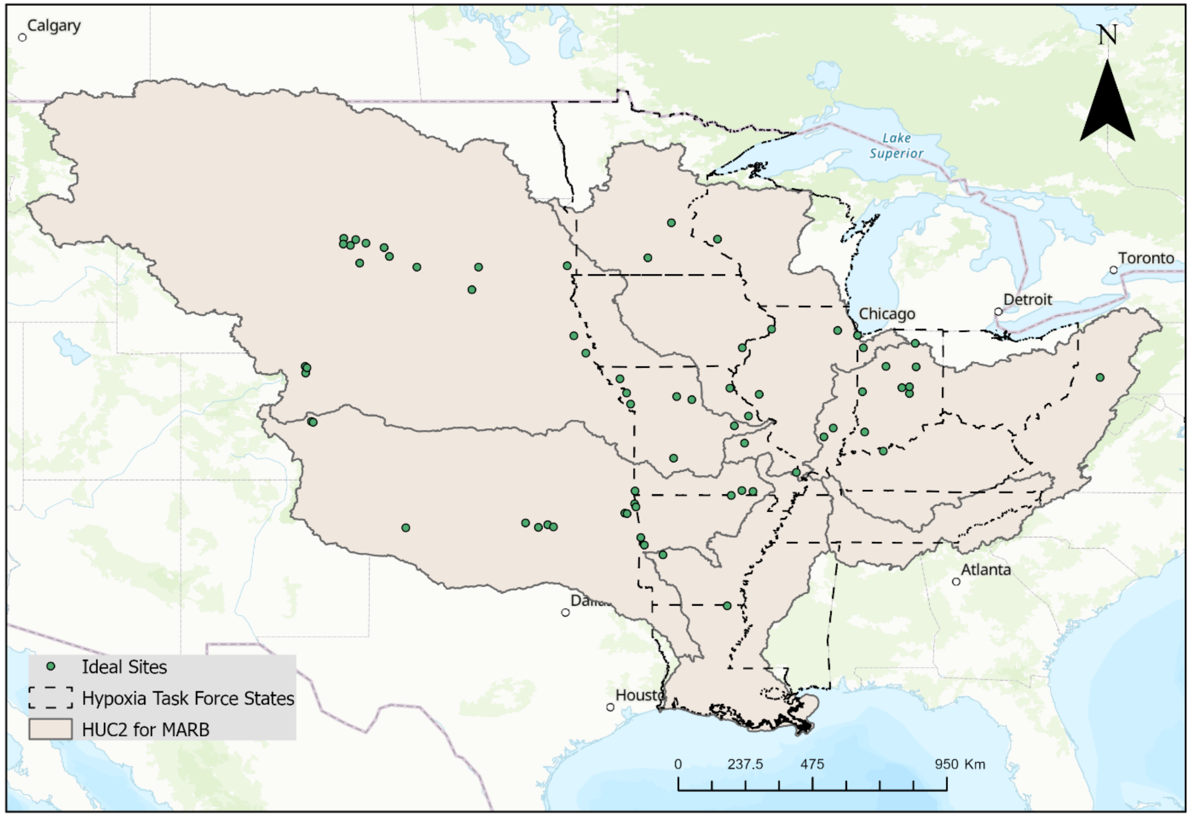
Number of records=113

Downward trend in concentration is likely

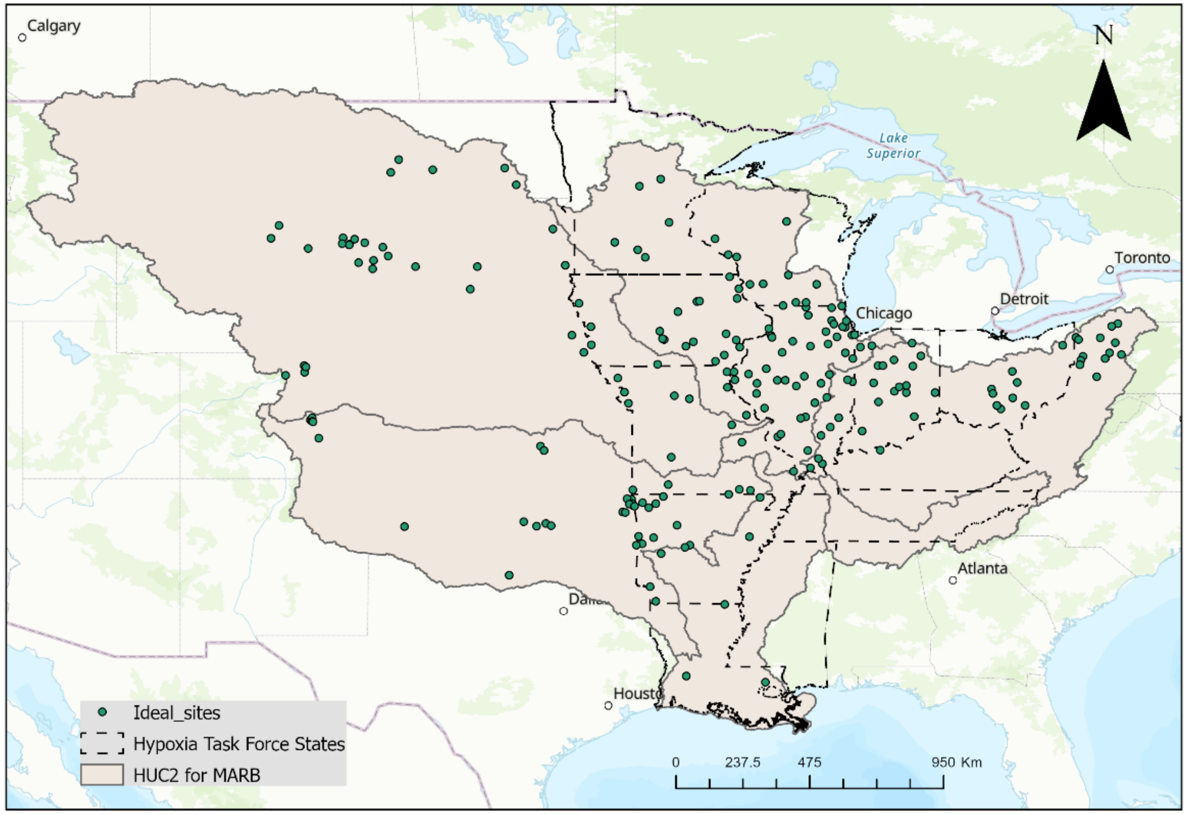
Number of records=54

MARBS Trends “Ideal” Sites for Trends Periods

1990-2020: 68 ideal sites

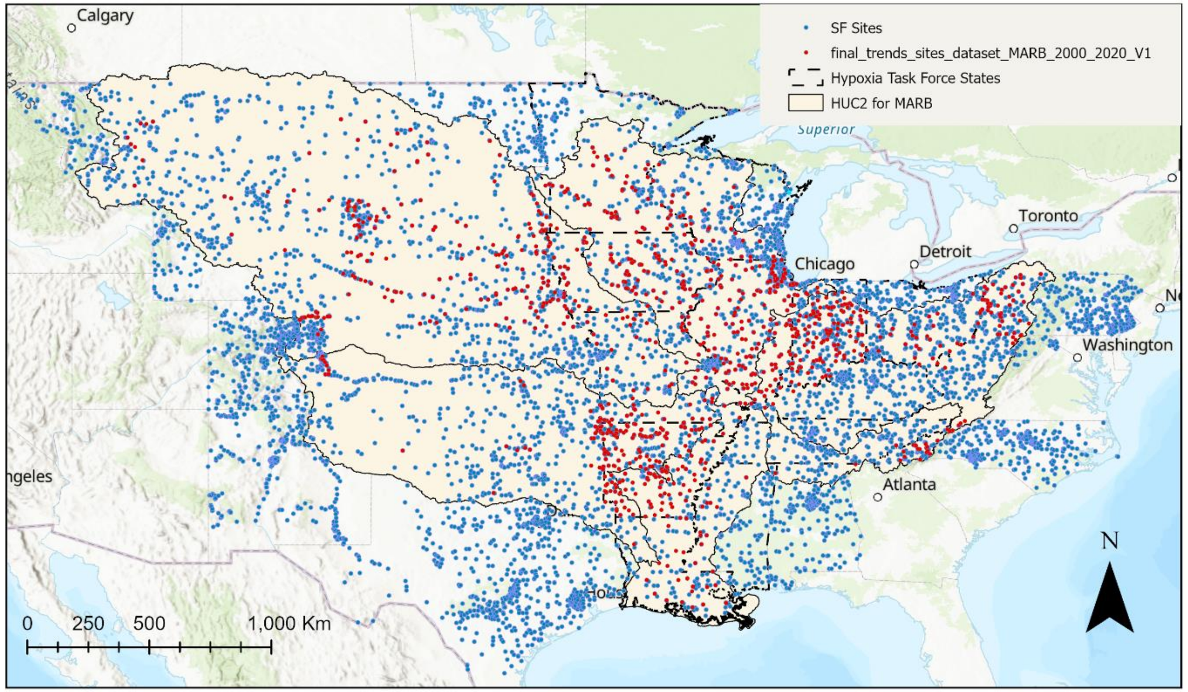


2000-2020: 219 ideal sites

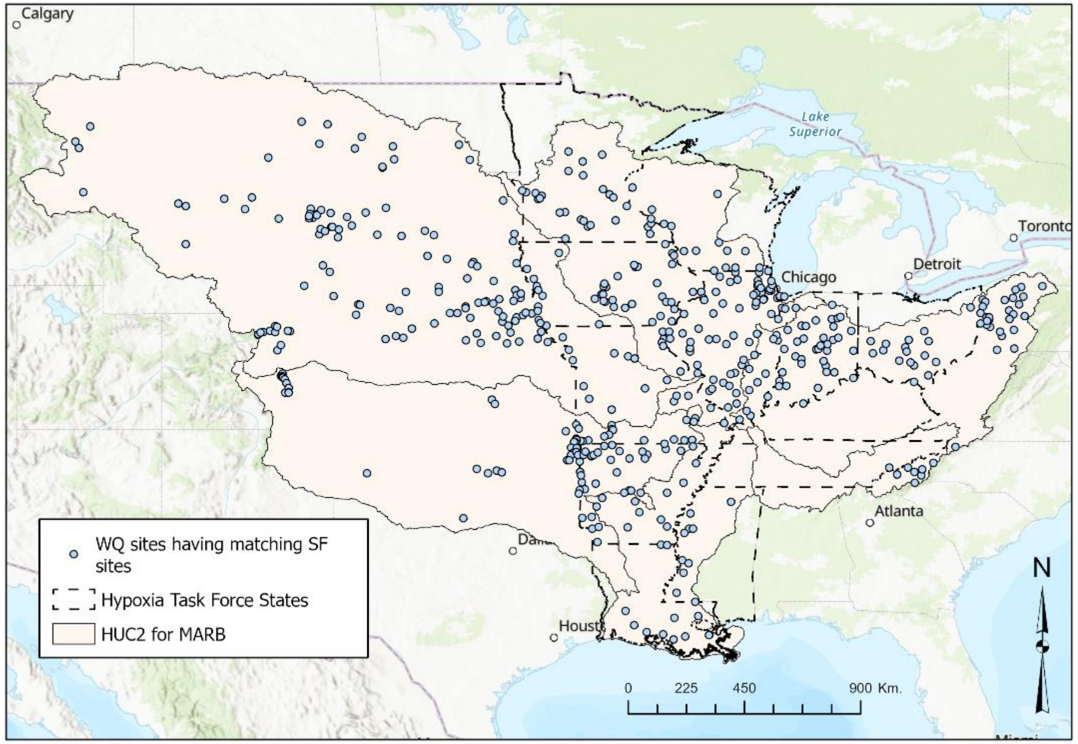


Best trends period to select is one that yields **max number of sites having the max number of records over time** – in this case we recommend 2000-2020 as many stations drop out when use 1990-2000 which we started with.

Preliminary SF-WQ matching pairs 2000-2020 (544 matching pairs)



Water Quality (WQ) and Streamflow (SF) sites used in preliminary matching.

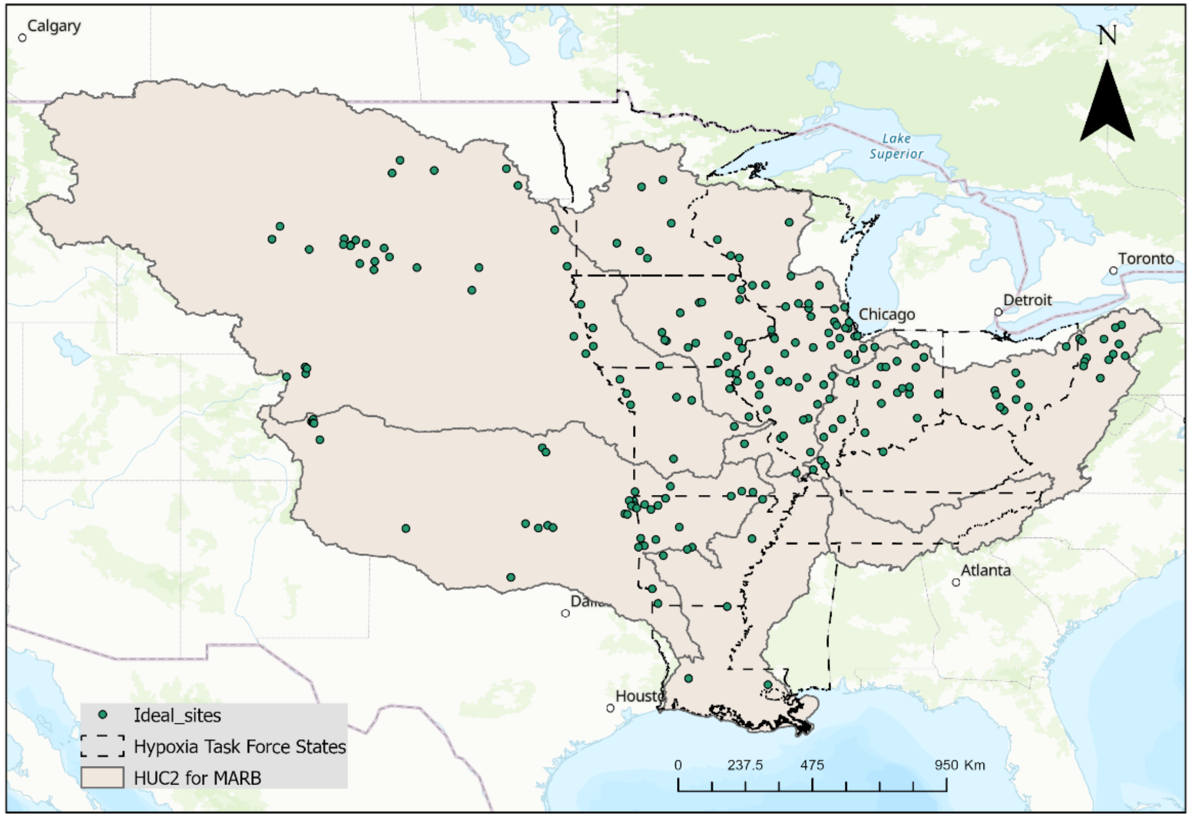


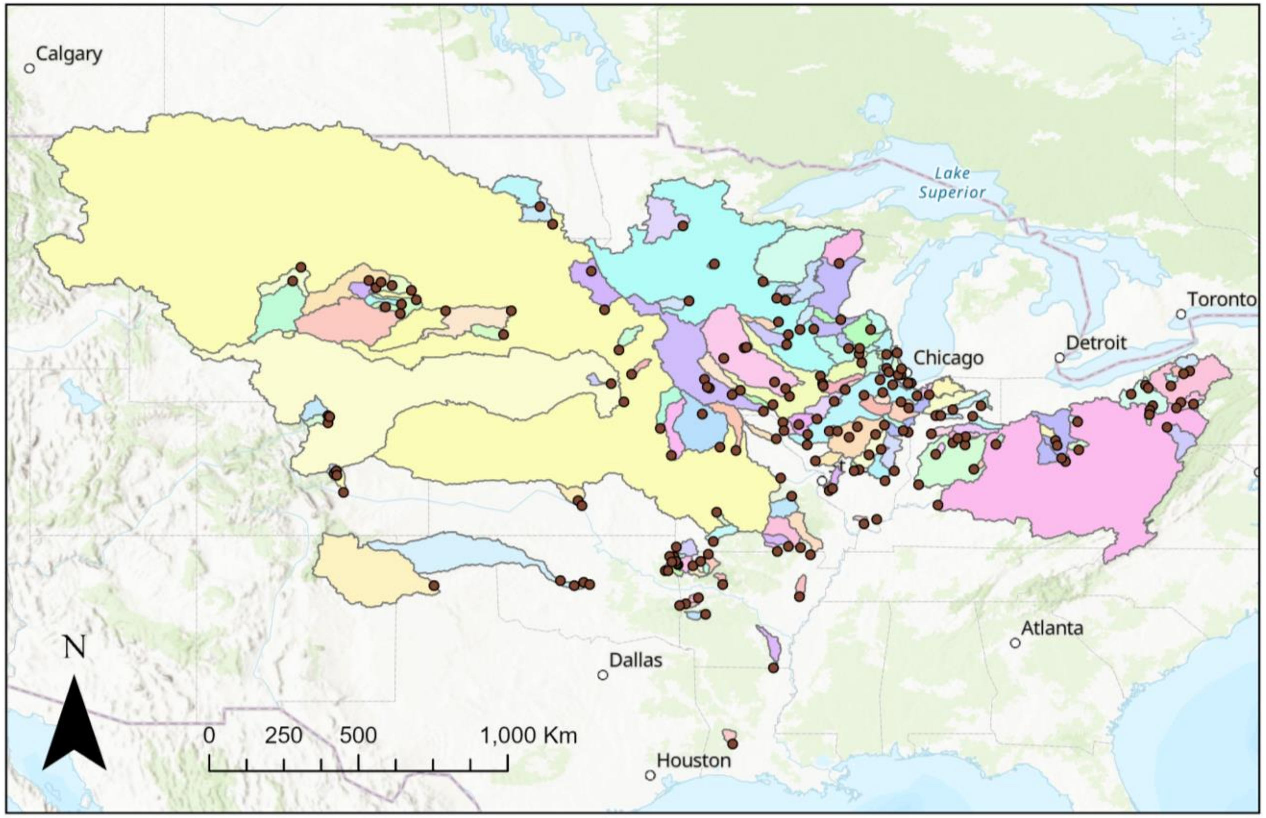
544 WQ sites with a matching SF site.

WQ Sites <50% left-censored data

Data quality of 544 matching pairs:

WQ_site_quarterly_coverage	SF_Full_period_coverage	WQ_data_High_flow_2000_2010_label	WQ_data_High_flow_2010_2020_label	ratio_areas_label	n
>=70%	YES	>=10%	>=10%	area dif<10%	219
>=70%	YES	<10%	>=10%	area dif<10%	14
>=70%	YES	>=10%	<10%	area dif<10%	17
>=70%	YES	<10%	<10%	area dif<10%	4
60%-70%	YES	>=10%	>=10%	area dif<10%	18
60%-70%	YES	>=10%	<10%	area dif<10%	4
>=70%	NO	>=10%	>=10%	area dif<10%	42
>=70%	NO	<10%	>=10%	area dif<10%	28
>=70%	NO	>=10%	<10%	area dif<10%	17
>=70%	NO	<10%	<10%	area dif<10%	38
60%-70%	NO	>=10%	>=10%	area dif<10%	6
60%-70%	NO	<10%	>=10%	area dif<10%	3
60%-70%	NO	>=10%	<10%	area dif<10%	3
60%-70%	NO	<10%	<10%	area dif<10%	5





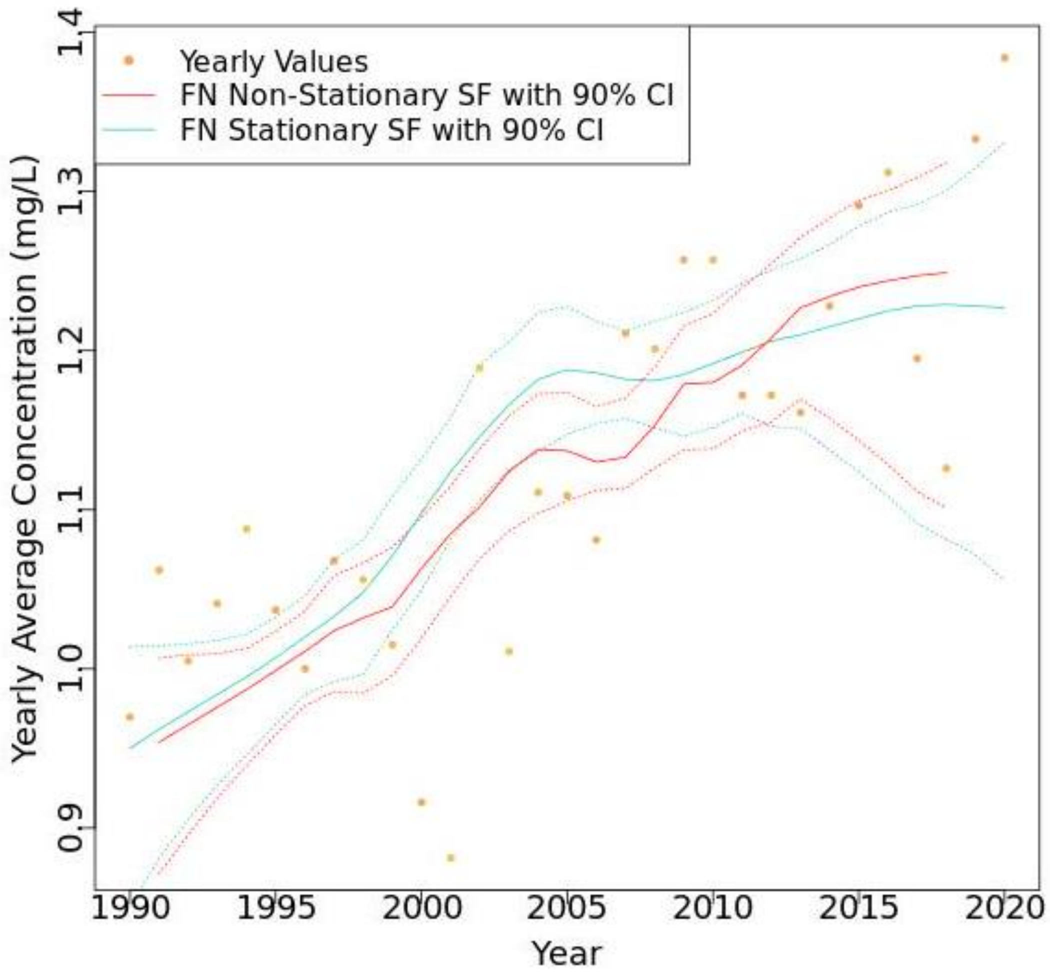
The 219 “ideal” sites selected for Nitrate-N trends analysis.

Reduced to 187 sites after WRTDS performance evaluation (metrics and residuals inspection).

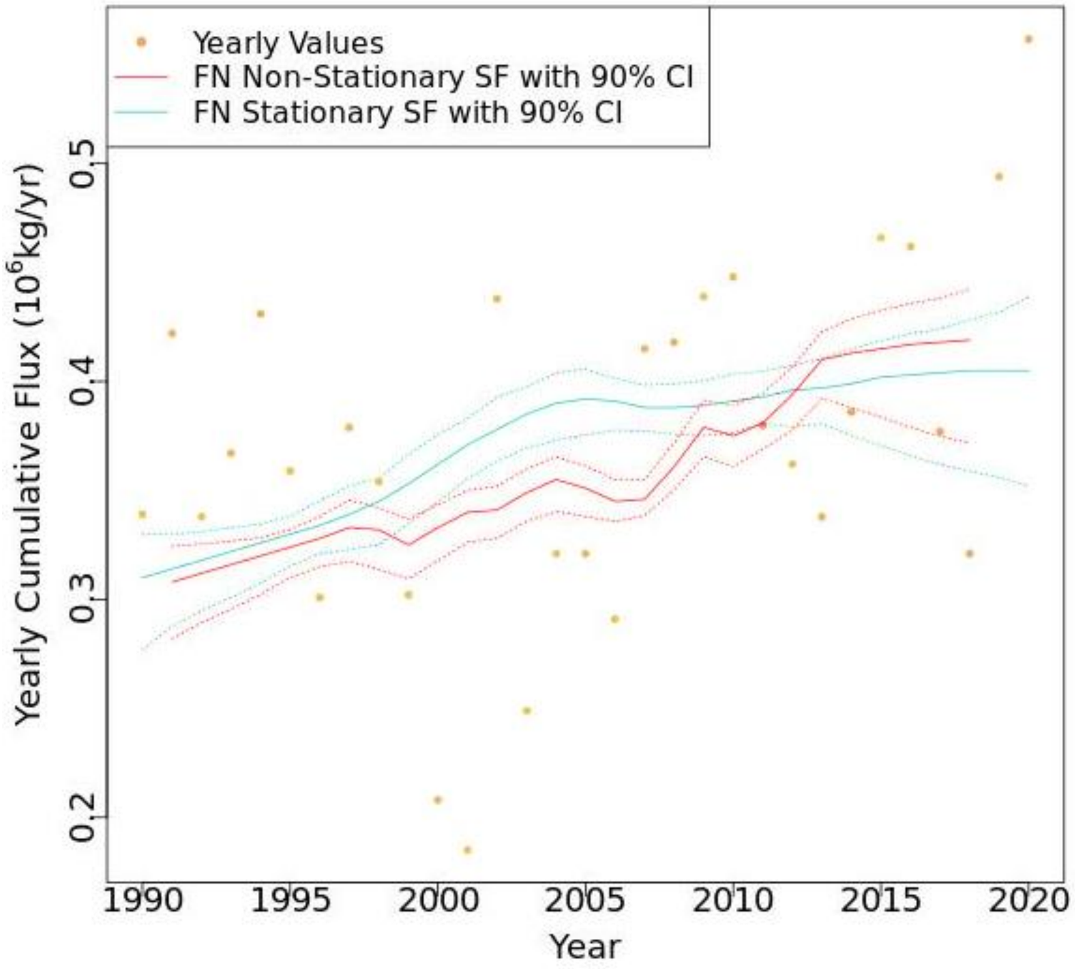
The basins associated with the 187 sites.

Example of Results for Each Site

Nitrate-N concentration [mg/L]



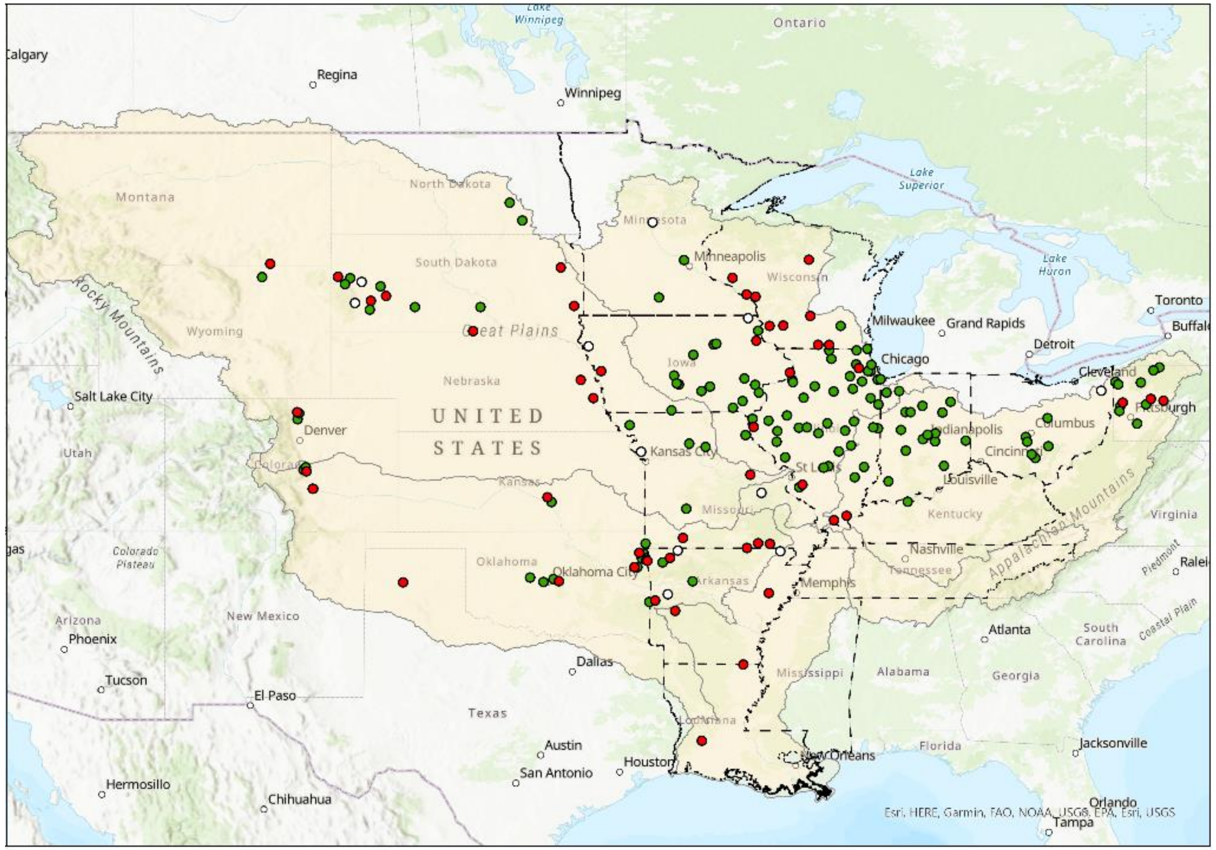
Nitrate-N Flux (load) [kg/year]



And the statistical Significance Label for concentration and flux trends

Results –Trends

2000-2020 (187 sites)



LEGEND

Trend significance per site*

- Upward trend
- Downward trend
- No significant trend

Hypoxia Task Force States

HUC2 basins MARB

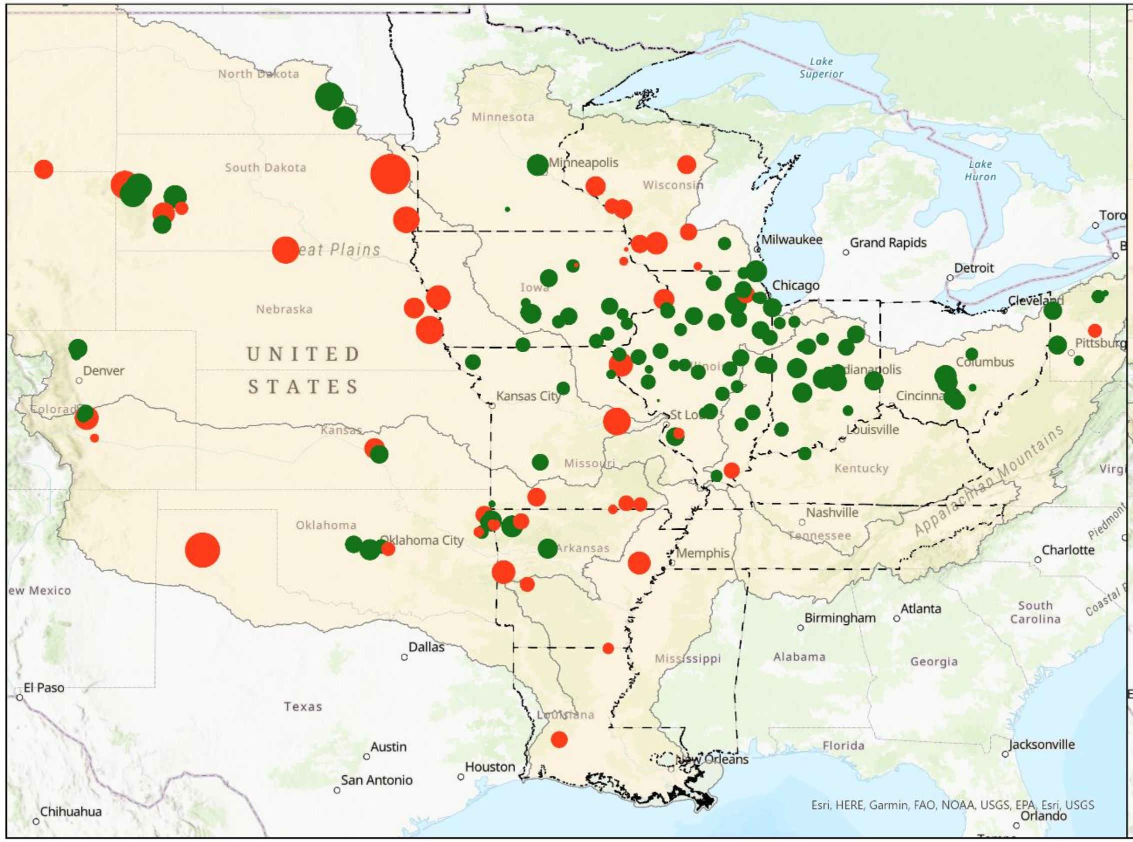
Tables per state 2000-2020 trends period (**HTF states**):

State_Name	Number of Sites	Upward Trend*	Downward Trend*	No Significant Trend*
ARKANSAS	**12**	**7**	**2**	**3**
COLORADO	7	3	4	0
IOWA	**19**	**2**	**15**	**2**
ILLINOIS	**45**	**6**	**39**	**0**
INDIANA	**18**	**0**	**18**	**0**
KANSAS	2	1	1	0
KENTUCKY	**1**	**0**	**1**	**0**
LOUISIANA	**2**	**2**	**0**	**0**
MINNESOTA	**3**	**0**	**2**	**1**
MISSISSIPPI	**0**	**0**	**0**	**0**
MISSOURI	**13**	**5**	**6**	**2**
MONTANA	1	1	0	0
NORTH DAKOTA	2	0	2	0
NEBRASKA	2	2	0	0
OHIO	**7**	**0**	**6**	**1**
OKLAHOMA	13	4	9	0
PENNSYLVANIA	12	3	9	0
SOUTH DAKOTA	15	6	7	2
TENNESSEE	**0**	**0**	**0**	**0**
TEXAS	1	1	0	0
WISCONSIN	**11**	**9**	**2**	**0**
WYOMING	1	0	1	0

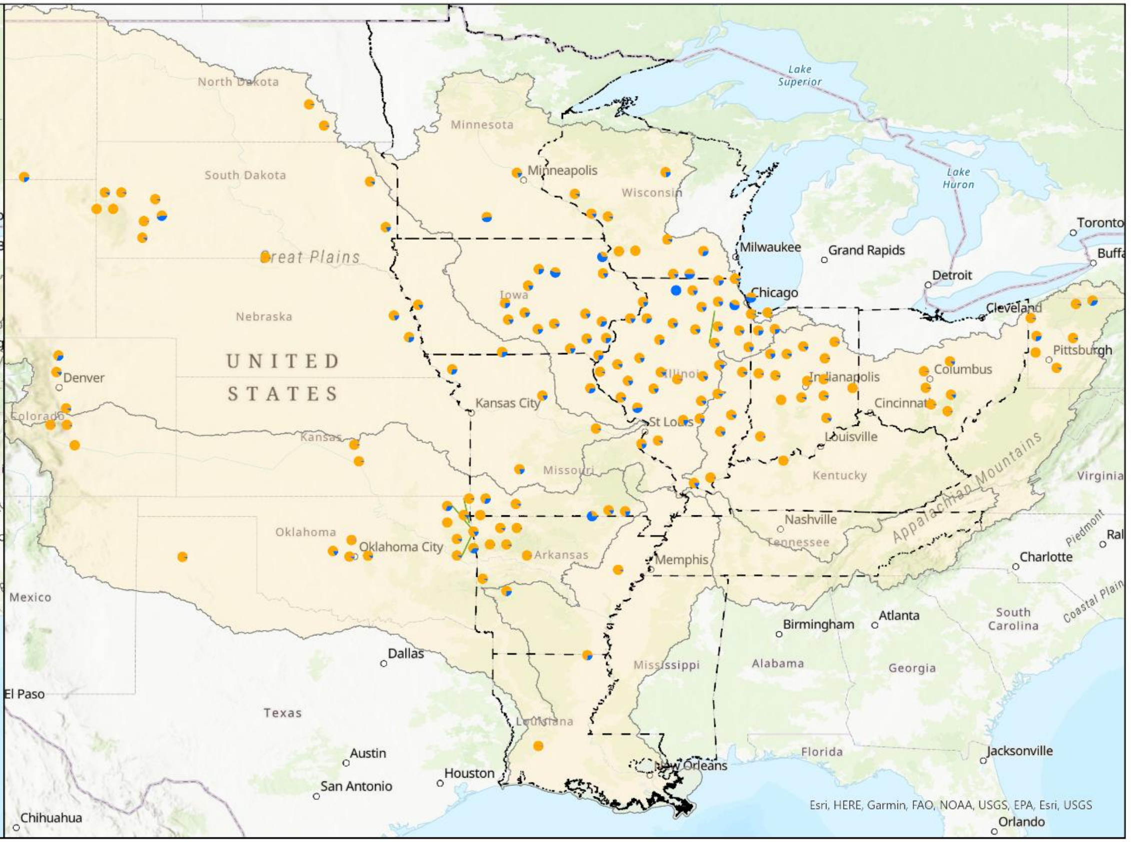
*Definition of Site Trend Significance based on Bootstrap Statistical Test:	
Upward trend Site:	Flux OR Concentration have an upward trend
Downward trend Site:	Flux OR Concentration have a downward trend AND neither has an upward trend
No significant trend Site:	Flux AND concentration have No significant trend

Concentration Trends for the 2000-2020 analysis, showing only sites with Statistically Significant Concentration Trends:

Total Trends presented as yearly relative changes (final-initial)/initial.



Source/Sink and Flow component of Total Trends:



%/year Total Trend of Concentration (Yearly relative change with respect to the initial value)

- 1
- 2.5
- 5
- 10

Trend Direction

- Downward Trend (- Total Trend)
- Upward Trend (+ Total Trend)

Hypoxia Task Force States

HUC2 for MARB

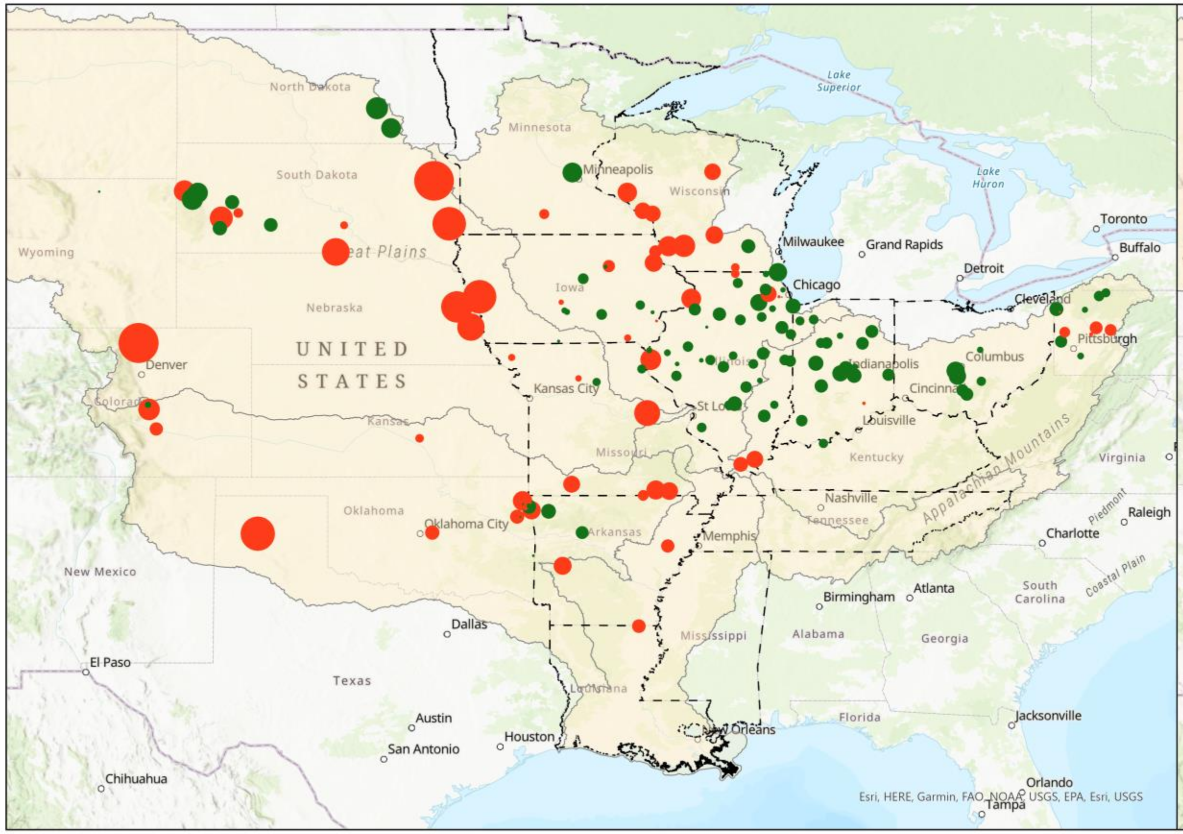
Components of Concentration trends

- Influence source/sink component
- Influence flow component

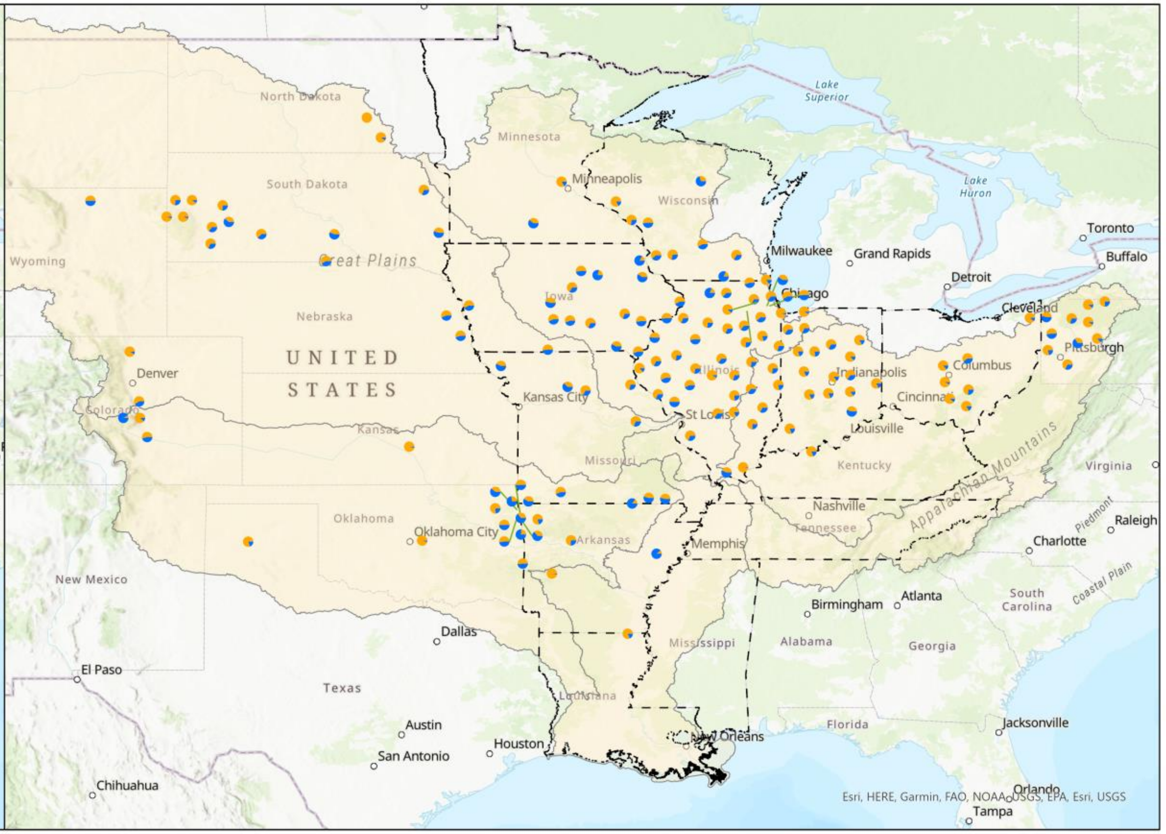
Relative! Depend on initial values.

Flux Trends for the 2000-2020 analysis, showing only sites with Statistically Significant Flux Trends:

Total Trends presented as yearly relative changes (final-initial)/initial.



Source/Sink and Flow component of Total Trends:



%/year Total Trend of Flux (Yearly relative change with respect to the initial value)

- 1
- 2.5
- 5
- 10

Trend Direction

- Downward Trend (- Total Trend)
- Upward Trend (+ Total Trend)

Hypoxia Task Force States

HUC2 for MARB

Components of Flux trends

- Influence source/sink component
- Influence flow component

Relative! Depend on initial values.

Next Steps

- Correlate significant trends with data on conservation practices, dollars spent, etc. – These data layers exist on GLTG.
- Do it all again for Phosphorus.
- Increase number of sites (**Sensitivity analysis**):
    - Use non-co-located SF gauges (keeping the area difference <10%)
    - Use simulated SF data (WQ sites without matching SF gauge)
    - Relax criteria for trends sites selection (WQ sites with <70% coverage).

Lessons Learned

- Quality of the dataset evaluated by a structured harmonization process is key.

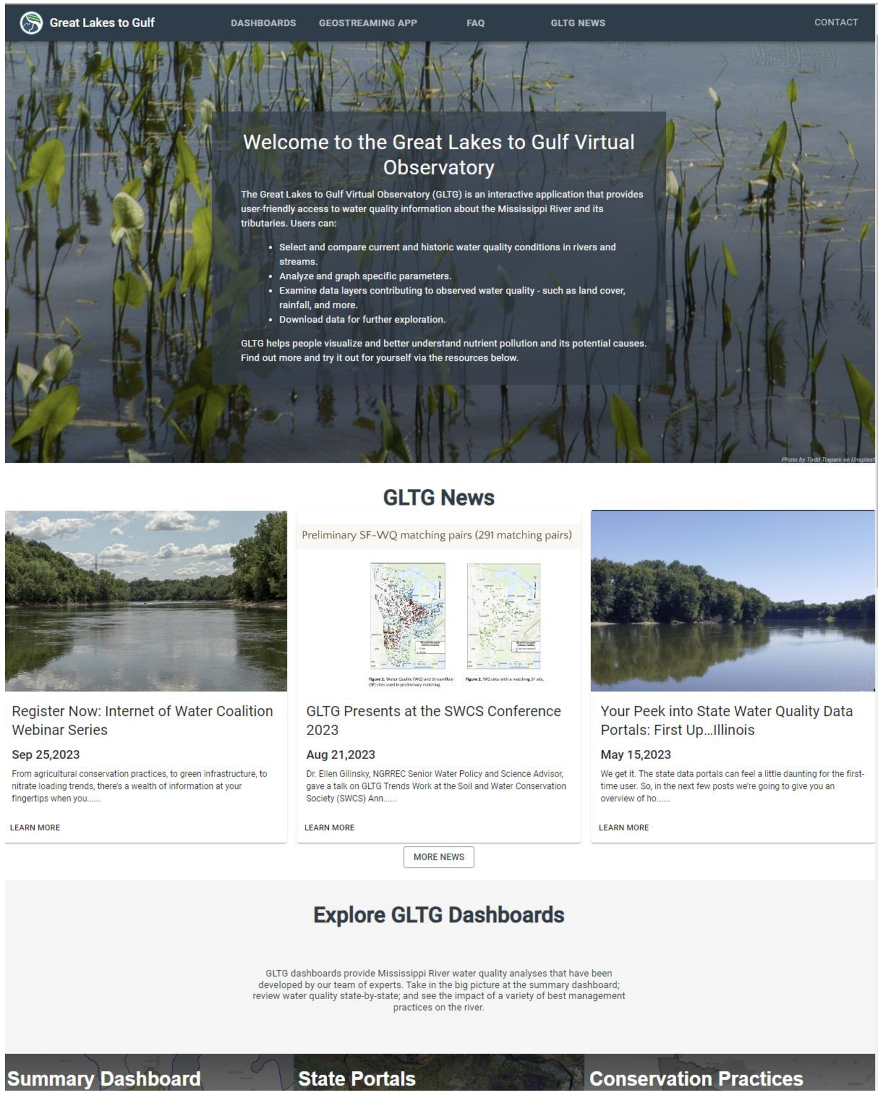
- Methods and statistics used to select sites and do calculations must be documented as they are important to the interpretation of the results.

- A watershed process such as Nutrient transport should be analyzed at watershed scale.

- Our results highlight the importance of long-term planning and strategy when creating a national WQ sampling network and dataset:
  - Collecting streamflow at all sites.
  - Using uniform labels when reporting data.
  - Provide all relevant information to the dataset user (e.g. molecular vs elemental, COMID of WQ and SF sites)

Trends for Nitrogen Shown on the GLTG Dashboard

Live Demonstration of Trends Dashboard



QUESTIONS and DISCUSSION

Agenda Item 4:

An Assessment of the Influence of Reservoirs on Ohio River Low Flow & A Discussion of the Benefits and Costs

Dr. Patrick Ray, University of Cincinnati

Gaurav Atreya, University of Coincinnati

Tolulope Odunola, University of Cincinnati

An Assessment of the Influence of Reservoirs on Ohio River Low Flow

Patrick Ray, Gaurav Atreya, Erich Emery
And other colleagues at UC and USACE

ORSANCO Technical Committee Meeting
Embassy Suites RiverCenter
Covington, Kentucky
6 February 2024

University of CINCINNATI

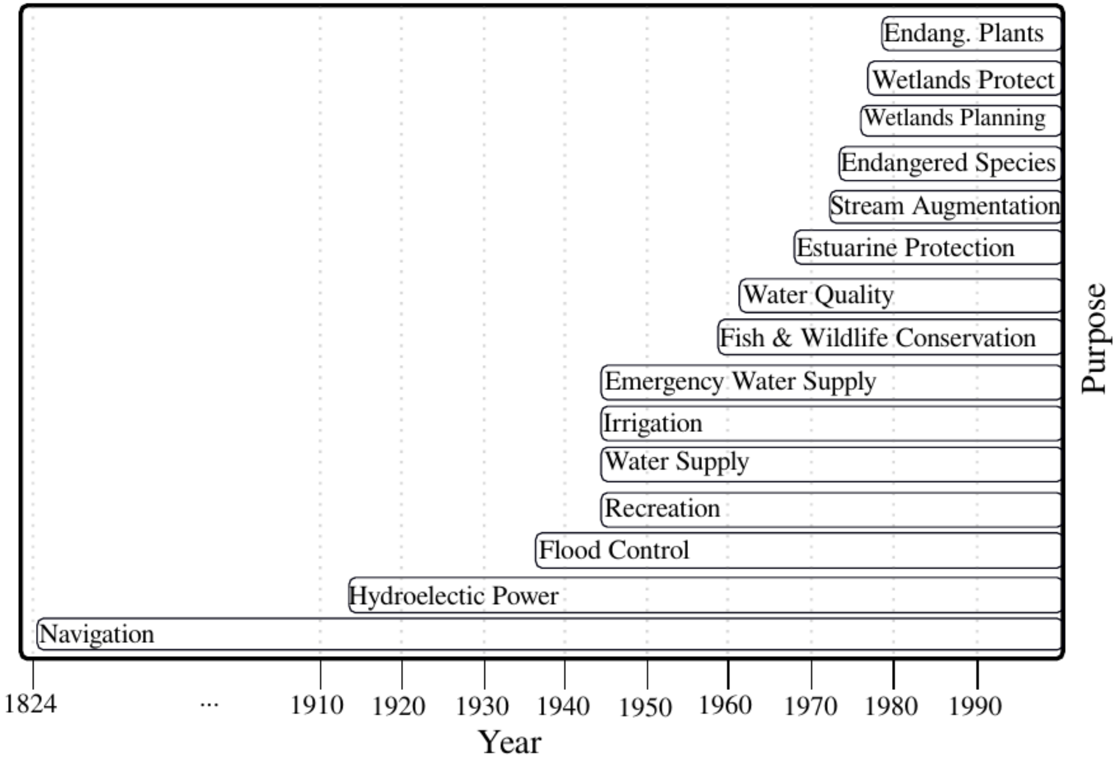
Photo credit: Asphota Wasti

The Value of our Infrastructure

7 March 2021: Policy Directive – Comprehensive Documentation of Benefits in Decision Documents.

- Documentation of benefits in the conduct of U.S. Army Corps of Engineers (USACE) water resources development project planning.
- Emphasizes and expands upon policies and guidance to ensure the USACE decision framework considers, in a comprehensive manner, the total benefits of project alternatives, including equal consideration of economic, environmental and social categories.

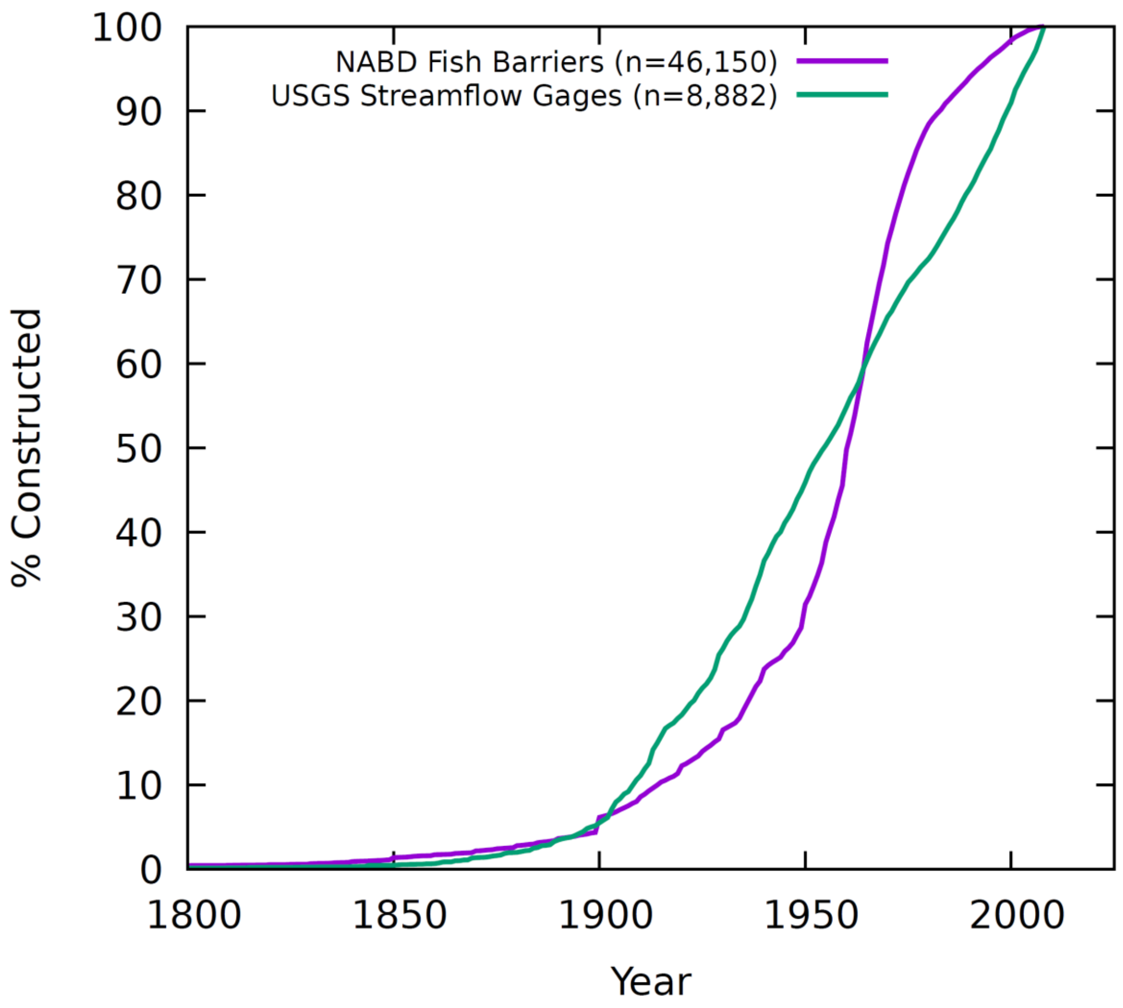
The Contribution of US Army Corps Infrastructure to National Economic Development



Purpose and Programs Authorized by the Congress
(Reason the Lock and Dams were Built)

Program	NED Benefit Estimate
Flood Risk Management	Flood Damages Prevented
Coastal Navigation	Transportation Cost Savings
Inland Navigation	Transportation Cost Savings
Water Supply	Average Price of Water in the U.S. x Yield from Contracted Storage
Hydropower	Average of Regional Energy Prices x Energy Generated
Recreational	Unit Day Values x Visitation

Factors Taken into Account for the National Economic Development (NED) Net Benefit Calculations (from IWD 2013)



Rate of installation of US Geological Survey (USGS) streamflow gages relative to US water control structures

Stream gages having trouble keeping up

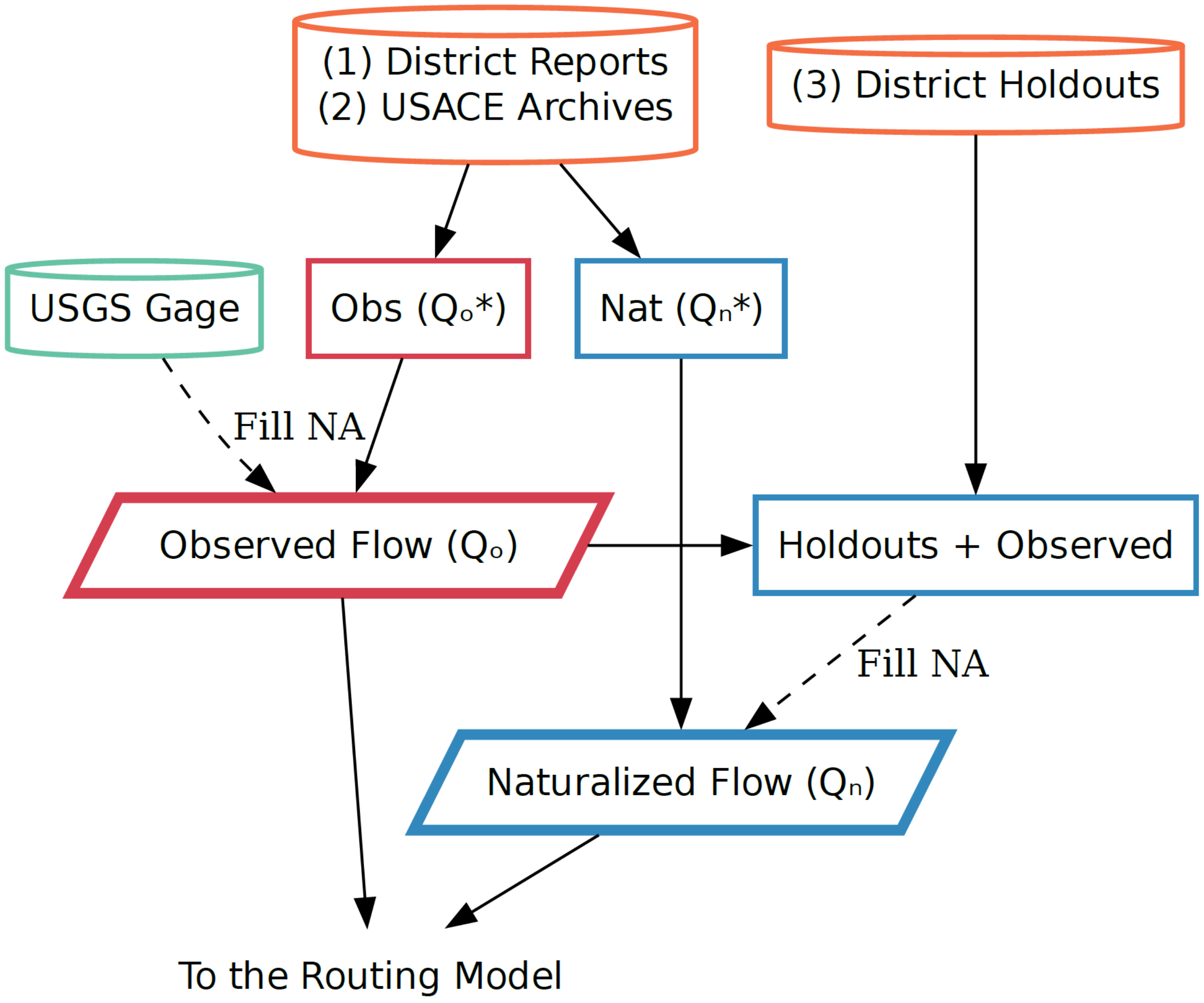
We have installed many of America's stream gages in river basins that were already developed.

This means that, though we would prefer to make policies based on "natural" flow regimes, we forgot to write down what those were before developing the basins and now we can't easily know what "natural conditions" our policies should aim for.

Atreya et al. (2024) *J Hyd Reg Studies*, under review.

Data Processing Workflow

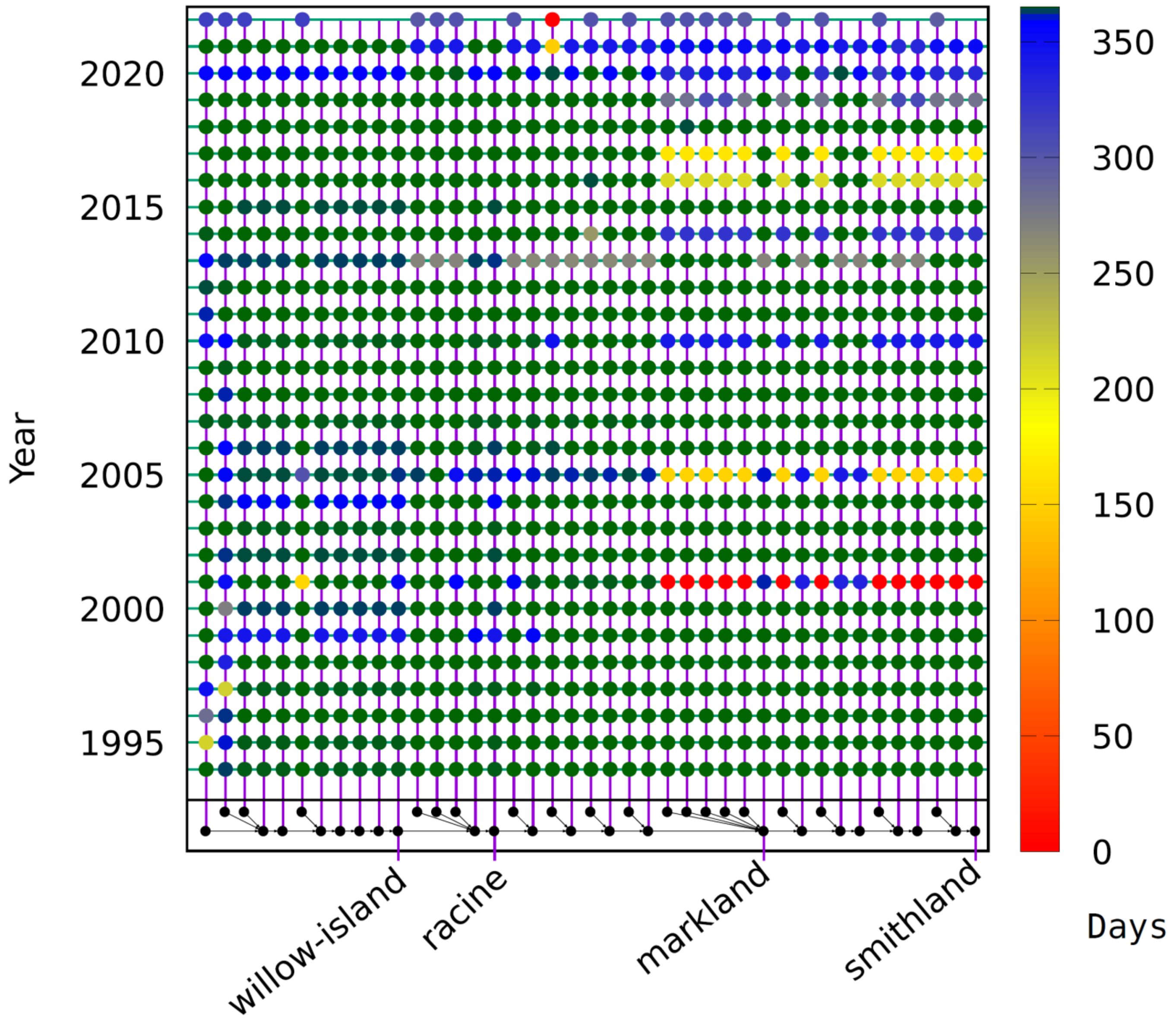
Data processing workflow to prepare naturalized and observed vectors for input to the routing model



Atreya et al. (2024) *J Hyd Reg Studies*, under review.

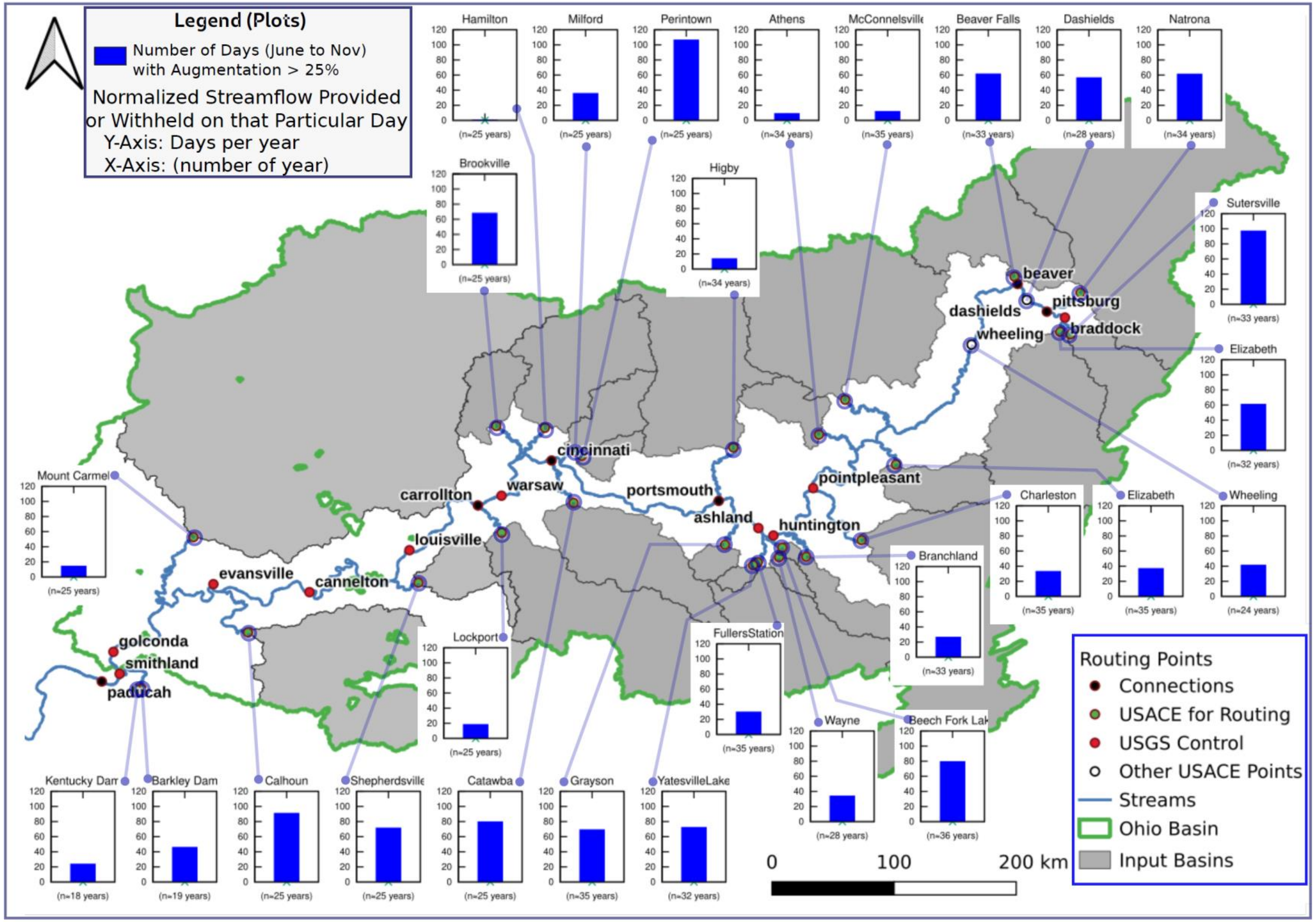
Data Availability

Streamflow data availability from USACE

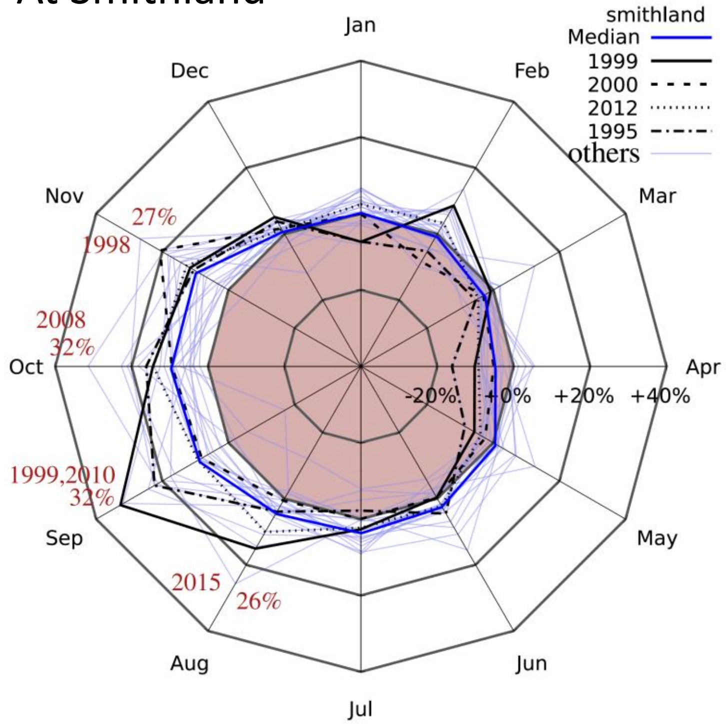


Atreya et al. (2024) *J Hyd Reg Studies*, under review.

Augmentation in the tributaries

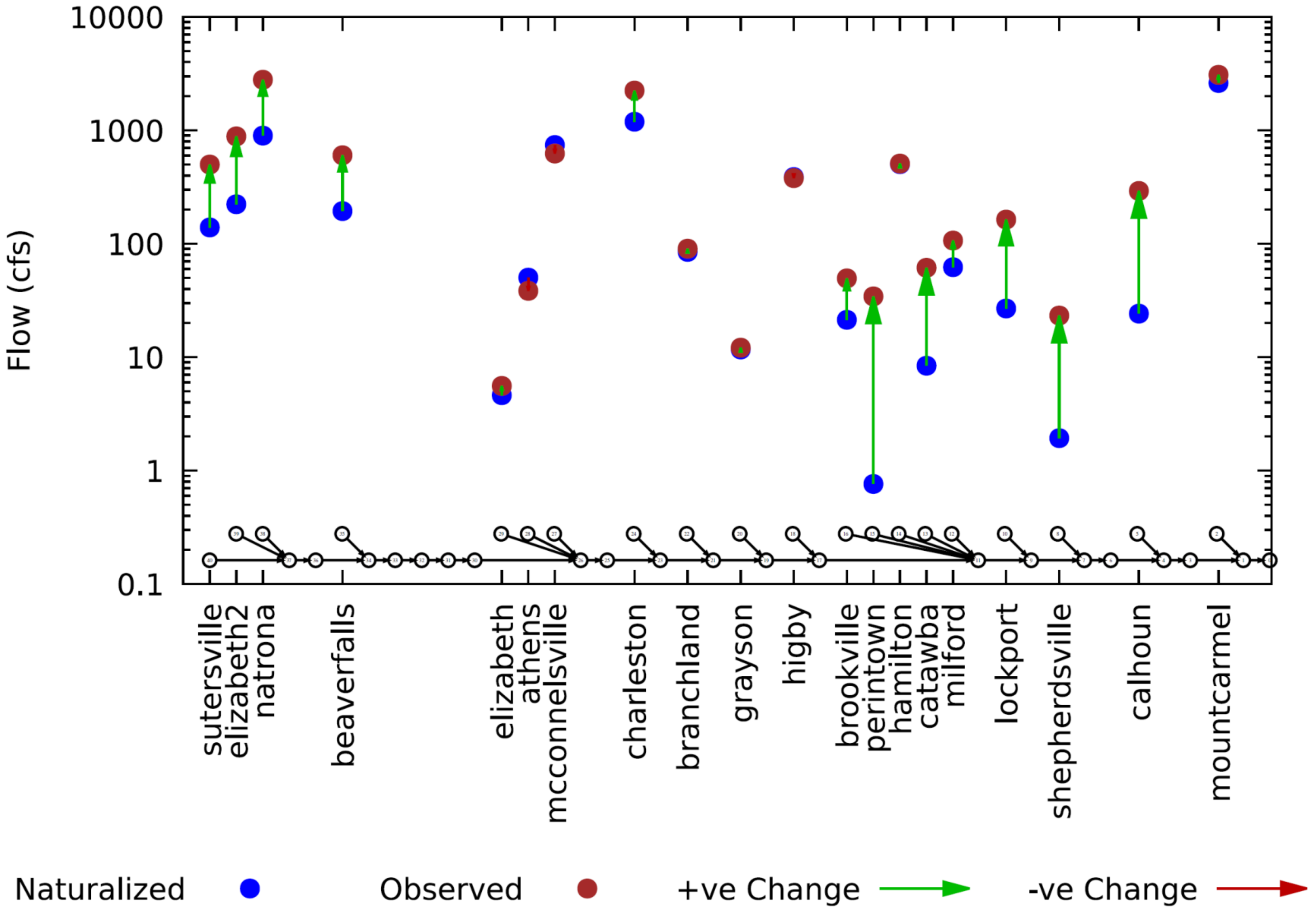


At Smithland



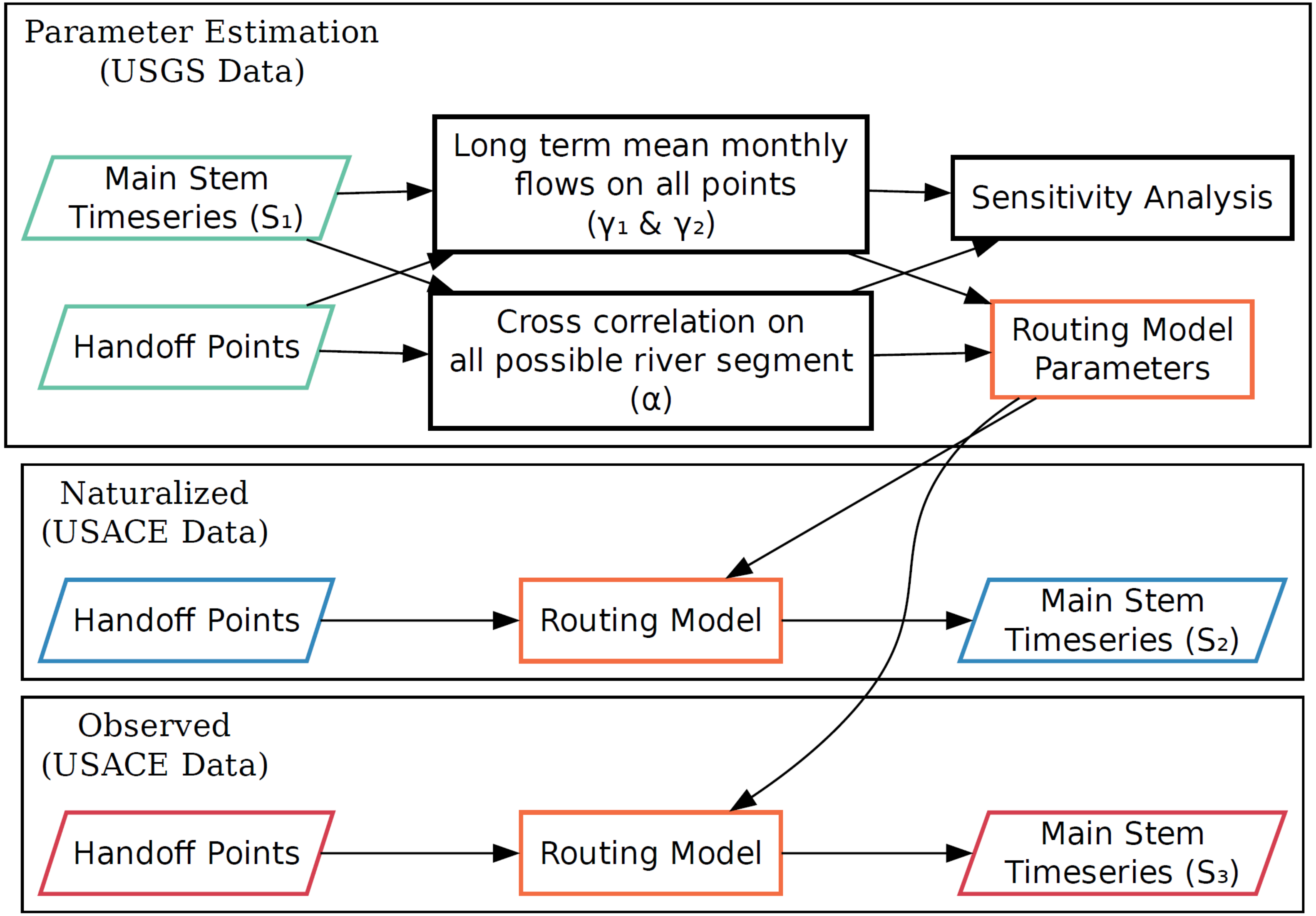
Atreya et al. (2024) *J Hyd Reg Studies*, under review.

7Q10 in the tributaries



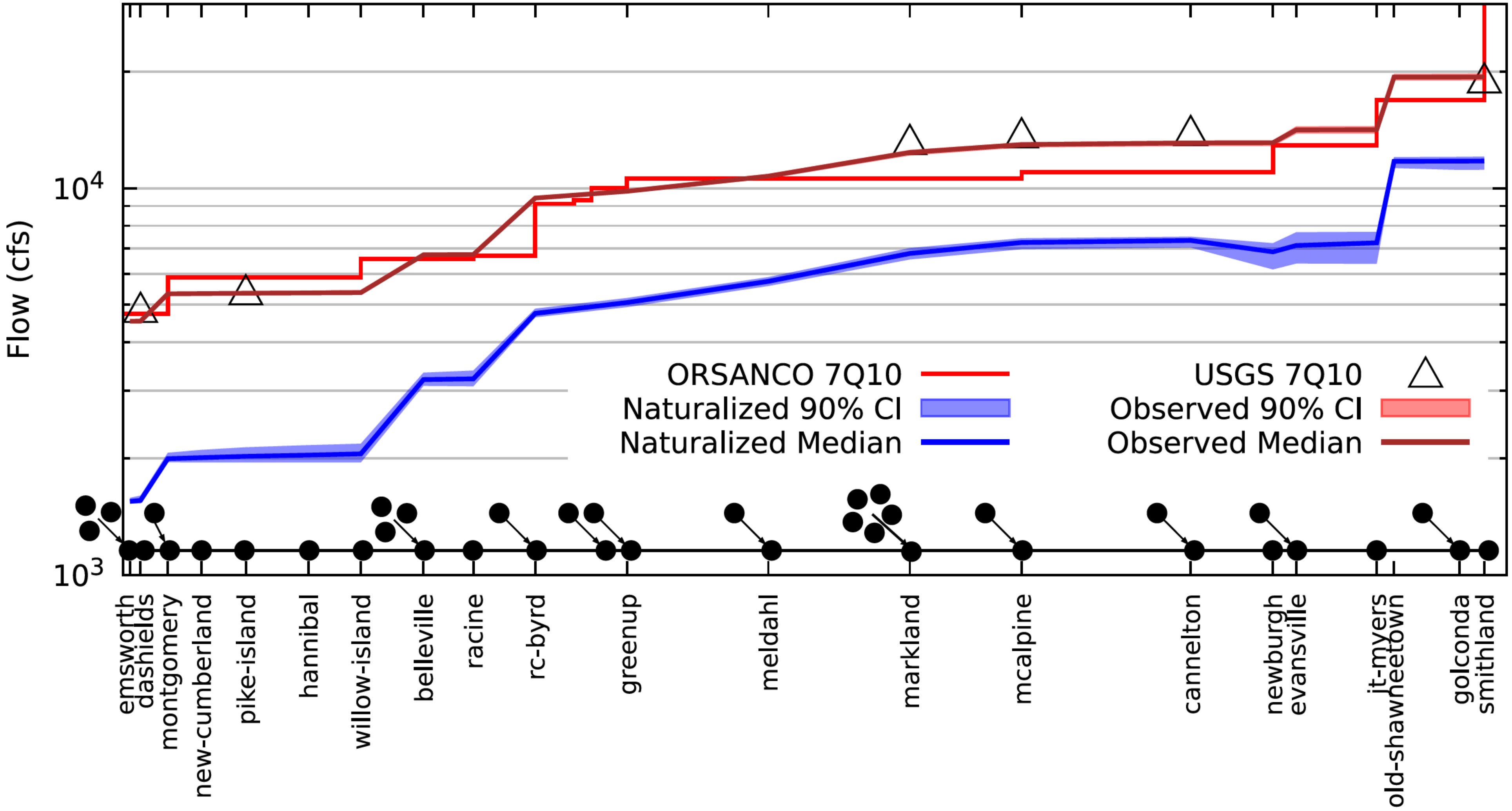
Atreya et al. (2024) *J Hyd Reg Studies*, under review.

Routing Model Workflow



Atreya et al. (2024) *J Hyd Reg Studies*, under review.

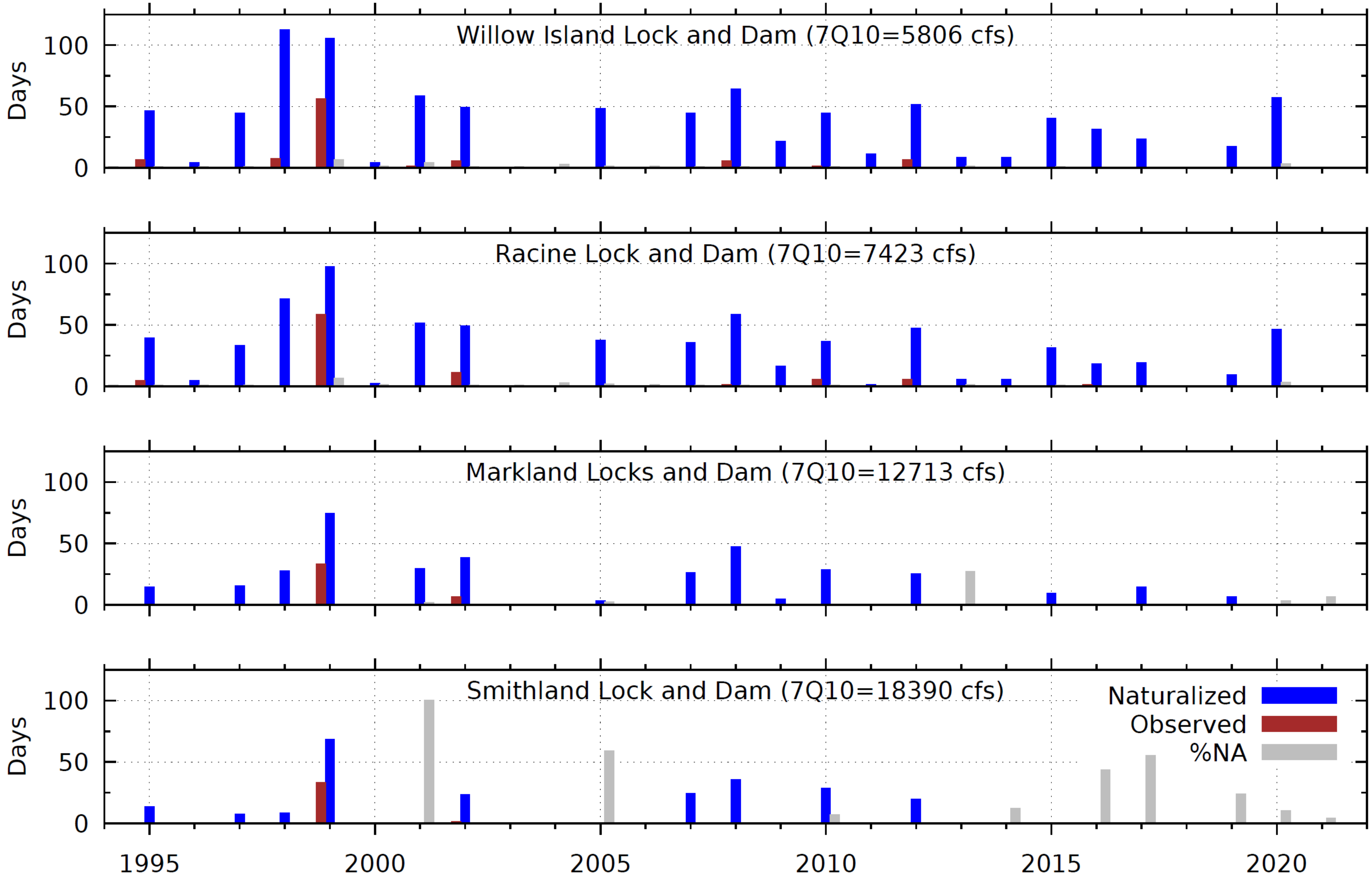
7Q10 on the mainstem



Atreya et al. (2024) *J Hyd Reg Studies*, under review.

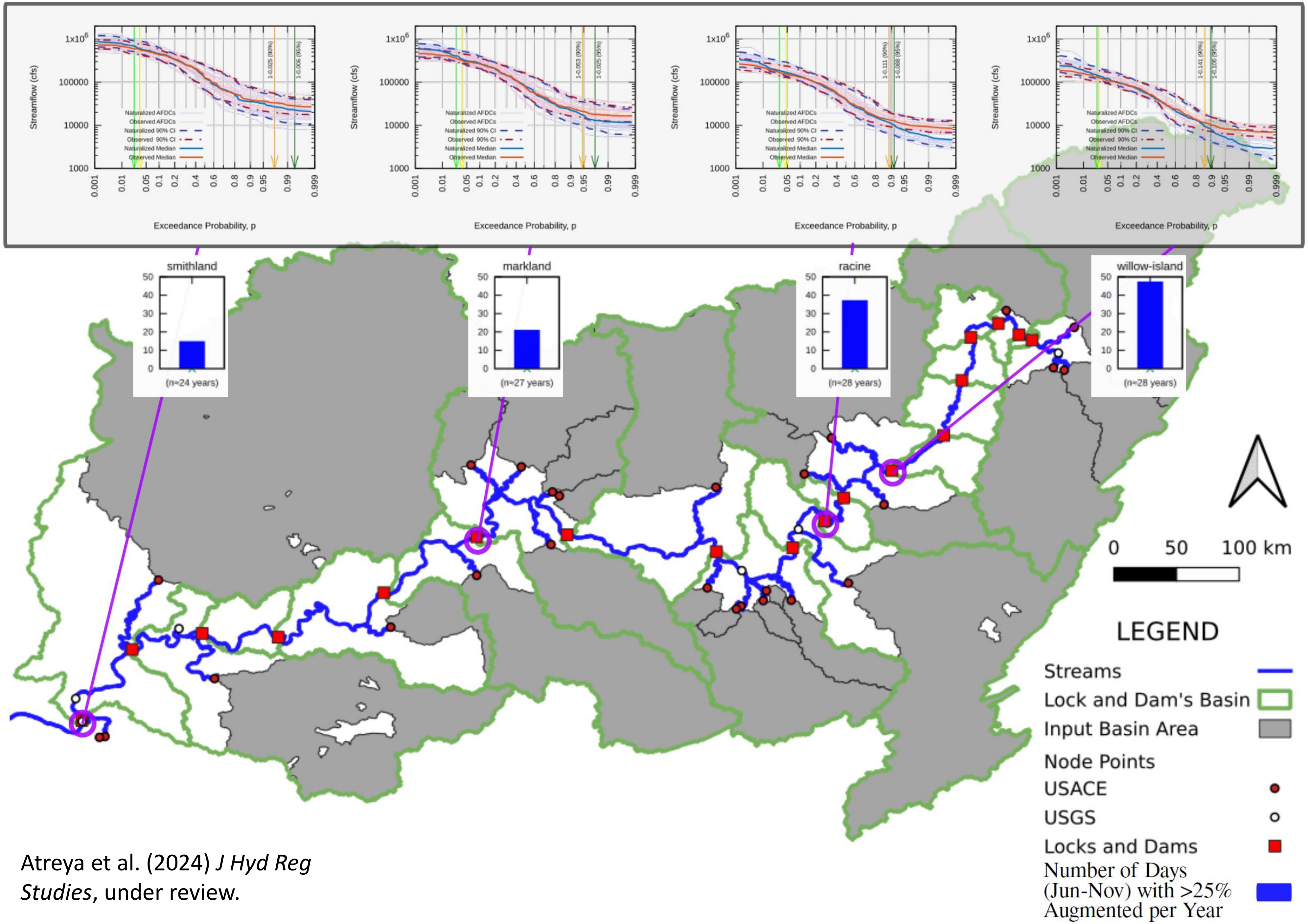
Days each year below 7Q10 threshold

(calculated from historical observations)



Atreya et al. (2024) *J Hyd Reg Studies*, under review.

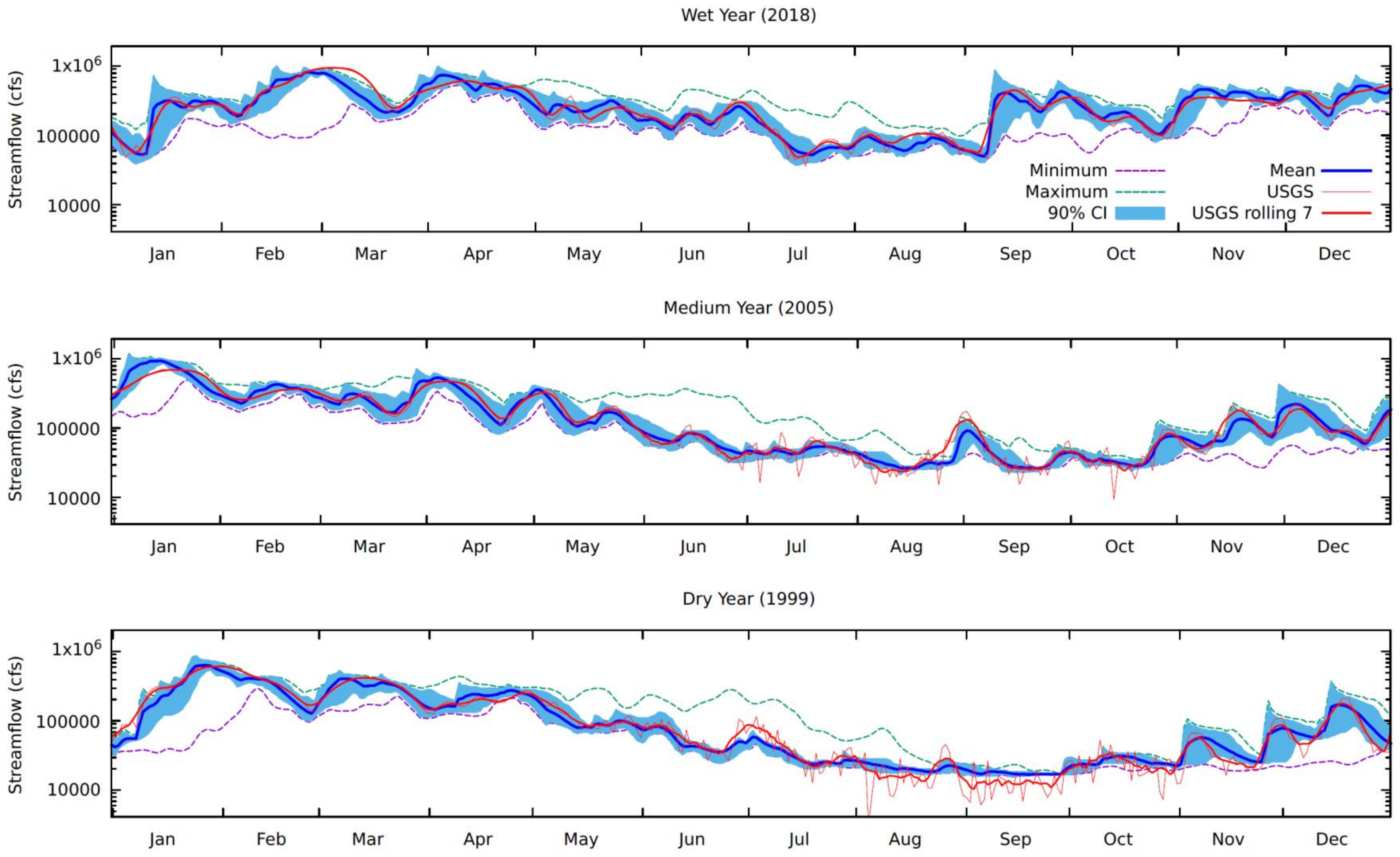
Flow Duration Curves



Atreya et al. (2024) *J Hyd Reg Studies*, under review.

Confidence Intervals

(see instability at extreme low flow)



90% CI for the routing model for both the simulated and observed USGS streamflow data at Smithland Lock and Dam

Atreya et al. (2024) *J Hyd Reg Studies*, under review.

Economic Implications

1. **Water Supply**
   a. River stage is more important than river flow rate for GCWW purposes.
   b. GCWW withdraws approximately only 0.18% of the flow from the Ohio River in a typical dry season.
   c. If river stage were allowed to vary greatly annually, more landslides and bank loss would occur.
2. **Sewage Assimilation**
   a. The National Pollution Discharge Elimination System (NPDES) and Total Maximum Daily Loads (TMDLs) establish permit limits based in part on the 7Q10 flow (the lowest 7-day average flow that occurs on average once every 10 years)
   b. Further, the 7Q10 flow values calculated in 1994 included flows from USACE reservoirs, and therefore are not representative of natural hydrologic conditions.
3. **Navigation**
   a. When flow on the Ohio River main stem is very low, policies of "reduction" days, or even closure days, are enacted at the locks
   b. However, if there is only exactly 9 ft of water depth available, barges must be lighter (loaded down with less cargo) in order to successfully pass.
4. Other benefits, such as **hydropower**

Thank you.

Questions: patrick.ray@uc.edu

ANNEX

EXTRA STORIES

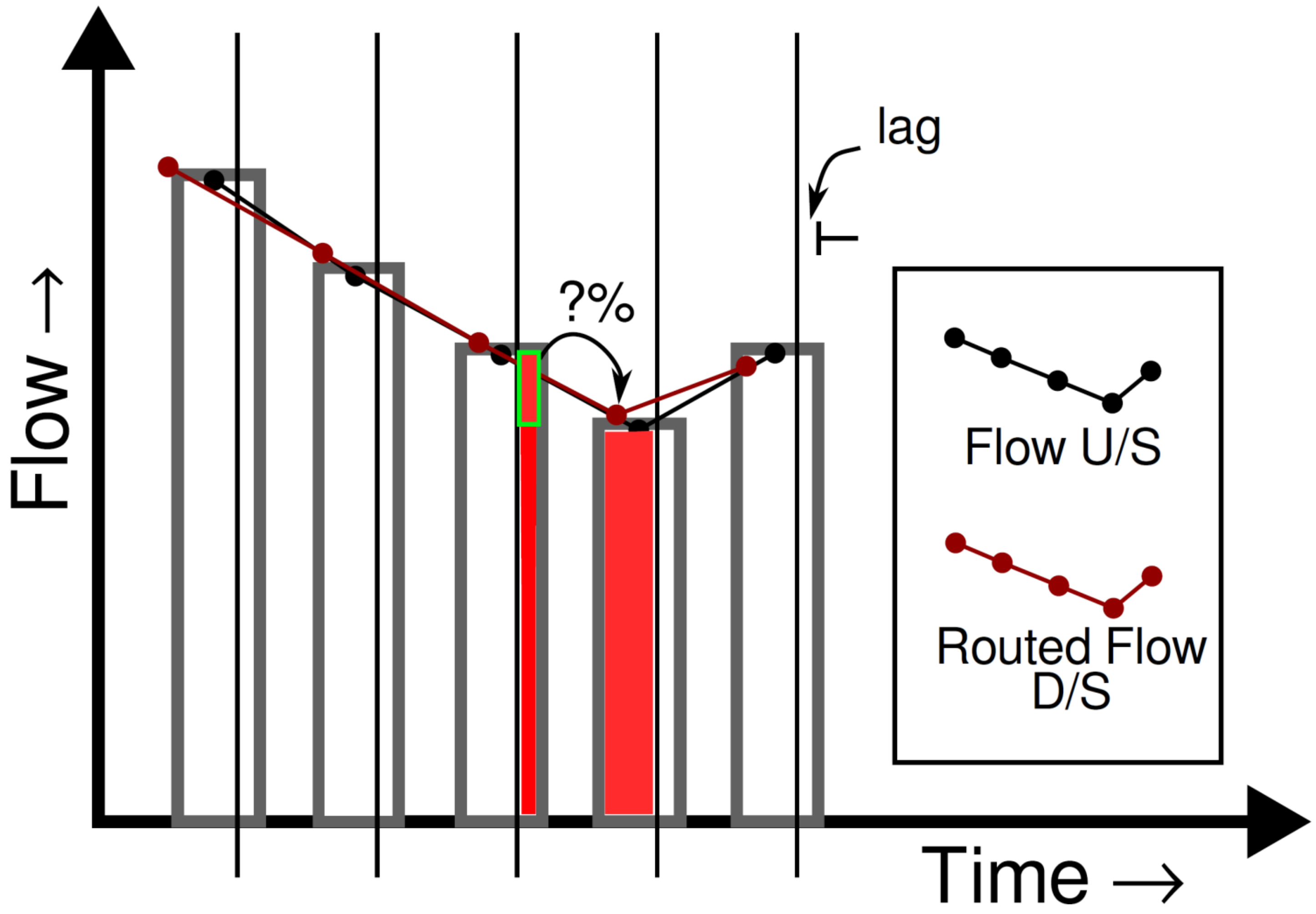


Figure 7: Conceptual illustration of the effect of lag on the downstream discharge

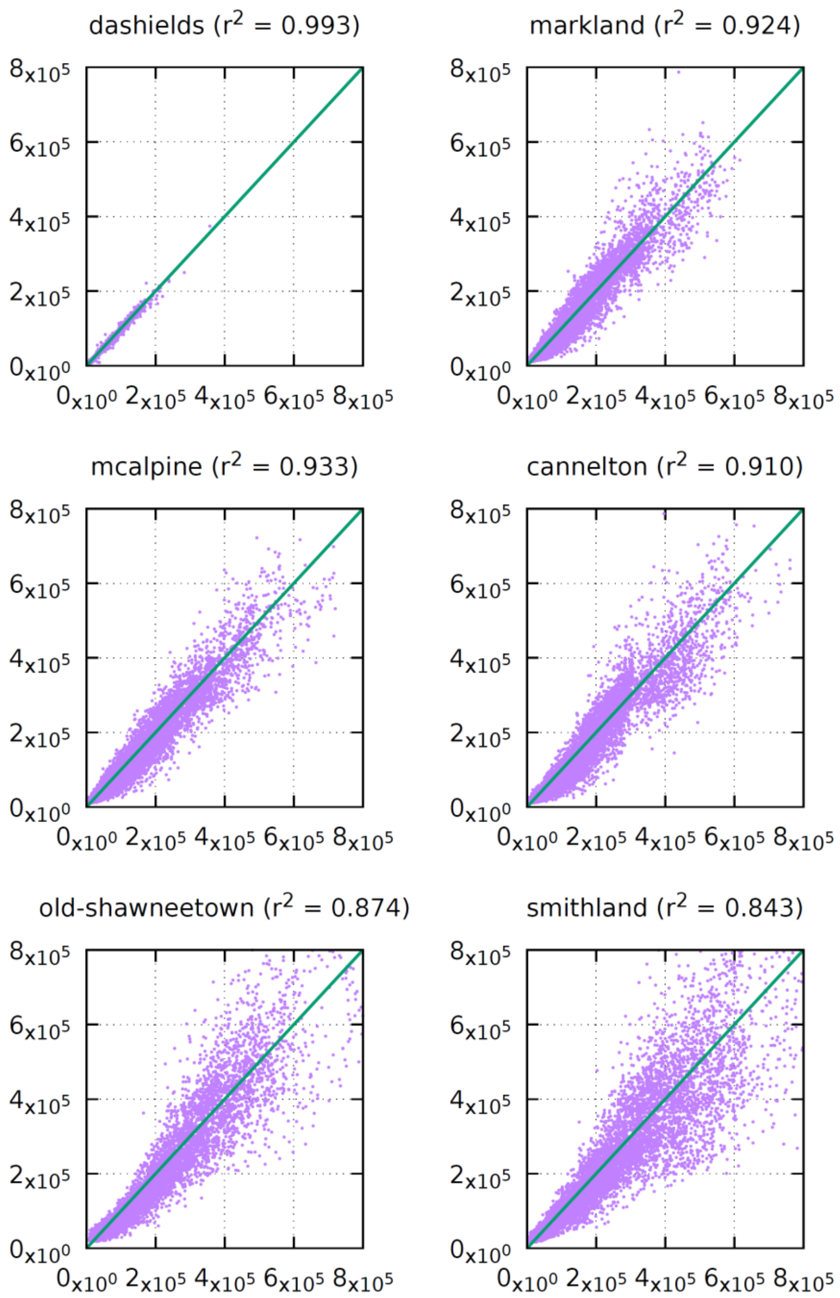


Figure 8: Simulated (routed) vs. observed USGS streamflow at select locatinos along the Ohio River main-stem

Modeling River Water Quality

Machine Learning informed by… everything!

What is the climate change impact on water quality? It’s complicated. We really need to study this more.

> “As climate change alters weather patterns and variability, conditions conducive to severe water impairment are likely to become more frequent. Yet **there has been scant study of how climate will affect the occurrence of the extreme events that relate to water quality rather than quantity**. We do not know how to relate water-quality extremes, their causes, their severity or their occurrence directly to changes in climate. It is time to plug this knowledge gap.”
>
> \- Michalak, Nature, 2016

An algal bloom in Stuart, Florida, in June led to a state of emergency.

Study role of climate change in extreme threats to water quality

Record-breaking harmful algal blooms and other severe impacts are becoming more frequent. We need to understand why, says **Anna M. Michalak**.

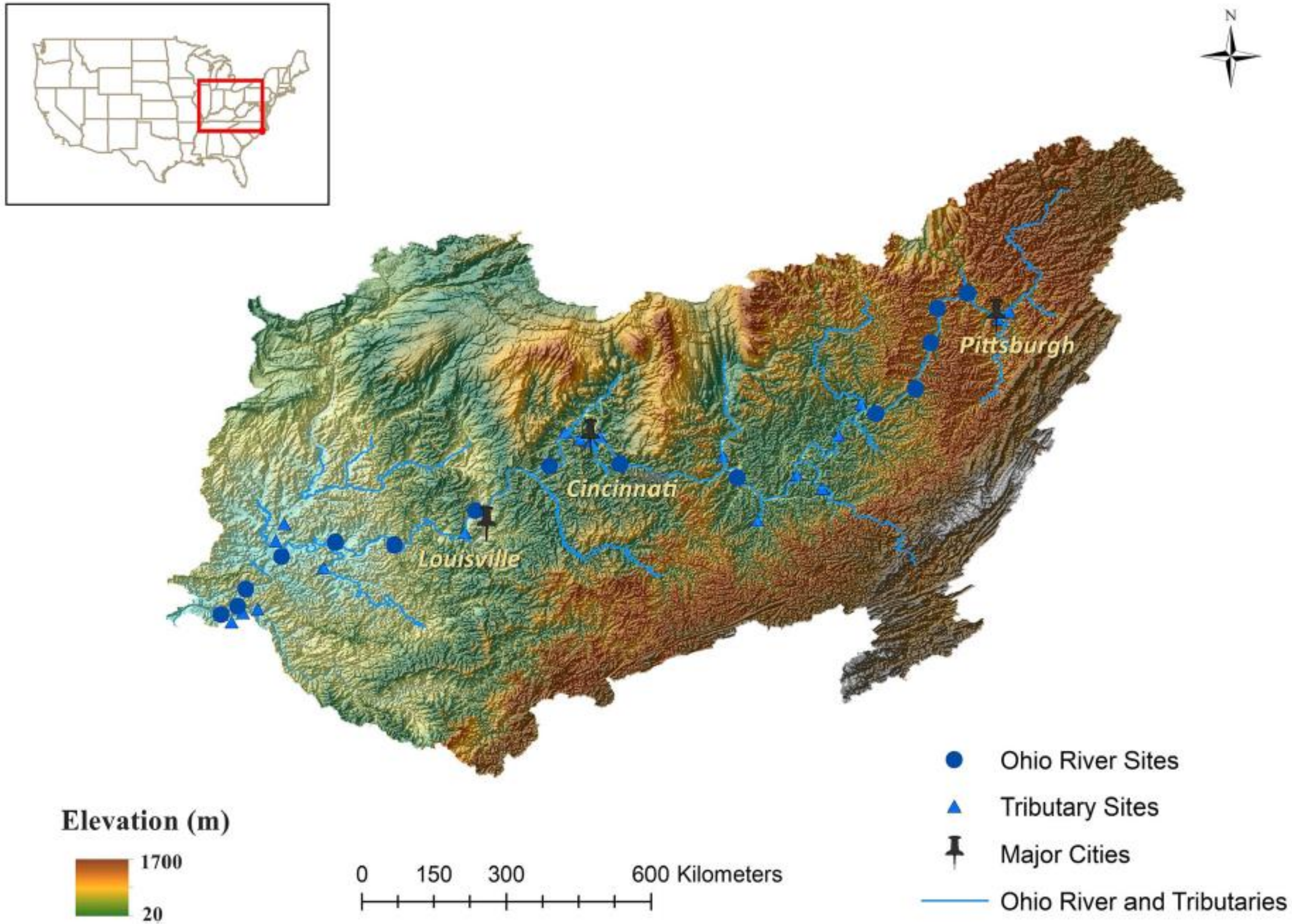


Fig. 2. Spatial distribution of ORSANCO Water Quality Stations.

The existing water quality data is limited in space and time.

Rahat, S. H., Steissberg, T., Chang, W., Chen, X., Mandavya, G., Tracy, J., Wasti, A., Atreya, G., Saki, S., Bhuiyan, E., Ray, P. (2023). “Remote Sensing-Enabled Machine Learning for River Water Quality Modeling Under Multidimensional Uncertainty”. *Science of the Total Environment*, 898, 165504 https://doi.org/10.1016/j.scitotenv.2023.165504

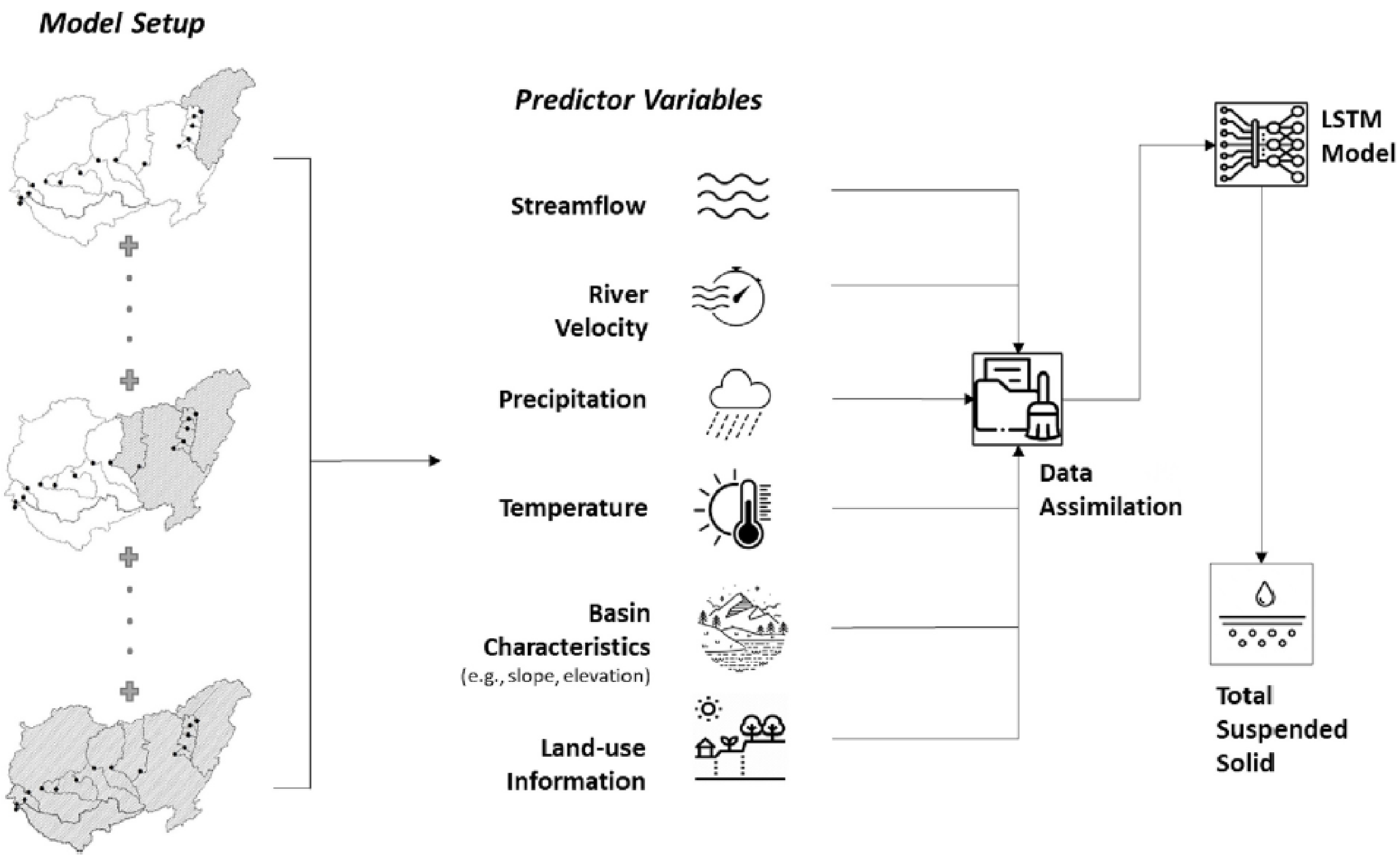
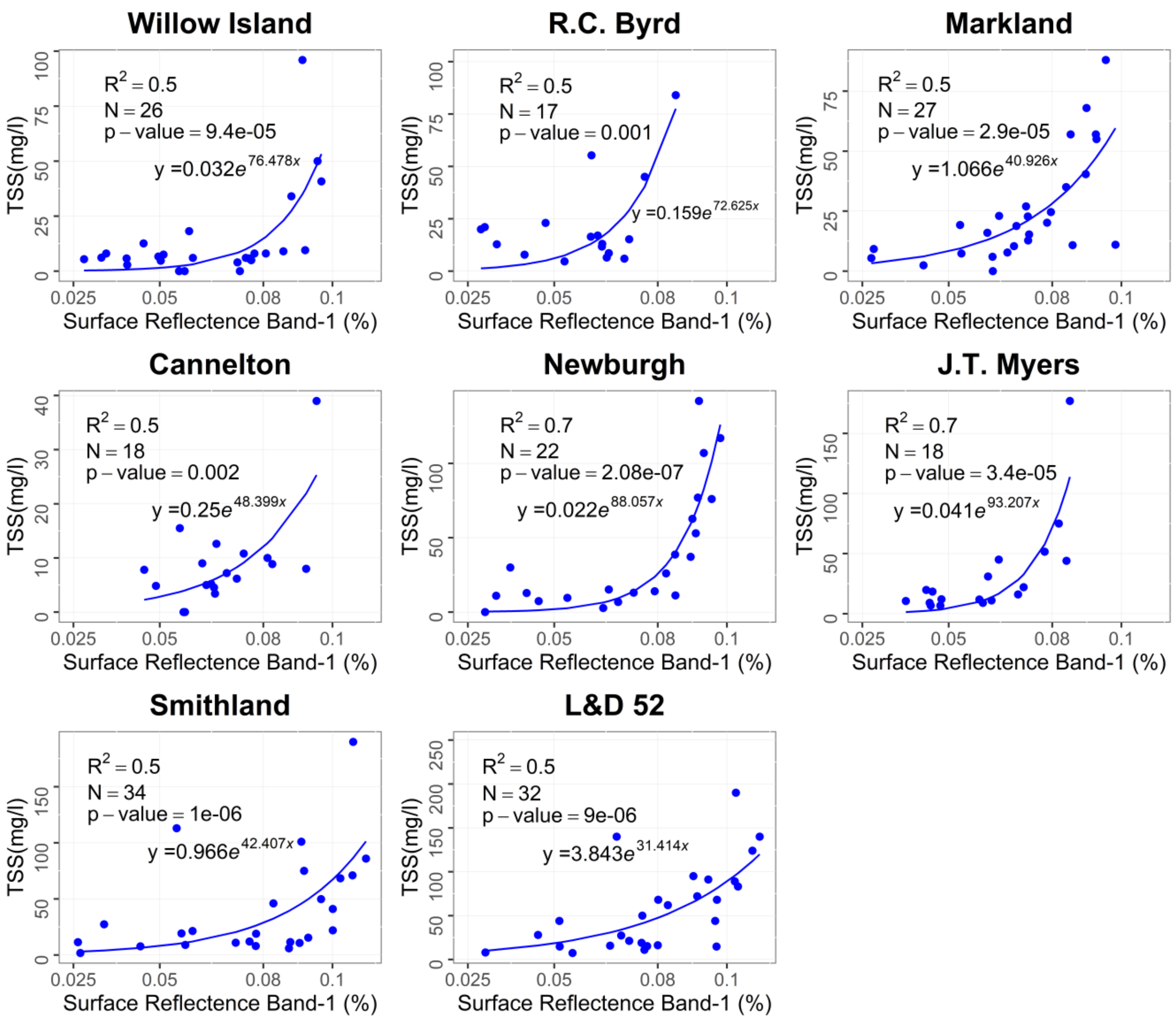
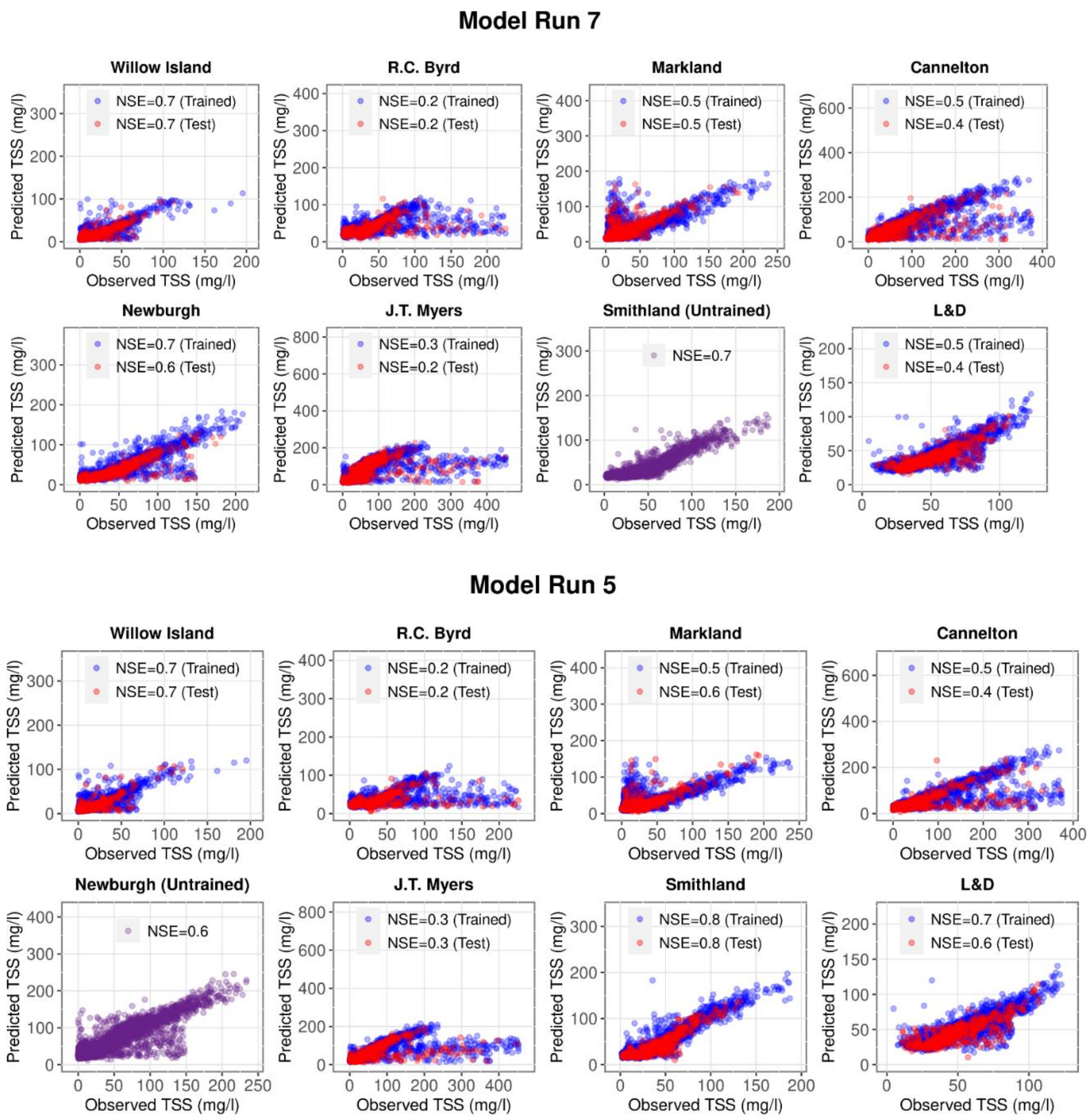


Fig. 3. Model development and data assimilation for outcome variables.

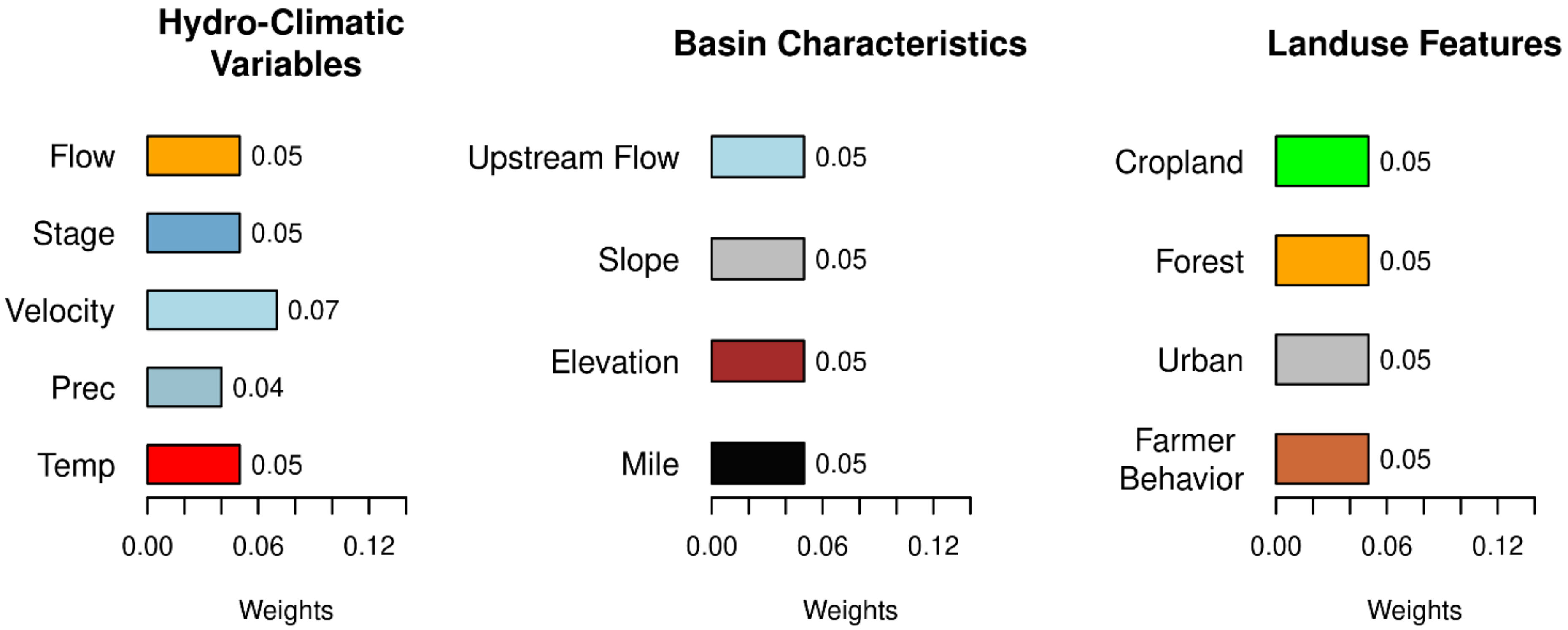
We can use satellite reflectance to estimate historical concentrations of Total Suspended Solids



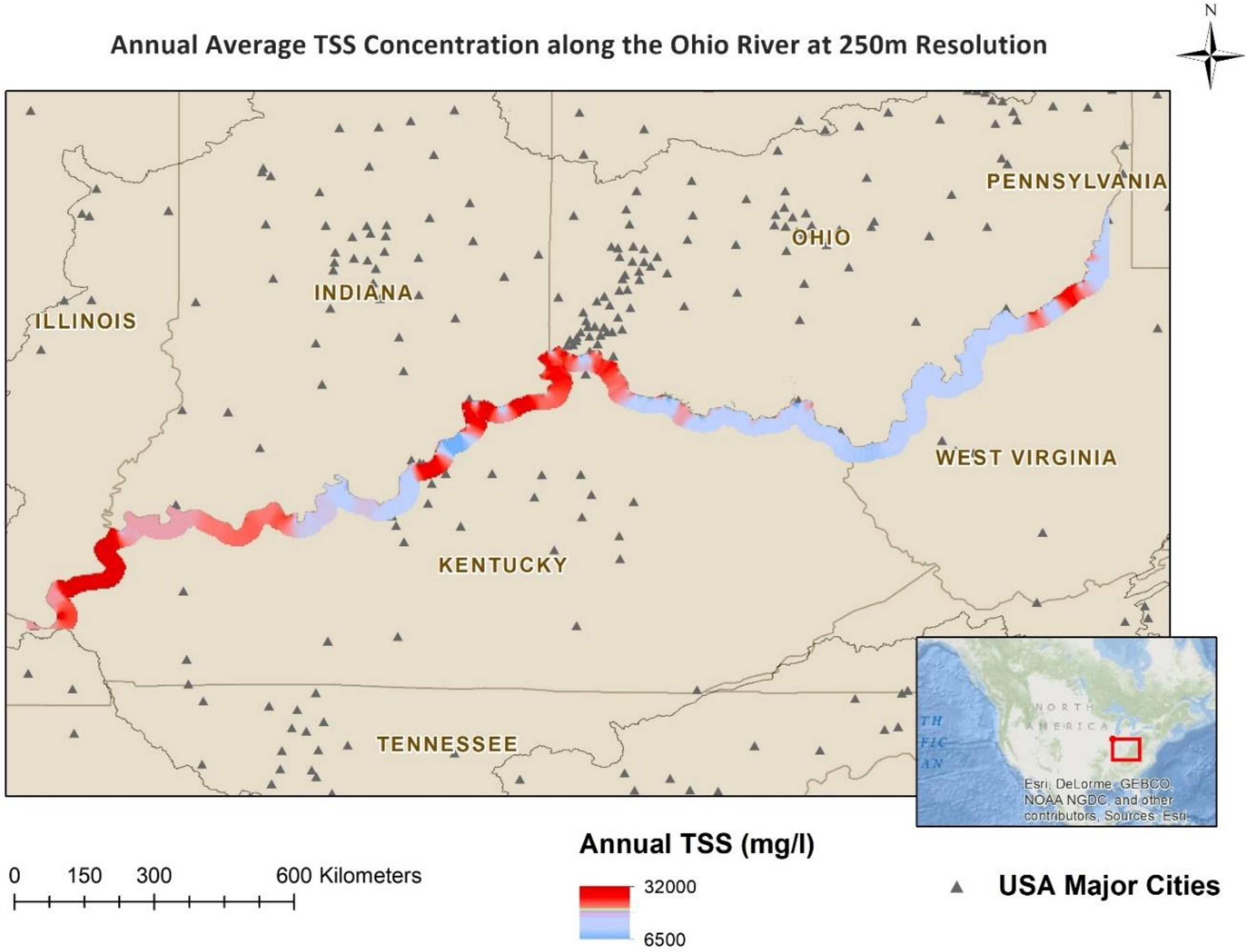
We can use machine learning (LSTM models) to estimate future TSS concentrations in response to changes in explanatory factors such as climate and land use.



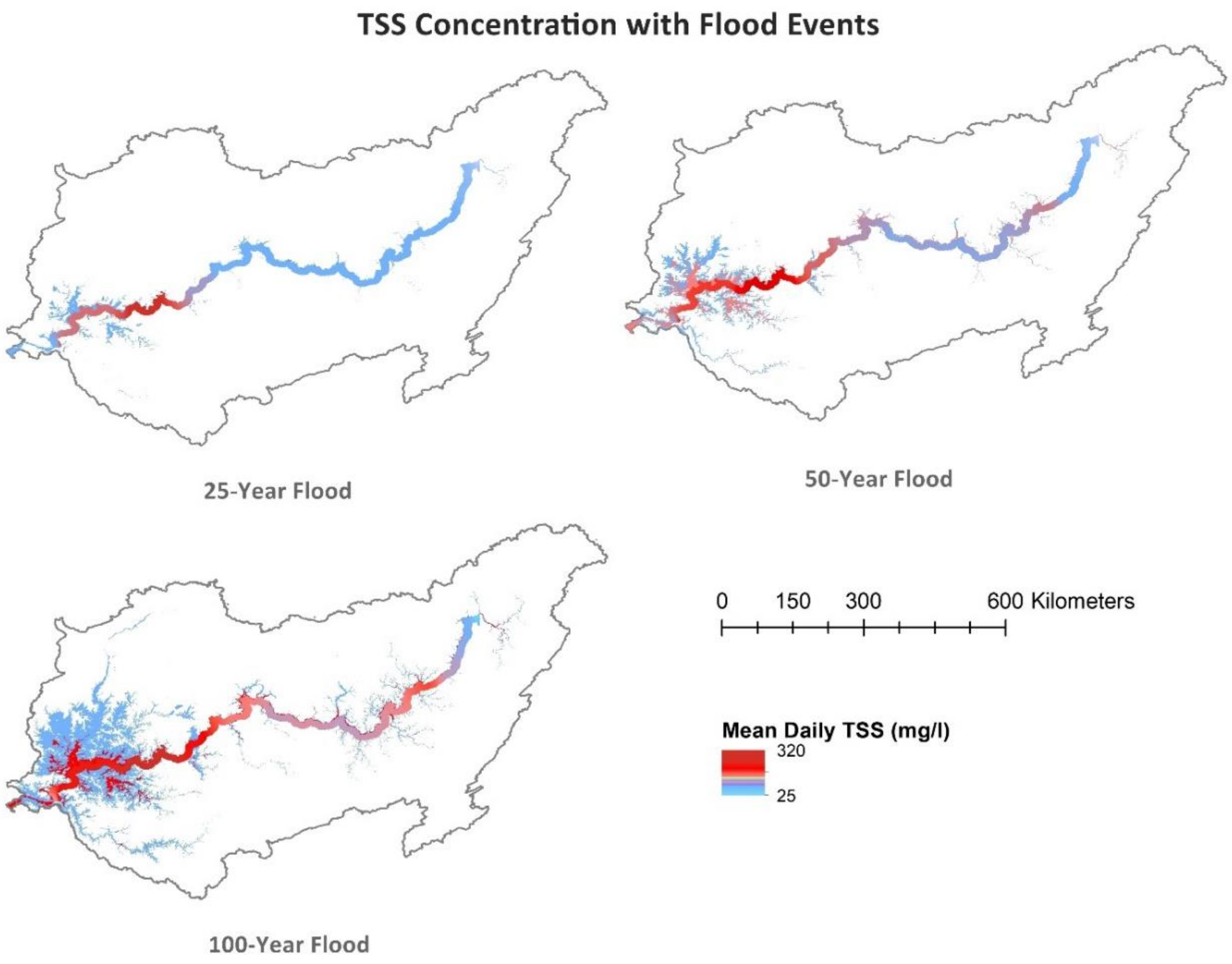
We can use the weights of the LSTM model to understand the relative impacts on contaminant concentrations of a large number of explanatory factors.



We can use the calibrated LSTM model to estimate TSS concentrations at every location (250 m resolution) along the river mainstem.



We can use the LSTM model to estimate TSS response to extreme climatic events, such as floods.



Summary

University of CINCINNATI

Decision Relevance

Vulnerability Analysis, Likelihood Estimation, Risk Management

- Translational Science: Collaborative and Multi-disciplinary
- Sophisticated understanding of drivers of climate (and other) uncertainty)

Big Data

How get it and how use it?

- Remote Sensing
- Machine Learning
- Uncertainty Analysis

Equity

Temporal and Spatial

- Sustainability
- Resilience
- Distributions of Benefits and Costs

Agenda Item 5:

Kentucky Communities Are Embracing Their Local Waterways and Basin Coordinators Have a Seat at the Table

Brian Storz, Kentucky Division of Water

Kentucky Communities Are Embracing Their Local Waterways and Basin Coordinators Have a Seat at the Table

"We've had our backs to the creek for too long, and now it's time to turn around and face it."
Mayor Debra Cotterill, Maysville, KY

BRIAN STORZ, PHD

LICKING RIVER BASIN COORDINATOR

WATERSHED MANAGEMENT BRANCH

DIVISION OF WATER

Presentation Outline

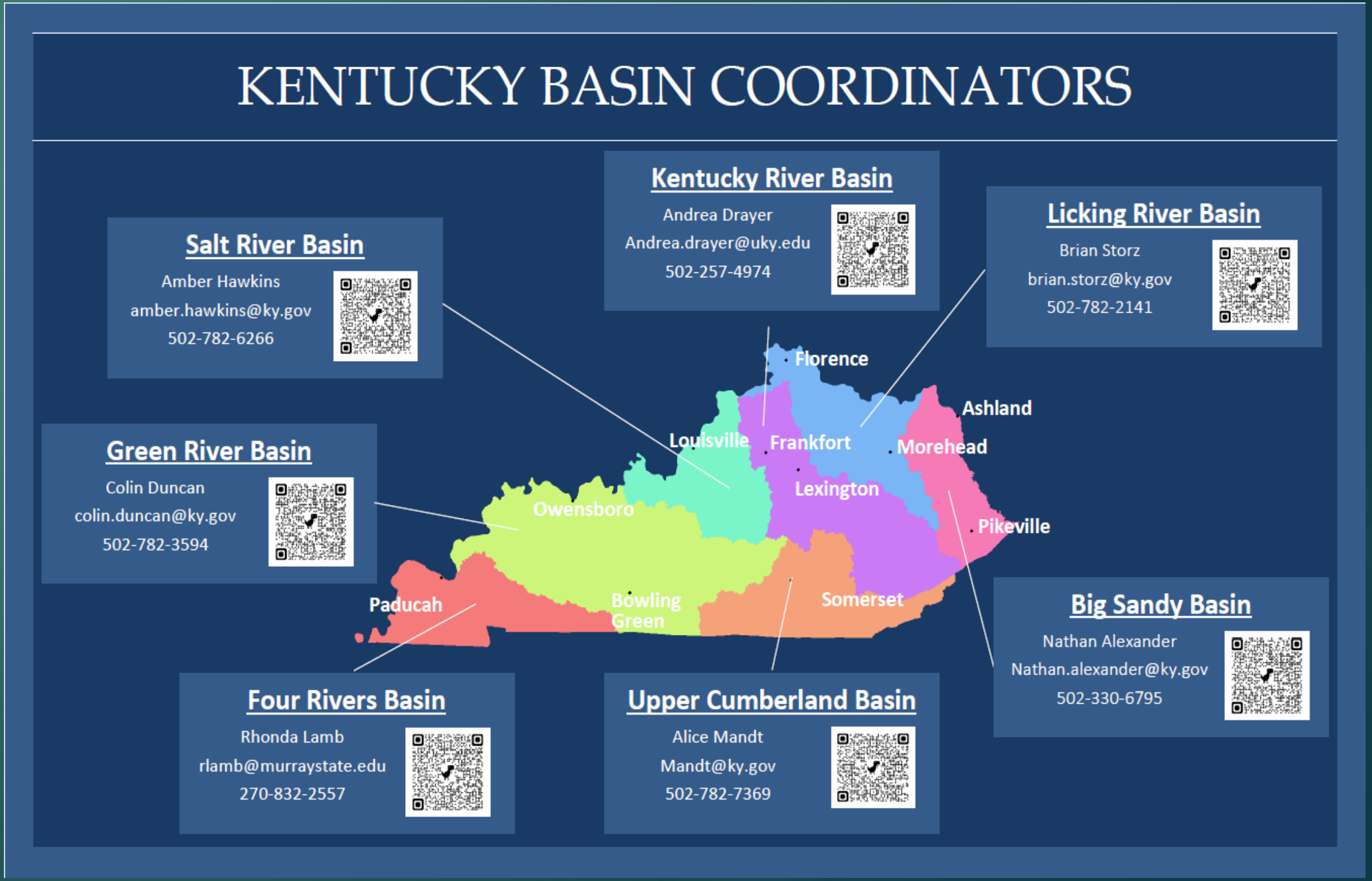
- Objective: Discuss how Basin Coordinators are working at the community-level on watershed plans, flood mitigation, and reducing nonpoint source runoff.

  - Basin Coordinator Role
  - Maysville Example
    - Maysville Request for Assistance
    - Maysville Takes the Lead

Basin Coordinators

- "Basin Coordinators serve as facilitators for agency activities and as a point of contact for local organizations interested in addressing clean water issues." (KDOW)

- Match local organizations with experts
  - Flood mitigation
  - Outdoor Recreation
  - Water Quality
  - Fish Kills
- Match local organizations with funding
- Education and outreach
- Assist with watershed planning
- Listen and learn

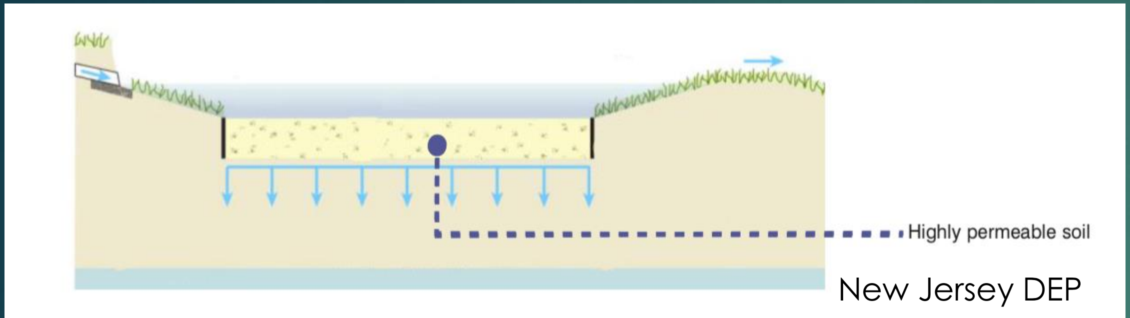


Flooding at the Mason County Public Library

- Regular Flooding at Library
- Large basins previously dredged
- Silted in and wanted to re-dredge


Limestone Creek
Mason County Public Library
Off Channel Basin
Off Channel Basin
Limestone Creek
Walking Trial:
Google Earth
1985
Imagery Date: 10/8/2022 38°38'35.21" N 83°45'34.35" W elev 485 ft eye alt 1925 ft

Using Nature-Based Solutions for Flood Mitigation Instead of Dredging



New Jersey DEP

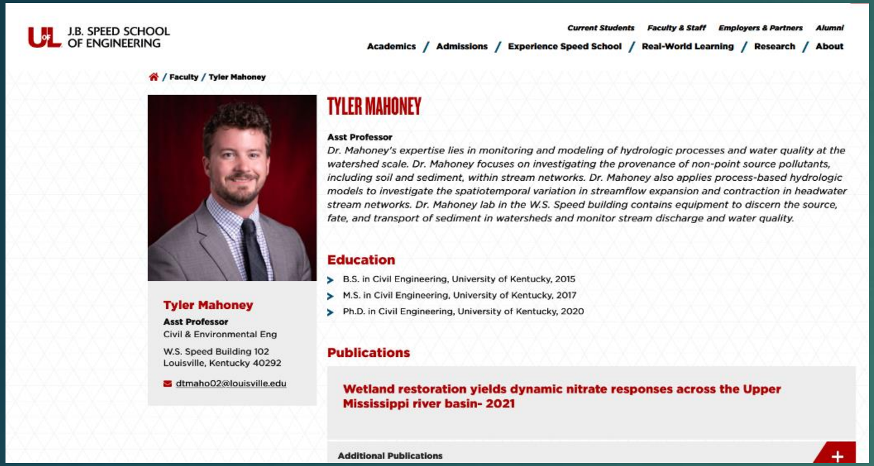
Green Sinks

Bob Hawley, Sustainable Streams, LLC

Silt Source?

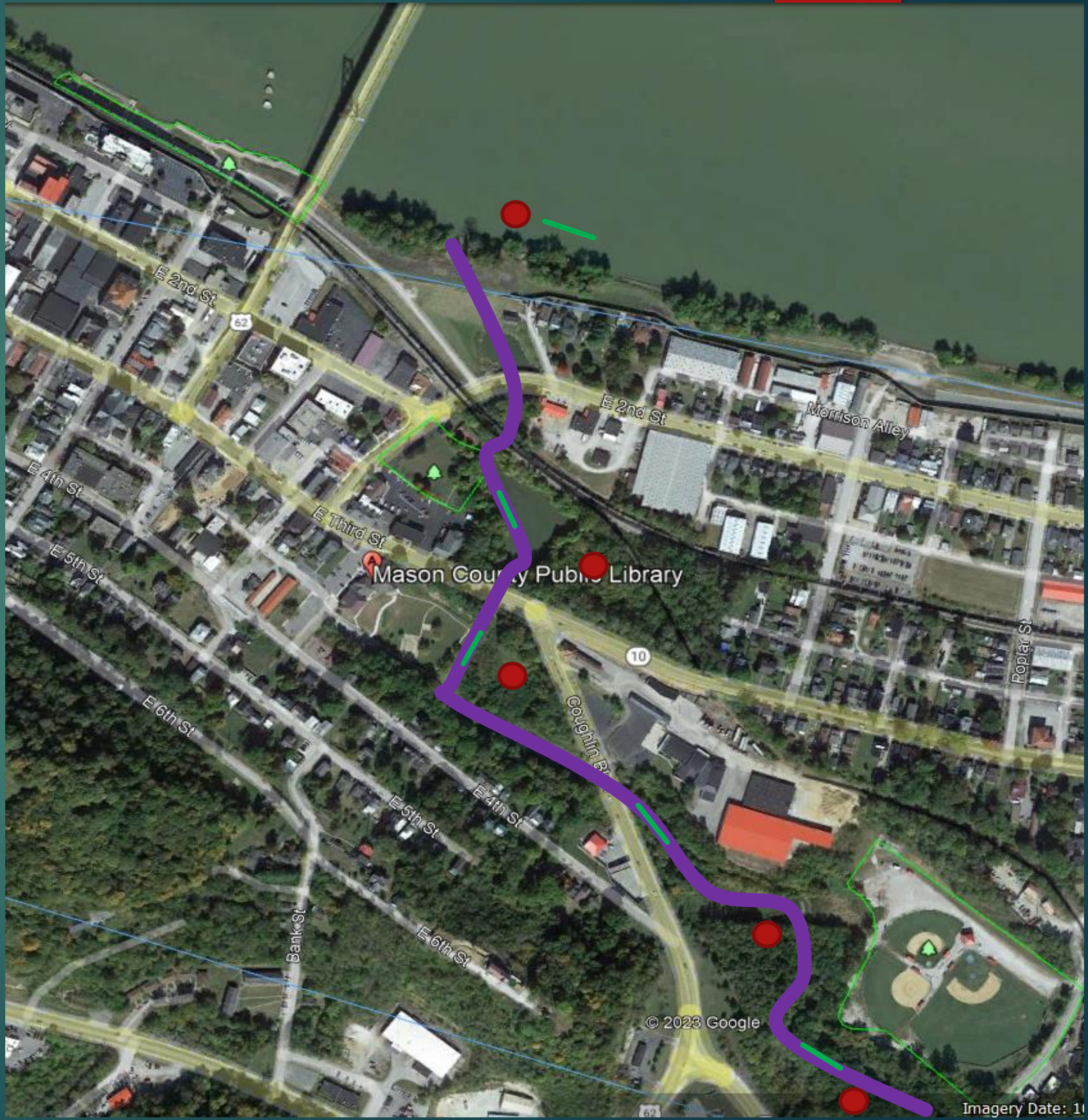
- Ohio River backing up into Limestone Creek?
- Upstream erosion of Limestone Creek?
- Both?

Library Partnering with University of Louisville for Sediment Tracing Study



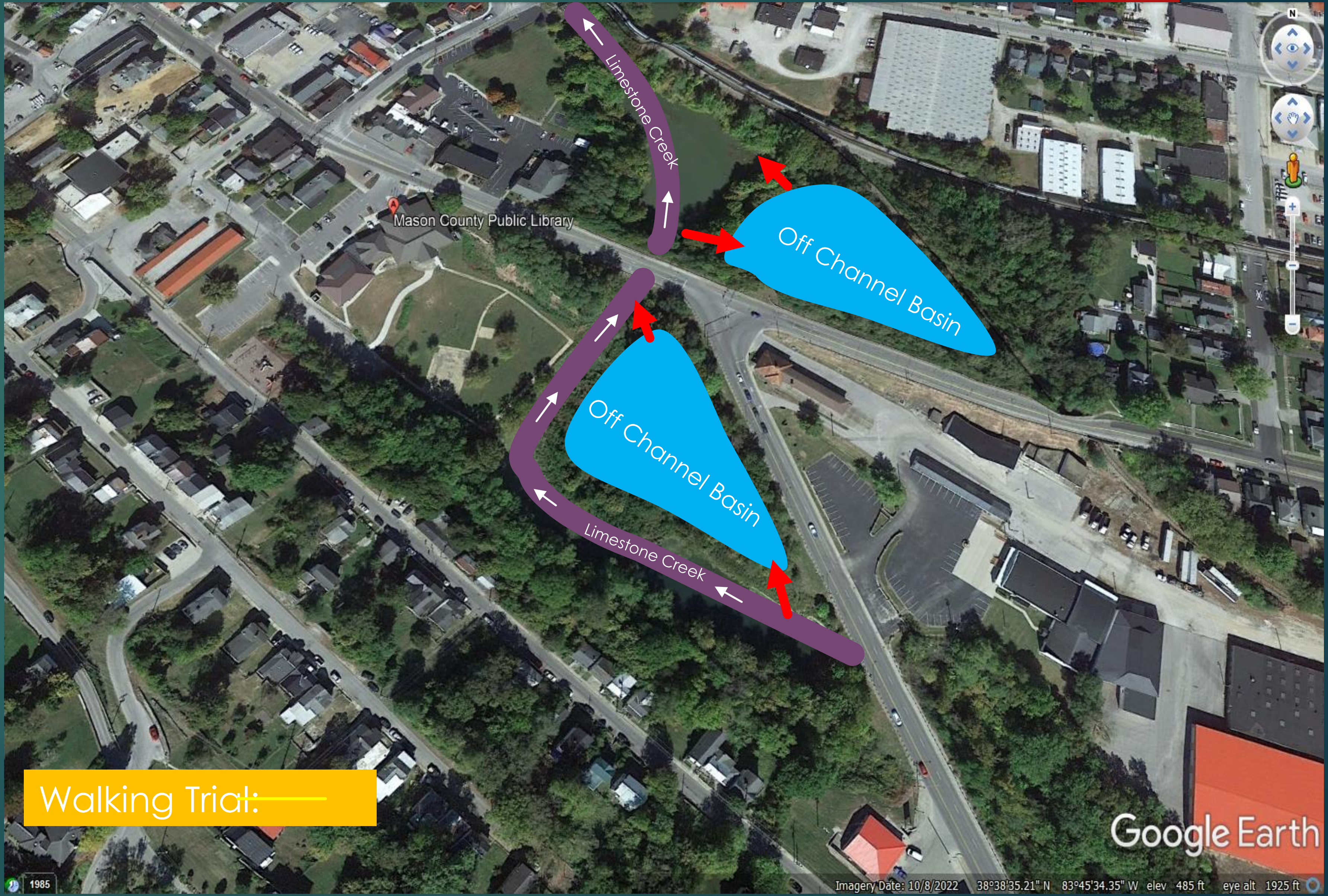
INSPIRE

Mason County Public Library



Future for Limestone Creek?

- Public Greenspace
- Outdoor Recreation



Watershed Plan

City allocated 3 years of match for Limestone Creek Watershed Plan

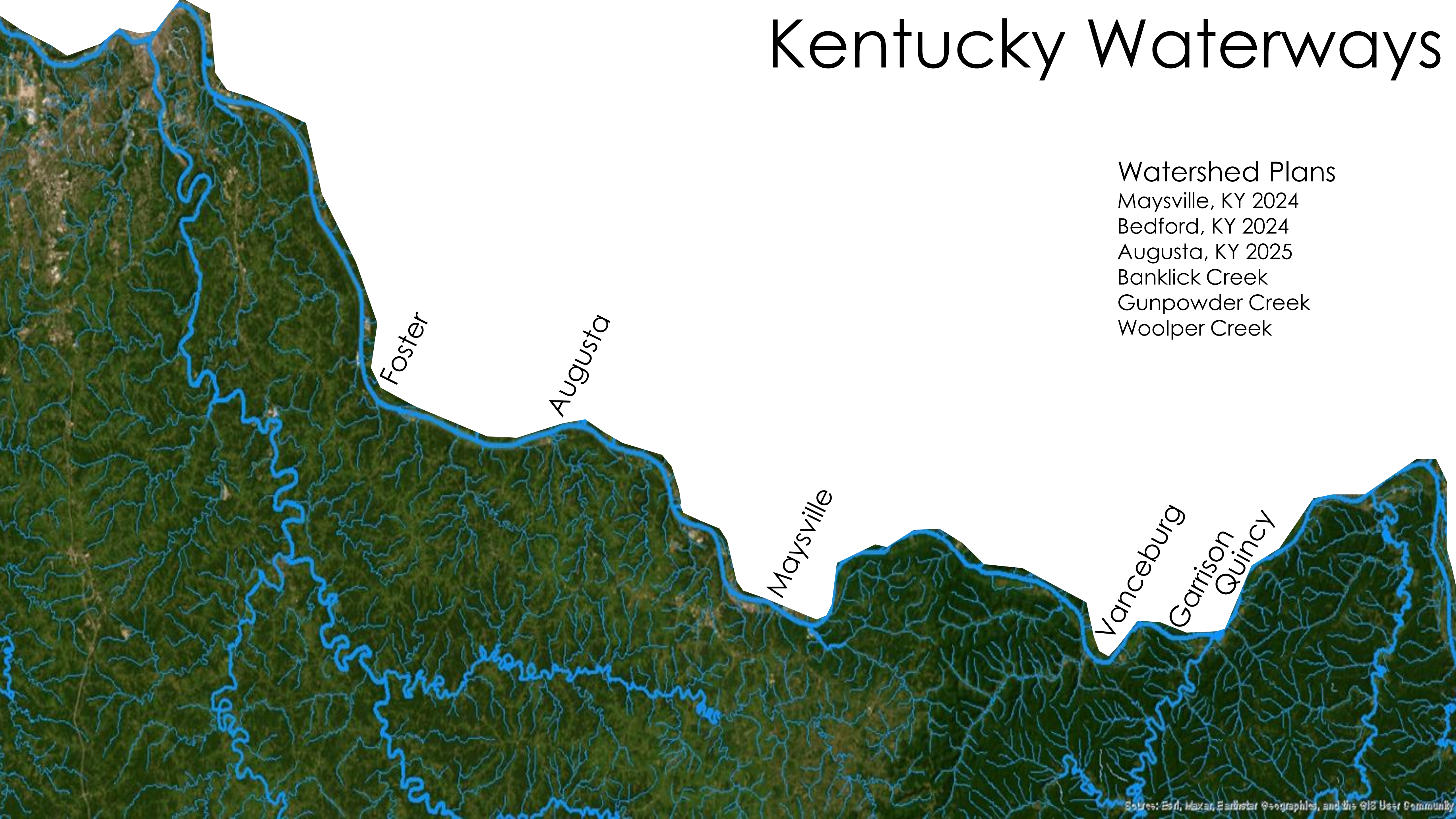
Library and City of Maysville Planning for Public Greenspace and Outdoor Recreation in/around Limestone Creek

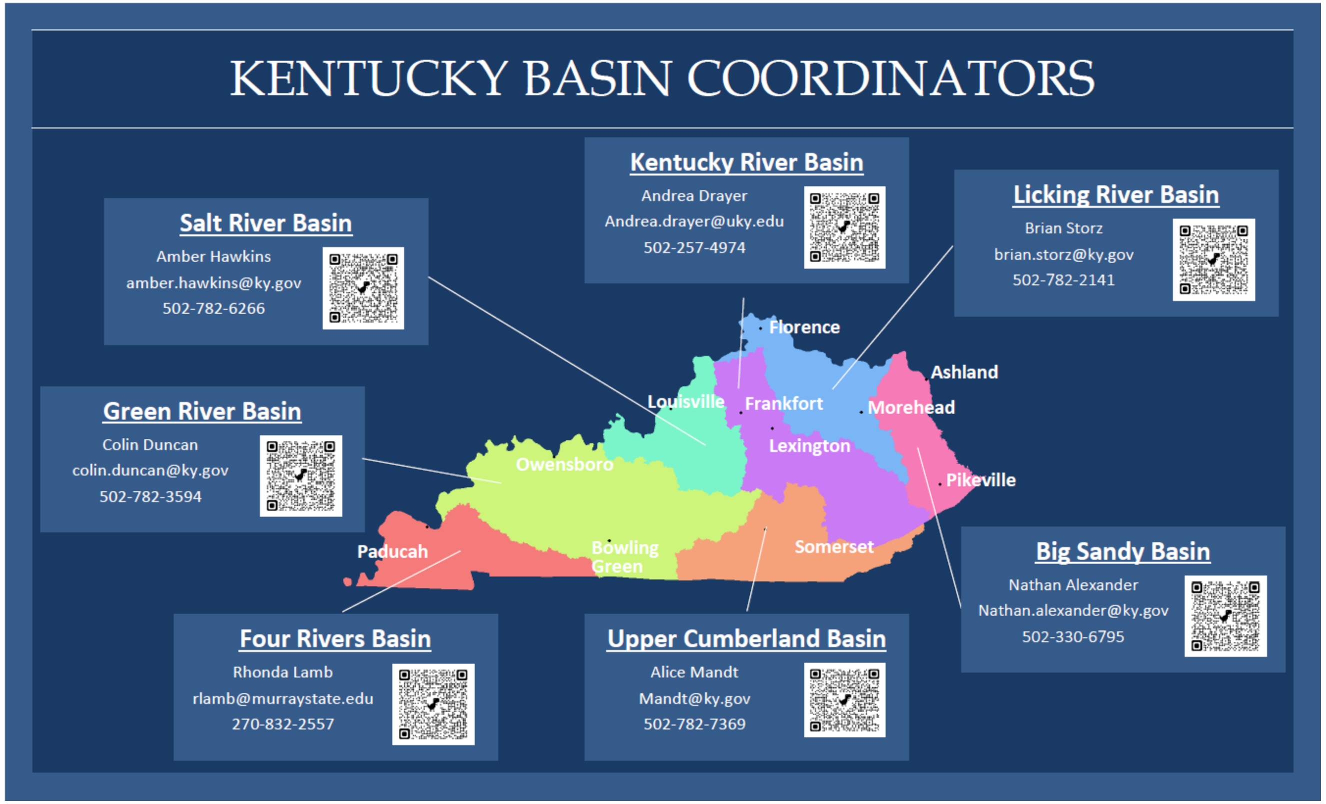
From Flood Mitigation to Limestone Creek Restoration

- Nature-Based Solutions for Flood Mitigation Instead of Dredging
- Library is Funding UofL Sediment Tracing Study
- City Funding Match for Limestone Creek Watershed Plan
- Library and City Planning for Public Greenspace and Outdoor Recreation in/around Limestone Creek
- Future
  - City of Maysville Investigating Nature-Based Solutions to Address CSOs
  - City of Maysville Planning a Full Restoration of Limestone Creek

Kentucky Waterways

Watershed Plans
Maysville, KY 2024
Bedford, KY 2024
Augusta, KY 2025
Banklick Creek
Gunpowder Creek
Woolper Creek




KENTUCKY BASIN COORDINATORS
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Ashland
Louisville
Frankfort
Morehead
Lexington
Owensboro
Pikeville
Paducah
Bowling Green
Somerset

Questions?

Why Not Dredge?

- Massively expensive
- Destroys stream and bank habitat
- Bridge and culvert foundations are undermined
- Creates continuous erosion, property loss, and habitat destruction
- Faster, more powerful streams are even more dangerous to downstream infrastructure and public
- Basins refill with sediment and stream reestablished

Used with permission, Loring Bullard

Agenda Item 6:

2024 Biennial Assessment of Ohio River Water Quality Conditions (2018-2022)

Ryan Argo, ORSANCO

2024 Biennial Report: Background Information

- **Covers years 2018-2022**
  - Depending on data availability, older data may be applied
- ORSANCO employs **Weight of Evidence** approach
  - Approved by TEC and Commission in Feb. 2011
- Retain **Partial Support** listing for narrative purposes (still impaired state)
- **November 15th, 2023** – workgroup approved assessment methodologies
  - Remain unchanged from 2022 cycle
    - Added distinction between conventional and toxic pollutants
- **January 25th, 2024** – workgroup approved the draft assessments
  - Aquatic Life Use
  - Contact Recreation
  - Public Water Supply
  - Fish Consumption

Aquatic Life Use Assessment Methodology

Fully Supporting

- Conventional - ≤10% criteria exceedance for any one
- **Toxic - No exceedances or 1 exceedance**

Bimonthly and Clean Metals Data

and/or

- Biota - *m*ORFIn and ORMIn scores are greater than or equal to 20.0
  - (i.e. a condition rating of 'Fair', 'Good', 'Very Good', or 'Excellent')

Partially Supporting - Impaired

- Conventional - >10% and ≤25% criteria exceedance for any one
- **Toxic - >1 exceedance, AND ≤10% of samples**

and/or

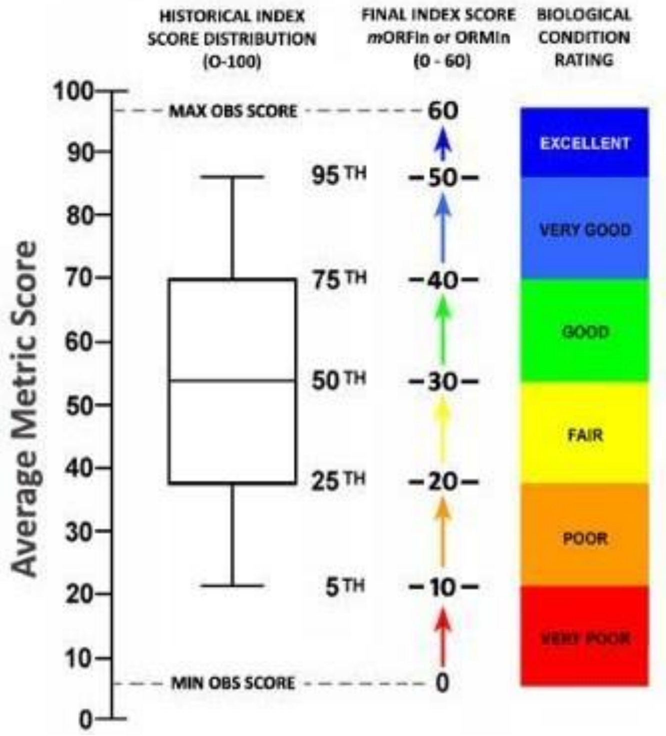
- Biota - one of the indices scores 'Fair' or better (>20.0) and, the other index scores 'Poor' (10.0 - 19.9)

Not Supporting - Impaired

- Conventional - >25% criteria exceedance for any one
- **Toxic - >1 exceedance AND >10% of samples**

and/or

- Biota - pool in which both indices score 'Poor' (<20.0) or, in which either index scores 'Very Poor' (<10.0)



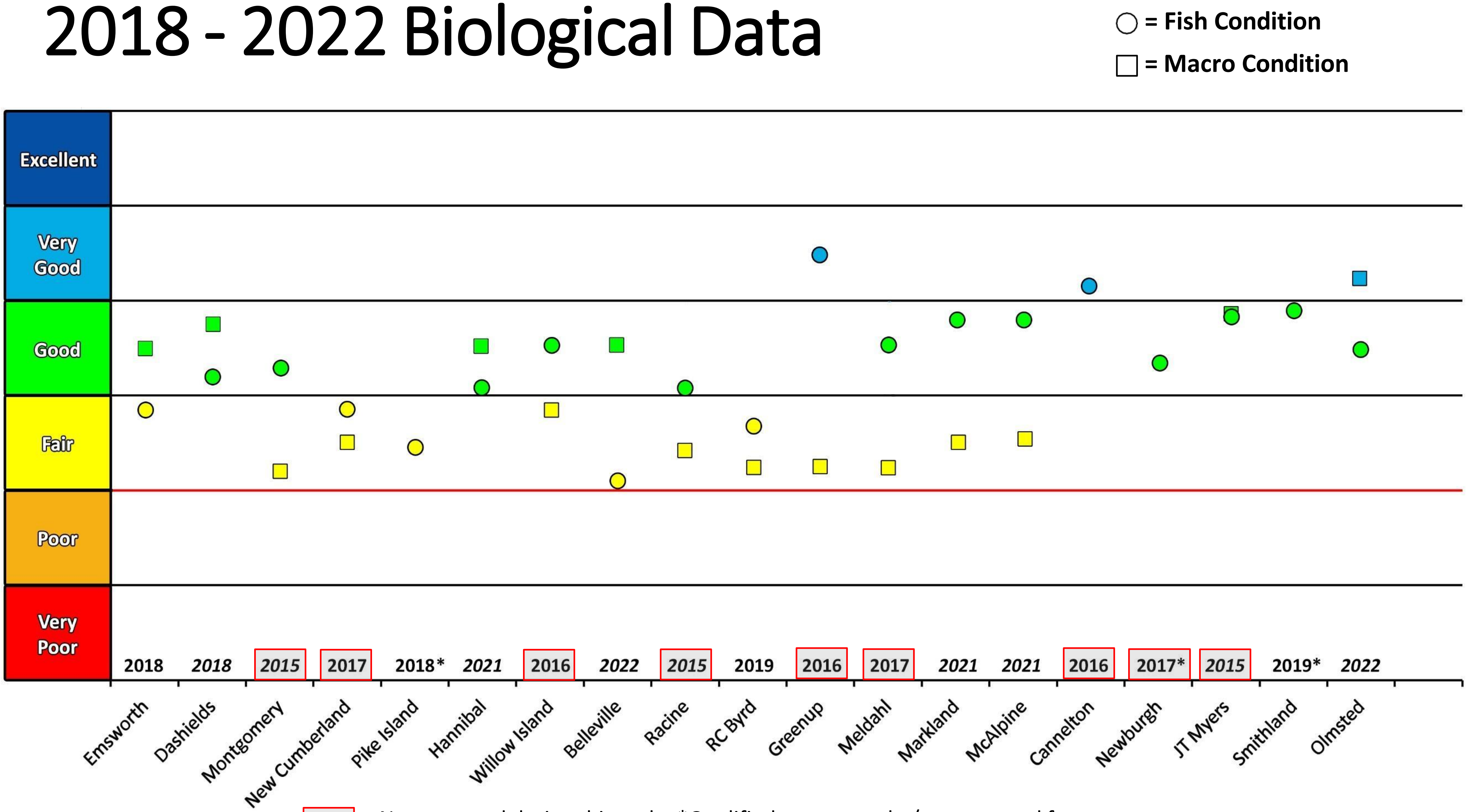
Observed ALU Exceedances – Iron (µg/L)

January 2018 – December 2022

River Mile	Site Name	Criteria (ug/L)	Max Result (ug/L)	Total Samples	WQC Exceedances	% Exceedances	305b ALU Assessment
26.3	Monaca	WV (1500)	535	6	0	0%	Fully Supporting
54.4	New Cumberland	WV (1500)	4,360	27	4	15%	Partially Supporting
84.2	Pike Island	WV (1500)	7,370	30	3	10%	Partially Supporting
126.4	Hannibal	WV (1500)	8,540	30	3	10%	Partially Supporting
161.8	Willow Island	WV (1500)	7,290	30	5	17%	Partially Supporting
203.9	Belleville	WV (1500)	7,310	28	5	18%	Partially Supporting
279.2	R.C. Byrd	WV (1500)	11,200	30	7	23%	Partially Supporting
341	Greenup	KY (3500)	8,360	29	3	10%	Partially Supporting
436.2	Meldahl	KY (3500)	10,200	29	3	10%	Partially Supporting
531.5	Markland	KY (3500)	16,400	30	7	23%	Partially Supporting
606.8	McAlpine	KY (3500)	4,870	25	1	4%	Fully Supporting
720.7	Cannelton	KY (3500)	11,400	30	6	20%	Partially Supporting
776	Newburgh	KY (3500)	6,580	30	7	23%	Partially Supporting
846	J.T. Myers	KY (3500)	9,720	28	7	25%	Partially Supporting
918.5	Smithland	KY (3500)	6,140	27	5	19%	Partially Supporting
938.9	L&D 52	KY (3500)	11,200	6	2	33%	Not Supporting
964.8	Olmsted	KY (3500)	5,470	22	3	14%	Partially Supporting

*No Exceedances of ORSANCO ALU criteria

2018 - 2022 Biological Data



= Not surveyed during this cycle, *Qualified macro results/not assessed for macros

Aquatic Life Use Assessment Summary

- No exceedances of ORSANCO ALU criteria
  - No conventional pollutants exceedances >10%
  - No toxic pollutant exceedances > 1
- State's aquatic life criteria was exceeded for Total Iron
- Bioassessments of most recent pool data all met biocriteria
- "Weight-of-Evidence Approach" relies on biological assessments, i.e. fish and macroinvertebrate indices
  - **ALU assessed as in "Full Support" for entire river**

Contact Recreation Use

- Vast majority of data are historical *E. coli* data from longitudinal survey
  - 2003-2008
  - Assessed using single sample max criteria (SSM)
- Routine monitoring at 6 largest CSO communities during recreation months
  - Pittsburgh, Huntington, Portsmouth, Cincinnati, Louisville, and Evansville
- ORSANCO's *E. coli* (EC) criteria is 130 colonies/100mL
  - Assessed against monthly geometric means (GM)
  - The most stringent state criterion is applied

State	River Mile	Criterion used to Assess
PA	0 - 40.2	EC GM 126 CFU/100mL
OH	40.2 - 491.3	EC GM 126 CFU/100mL
WV*	40.2 - 317.1	EC GM 130 CFU/100mL
KY	317.1 - 981.0	EC GM 130 CFU/100mL
IN	491.3 - 848.0	EC GM 125 CFU/100mL
IL*	848.0 - 981.0	EC GM 130 CFU/100mL

* WV and IL only have fecal coliform criteria

Contact Rec. Use Assessment Methodology

Fully Supporting

- Water - $\leq$10% criteria exceedance at a given station

Partially Supporting - Impaired

- Water - >10% and $\leq$25% criteria exceedance at a given station

Not Supporting - Impaired

- Water - >25% criteria exceedance at a given station

Contact Recreation Use Assessment Summary

Site	Assessment 2022 (2016-2020)	Assessment 2024 (2018-2022)	River Mile
594	Not Supporting	Partially Supporting	539.1-595.5
791.5	Not Supporting	Partially Supporting	760.6-793.2

There were different assessment endpoints for two segments in this cycle

- Partially Supporting is still an impaired state
- **Total impaired river miles did not change from 2022 assessment**

Public Water Supply Use Assessment Methodology

Fully Supporting

- Conventional - ≤10% criteria exceedance for any one conventional pollutant
- **Toxic - No exceedances or 1 exceedance**
- Survey/USEPA DB - and there are no finished water MCL violations caused by Ohio River water quality

Partially Supporting - Impaired

- Conventional - >10% and ≤25% criteria exceedance for any one pollutant (toxic or conventional), and there was a corresponding finished water MCL violation caused by Ohio River water quality, OR
- **Toxic - >1 exceedance, but ≤10% of samples, OR**
- Survey - Frequent intake closures due to elevated levels of pollutants are necessary to protect water supplies and comply with provisions of the Safe Drinking Water Act (meet MCLs), OR
- Survey - Frequent "non-routine" additional treatment was necessary to protect water supplies and comply with provisions of the Safe Drinking Water Act (meet MCLs)

Not Supporting - Impaired

- Conventional - >25% criteria exceedance for any one pollutant, AND
- **Toxic - >1 exceedance AND >10% of samples, AND**
- Survey - There was a corresponding finished water MCL violation caused by Ohio River water quality

Safe Drinking Water Information System Results 2018-2022

Facility	Contaminant*	Days with Violations	305(b) PWS Assessment
Russel Water Works	Total Haloacetic Acid (HAA%)	5%	Supporting
Midland	TTHM	5%	Supporting
Steubenville Water	TTHM	5%	Supporting

*All Human Health related MCL violations in SDWIS for Ohio River Drinking utilities were byproducts of drinking water disinfection

- Not source water related issues

PWS Drinking Water Utility Survey

- Solicited response from 32 utilities that have Ohio River source water

From January 2018 – December 2022…

1) Did you **close your intake** as a result of Ohio River water quality conditions in order to avoid MCL violations?
2) Did your plant have **any MCL violations** caused in whole or part by Ohio River water quality conditions?
3) Was **“nonroutine” or extraordinary treatment** necessary to comply with SDWA MCLs as a result of Ohio River water quality conditions?

- As of 1/4/24 – Nine of 32 have responded
  - Only “Yes” responses concerned precautionary shutdown/treatment relating to East Palestine Derailment and one due to seasonal atrazine runoff

Public Water Supply Use Assessment Summary

- No Human health criteria exceedances in > 10% of samples relative to source water conditions
  - i.e. Attributed to treatment issues, not Ohio River water quality

- No chronic issues associated with source water indicated in survey responses
  - Only in response to acute issue (E. Palestine Derailment)

- **Entire river assessed as fully supporting public water supply use**

Fish Consumption Use Assessment Methodology

<u>Fully Supporting</u>

- **Water** - **No exceedances or 1 exceedance** (PCBs, Dioxins, and Hg)

  or

- Fish Tissue - The consumption-weighted average MeHg conc. for a pool $\leq$ 0.3 ppm

<u>Partially Supporting - Impaired</u>

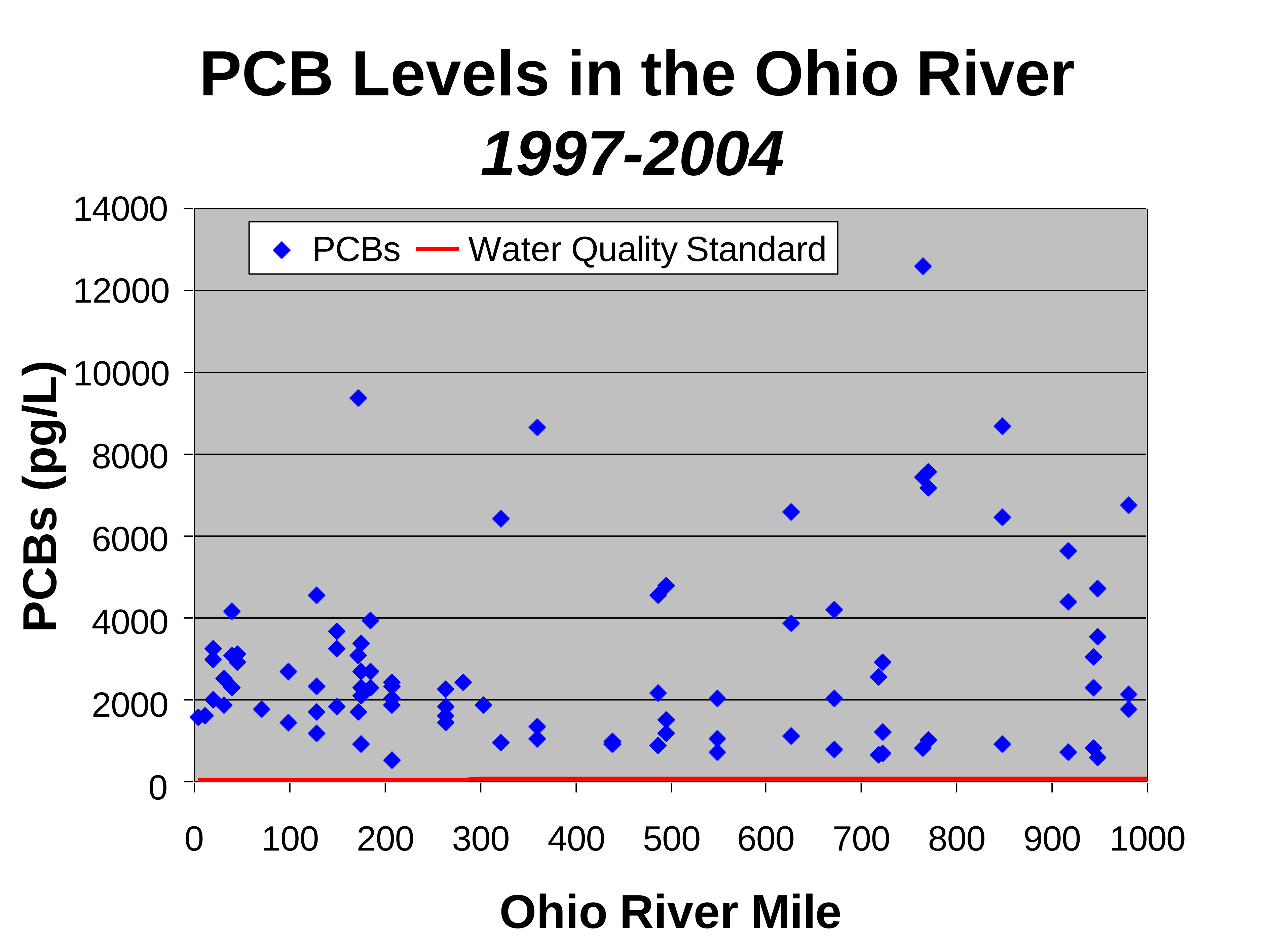
- **Water** - **>1 exceedance, but $\leq$10% of samples** (PCBs, Dioxins, and Hg)

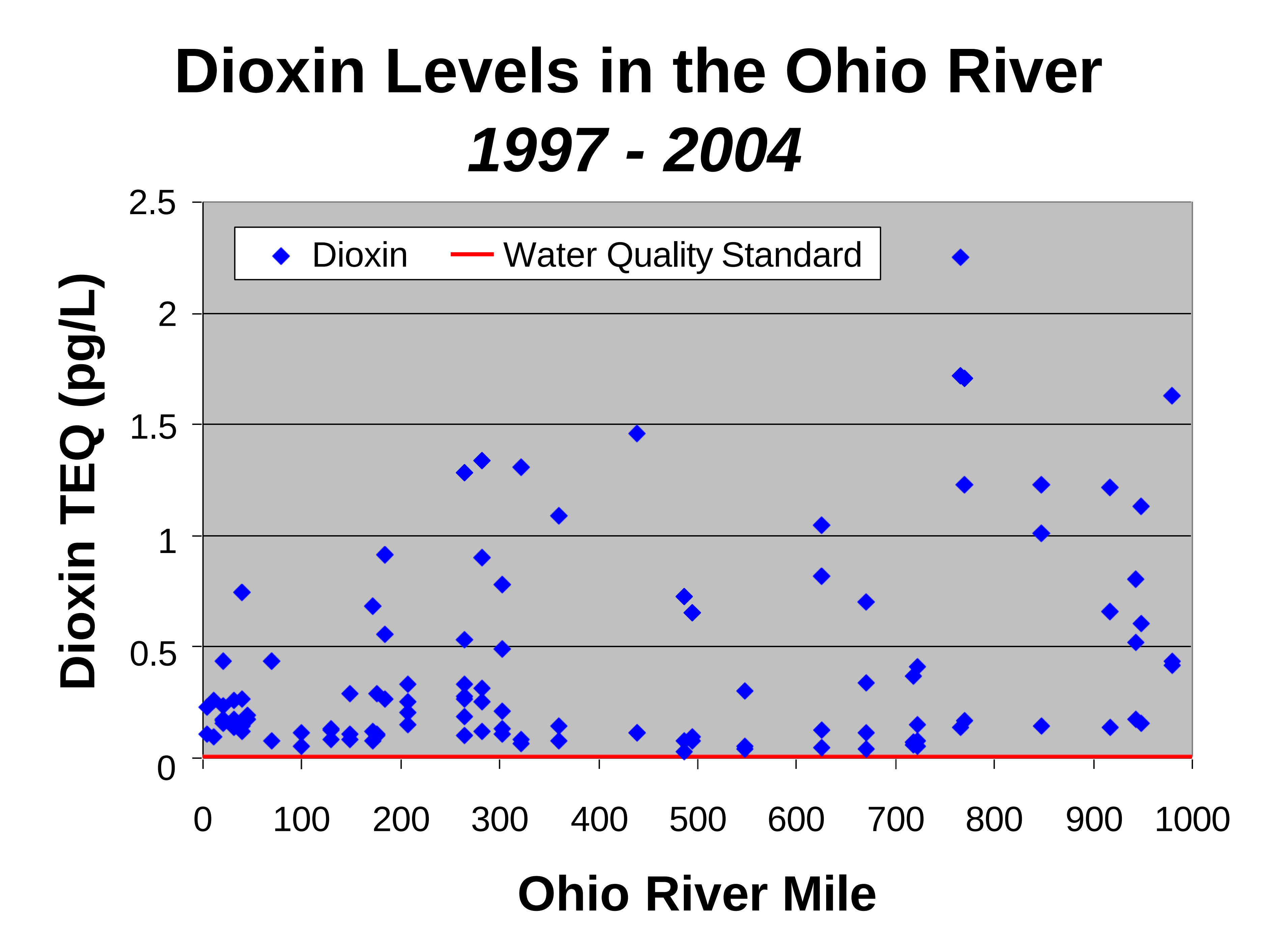
<u>Not Supporting - Impaired</u>

- **Water** - **>1 exceedance AND >10% of samples** (PCBs, Dioxins, and Hg)

  or

- Fish Tissue - The consumption-weighted average MeHg conc. for a pool > 0.3 ppm


PCB Levels in the Ohio River
1997-2004
PCBs
Water Quality Standard
PCBs (pg/L)
14000
12000
10000
8000
6000
4000
2000
0
0
100
200
300
400
500
600
700
800
900
1000
Ohio River Mile



Dioxin Levels in the Ohio River
1997 - 2004
Dioxin
Water Quality Standard
Dioxin TEQ (pg/L)
2.5
2
1.5
1
0.5
0
0
100
200
300
400
500
600
700
800
900
1000
Ohio River Mile

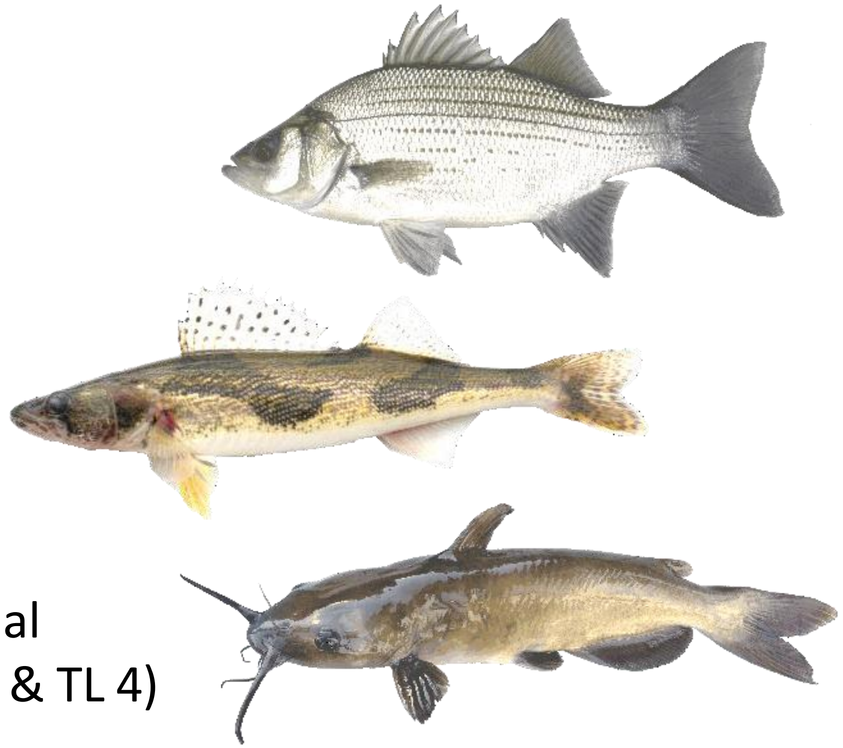
Observed Human Health Exceedances– Total Hg (12 ng/L)

January 2018 – December 2022

River Mile	Site Name	Criteria (ng/L)	Max Result (ng/L)	Total Samples	WQC Exceedances	% Exceedances	305b ALU Assessment
26.3	Monaca	12	0	6	0	0%	Fully Supporting
54.4	New Cumberland	12	10.7	27	0	0%	Fully Supporting
84.2	Pike Island	12	24	30	1	3%	Fully Supporting
126.4	Hannibal	12	27.1	30	1	3%	Fully Supporting
161.8	Willow Island	12	20.3	30	2	7%	Partially Supporting
203.9	Belleville	12	25.7	28	1	4%	Fully Supporting
279.2	R.C. Byrd	12	35.7	30	2	7%	Partially Supporting
341	Greenup	12	28	29	2	7%	Partially Supporting
436.2	Meldahl	12	21.2	29	1	3%	Fully Supporting
531.5	Markland	12	28.7	30	3	10%	Partially Supporting
606.8	McAlpine	12	10.2	25	0	0%	Fully Supporting
720.7	Cannelton	12	16.9	30	5	17%	Not Supporting
776	Newburgh	12	15	30	2	7%	Partially Supporting
846	J.T. Myers	12	34.6	28	2	7%	Partially Supporting
918.5	Smithland	12	18.9	27	3	11%	Not Supporting
938.9	L&D 52	12	33.1	6	1	17%	Fully Supporting
964.8	Olmsted	12	13.3	22	2	9%	Partially Supporting

MeHg Consumption-Weighted Average

$$C_{avg} = \frac{8.0 * C_3 + 5.7 * C_4}{(8.0 + 5.7)}$$



Where:

C_3 = average mercury concentration for trophic level 3
C_4 = average mercury concentration for trophic level 4

**Calculation is based on apportioning the 13.7 grams/day national default consumption rate for freshwater fish by trophic level (TL 3 & TL 4)

5.7 grams/day of TL 4 fish
8.0 grams/day of TL 3 fish

Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion – US EPA

MeHg Fish Tissue Data – Prob Surveys & Fix Stations

Pool	# Samples	Max. MeHg Conc. (ppm)	N > 0.3 ppm	MeHg Consumption-Weighted Avg. Conc. (ppm) 2016-2020	MeHg Consumption-Weighted Avg. Conc. (ppm) 2018-2022*	Change from last cycle**
Emsworth	9	0.223	0	0.083	**0.083**	
Dashields	6	0.306	1	0.109	**0.140**	+
Montgomery	5	0.292	0	0.192	**0.193**	+
New Cumb.	6	0.223	0	0.136	**0.136**	
Pike Island	8	0.259	0	0.113	**0.175**	+
Hannibal	7	0.189	0	0.114	**0.064**	-
Willow Island	10	0.244	0	0.148	**0.064**	-
Belleville	4	0.338	1	0.223	**0.231**	+
Racine	11	0.345	2	0.141	**0.152**	+
RC Byrd	9	0.261	0	0.118	**0.109**	-
Greenup	9	0.232	0	0.190	**0.157**	-
Meldahl	13	0.325	1	0.119	**0.114**	-
Markland	13	0.362	2	0.173	**0.059**	-
McAlpine	9	0.233	0	0.103	**0.053**	-
Cannelton	5	0.377	2	0.253	**0.201**	-
Newburgh	11	0.290	0	0.136	**0.157**	+
JT Myers	10	0.331	1	0.236	**0.177**	-
Smithland	14	0.416	1	0.151	**0.075**	-
Olmsted	6	0.399	1	0.236	**0.210**	-
Open Water	3	0.327	1	0.100	**0.126**	+

*No Pool Avg >0.30 ppm criteria **No significant difference between cycles – Wilcoxon Matched Pairs Test, p>0.0.89, α=0.05

Fish Consumption Use Assessment Summary

- **The entire Ohio River is designated as impaired for PCBs and dioxin based on water column data from 1997-2004**

- Total Hg (12 ng/L) ORSANCO water column Human Health criteria serves to protect against exposure via fish consumption

- ORSANCO directed by TEC to use US EPA's approach for determining impairment based on consumption weighted-average methylmercury fish tissue data (used in prior assessment cycles)

- **Using "WOE Approach", entire river Full Support for fish consumption based on methylmercury relying on the consumption-weighted average data**

2024 Use Assessment Summary

unchanged from 2022 assessment

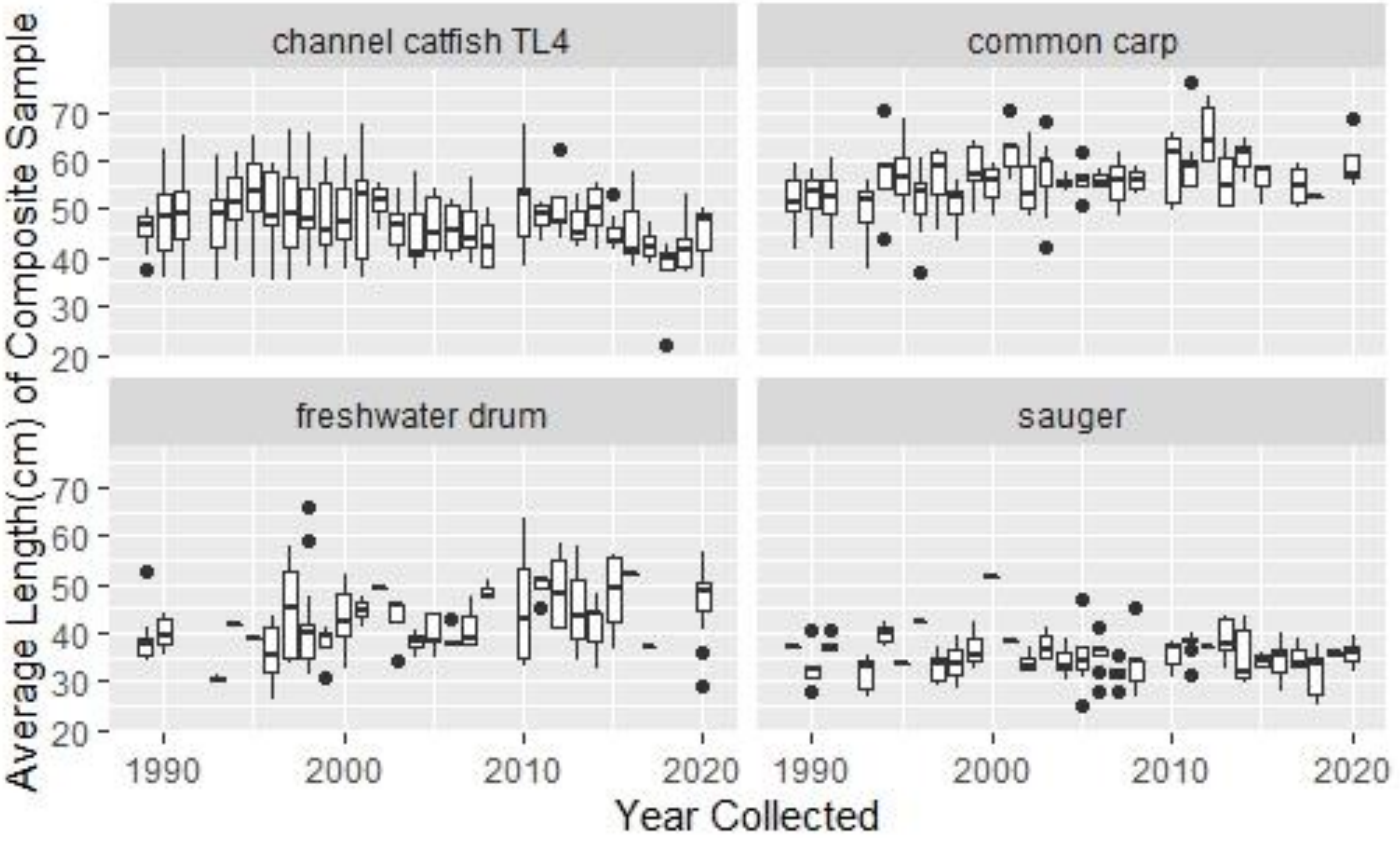
		Number Miles Use is Impaired				
	States	Aquatic Life	Contact Recreation	Public Water Supply	Fish Consumption for PCBs & Dioxin	Fish Consumption for Mercury
PA	0.0-40.2	0	40.2	0	40.2	0
OH-WV	40.2-317.1	0	245.0	0	276.9	0
OH-KY	317.1-491.3	0	60.8	0	174.2	0
IN-KY	491.3-848.0	0	243.3	0	356.7	0
IL-KY	848.0-981.0	0	40.6	0	133.0	0
TOTAL	981.0	0	629.9	0	981.0	0

***Action Requested: Accept the 2024 assessments, continue report preparation for June approval**

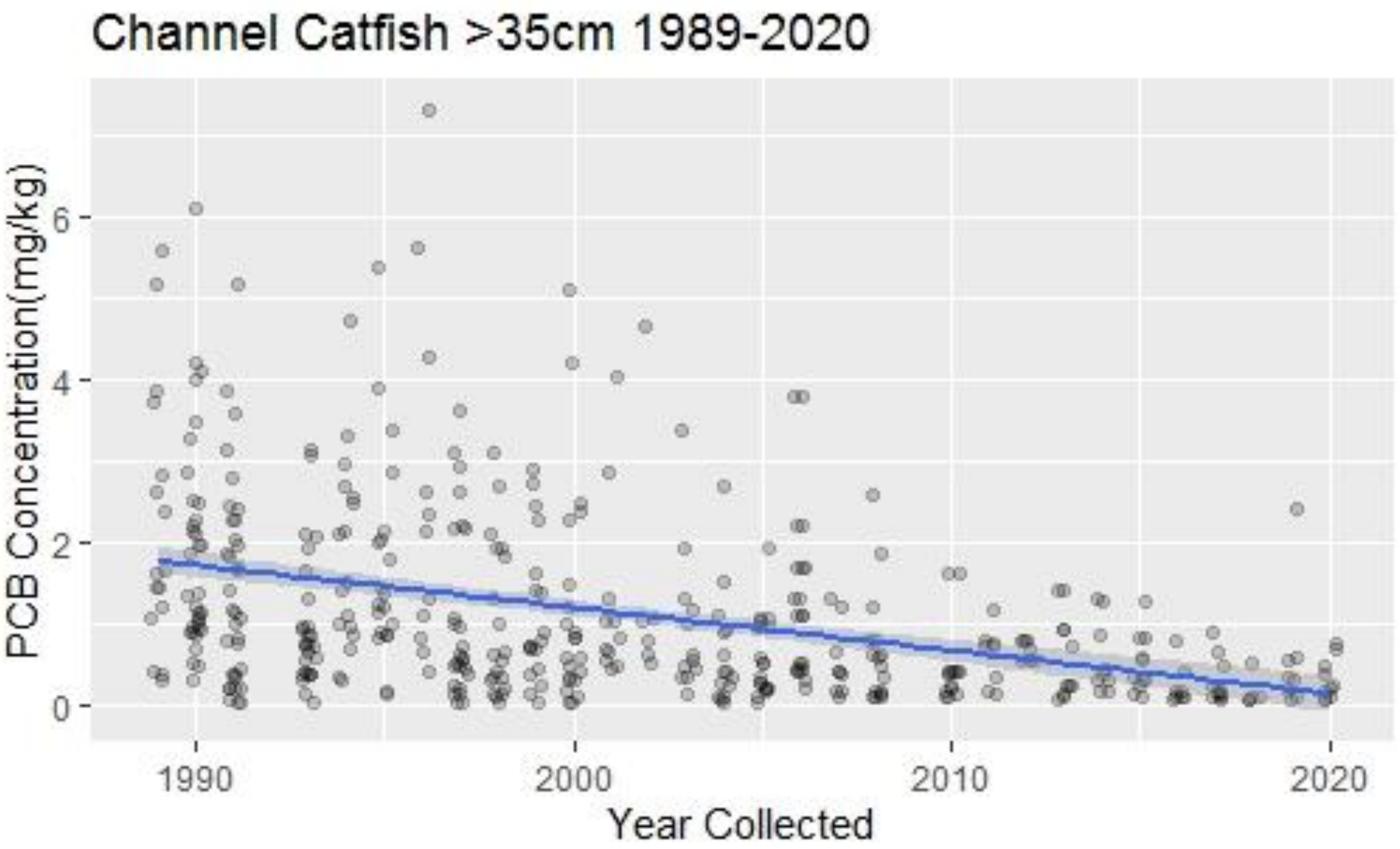
Agenda Item 7:

PCBs Trends in Fish Tissue

Daniel Cleves, ORSANCO



channel catfish TL4
common carp
freshwater drum
sauger
Average Length(cm) of Composite Sample
Year Collected
20
30
40
50
60
70
1990
2000
2010
2020



Channel Catfish >35cm 1989-2020
PCB Concentration(mg/kg)
0
2
4
6
1990
2000
2010
2020
Year Collected

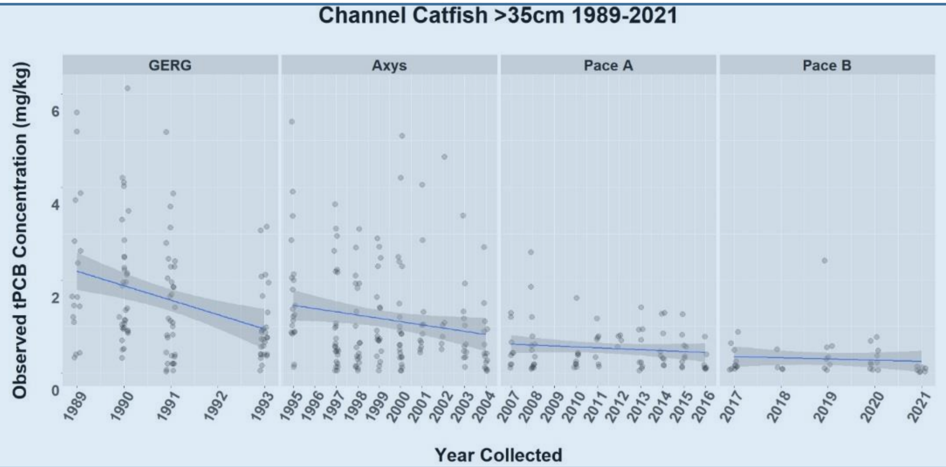
Why did we choose this approach?

- **Confounding factors**
  - Differences in “total PCB” enumeration schemes, laboratory standards, and analytical methods
  - Inherent biases within an historic dataset (length bias, spatial bias (river mile), etc.)
  - Species’ differences (different diets/lifecycle changes lead to differing rates of bioaccumulation)
  - Seasonal variability (lipid content and PCBs are positively correlated; lipid content fluctuates seasonally)

- **Can we group consistent analytical methods conducted by different labs?**

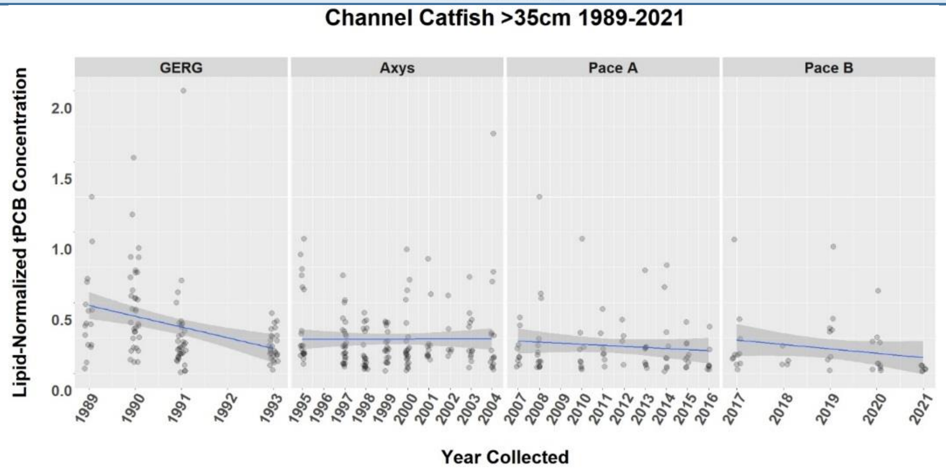
- **How can we concurrently apply length standardization, lipid normalization, and account for spatial bias?**

  - Length Standardization: PCB Concentration/Length
  - Lipid normalization: PCB Concentration/Lipid Content
  - Collection location: negative correlation, as river mile increases PCBs tend to decrease



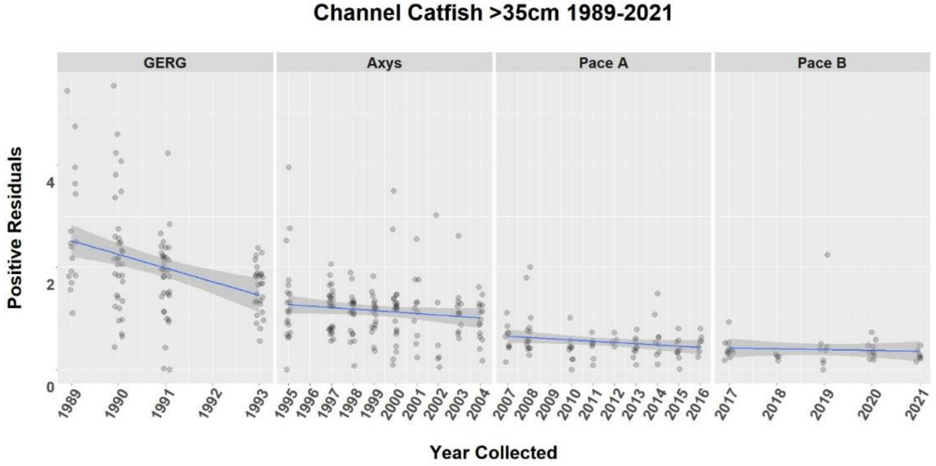
Least conservative approach; fewest biases addressed

- Species differences
- Lab and analytical method



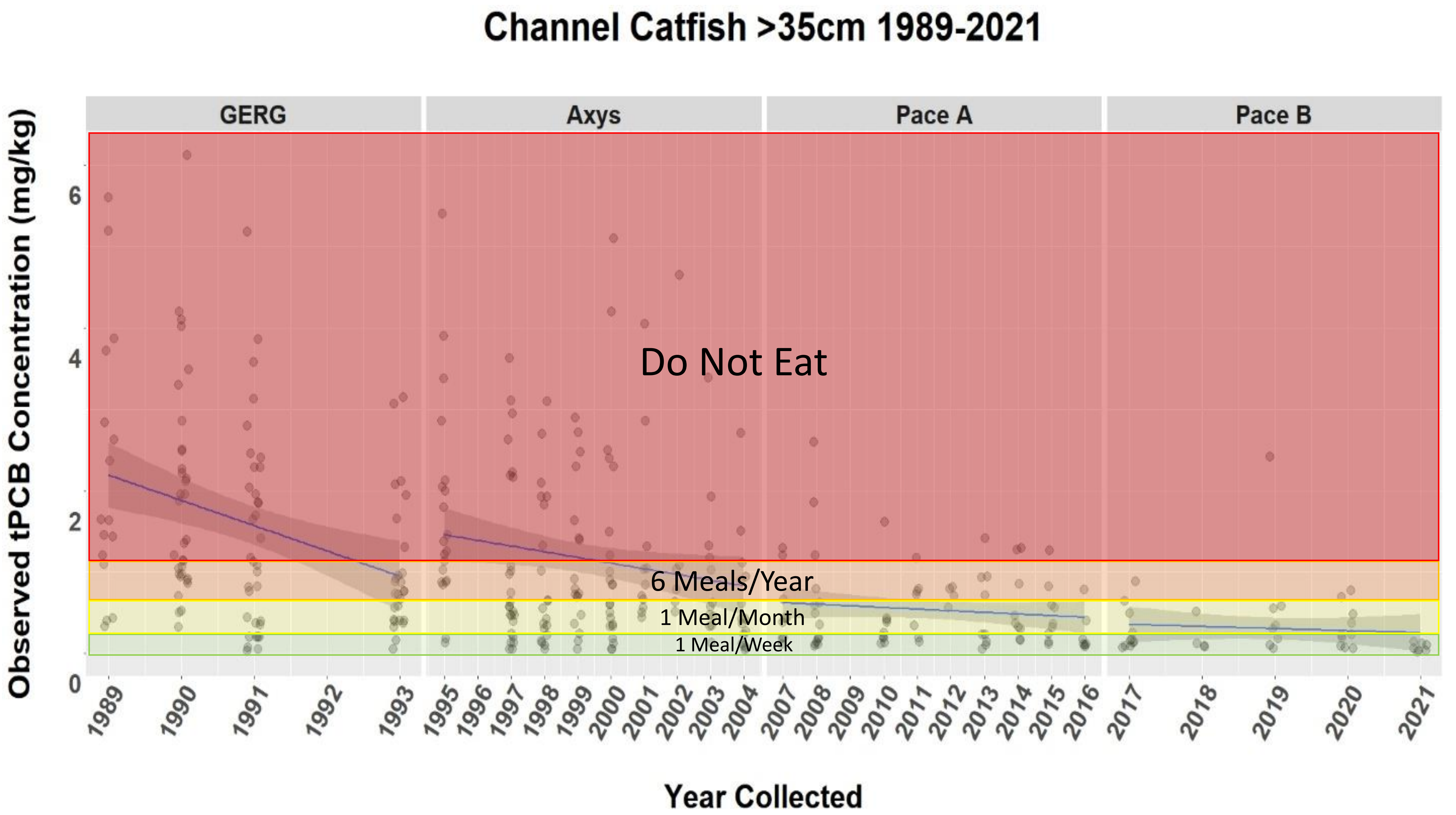
Most conservative approach; some biases addressed

- Species differences
- Lab and analytical method
- Seasonal variation of lipid content

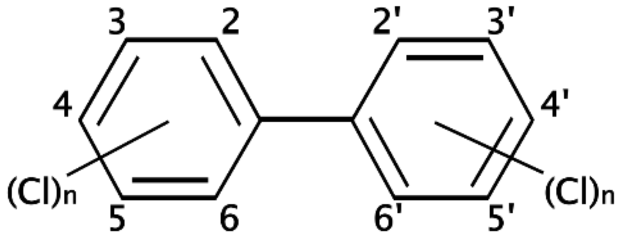


Moderately conservative approach: most biases addressed

- Species differences
- Lab and analytical method
- Seasonal variation of lipid content
- Length (surrogate for age/environmental exposure)
- Collection location (spatial bias)



Channel Catfish >35cm 1989-2021
GERG
Axys
Pace A
Pace B
Observed tPCB Concentration (mg/kg)
0
2
4
6
Do Not Eat
6 Meals/Year
1 Meal/Month
1 Meal/Week
1989
1990
1991
1992
1993
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Year Collected



PCBs in Channel Catfish

PCBs showed decline across all data groups with the steepest rates of decline in older data groups; declining river mile trend

Tracks with historic sources & ban on PCB production

Report Timeline

- January 2023 - Draft reviewed by BWQSC members and associates
- Comments and suggestions incorporated returned for review to **BWQSC** in January 2024
- **BWQSC supports submitting the report for review by TEC**

- All three methods of evaluating PCB concentrations over time were in agreement
- PCBs in Channel Catfish tissue are likely decreasing on the Ohio River
- It is difficult to quantify how much is due to decreasing environmental exposure, declining lipid content, and/or seasonal variation of lipid content
- Samples classified as "Do Not Eat" are extremely uncommon
- Lipid content has also decreased over time
  - this has been observed across fresh and marine ecosystems; possible link to climate change

Agenda Item 8:
Broad Scan Survey Interim Results

Lila Ziolkowski, ORSANCO

2023 BROADSCAN SURVEY

TEC Meeting
Agenda Item 8
Lila X. Ziolkowski
February 8, 2024

Photo by Durand Clark 1/8/2012

AGENDA

Introduction

Results

Summary

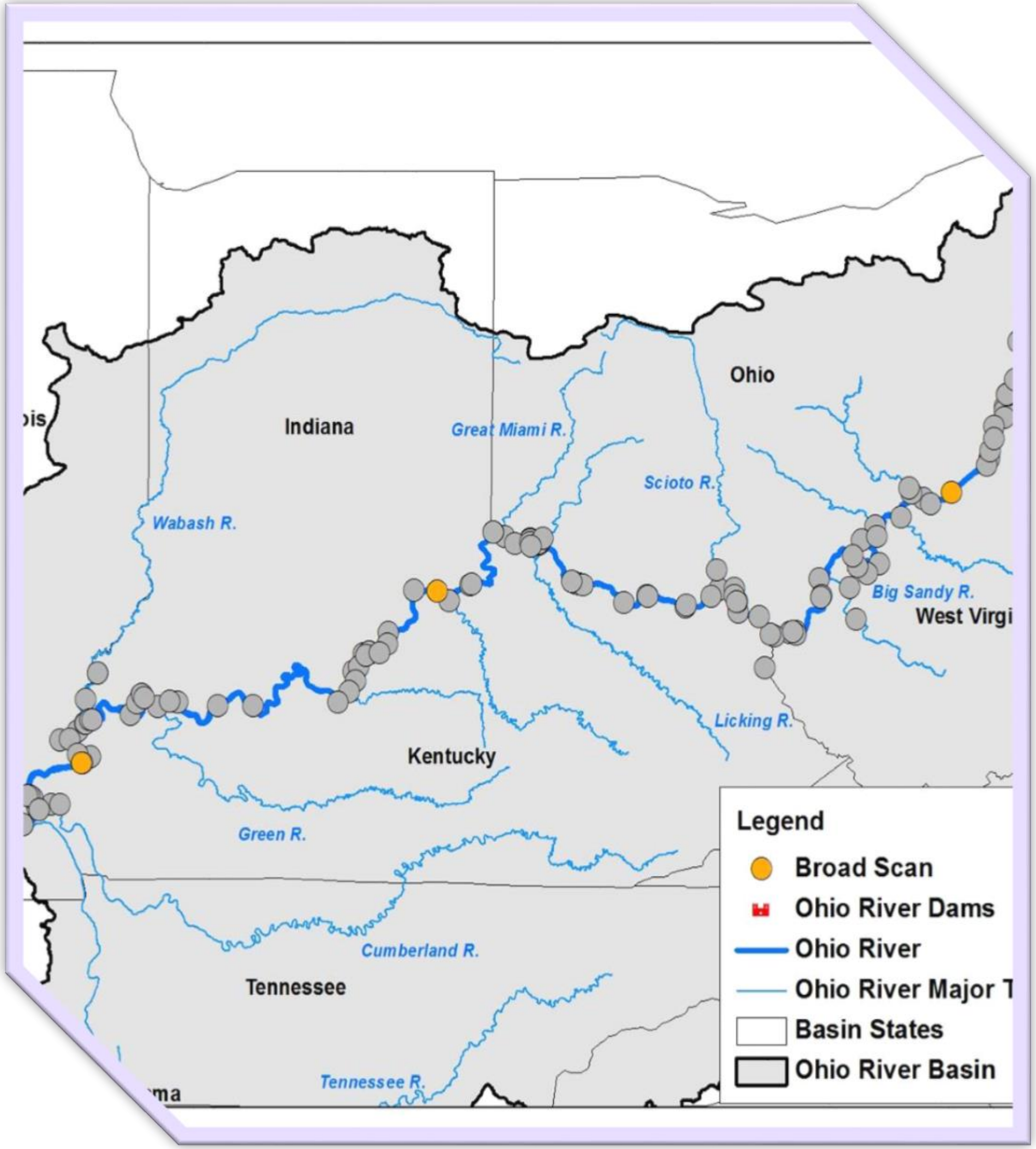
Introduction

ORSANCO staff were charged by Commission Member States as part of 2022/2023 Monitoring Initiative to assess parameters listed in ORSANCO's Pollution Control Standards (2019) which are not routinely monitored through core monitoring programs to determine if additional pollutants should be considered for inclusion into current monitoring programs.

2023 BSS is repeat survey of the BSS performed in 2012

- Two rounds sampling (May, September)
- same sample locations (ORM 192,633, 912)
- Semi-volatiles, pesticides, volatiles, radionuclides, PCB's, dioxin, asbestos fibers, hexavalent chromium, and fluoride were primary target pollutants for 2023 BSS.
- Added 40 PFAS pollutants as contaminants of concern (data collection effort)

BSS Analytical cost for project $ 35,000



FIELD SAMPLING CREW

2023 BROADSCAN SURVEY

Sam & Greg

Bridget

Stacey, Sam & Greg

Greg

Emilee

General Sample Summary Results

	Any Detects >= RL	PCS criteria exceeded?
SVOCS, VOCS, Pesticides	**No**	**No** (various ug/L)
Hexavalent Chromium **Fluoride**	**Yes** **Yes**	**Yes** (0.0157 mg/L) **No** (1 mg/L)
Radionuclides	**Yes**	**No** (4 pCi/L)
Asbestos Fibers	**Yes**	**No** (7 MFL)
Total PCB's	**Yes** all sites both Rds; <1 ng/L	**Yes** (0.064 ng/L)
Dioxin	**No**	**No** (0.005 pg/L)
PFAS	**Yes**	**No criteria for ambient water**

RESULTS OVERVIEW-BSS

For pollutants not routinely monitored in core programs, there were no detections found for semi-volatiles, volatiles, or pesticides in either round.

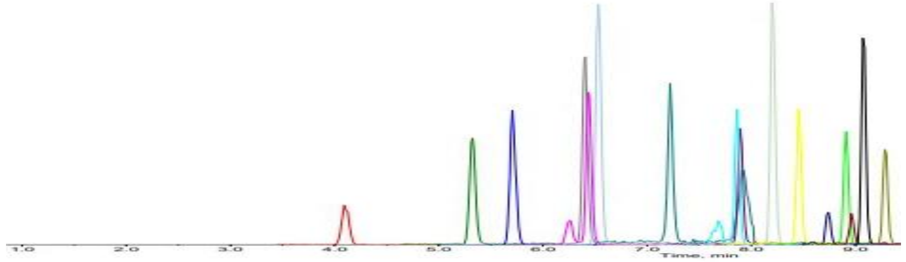
Fluoride was ND in RD1, but present in RD2 ~ 0.25 mg/L at 0192 and 0912, no water quality criteria exceedance (1 mg/L).

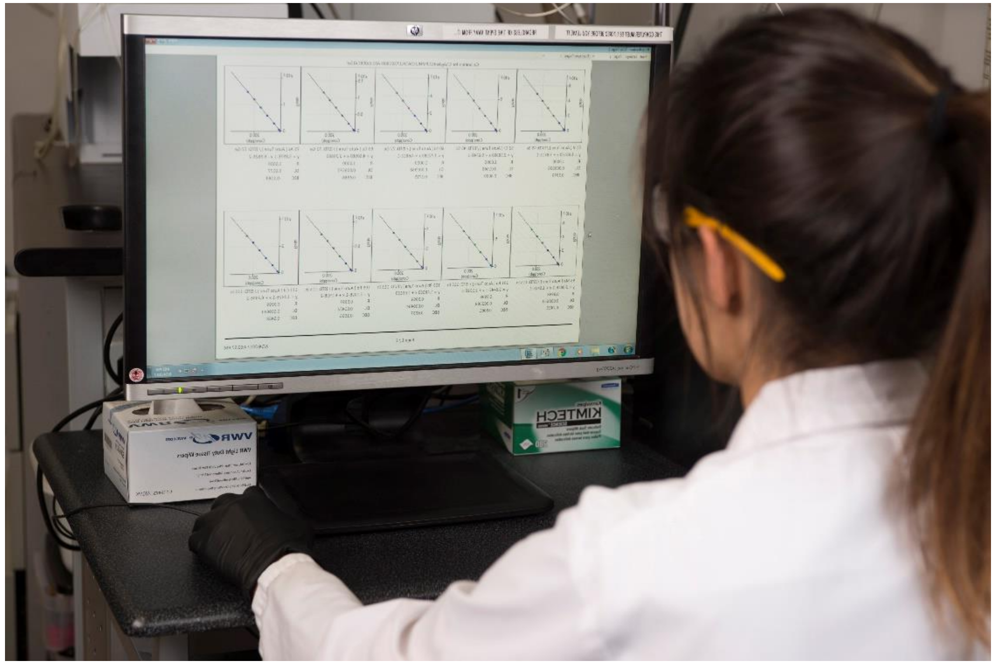
Hexavalent Chromium exceeded WQ criteria (0.016 ug/L) in RD1 at site 0912 (0.08 ug/L).

Trace levels of radionuclides were present in all samples for both rounds 2.5 pCi/L RD1 at site 0912 and 1.0 pCi/L in RD2 at site 0192. Did not exceed WQ criteria level (4 pCi/L).

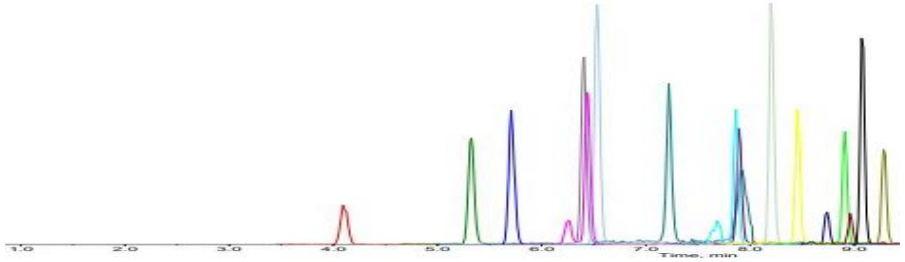
Trace amounts of asbestos fibers were found in all samples in both rounds (<2 MFL), but well under WQ criteria of (<7 MFL)

Total PCB's were present at all reported sites* in both rounds at very low levels, but exceeding PCS water quality criteria of 0.064 ng/L.





RESULTS OVERVIEW-PFAS



11 different PFAS present between both rounds; 2 PFAS >RL in RD1; 7 PFAS > RL in RD2

Other PFAS were present as estimated low level concentrations "J" flagged

RD2 PFAS levels slightly higher values than RD1; highest overall PFAS in RD2 HFPO-DA 8.4 ng/L.

PFOA was found at very low levels in both rounds at low levels, ~2.5 ng/L (RD1), slightly higher near 6 ng/L (RD2).

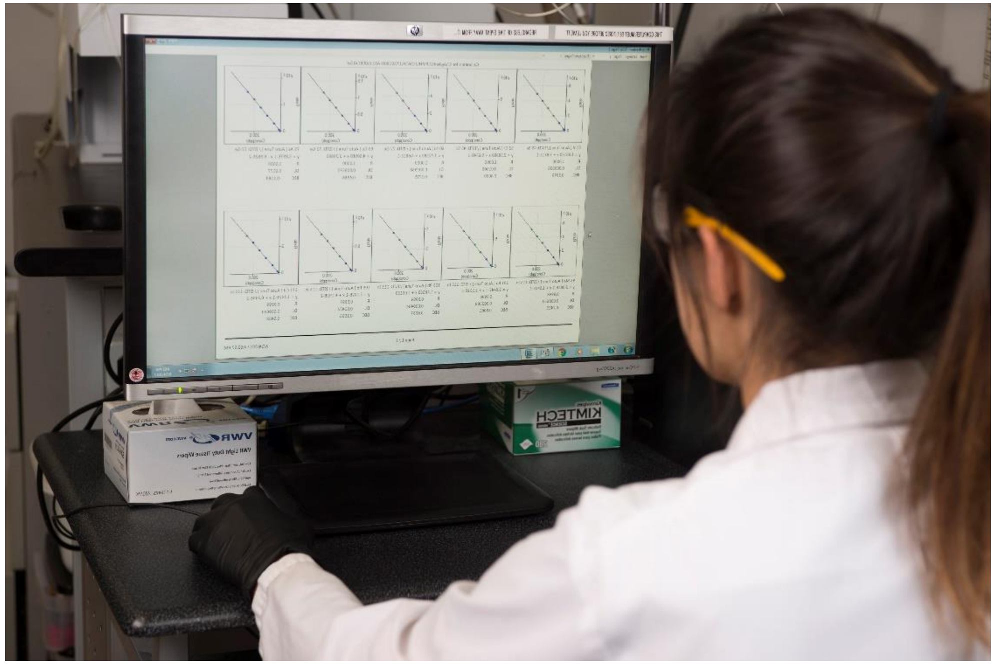
PFOS was found at all sites in Round 2, near 3ppt.

Similarly, PFBS was found in Round1 at site 0912 at 1.6 ng/L and at all sites in Round 2 at levels between 3-4 ng/L.

HFPO-DA was present at sites 0633 and 0912 in RD1; found at site 0192 (RD2) ~8 ng/L.

PFPHxA was found in Round 2 between 2-3 ng/L across all three sites.

PFPeA present in RD2 at 0633 at 3.2 ng/L



2023 BROADSCAN SURVEY

In summary, the 2023 BSS was undertaken to analyze priority pollutants that are not routinely monitored for in core ORSANCO programs

No pesticides, SVOC's, volatiles, inorganics, pesticides, dioxin, radionuclides, or asbestos fibers that are not routinely monitored for were detected at levels exceeding water quality criteria as listed in 2019 PCS.

Trace levels of PCB's found >0.064 ng/L WQ criteria at all sites in both rounds

Hexavalent Chromium was detected at site 0912 >0.0157 mg/L in RD1.

Certain PFAS found at levels at or above RL including PFOA, PFOS, HFPO-DA; estimated concentrations for other PFAS. RD2 had more detections above RL than RD1. No CWA WQ criteria established yet

These findings will be included in the FY24 Monitoring Strategy document

A draft of the Final Report of Findings to be developed for June TEC meeting

QUESTIONS/COMMENTS

Agenda Item 9:
ORSANCO's Contact Recreation/Bacteria Monitoring and Trends Analyses

Stacey Cochran, ORSANCO

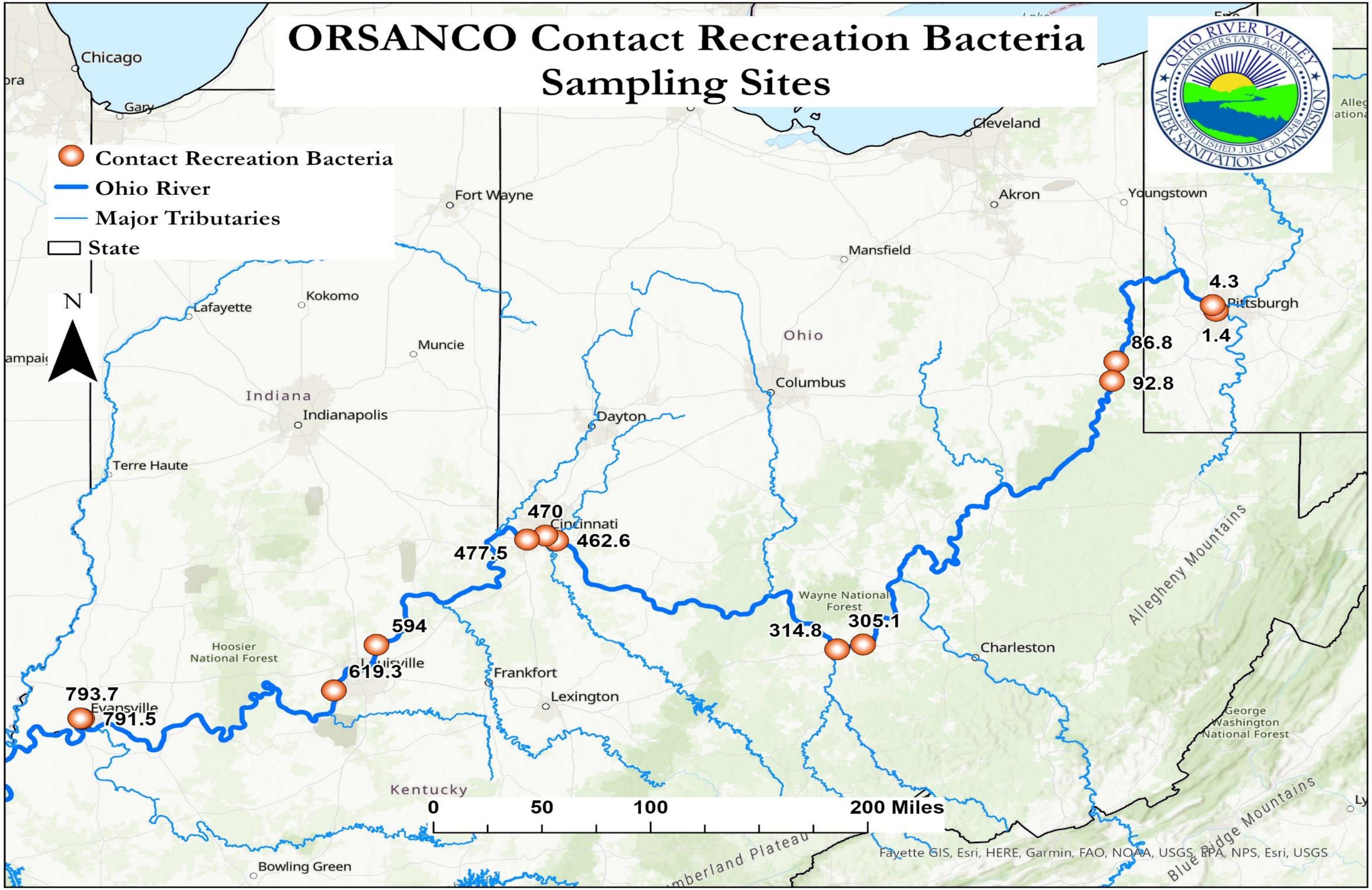
ORSANCO'S CONTACT RECREATION/BACTERIA MONITORING AND TRENDS ANALYSES

February 6-7, 2024

Agenda Item 9

Informational Item

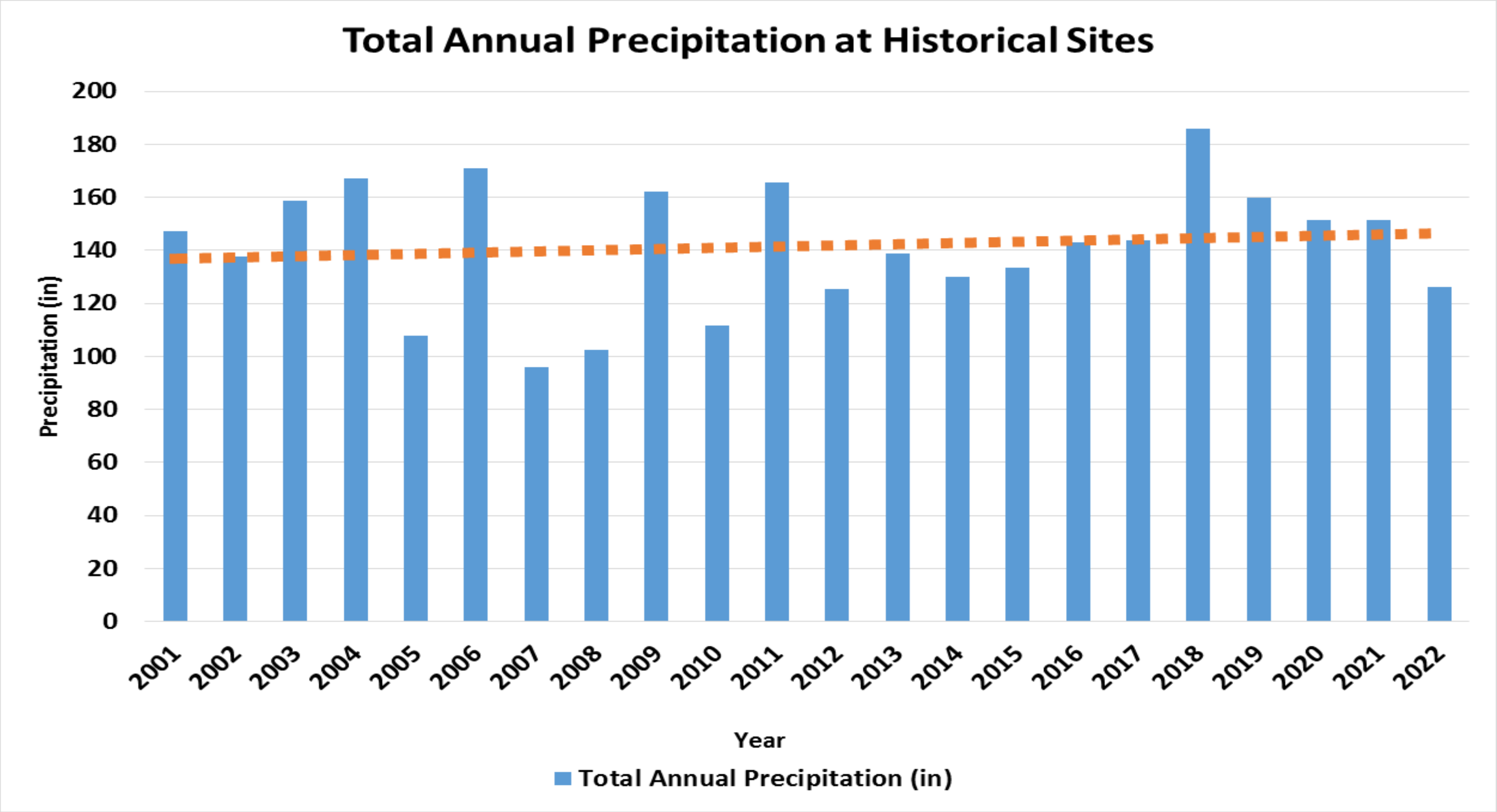
ORSANCO Contact Recreation Bacteria Sampling Sites



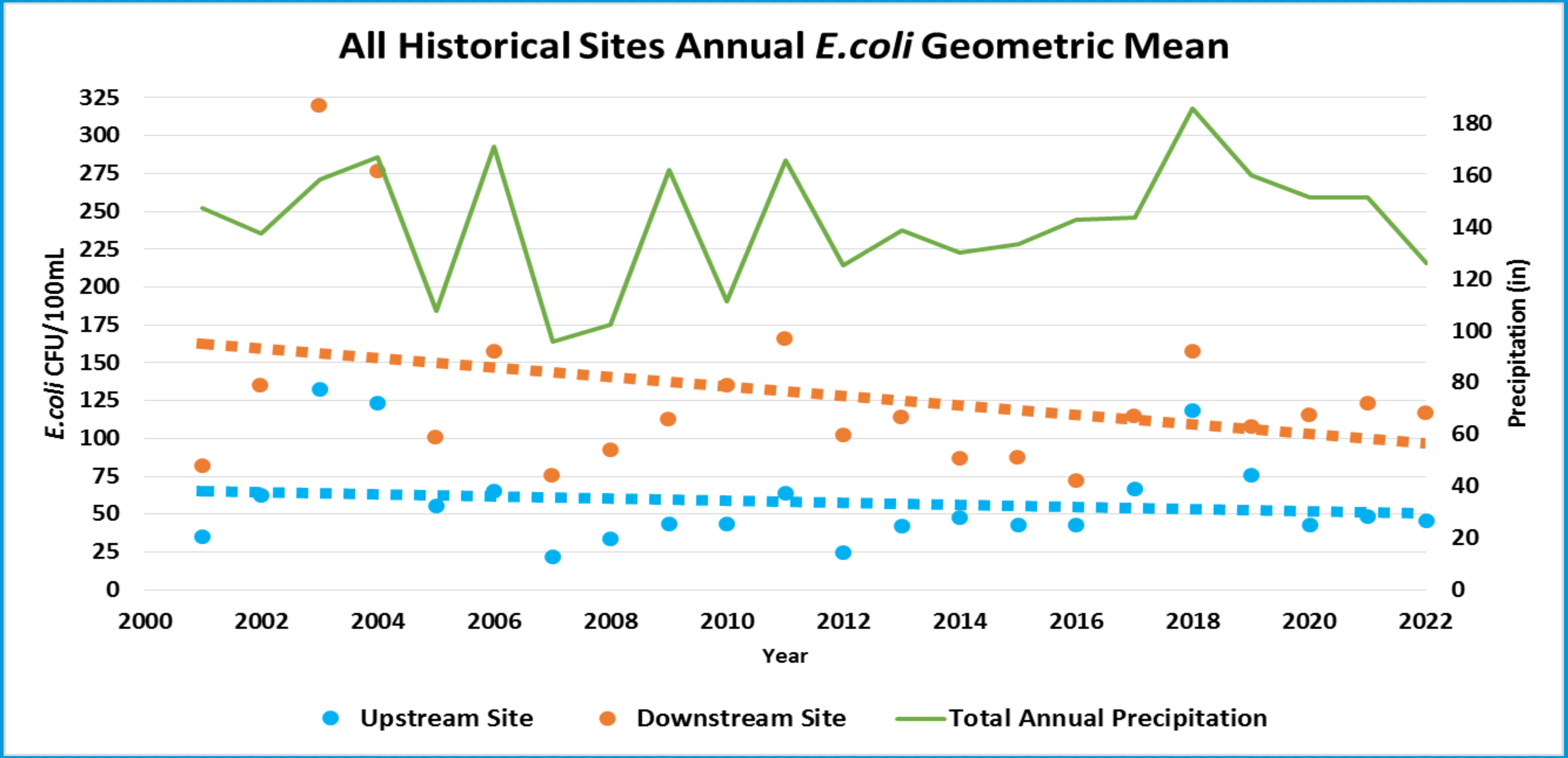
- Weekly sampling April-October
  - April was added in 2013

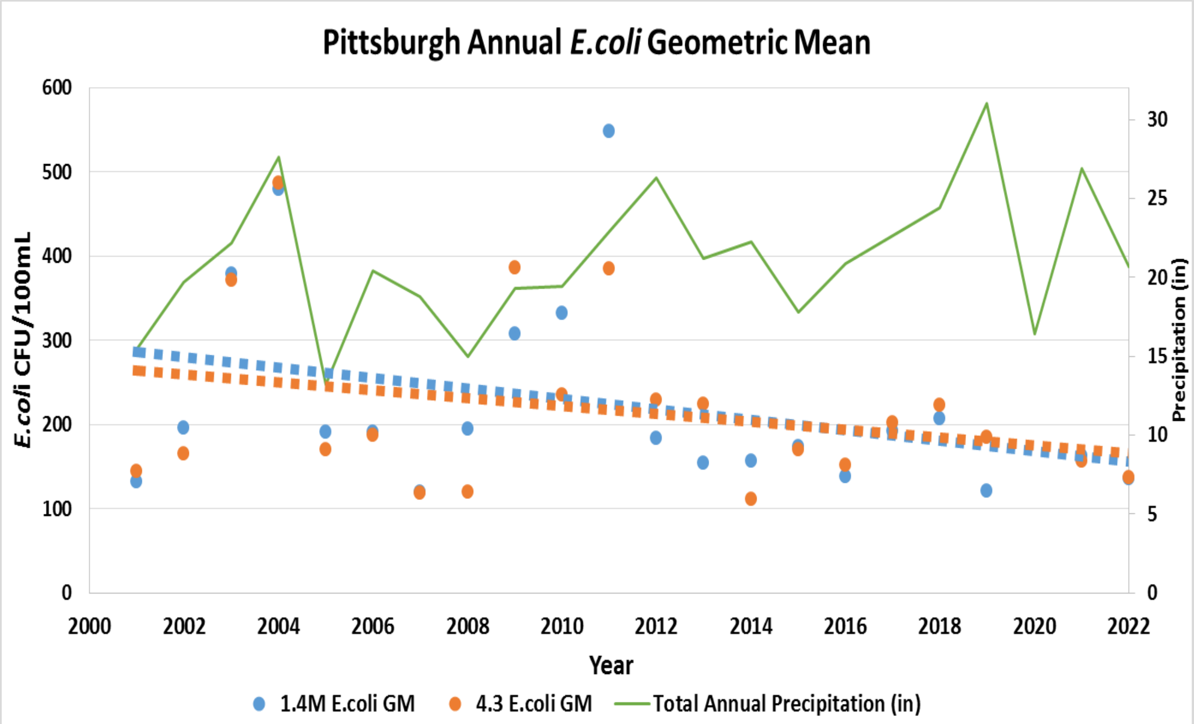
- Stations Upstream & Downstream of CSO Systems
  - 2000-2009 includes Downtown Station
- Surface Grab Samples
- Fecal Coliform and *E. coli* Analysis
  - 2000-2016 both by Membrane Filtration
  - 2017-Present *E.coli* by Colilert Method at all 6 Communities
    - Fecal Coliform by Colilert Method at Wheeling and Huntington sites
- Bacteria Trends Report (2001-2022)
  - *E.coli* Geometric Mean
  - May-October at Upstream and Downstream sites

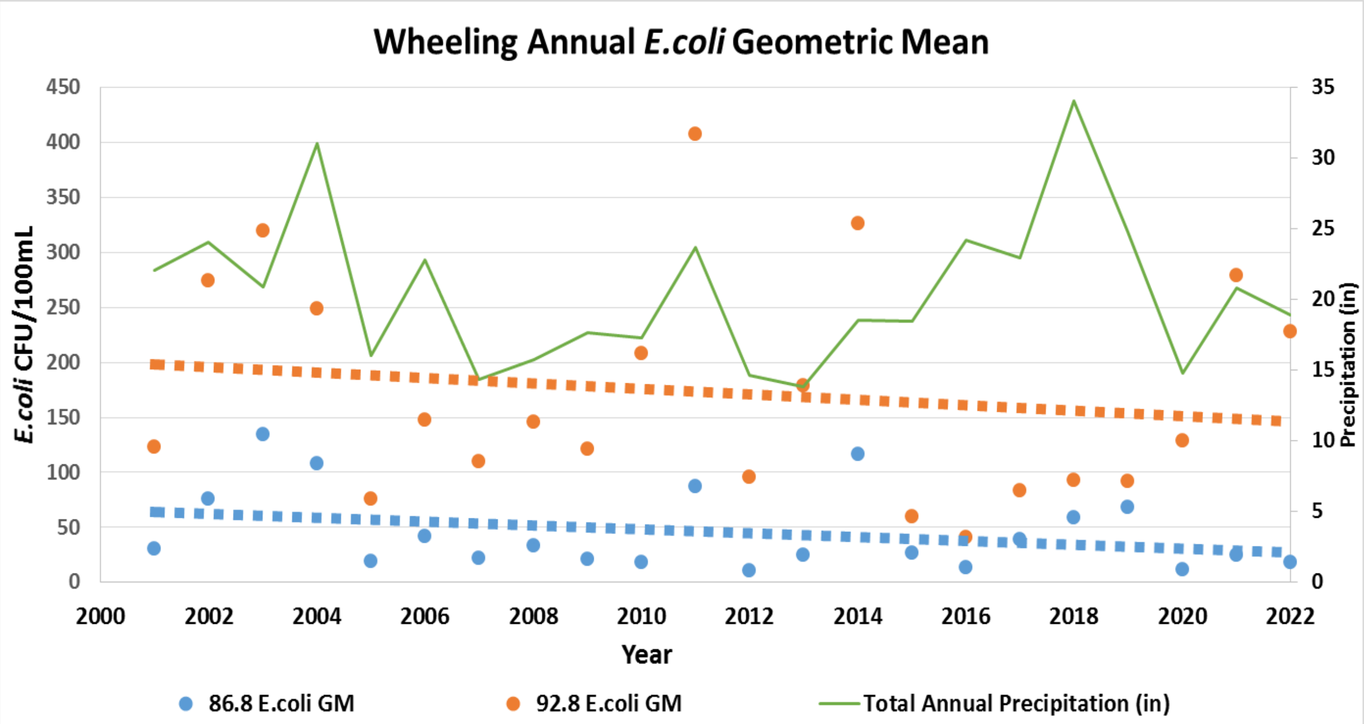
PRECIPITATION DATA

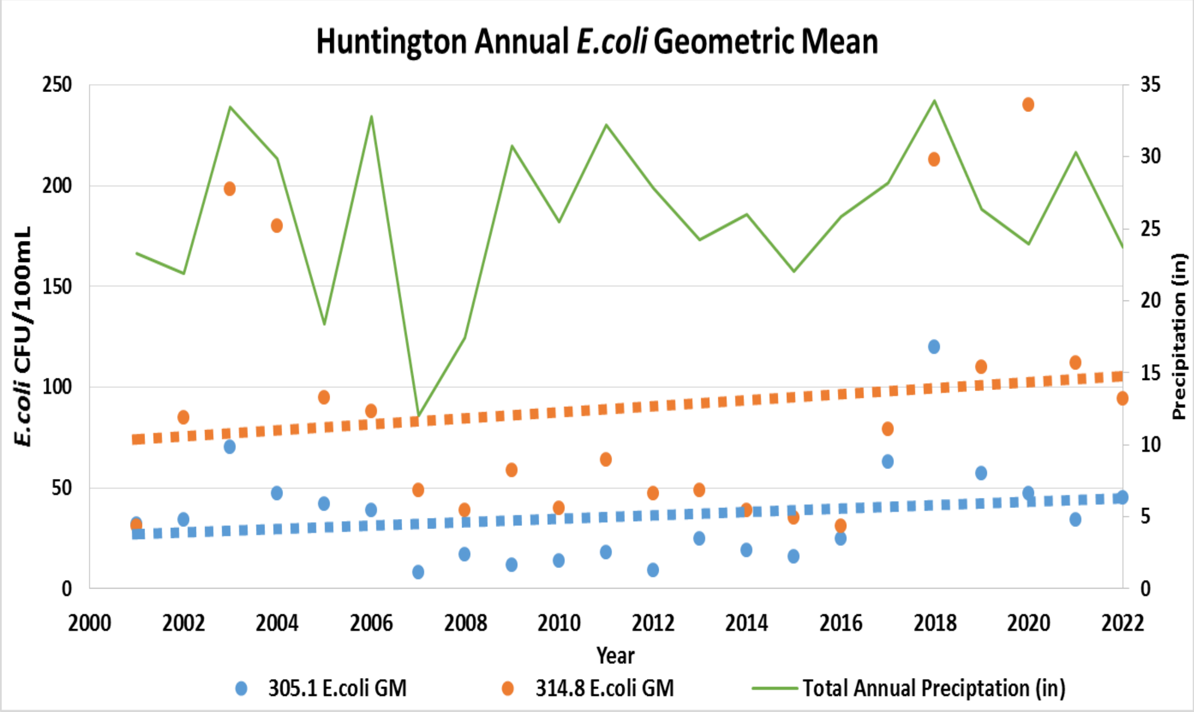


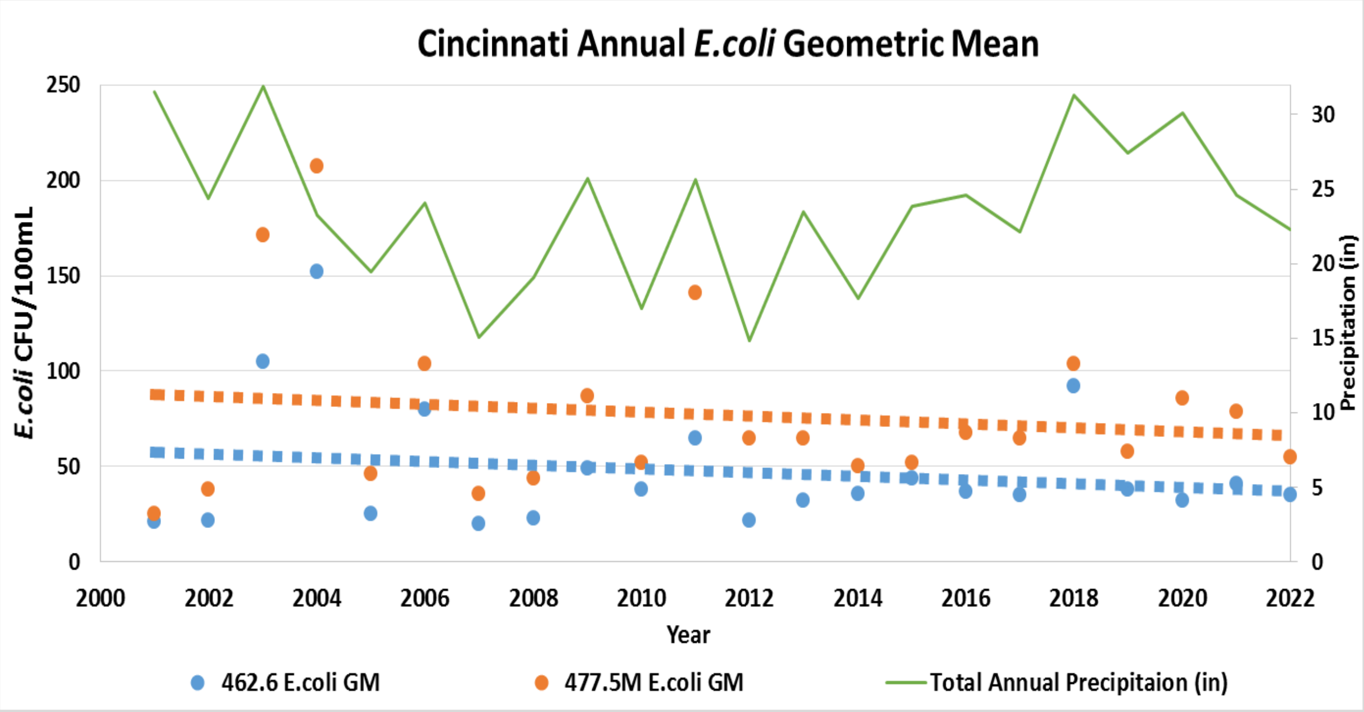
BACTERIA TRENDS REPORT
ANNUAL DATA

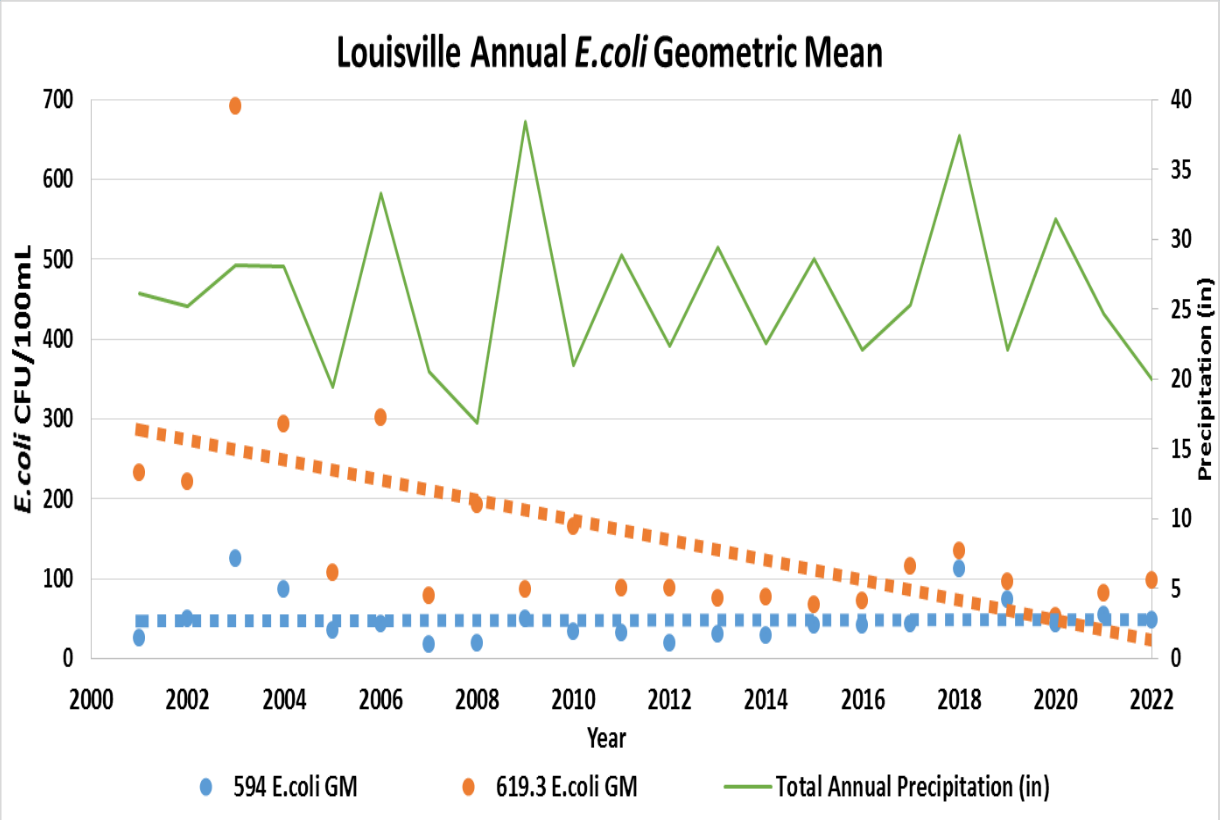


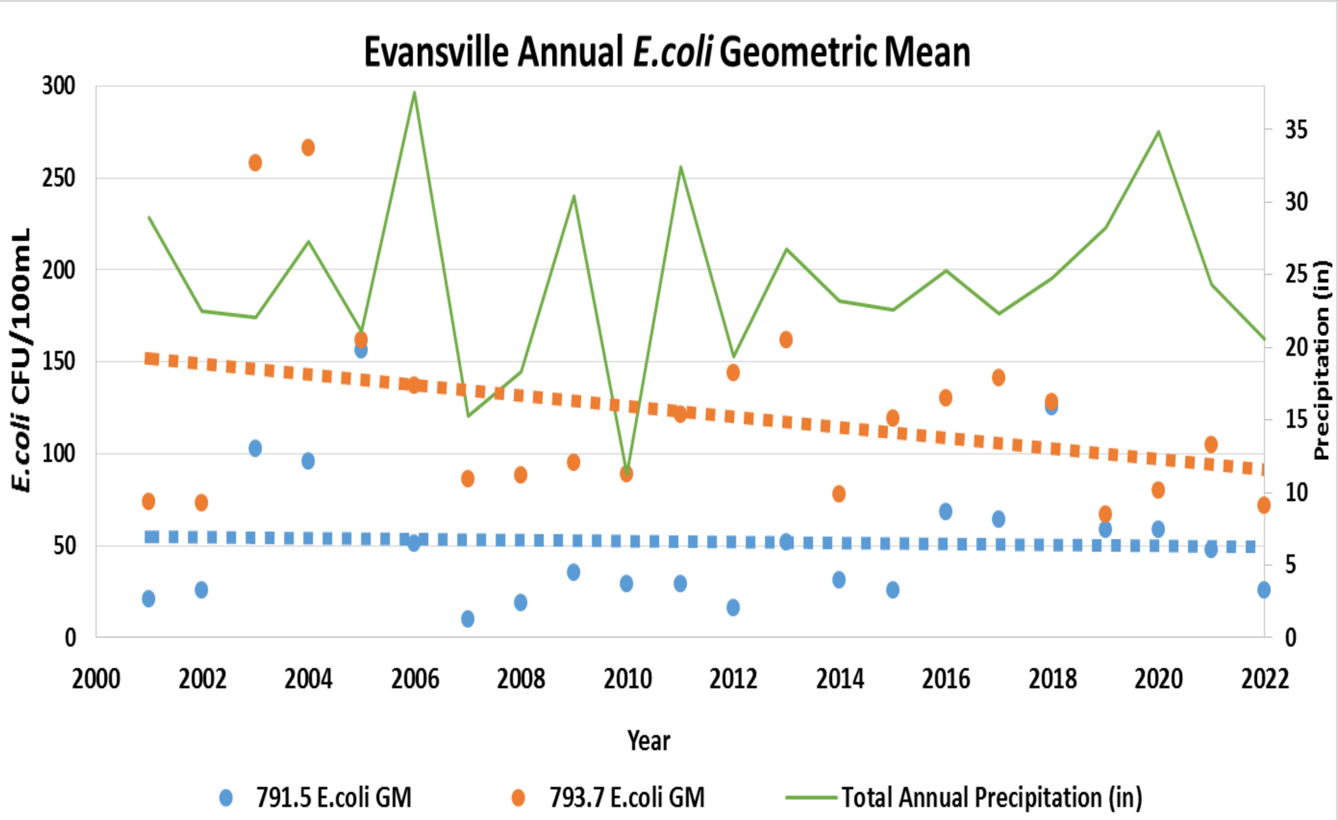

Pittsburgh Annual E.coli Geometric Mean
E.coli CFU/100mL
Precipitation (in)
Year
1.4M E.coli GM
4.3 E.coli GM
Total Annual Precipitation (in)


Wheeling Annual E.coli Geometric Mean
E.coli CFU/100mL
Precipitation (in)
Year
86.8 E.coli GM
92.8 E.coli GM
Total Annual Precipitation (in)


Huntington Annual E.coli Geometric Mean
E.coli CFU/100mL
Precipitation (in)
Year
305.1 E.coli GM
314.8 E.coli GM
Total Annual Preciptation (in)

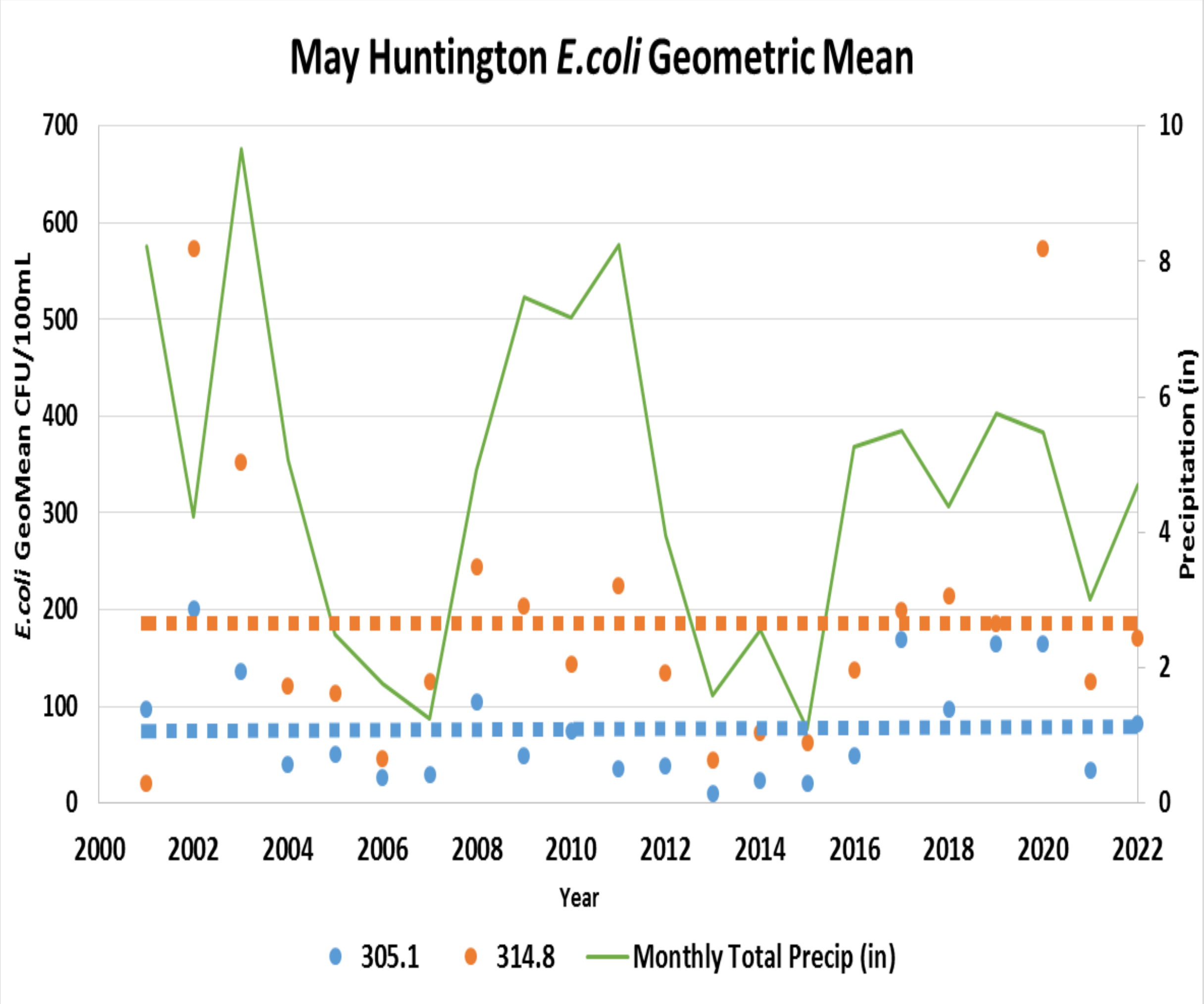

Cincinnati Annual E.coli Geometric Mean
E.coli CFU/100mL
Precipitation (in)
Year
462.6 E.coli GM
477.5M E.coli GM
Total Annual Precipitaion (in)

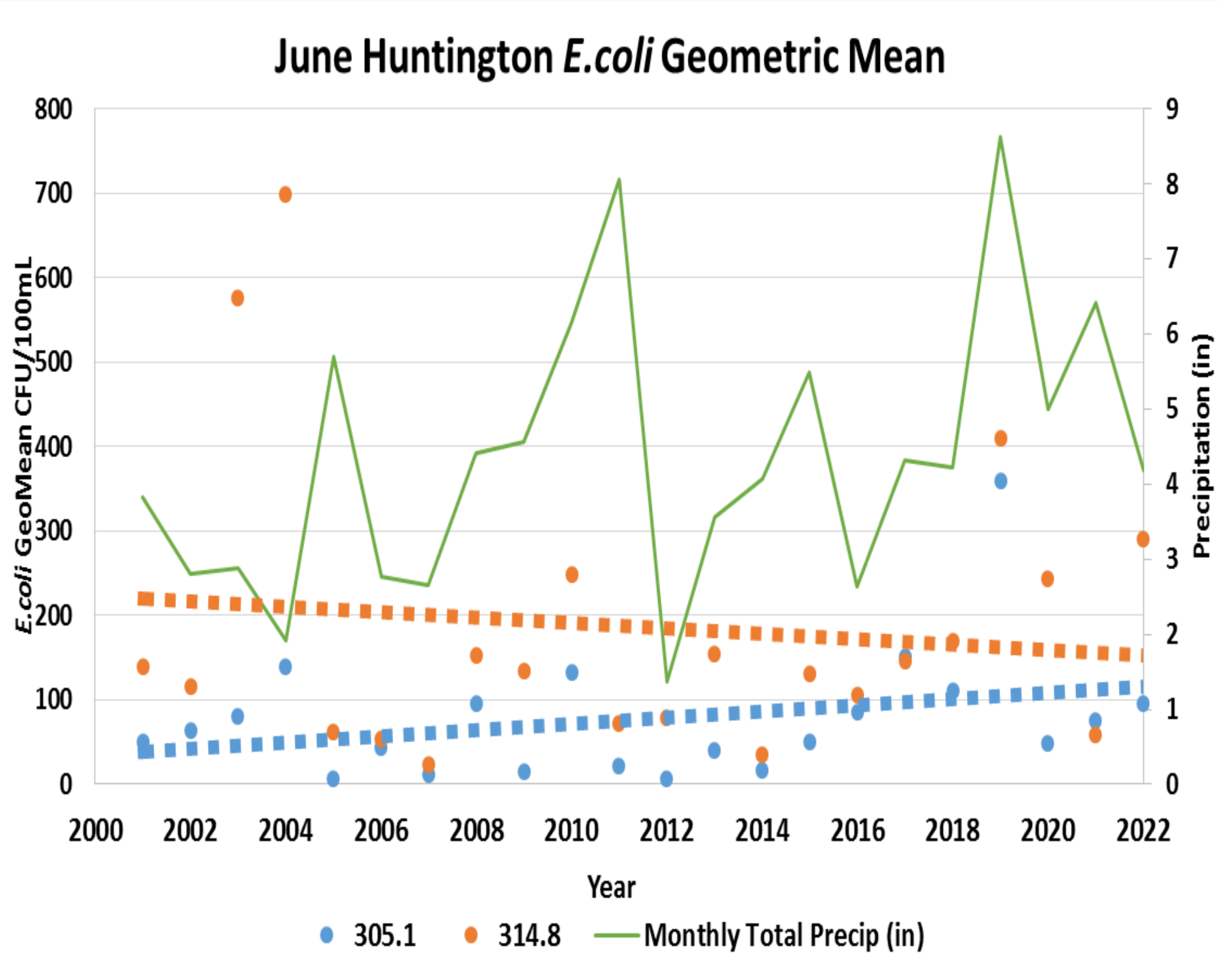


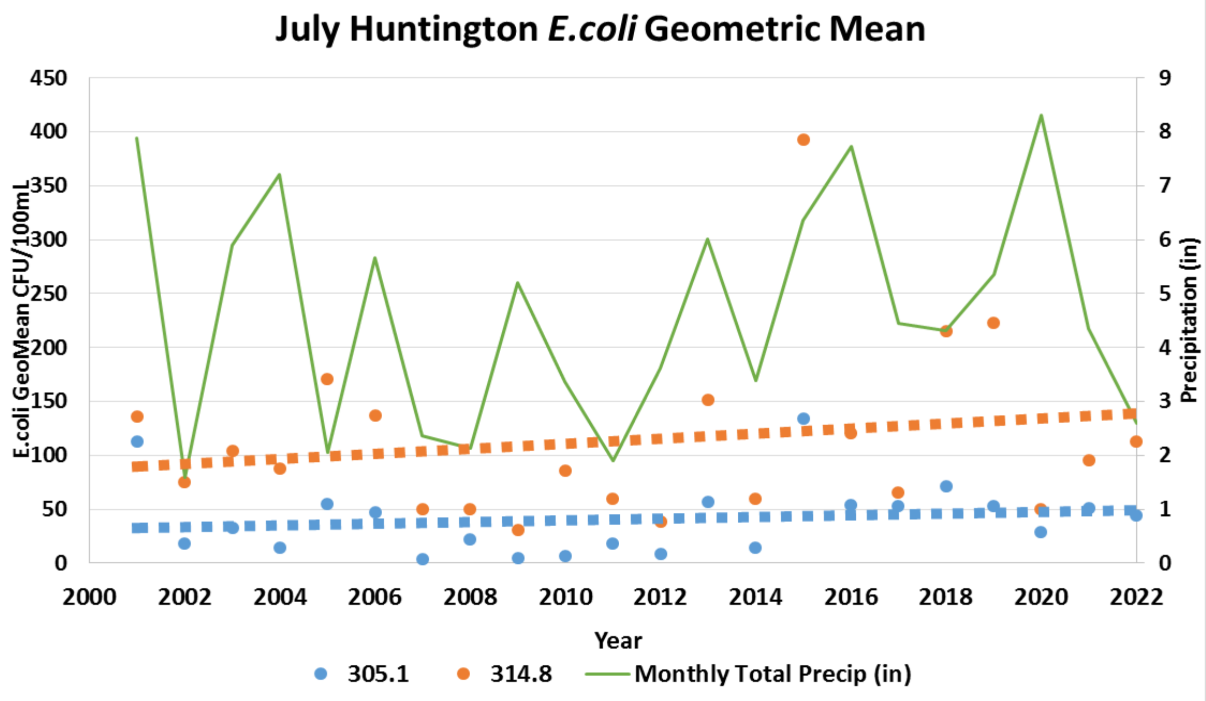


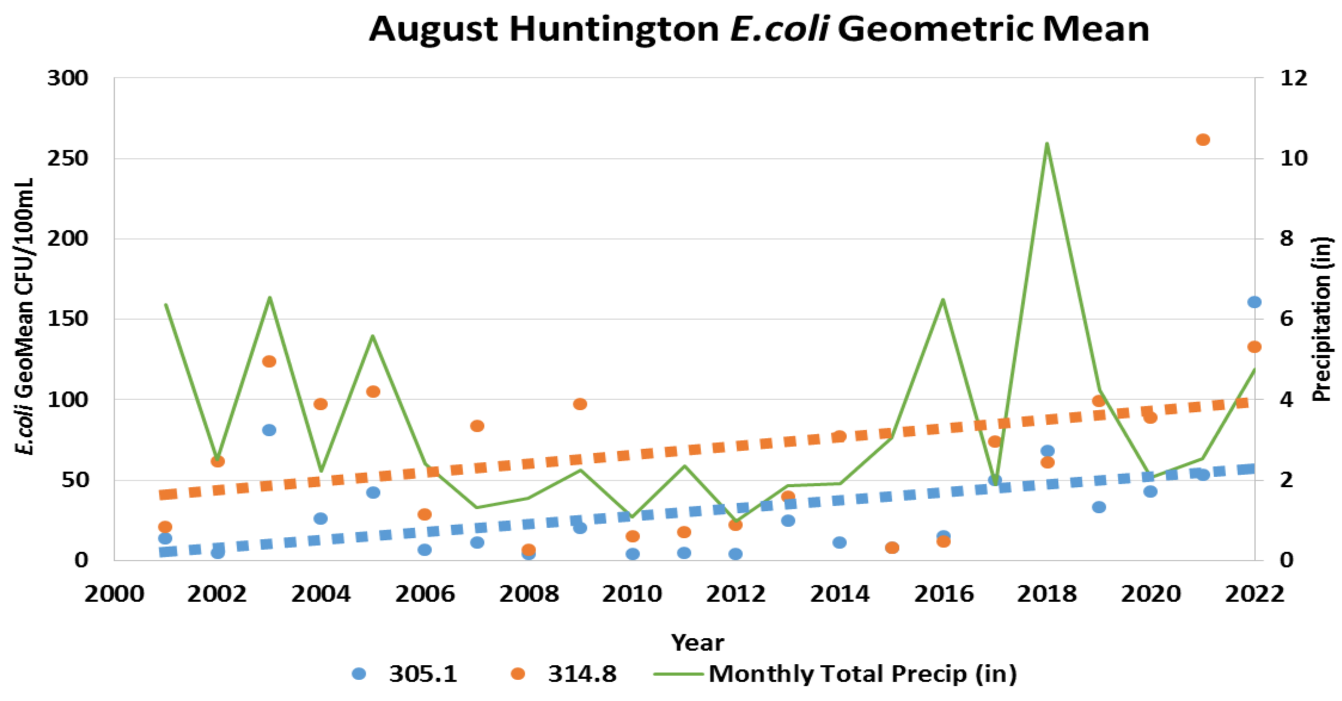
- All sites show a decreasing linear regression for *E.coli* except in Huntington on an annual basis
- Higher *E.coli* geometric means were displayed at downstream sites with the exception of Pittsburgh
  - The confluence of the Monongahela and Allegheny Rivers are relatively close to the sample site and may have an impact on those results

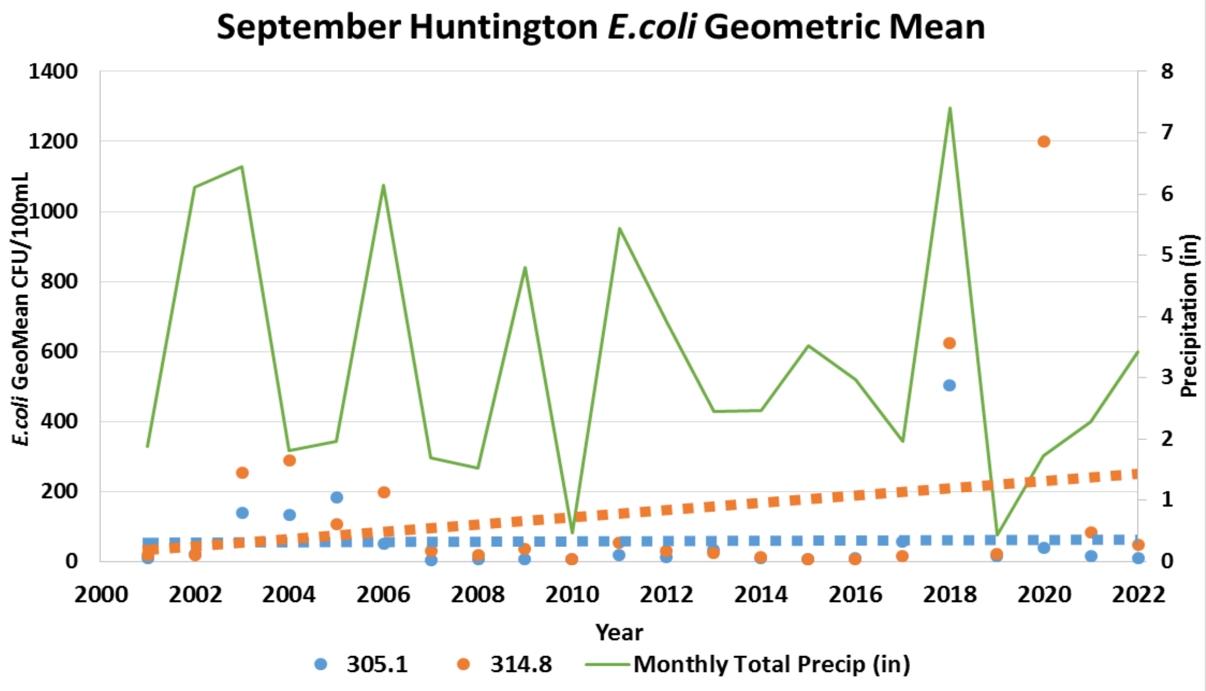
BACTERIA TRENDS REPORT
MONTHLY DATA

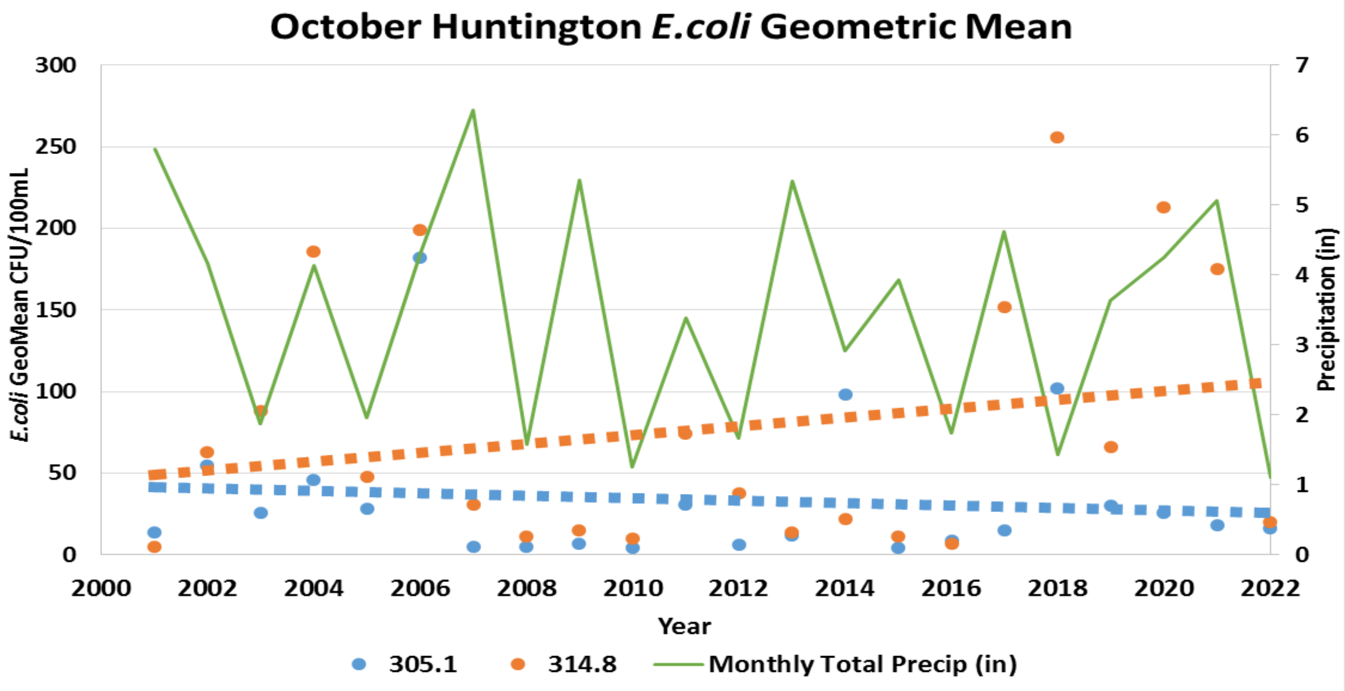


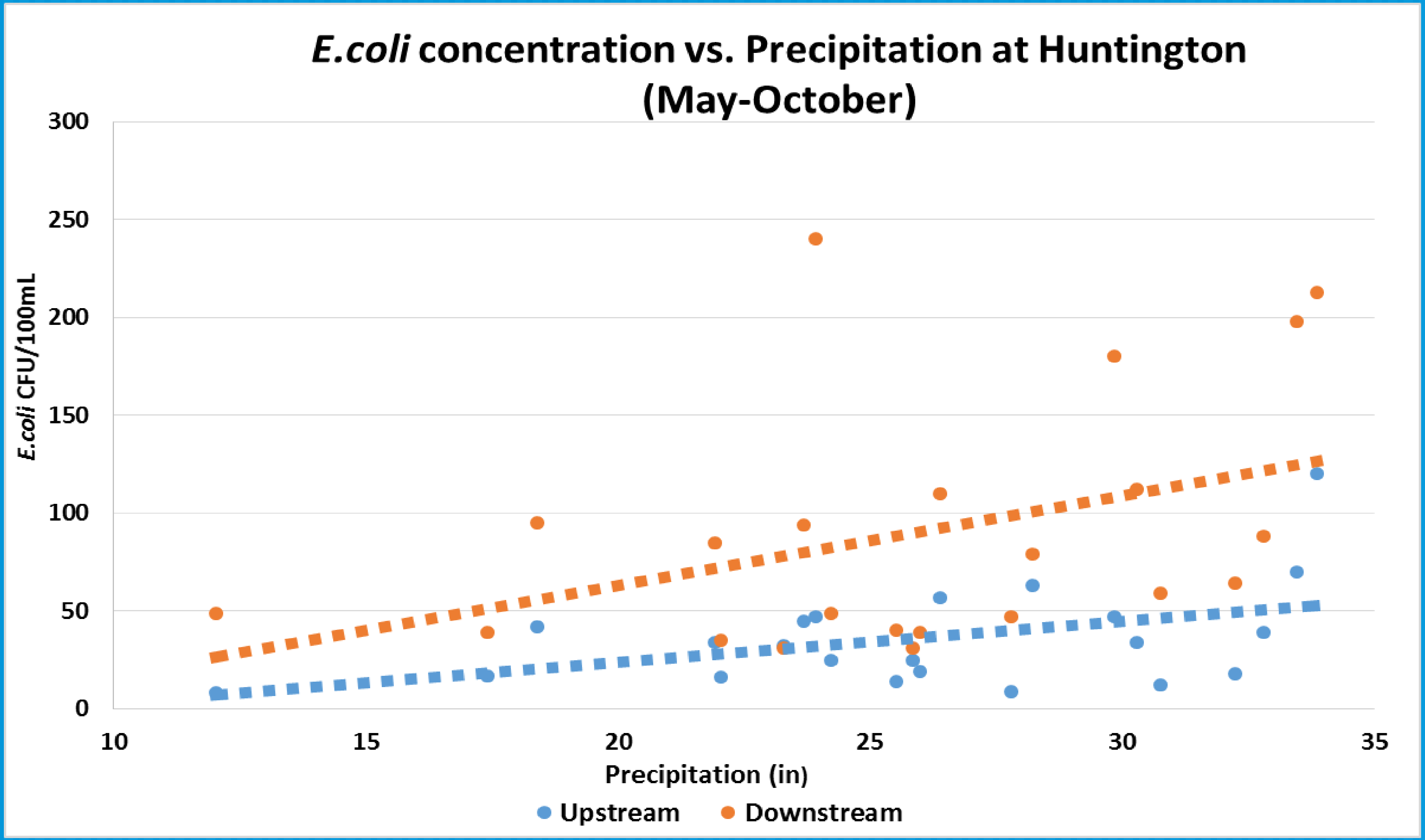



July Huntington E.coli Geometric Mean
E.coli GeoMean CFU/100mL
Precipitation (in)
Year
305.1
314.8
Monthly Total Precip (in)


August Huntington E.coli Geometric Mean
E.coli GeoMean CFU/100mL
Precipitation (in)
Year
305.1
314.8
Monthly Total Precip (in)


September Huntington E.coli Geometric Mean
E.coli GeoMean CFU/100mL
Precipitation (in)
Year
305.1
314.8
Monthly Total Precip (in)

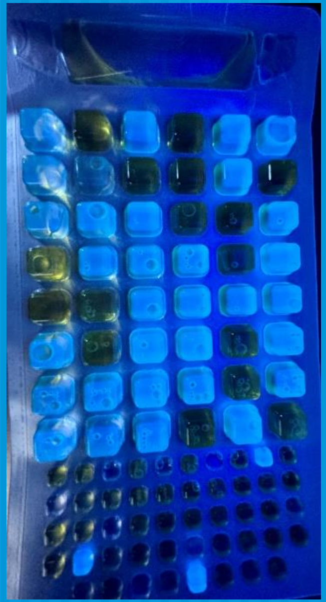

October Huntington E.coli Geometric Mean
E.coli GeoMean CFU/100mL
Precipitation (in)
Year
305.1
314.8
Monthly Total Precip (in)



- Huntington had four months which DS trend increased, one that decreased and one that remained constant
- Even though statistically weak, an increase in bacteria concentration corresponds to an increase in precipitation

BACTERIA COMPARISON STUDY

- WV 604b Grant
  - Comparison study of Fecal Coliform, *E.coli* and Total Coliforms by Colilert Method and Real-Time Proteus instrument
- Colilert Method
  - Use of substrate media
  - Results calculated after Incubation of 18 or 24 hours
- Proteus Instrument
  - Use of Tryptophan-like fluorescence to detect active coliforms
  - Real-Time Results calculated based off an Algorithm



- Acquired Proteus instrument beginning of January

- Site calibration
  - Minimum of 15 paired samples alongside Proteus unit (both fecal & *E.coli*)
  - Seasonal differences (dry/wet)
  - Local sites (3)
  - Data will help create an algorithm

- Scheduled start date
  - April 2, 2024 (first day of Contact Recreation Season)

- Side-by-side sampling throughout Contact Recreation Season
  - April-October 2024

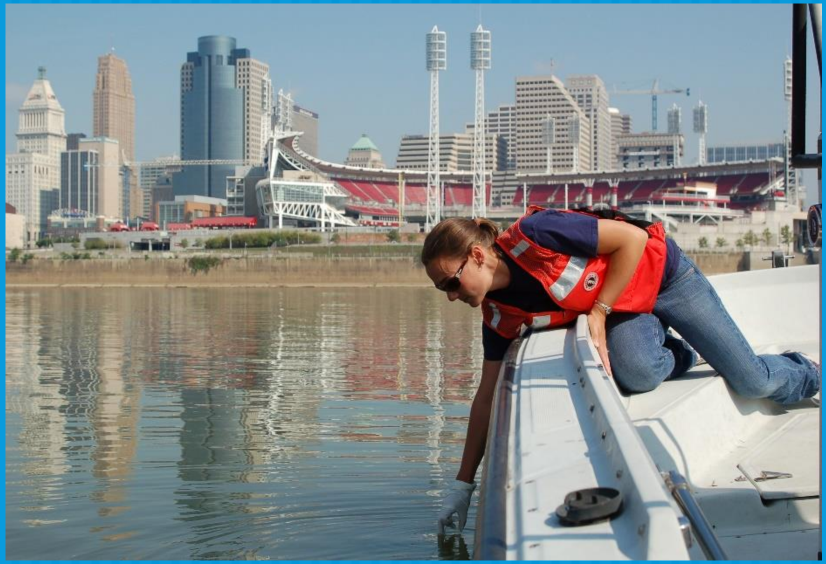
- Summary Report of data
  - After season ends more in depth look
  - Is this a possibility in the future

Questions?

Stacey Cochran

stacey@orsanco.org

513-231-7719



234th Technical Committee Meeting

Scott Mandirola, Chair
Presiding
February 6-7, 2024

The meeting will reconvene at 9:0 A.M. (Eastern) on October 11 at 9am and conclude by Noon. Below are a few tips to effectively navigate the meeting:

- ***Confirm that your first and last name is entered correctly in the GoToMeeting software.***
- ***Mute your microphone at all times unless speaking.***
- ***Disable your camera unless you are a Technical Committee member.***
- ***The presenter will prompt participants for verbal questions, or use the Chat feature.***
- ***Detailed GoToMeeting instructions and important information can be found in the previously emailed document, "ORSANCO Virtual Technical Committee and Commission Meeting Instructions."***

Agenda Item 10:
Waterbody Impairment Compilation Maps for the Ohio River Basin

Bridget Taylor, ORSANCO

Item 10: Waterbody Impairment Compilation Maps for the Ohio River Basin

Bridget Taylor (btaylor@orsanco.org)

OHIO RIVER VALLEY
AN INTERSTATE AGENCY
ESTABLISHED JUNE 30, 1948
WATER SANITATION COMMISSION

Intended Application of the Maps

Goal: Communicate to representatives the impaired waterways within their individual congressional districts

- Determine the total number of stream miles & lake acres in the Ohio River Basin (ORB)
- Determine the number of stream miles & lake acres assessed as impaired & good based on the appropriate state's 305b report in the ORB
- Determine the number of stream miles & lake acres that remain unassessed in the ORB
- Calculate proportions of impaired waterway

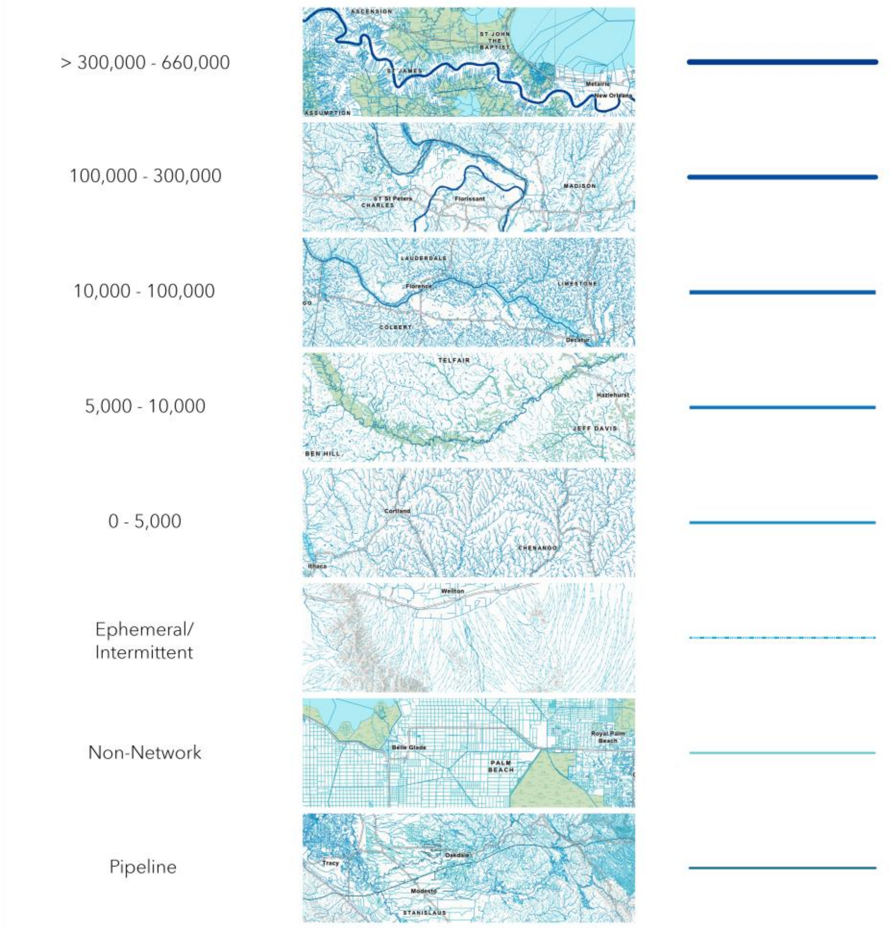
Two Spatial Data Sources

- National Hydrography Dataset Plus High Resolution (NDHPlus HR)
  - United States Geological Survey (USGS)'s geospatial dataset depicting the flow of water across the Nation's landscapes and through the stream network
  - The NHDPlus HR is built using the National Hydrography Dataset High Resolution data at 1:24,000 scale or more detailed, the 10 meter 3D Elevation Program data, and the nationally complete Watershed Boundary Dataset.
  - Data retrieved on October 4, 2023
- Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS)
  - Environmental Protection Agency (EPA)'s online system for accessing information about the conditions in the nation's surface waters
  - State water quality assessment decisions reported to EPA under the Integrated Report (IR), and Clean Water Act Sections 303(d) and 305(b)
    - Impaired, Good, or Unassessed
  - Data retrieved on October 20, 2023

NHDPlus High Resolution

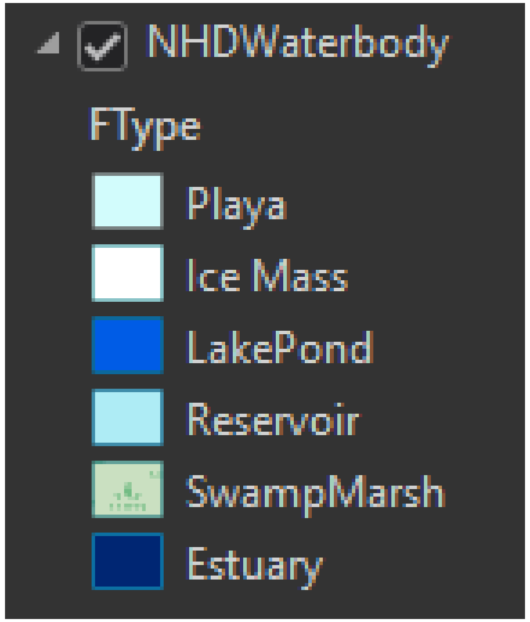
Streams

- From the ‘NetworkNHDFlowline’ and ‘NonNetworkNHDFlowline’ layers
- Lines are symbolized by annual flow in cubic feet per second and feature type for ephemeral, intermittent, non-network and pipelines (Image source).



Lakes

- From the ‘NHDWaterbody’ layer



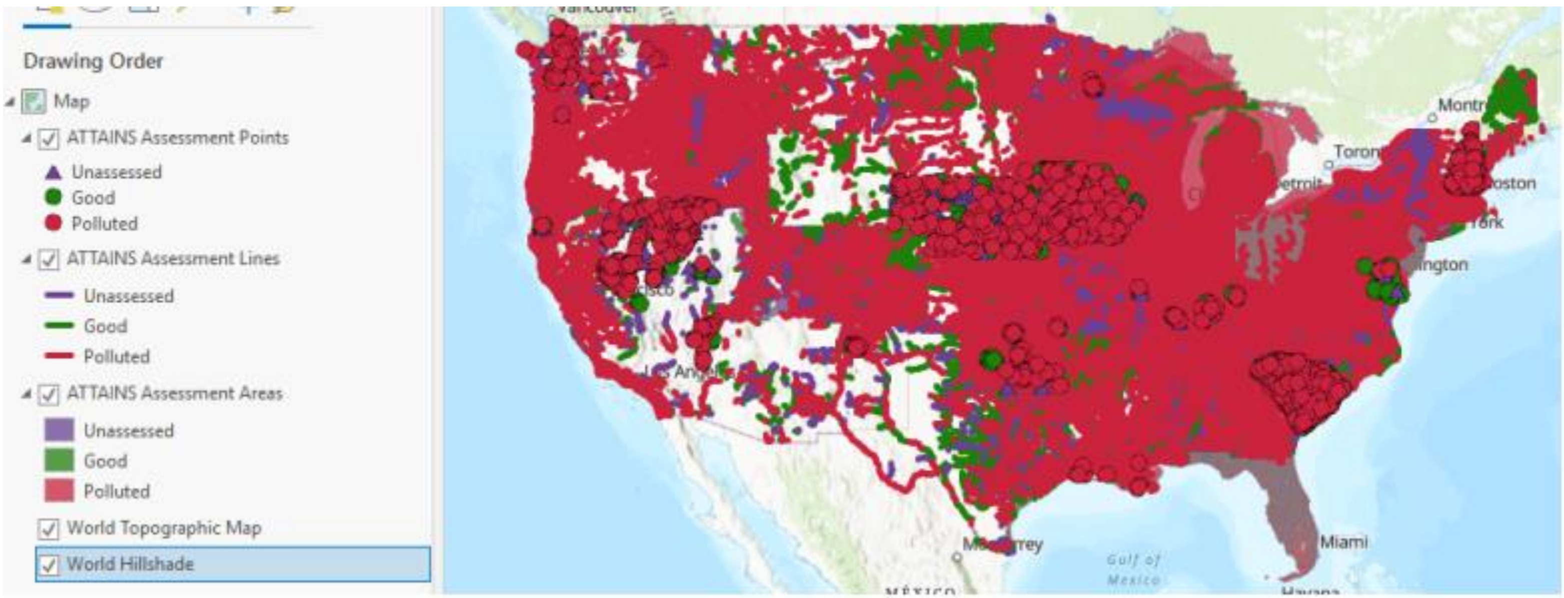
ATTAINS

Streams

- From the ‘ATTAINS Assessment Lines’ layer

Lakes

- From the ‘ATTAINS Assessment Areas’ layer



State	Year Assessed
Alabama (AL)	2020
Georgia (GA)	2022
Illinois (IL)	2022
Indiana (IN)	2022
Kentucky (KY)	2022
Maryland (MD)	2022
Mississippi (MI)	2022
New York (NY)	2018
North Carolina (NC)	2022
Ohio (OH)	2022
Pennsylvania (PA)	2022
Tennessee (TN)	2022
Virginia (VA)	2022
West Virginia (WV)	2022

ATTAINS

Streams

- From the 'ATTAINS Assessment Lines' layer

Lakes

- From the 'ATTAINS Assessment Areas' layer

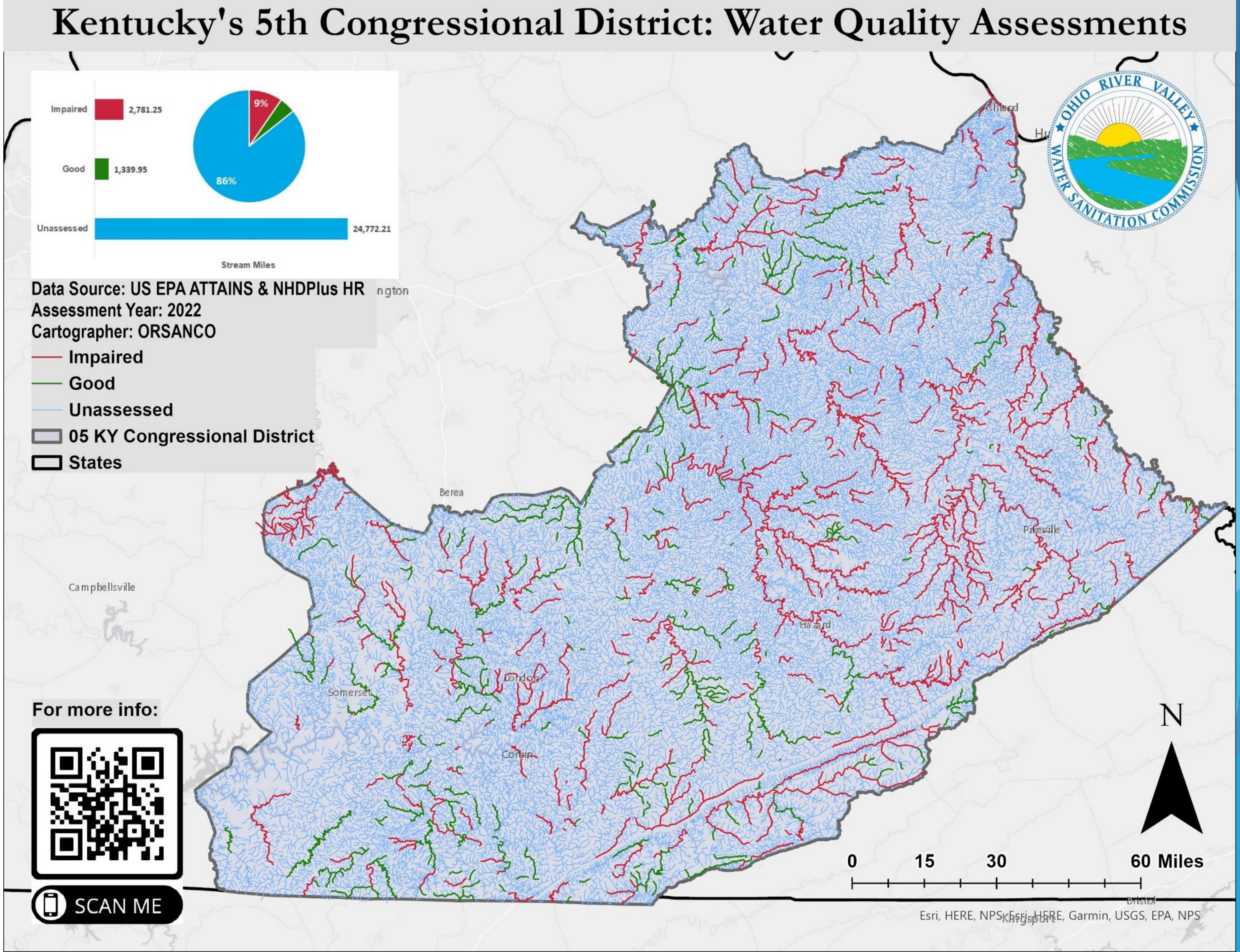
State	Year Assessed
Alabama (AL)	2020
Georgia (GA)	2022
Illinois (IL)	2022
Indiana (IN)	2022
Kentucky (KY)	2022
Maryland (MD)	2022
Mississippi (MI)	2022
New York (NY)	2018
North Carolina (NC)	2022
Ohio (OH)	2022
Pennsylvania (PA)	2022
Tennessee (TN)	2022
Virginia (VA)	2022
West Virginia (WV)	2022

- **All (Streams or Lakes):** This figure represents the total sum of all streams/lakes, including both impaired and good streams/lakes, as well as those that have not been assessed. This is the sum of all the stream miles within the basin and provides a comprehensive overview of the extent of water resources in the region. *Calculated from NHDPlus HR*.
- **Impaired:** *Do not meet the water quality standards* set by regulatory agencies. The pollutant causes of impairment are in graphical format by stream mile & lake acre. These streams & lakes are in need of remediation and restoration efforts to bring them back to a healthier state. *Calculated from ATTAINS*.
- **Good:** *Have been assessed and found to be in good condition*, meeting water quality standards and supporting healthy ecosystems. *Calculated from ATTAINS*.
- **Unassessed:** There is limited or *no available data on their current condition*. This could be due to a lack of resources, monitoring efforts, or data collection in these areas. Calculated by subtracting total streams/lakes by the sum of the impaired and good streams/lakes.
  - Unassessed = All – (impaired + good)

https://storymaps.arcgis.com/stories/b7314a84fb9f4abd80b96b9f456c1f81

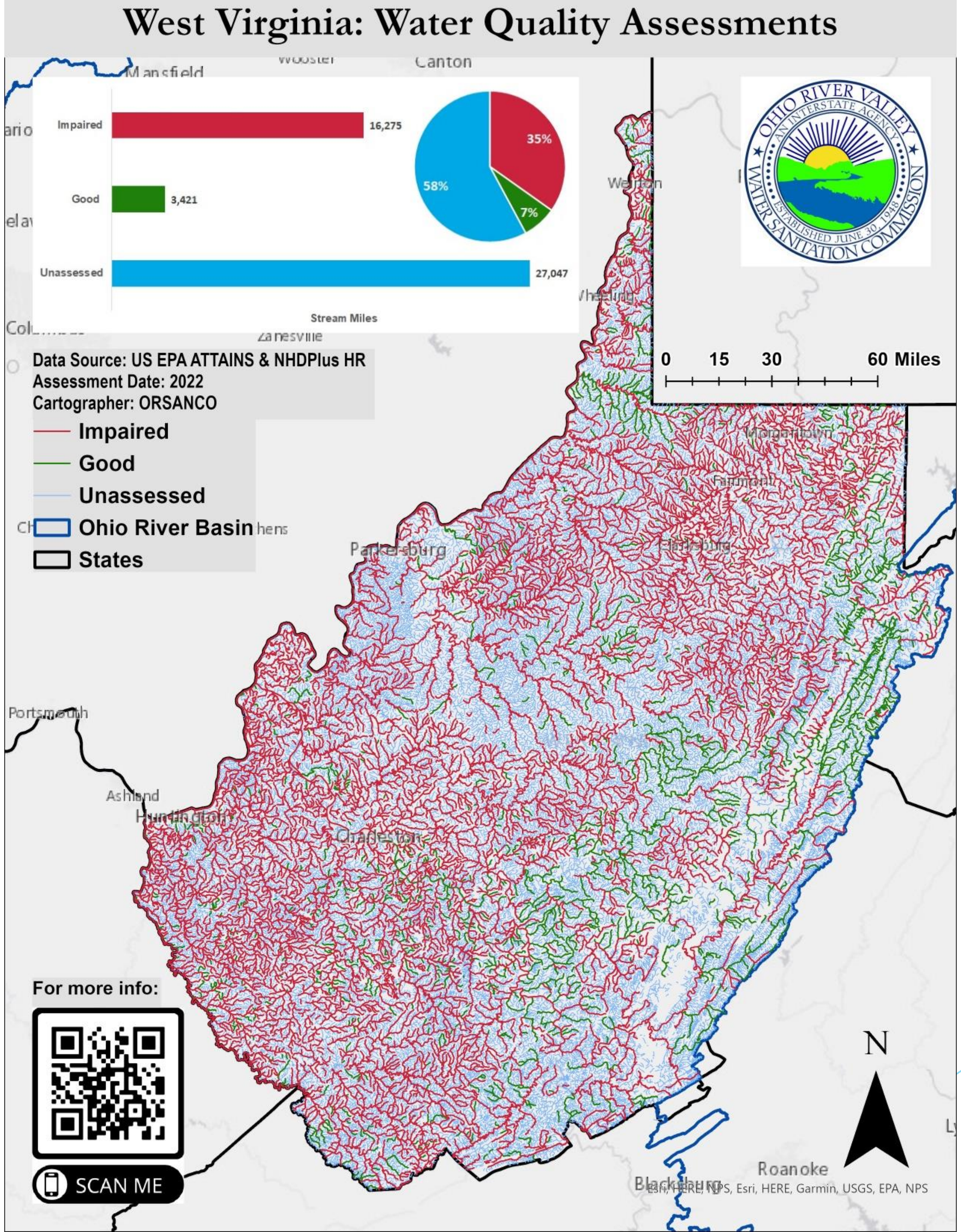
SCAN ME

Example



Kentucky's 5th Congressional District: Water Quality Assessments
Impaired
2,781.25
Good
1,339.95
Unassessed
24,772.21
Stream Miles
9%
86%
Data Source: US EPA ATTAINS & NHDPlus HR
Assessment Year: 2022
Cartographer: ORSANCO
Impaired
Good
Unassessed
05 KY Congressional District
States
For more info:
SCAN ME
OHIO RIVER VALLEY WATER SANITATION COMMISSION
Berea
Campbellsville
Somerset
London
Corbin
Hazard
Pikeville
N
0 15 30 60 Miles
Esri, HERE, NPS, Esri, HERE, Garmin, USGS, EPA, NPS

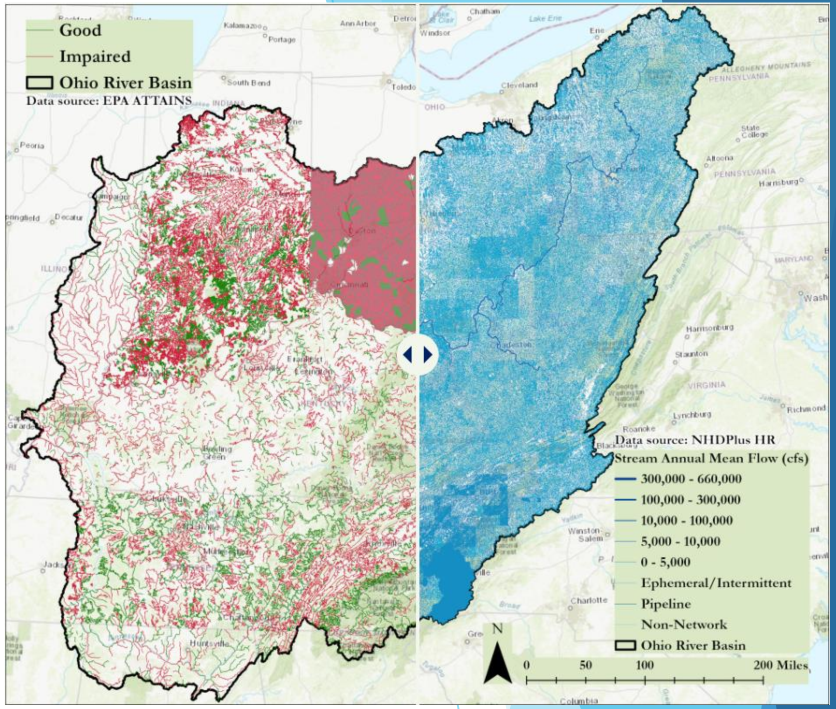
Example

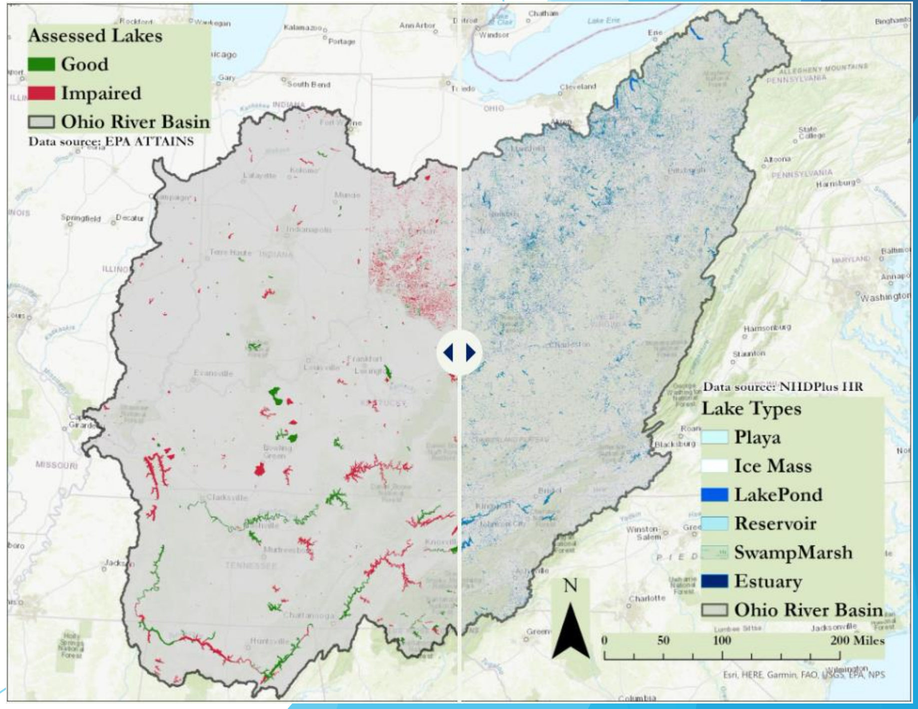


West Virginia: Water Quality Assessments
Impaired
16,275
Good
3,421
Unassessed
27,047
Stream Miles
35%
7%
58%
0 15 30 60 Miles
Data Source: US EPA ATTAINS & NHDPlus HR
Assessment Date: 2022
Cartographer: ORSANCO
Impaired
Good
Unassessed
Ohio River Basin
States
For more info:
SCAN ME
N
Canton
Mansfield
Zanesville
Parkersburg
Portsmouth
Ashland
Huntington
Charleston
Roanoke
Esri, HERE, NPS, Esri, HERE, Garmin, USGS, EPA, NPS

Feedback Requested

- Are these the best sources to represent your state?
  - USGS's 1:24K NHDPlusHR or a different stream layer be used?
- Is this the best way to approach congressional representatives & state senators to request funding?
- Layer recommendations
  - Should some stream types or lake types be omitted?
- Should anything else be included?





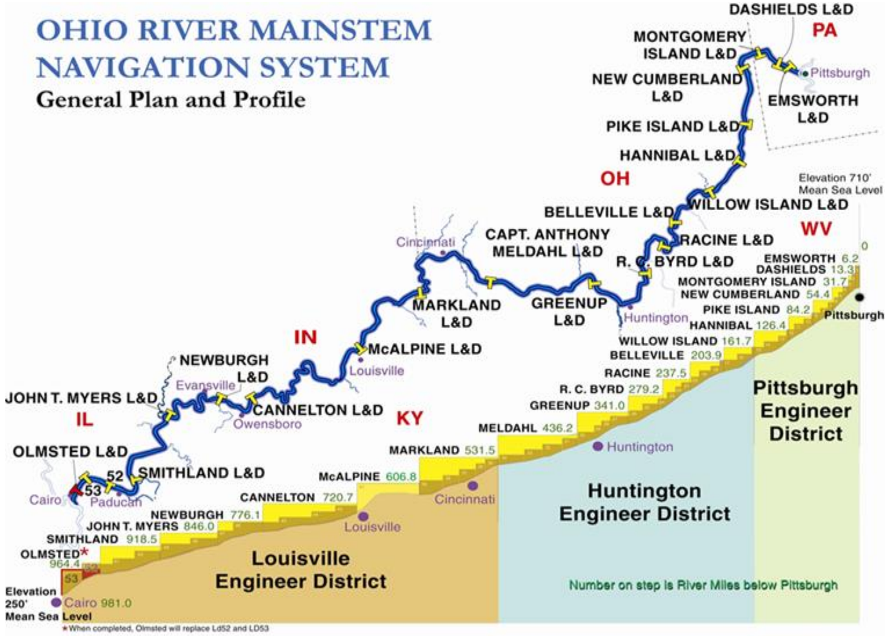
Agenda Item 11:
ORSANCO's Response to the East Palestine Derailment Using EPA's River Spill Model

Sam Dinkins, ORSANCO

Dr. James Goodrich, USEPA

ORSANCO's Response to the East Palestine Derailment Using EPA's River Spill Model

Jim Goodrich (USEPA/ORD), Sam Dinkins (ORSANCO), Jason Heath (ORSANCO), and Sudhir Kshirsagar (Global Quality Corp.)



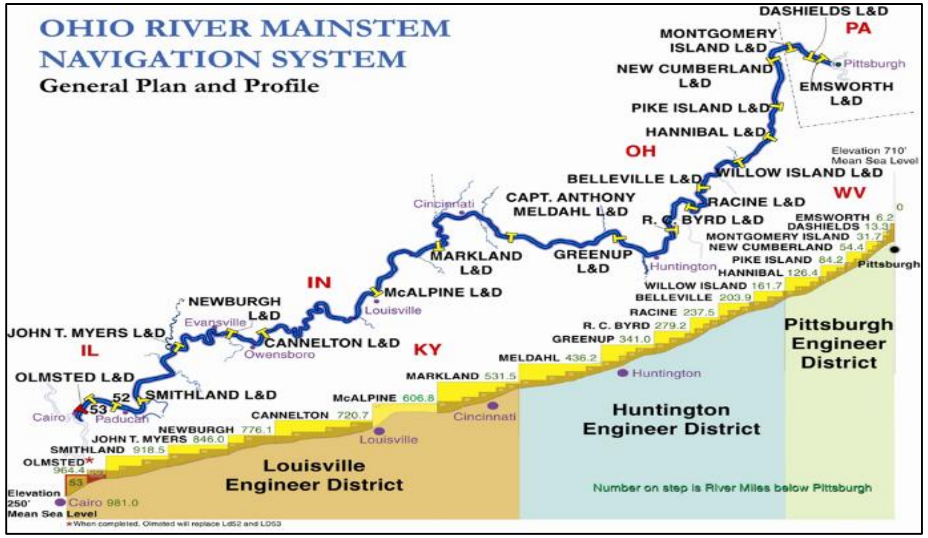
EPA United States Environmental Protection Agency

USEPA Riverine Spill Model Development

Riverine Spill Modeling System (RSMS) Software

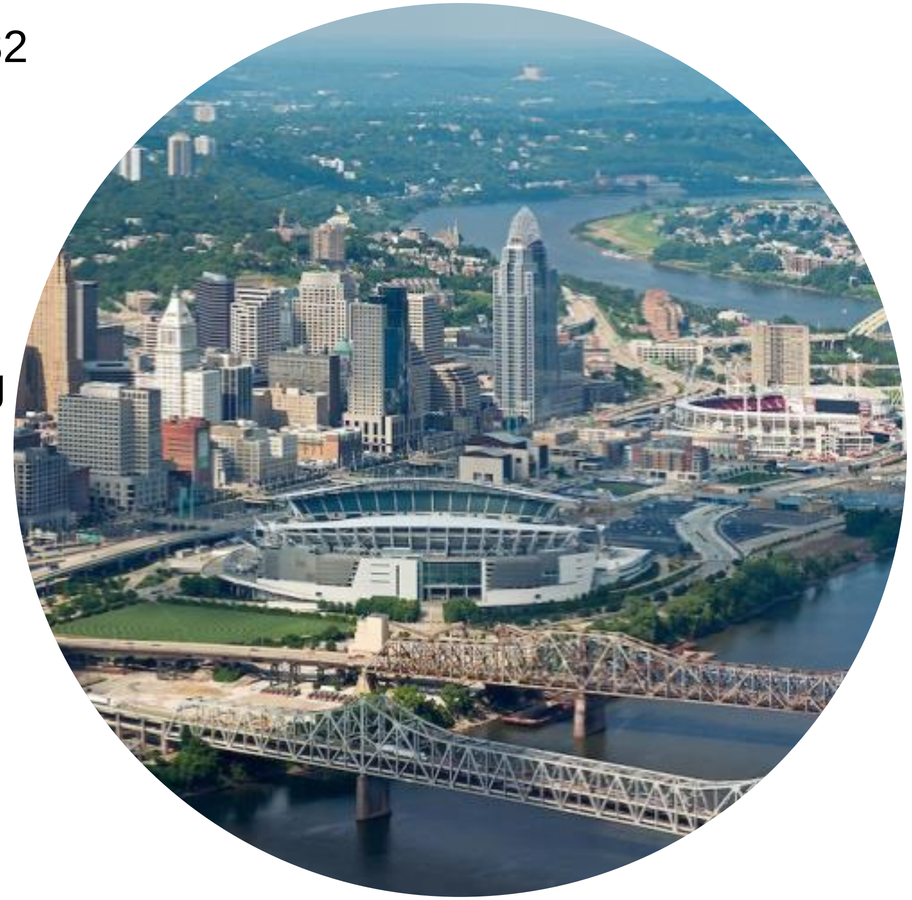
- Collaborative project with EPA, ORSANCO, GQC, and the US Army Corps of Engineers (USACE)
- ORD developed Cloud-based RSMS that simulates a 2-D spill transport
- RSMS uses real time river data from USGS and the USACE
- RSMS leverages the predicted river flows provided NOAA/USACE HEC-RAS
- When a spill happens, ORSANCO shares the RSMS predictions with water utilities to plan intake closures

- The model has been used to provide utilities decision making support during real spills on the Ohio River for the past thirty years
- The model can be expanded to other waterways



Source Water Quality is Vulnerable

- 981 navigable miles on the Ohio river and 2582 navigable miles counting all the 34 major tributaries.
- $43 B estimated value of commodities transported/yr.
- 180 M tons/yr. thru Ohio River Lock & dam system
- 5 M people depend the Ohio River for drinking water
- 37 drinking water intakes
- 38 power plants
- Almost 600 permitted industrial and municipal dischargers
- ~ 200 marinas
- 160 species of fish

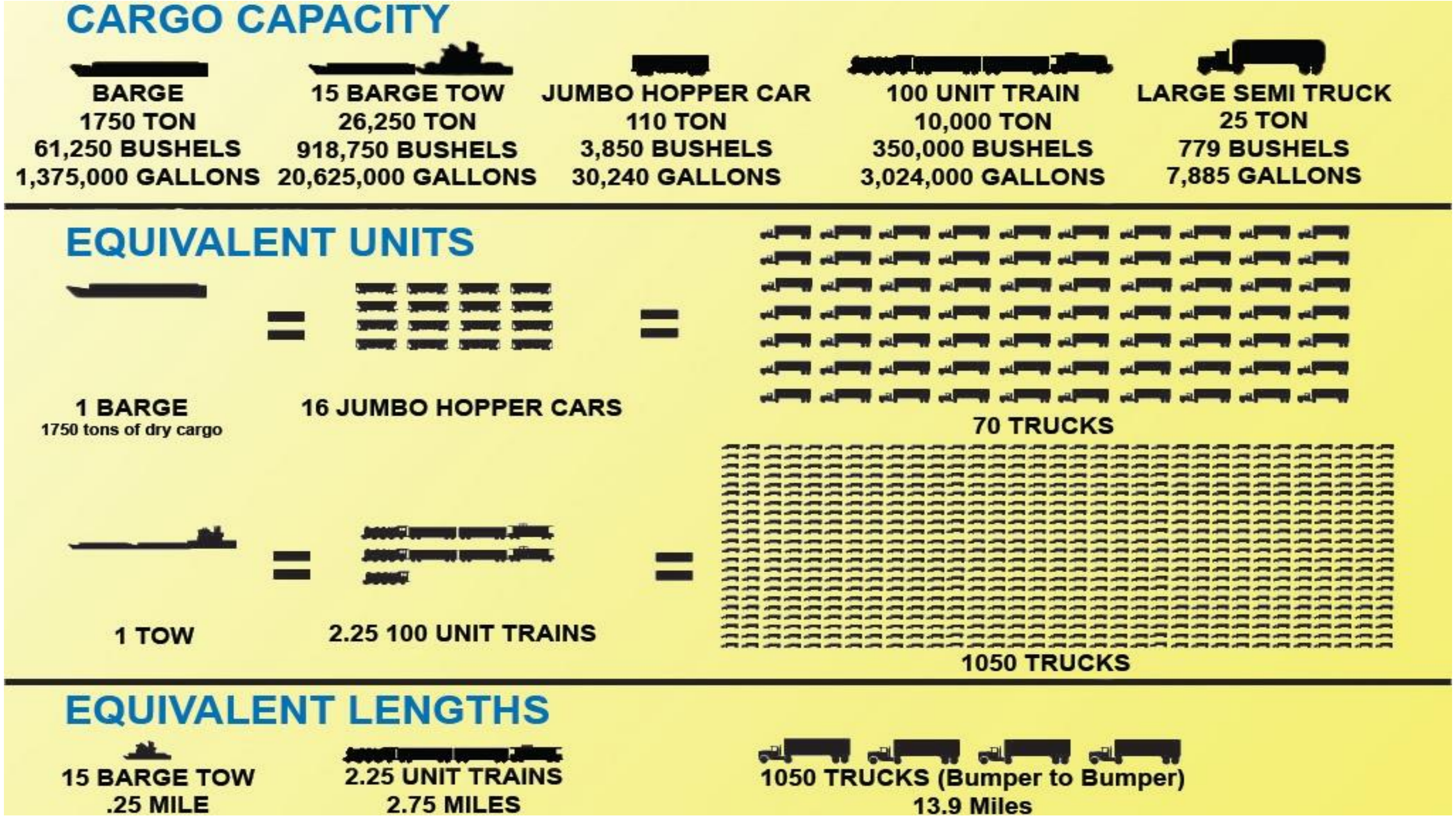


United States Environmental Protection Agency

Example Risks to the Ohio River

- Over 230 spills reported annually by National Response Center to ORSANCO
- Majority of spills were:
  - Unknown sheen
  - Vessel related
  - Fixed facility
- ~ 35 spills from mile mark 900-949.9 (Pittsburgh)
- 36 different materials spilled in Ohio River in 2016
- 75 highway and bridge crossings over the Ohio River
- Pipeline crossings, Too Numerous To Count.

What Could be the Magnitude of a Spill?



Goals for RSMS

On demand real time river spill modelling:

- Enable Water Treatment Plant Decision Makers to get quick, accurate, and accessible information about spills within their source water supply network.
  - Input spill volume and location (Mile marker) and push the button.
  - Information on leading edge and trailing edge and maximum concentration expected at intake.
  - Are existing plant treatment systems sufficient?

Future: Be able to model and predict worst case spill events to increase Water System resiliency. Also an excellent table-top training opportunity

Riverine Spill Modeling System

RSMS Quickstart Guide: https://rsms.eastus.cloudapp.azure.com/

Simulating a spill is easy

3. Click on the **Spills** Page.

   The active spill will be shown highlighted (Figure 3).

Home About Contact **Spills** Parameters Results Flows Barges Delete Login Register Role Log off

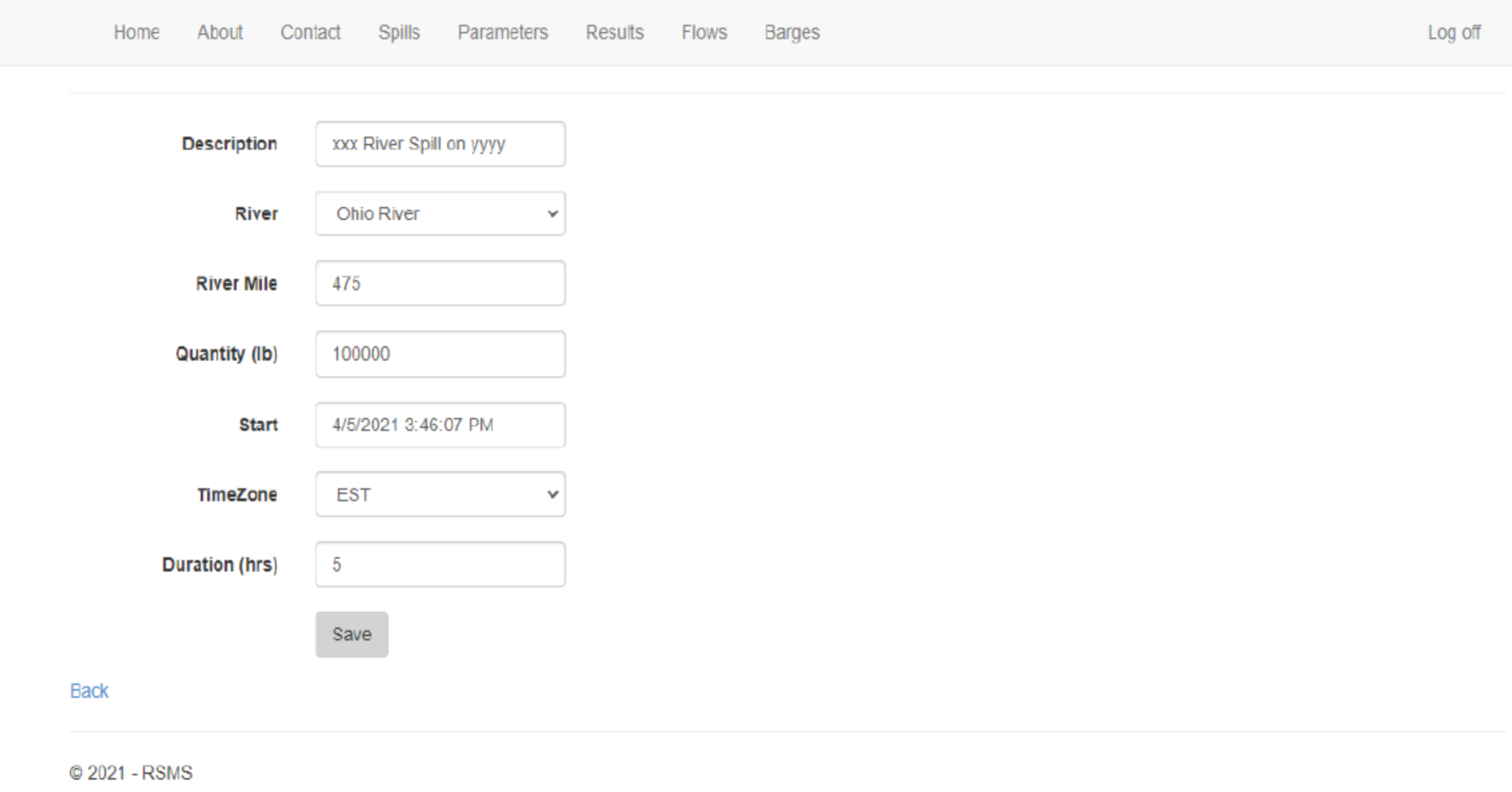
View Edit Delete Create Simulate with Parameter ID 1

Spill ID	Description	River	River Mile	Quantity (lb)	Start	Time Zone	Duration (hrs)
82	xxx River Spill on yyyy	Ohio River	475	100000	3/17/2021 11:26:59 AM	EST	5
81	xxx River Spill on yyyy	Ohio River	475	100000	3/17/2021 11:26:48 AM	EST	5
80	test River Spill on 3/17	Ohio River	475	100000	3/17/2021 7:19:44 AM	EST	5
56	BOSC Kanawha River Spill	Kanawha River	15	1000000	12/7/2018 9:23:04 AM	EST	5
55	Louisville Christmas Spill	Ohio River	478	4000000	12/20/2017 12:00:00 PM	EST	5
50	Test Marathon Refinery Spill	Ohio River	318	100000	3/1/2017 1:53:48 PM	EST	5
10	**Microcystis Bloom - Aug-Sept 2015**	**Ohio River**	**341**	**10000**	**9/28/2015 4:00:00 AM**	**EST**	**5**
1	Elk Spill	Kanawha River	54	80000	1/9/2014 8:00:00 AM	EST	24

View Edit Delete Create Simulate with Parameter ID 1

Create a Spill File

To edit a spill, click on that row and then click on the **Edit** action link to go to the **Edit** page and use the form as shown in (Figure 6)



United States Environmental Protection Agency

Active Parameters

Parameter ID	Description	River Stations	Dispersion Factor	Decay rate (/day)	Simulation Duration (days)	Simulation Time step (hours)	Flow Tolerance (cfs)	Concentration Tolerance (mg/l)	Minimum Velocity (ft/s)	Flow Multiplier	Dead Zone Mainstem Average Velocity (cfs)	Dead Zone Exchange Rate	Dead Zone Flow Area Fraction
1	Default Simulation Parameters	49	0	0.00000	3	1	10	1	0.1	1	1	0.0000045	0.1
35	Simulation Parameters	50	0	0.00000	2	1	10	0.001	0.1	1	1	0.0000045	0.1
34	Test Simulation Parameters	150	0	0.00000	7	1	10	0.001	0.1	1	1	0.0000045	0.1
33	Simulation Parameters	80	0	0.00000	7	1	10	0.001	0.1	1	1	0.0000045	0.1

United States Environmental Protection Agency

Edit Parameters

Description	Simulation Parameters
River Stations	50
Dispersion Factor	0
Decay rate (/day)	0.00000
Simulation Duration (days)	3

Hide Advanced Settings

Simulation Time step (hours)	1
Flow Tolerance (cfs)	10
Concentration Tolerance (mg/l)	0.001
Minimum Velocity (ft/s)	0.1
Flow Multiplier	1

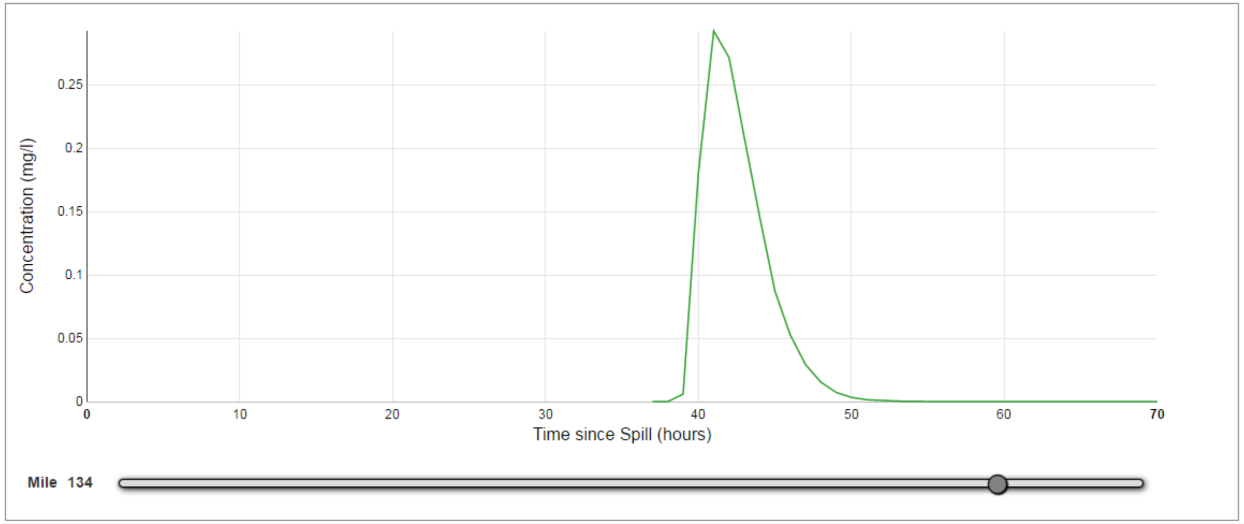
Dead Zone

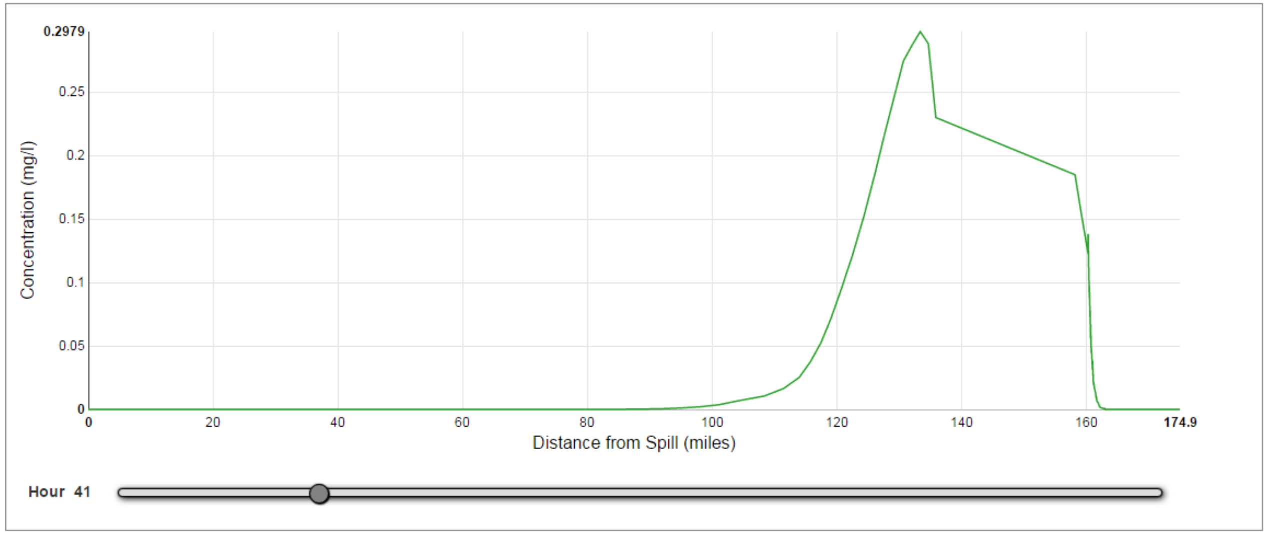
Mainstem Average Velocity (cfs)	1
Exchange Rate	0.0000045
Flow Area Fraction	0.1

Create

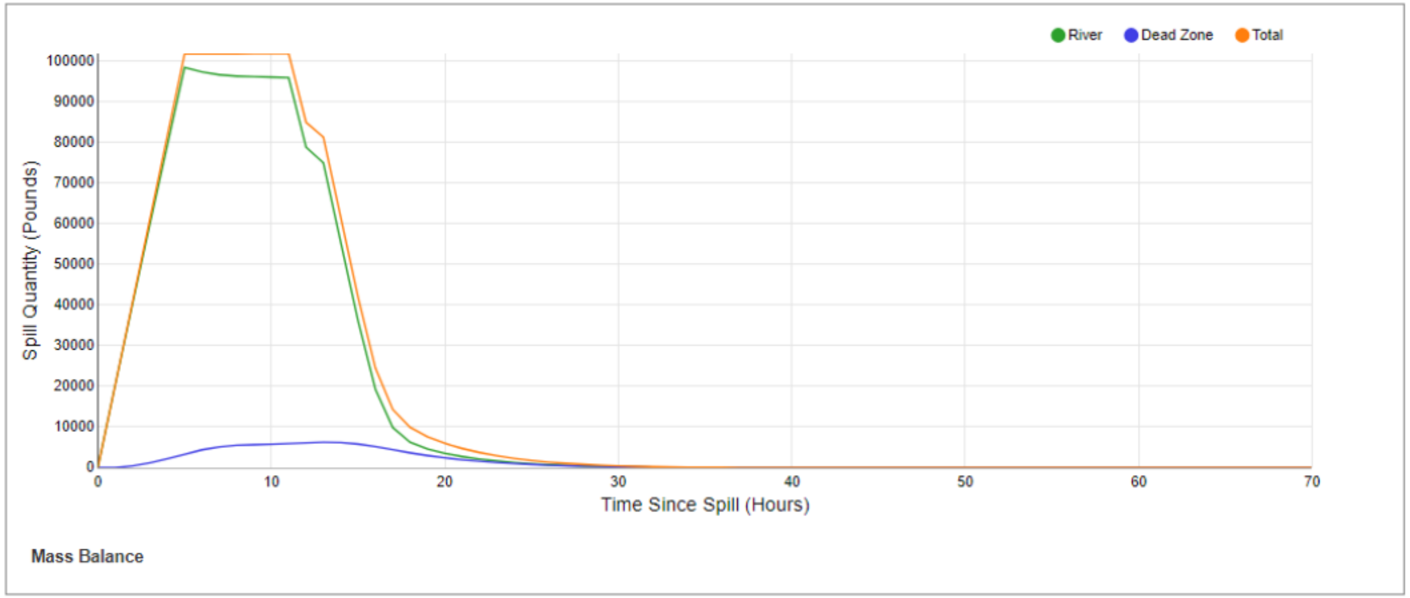
Back

Spill Simulation by Time & Location





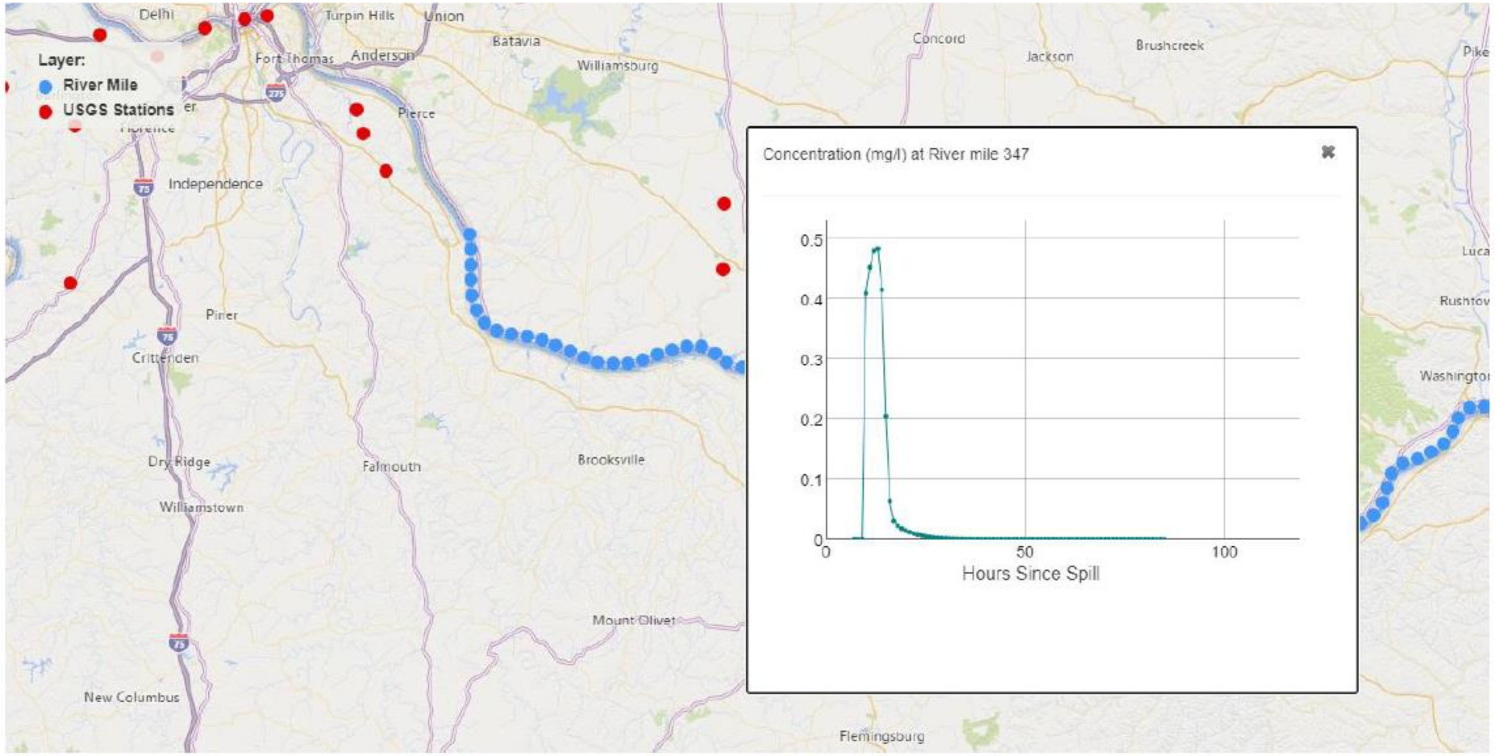
Mass Balance of Plume



Back

Interactive Results

Clicking on a blue pushpin will show a graph of the Spill plume at that river mile (Figure 22).



UAN Barge Incident – Initial Report

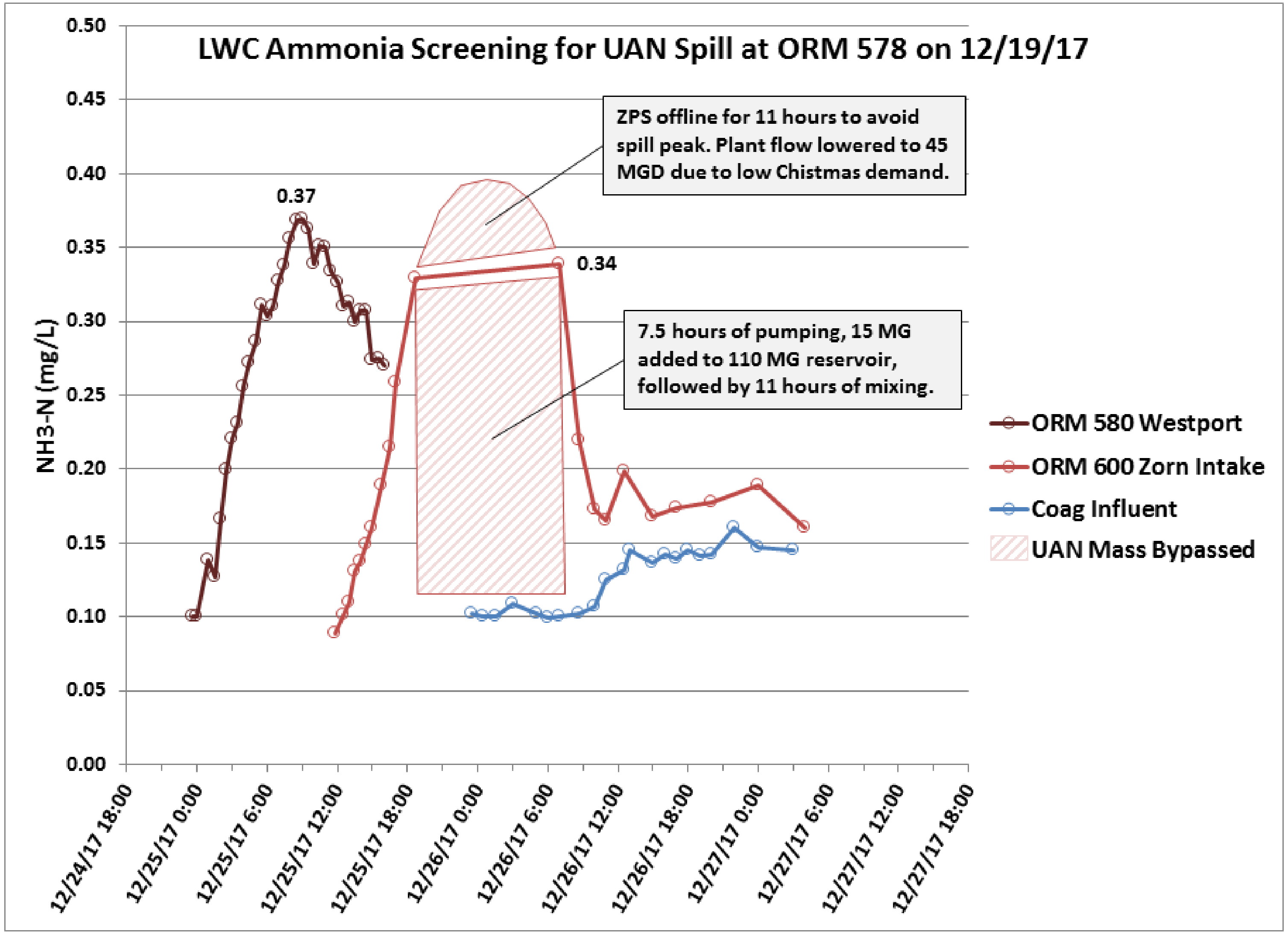
- Notification – December 19, 2017
- NRC report indicated barge "cracked in half" while offloading (ORM 478.7)
  - Urea ammonia nitrate was discharging into the river
  - Amount of release initially not reported

- *Time-of-Travel modeling requested by KY DEP, LWC, USCG, Clifty Creek Power Plant*

Fixed Station Monitoring

- Initial time-of-travel model estimated travel time to Louisville at 9 days (i.e. 12/28)
- Precipitation increased river velocities significantly.
  - *Moved up projected arrival at Louisville by 2.5 days (i.e. mid-day on 12/25)*

Plume Avoided



Application to East Palestine Incident

EPA United States Environmental Protection Agency

Key Questions During Spill Response?

- What?
- Where?
- How much?
- Actions taken?
- Concentration?
- When will it arrive at downstream intakes?
- How long is the plume?

Initial Details – Train Derailment

Feb 3, 2023 – **Train derails in East Palestine, OH**

- Large fire reported
- Some cars carrying unknown hazmat
- Reported as "POTENTIAL RELEASE"

Melissa Smith via AP

Feb 4, 2023 –

- Fire ongoing, but reduced
- 5 vinyl chloride tankers derailed
- Other hazmat railcars also burned
- Unknown materials/quantities released
- Sulphur Run to Leslie Run impacted by runoff
- Fish kill observed
- Incident location is 19 stream miles to the Ohio River

United States Environmental Protection Agency

Many Unknowns

Feb 5, 2023 –

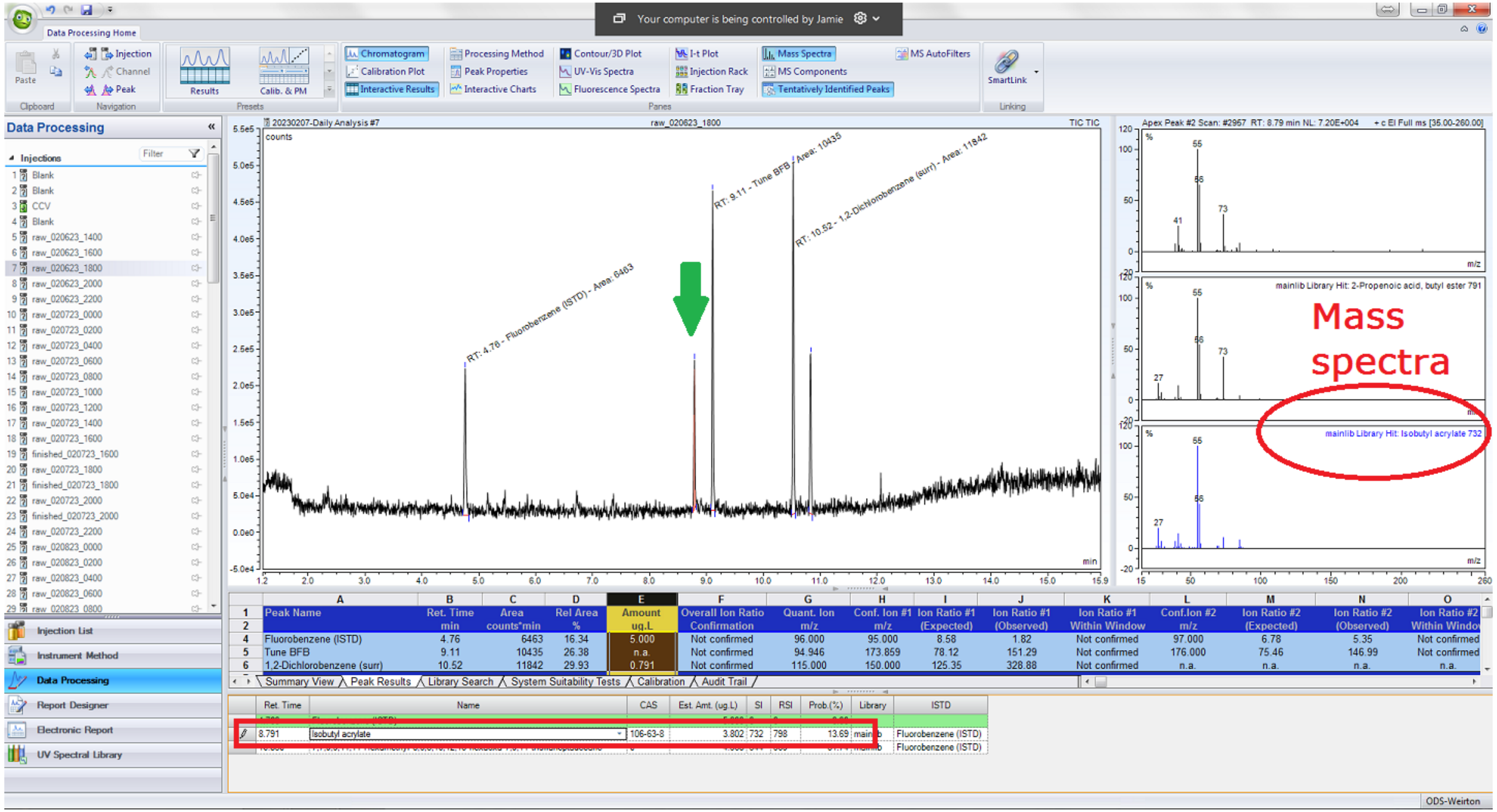
- Pressure buildup noted in vinyl chloride railcar
- Water quality sampling of nearby creeks underway

Feb 6, 2023

- Products being transported include:
  - Vinyl chloride
  - Butyl acrylate
  - Benzene residue
  - Combustible liquids
- Volumes released unknown
- Unknown if materials will reach the Ohio River
- Weirton, WV ODS station running samples every 2 hours

Gene J. Puskar / AP

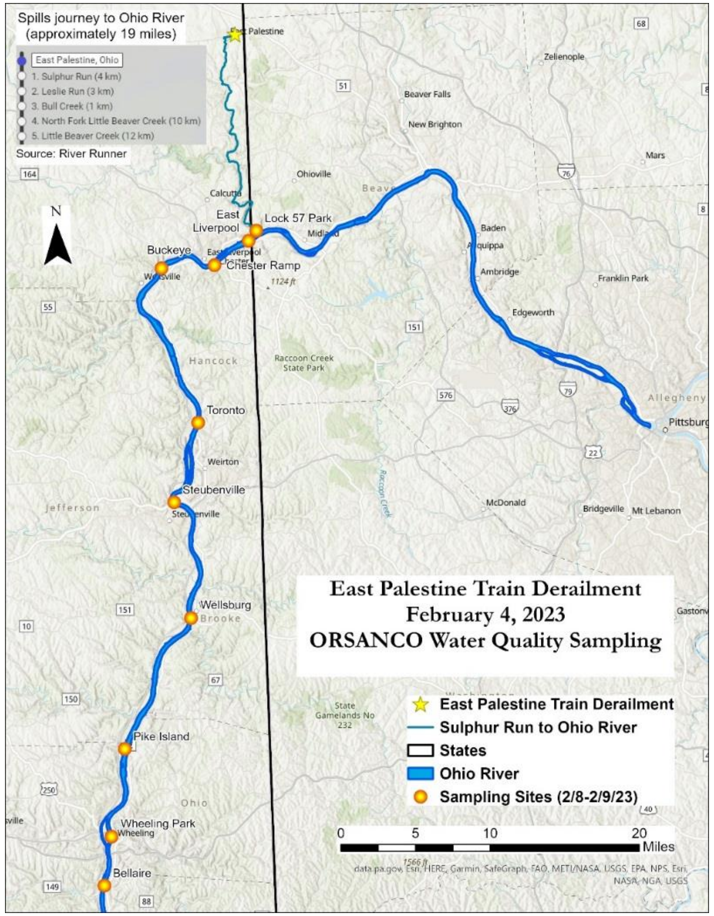
Initial Detection in Ohio River Weirton, WV Feb 6, 2023 at 1600



Ohio River Sampling Initiated

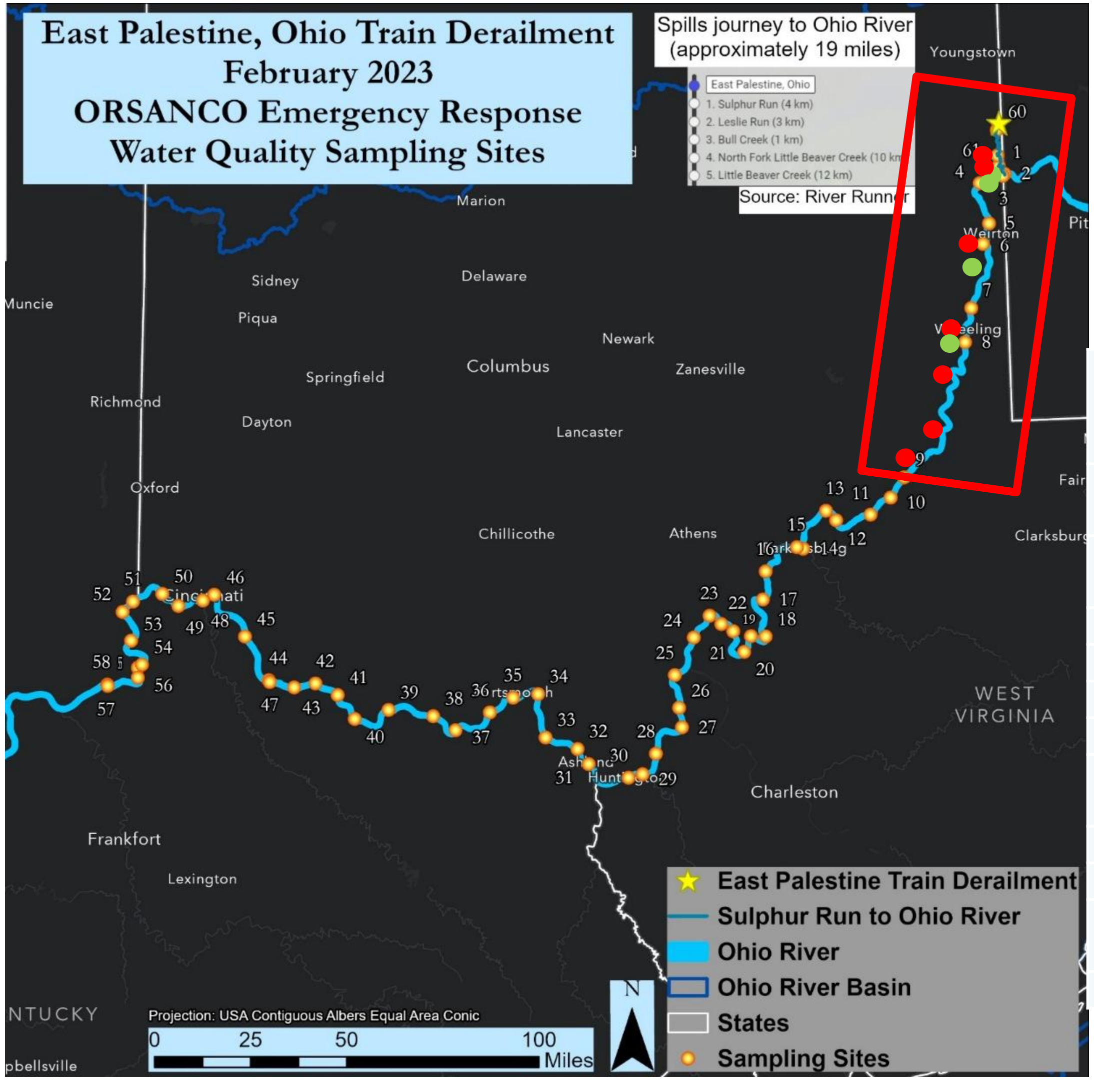
Feb 8-10, 2023 –

- ORSANCO conducts sampling
  - –Little Beaver Creek (PA) to Sistersville, WV
  - –Approximately 100 river miles
- Define where spill plume is located
- Utilized Organics Detection System to provide quick screening results



United States Environmental Protection Agency

February 10, 2023



● Detection

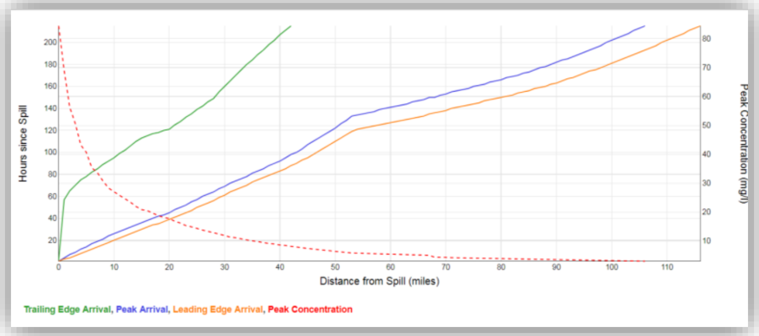
● Non-Detect

Surface Grab Samples analyzed at Wheeling ODS; presence/absence

Ref	City	Mile Point	State	Date	Time	n-Butyl Acrylate (p/a)
1	Grimms Bridge	Beaver 3.0	OH	2/10/2023	1350	present
2	Lock 57 Park	Beaver 0.2	PA	2/10/2023	1300	present
3	East Liverpool	40.2	OH	2/10/2023	1420	absent
	Chester	43.0	OH	2/10/2023	1125	absent
6	Steubenville	65.3	PA	2/10/2023	1605	present
	Follansbee	70.8	OH	2/10/2023	1300	absent
	Wheeling River Grab	86.0	WV	2/10/2023	1600	present
8	Bellaire	93.9	WV	2/10/2023	1715	absent
	Moundsville	101.7	WV	2/10/2023	1750	present
	New Martinsville	126.0	WV	2/10/2023	1900	present
	Sisterville	137.2	OH	2/10/2023	1945	present

Recap: Time-of-Travel Modeling

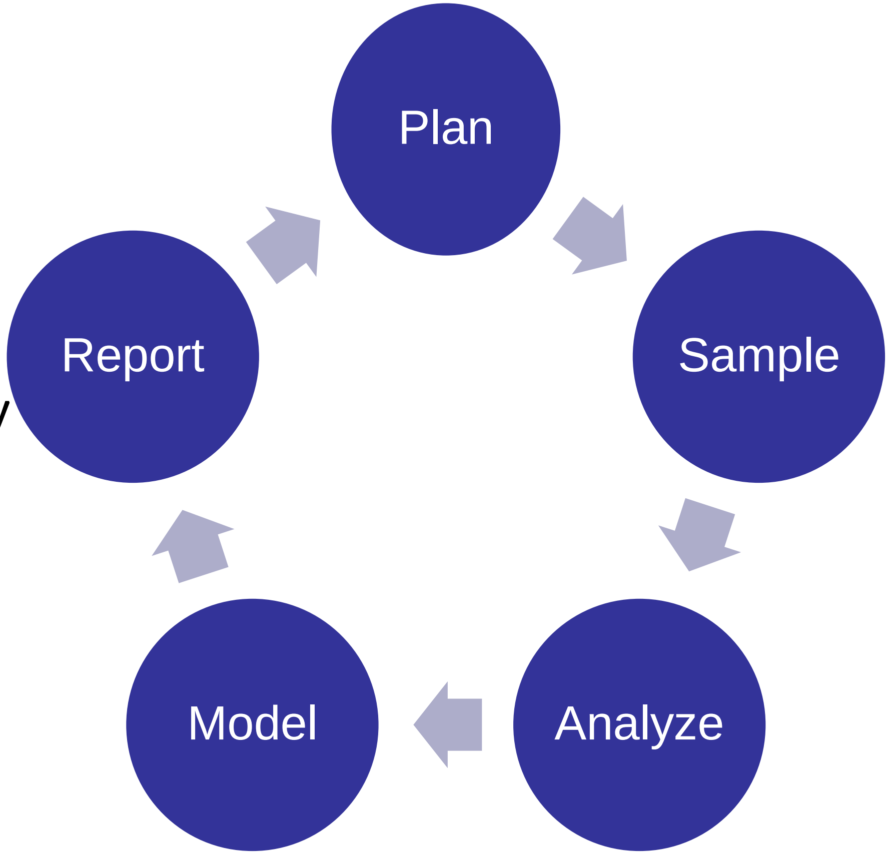
- Ohio River Spill Modeling System
  - Input date, time, amount, duration, decay
  - Uses daily HEC-RAS flow file from NWS
- Predicts plume time-of-travel
  - Leading edge; peak; trailing edge
- Estimates pollutant concentration
- Utilized to:
  - Inform water utilities and others of spill location
  - Inform sampling crews where to monitor



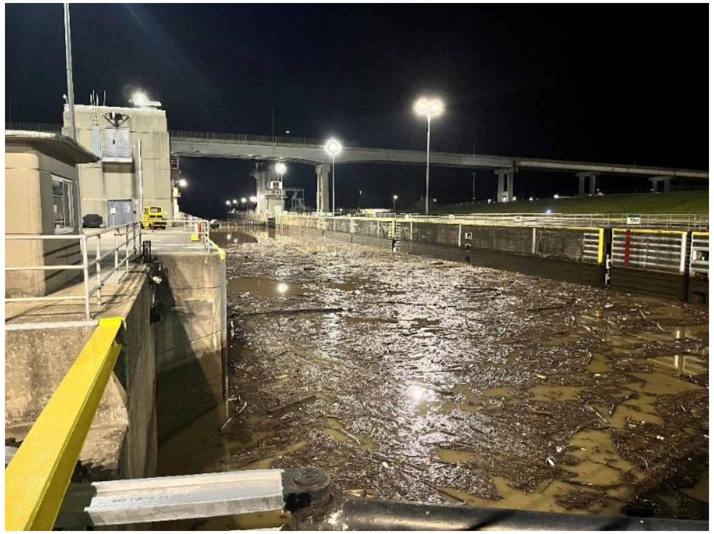
Tracking Leading Edge

Feb 11-19, 2023 –

- Transitioned sampling to tracking leading edge
  - Sampled 50 to 120 miles per day
  - Early on plume traveled ~25 miles/day
  - Later, velocities increased to ~100 miles/day
- Modeling informed water utilities and field sampling crews



Downstream Tracking Concludes:



Feb 19-20, 2023 –

- Fixed station sampling at Markland Locks & Dam
  - ~500 miles downstream of derailment
  - Sampled every two hours from lockwall
  - Samples analyzed by Louisville Water

Feb 21-22, 2023:

- Fixed station sampling at Cannelton Locks & Dam
  - ~700 downstream of derailment
  - Sampled every two hours from lockwall
  - Samples analyzed by Evansville Water

All samples from Markland & Cannelton non-detect

The Bottom Line

- River systems and inland waterways in US are vital to commerce, jobs (Navigation), power supply, recreation, and drinking water supply (Public Health)
- Accidental spills and releases are already affecting their ability to provide navigation and clean water supply (Homeland Security)
- Threat to drinking water safety and Homeland Security greatly underestimated
- We are building a software product with the Ohio River Valley Water Sanitation Commission (ORSANCO) for State Emergency Response Agencies, Federal On-Scene Coordinators, the Coast Guard, and Water Utilities
- Tool enables emergency responders and water utilities to know when and for how long to close river intakes and adjust treatment operation in response to spills
- Tool also enables preparation and training for potential worst case scenarios and long-term asset management and resilience planning

Research Needs

- Verification/calibration of model time-of-travel based on E. Palestine and other spills
- Backcasting mode to investigate potential sources of unknown spills
- Understand the effects of dam aeration and turbulence on contaminants
- Sensitivity analysis of model input variables
- Portable water quality GC evaluations to enable faster modeling results

Thank You!

- Jim Goodrich
  - Goodrich.james@epa.gov
- Sam Dinkins
  - sdinkins@orsanco.org
- Jason Heath
  - jheath@orsanco.org
- Sudhir Kshirsagar
  - sudhir@gqc.com

Agenda Item 12:
Source Water Protection & Emergency Response Programs Update

Sam Dinkins, ORSANCO

SOURCE WATER PROTECTION & EMERGENCY RESPONSE

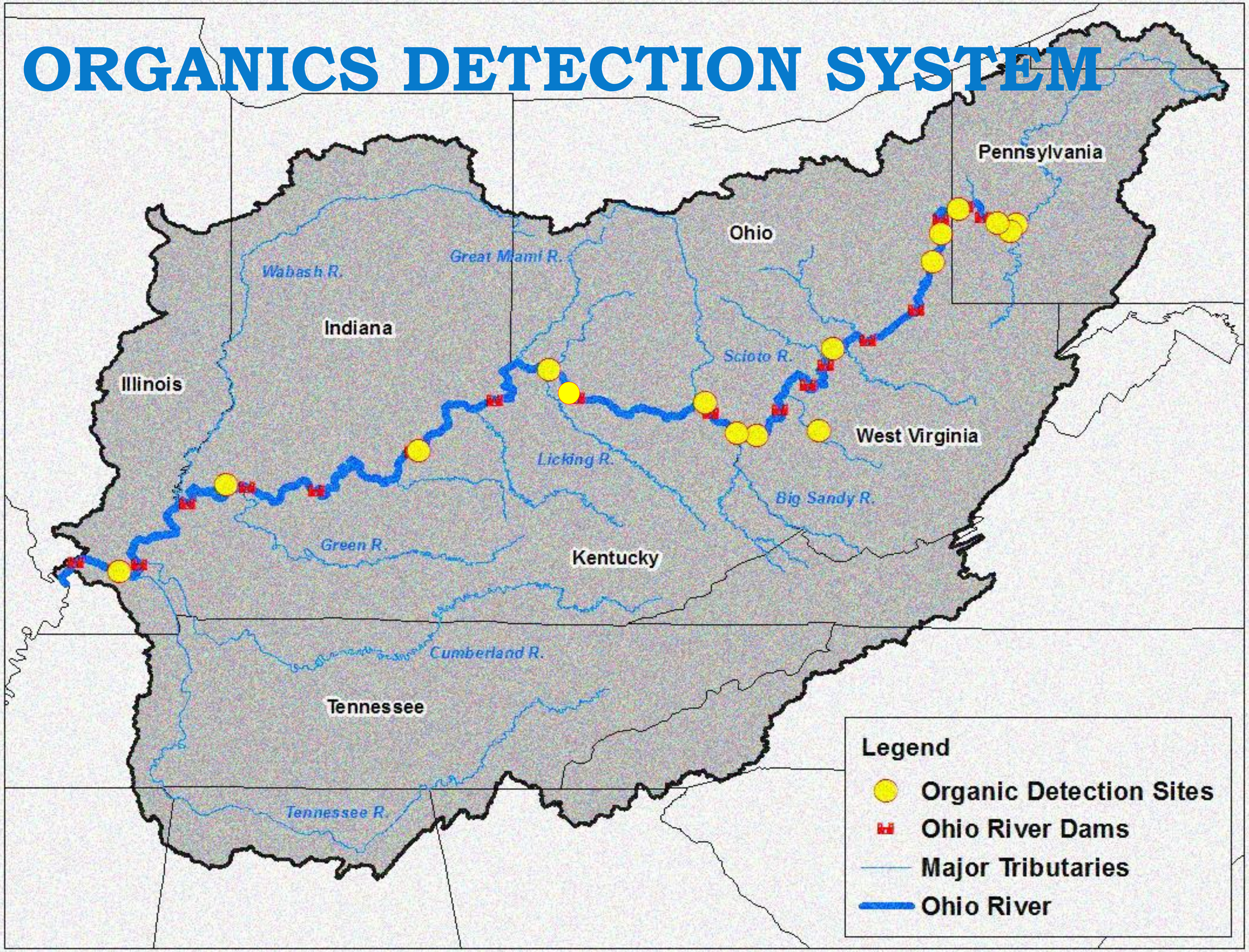
Technical Committee

February 6-7, 2024

OUTLINE

- Source Water Protection
  - Organics Detection System Status
  - Upper Ohio River Basin Activities
- Emergency Response
  - Mahoning River Benzene Detections
  - East Palestine

ORGANICS DETECTION SYSTEM



ODS Updates

1. PWSA
   - Donated GC/MS
   - Installed at West View
2. Parkersburg, WV
   - Purchased new GC/MS
3. Maysville to TMU
   - Relocated to Thomas More University Field Station
4. Louisville
   - LWC purchased GC/MS

UPPER OHIO RIVER BASIN SOURCE WATER PROTECTION

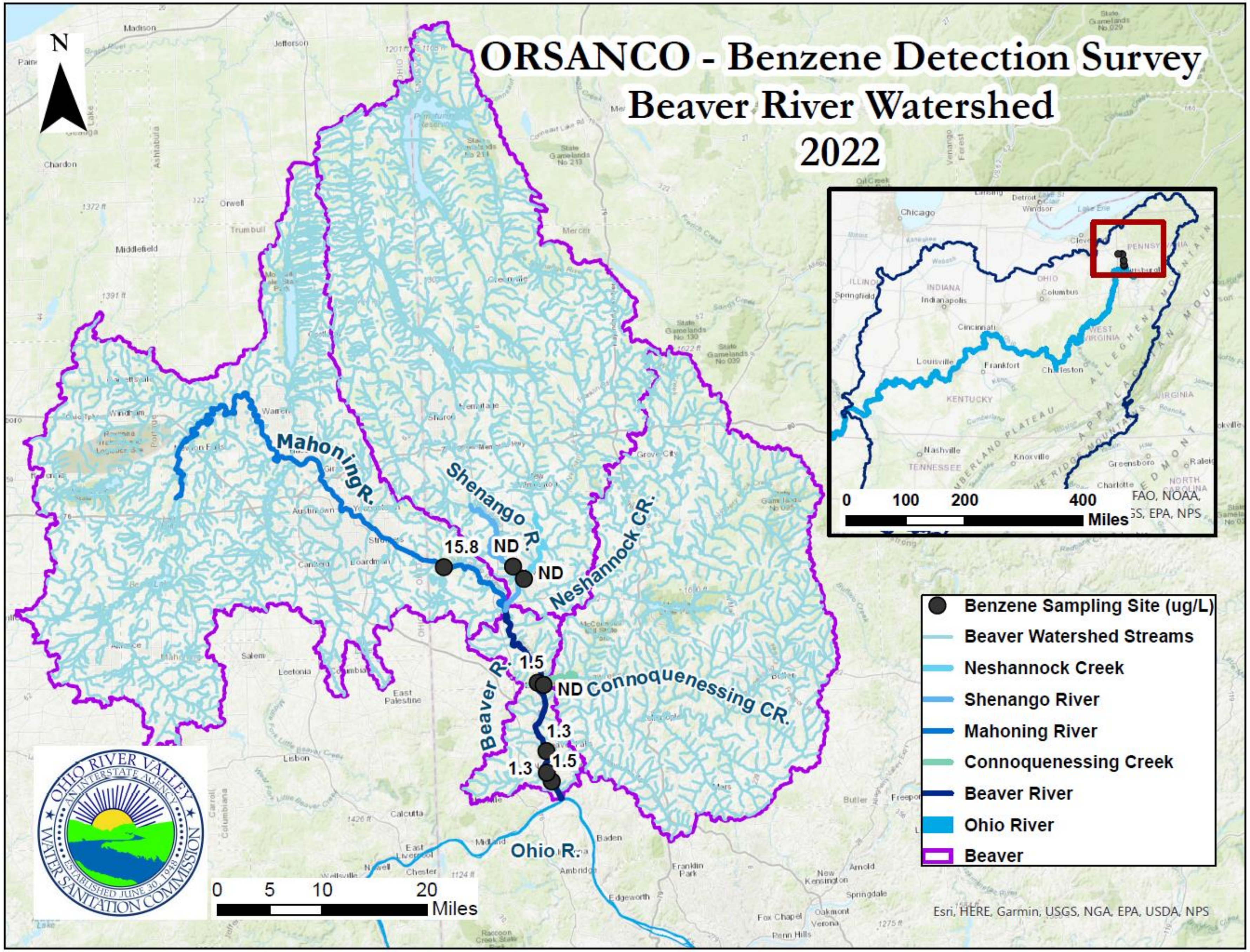
- Exploring potential expanded role for ORSANCO to address source water protection needs in upper basin

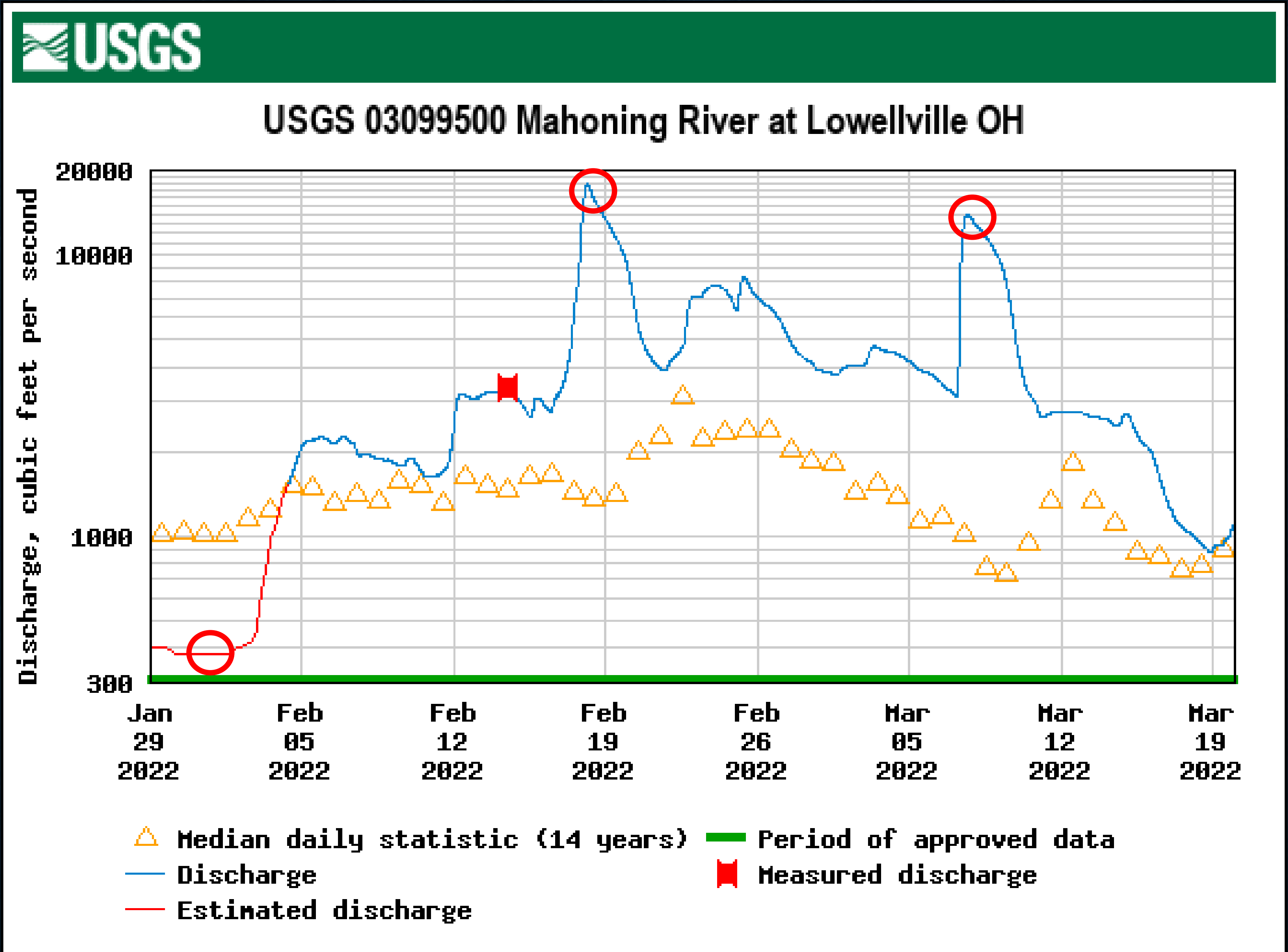
- Potential areas for expanded activities ???
  - Create Southwest PA Water Users Committee
  - Develop headwaters spill notification directory
  - Extend spill notifications to upper basin tributaries
  - Extend spill response services to tributaries
  - Extend source water protection monitoring to tributaries
- Ongoing discussions regarding need/desire and possible funding mechanisms

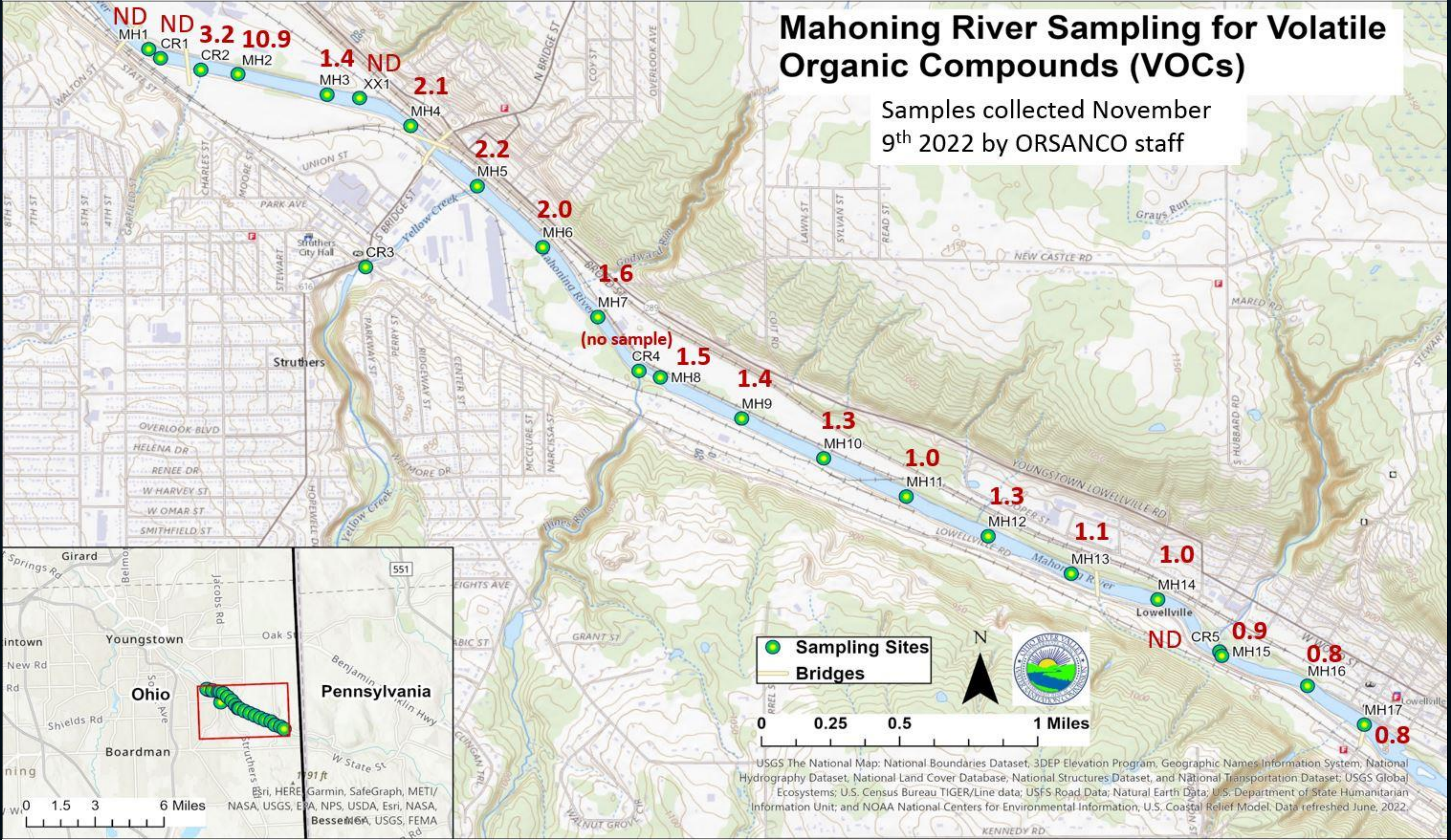
MAHONING RIVER BENZENE DETECTIONS

- Feb 1, 2022: Benzene & toluene first detected at Midland, PA
- Subsequent detections at numerous downstream ODS stations
- Source isolated to 4-mile stretch of Mahoning River
- Detections persisted for months
- Detections resumed during winter months
- On-going investigation to determine specific source





ORSANCO - Benzene Detection Survey
Beaver River Watershed
2022
N
Mahoning R.
Shenango R.
Neshannock CR.
Connoquenessing CR.
Beaver R.
Ohio R.
15.8
ND
ND
1.5
ND
1.3
1.3
1.5
0 5 10 20 Miles
0 100 200 400 Miles
Benzene Sampling Site (ug/L)
Beaver Watershed Streams
Neshannock Creek
Shenango River
Mahoning River
Connoquenessing Creek
Beaver River
Ohio River
Beaver
Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
OHIO RIVER VALLEY
AN INTERSTATE AGENCY
WATER SANITATION COMMISSION
ESTABLISHED JUNE 30, 1948

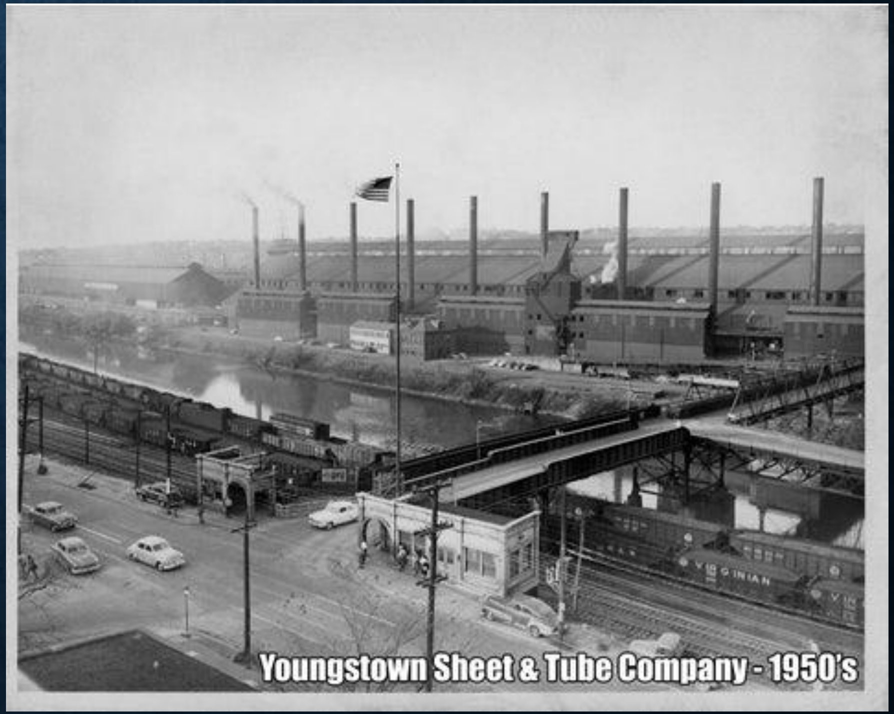

USGS
USGS 03099500 Mahoning River at Lowellville OH
Discharge, cubic feet per second
20000
10000
1000
300
Jan 29 2022
Feb 05 2022
Feb 12 2022
Feb 19 2022
Feb 26 2022
Mar 05 2022
Mar 12 2022
Mar 19 2022
Median daily statistic (14 years)
Discharge
Estimated discharge
Period of approved data
Measured discharge



Mahoning River Sampling for Volatile Organic Compounds (VOCs)
Samples collected November 9th 2022 by ORSANCO staff
MH1 ND
CR1 ND
CR2 3.2
MH2 10.9
MH3 1.4
XX1 ND
MH4 2.1
MH5 2.2
MH6 2.0
CR3
MH7 1.6
(no sample)
CR4
MH8 1.5
MH9 1.4
MH10 1.3
MH11 1.0
MH12 1.3
MH13 1.1
MH14 1.0
CR5 ND
MH15 0.9
MH16 0.8
MH17 0.8
Struthers
Lowellville
Mahoning River
Yellow Creek
Struthers City Hall
Youngstown
Ohio
Pennsylvania
Boardman
Girard
Sampling Sites
Bridges
N
0 0.25 0.5 1 Miles
0 1.5 3 6 Miles
USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed June, 2022.
Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, USGS, FEMA

PERSISTENT PRESENCE

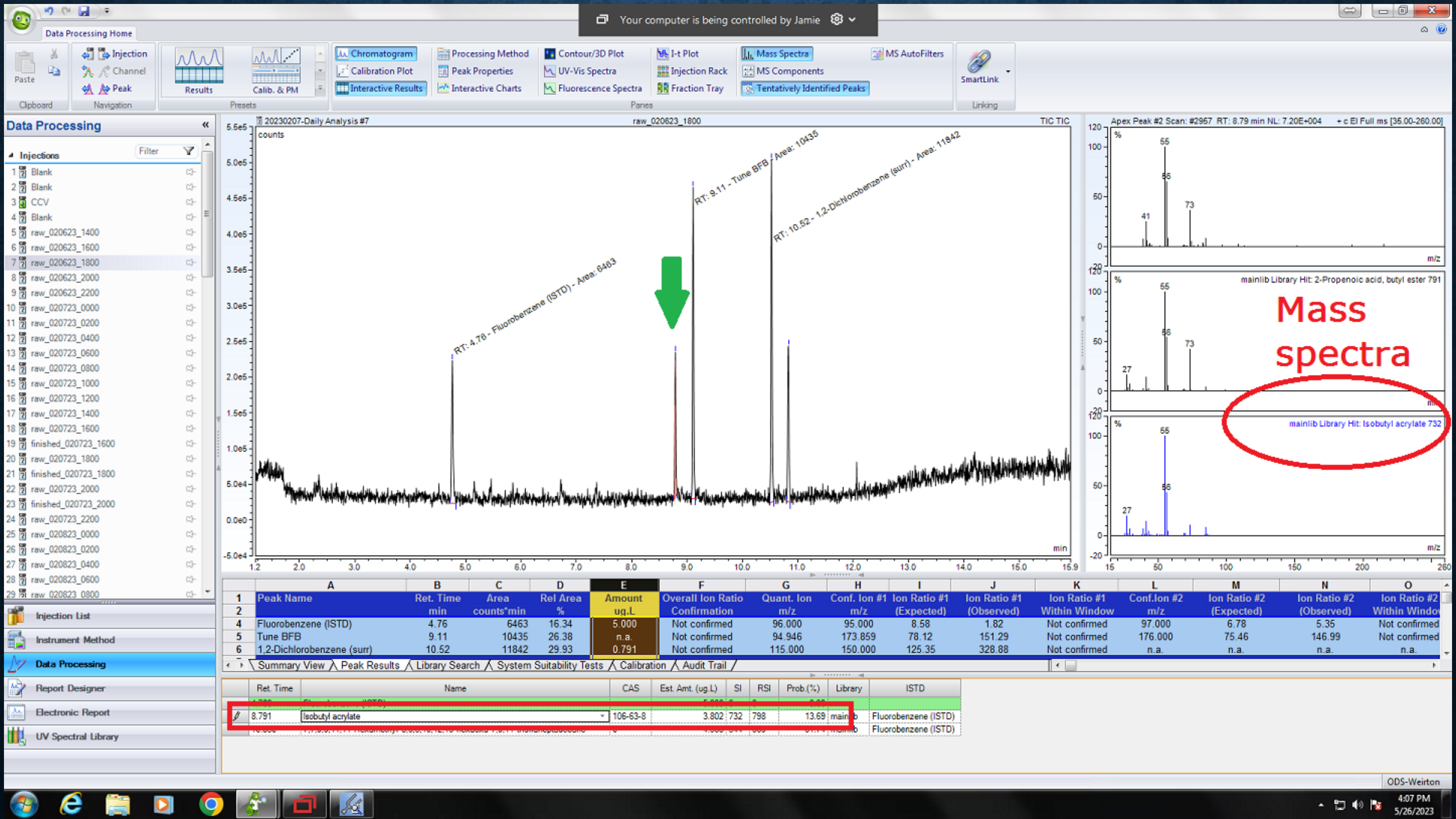
- Benzene detections on Ohio River continued for roughly 2 months
  - Two additional peaks detected mid Feb and early March 2022
- Beaver Falls Water began sending water samples to ORSANCO
  - Benzene consistently detected thru late May 2022
  - Only one detection June thru October 2022
  - Low-level detections resumed Nov 2022 thru March 2023
  - ORSANCO continues to run samples for Beaver Falls
- Detections coincide with high stream flow events
- Additional site investigations ongoing by brownfields group



EAST PALESTINE – ONE YEAR LATER

Ohio River Valley Water Sanitation Commission (ORSANCO)

INITIAL DETECTION IN OHIO RIVER WEIRTON, WV FEB 6, 2023 AT 1600



EAST PALESTINE, OHIO TRAIN DERAILMENT

- Feb 3, 2023 – Train derails in East Palestine, OH
- 50 railcars derailed or damaged (10 carrying hazardous materials)
- Feb 6 – ODS at Weirton, WV detects butyl acrylate
- Used ODS, field sampling & time-of-travel model
- Spill tracked for 3 weeks over 400 stream miles
- Intense media coverage and public concern
- Monitoring continued to assure public water is safe

CONTINUED INTEREST

- Clean-up effort continues
- Incident presents unique opportunity to discuss lessons learned
- Many groups interested to learn from incident response
- Interagency after-action discussion would be helpful to improve spill response preparedness

QUESTIONS OR COMMENTS

Agenda Item 13:
Biological Programs Update
Report of the BWQSC

Informative Item – No Action Required

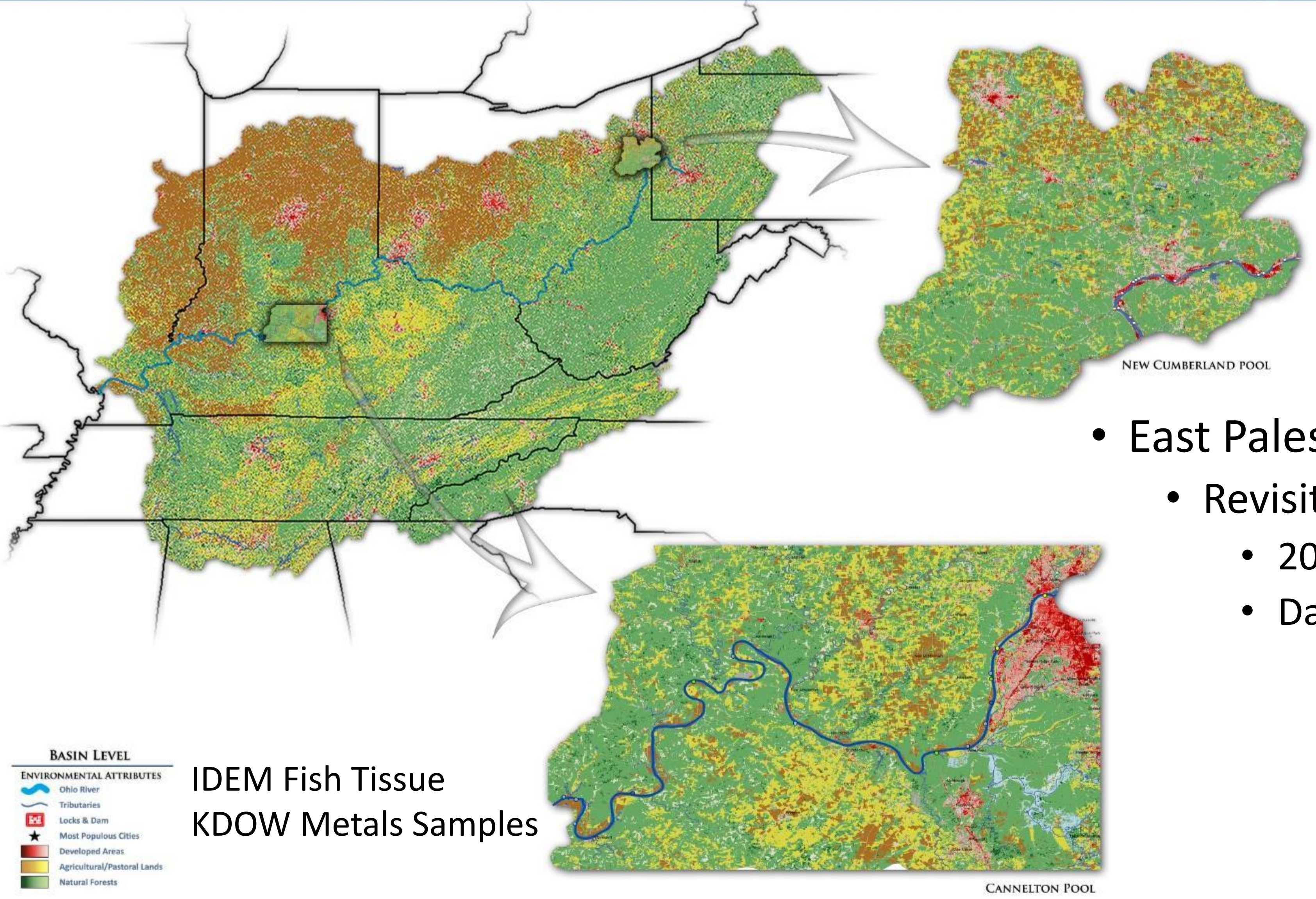
Presented by Biological Staff

ORSANCO Biological 2023 Sampling Overview

- Two probabilistic pool surveys (19 Ohio River pools)
  - Night-time electrofishing
  - Macroinvertebrates (Hester-Dendy, multi-habitat kicks)
  - Habitat Classification (benthic substrate, submerged aquatic vegetation)
- 15 random sites per pool
  - Collectively represent the condition of pool
  - Scored using a fish (*m*ORFIn) and macro (ORMIn) indices
  - Paired water quality (some special requests from states)
- 18 river-wide fixed stations (fish, macros, habitat, SAV) 2004-present
- River-wide fish tissue collection
  - PFAS added to all ORSANCO collections in 2022
  - Collections on behalf of IDEM, 2021-2025
- 92 NRSA Events across 2023/2024
- Added a Full-time biologist (4 total)
  - 2 additional seasonal biologists (6 total)

2023 Pool Surveys

The results of the 2023 biological surveys are detailed in the following pages (relative pool locations shown below). Included are brief descriptions of the land use & hydrology, site level mORFIn & ORMIn ratings, summaries of notible catches & instream habitat, and the overall biological condition of each pool.



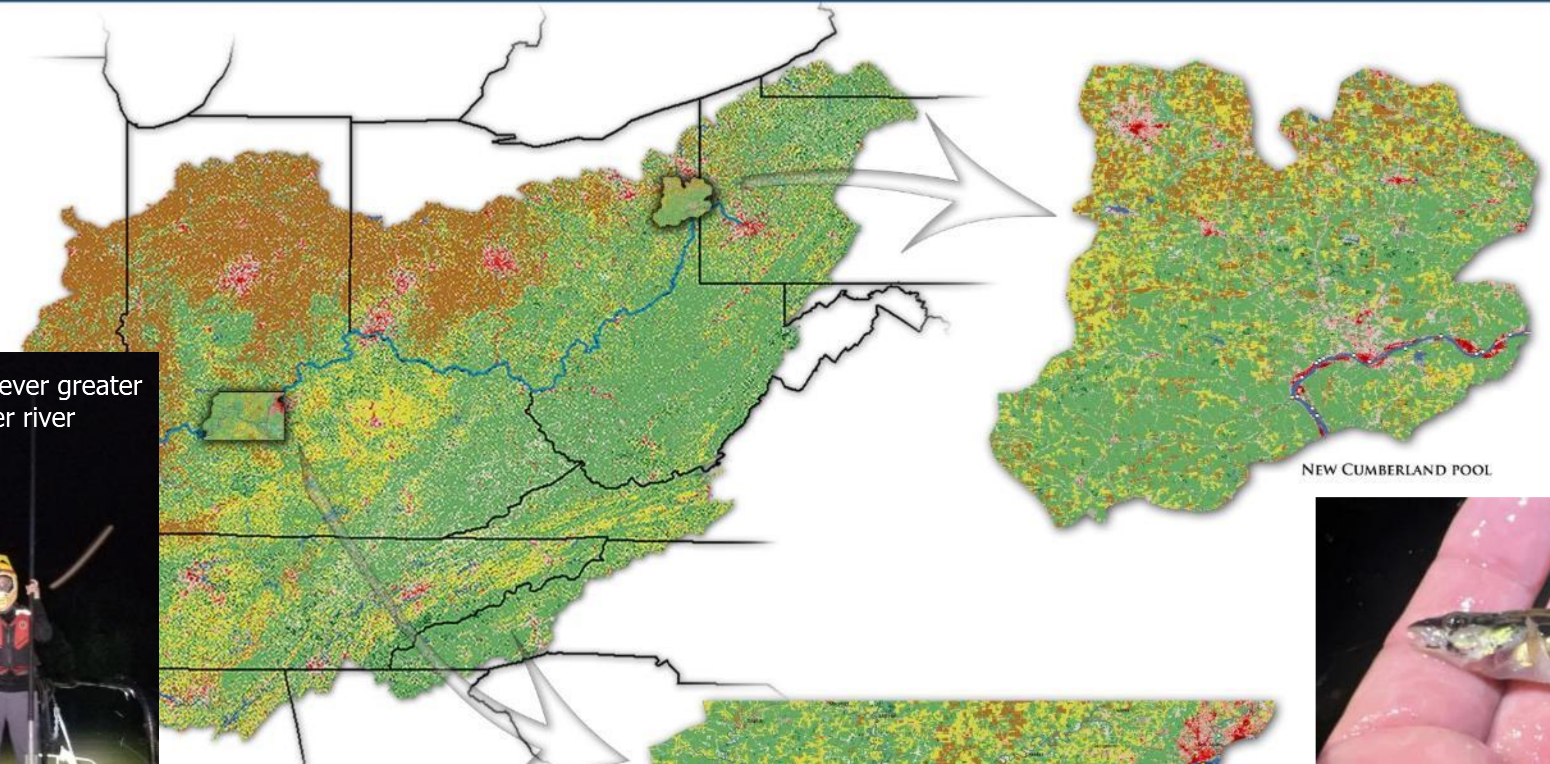
IDEM Fish Tissue
KDOW Metals Samples

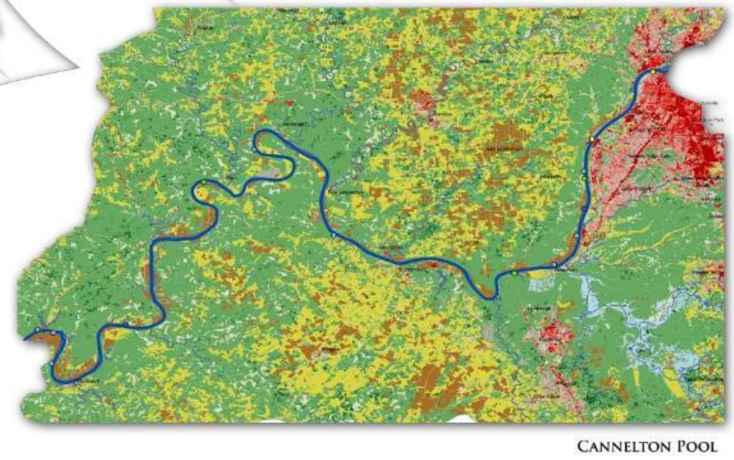
- East Palestine Follow-up
  - Revisit Lower Little Beaver Creek
    - 2017: Two 500m sites
    - Day-time electrofishing only

For more detailed catch, metric, and index scores visit www.orsanco.org/programs/biological-programs

2023 Pool Surveys

The results of the 2023 biological surveys are detailed in the following pages (relative pool locations shown below). Included are brief descriptions of the land use & hydrology, site level mORFIn & ORMIn ratings, summaries of notible catches & instream habitat, and the overall biological condition of each pool.

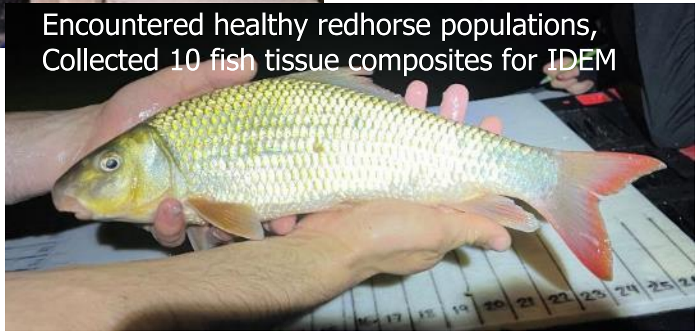




Abundant submerged vegetation, first observation of lily pads

Encountered multiple Longhead Darters, Considered extirpated from Ohio waters for 80yrs, until recently

Silver Carp becoming ever greater safety concern in lower river



Encountered healthy redhorse populations, Collected 10 fish tissue composites for IDEM

Awaiting return of 2023 macro and fish contaminant data that are analyzed by contractual labs (early 2024)

For more detailed catch, metric, and index scores visit www.orsanco.org/programs/biological-programs

92 Events

- OH (40)
- KY (16)
- IN (23)
- IL (13)

Site Lengths

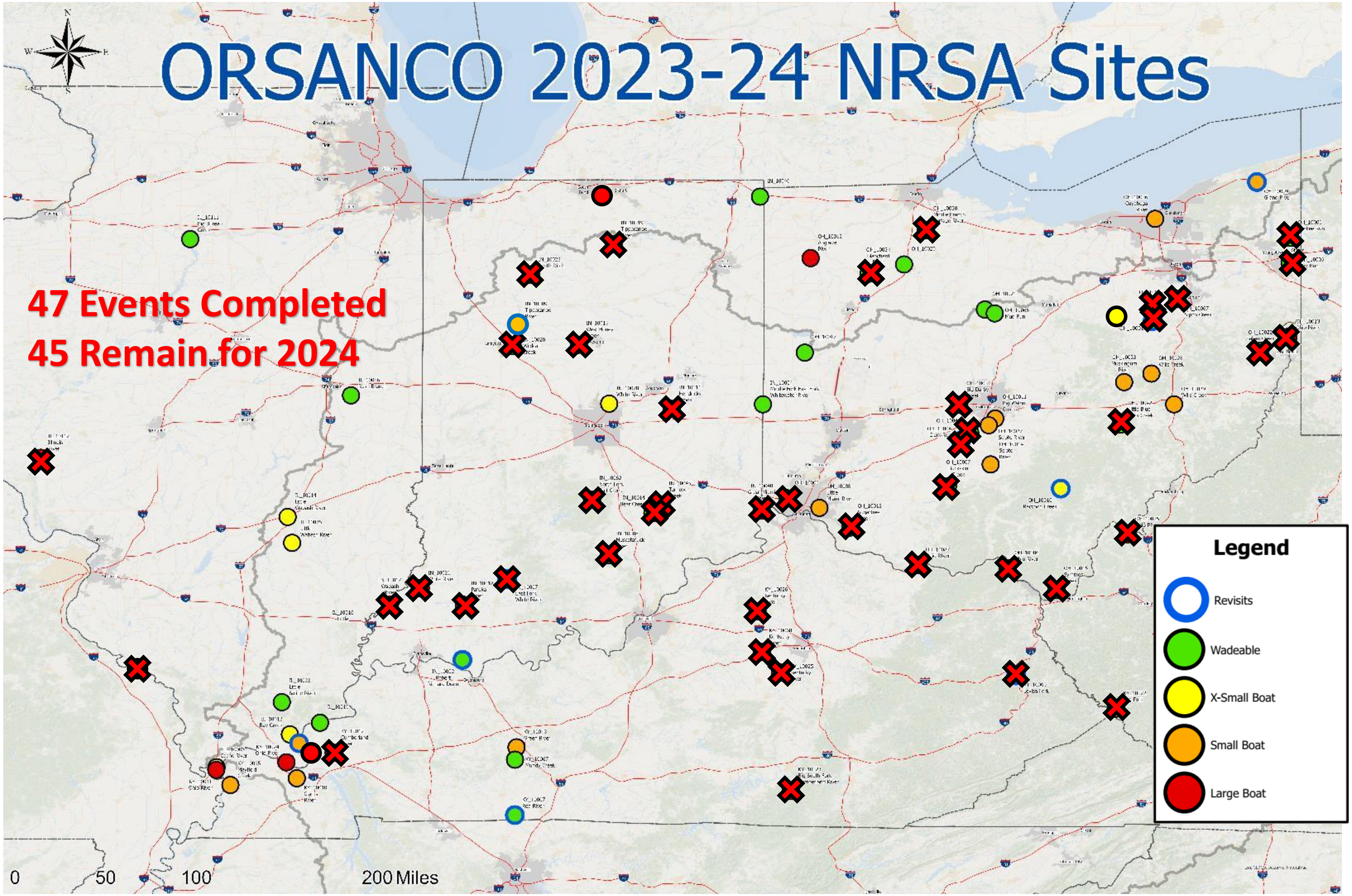
- 150m – 4km

Dedicated Staff

- Six ORSANCO
- Six Seasonal

4 Site Types

- 20’ Jon Boats
- 14’ Jon Boat/Canoe
- 10’ Buggy/Canoe
- Wadeables

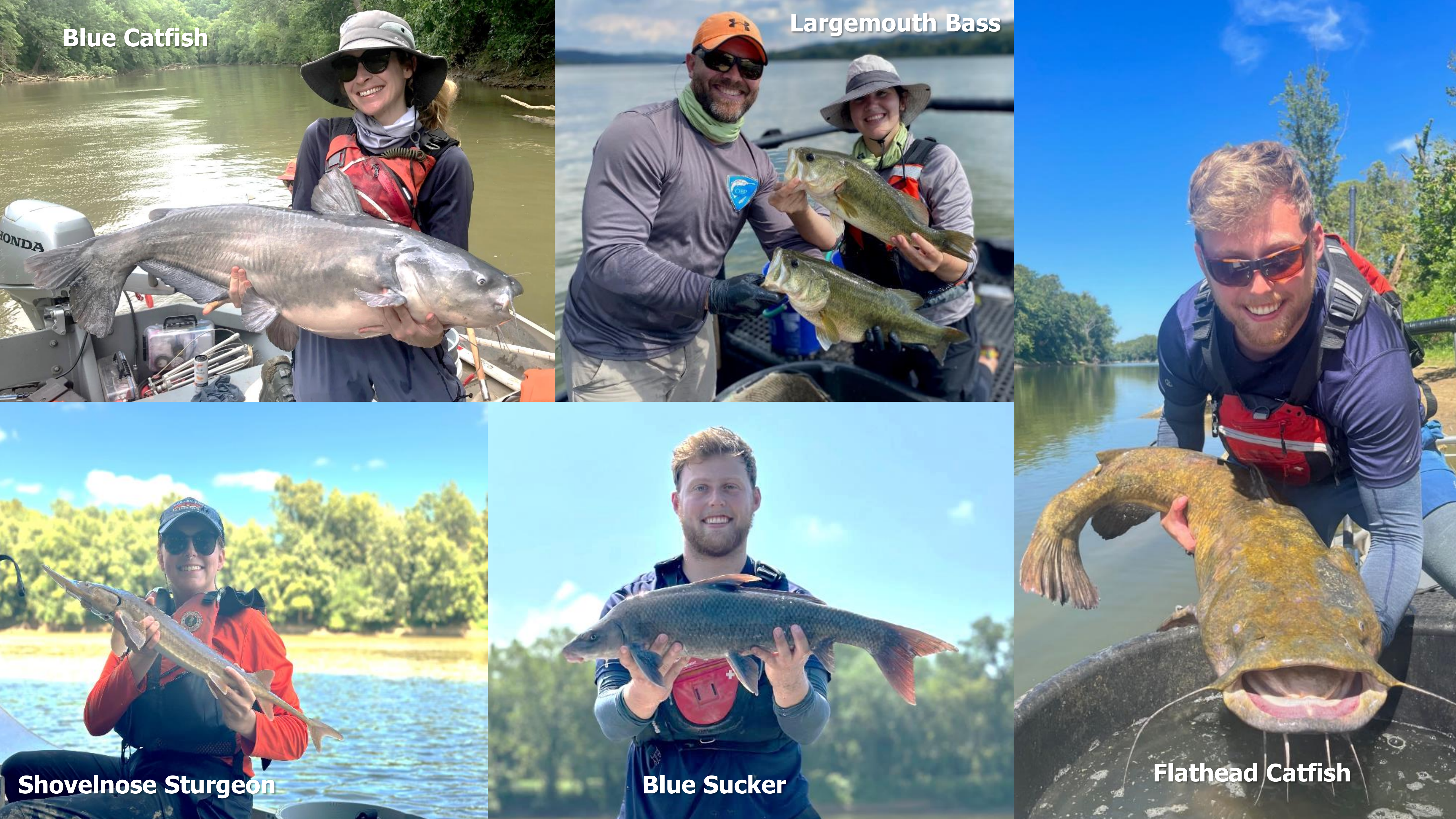



Water Chemistry
Riparian Assessment
Macroinvertebrates
& Periphyton
Stream Anatomy
Canopy Cover
Slope & Sinuousity
Sample Filtration
Processing & Shipment


BIOLOGICAL SURVEY
HONDA
25
ORSANCO
BASS RAIDER


North Fork Salt Creek (IN)
Sippo Creek (OH)
Big Darby Creek (OH)
Hendricks Brook (IN)


Southern
Redbelly Dace
Longear Sunfish
Northern Studfish
Stonecat
Mottled Sculpin


Blue Catfish
Largemouth Bass
Flathead Catfish
Shovelnose Sturgeon
Blue Sucker

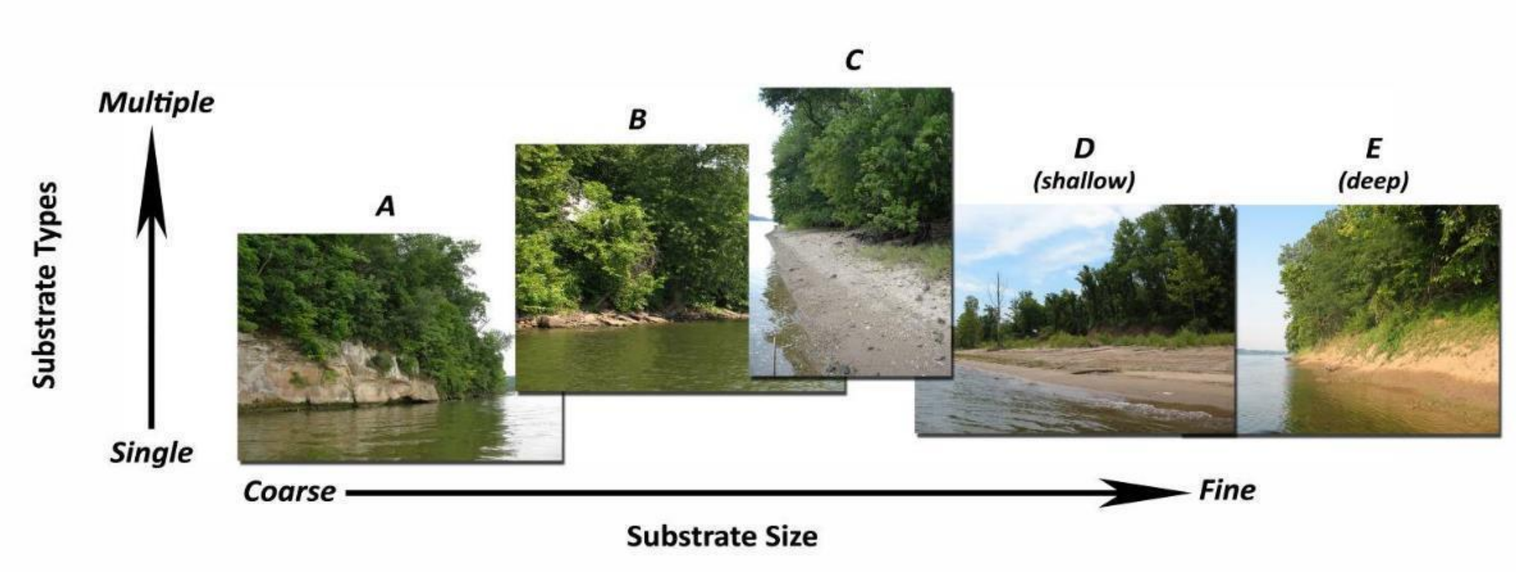
Untitled.svg

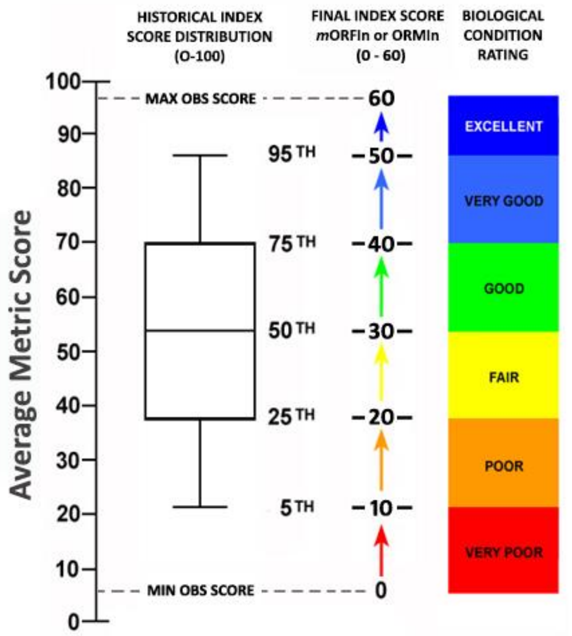
NARS Data Availability

- Shiny App: https://owshiny.epa.gov/nars-data-download/
  - Download csv files for all past assessment cycles and parameters
- Dashboard: https://riverstreamassessment.epa.gov/dashboard/
  - Shows change in condition of specific site categories/parameters through time
- ORSANCO retains all fish population data and site location information in our internal databases for NRSA sites surveyed
  - 2008-2009, 2013-2014, 2018-2019, & 2023-2024

Biological Index Recalibration

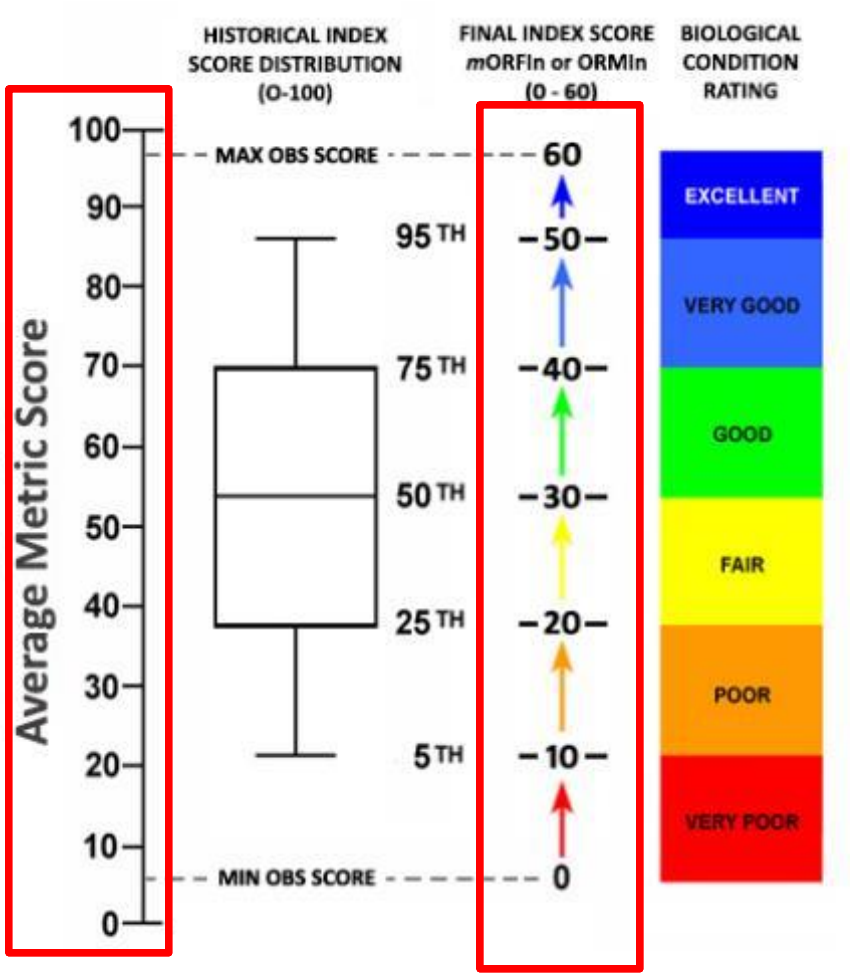
Addressing the Emergence
of invasive
Submerged Aquatic Vegetation





ORSANCO Assessment Indices

- ORFIn (2003-2008)
  - Average score of 13 fish metrics (0-100)
- *m*ORFIn (2009-present)
  - Scaled value of ORFIn (0-60)
  - Based on past performance of sites with similar habitat
- ORMIn (2015-2022)
  - HDD primary, 200ind (min) MH
  - 8 metrics
- 2023 Recalibration (ORMIn & *m*ORFIn)
  - Created habitat subcategories for SAV
  - Set new scoring thresholds



Overview –Datasets & Methods PI: Bridget Borrowdale, Aquatic Biologist

Qualitative Dataset (2004-2022; n=777)

– Assess existing habitat classes with more recent data than original mORFIn calibration dataset

- Original 80 habitat variables
- Added 2 *qualitative* SAV and Woody Cover variables

Quantitative Dataset(2016-2022; n=248)

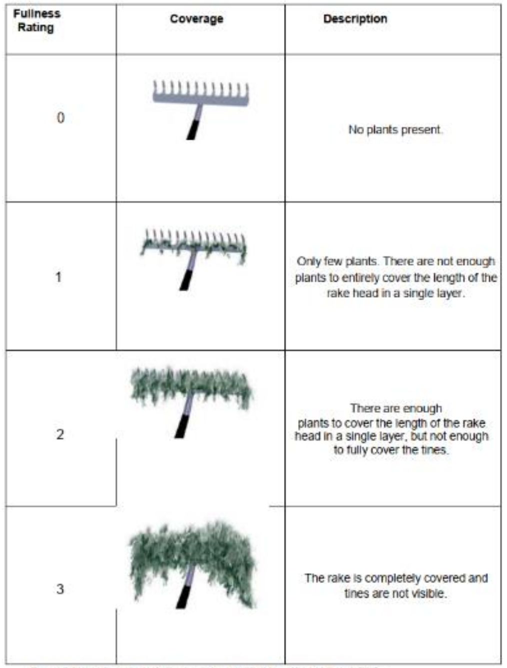
– Assess existing habitat classes with more comprehensive SAV data

- Original 80 habitat variables
- Added 15 *quantitative* SAV variables

– Further investigate SAV

- Impacts on biology and mORFIn metrics

			Species Name (abbreviate & circle rake fullness observed)						
Transect	DFS (ft)	Device							
100	0	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	10	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	20	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	30	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	40	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	50	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	60	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	70	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	80	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	90	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
100	100	P R	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
		Voucher Type	Photo Sample	Photo Sample	Photo Sample	Photo Sample	Photo Sample	Photo Sample	Photo Sample
		Visual Veg. Observation:							
Transect	100 - 200	Emergent %:		Emergent Type:		Submergent %:		Woody Cover %:	



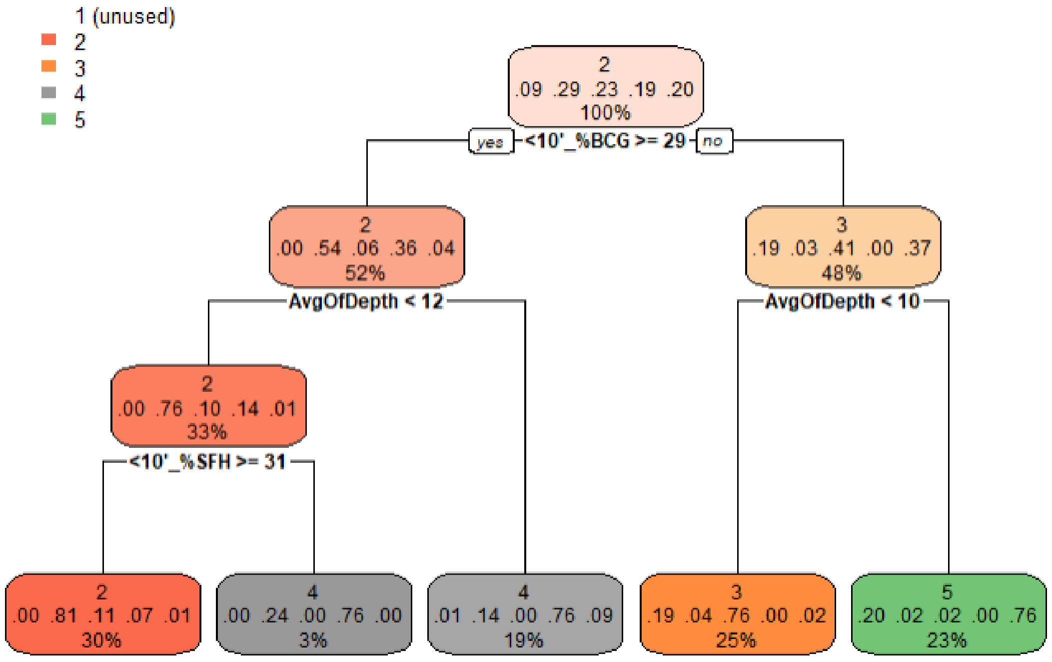
Fullness Rating	Coverage	Description
0		No plants present.
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered and tines are not visible.

Figure 3. Illustration of rake fullness ratings modified from Hauxwell et al. 2010.

Used K-means Clustering, Principal Components Analysis, CART Analysis, and **Breakpoint Analysis**

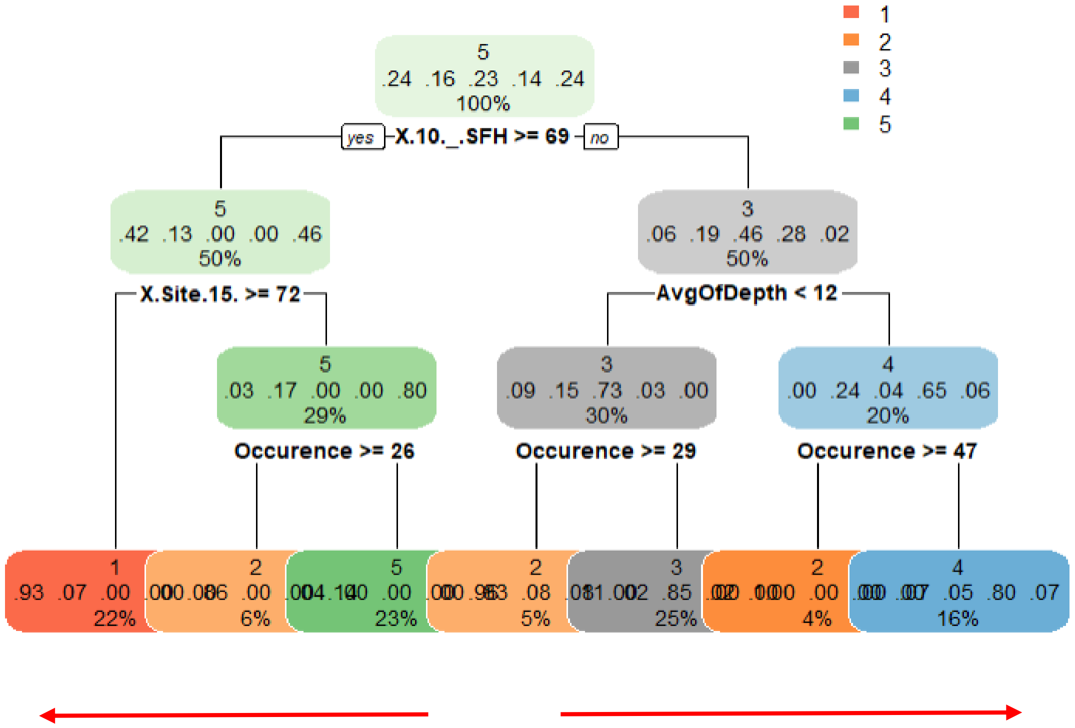
Finding 1: CART Analysis confirmed existing Habitat Classes

Qualitative SAV



C B D E

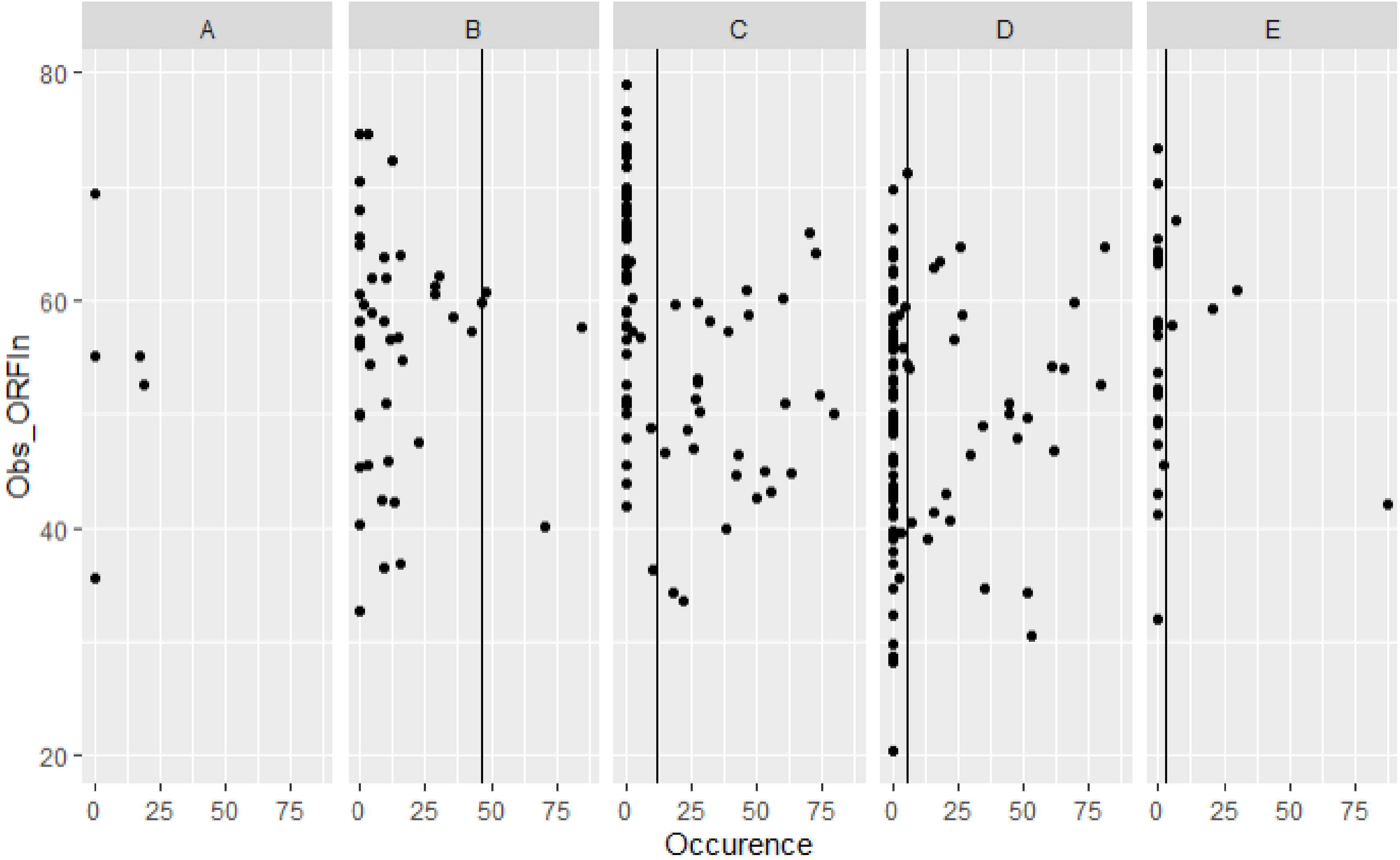
Quantitative SAV



C, D, & E A, B, & C

Visual SAV not as valuable as measured occurrence

Finding 2: Breakpoint analysis showed ORFIn and raw fish metrics decreasing beyond 15-25% SAV Occurrence

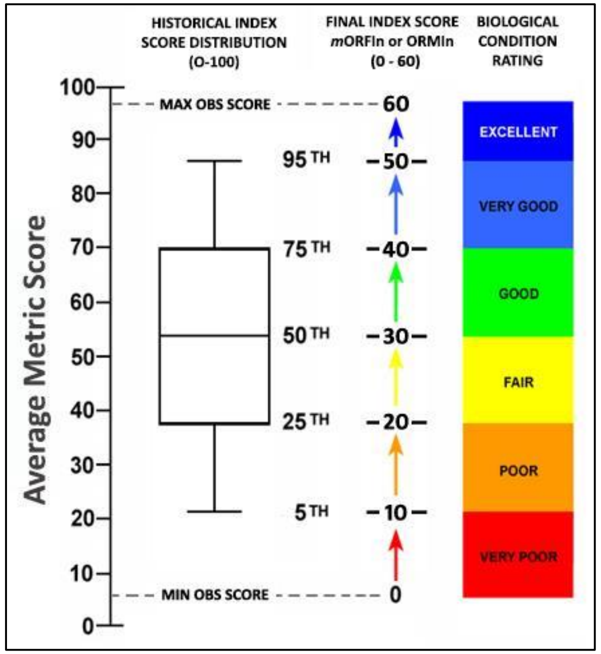


Value needs further investigation / More Data

Biological Index Recalibration

Retained

- 13 original ORFIn fish metrics
- 8 original ORMin bug metrics
- River-mile adjustments
- Continuous metric scoring (0-100)



Updated

- Created SAV subcategories for each Habitat class
  - Based on Presence/Absence
  - **Not enough data for %Occurence**
- Calculated new scoring thresholds for subcategories with SAV

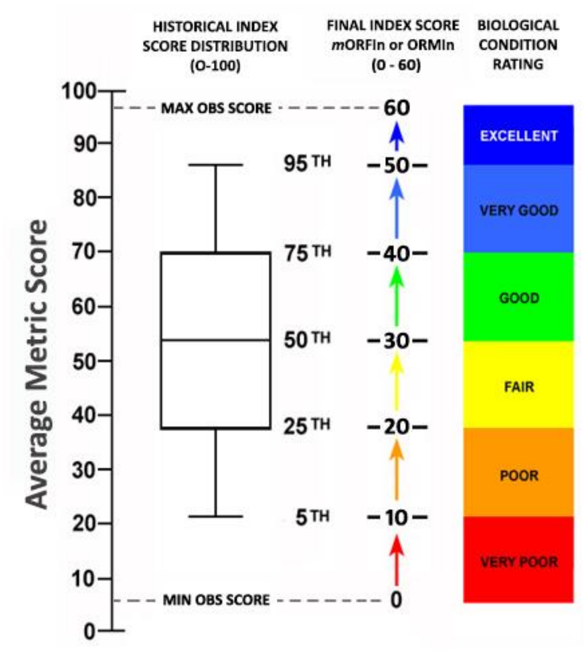
All Prob Sites

SAV Present → Assessed two different ways
- only raising thresholds
- using new thresholds regardless of directionality

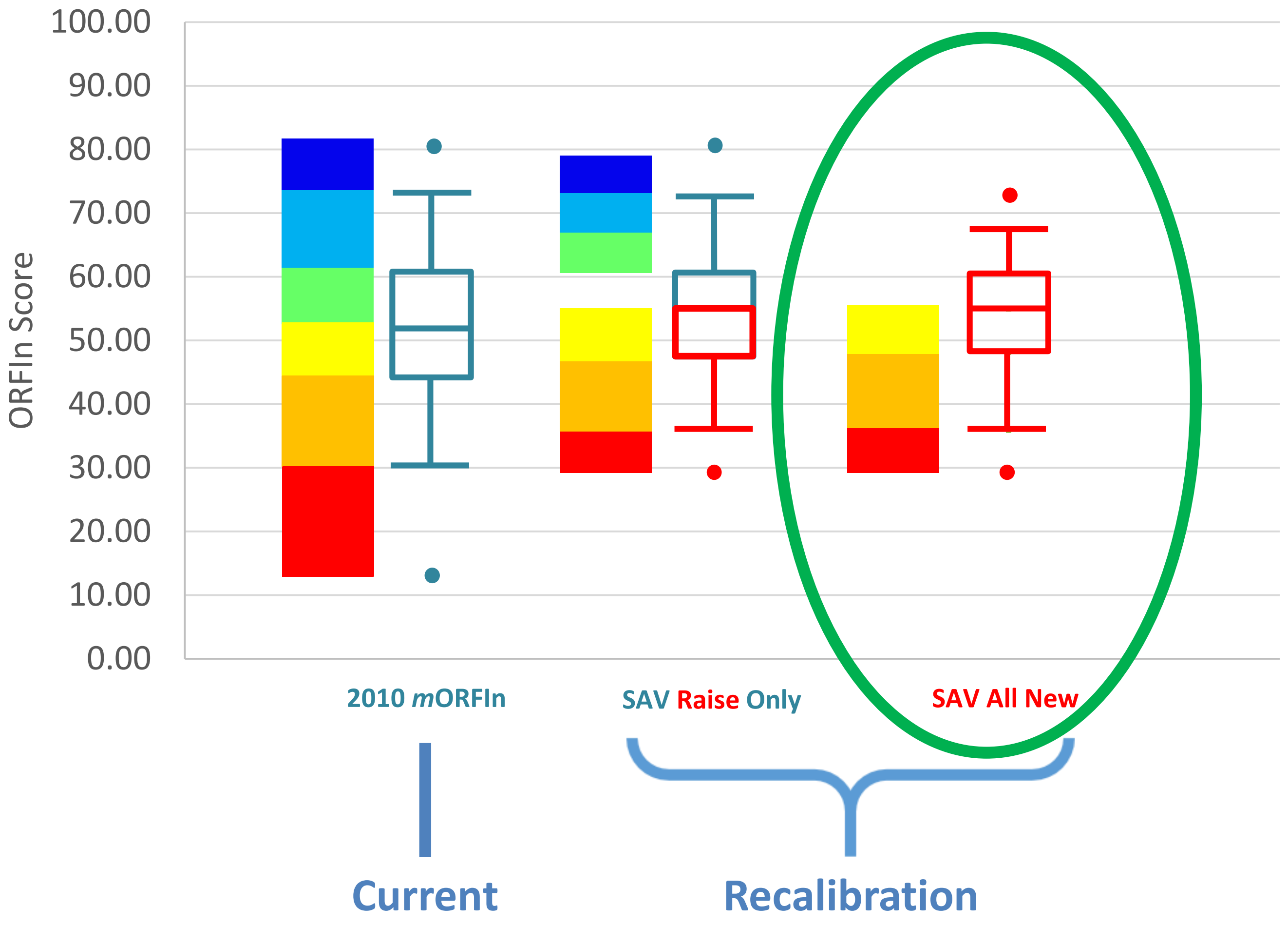
NO SAV → Assessed with original thresholds

Biological Index Recalibration: EXAMPLE

Retained Scoring Methods



Just included recent data and SAV subcategories to adjust for effects



Finding 3: Recalibrated indices account for known SAV effects

2nd Assessment Cycle 2010 - 2014

Index Recalibration BWQSC Input

1. Support the addition of a SAV habitat subcategory and assignment of new scoring thresholds

2. Support moving forward with the recalibrated indices for use in assessing 4th cycle navigational pools

Postponed Pending Index Recalibration

Fish – Fair
Bugs - Good

Awaiting Macro Samples

Great Hester-Dendy Retrieval Rates – 14 / 15

Dominant Macro Groups

New Cumberland Pool (2023) - Healthy Condition

The New Cumberland Pool is 22.7 miles long, extending from Montgomery Locks and Dam (ORM 31.7) to New Cumberland Locks and Dam (ORM 54.4). The pool has a gradient drop of 0.2 feet per mile and averages 1,439 feet wide and 22 feet deep (ORSANCO 1994). The pool flows within the state of Pennsylvania for the first nine miles, and is bordered by Ohio and West Virginia for the remaining 13.7 miles. Though there are few metropolises within the pool (East Liverpool, OH), New Cumberland is only 31.7 miles downstream of Pittsburgh and lies in a portion of the Ohio River heavily influenced by industry with a large amount of barge activity. The New Cumberland Pool receives water from two small tributaries: Little Beaver Creek and Yellow Creek. The pool's watershed is primarily forested (54.8%) but also has a considerable amount of pasture (21.1%) and developed land (12.0%). New Cumberland pool has experienced shifts in substrate composition, an average increase in fine sediments from 22% to 37% between 2011 and 2023.

Dominant Fish Families

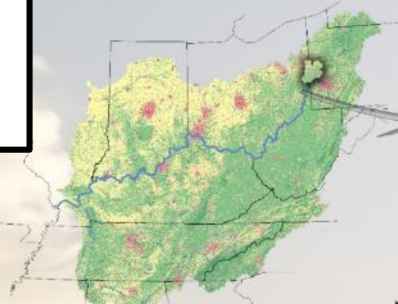
Herring and Shad 66.3% — *Gizzard Shad*

Sunfish & Bass 10.5% — *Smallmouth Bass*

Minnows 8.9% — *Emerald Shiner*

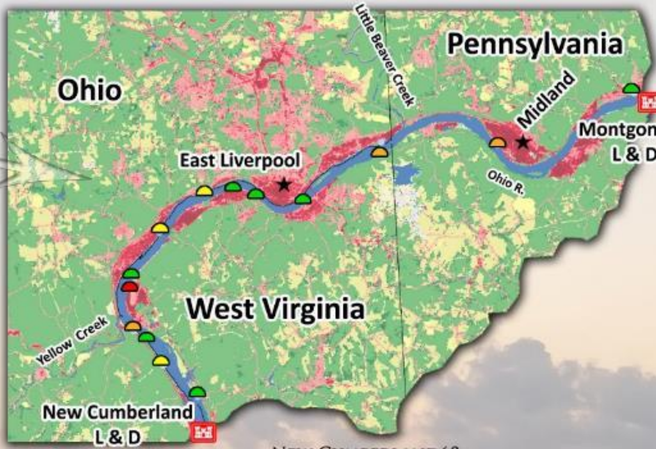
Suckers 7.0% — *Golden Redhorse*

Perches 5.1% — *Logperch*



Ohio River Basin

New Cumberland Pool Sub-Basin



New Cumberland60 Pool

Basin Level		Site Level		
Environmental Attributes		Biological Condition Ratings		
		Fish		Macros
	Ohio River		Excellent	
	Tributaries		Very Good	
	Locks & Dam		Good	
	Most Populous Cities		Fair	
	Developed Areas		Poor	
	Agricultural/Pastoral Lands		Very Poor	
	Natural Forests			

Aquatic Invasives Watch

- ☐ Silver Carp
- ☐ Bighead Carp
- ☑ Asiatic Clams
- ☑ Zebra Mussels
- ☑ Marine Scuds
- ☑ Hydrilla

Survey Summary

Electrofishing sampling occurred during normal sampling conditions during the second week of July during moderate flow conditions. Notable observations over the last three asessment cycles included an increased abundance of Perches (*Percidae*) and Gizzard Shad (*Dorosoma cepedianum*). Declines in catfish (*Ictalurus punctatus* and *Pylodictis olivaris*) populations were observed, as well as a decline in cyprinid diversity and abundance. Two species of concern listed in the states of PA and OH were observed: Bowfin (*Amia calva*; n=1) and River Redhorse (*Moxostoma carinatum*; n=6). A species once thought to be extirpated in Ohio, Longhead Darter (*Percina macrocephala*), was observed four times this assessment.

Pool Substrate Composition

Boulder 4.5% · Cobble 10.9% · Gravel 22.1% · Sand 23.9% · Fines 37.2% · Hardpan 0.8% · Other 0.7%

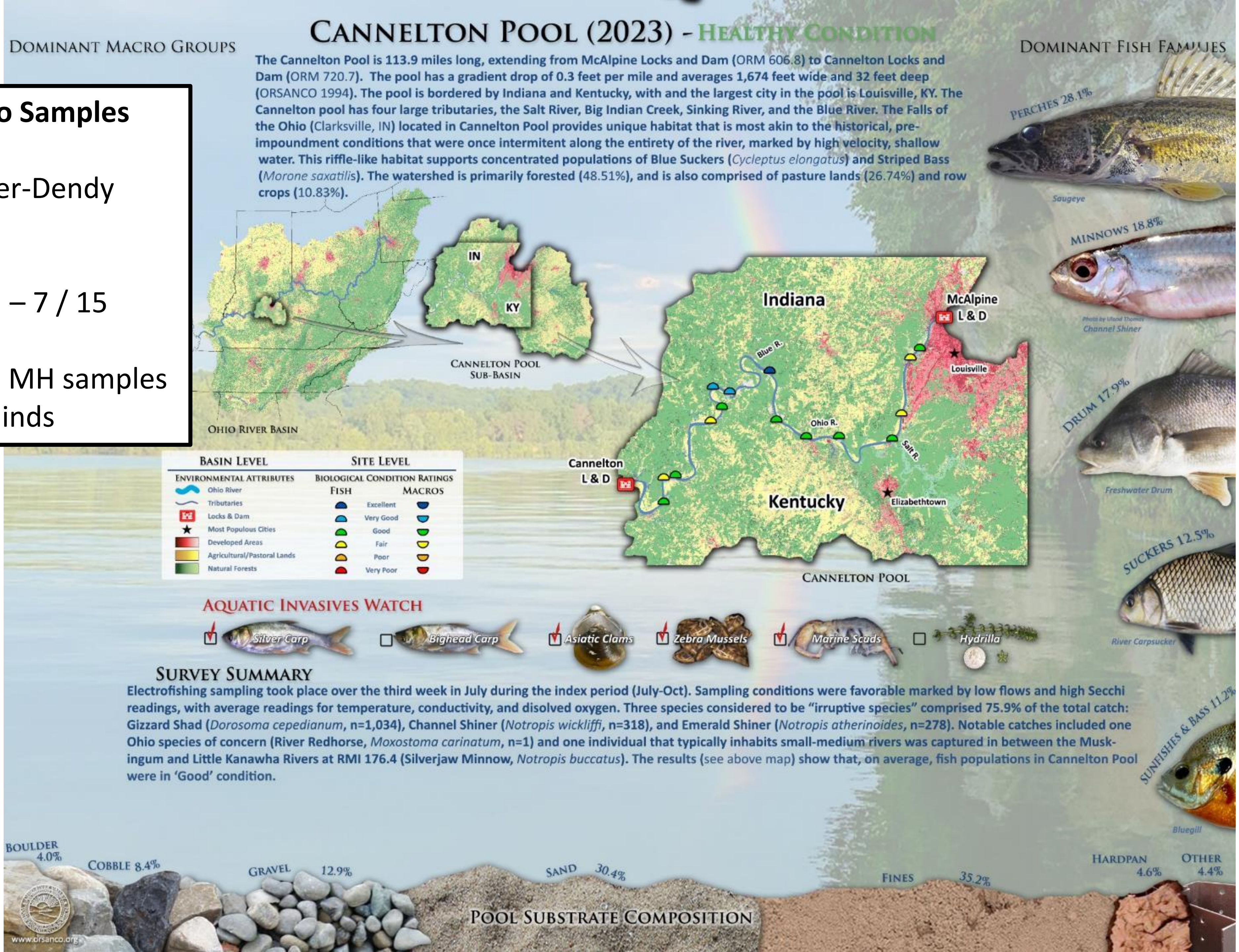
www.orsanco.org

Awaiting Macro Samples

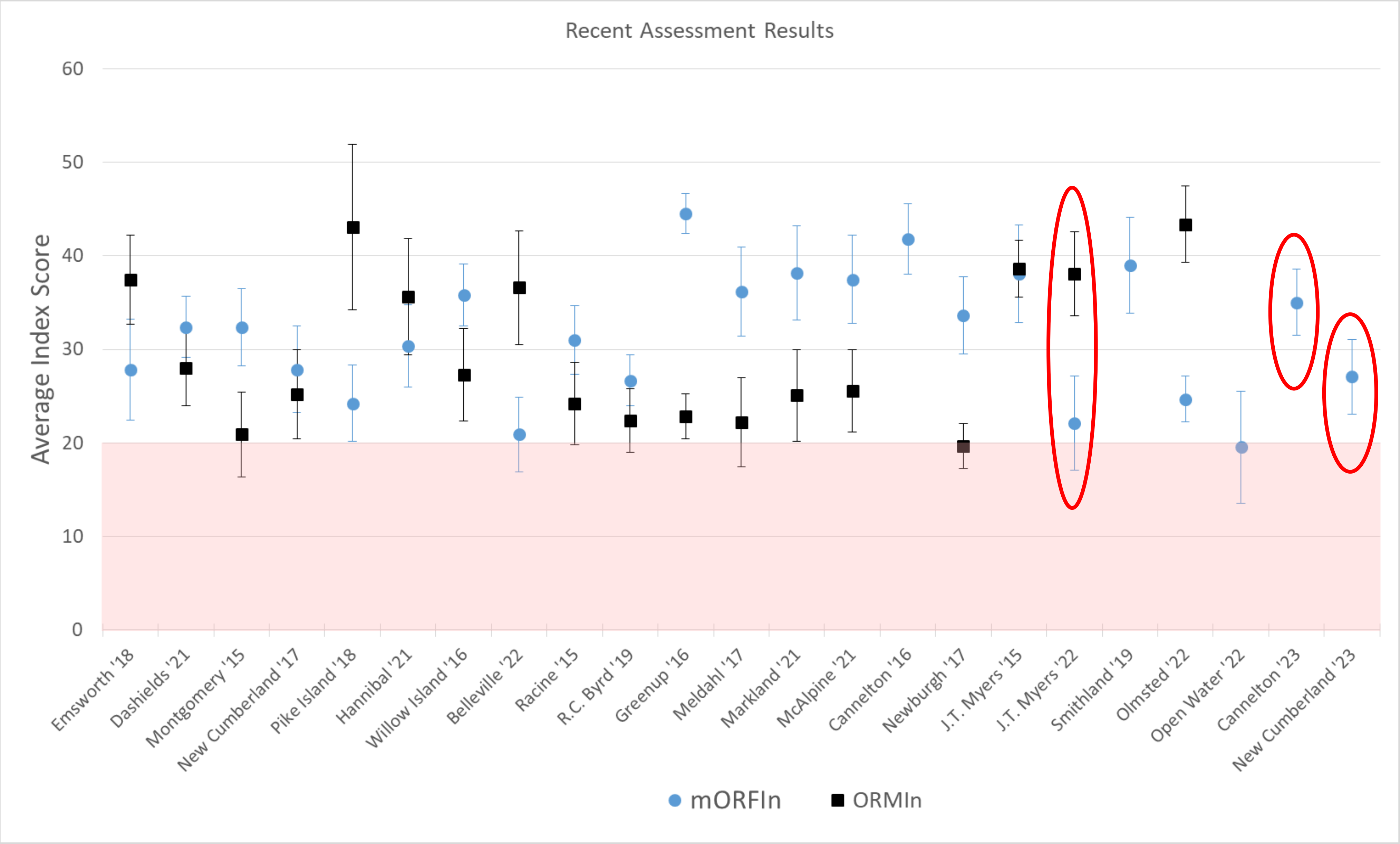
Very Poor Hester-Dendy Retrieval Rates

Historically Bad – 7 / 15

Will depend on MH samples containing 200 inds



Third Assessment Cycle (2015-2022) and Fourth Assessment Cycle (2023) - Probabilistic



Other Investigations & Priorities: BWQSC Discussion

1. Functionality Indices / IBI alternatives for Bio Assessments
2. Expanding contaminants tracking
   - PFAS
     - pathways, lower trophic level, and other environmental measures
   - Neonicotinoids
     - EPA Reg 5 and basin states have conducted screening samples
3. Nutrient Criteria

Alternatives to IBI

This idea arose from discussions during index recalibration

- Communities shift in response to human-introduced changes to the environment (climate change, invasive species, etc.)
  - Lentic species replacing lotic species in the presence of SAV
  - Silver Carp replacing native planktivores
- If it is difficult or nearly impossible to remediate these changes, are we to consider the resulting community shift as negative, or do we reevaluate our expectations?

Functional Diversity

Global Change Biology

PRIMARY RESEARCH ARTICLE

Fish communities diverge in species but converge in traits over three decades of warming

Matthew McLean, David Mouillot, Martin Lindegren, Sébastien Villéger, Georg Engelhard, Juliette Murgier, Arnaud Auber

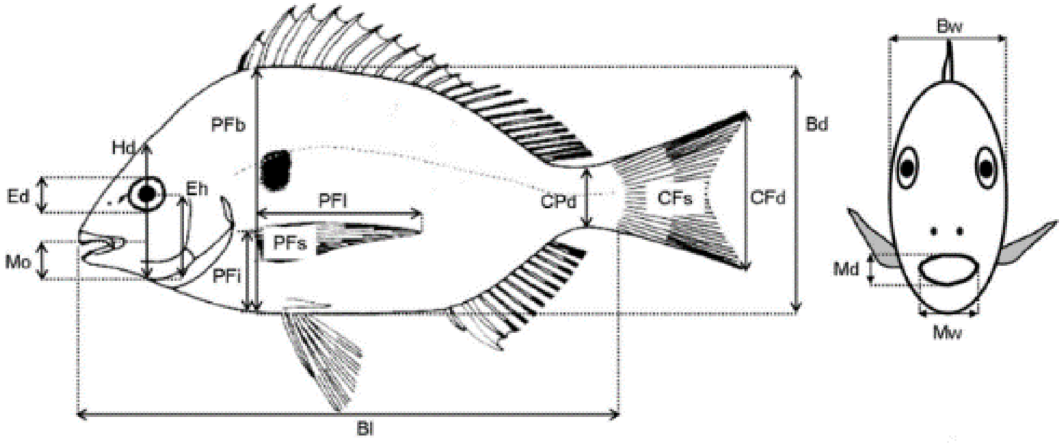
- Species diversity and composition may change, but the community may still be functionally diverse

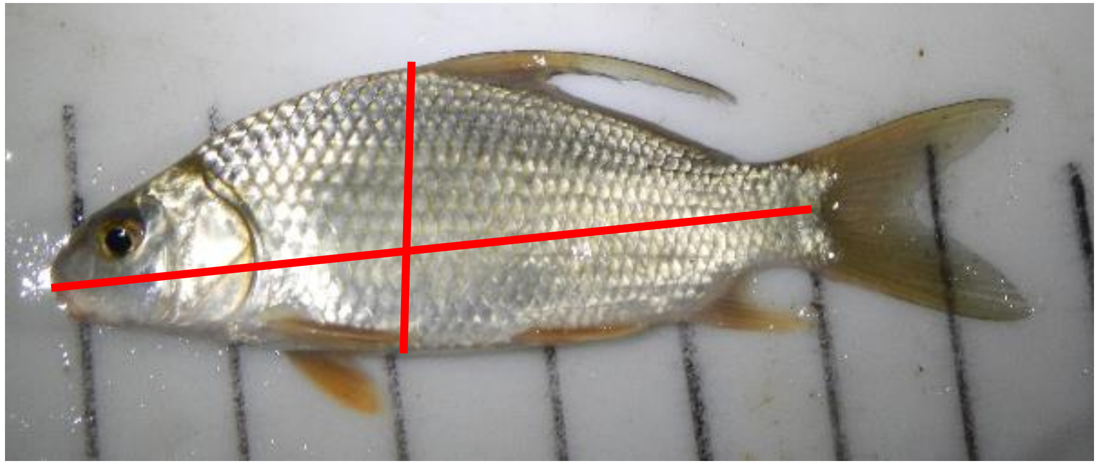
Biomass

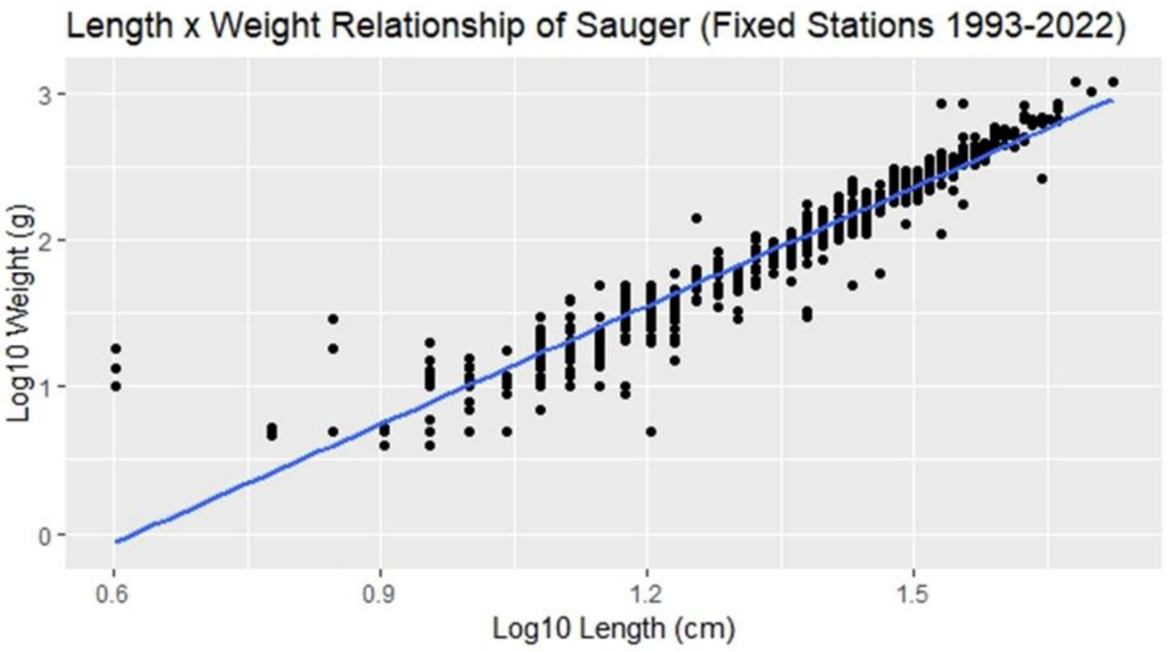
- Functional diversity analysis is best paired with biomass data
  - Biomass reflects the productivity of the ecosystem
  - Abundance can be skewed towards smaller, more numerous species

- Biomass calculation requires length and weight measurements. We have a lot of this data but not of recent.
  - Recent data would be required to track trends in growth rates

Implications







Collecting lengths and weights is time consuming in the field. Is it worth it?

BWQSC Member Discussion

- **Functional Diversity Measures** – Worth Exploring?
  - Minimal additional effort to explore existing photos / growth curves
  - Resource implications if more detailed photos / office time are required

- **Biomass** – Should we reincorporate within probabilistic surveys?
  - Remains important regardless of Functional Diversity, no current metrics
  - Would decrease amount of available crew weeks for other activities

Expanding Contaminants Tracking

- ORSANCO has been collecting fish tissue contaminants data from the Ohio River since the 1980s.
- Primary uses
  - Inform Ohio River consumption advisories derived by mainstem state FCA coordinators
  - Use to assess fish consumption use in biennial 305b reports
- ORSANCO sends between 15 and 25 frozen, whole-fish composites to our contract laboratory annually
- Analytes include:
  - PCBs (Aroclors)
  - Metals (Cd, Pb, Se, Hg)
  - MeHg
  - Pesticides (catfishes)
  - PFAS (35 compounds) *since 2021*

ORSANCO Fish Tissue Contaminants Monitoring PFOS & PFOA

ID	RMI	Species	PFOA	PFOS PPB ug/kg	PFOS PPM mg/kg	PCBs_mg/kg	Program	Year Collected
2021-12-1	12	Common Carp	ND	**4.7**	0.0047	1.48	ORSANCO	2021
2021-12-10	12	Spotted Bass	ND	**42**	0.042	0.436	ORSANCO	2021
2021-11-2.7	11	Black Buffalo	ND	**3.5**	0.0035	0.526	ORSANCO	2021
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2022-844-9	844	Bluegill	ND	**25**	0.025	0.0421	IDEM	2022
2022-888-4B	888	Channel Catfish	ND	**0.86**	0.00086	0.059	ORSANCO	2022
2022-959-4B	959	Channel Catfish	ND	**4.8**	0.0048	0.17	ORSANCO	2022
2022-965-1	965	Common Carp	ND	**9.6**	0.0096	0.134	ORSANCO	2022
2022-966-1.6	966	River Carpsucker	ND	**7.5**	0.0075	0.128	ORSANCO	2022
2022-966-18A	966	Freshwater Drum	ND	**18**	0.018	0.0209	ORSANCO	2022
2022-972-4B	972	Channel Catfish	ND	**1.9**	0.0019	0.0974	ORSANCO	2022
2022-974-17	974	Sauger	ND	**19**	0.019	0.122	ORSANCO	2022
2022-978-0.6	978	Silver Carp	ND	**6.6**	0.0066	0.0091	ORSANCO	2022

Ohio River Fish Consumption Advisory Protocol

Advisory Groupings	
Level 1	Unlimited Consumption
Level 2	1 meal/week
Level 3	1 meal/month
Level 4	6 meals/year
Level 5	No Consumption

Contaminant	limited Consumpt	1 ml/wk	1 ml/mo	6 ml/yr	No Consumption
	Level 1	Level 2	Level 3	Level 4	Level 5
Hg (ppm)	<=0.05	0.05<x<=0.22	0.22<x<=0.94	NA	>0.94
PCB (ppm) skin on	<=0.05	0.05<x<=0.22	0.22<x<=0.94	0.94<x<=1.88	>1.88
PCB (ppm) skin off	<=0.036	0.036<x<=0.155	0.155<x<=0.67	0.67<x<=1.34	>1.34

A uniform fish consumption advisory protocol for the Ohio River. Environ Monit Assess, 2011.

Great Lakes Consortium

PFOS in Fish (µg/kg)	Meal Frequency
≤ 10	Unrestricted
> 10-20	2 meals/week
> 20-50	1 meal/week
> 50-200	1 meal/month
> 200	DO NOT EAT

Great Lakes Consortium for Fish Consumption Advisories; Best Practice for Perfluorooctane Sulfonate (PFOS) Guidelines, Nov. 2019.

USEPA 2022

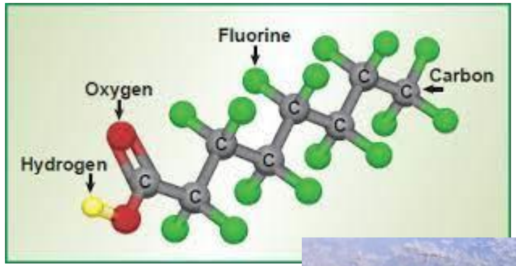
Contaminant	Fish Muscle (mg/kg)
PFOA	0.125
PFOS	2.91

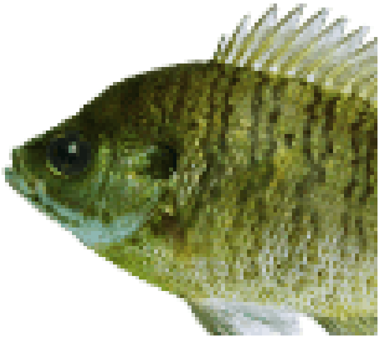
ENVIRONMENTAL PROTECTION AGENCY Draft Recommended Aquatic Life Ambient Water Quality Criteria for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonic Acid (PFOS) Federal Register May 3, 2022.

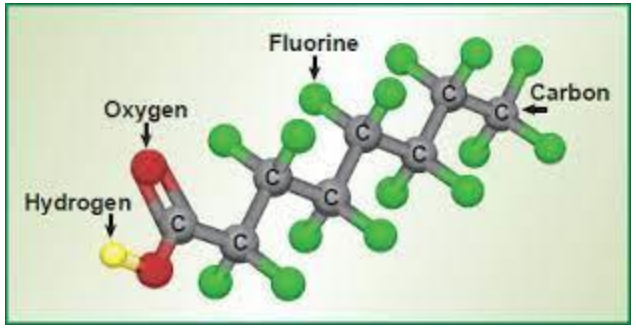
Expanding Contaminants Tracking

What changes have we observed in pools where Hydrilla verticillata is well established?

- Shifting fish communities
- Decreased MORFIn Scores (fish)
- Increased ORFIn Scores (macro)
- Huge Dissolved Oxygen Swings
- Changing habitats
- **What else is going on that we have not yet been able to connect with Hydrilla?**

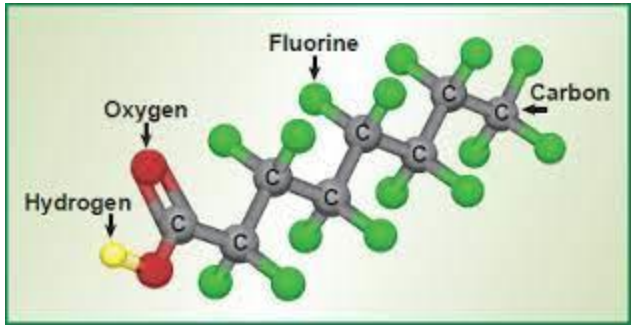






Expanding Contaminants Tracking

- Where are PFAS accumulating in the food web?
  - Sediment
  - Submerged Aquatic Vegetation (Hydrilla vs Native)
  - Emergent/Floating Vegetation
  - Macroinvertebrates Benthic/Pelagic
  - Fish-all trophic level fish
- Are there major differences in contaminant levels where hydrilla is present vs not present?



Expanding Contaminants Tracking

Fish

- Channel Shiners
- Emerald Shiners
- Gizzard Shad
- Centrarchids
- Small Freshwater Drum
- Small Channel Catfish
- Any suggestions?

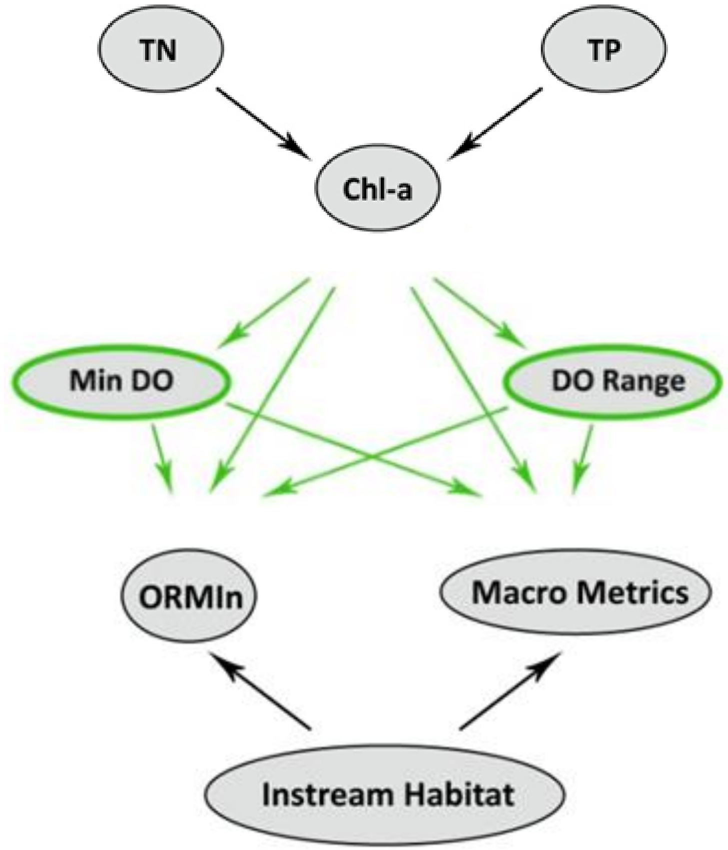
Macroinvertebrates

- Gammarus (Scuds)
- Hexagenia (Mayflies)
- Dreissena Polymorpha (Zebra Mussels)
- Crayfish?
- Odonates?
- Any suggestions?

Which species are available for consistent capture and adequate biomass for contaminant analysis?

Nutrient Investigations

- ORMIn metrics showed responsiveness to nutrients
- Missing Piece = Continuous DO at macro sites
  - Continuous DO / Temp loggers deployed
  - 3 rounds
    - Grab samples for TKN, N-N, Ammonia, TP and Chl-a
- Data Range 2014 – 2021
- All HOBO data QA'd via manual review and R packages in late 2022
- Analyses began in late 2022
  - Took lower priority behind index recalibration and NRSA
  - Will benefit from recent developments with flow database



ORSANCO's conceptual approach to nutrient criteria development modified from Qian & Miltner (OEPA)

Summary of BWQSC Recommendations

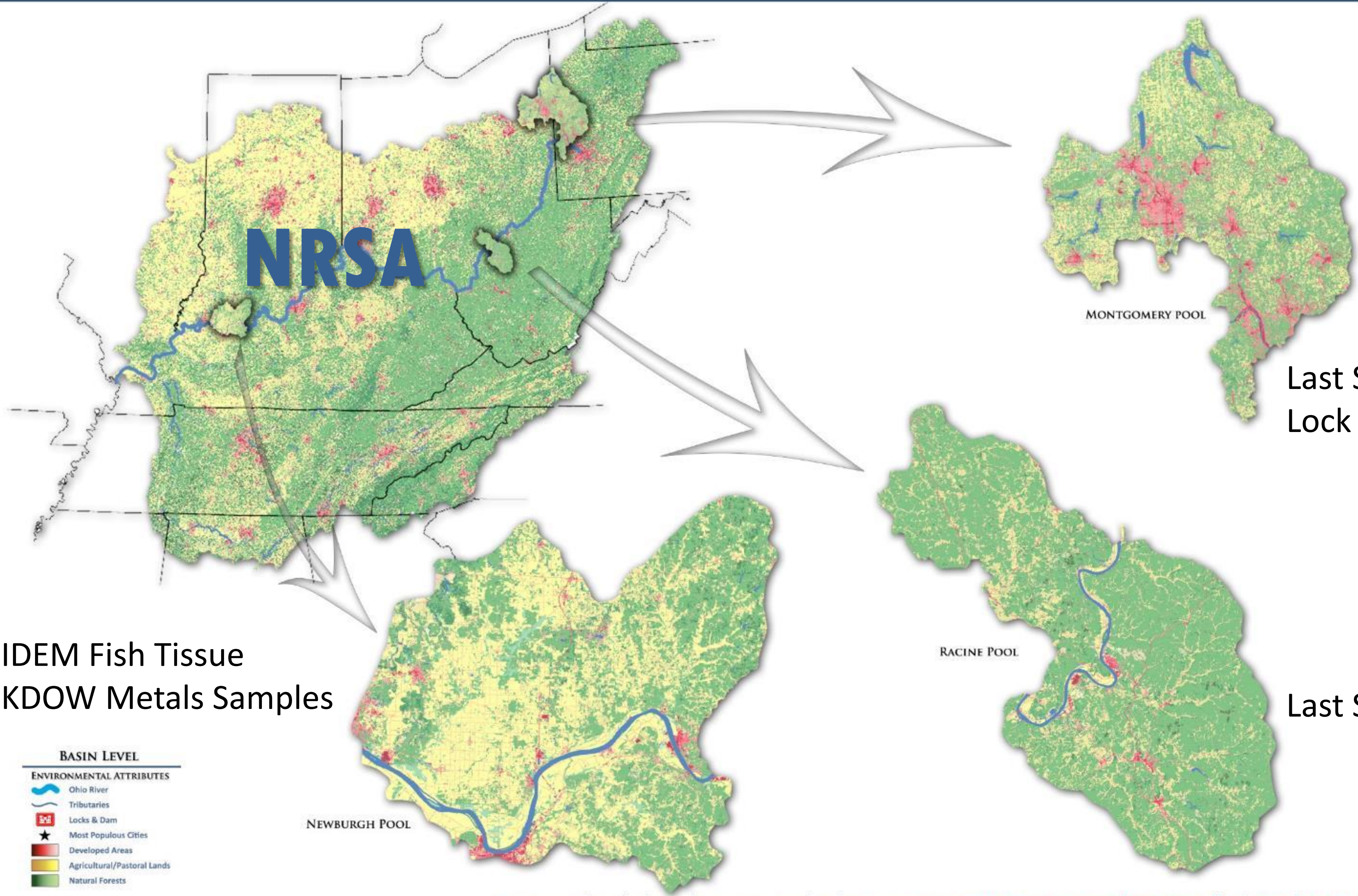
1. Recommend dissemination of the Draft PCBs Trends in Ohio River Channel Catfish Tissue to the Technical Committee for review
2. Approve the recalibrated fish and macroinvertebrate indices for use in the 4th assessment cycle
3. Approve the 2022 assessment of John T. Myers pool as supporting its ALU designation
4. Approve the 2023 fish results of New Cumberland and Cannelton pools for use in assessments
5. Allow staff the flexibility to divert resources as necessary from routine Ohio River surveys in order to complete the remaining 45 NRSA events in the 2024 field season

Convene a meeting in April to review

1. 2023 Macroinvertebrate Results and final pool assessments
2. 2024 Field season Priorities

2024 Potential Pool Surveys

Montgomery or Racine and Newburgh



Last Surveyed in 2015
Lock Chamber Expansion

Last Surveyed in 2015

IDEM Fish Tissue
KDOW Metals Samples

Agenda Item 14:
Monitoring Strategy Update

Jason Heath, ORSANCO

Results of June 16, 2023 Monitoring Strategy Committee Meeting

Discussed current monitoring issues and options for FFY24 Monitoring Initiative Funds of approx. $79,000. These funds are not for ongoing, routine monitoring programs, but more to fill short-term needs. For the period Oct 2023 through Sept 2024.

Alternative Projects & Rankings:

	IL	IN	KY	PA	WV	
Monitoring Strategy		2	1	1		*
Long-term Trends	3	2	1	2		*
PFAS	2 Water	1 tribs	2 tribs	4 – passive 6 – eval of grabs needed	1	*
Evaluate Bacteria Technologies	1 Fluidion			3 Proteus	2 Proteus	*
PCBs/Dioxin						
Mussel Survey				5		
Tributary Metals			3			
Data Mgnt/Systems			4			

- **Monitoring Strategy & Long-term Trends are all staff time and therefore best for the budget.**
- **Benefits of Monitoring Strategy that it will allow us a further evaluation of all alternatives.**
- **PFAS water sampling analytical $43K-45K plus shipping. Remainder for staff time.**
- **Proteus/Turner real-time monitors may not be suitable to replace 305b/303d listing data.**

Ongoing Monitoring Issues

I. 305b Workgroup Has Been Recommending Monitoring Programs to Update Bacteria, PCBs, and Dioxin Data for Use in Future Ohio River 305(b) Assessments.

II. Routine PFAS Monitoring.

III. Mussel Surveys/Addition to biological monitoring as additional indicator.

IV. Tributary Metals

V. Data Mgnt/Systems

VI. Long-term trends of bimonthly/clean metals

Updating Bacteria Data for 305b Assessments

- Vast majority of 305b Report Contact Recreation Use Assessment based on longitudinal bacteria surveys collected up until 2008.
- Based on that data, 2/3 of the Ohio River designated as impaired. Impairments are highly dependent on when sampling conducted in relation to precipitation events..
- Longitudinal surveys were comprised of 5 rounds of weekly sampling, collected every 5 miles for 981 Ohio River miles, 4 staff & mobile lab, 15 weeks to complete.
- **This would be a huge undertaking to repeat the longitudinal surveys.**
- **Unclear what the benefits of updating this data would be.**
- **We are in the process of completing long term trends on bacteria data which may show general improvement in bacteria levels in the river.**
- **Evaluating Proteus sensor for real-time bacteria monitoring (Real-time tryptophan sensors with algorithms to estimate bacteria)**
- **Not evaluating Fluidion 7 bay sampler which utilizes Colilert-type technology; USGS is evaluating this technology.**

Evaluating Proteus Realtime Monitor

- Measures tryptophan and uses an algorithm to estimate total coliforms, E. coli, enterococci.
- Cost of the unit is $26K.
- Potential interferences with turbidity.
- Purchased Proteus sensor with WV604b funding.
  - Project set to begin April, 2024.
  - Side-by-side sampling at the Cincinnati bacteria monitoring sites.
  - Depending on successful results in Cincinnati, how does the algorithm hold up under changing river conditions over time and spatially.

PCBs & Dioxin Fish Consumption Impairments

- PCBs and Dioxins were collected in the water column until 2004 using "High Volume" sampling.
- High vol sampling entails pumping 1000 liters of water through a resin-packed column over multiple hours.
- The fish consumption use was evaluated based on sampling every 50 miles.
- All samples much higher than criteria (two orders of magnitude)
- Entire river is designated impaired for fish consumption based on both dioxin and PCBs.
- PCBs are included in fish tissue monitoring programs.
- Challenges:
  - High vol sampling necessary to evaluate dioxin & PCBs to achieve detection levels below the criteria.
  - Time/staff intensive.
  - Analytical costs are very expensive.

PCBs in Ohio River Water Data

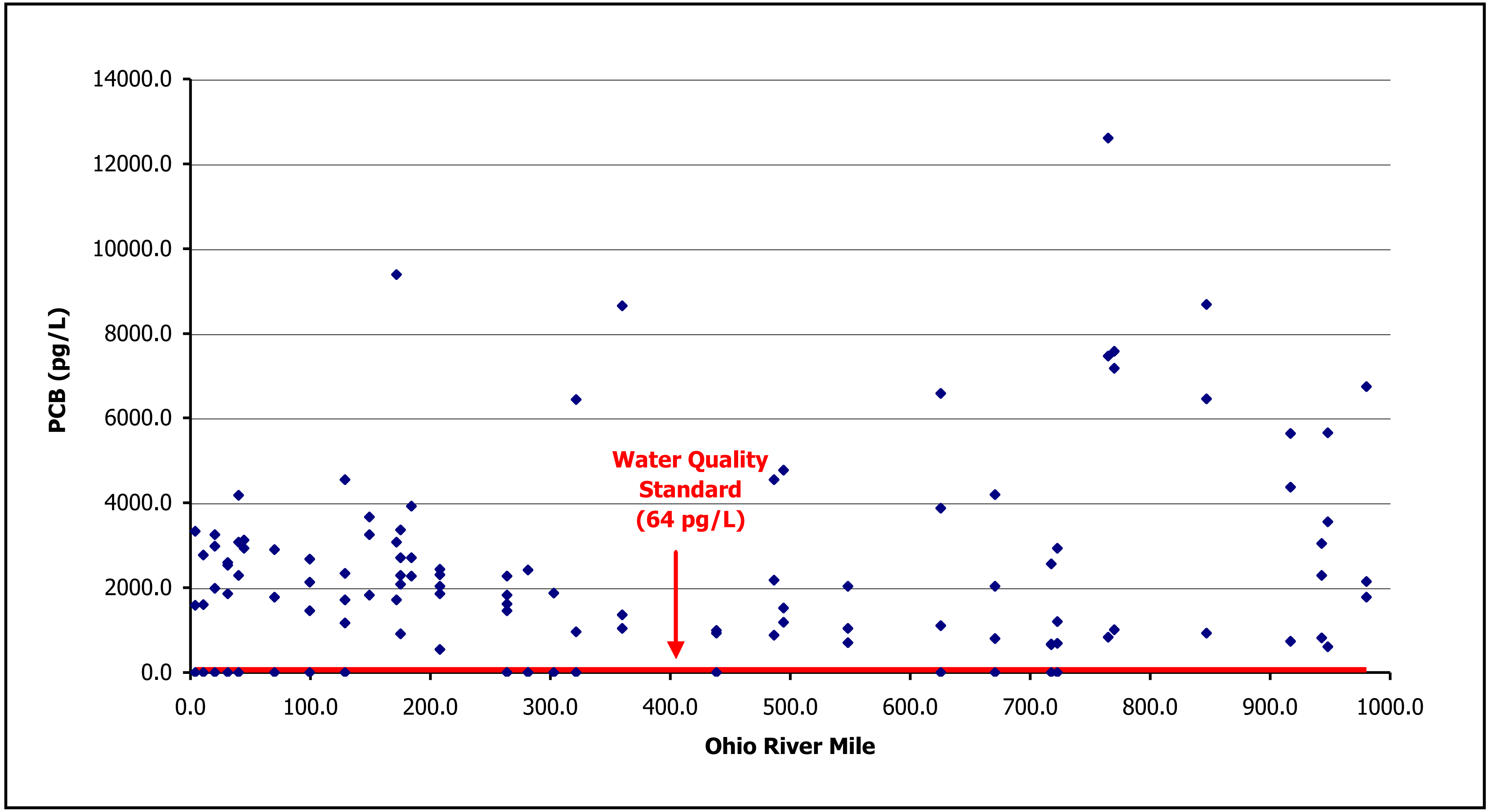


Figure 11. PCB data from the Ohio River collected from 1997-2004.

Dioxin in Ohio River Water Data

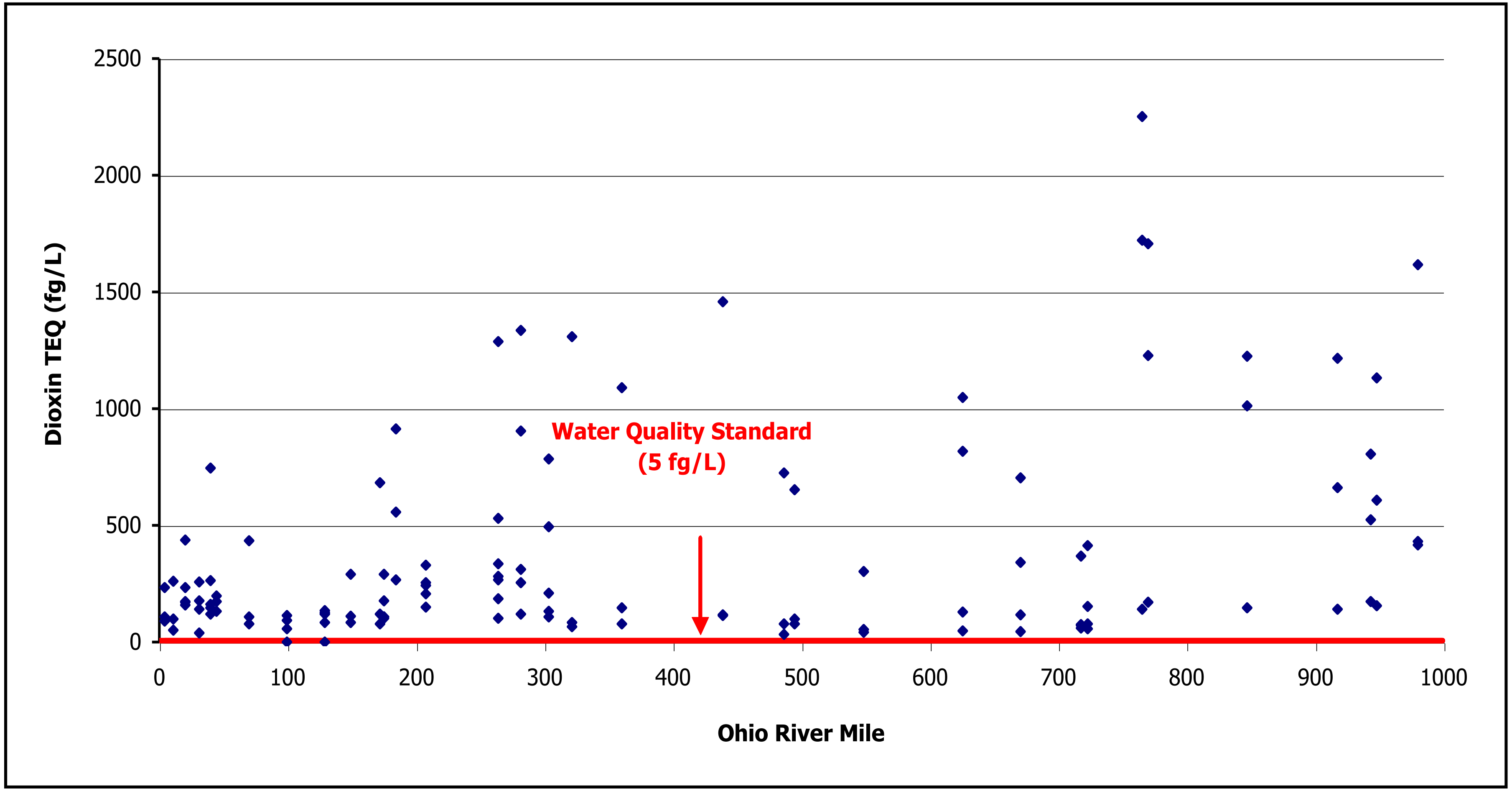
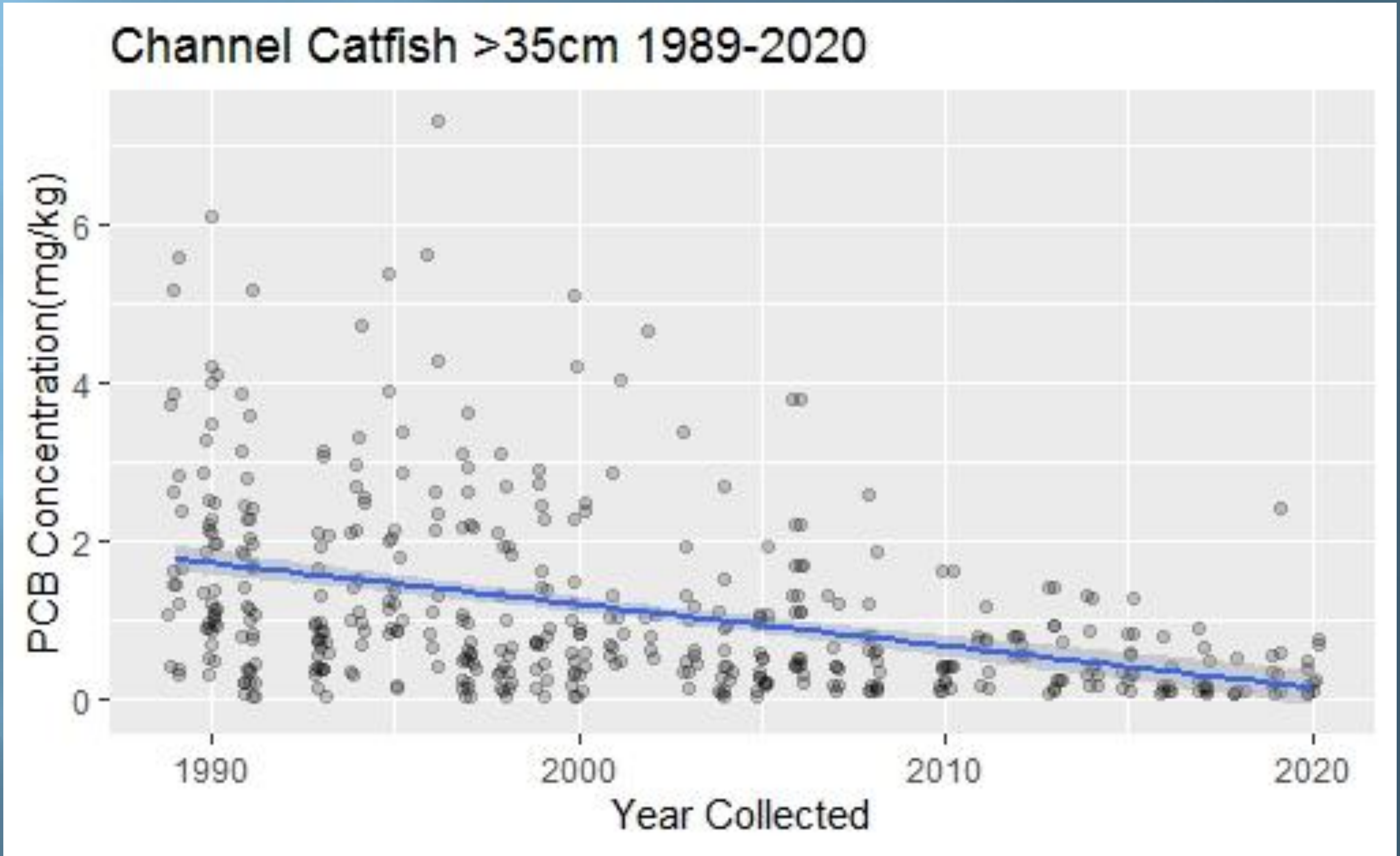


Figure 10. Dioxin TEQ concentrations in the Ohio River (1997-2004).



Channel Catfish >35cm 1989-2020
PCB Concentration(mg/kg)
0
2
4
6
1990
2000
2010
2020
Year Collected

Options for PCBs & Dioxins

- Repeat high volume sampling at twenty Ohio River sites.
  - Several hundred thousand dollar project.
- Repeat for a subset of 3ish sites (upper, middle and lower river) much more manageable.
  - $100,000 project.
  - Would require evaluation and potentially refurbishment of High Vol sampler.
- There are indications that PCBs may be decreasing based on fish tissue trends.

II. Routine PFAS Monitoring

- In 2021, completed an ambient survey of PFAS in water at 20 Ohio River sites, two rounds of sampling.
- Currently have PFAS fish tissue monitoring programmed annually. There are indications that PFAS would generate fish consumption advisories based on Great Lakes guidelines.
- Water quality criteria are under development.
- Is routine water quality monitoring needed?
  - If so, options to add to bimonthly grab sampling of mainstem and tribs, or independent EDI sampling events which would be much more expensive.
  - Analytics are $500 per sample ($100k annually at all 33 sites plus shipping).

ORSANCO Fish Tissue Contaminants Monitoring PFAS

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2022-966-1.6	966	River Carpsucker	ND	7500	**7.5**	0.0075	0.128	ORSANCO	2022
2022-966-18A	966	Freshwater Drum	ND	18000	**18**	0.018	0.0209	ORSANCO	2022
2022-972-4B	972	Channel Catfish	ND	1900	**1.9**	0.0019	0.0974	ORSANCO	2022
2022-974-17	974	Sauger	ND	19000	**19**	0.019	0.122	ORSANCO	2022
2022-978-0.6	978	Silver Carp	ND	6600	**6.6**	0.0066	0.0091	ORSANCO	2022

Advisory Groupings

Level 1	Unlimited Consumption
Level 2	1 meal/week
Level 3	1 meal/month
Level 4	6 meals/year
Level 5	No Consumption

Contaminant	limited Consumpt	1 ml/wk	1 ml/mo	6 ml/yr	No Consumption
	Level 1	Level 2	Level 3	Level 4	Level 5
Hg (ppm)	<=0.05	0.05<x<=0.22	0.22<x<=0.94	NA	>0.94
PCB (ppm) skin on	<=0.05	0.05<x<=0.22	0.22<x<=0.94	0.94<x<=1.88	>1.88
PCB (ppm) skin off	<=0.036	0.036<x<=0.155	0.155<x<=0.67	0.67<x<=1.34	>1.34

A uniform fish consumption advisory protocol for the Ohio River. Environ Monit Assess, 2011.

Table 1. Levels of PFOS in Fish and Corresponding Meal Advice Categories for all Populations

PFOS in Fish (µg/kg)	Meal Frequency
≤ 10	Unrestricted
> 10-20	2 meals/week
> 20-50	1 meal/week
> 50-200	1 meal/month
> 200	DO NOT EAT

Great Lakes Consortium for Fish Consumption Advisories; Best Practice for Perfluorooctane Sulfonate (PFOS) Guidelines, Nov. 2019.

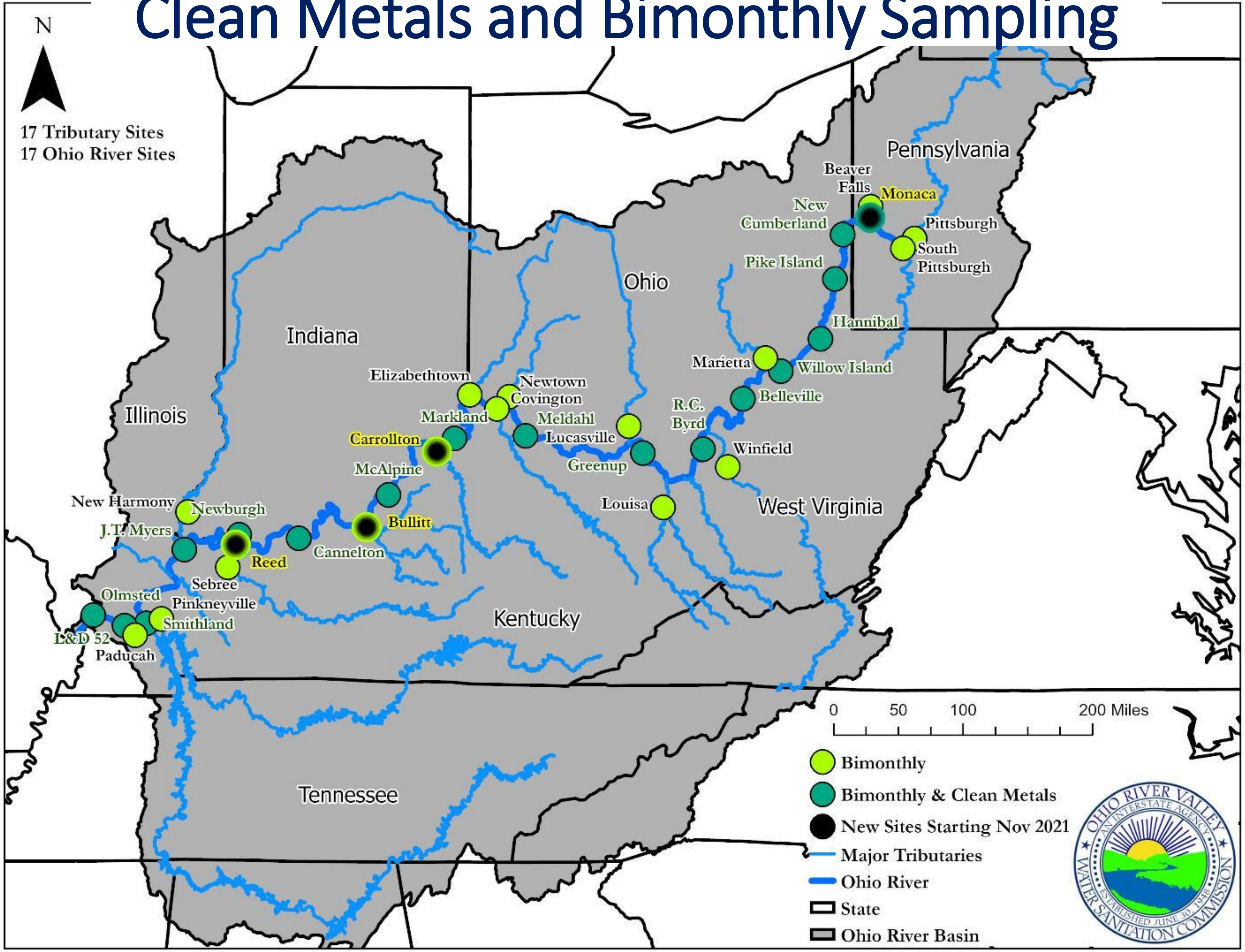
Mussel Surveys

- Work towards third bio indicator.
- Develop baseline mussel occurrence information.
- 1 pool is $50k.
- Entails 15 probabilistic sites per pool at fish and bug locations.

Tributary Clean Metals Sampling

- Currently collect mainstem clean metals samples at 16 mainstem sites.
- Analyze for total and dissolved metals.
  - Criteria violations for total mercury and iron; no impairments based on data.
- Is tributary sampling desirable on the 17 major trib sampling sites?

Clean Metals and Bimonthly Sampling



Data Management & Information Systems

- **We are in the early stages of overhauling our data management systems. Probably 3 years out from completion.**
- **Currently funding an evaluation of options with set aside funds.**

Long Term Trends of Bimonthly/Clean Metals

- **Last analysis of these data completed in 2008.**
- **Use Seasonal Kendall Trends Test on concentration and flow-adjusted data.**

- **Are there more accepted statistical methods available now?**

Seasonal Kendall Test on Direct Concentrations

Bimonthly SiteName	River	Al	Cl-	Fe	Hardness	Mg	Mn	NH3-N	NO2-NO3-N	SO4	TP	TSS	Zn
Pittsburgh	Allegheny	O	INC	DEC	INC	INC	DEC	O	INC	O	O	O	dec
South Pittsburgh	Monongahela	O	INC	O	O	INC	DEC	O	inc	O	O	O	DEC
Beaver Falls	Beaver	O	INC	DEC	O	INC	DEC	O	dec	O	INC	O	O
New Cumberland	Ohio	DEC	INC	DEC	INC	INC	DEC	O	INC	O	DEC	DEC	DEC
Pike Island	Ohio	DEC	INC	DEC	O	inc	DEC	DEC	O	O	DEC	DEC	DEC
Hannibal	Ohio	O	INC	DEC	INC	INC	dec	O	O	O	O	O	DEC
Willow Island	Ohio	dec	INC	DEC	inc	INC	DEC	DEC	O	O	DEC	DEC	O
Marietta	Muskingum	DEC	O	DEC	O	INC	DEC	O	O	O	INC	DEC	DEC
Belleville	Ohio	DEC	INC	DEC	inc	INC	DEC	O	O	O	inc	DEC	DEC
Winfield	Kanawha	O	INC	O	INC	INC	inc	O	INC	INC	DEC	O	DEC
R.C. Byrd	Ohio	O	INC	O	O	INC	O	O	O	O	INC	inc	DEC
Louisa	Big Sandy	dec	O	dec	INC	INC	dec	INC	O	INC	O	DEC	DEC
Greenup	Ohio	DEC	INC	O	INC	INC	O	O	INC	O	INC	O	DEC
Lucasville	Scioto	O	inc	O	INC	INC	O	INC	DEC	O	INC	DEC	DEC
Meldahl	Ohio	O	INC	O	DEC	O	O	DEC	DEC	INC	O	O	DEC
Newtown	Little Miami	O	INC	O	inc	INC	O	inc	DEC	O	INC	DEC	dec
Covington	Licking	O	DEC	O	DEC	O	O	DEC	DEC	DEC	O	DEC	DEC
Anderson Ferry	Ohio	dec	INC	O	O	INC	O	INC	O	O	INC	O	O
Elizabethtown	Great Miami	O	O	O	O	inc	O	O	DEC	DEC	O	DEC	O
Markland	Ohio	O	INC	DEC	DEC	O	DEC	O	DEC	inc	INC	DEC	DEC
Louisville	Ohio	O	O	O	O	INC	O	dec	O	INC	INC	O	DEC
West Point	Ohio	DEC	INC	DEC	INC	INC	O	O	O	INC	INC	O	DEC
Cannelton	Ohio	O	INC	DEC	INC	INC	DEC	O	O	INC	INC	O	DEC
Newburgh	Ohio	O	INC	O	INC	INC	O	O	INC	INC	INC	O	DEC
Sebree	Green	dec	INC	O	INC	INC	O	O	INC	INC	INC	O	DEC
J.T. Myers	Ohio	O	INC	dec	INC	INC	DEC	O	O	INC	INC	O	DEC
Route 62 Bridge	Wabash		O	O	O	O	O	O	O	O	O	O	O
Smithland	Ohio	DEC	INC	DEC	INC	INC	dec	O	O	INC	INC	O	O
Pinkneyville	Cumberland	O	INC	inc	INC	INC	O	O	O	INC	INC	O	O
Paducah	Tennessee	DEC	INC	DEC	INC	INC	DEC	O	INC	INC	DEC	O	DEC
L&D 52	Ohio	DEC	INC	DEC	INC	INC	DEC	O	inc	INC	INC	O	DEC

INC - Strong significant increasing trend ($p < 0.05$, $Z_{0.025} = 1.96$)
inc - Significant increasing trend ($p < 0.10$, $Z_{0.05} = 1.6449$))
O - No significant trend found
dec - Significant decreasing trend ($p < 0.10$, $Z_{0.05} = 1.6449$)
DEC - Strong significant decreasing trend ($p < 0.05$, $Z_{0.025} = 1.96$)

Summary of Monitoring Issues

- Revised Monitoring Strategy document due for the federal monitoring initiative grant funds by Sept 30, 2024.
- Update bacteria, PCBs and dioxin data for 305b.
  - Bacteria data are so highly dependent on precipitation, unclear if there is any benefit to updating this data.
  - Bacteria trends showing some improvement.
  - PCBs and dioxin require high volume sampling which is resource intensive and not likely to change impairments
  - Could more easily do a subset of the last PCBs/dioxin survey.
  - Fish tissue showing improving trend for PCBs.
- Evaluate Proteus real time monitor for bacteria – this project begins in April.
  - Evaluate other technologies (Fluidion)? USGS is conducting an evaluation.
- Add PFAS to the Bimonthly Clean Metals Sampling Program?
  - Currently monitoring fish tissue
  - Grab versus EDI sampling? Passive sampling?
- Mussel Surveys/Indicator development - $50k per pool.
- Tributary Metals - $60K annually + shipping.
- Data Management project has funding and work initiated.
- Long-Term Trends Analysis on Bimonthly/Clean Metals data.
- Review Broad Scan Survey results (sampling completed 2023) for consideration of adding parameters to routine monitoing programs.

Open Discussion

1) Prioritize Issues

2) Addition of other Issues

2) Consider options for FFY25 Monitoring Initiative Funds ($66K-$79K)

4) Add Chapter to Monitoring Strategy Document on Current Monitoring Program Issues and Direction.

Agenda Item 15:
TEC Members Reports

- IL – Scott Twait
- IN – Brad Gavin
- KY – Katie McKone
- NY – Damianos Skaros
- OH – Melinda Harris
- PA – Kevin Halloran
- VA – Jeffrey Hurst
- WV – Scott Mandirola
- USACE – Erich Emery
- USCG – Michael Franke-Rose
- USEPA – David Pfeifer
- USGS – Jeff Frey
- CIAC – Kathy Beckett
- PIAC – Cheri Budzynski
- PIACO – Betsy Bialosky
- POTW – Reese Johnson
- WOAC – Heather Hulton VanTassel
- WUAC – Chris Bobay

Other Business:

- Comments by Guests
- Announcement of Upcoming Meetings

  June 11-12, 2024: Louisville, KY

  October 8-10, 2024: Charleston, WV
- Adjourn

Chair, Scott Mandirola