Cincinnati
New Richmond
Agusta
Maysville
Portsmouth
Rising Sun
Vevay
Madison
Carrollton
Westport
Louisville
Westport
The Ohio River Recreational Trail
Portsmouth to Cincinnati - 120 River Miles
Cincinnati to Louisville - 133 River Miles
Louisville to West Point - 25 River Miles

Dr. David Wicks

River City Paddlesports: Board President

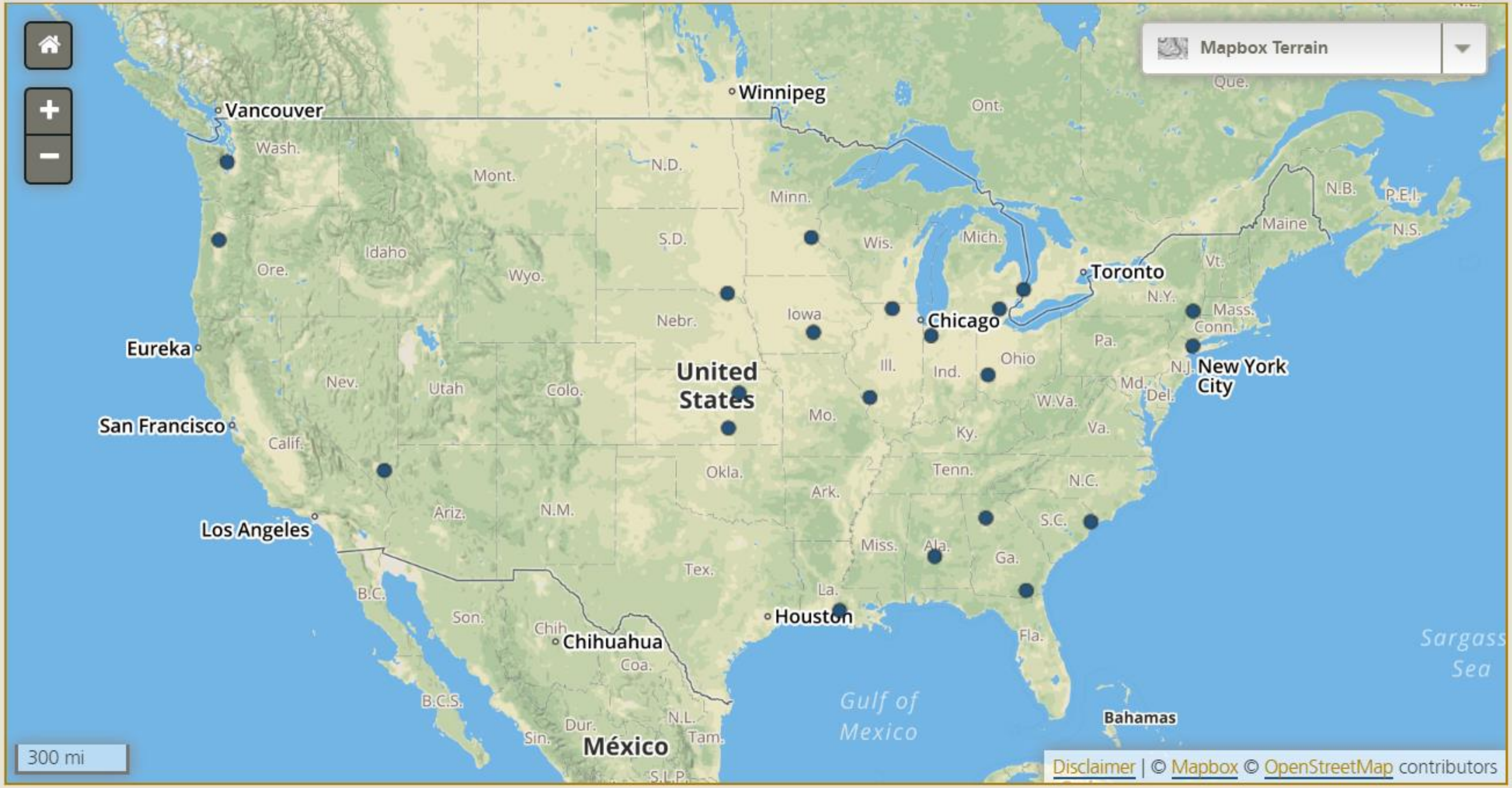
Ohio River Recreational Trail Committee Co-Chair

www.rivercitypaddlesports.org

We are here to show our support and willingness to participate in the development of the Ohio River Basin Strategy.

National Parks Service Water Trail System

A distinctive national network of exemplary water trails across the country is ready to be explored!



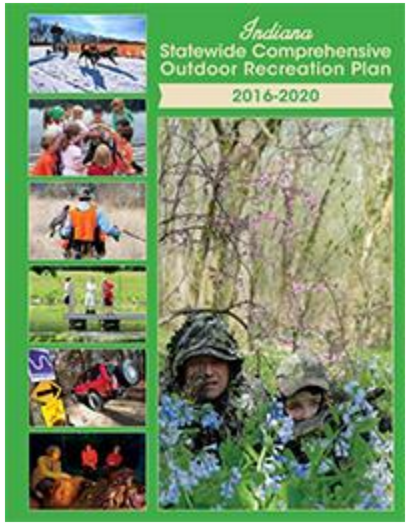
Great Miami Water Trail

Benefits of National Water Trail designation

- The Secretary of the Interior issues a letter and certificate announcing the designation as a national water trail.
- National promotion and visibility, including use by the management entity of the National Water Trails System logo.
- Opportunities to obtain technical assistance and funding for planning and implementing water trail projects.
- National water trails gain positive economic impact from increased tourism.
- Assistance with stewardship and sustainability projects.
- Increased protection for outdoor recreation and water resources.
- Contribution to public health and quality of life from maintaining and restoring watershed resources.

National Water Trails System

Kentucky Dept. of Fish & Wildlife Resources


Indiana
Statewide Comprehensive Outdoor Recreation Plan
2016-2020

Thomas More University

Oldham County Kentucky Established 1824

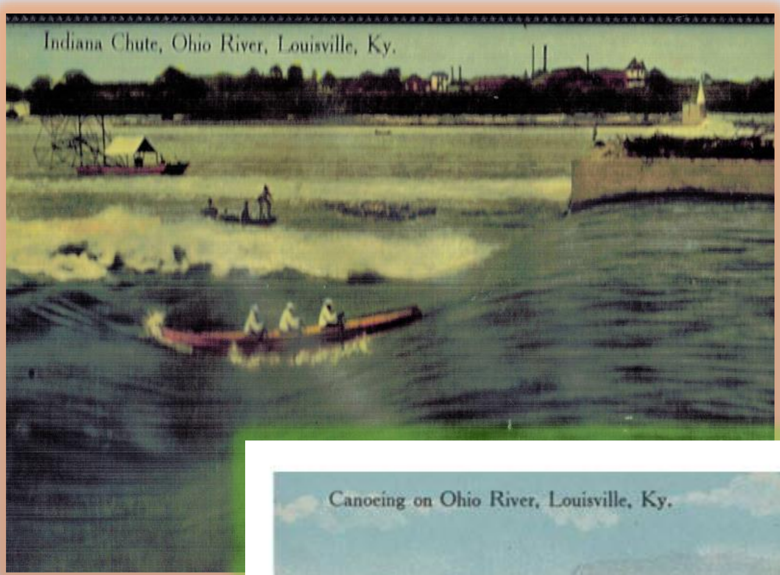
Switzerland County Tourism

Rising Sun

Woodland Farm

The economic impact is huge, no one knows the number of river users

From canoeing and rowing on the river in the late 1800s to floating on the river today, the river is used for recreation.

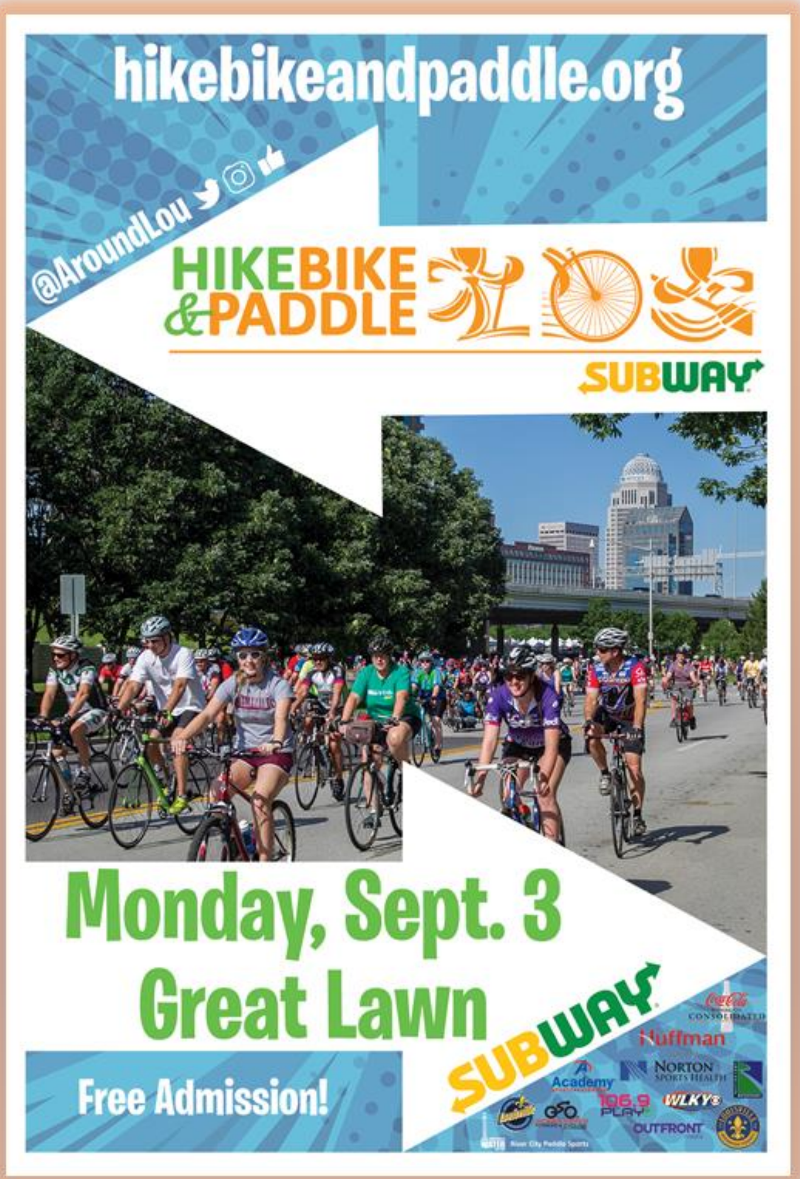


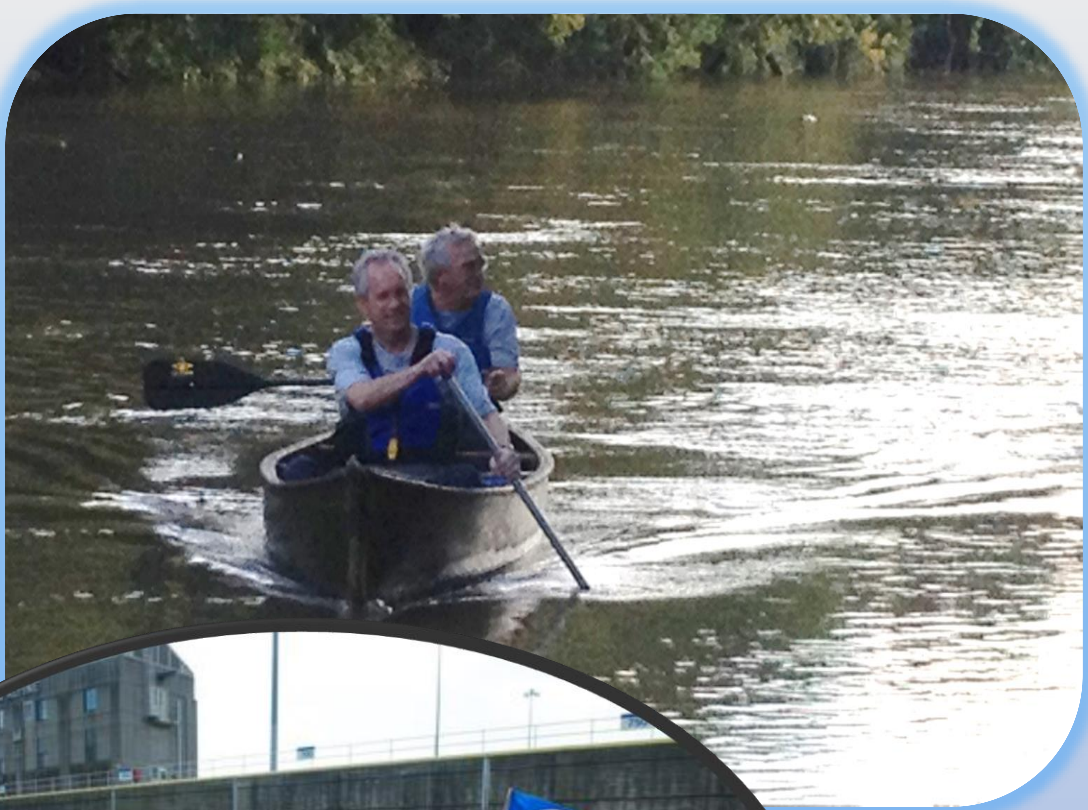
Establishing the Ohio River Recreational Trail

NATIONAL WATER TRAILS SYSTEM

Ohio River Paddlefest

Hike Bike and Paddle





Environmental education on the Ohio River and Beargrass Creek

Mayor Fischer is a huge supporter of connecting with the Ohio River!

The Ohio River Voyageur Canoe Trip, June 6-9

Biking the Ohio River Corridor – Cincinnati to Louisville – June 6 to 7, in collaboration with the Ohio River Voyageur Canoe Trip.

Gilday Park, Cincinnati, Ohio River Mile 475.5

Louisville, Kentucky, Waterfront Park, Ohio River Mile 603.3

During the Ohio River Voyageur Trip we will be collecting the stories of the river.


The Artistic


Access Points

River towns

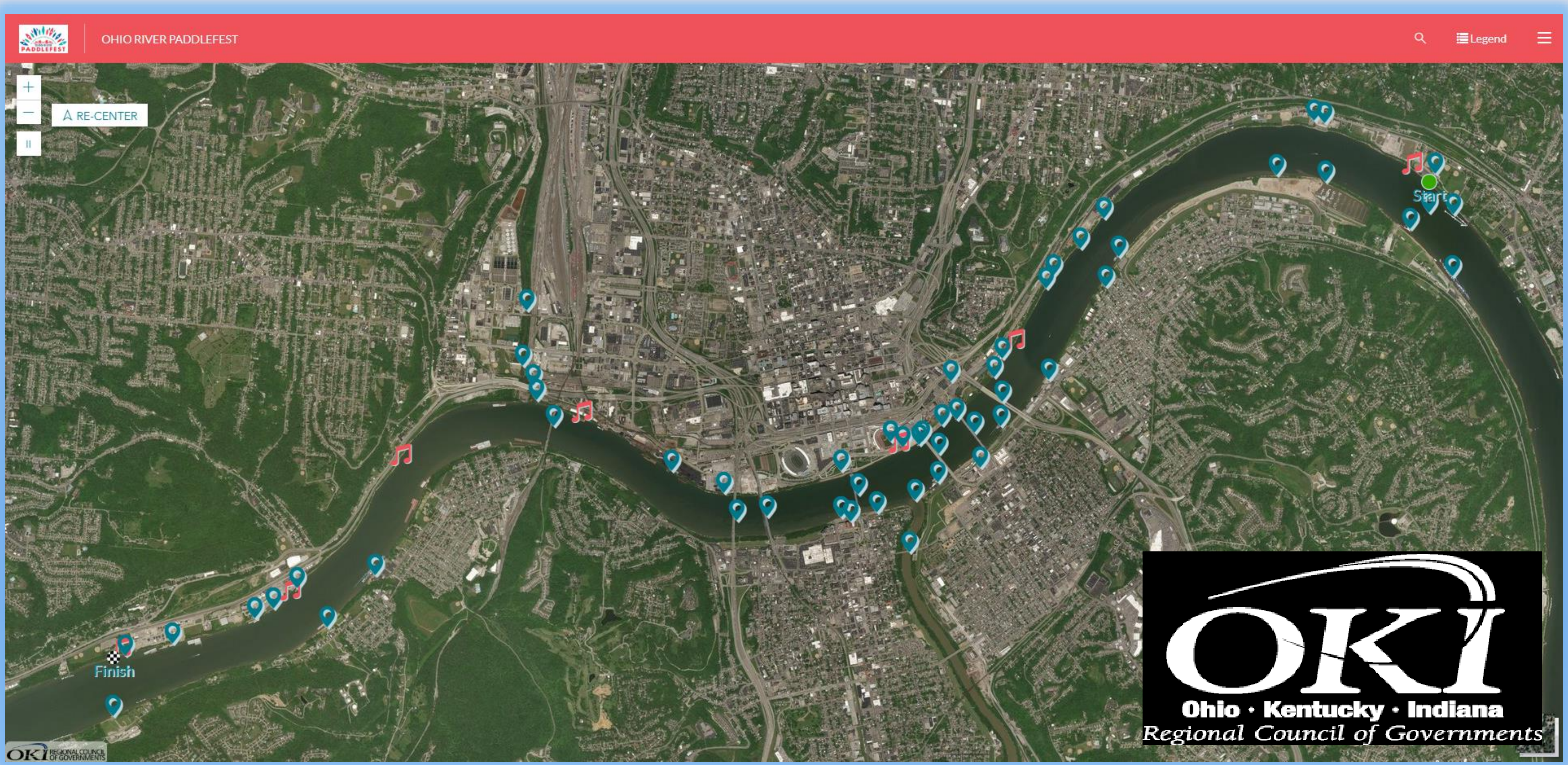

Interesting people – river rats


The Pollution


The Biodiversity

The Digital Guide to the Ohio River

Using the stories and data collected, the Digital Guide to the Ohio River by OKI that was developed for the Ohio River Paddlefest will be expanded to cover the entire Ohio River Recreational Trail.



The Ohio River Recreational Trail Committee is looking forward to work with ORSANCO and the Ohio River Basin Alliance

Ohio River Basin Strategy

We look forward to working with:

Recreation Work Group

Education and Research Work Group

Through active involvement we will help energize the education and recreation communities to speak in a unified voice for the Ohio River.


The Ohio River Recreational Trail

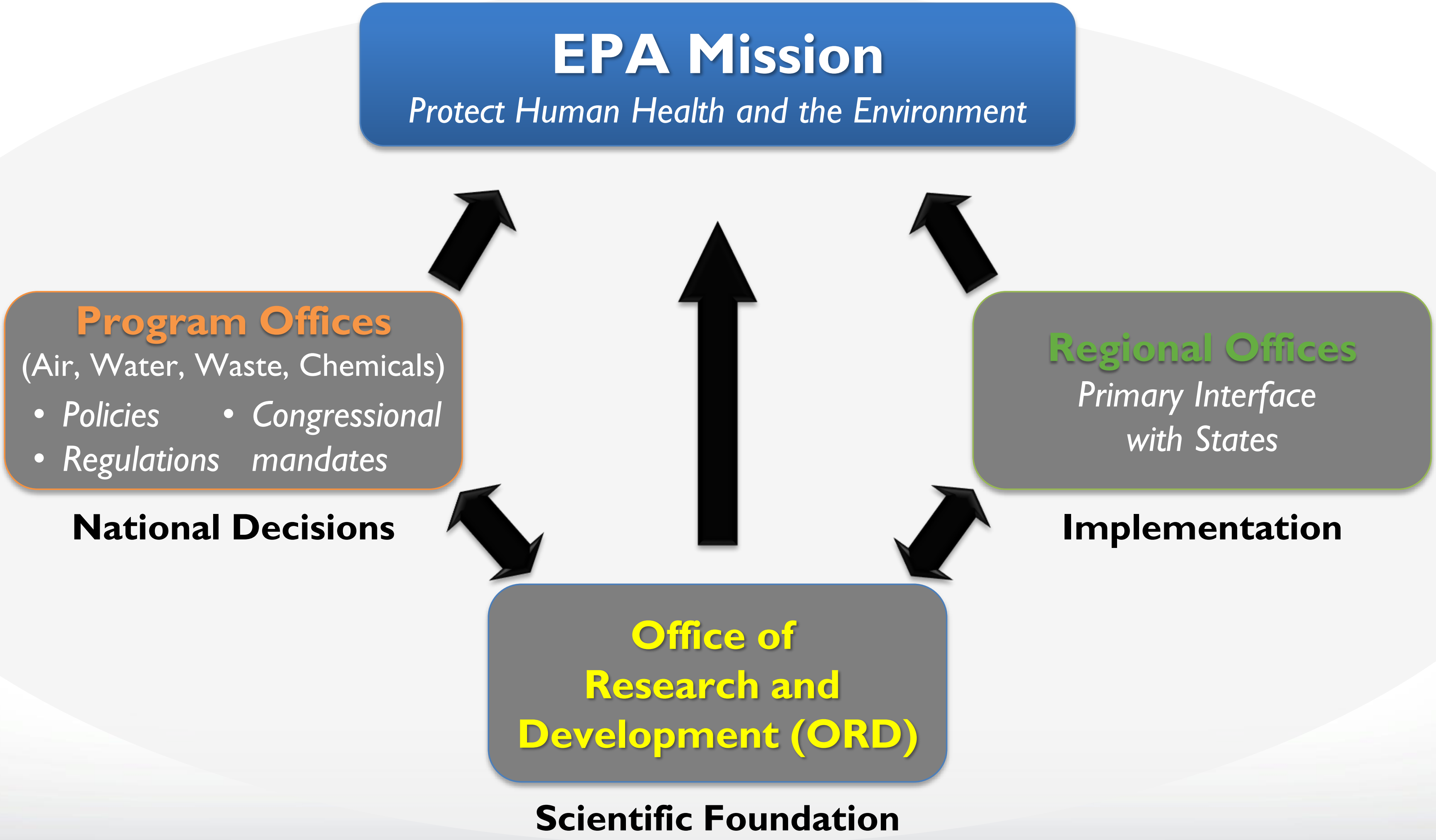
February 2, 2019

Office of Research and Development

Safe and Sustainable Water Resources Research Program

Proposed Research 2019-2021

Science to Support EPA's Mission

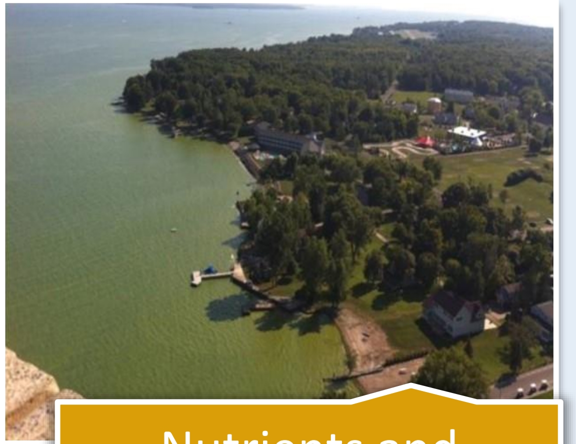


Overarching Topics

Safe and Sustainable Water Resources Research Program

Clean Water Act | **Safe Drinking Water Act**

Watersheds

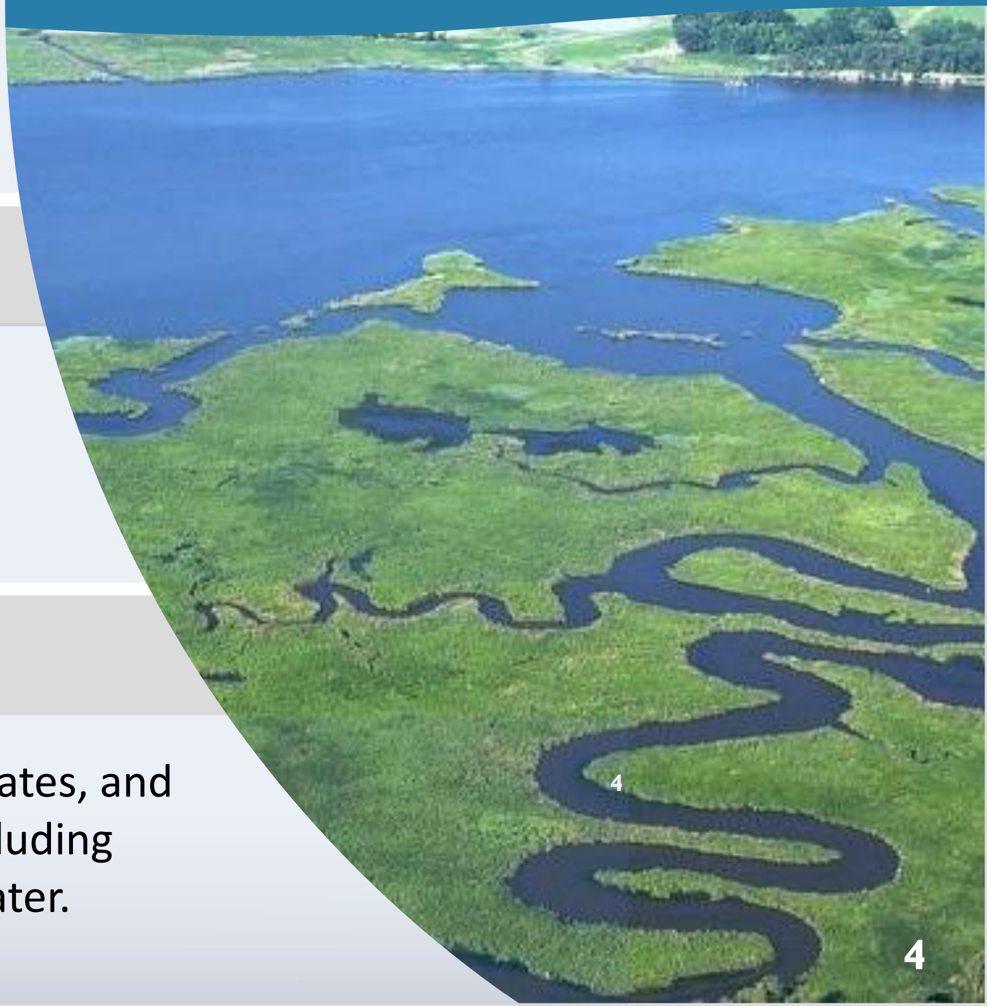


Nutrients and Harmful Algal Blooms

Water Treatment and Infrastructure

Research Topic and Research Areas

Watersheds



Research Area 1 — **Assessment, Monitoring, and Management of Aquatic Resources**

Will provide nationally consistent and scientifically defensible assessments of U.S. waters to implement the National Aquatic Resource Surveys (NARS).

Research Area 2 — **Improved Aquatic Resource Mapping**

Will provide methodologies, tools, and datasets for aquatic resource mapping of waters of the United States.

Research Area 3 — **Human Health and Aquatic Life Criteria**

Will provide science to support EPA's Office of Water (OW) to assist regions, states, and tribes with new or revised water quality criteria and their implementation, including support to protect human health and aquatic life from pollutants in surface water.

Research Topic

Nutrients and HABs

Research Area 1 — **Assessment & Management of Harmful Algal Blooms**

Will provide stakeholders and decision makers at the national, regional, state, and local levels with scientific information and tools to more effectively assess and manage HABs and associated toxicity events.

Research Area 2 — **Science to Support Nutrient-Related Water Quality Goals**

Will advance the science to inform decisions related to nutrient and co-pollutant water quality goals of program offices, regions, states, and tribes.

Research Area 3 — **Assessment and Management of Nutrients**

Will help our customers plan, implement, and track the effectiveness of nutrient reduction strategies at multiple scales, including watersheds draining to receiving waters potentially affected by HABs or other nutrient-related water quality issues.

Research Topic

Water Treatment and Infrastructure

Research Area 1 — **Drinking Water/Distribution Systems**

Will provide essential results and tools to our customers for managing existing and future drinking water needs. Specifically, it focuses on areas of recent concern that require novel solutions.

Research Area 2 — **Per- and Polyfluoroalkyl Substances (PFAS)**

Will provide robust analytical methods for analyzing PFAS in water, solid, and tissue samples, and a centralized website for treatment and pretreatment recommendations for wastewater and water reuse. Will also provide characterization of PFAS in biosolids, wastewater, and landfill leachates with an emphasis on pretreatment strategies for minimizing PFAS contamination in water resources.

Research Area 3 — **Wastewater/Water Reuse/Integrated Stormwater Management**

Will provide guidance on new and existing treatment technologies and analytical methods for emerging contaminants and contaminant risks. Will also focus on integrated aspects of green/gray infrastructure and stormwater flow control to help states, municipalities, and utilities reduce the number of combined sewer overflows.

Research Area 4 — **Technical Support**

Will provide a means for rapid response to specific, unplanned program office, state, tribe, and community research needs concerning high-priority issues.

USGS Ohio-Kentucky-Indiana Water Science Center

Serving the Nation and providing high-quality science for over 100 years

Brief overview: USGS Super Gages

Large-River Nutrient and Sediment Sampling Network – Fixed Station and Mobile Deployment

Pete Cinotto

Deputy Director

USGS OKI WSC

Louisville, KY

U.S. Department of the Interior
U.S. Geological Survey

“Note: all Data Herein is Considered Preliminary Information and is Subject to Revision. Not for Citation or Distribution"

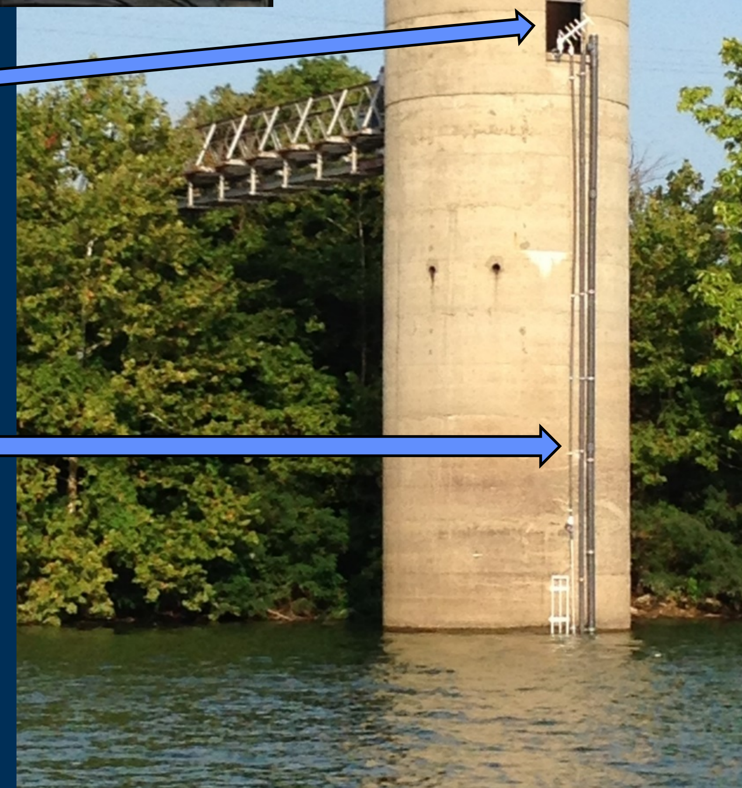
What is a USGS “super gage”?

Satellite telemetry and GPS

Nitrate plus nitrite sensor

Water quality sonde

ADVM

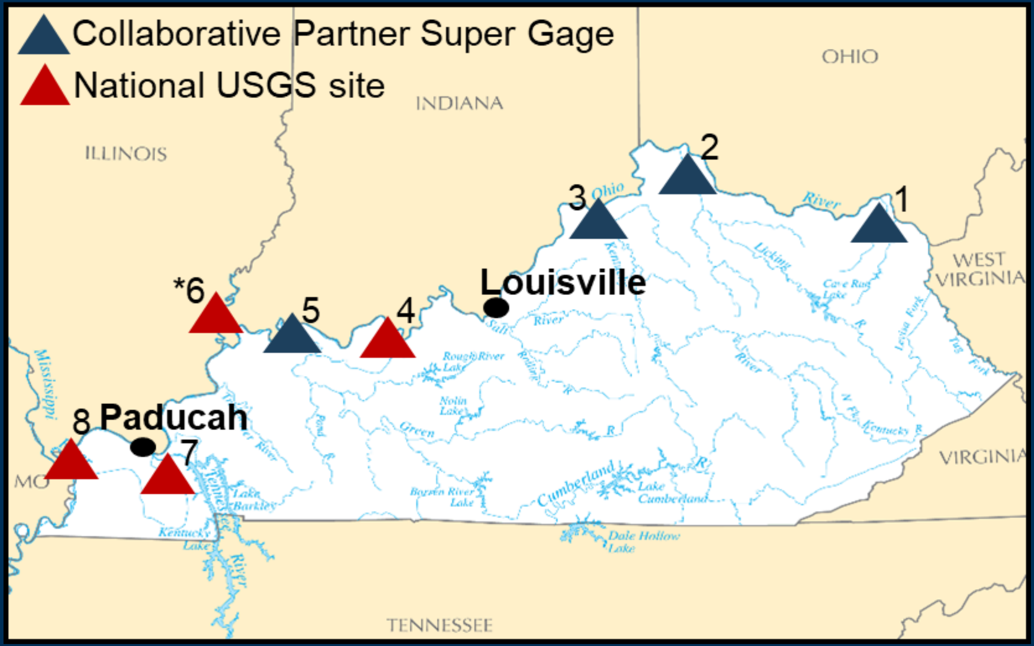


USGS

Fixed-site locations

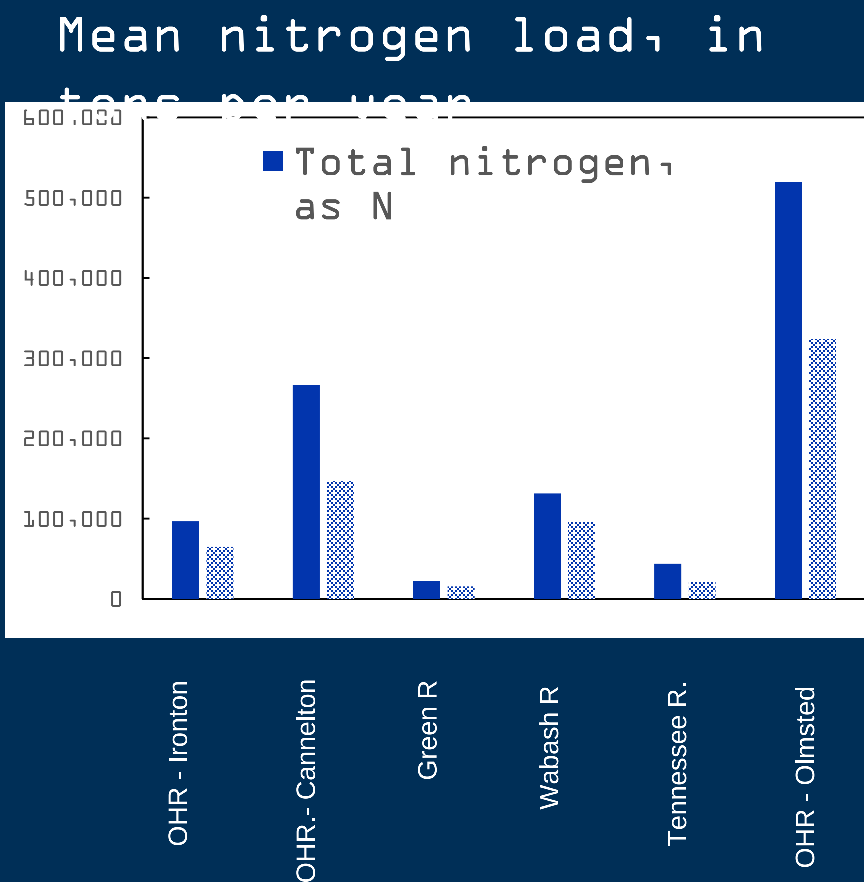
1) Ohio River at Ironton, OH
2) Licking River near Alexandria, KY
3) Kentucky River at Lockport (Lock 2)
4) Ohio River at Cannelton, IN
5) Green River at Spottsville, KY
6) *Wabash River at New Harmony, IN
7) Tennessee River near Paducah, KY
8) Ohio River at Olmsted, IL

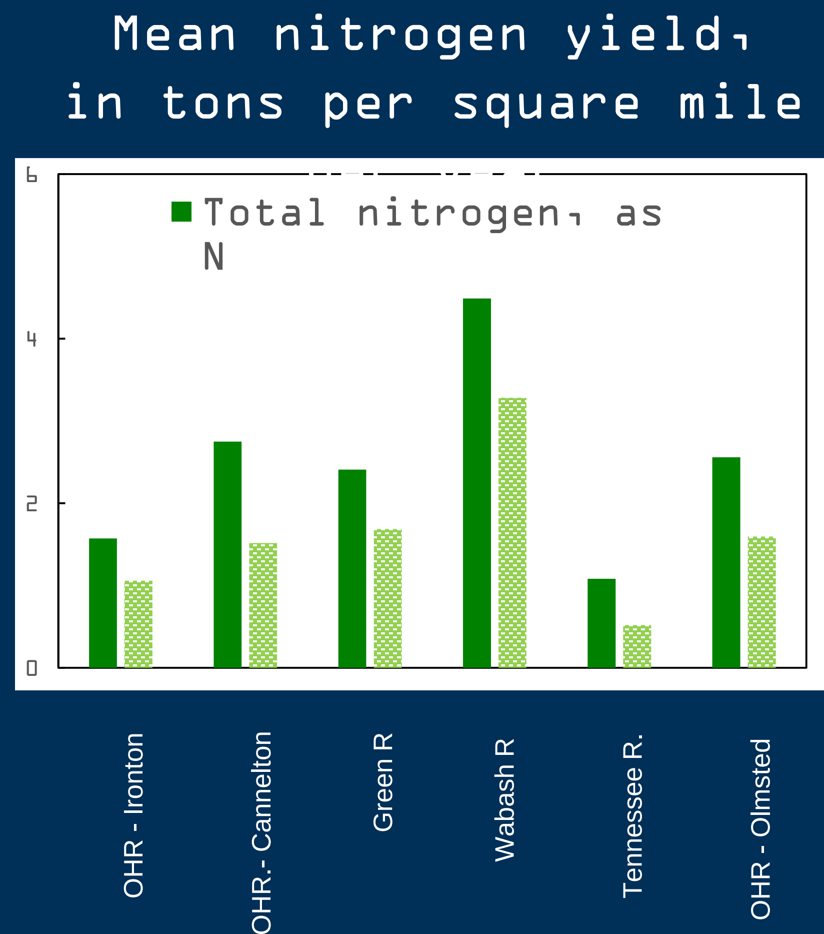
Long-term fixed sites are required to compute loads, yields, climate response, etc.



USGS

Mean Nitrogen Loads and Yields 2014-2017

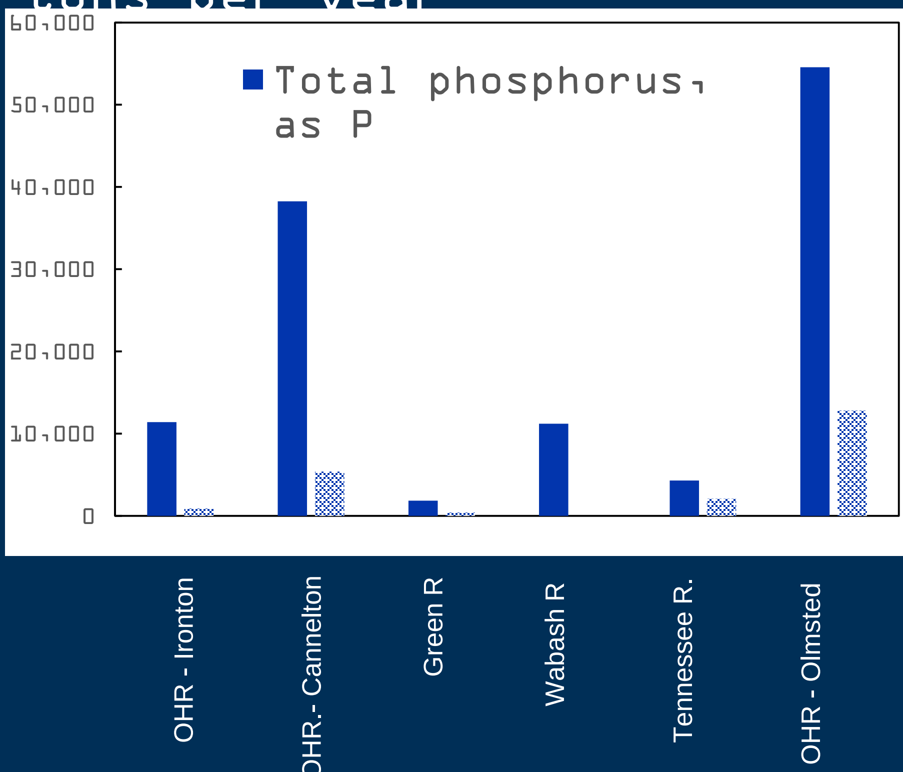




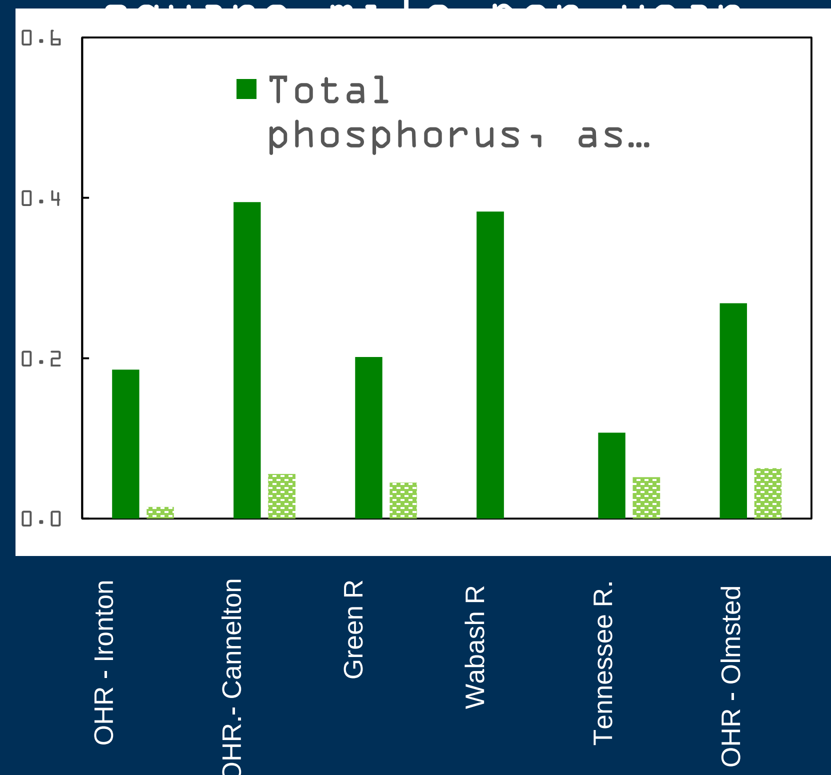
USGS

Mean Phosphorus Loads and Yields 2014-2017

Mean phosphorus load, in tons per year



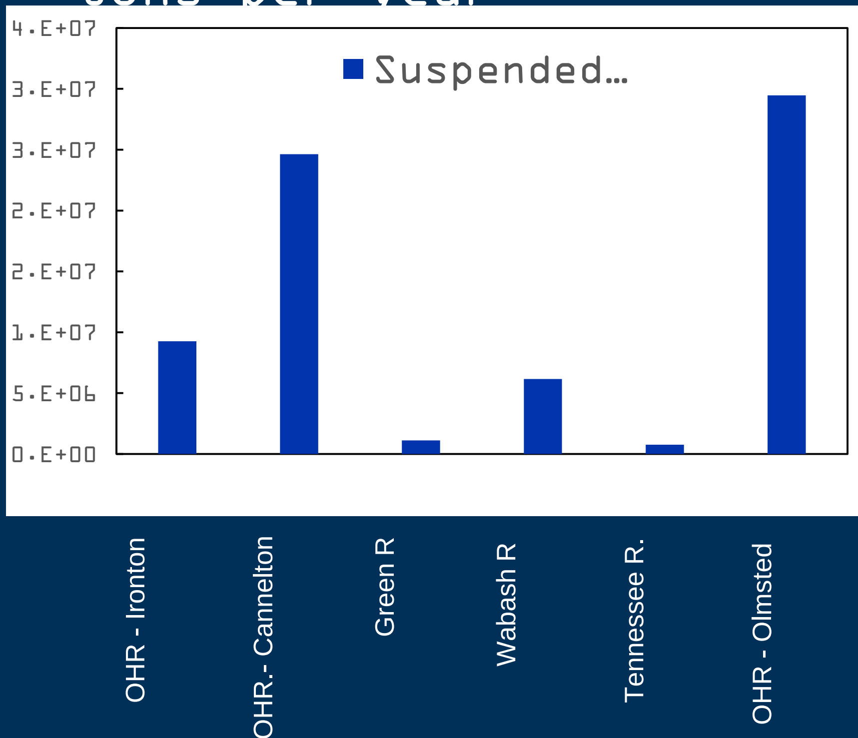
Mean phosphorus yield, in tons per square mile per year



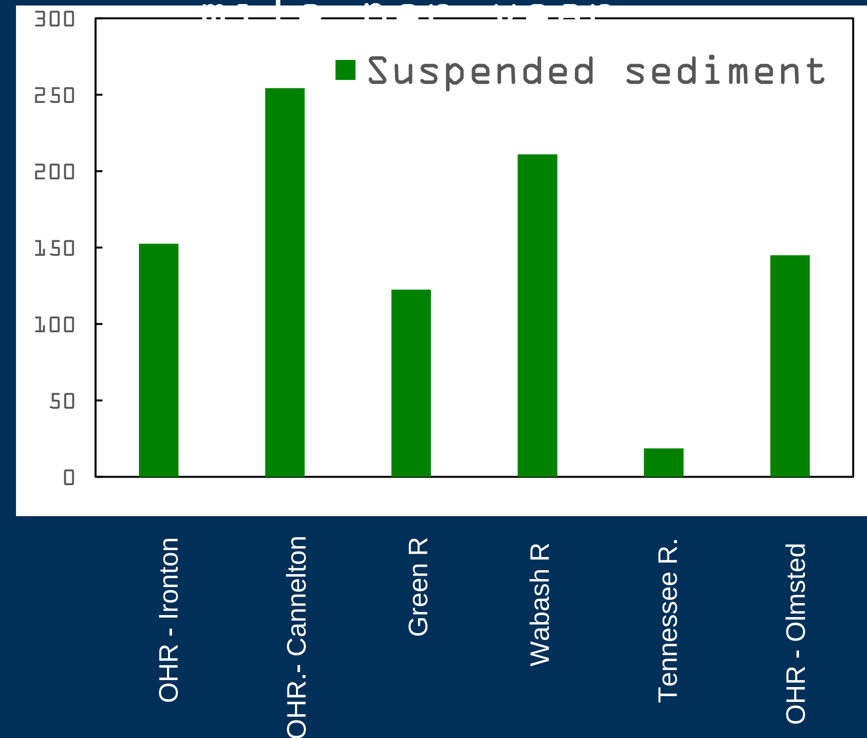
USGS

Mean Suspended Sediment Loads and Yields - 2014-2017

Mean annual load, in tons per year



Mean annual yield, in tons per square mile per year



New prototype / concept – USGS MOBILE super gage

USGS

What is a USGS “mobile super gage”?

Water Quality Parameters

- Water Temperature
- Specific Conductance
- pH
- Dissolved Oxygen
- Turbidity
- Nitrate + Nitrite

gps_tracker_log_20181026.csv

```
10/25/2018,15:25:00,DO_base,9.49,,G
10/25/2018,15:25:00,NTU_base,212.36,,G
10/25/2018,15:25:00,SC_base,215,,G
10/25/2018,15:26:58,Freq Disc,-154.9169,Hz,G
10/25/2018,15:26:58,Battery,13.43,,G
10/25/2018,15:30:00,Lat,38.906636,,G
10/25/2018,15:30:00,Long,-84.872892,,G
10/25/2018,15:30:00,Nitro,0.54,,G
10/25/2018,15:30:00,Nitro_base,0.90,,G
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10/25/2018,15:30:00,SC,294.15,,G
10/25/2018,15:30:00,pH,8.00,,G
10/25/2018,15:30:00,DO,9.14,,G
10/25/2018,15:30:00,NTU,14.40,,G
10/25/2018,15:30:00,WTemp_base,15.60,,G
10/25/2018,15:30:00,SC_base,265,,G
10/25/2018,15:30:00,pH_base,7.91,,G
10/25/2018,15:30:00,DO_base,9.49,,G
10/25/2018,15:30:00,NTU_base,557.57,,G
10/25/2018,15:31:58,Freq Disc,-155.7771,Hz,G
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10/25/2018,15:35:00,Lat,38.899425,,G
10/25/2018,15:35:00,Long,-84.861842,,G
```
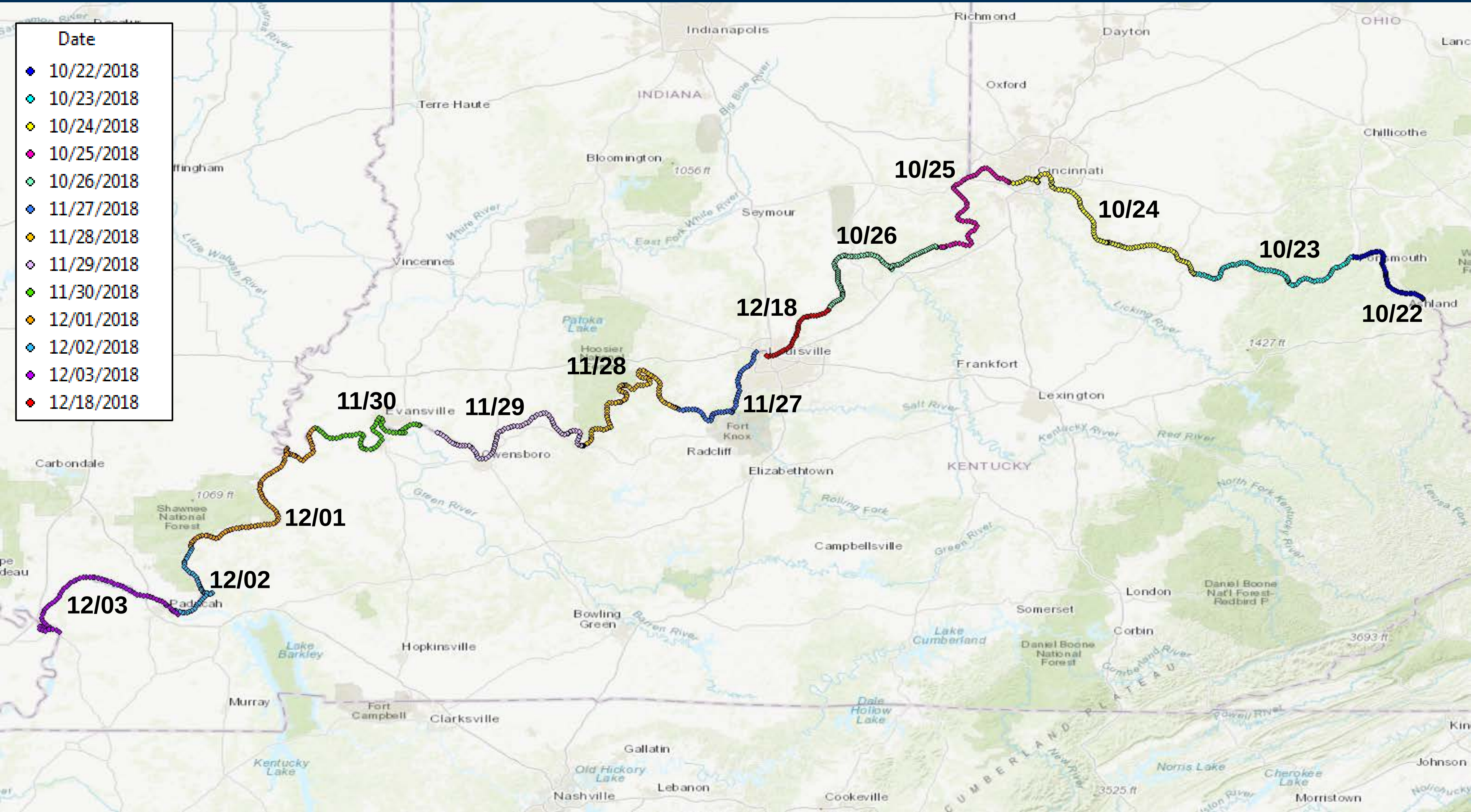
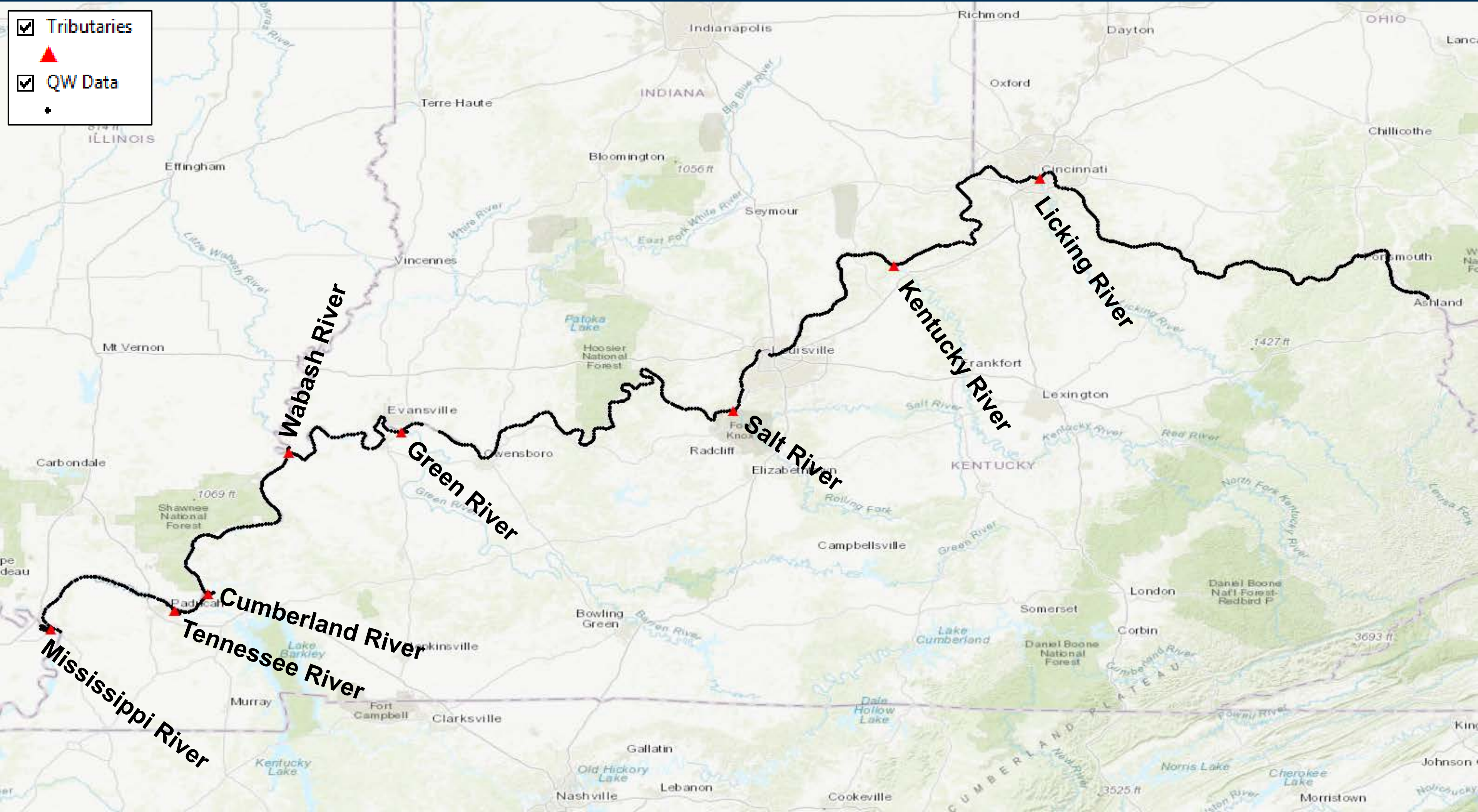

Chamber Unit and External Sonde (aka ‘_base’)

Float Trip Dates – we ran the entire length of Kentucky for the test



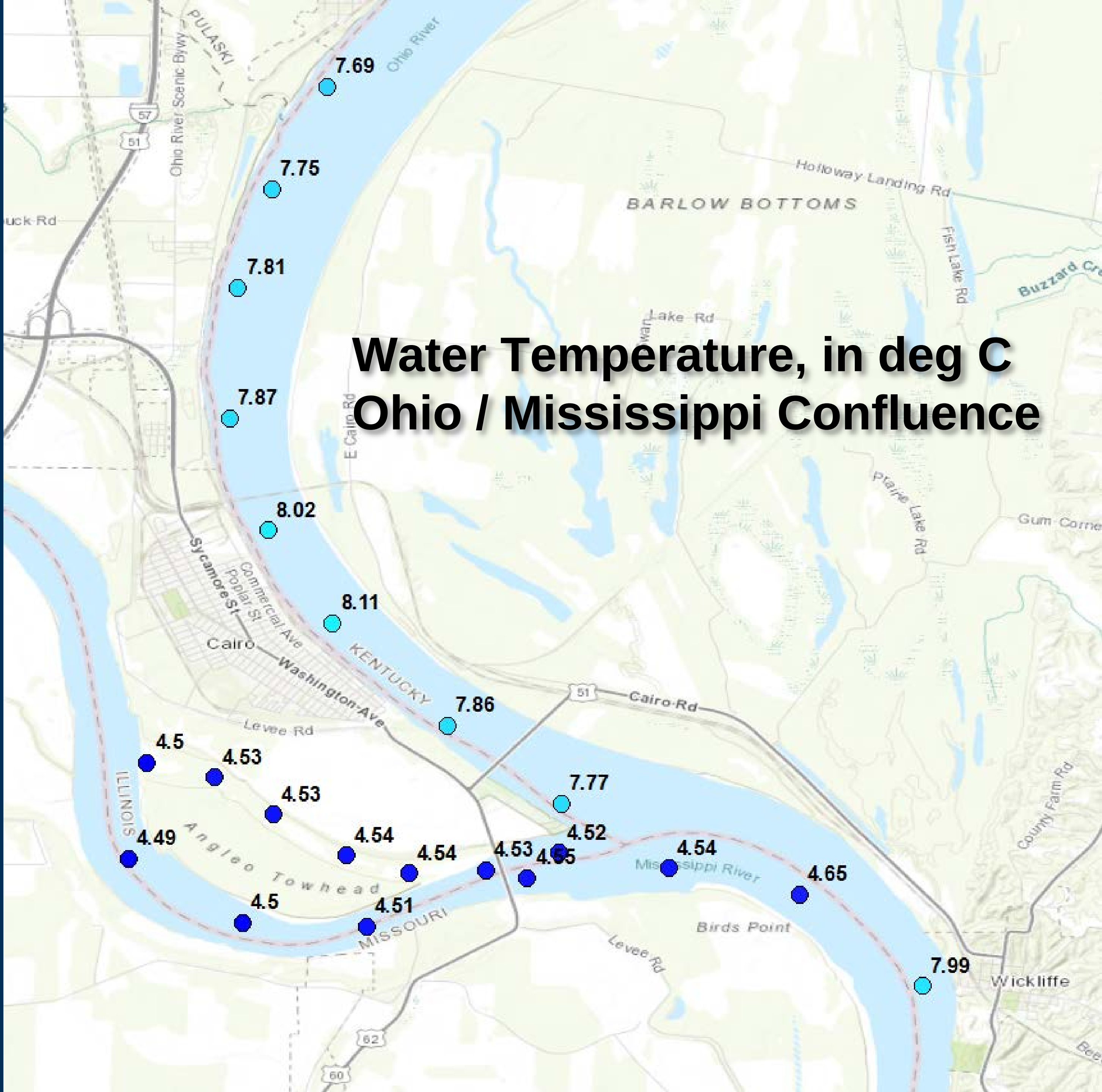
Collected data up 8 tributaries



Example

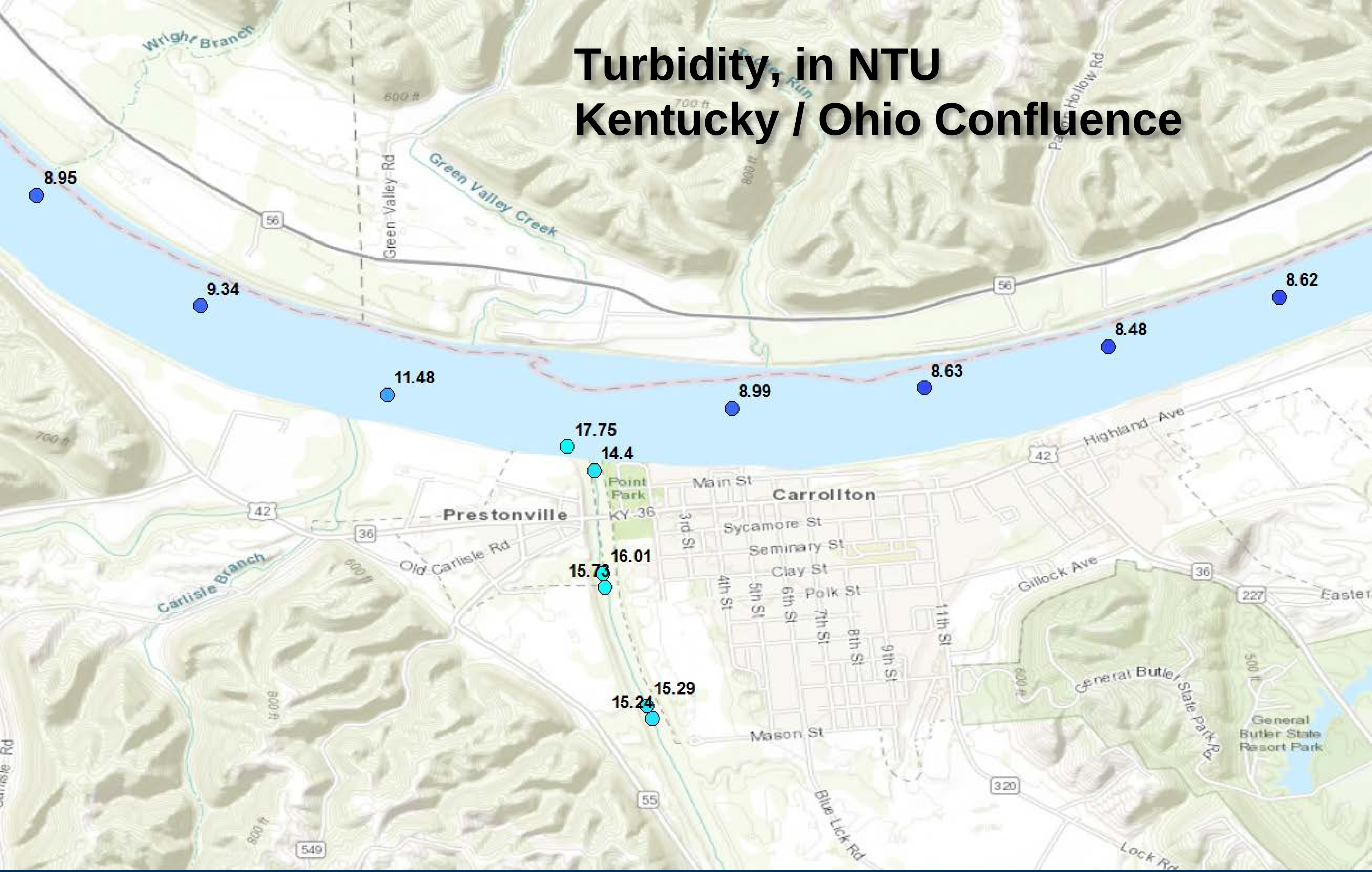
Tributary

Data



USGS

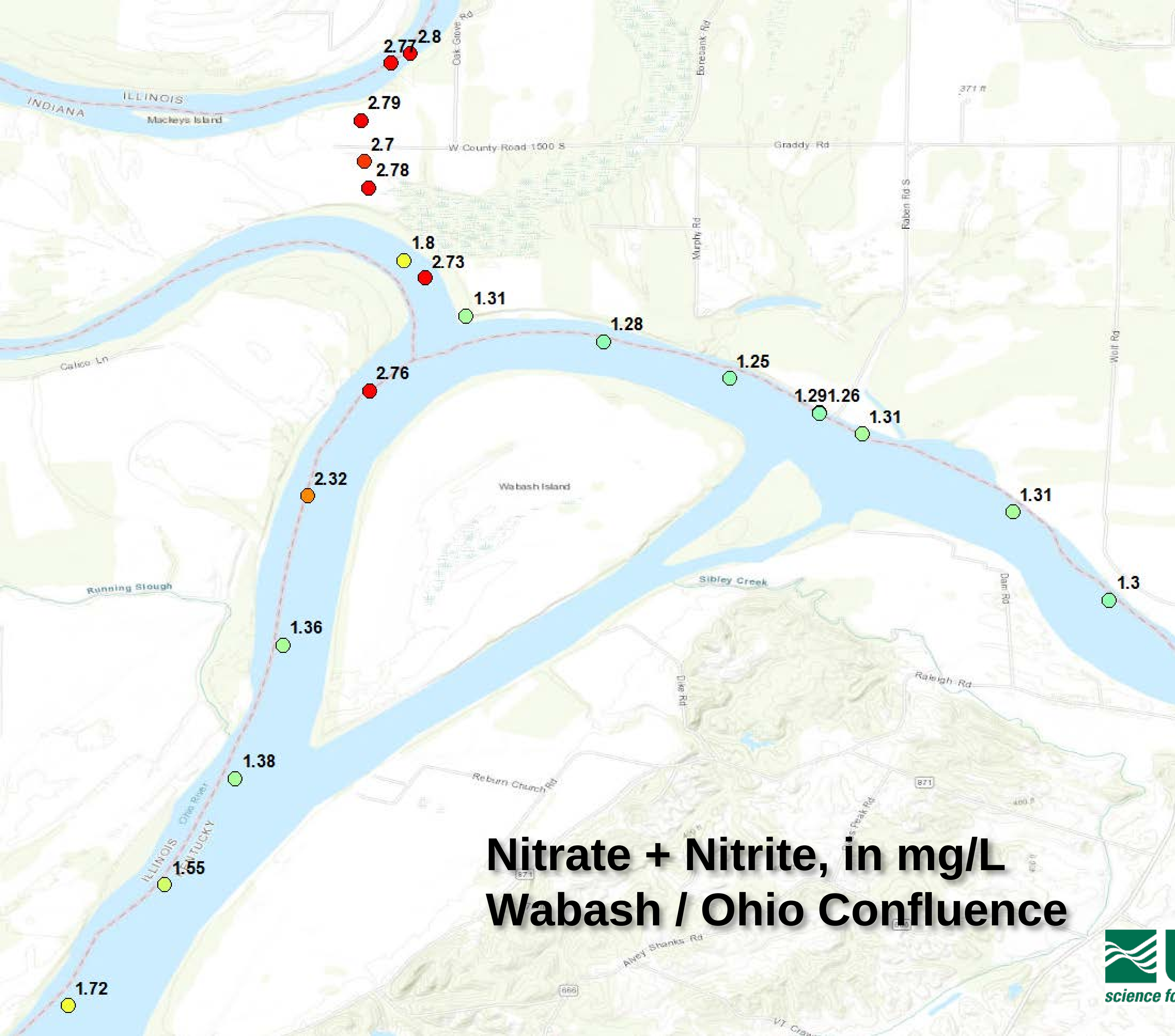
Turbidity, in NTU
Kentucky / Ohio Confluence



USGS

Example Tributary Data

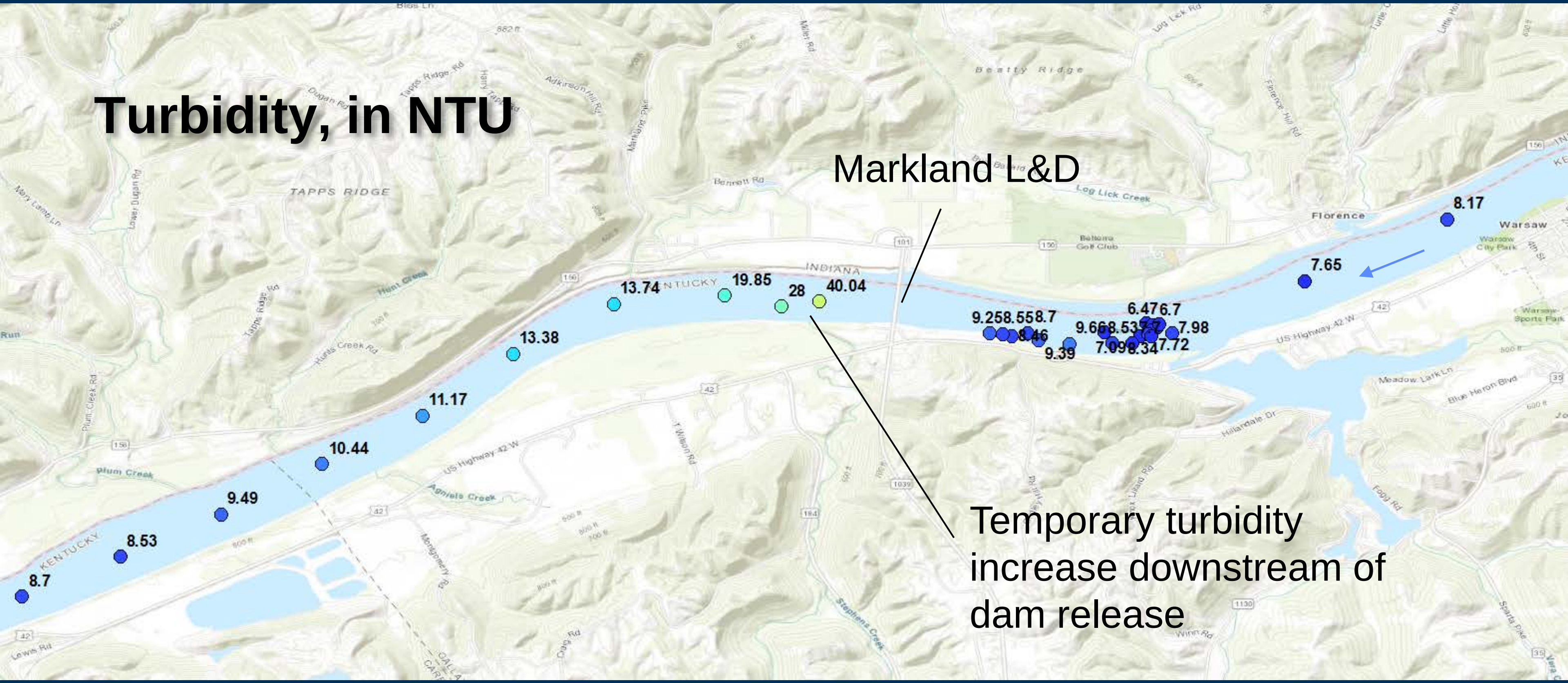
Example Tributary Data



Nitrate + Nitrite, in mg/L
Wabash / Ohio Confluence

USGS
science for a changing world

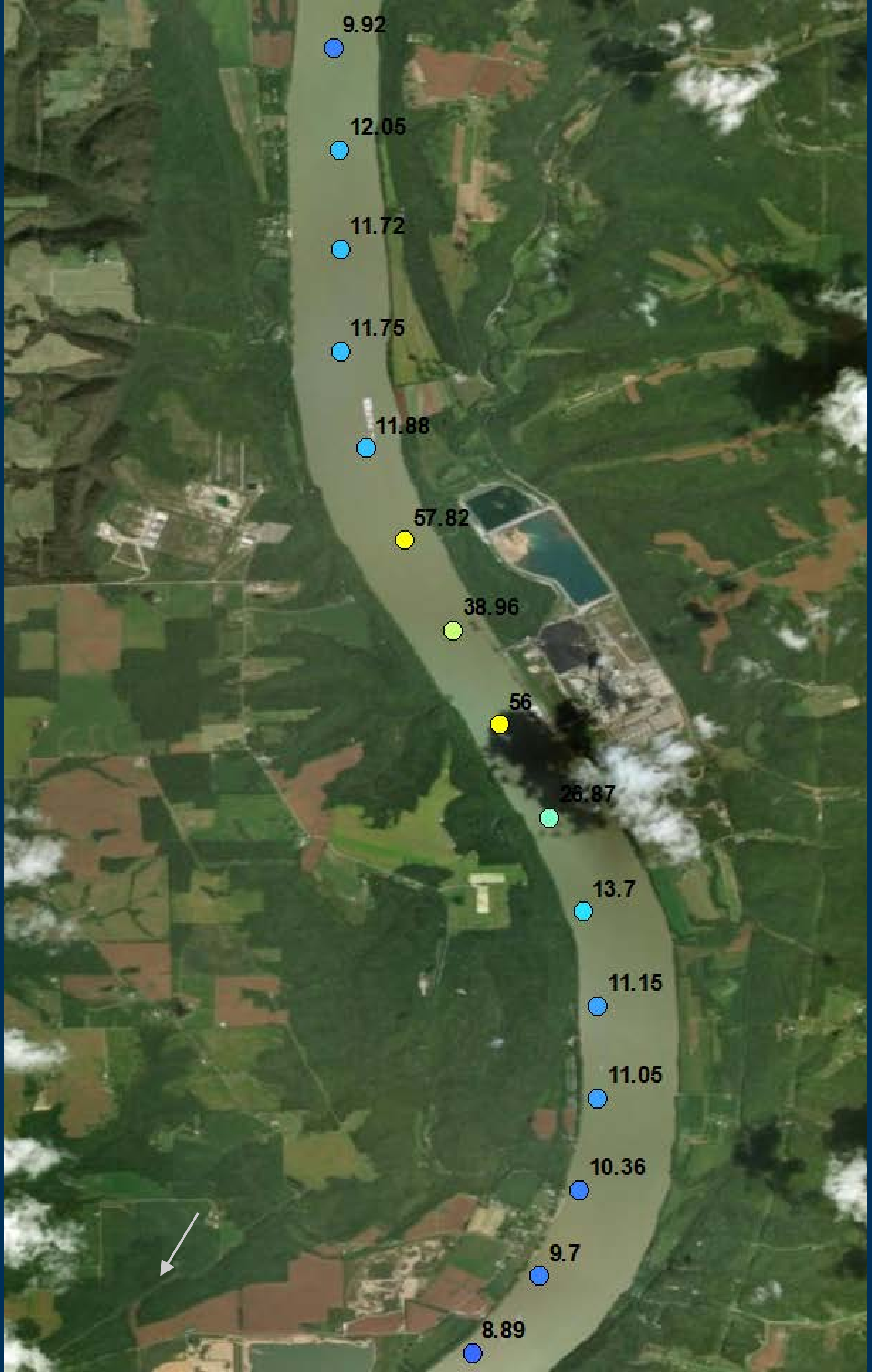
Other locations of interest…



USGS

Turbidity, in NTU

Trimble County Generating Station



USGS

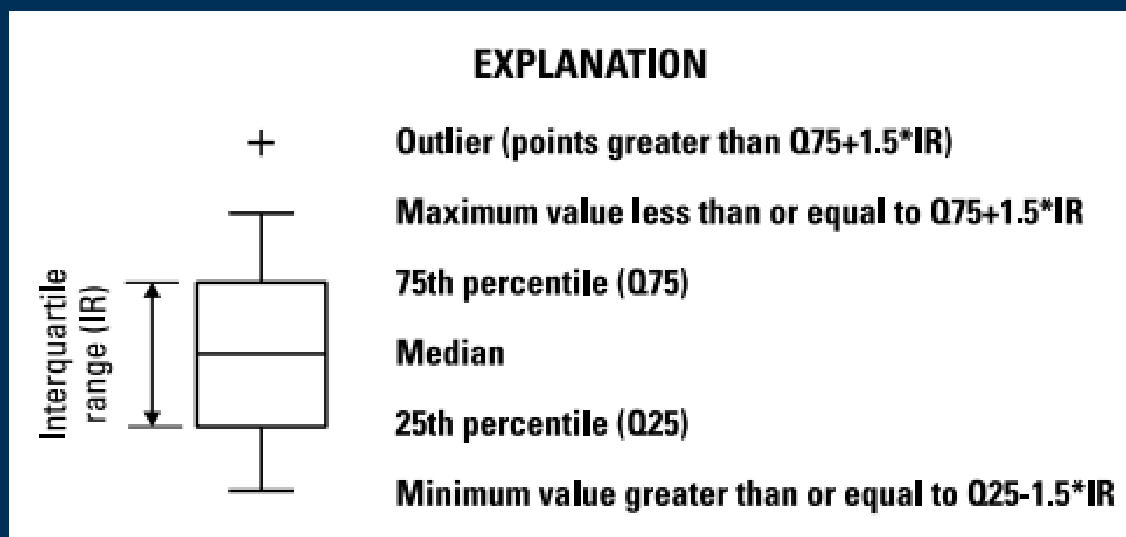
Boxplots & QA/QC – is this defensible?

Difference = Chamber – Sonde

If the two values are the same or nearly the same,
we should have a lot of differences near 0.

For example, 15.0°C – 14.9°C = 0.1

Chamber Sonde

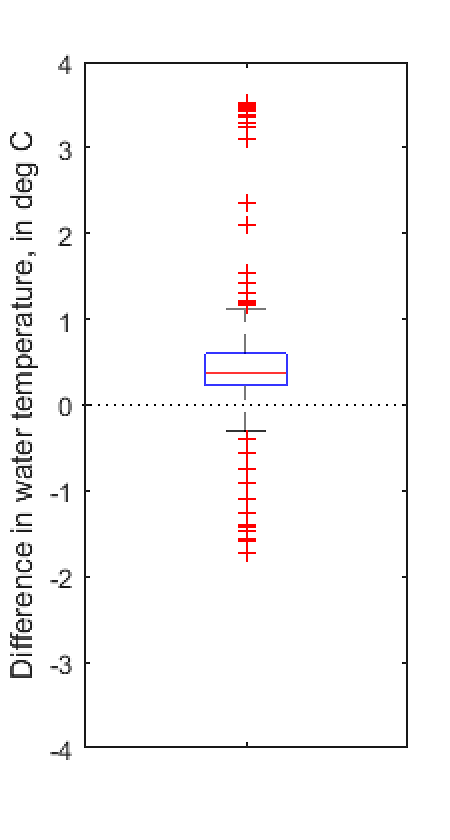


USGS

Boxplot: Water Temperature

Chamber higher

Sonde higher



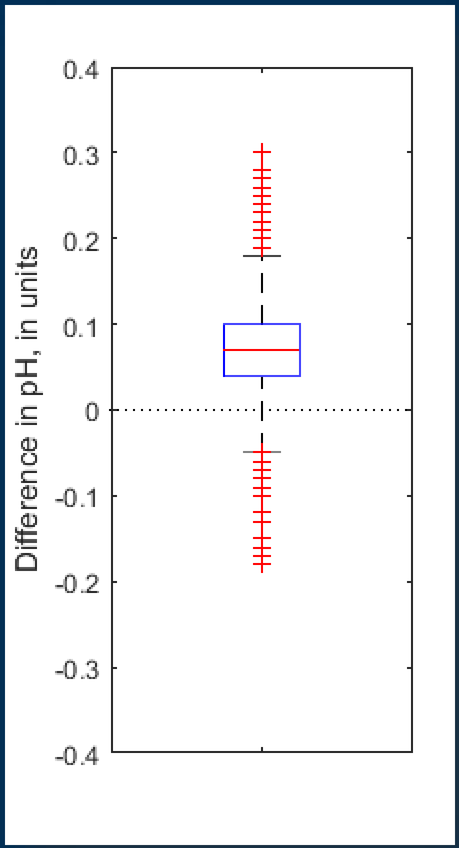
Median: +0.4°C

	10/22/2018	10/23/2018	10/24/2018	10/25/2018	10/26/2018	11/27/2018	11/28/2018	11/29/2018	11/30/2018	12/1/2018	12/2/2018	12/3/2018	12/18/2018	ALL DATA
min	2.2	-1.1	0.1	-1.5	0.5	-1.7	0.2	-0.1	0.3	0.3	-0.3	-0.3	0.4	-1.7
median	2.7	0.5	0.2	0.7	0.7	0.1	0.3	0.3	0.4	0.4	0.3	0.2	0.6	0.4
max	3.1	2.9	1.0	0.9	0.8	1.2	0.5	0.8	2.1	1.4	2.4	3.5	1.5	3.5

Boxplot: pH

Chamber higher

Sonde higher



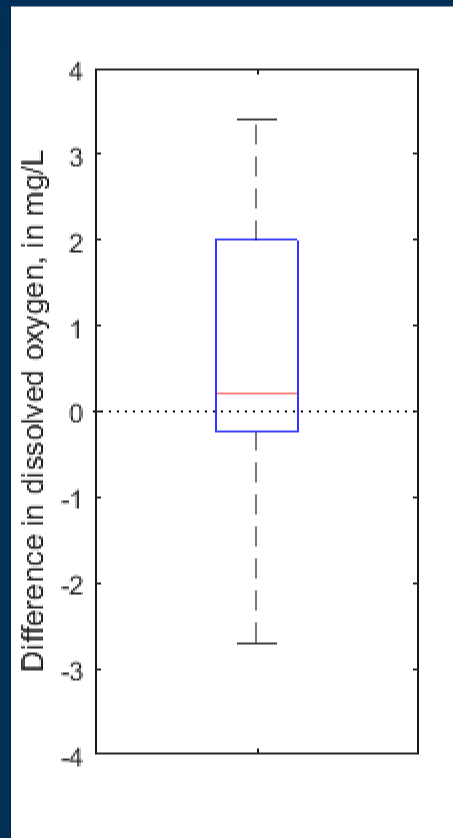
Median: +0.07 units

	10/22/2018	10/23/2018	10/24/2018	10/25/2018	10/26/2018	11/27/2018	11/28/2018	11/29/2018	11/30/2018	12/1/2018	12/2/2018	12/3/2018	12/18/2018	ALL DATA
min	0.1	0.2	-0.1	0.0	0.0	-1.7	-1.6	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	-1.7
median	0.1	0.2	0.1	0.1	0.1	-1.6	-1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1
max	0.1	0.3	0.1	0.1	0.1	-1.4	-1.6	0.1	0.1	0.3	0.1	0.3	0.0	0.3

Boxplot: Dissolved Oxygen

Chamber higher

Sonde higher



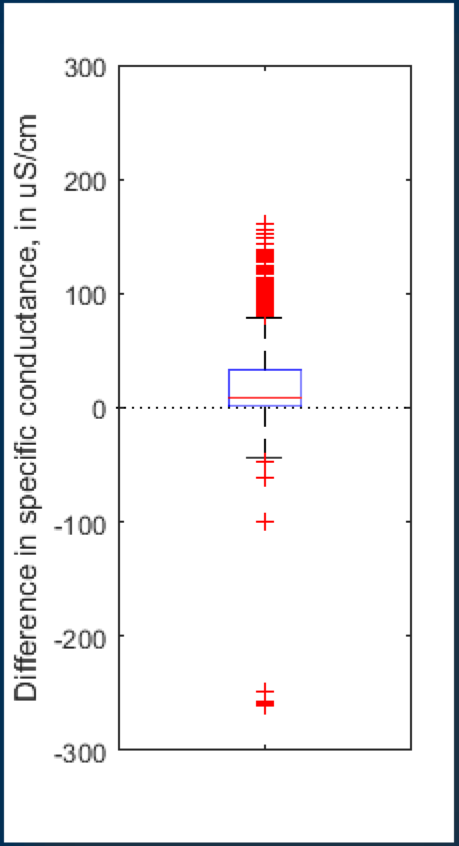
Median:
+0.2 mg/L

	10/22/2018	10/23/2018	10/24/2018	10/25/2018	10/26/2018	11/27/2018	11/28/2018	11/29/2018	11/30/2018	12/1/2018	12/2/2018	12/3/2018	12/18/2018	ALL DATA
min	-0.8	0.1	-0.4	-0.4	-0.3	-1.7	1.0	1.4	1.5	1.1	-1.8	-2.7	0.0	-2.7
median	-0.3	0.4	-0.3	-0.2	-0.2	0.5	1.9	2.7	2.6	2.4	-0.6	-0.5	0.5	0.2
max	0.1	1.0	0.1	0.8	0.6	2.4	2.2	3.4	3.0	3.3	-0.2	0.8	0.8	3.4

Boxplot: Specific Conductance

Chamber higher

Sonde higher



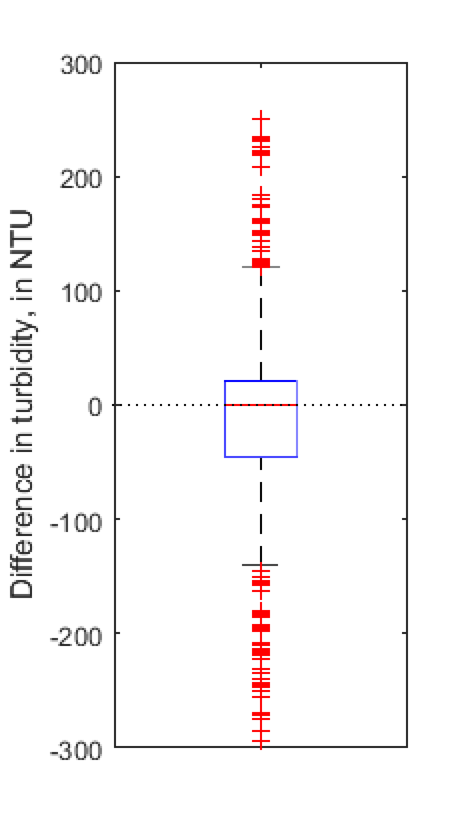
Median: +9 µS/cm

	10/22/2018	10/23/2018	10/24/2018	10/25/2018	10/26/2018	11/27/2018	11/28/2018	11/29/2018	11/30/2018	12/1/2018	12/2/2018	12/3/2018	12/18/2018	ALL DATA
min	-5	-13	0	-5	-4	-47	-6	-9	-40	-62	-38	-261	-11	-261
median	12	23	81	67	17	23	1	2	9	4	2	0	4	9
max	62	83	162	148	120	78	63	34	33	71	65	64	28	162

Boxplot: Turbidity

Chamber higher

Sonde higher



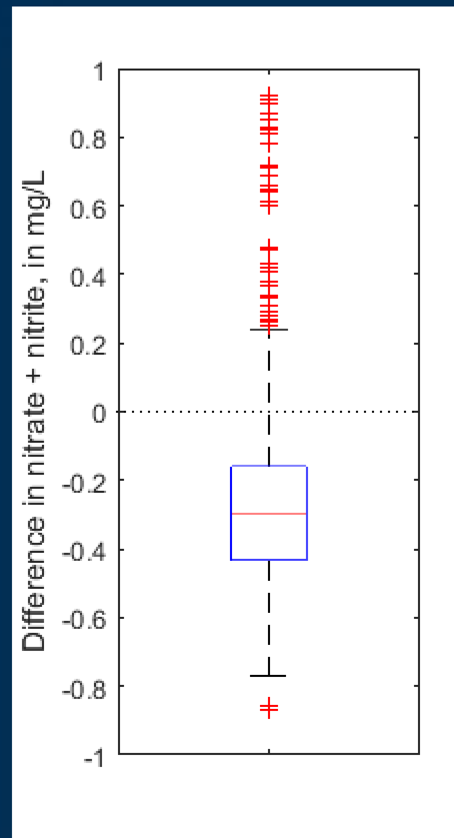
Median:
0 NTU

	10/22/2018	10/23/2018	10/24/2018	10/25/2018	10/26/2018	11/27/2018	11/28/2018	11/29/2018	11/30/2018	12/1/2018	12/2/2018	12/3/2018	12/18/2018	ALL DATA
min	-1532	-2345	-2227	-7226	-2551	-83	-1865	-184	-223	-294	-62	-157	-44	-7226
median	18	31	-97	-270	-193	120	5	27	15	10	-7	-11	-5	0
max	591	310	310	79	30	413	396	148	43	34	20	29	17	591

Boxplot: Nitrate + Nitrite

Chamber higher

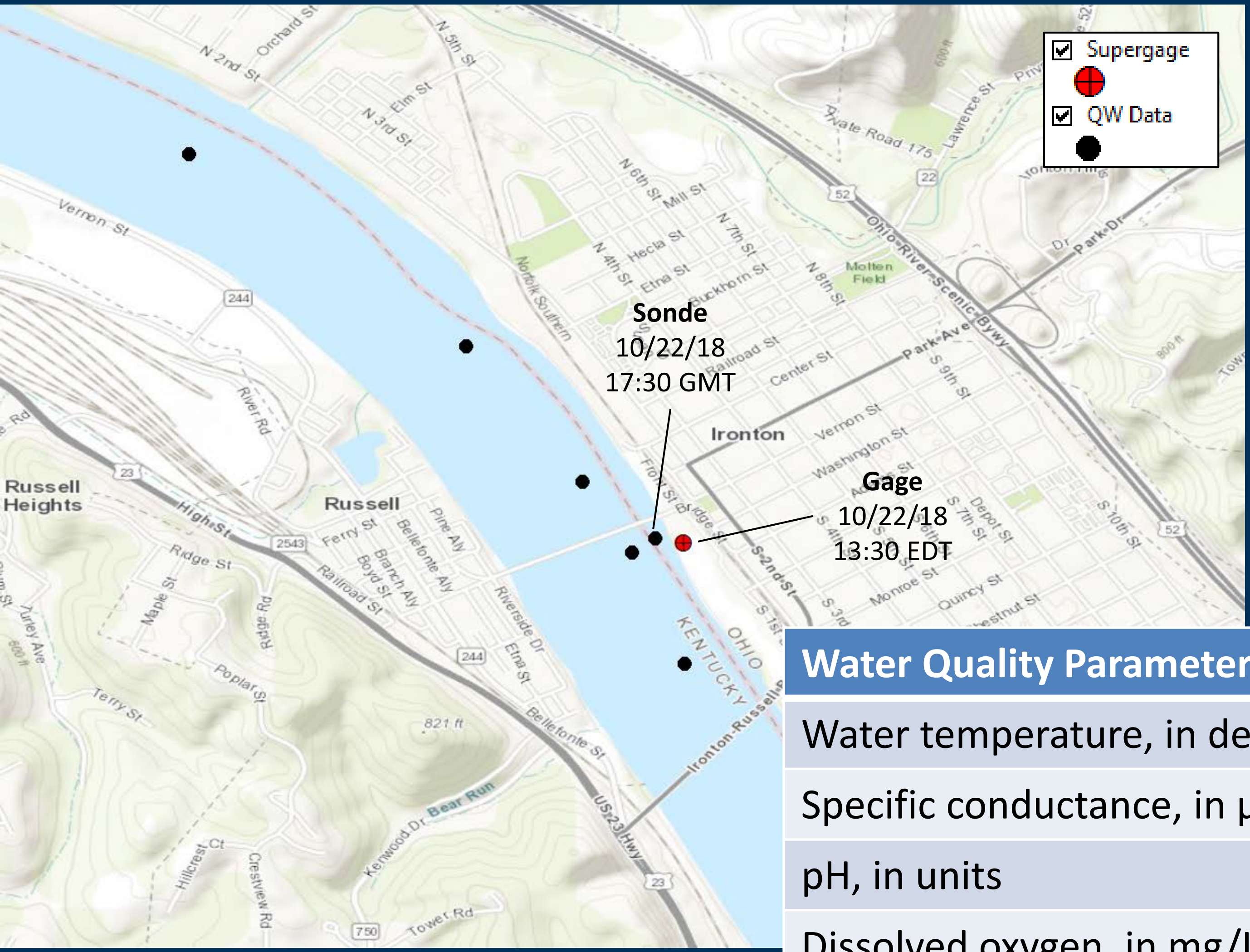
Sonde higher



Median:
–0.3 mg/L

	10/22/2018	10/23/2018	10/24/2018	10/25/2018	10/26/2018	11/27/2018	11/28/2018	11/29/2018	11/30/2018	12/1/2018	12/2/2018	12/3/2018	12/18/2018	ALL DATA
min	-0.7	-0.2	-0.3	-0.4	-0.3	-0.4	-0.8	-0.7	-0.4	-0.9	-0.6	-0.9	0.1	-0.9
median	-0.1	-0.1	-0.2	-0.3	-0.2	-0.3	-0.7	-0.5	-0.3	-0.3	-0.5	-0.5	0.2	-0.3
max	0.0	0.1	0.7	0.0	0.2	-0.2	-0.6	-0.3	0.5	0.1	-0.3	0.9	0.5	0.9

Ohio River at Ironton, OH



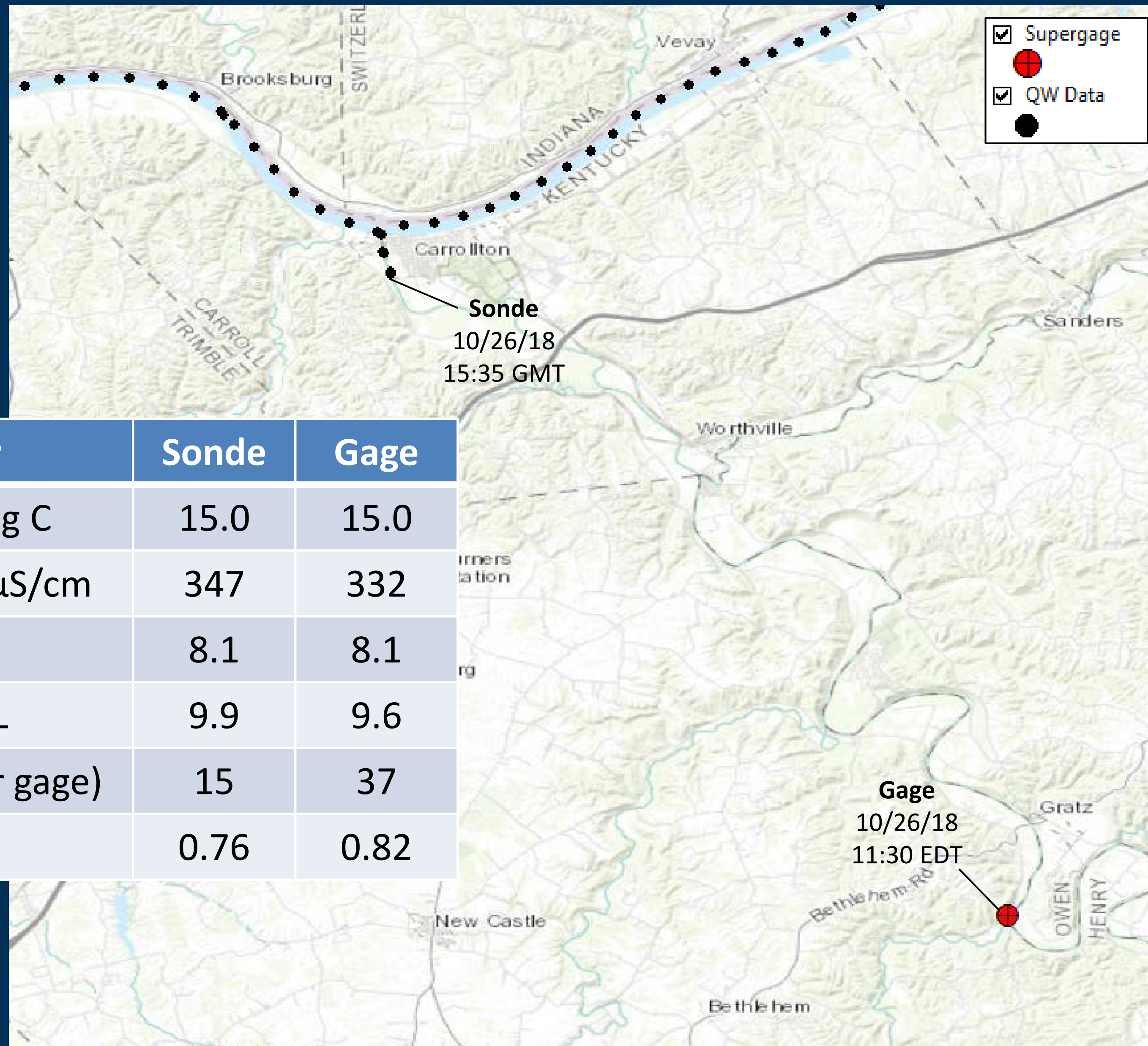
Comparison to fixed sites

Water Quality Parameter	Sonde	Gage
Water temperature, in deg C	16.1	16.2
Specific conductance, in µS/cm	271	267
pH, in units	7.8	7.7
Dissolved oxygen, in mg/L	9.3	9.1
Turbidity, in NTU (FNU for gage)	11	10
Nitrate + Nitrite, in mg/L	0.87	0.93

USGS

Kentucky River at Lock 2

Comparison to fixed sites



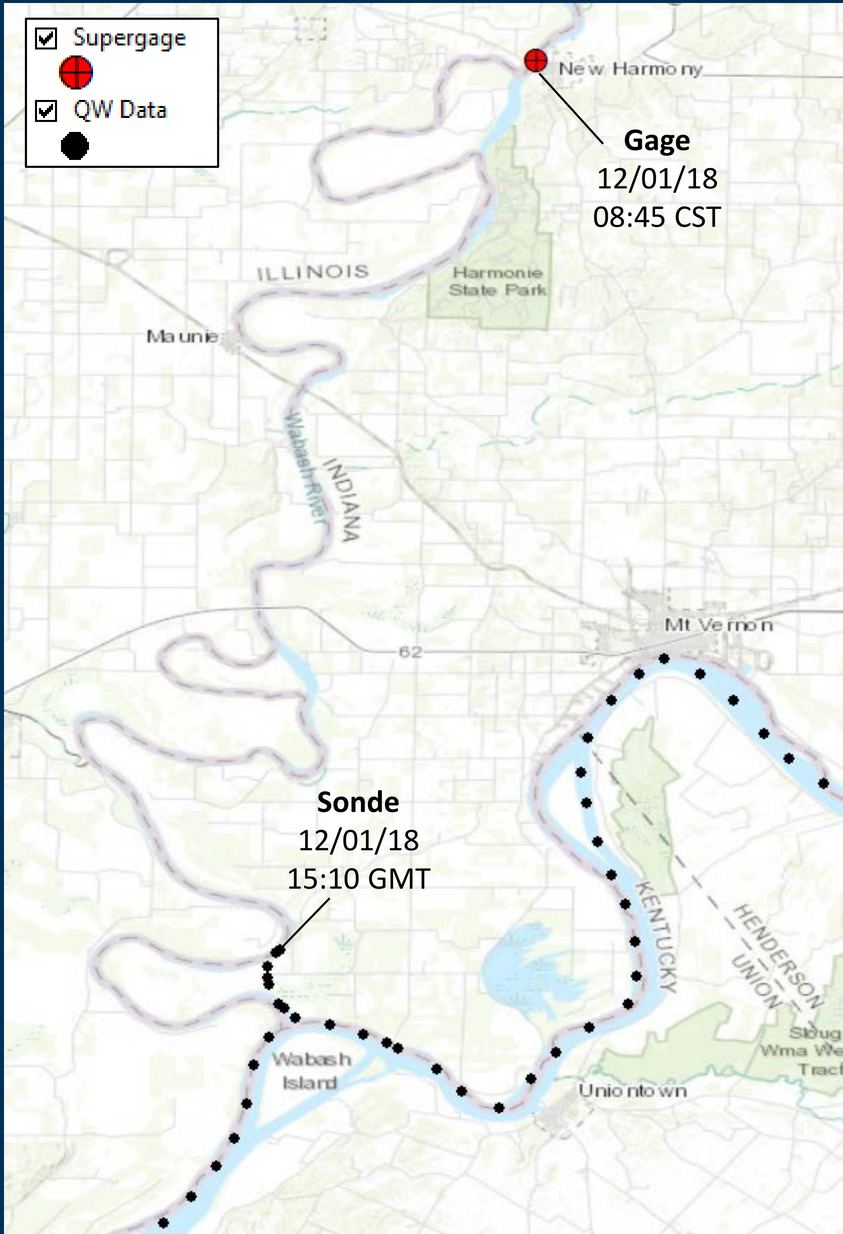
Water Quality Parameter	Sonde	Gage
Water temperature, in deg C	15.0	15.0
Specific conductance, in µS/cm	347	332
pH, in units	8.1	8.1
Dissolved oxygen, in mg/L	9.9	9.6
Turbidity, in NTU (FNU for gage)	15	37
Nitrate + Nitrite, in mg/L	0.76	0.82

USGS

Wabash River at New Harmony, IN

Comparison to fixed sites

Water Quality Parameter	Sonde	Gage
Water temperature, in deg C	6.5	6.4
Specific conductance, in µS/cm	557	456
pH, in units	8.2	8.2
Dissolved oxygen, in mg/L	11.5	11.8
Turbidity, in NTU (FNU for gage)	52	78
Nitrate + Nitrite, in mg/L	2.8	3.0



USGS

Questions?

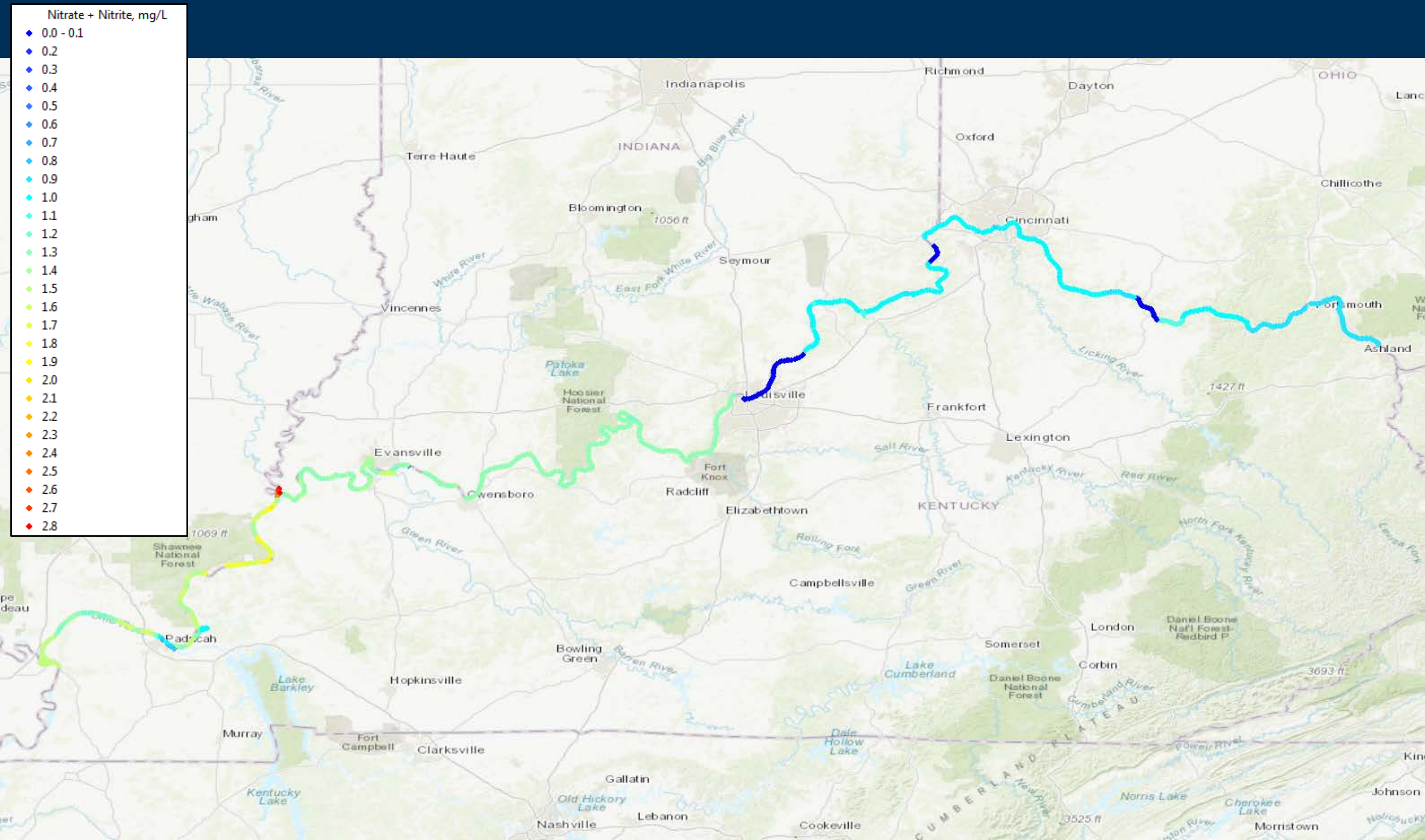
**Memorandum of Common Purpose signing,
Quad Cities III, IA - 9/20/2018**

USGS

Extra slides for discussion if required

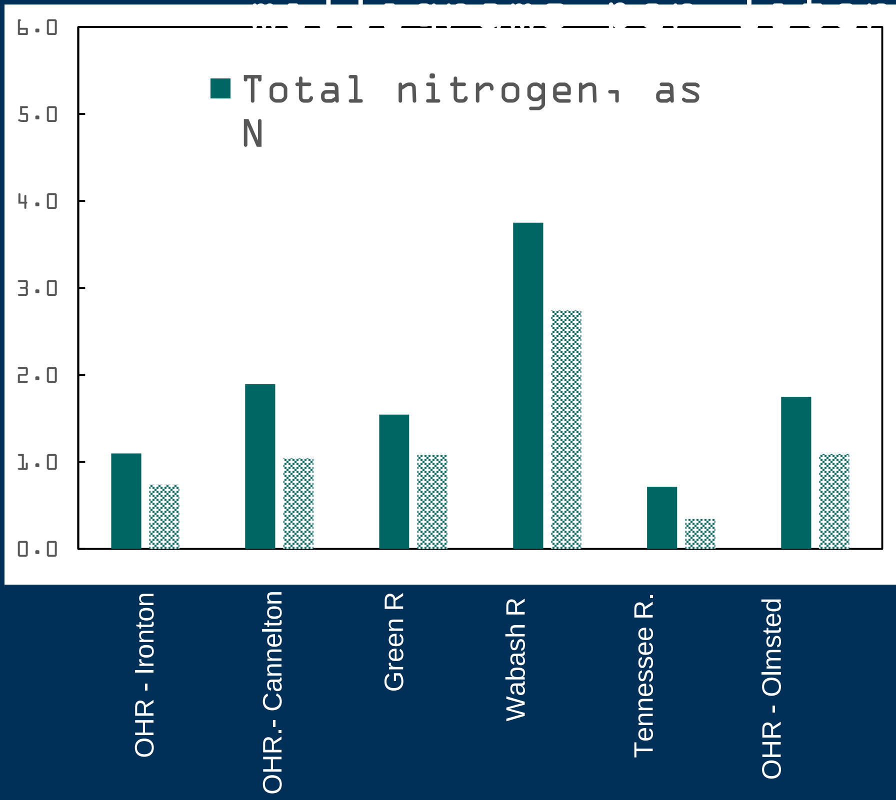
USGS

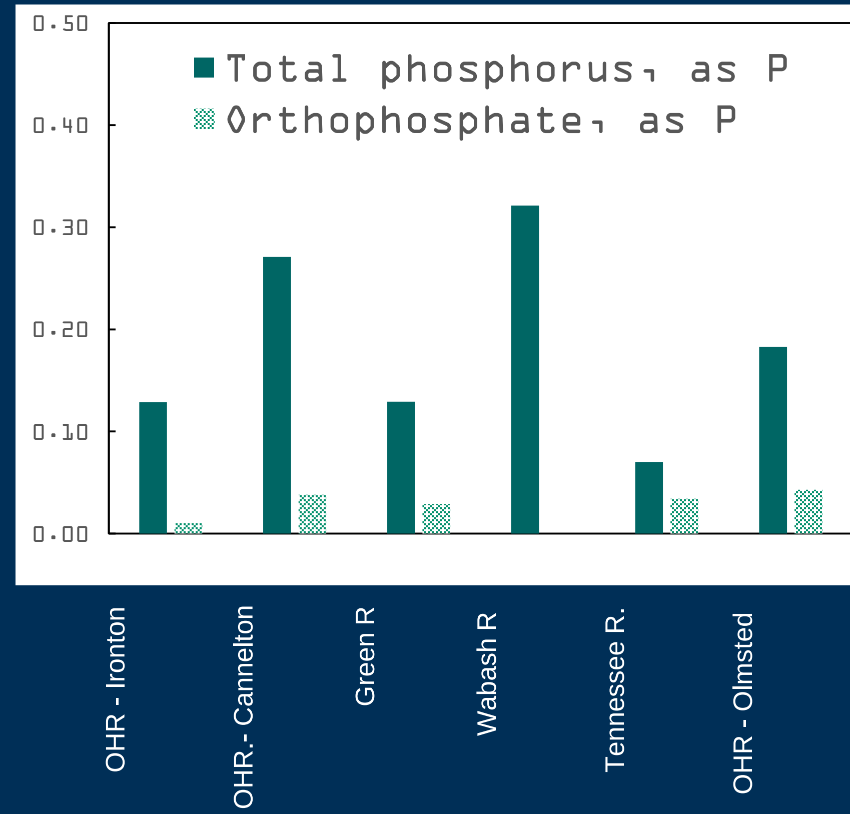
Nitrate + Nitrite, in mg/L



Flow-Weighted Mean Concentration of Nutrients - 2014-2017

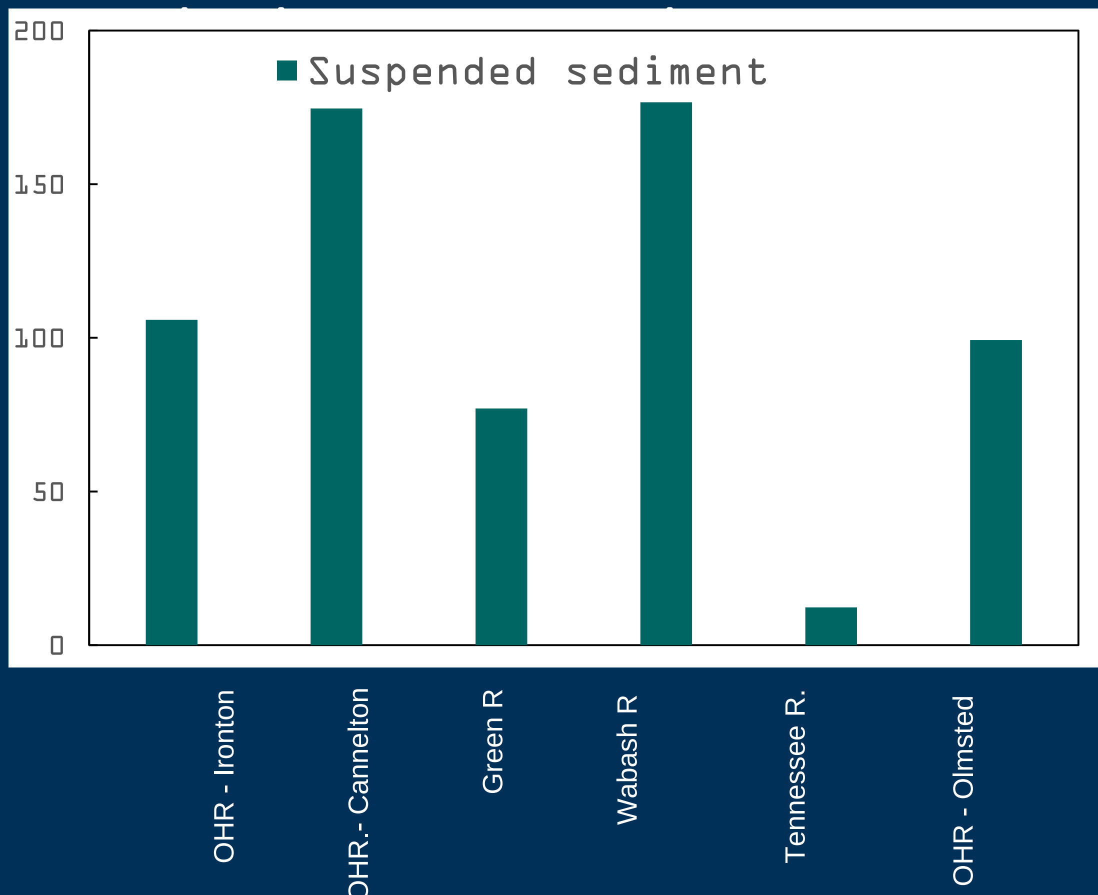
Flow-weighted mean concentrations, in milligrams per liter





Flow-Weighted Mean Concentration of Sediment - 2014-2017

Flow-weighted mean concentrations, in



ITEM 5: BIOLOGICAL PROGRAMS UPDATE

FEBRUARY 12-13, 2019








Item 7: Biological Programs Update

A. 2017 Final Pool Assessment Results
   - New Cumberland, Meldahl and Newburgh

B. 2018 Pool Survey Results
   - Emsworth and Pike Island

C. National Rivers and Streams Assessment (NRSA) Survey Update

D. Ohio River Mussel Survey and Database

ORSANCO Survey Design

Typically Survey 3 Pools Annually

- 15 probabilistic sites collectively represent pool condition
  - Night-time electrofishing (July-Oct)
  - Macroinvertebrates with two methods (Sept-Oct)

Survey 18 fixed stations for fish and macros

- Track long-term trends
- Contextualize pool survey results

Two Biological Indicators (since 2015)

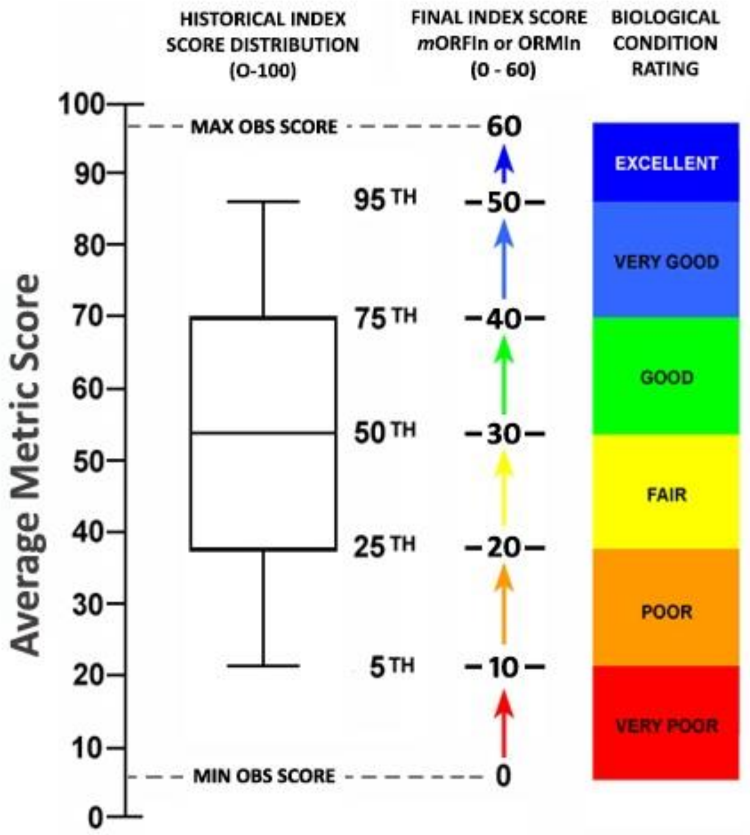
- ORFIn (2003-2008)
  - Average score of 13 fish metrics (0-100)
- *m*ORFIn (2009-present)
  - Scaled ORFIn score (0-60) to account for varying habitat expectation
- ORMIn (2015-present)
  - HDD primary, 200ind minimum MH

305(b) ALU Assessment Approach

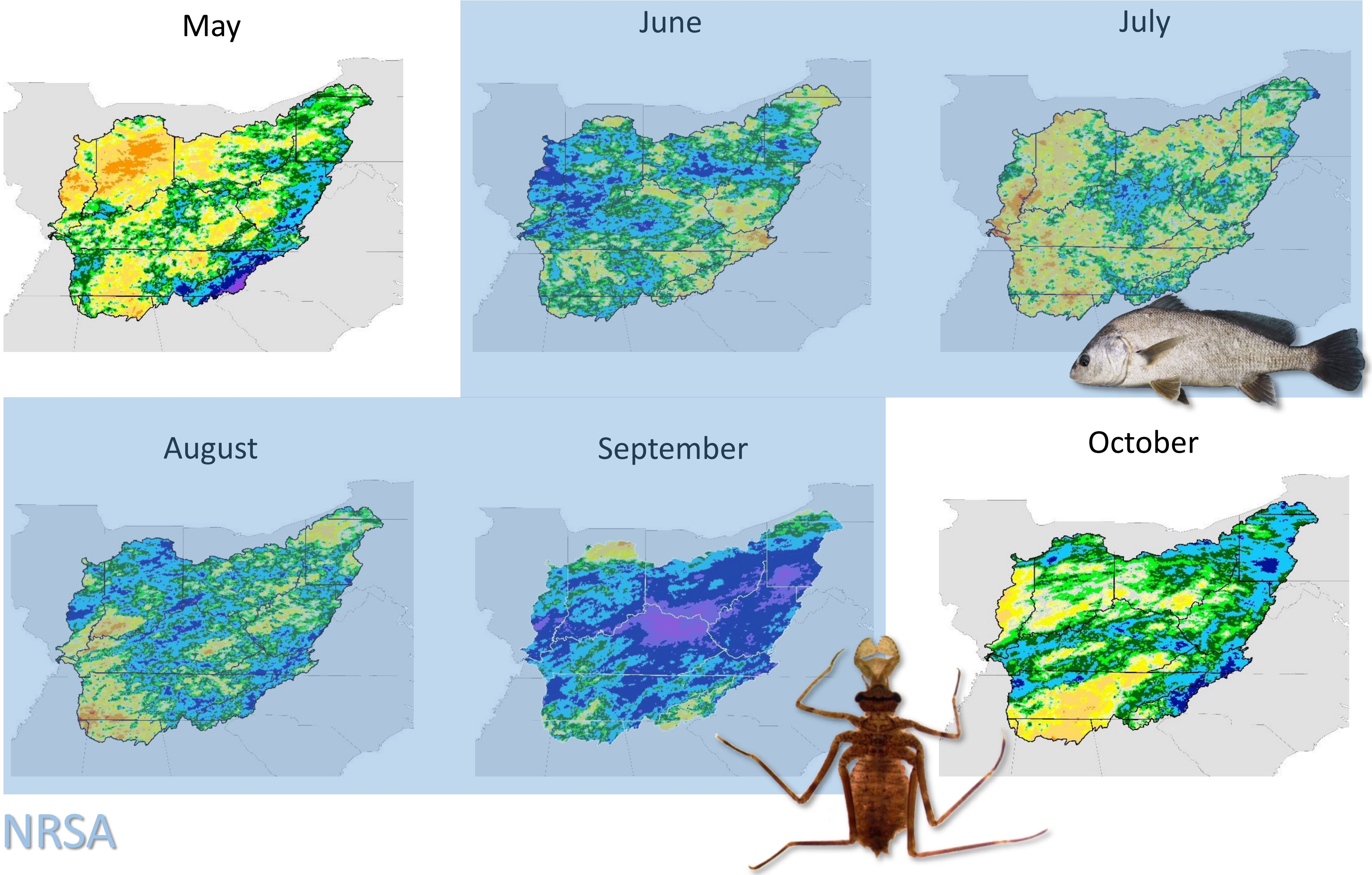
- **full support**
  - *m*ORFIn and ORMIn scores are greater than or equal to 20.0
    - (i.e. a condition rating of 'Fair', 'Good', 'Very Good', or 'Excellent')

- **partial support**
  - one of the indices scores 'Fair' or better (>20.0)
  - the other index scores 'Poor' (10.0 - 19.9)

- **non support**
  - pool in which both indices score 'Poor' (<20.0)
  - or in which either or both indices score 'Very Poor' (<10.0)



2018 NWS Precipitation Data

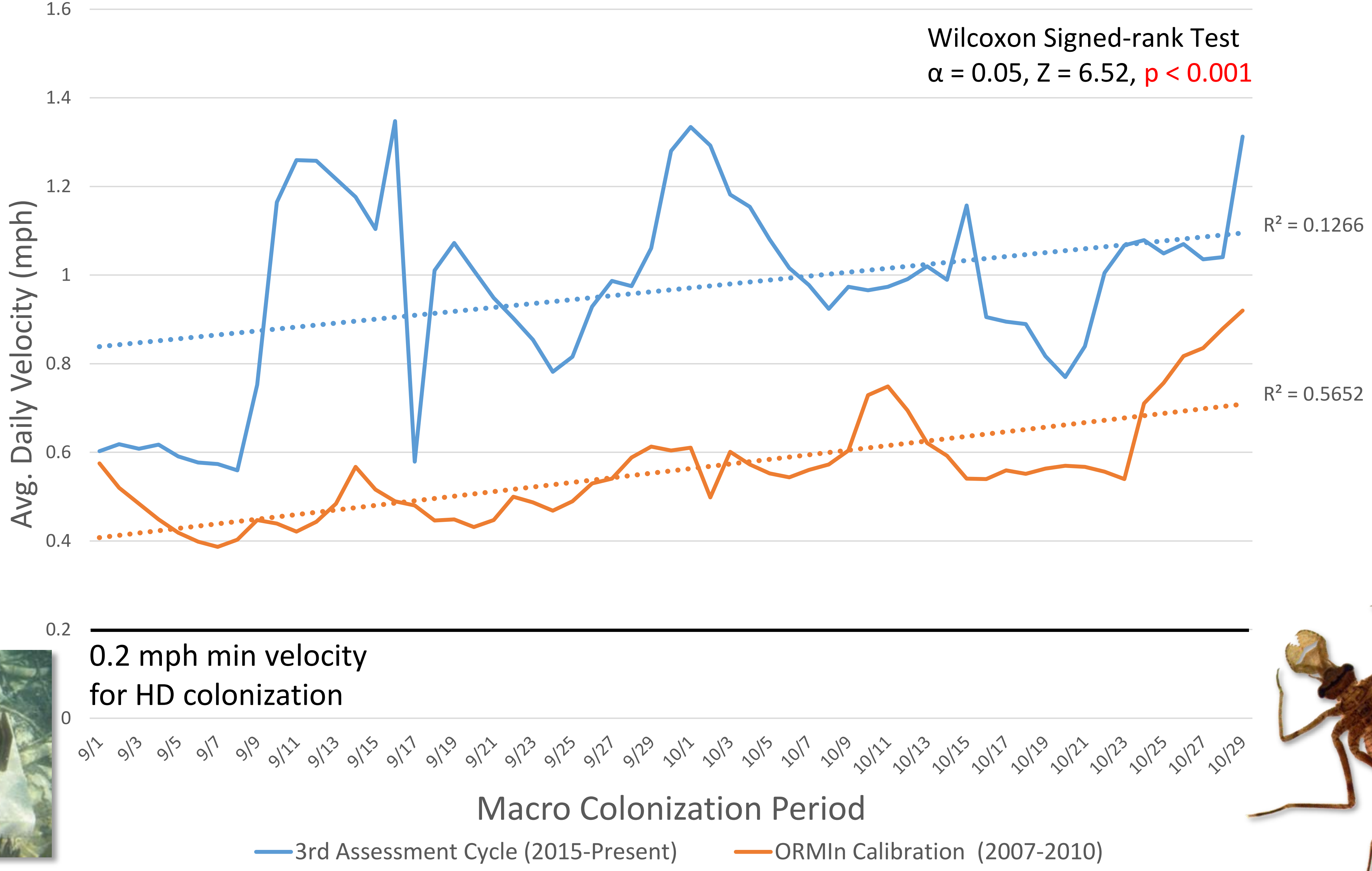


Percent of Normal

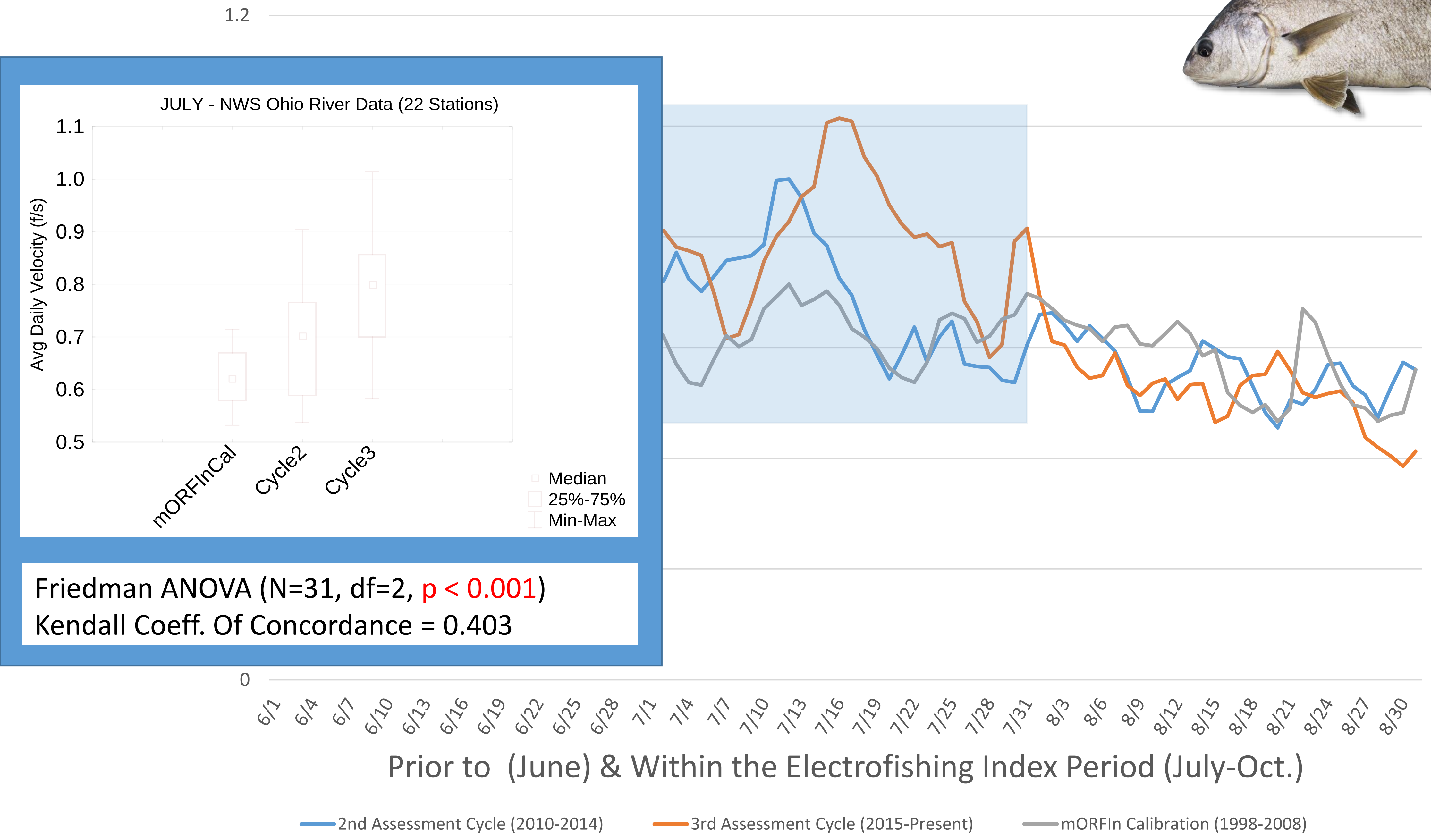
- > or = 600
- 400 to 600
- 300 to 400
- 200 to 300
- 150 to 200
- 125 to 150
- 110 to 125
- 100 to 110
- 90 to 100
- 75 to 90
- 50 to 75
- 25 to 50
- 10 to 25
- 5 to 10
- 0 to 5
- Missing Data

NRSA

NOAA/NWS Ohio River Data (22 Stations)



NOAA/NWS Ohio River Data (22 Stations)



Friedman ANOVA (N=31, df=2, $p < 0.001$)
Kendall Coeff. Of Concordance = 0.403

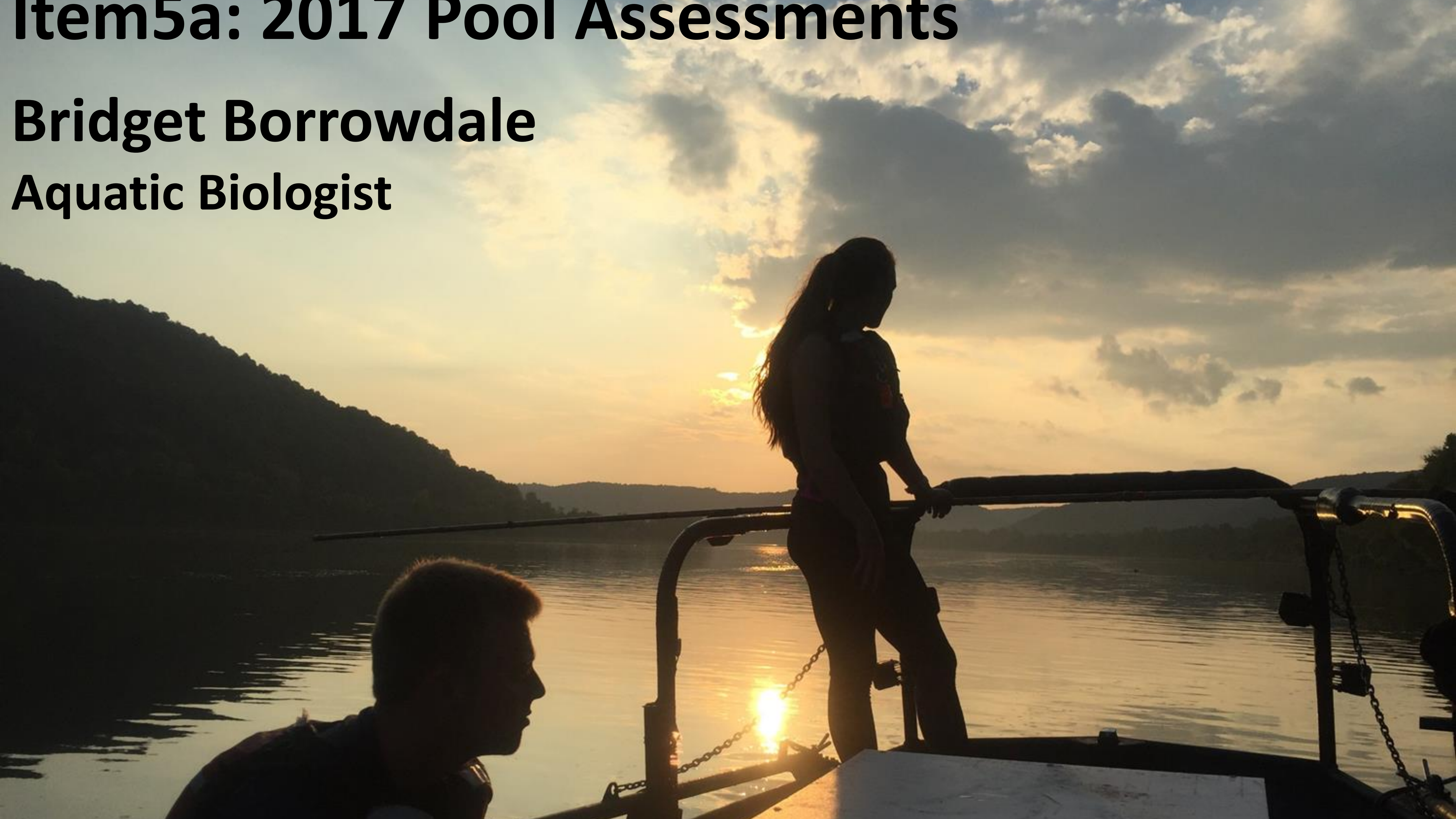
Available Ohio River Flow Data

Dataset/Model	Time Frame	OH Data points	Flow	Velocity	Stage/ Elevation
NOAA/NWS Gauges	1998-Present	25	X	X	X
USGS Stations	Variable	~30	X	X	X
Cascade Model (USACE)	1986-2016	234	X	X	X
HEC-RAS Model (USACE, NOAA, NWS)	2017-Present	1,000+	~	~	~

Item5a: 2017 Pool Assessments

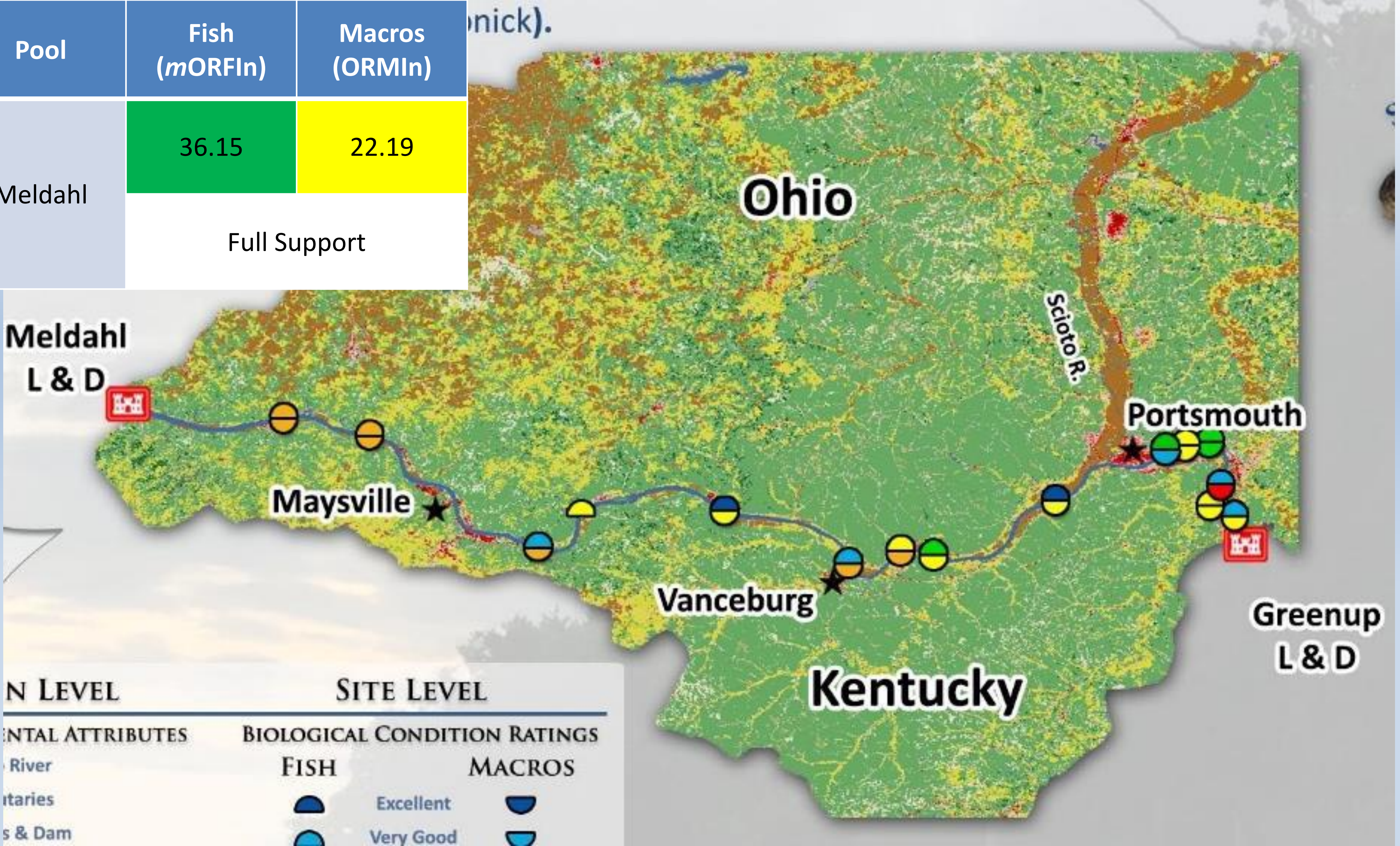
Bridget Borrowdale

Aquatic Biologist



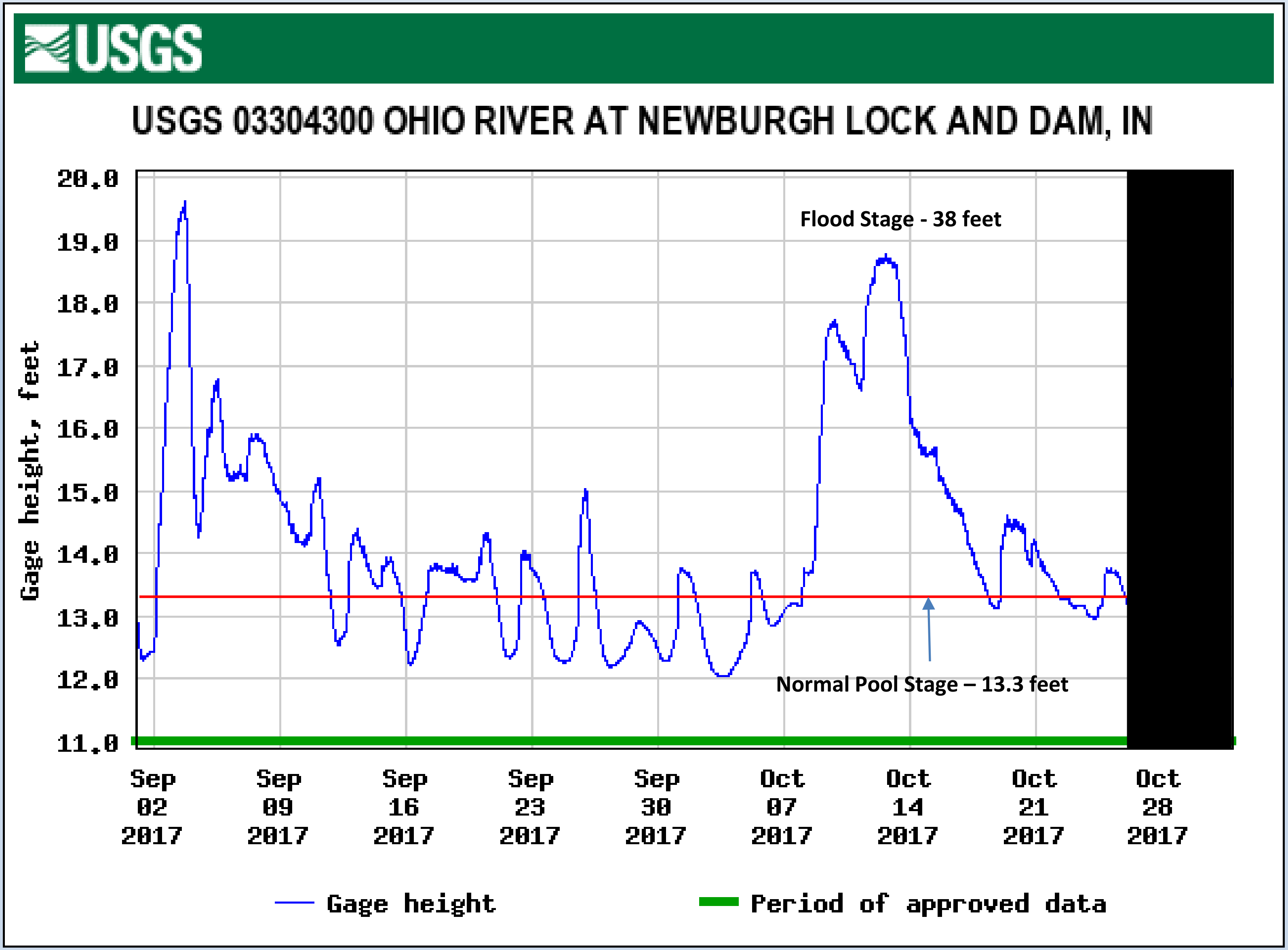
Pool	Fish (*m*ORFIn)	Macros (ORMIn)
New Cumberland	27.8	25.2
	Full Support	

Pool	Fish (*m*ORFIn)	Macros (ORMIn)
Meldahl	36.15	22.19
	Full Support	



Pool	Fish (*m*ORFIn)	Macros (ORMIn)
Newburgh	33.6	Unassessed
	Full Support	

2017 Newburgh Pool Flow Impacts
(Macro Colonization Period)



Available Ohio River Flow Data

Dataset/Model	Time Frame	OH Data points	Flow	Velocity	Stage/ Elevation
NWS/NOAA Gauges	1998-Present	25	X	X	X
USGS Stations	Variable	~30	X	X	X
Cascade Model (USACE)	1986-2016	234	X	X	X
HEC-RAS Model (USACE, NOAA, NWS)	2017-Present	1,000+	~	~	~

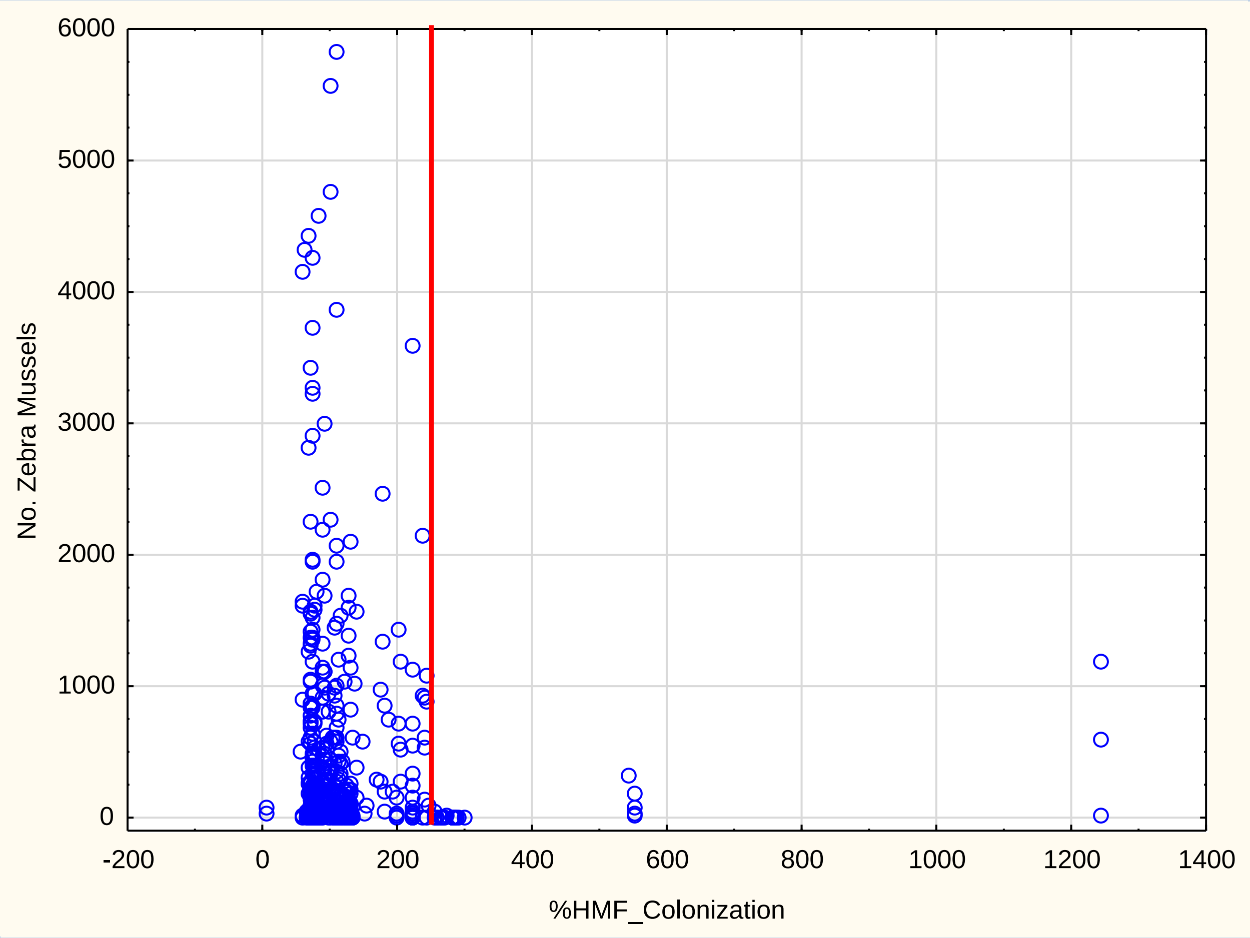
Logical Flow

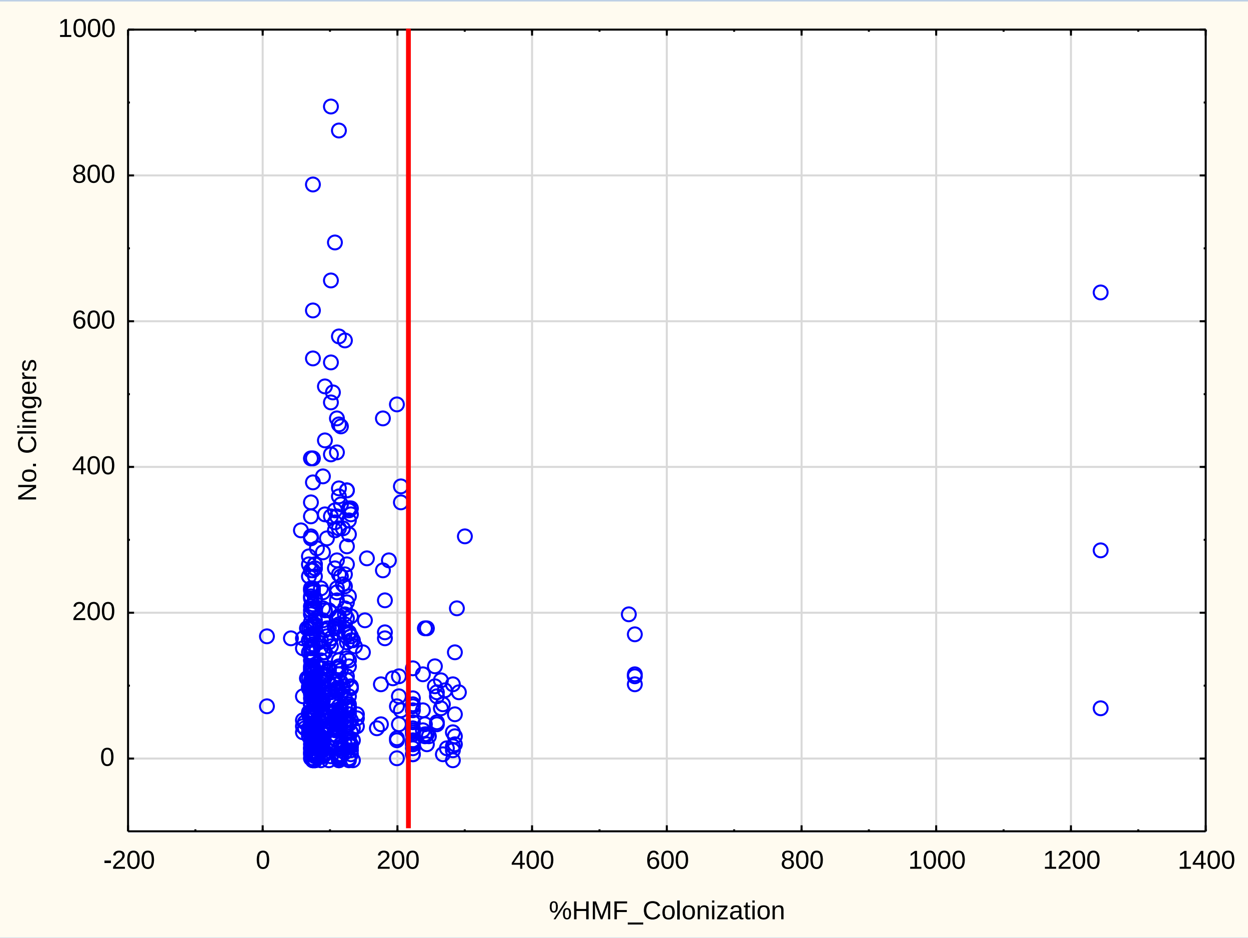
- Used Cascade data to calculate flow metrics
  - **Harmonic Mean Flow** by node for Sept-Oct from 1986 – 2016 (30yrs)
  - **%HMF** = HMF of sample year / HMF of 30yr
  - Compared with Macro metrics
    - Determine critical flow beyond which macro collections are depressed

- Determined the relative similarity of NWS/NOAA discharge measurements to Cascade Model
  - NWS/NOAA was ~6.5% higher, adjusted Cascade data
  - Calculated the discharge (cfs) value at each NWS/NOAA Station that related to the critical %HMF
  - Determined if the critical discharge was exceeded in the 2017 colonization periods

% Harmonic Mean Flow vs. Macro Metrics

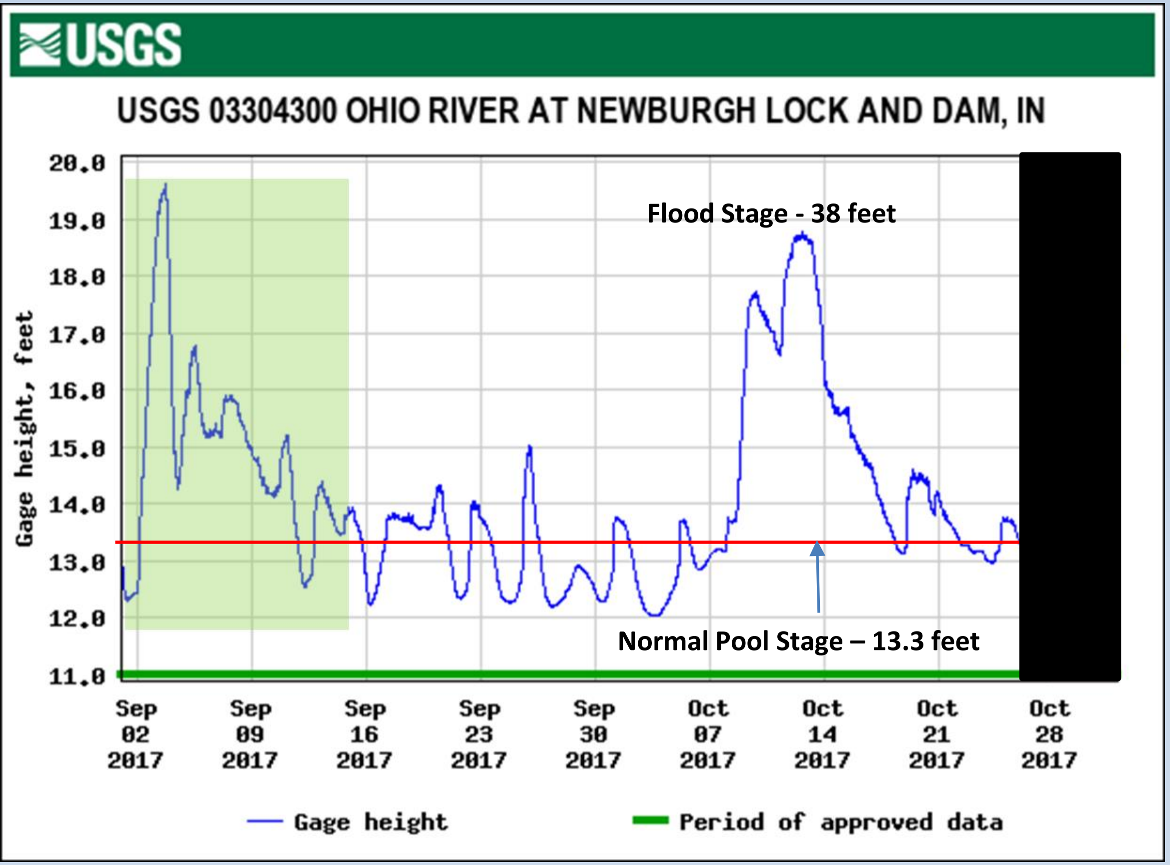
Critical Discharge = 240% HMF

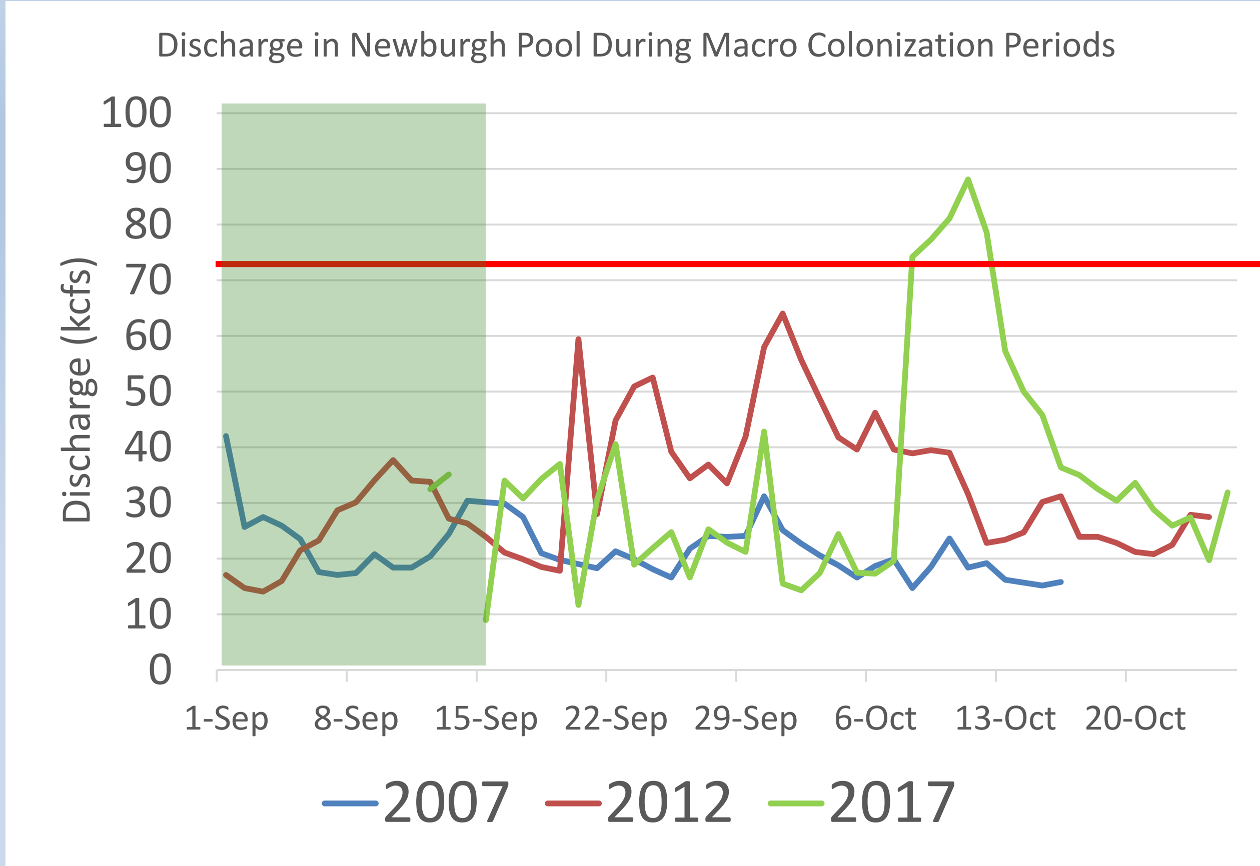




Newburgh Pool

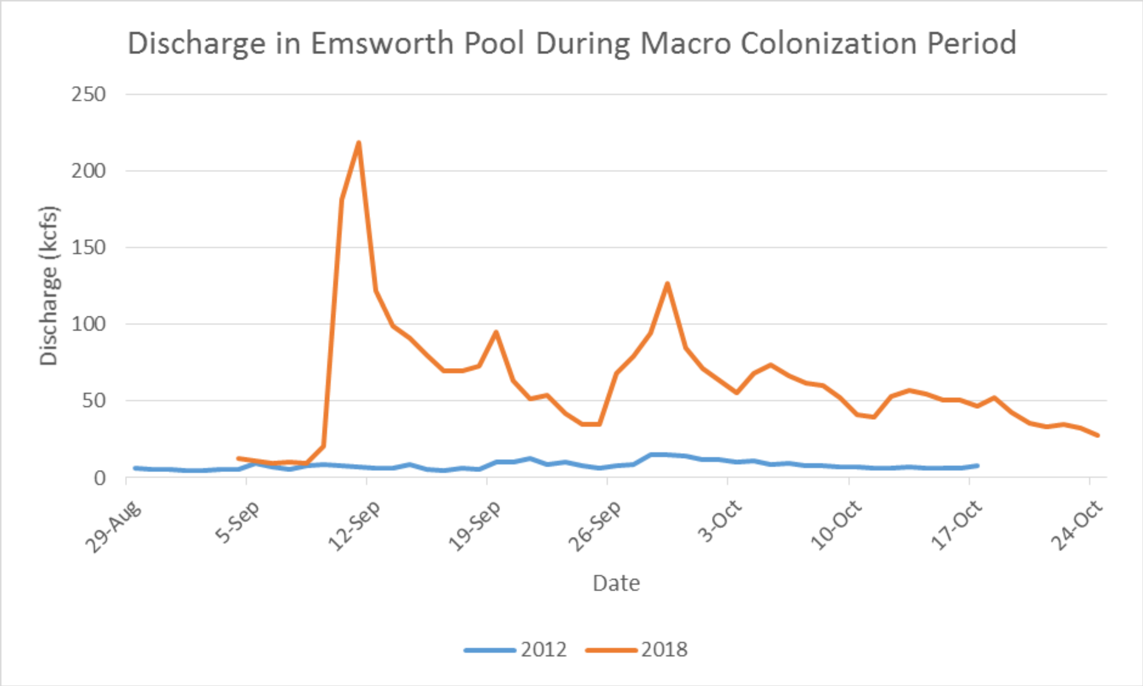
240% HMF = 72.5 kcfs

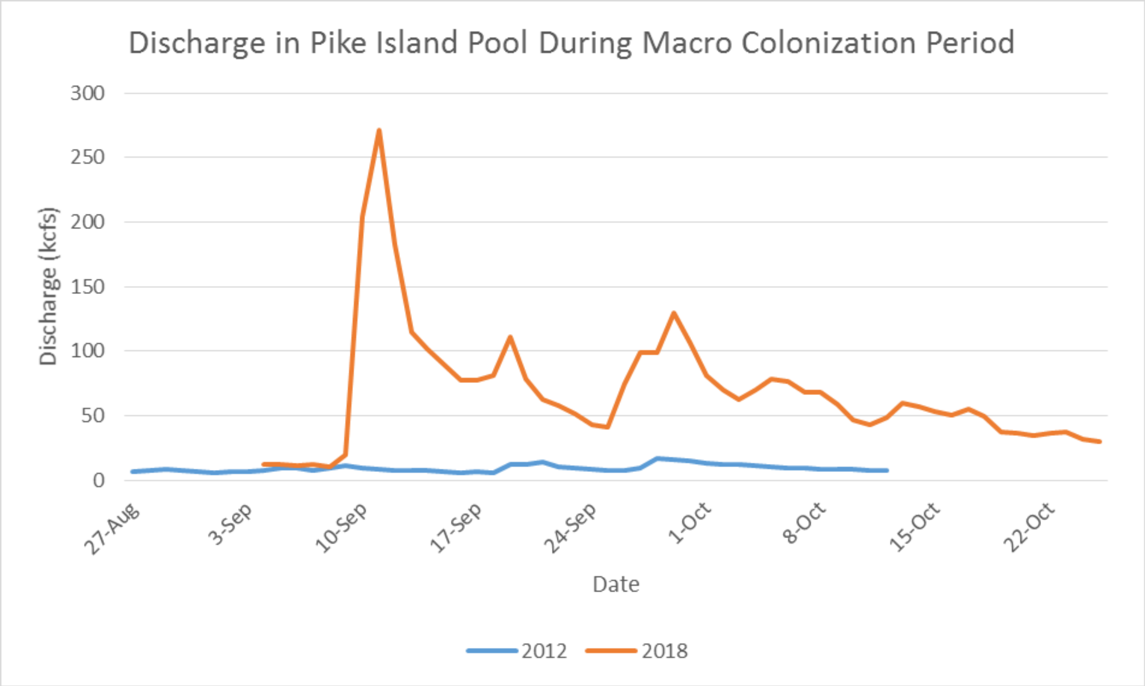




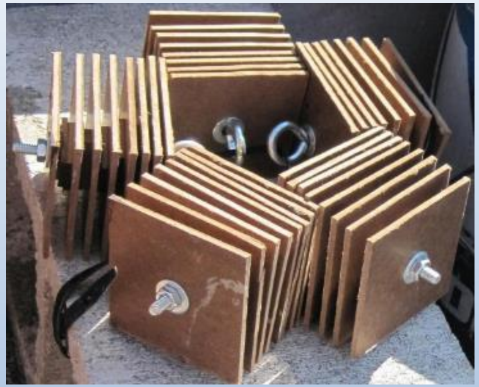
Pool	Fish (*m*ORFIn)	Macros (ORMIn)
Newburgh	33.6	Unassessed
	Full Support	

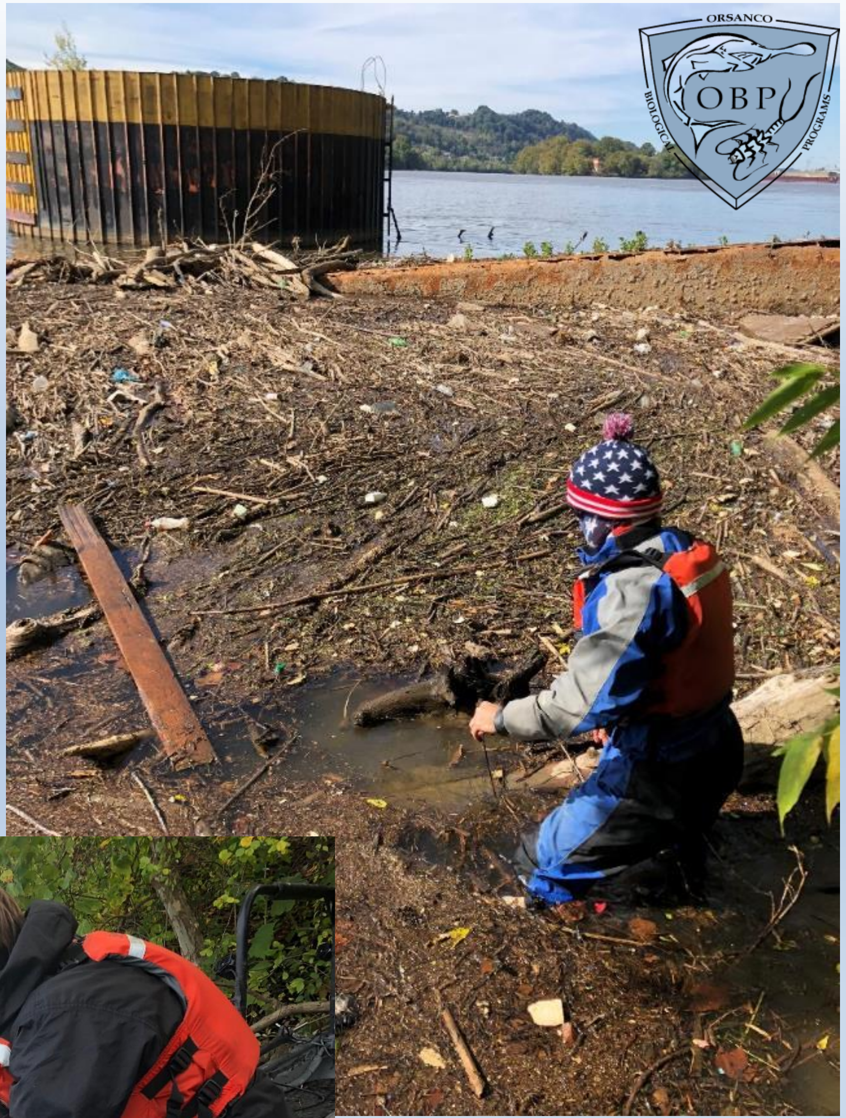
2018 Macro Colonization





Macro Retrieval





HDD and MH samples collected at each EF site

- Emsworth
  - ➢ HDD 14/15 recovered -2 covered in fine sediment
  - ➢ MH 15/15 collected

- Pike Island
  - ➢ HDD 9/15 recovered- 1 covered in fine sediment
  - ➢ MH 15/15 collected

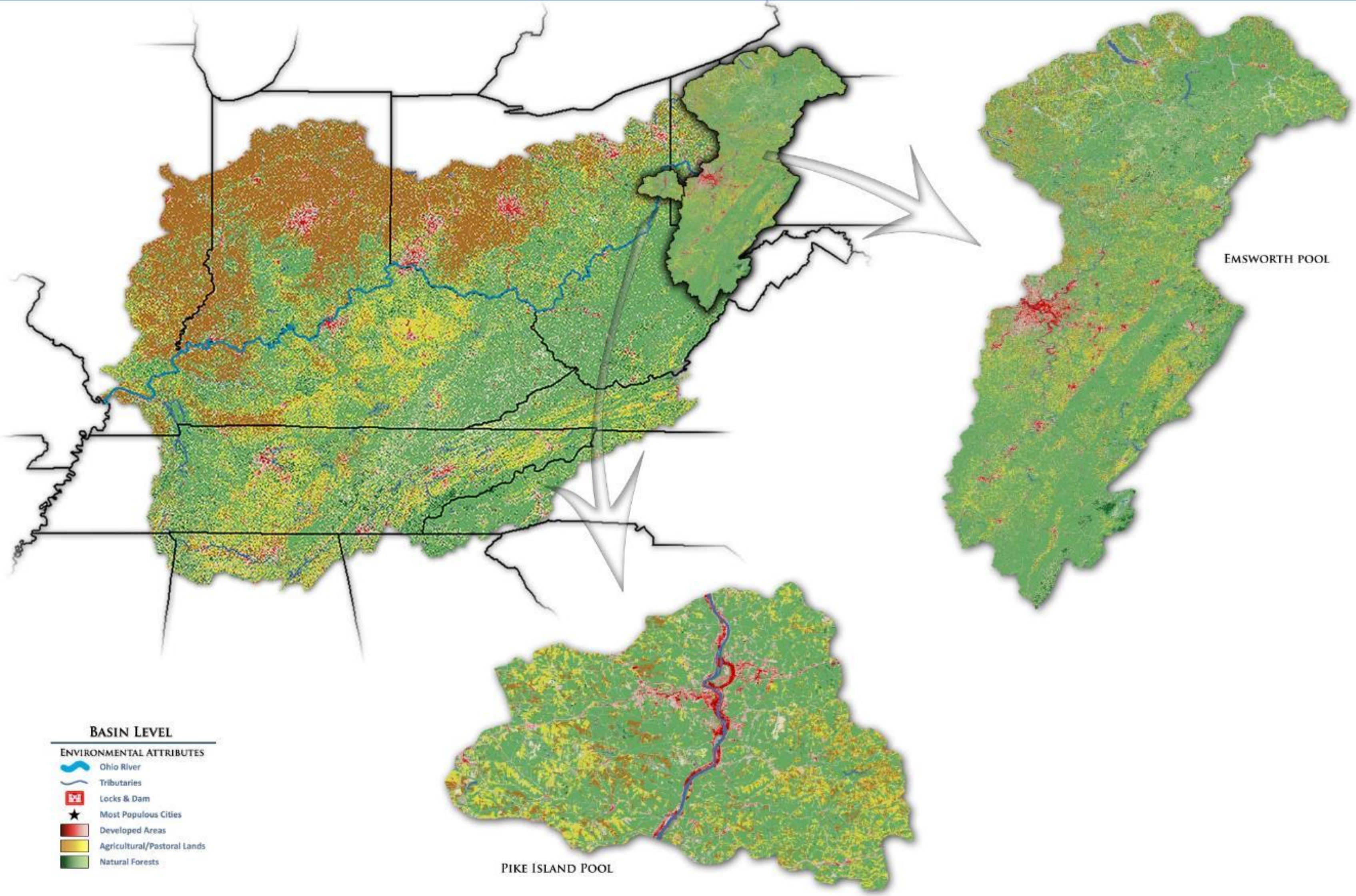
Item 5b: 2018 Monitoring Activities

Danny Cleves

Aquatic Biologist

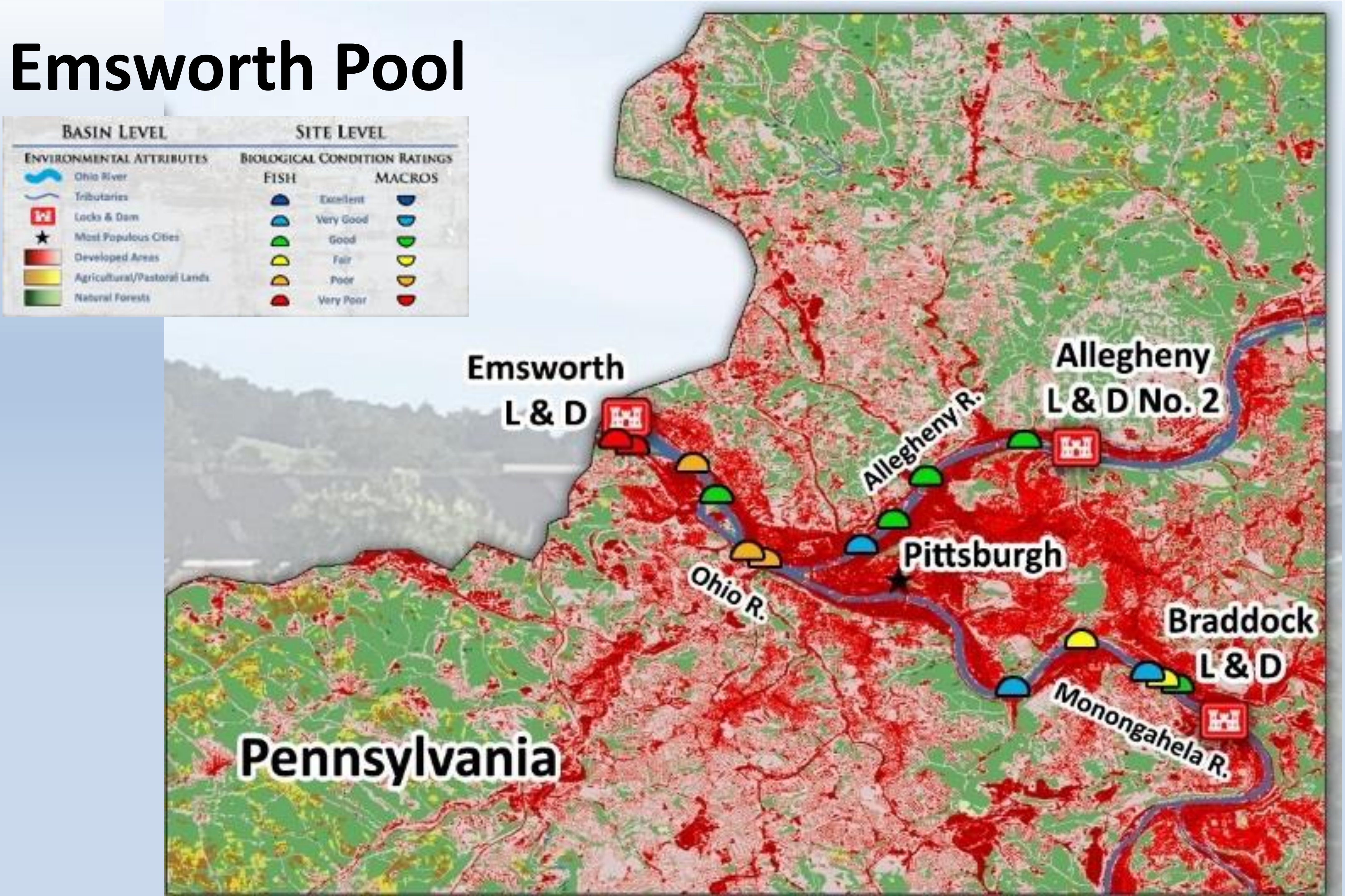
2018 Pool Survey Results

The results of the 2018 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.



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

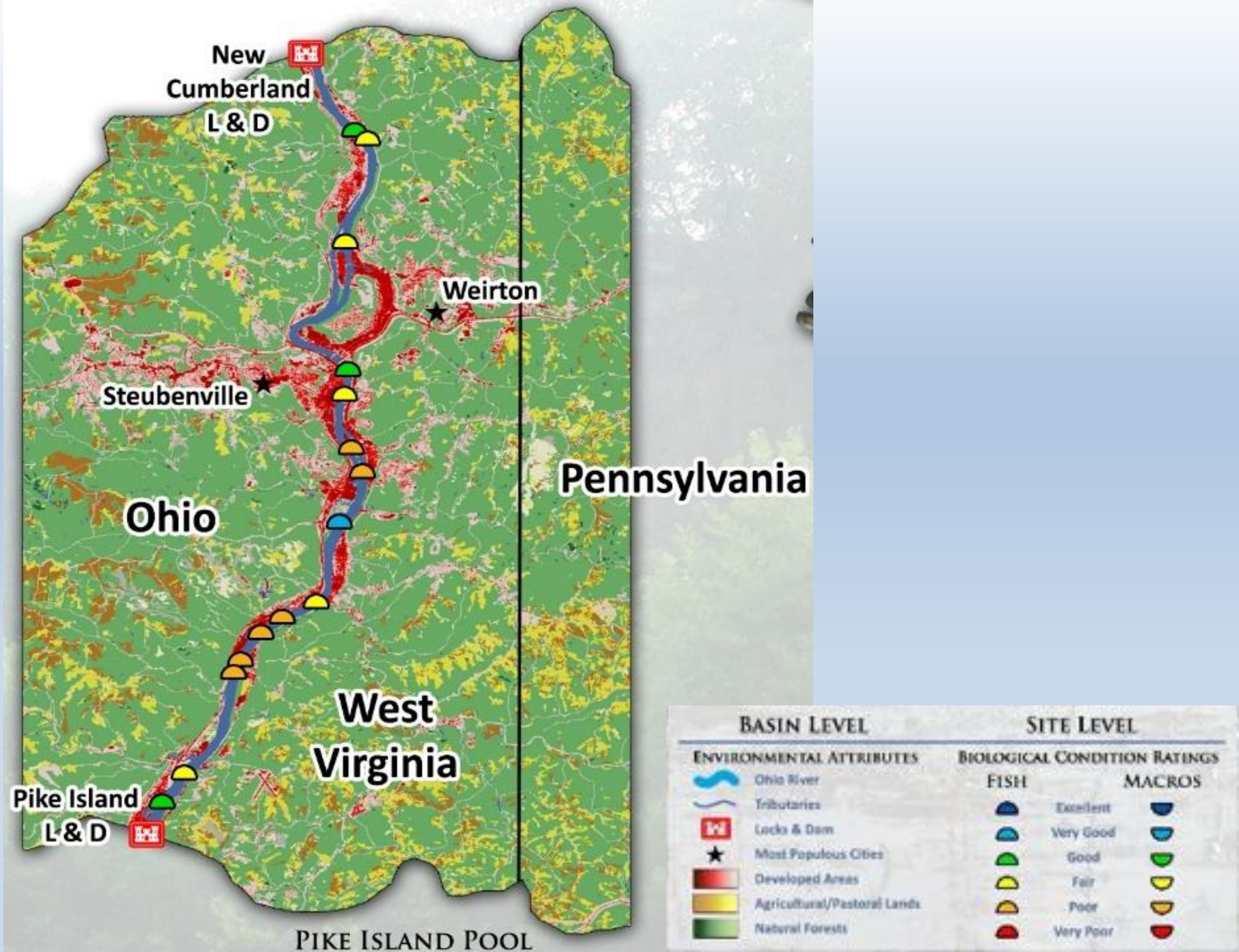
Emsworth Pool



Emsworth Pool (2007 – 2012 – 2018)

Variable	2007	2012	2018
Environmental Factors			
Avg. seasonal flow (cfs)	**Low**	**Low**	**Declining/Low**
Avg. Conductivity	441.1	488.2	383.5
Avg. Secchi Depth	46.8	45.7	33.1
Avg. CPUE Score	**14.3**	**43.4**	**12.1**
Gizzard Shad	167	3417	6
All Fish	2618	6074	2168
Avg. % Tolerant Score	**62.5**	**35.2**	**81.9**
Avg. % Non-Native Score	**68.1**	**64.9**	**93.6**
Common Carp	63	48	12
White Perch	5	0	0
Avg. % Simple Lithophil	**59.9**	**26.8**	**23.5**
Avg. % Piscivore Score	**59.4**	**52.0**	**42.2**
Sauger	283	39	13
Spotted Bass	125	24	7
Avg. Great River Species Score	**55.6**	**13.3**	**8.9**
Silver Chub	26	0	1
Mooneye	20	10	2
Assessment Result			
Avg. mORFIn Score	34.20	26.63	27.83
Fish Condition Rating	**Good**	**Fair**	**Fair**

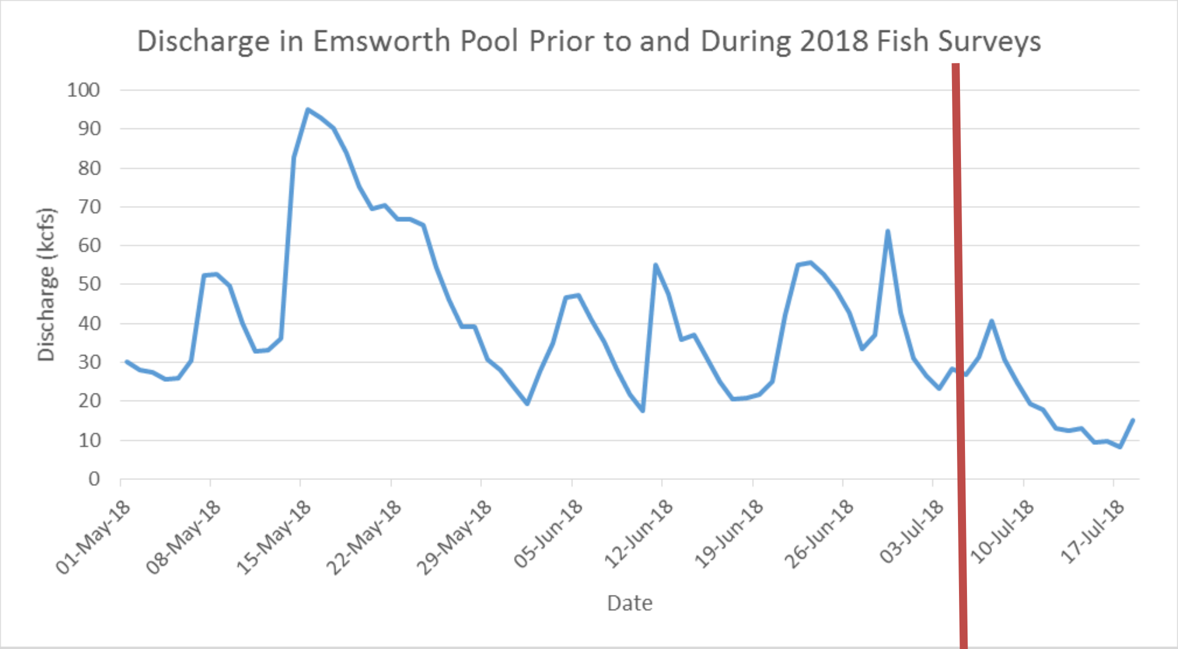
Pike Island Pool

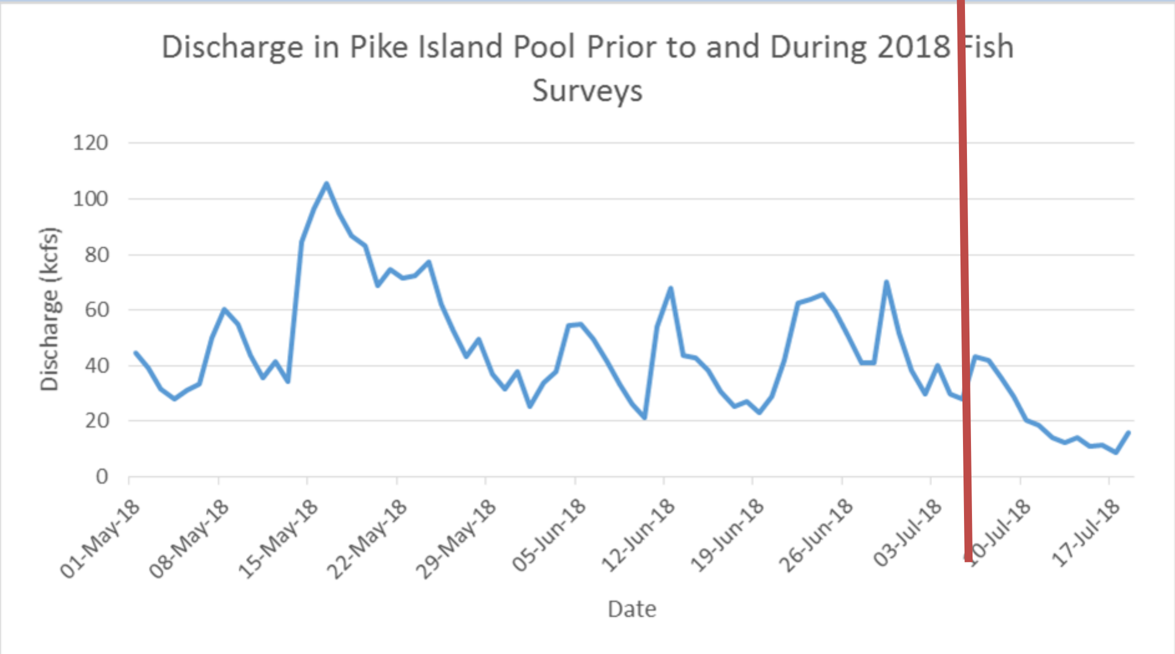


Pike Island Pool (2007 – 2012 – 2018)

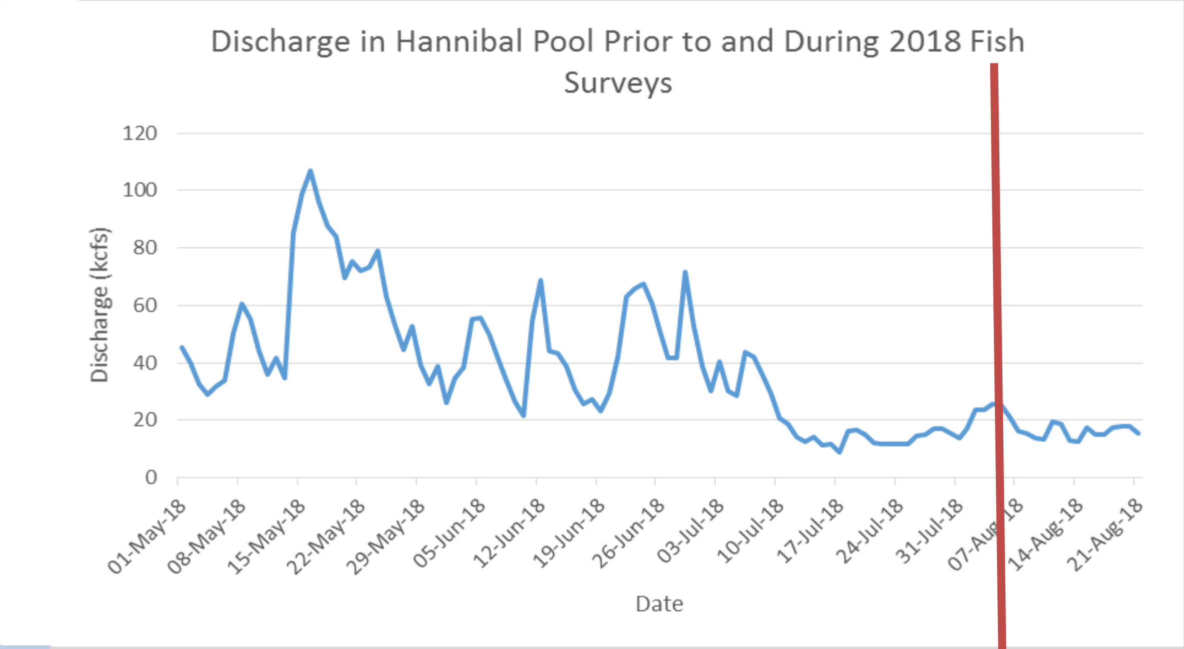
Variable	2007	2012	2018
Environmental Factors			
Avg. seasonal flow (cfs)	**Low**	**Low**	**Declining/Low**
Avg. Conductivity	541.9	517.1	353.1
Avg. Secchi Depth	47.6	56	37.5
Avg. CPUE Score	**63.8**	**69.7**	**7.0**
Gizzard Shad	7464	5092	37
All Fish	10097	8103	1666
Avg. % Tol Score	**90.9**	**63.9**	**63.3**
Bluntnose Minnow	2	28	33
Common Carp	15	36	16
Avg. % Piscivore Score	**70.5**	**52.8**	**39.4**
Sauger	244	39	31
Morone sp.	419	110	1
Flathead Catfish	35	47	10
Avg. GrRiver Score	**48.9**	**4.8**	**6.7**
Mooneye	37	2	3
Silver Chub	11	0	0
Avg. Intolerant Score	**57.7**	**57.2**	**43.8**
Logperch	85	40	35
Avg. Sucker Score	**69.8**	**46.4**	**34.0**
Total Round Bodied Suckers	203	143	182
Total Deep Bodied Suckers	186	105	63
Assessment Result			
Avg. mORFIn Score	**43.0**	**32.9**	**24.2**
Fish Condition Rating	**Very Good**	**Good**	**Fair**

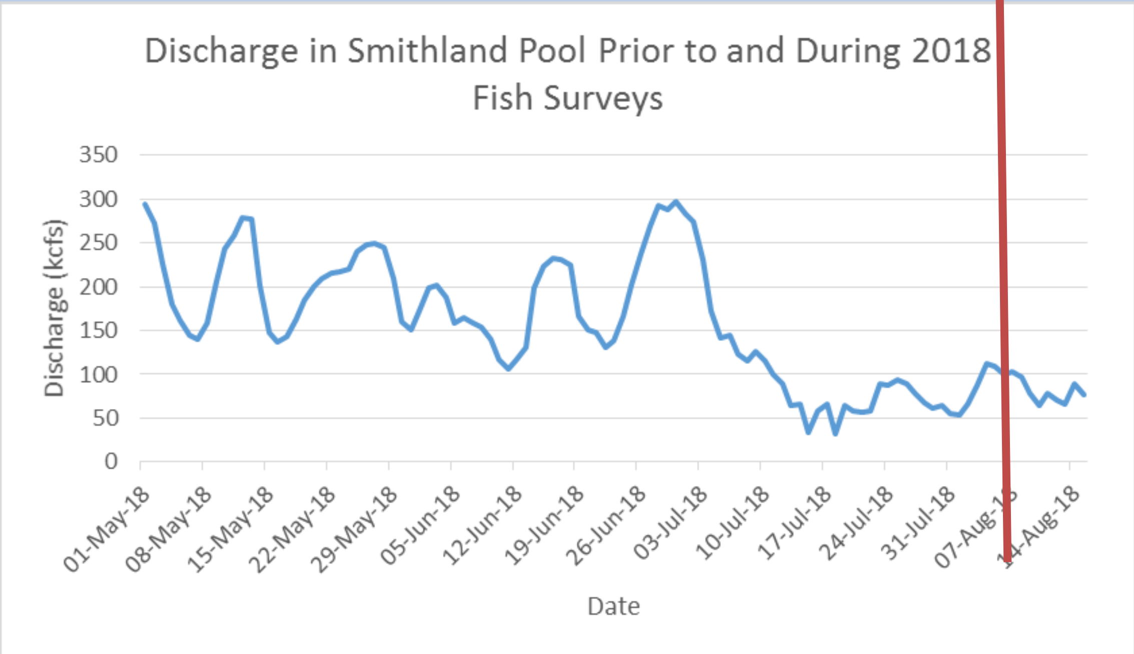
Flows Prior to Pool Surveys

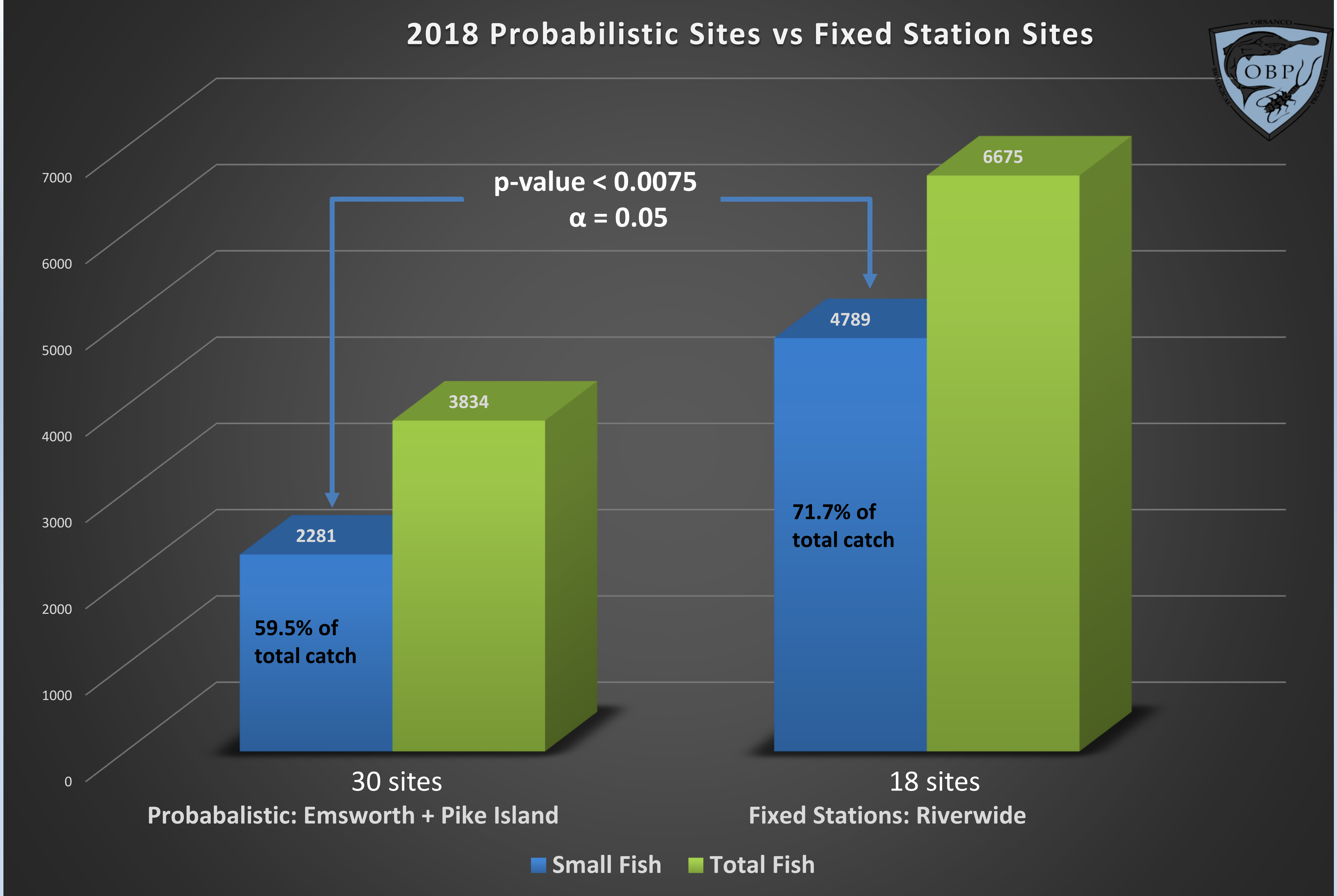




Flows Prior to Fixed Station Surveys

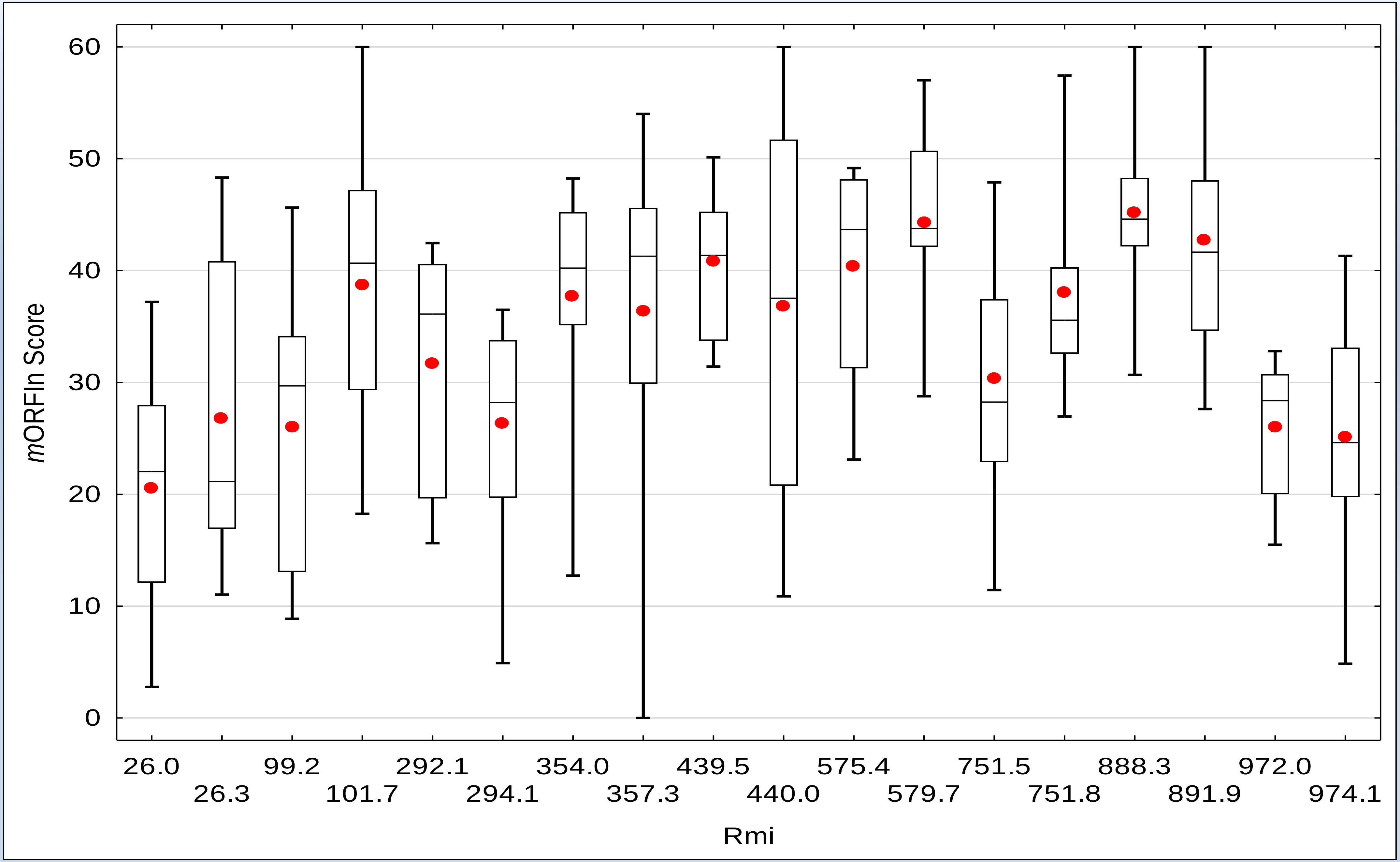





2018 Probabilistic Sites vs Fixed Station Sites
OBP
p-value < 0.0075
α = 0.05
7000
6000
5000
4000
3000
2000
1000
0
2281
3834
4789
6675
59.5% of total catch
71.7% of total catch
30 sites
Probabalistic: Emsworth + Pike Island
18 sites
Fixed Stations: Riverwide
Small Fish
Total Fish

Fixed Station *m*ORFIn Performance

2004-2017 Boxplots = Median, Interquartile range, 5th & 95th %tiles
2018 ●



Submerged Aquatic Vegetation (SAV) Summary

Emsworth			
All Vegetation		Invasives	
% Sites	% Transects	% Sites	% Transects
60	9.7	33.3	4.7

Pike Island			
All Vegetation		Invasives	
% Sites	% Transects	% Sites	% Transects
100	20.6	100	18.9

- Preliminary SAV data show a shift in species composition with increases in SAV density
- Continue to collect objective SAV data
- Goal: link changes in SAV communities to changes in the fish communities

OH River Fish Tissue Update

- 17 composite fish tissue samples were submitted to the lab for analysis in 2018. Data expected by February 2019.

- Staff conducted an RFP process in 2017 and selected PACE Analytical Services LLC. to continue to provide analyses and logistical support for the next 5 years.

Item 5c: Special Project Collaborations

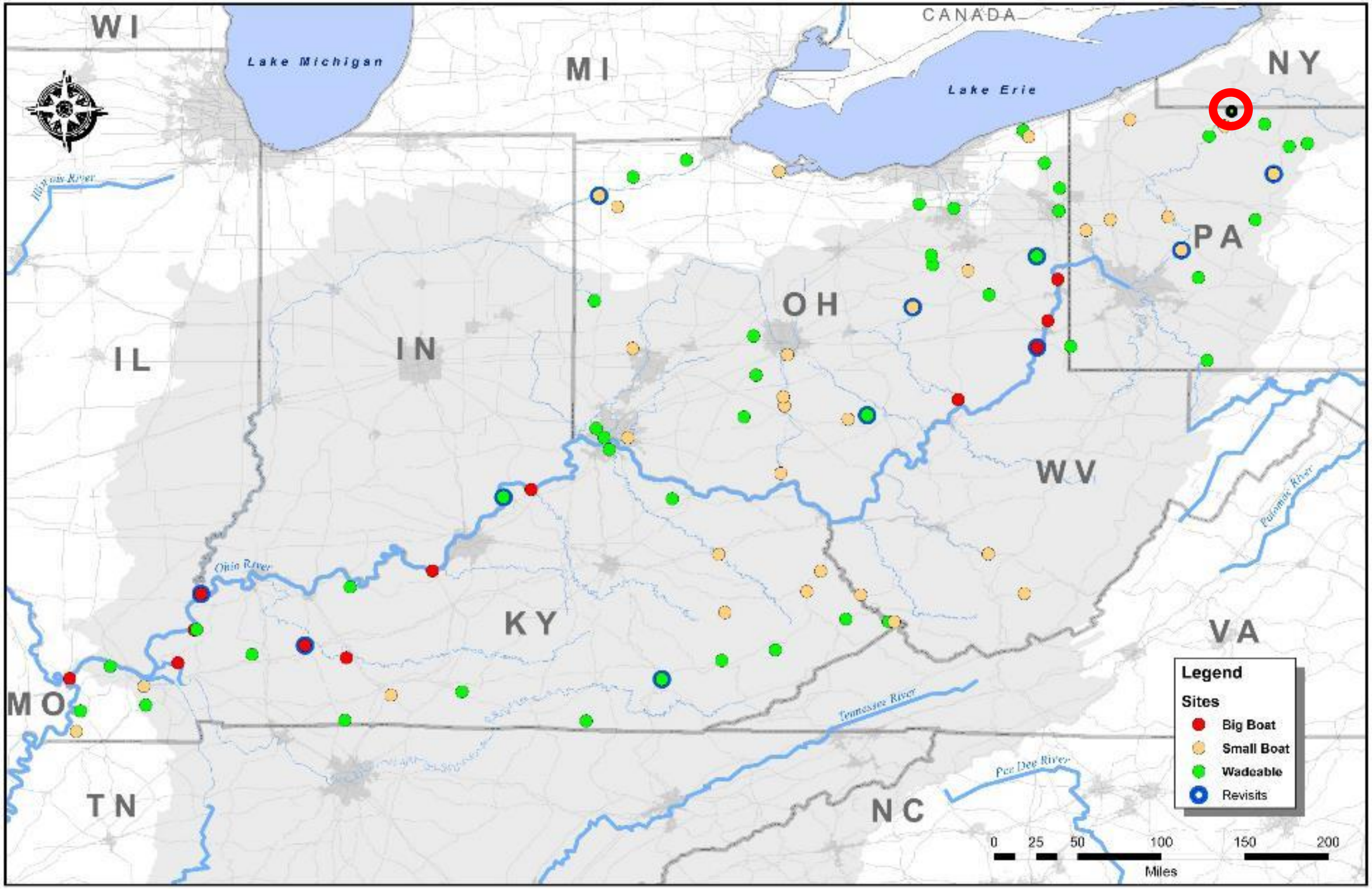
- PADEP – Set/Retrieved HDD samplers near ALCOSAN
- OEPA – Set/Retrieved HDD samplers in near Steubenville
- USACE Louisville District – Supported Fixed Station water quality & macro collections within District

Item 5d: NRSA Update

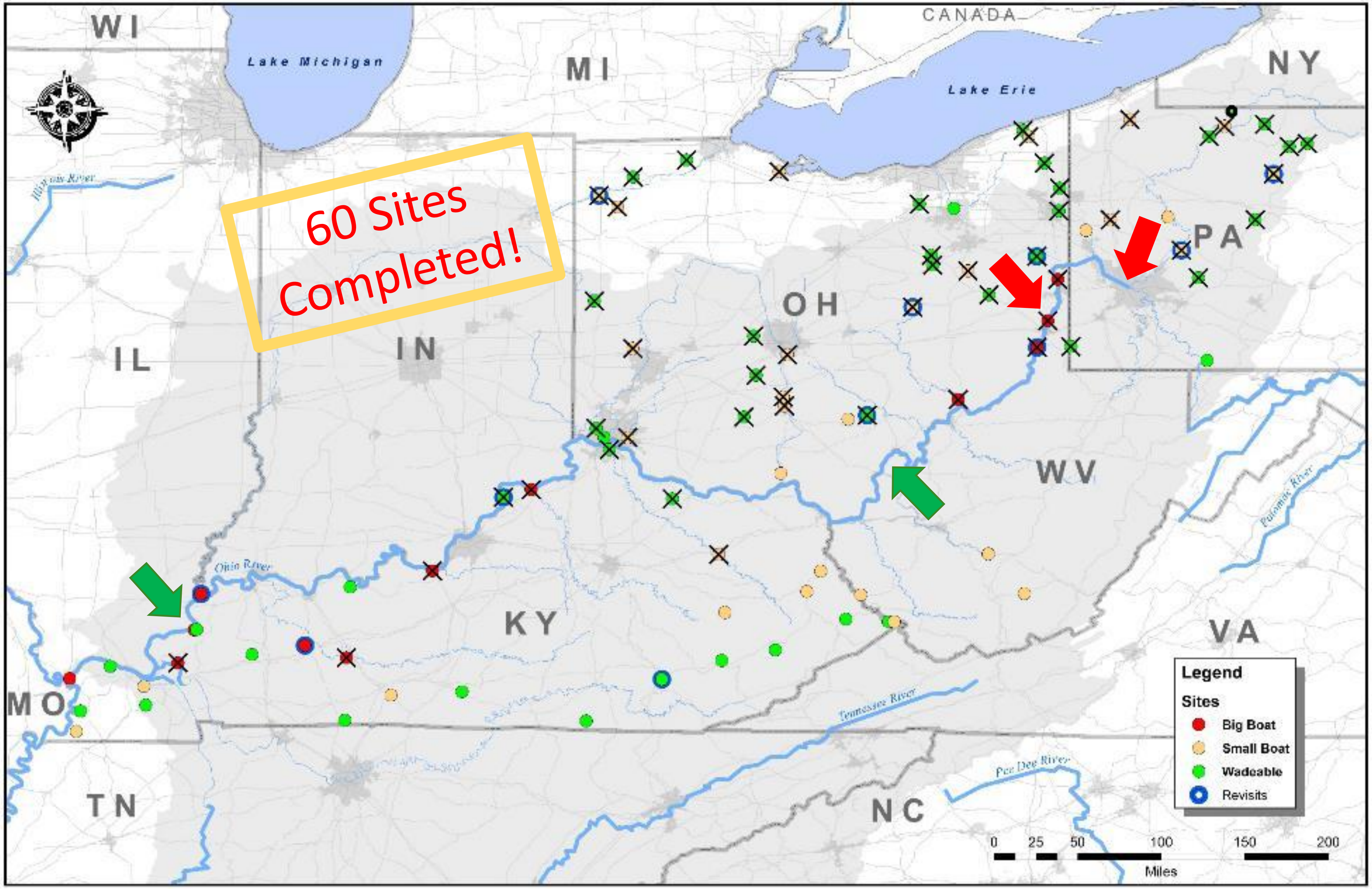
Ryan Hudson

Contractual Biologist

ORSANCO Sites for the 2018-2019 National Rivers and Streams Assessment (NRSA)



ORSANCO Sites for the 2018-2019 National Rivers and Streams Assessment (NRSA)



NRSA Crew

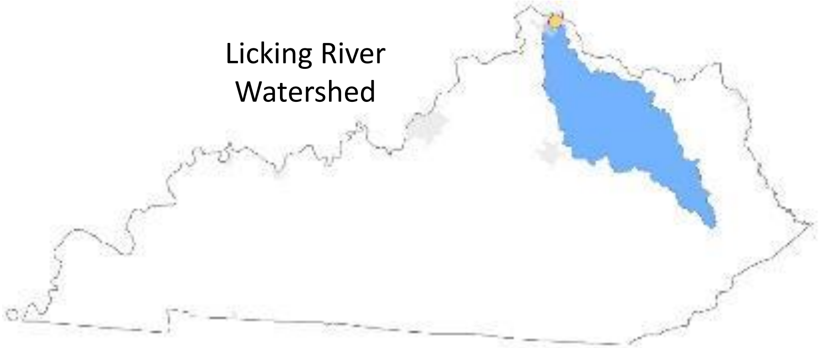
- Over 96 kilometers of stream sampled and 400 hours spent on site
- 60 hours of filtering and 30 hours of decontamination
- 117 species of fish identified and 20+ thousand individuals processed
- The fish data were retained and entered into our database

NRSA Data Availability

https://www.epa.gov/national-aquatic-resource-surveys/data-national-aquatic-resource-surveys

Banklick Creek

36 Species Collected!



Bigeye Chub	Freshwater Drum	Quillback
Blackstripe Topminnow	Gizzard Shad	Rainbow Darter
Bluegill	Golden Redhorse	Redear Sunfish
Bluntnose Minnow	Green Sunfish	River Shiner
Brook Silverside	Greenside Darter	Sauger
Central Stoneroller	Johnny Darter	Saugeye
Channel Catfish	Logperch	Smallmouth Bass
Channel Shiner	Longear Sunfish	Spotfin Shiner
Creek Chub	Longnose Gar	Spotted Bass
Emerald Shiner	Nothern Hog Sucker	Stonecat
Fantail Darter	Orangespotted Sunfish	Striped Shiner
Flathead Catfish	Orangethroat Darter	Western Mosquitofish

SD1 Report On Banklick Creek Combined Sewage Overflow

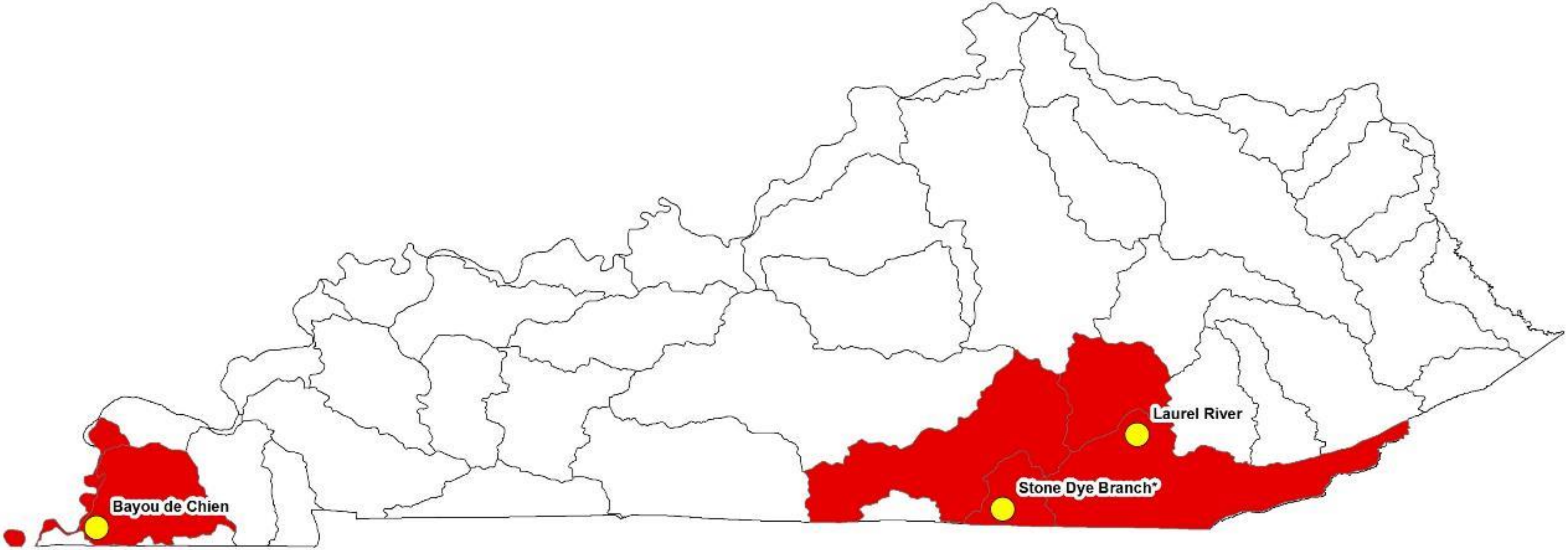
Manhole ID	Common Name	Direct Discharge to Waterbody	Typical Year Spill Frequency (# spills)[a]	Typical Year Volume (Million gallons)[a]
1870194 (outfall 79)	47th Street	Banklick Cr.	4	0.13
1850158 (outfall 76)	Church Street	Banklick Cr.	74	56.26
1870193 (outfall 78)	Decoursey Ave.	Banklick Cr.	24	1.29
1840130[b]	Latonia	Banklick Cr. trib.	25	1.12
1510245[b]	Henry Clay	Banklick Cr. trib.	0	0

Round Goby: A Relatively New Invasive to the Ohio River Basin

Confirmed in French Creek as of 2016.

Banded Darter	Least Brook Lamprey	Smallmouth Redhorse
Bigeye Chub	Logperch	Spotfin Shiner
Blackside Darter	Longhead Darter	Spotted Bass
Bluebreast Darter	Mimic Shiner	Spotted Darter
Bluegill	Nothern Hog Sucker	Streamline Chub
Bluntnose Minnow	Pumpkinseed	Striped Shiner
Brindled Madtom	Redfin Pickerel	Tippecanoe Darter
Central Stoneroller	Rock Bass	Variegate Darter
Creek Chub	Rosyface Shiner	White Sucker
Eastern Sand Darter	Round Goby	Yellow Bullhead
Golden Redhorse	Sand Shiner	
Greenside Darter	Smallmouth Bass	

2019 ORSANCO NRSA Sites Requiring Federal Scientific Collecting Permits



8-Digit HUCs With Federally Protected Fish

Importance of NRSA

- Obtain new and effective equipment
- Offset ORSANCO staff salary costs
- Improves the skills and credentials of our staff and seasonals
- Gain important knowledge on the landscape and inhabitants of the ORB
- Spreads our network with other agencies and people within the ORB

Summary of BWQSC Recommendations

1. **Accept the biological results of the 2017 Probabilistic Surveys**
   - New Cumberland, Meldahl, and Newburgh (fish only)
2. **Accept the fish results of the 2018 Probabilistic Surveys**
   - Emsworth and Pike Island
3. **Conduct two Probabilistic Surveys in 2019 Probabilistic Surveys**
   - Robert C. Byrd and Smithland
4. **Sample the 38 Remaining NRSA events in 2019**
   - in lieu of a 3rd Probabilistic Survey
5. **As resources allow, complete the following sampling efforts in 2019**
   a) Maintain current Fixed Station effort (18 sites)
   b) Incorporate Paired Water Quality Samples with Probabilistic Sites
   c) Conduct targeted sampling within the two probabilistic pools as directed by state and federal agencies.
6. **Continue investigating the effects of abiotic/biotic factors on biological indices (*m*ORFIn and ORMIn)**

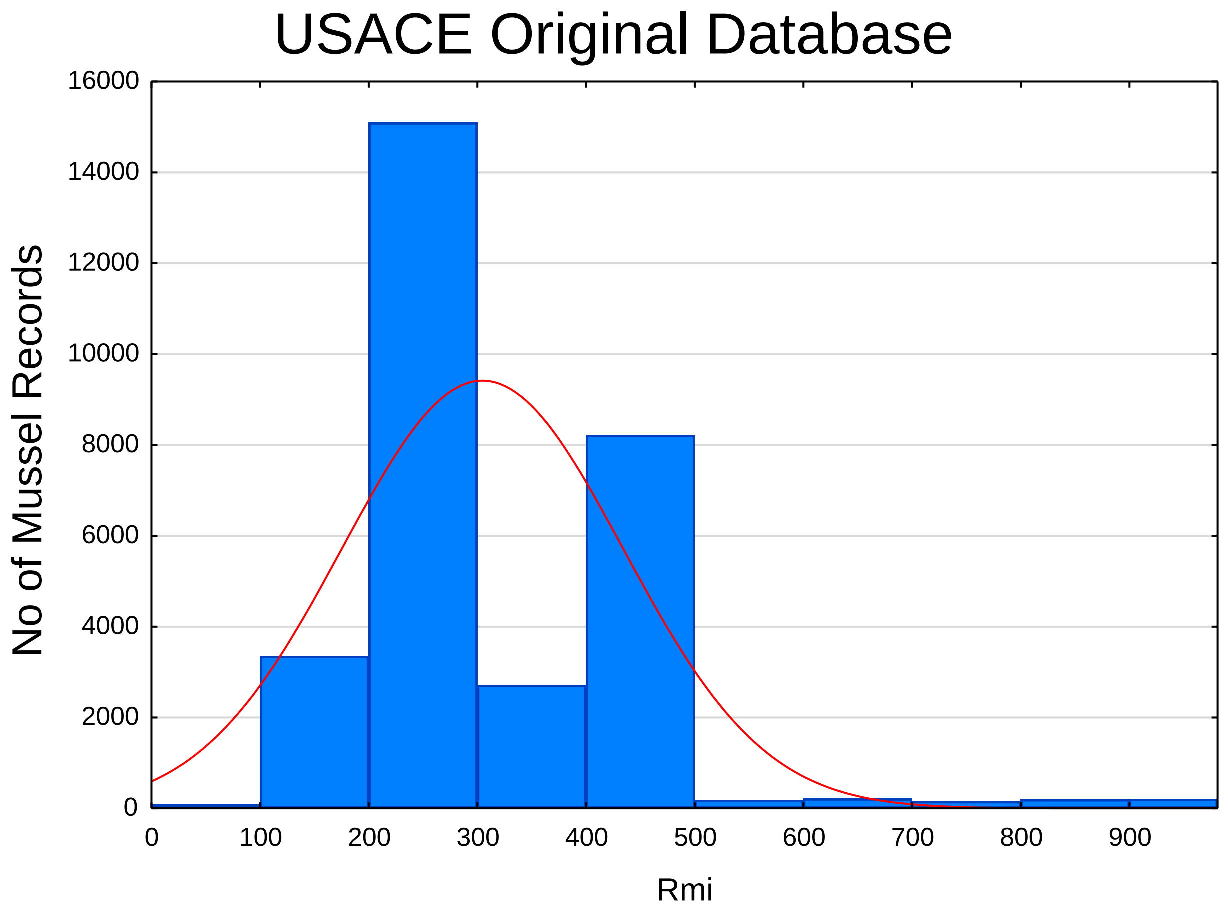
Item 5e: Ohio River Mussel Database

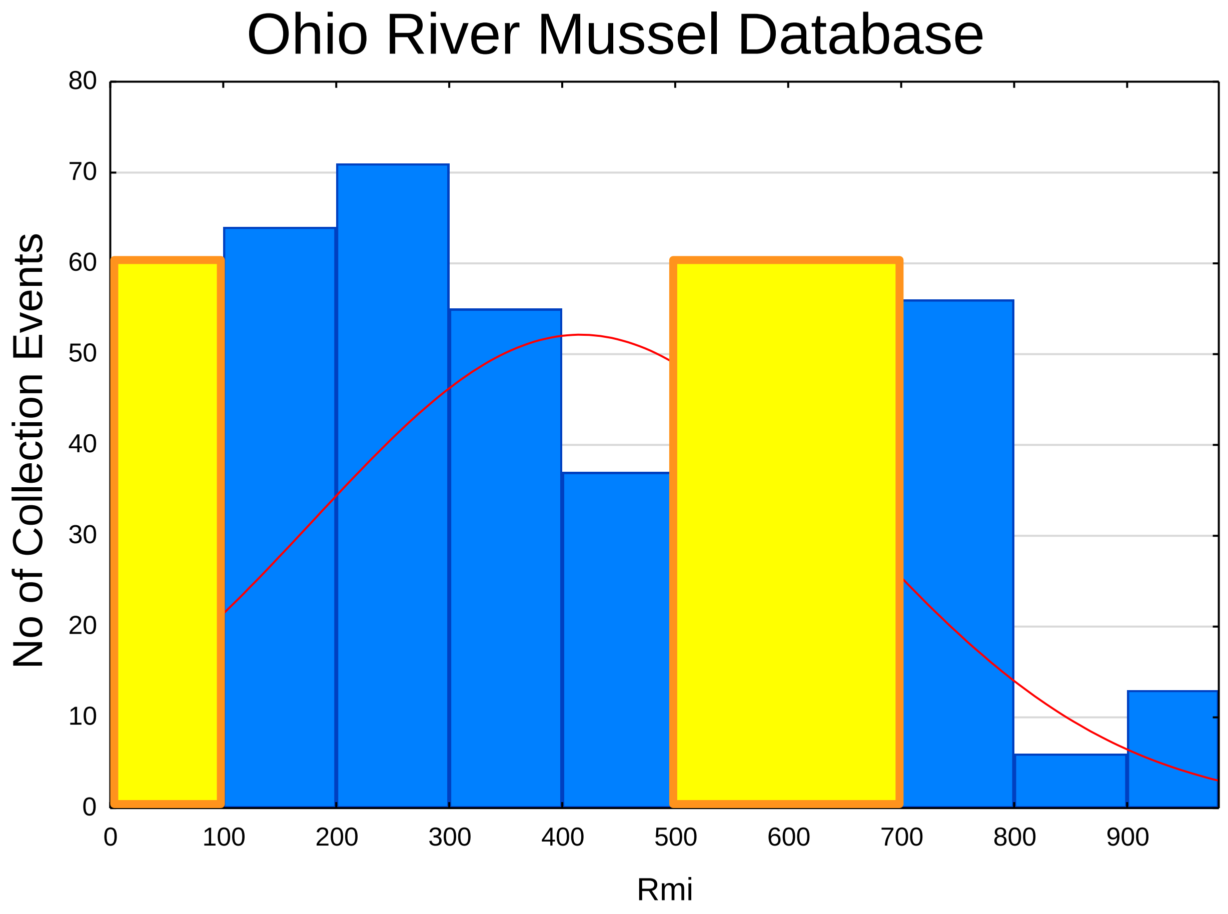
- Augment an existing Ohio River mussel database to accept new data
    - Generated by Tom Watters (Ohio State Univ.) for the USACE
    - Data from 1800 – 2000
  - Required updating species information
  - Incorporation of new metadata

- Populate the new Ohio River Mussel Database with recent surveys
  - Solicitation of data from multiple agencies and professional entities
    - Goal of 50 surveys

- Fund a new Ohio River pool mussel survey
  - Comparison to prior survey and inclusion in database

Distribution of Surveys





Data	Years	River Miles	Events	Mussel Records	Species
USACE	1800 – 2000	13.4 – 974.0	TBD	55,000	76
New	2001 - 2017	161.8 – 969.2	308	44,000	47

Mussel Data Availability / Requests

- The database will be housed on ORSANCO servers
  - Maintained by ORSANCO biologists
  - Intend to append new data annual or as available
  - Publicly available upon request

- Data requests can be submitted to info@orsanco.org

- Any entity wishing to contribute data, contact rargo@orsanco.org

- Technical brief detailing the database available via www.epri.com (Product ID: 3002013900)

Emerging Per- and Polyfluoroalkyl Substances (PFAS)

Andrew B. Lindstrom[1], Jason E. Galloway[2], Mark J. Strynar[1],
Detlef Knappe[3], Mei Sun[4], Seth Newton[1], Linda K. Weavers[2]

[1]U.S. Environmental Protection Agency, [2]The Ohio State University,
[3]North Carolina State University, [4]University of North Carolina Charlotte

Northeastern University
Social Science Environmental Health Research Institute

Highly Fluorinated Compounds
Social and Scientific Discovery
Northeastern University Social Science
Environmental Health Research Institute
June 14 – 15, 2017

Overview

- Sources and exposure pathways of legacy PFAS (PFOS & PFOA) somewhat known

- USEPA’s Stewardship Program has reduced legacy PFAS but has also resulted in the development of many new “emerging” PFAS

- New analytical capabilities (high resolution mass spectrometry) allow detection of many new PFAS

- Emerging PFAS almost completely uncharacterized with regard to sources, environmental fate, human exposure implications

- Discussion of some recent research on sources of emerging PFAS, human exposure pathways, overall implications

US Environmental Protection Agency PFOA Stewardship Program

- In January 2006, USEPA started this program to help minimize impact of PFOA in the environment

- Eight major international companies have agreed to participate (including 3M, DuPont, Asahi Glass, Daikin)

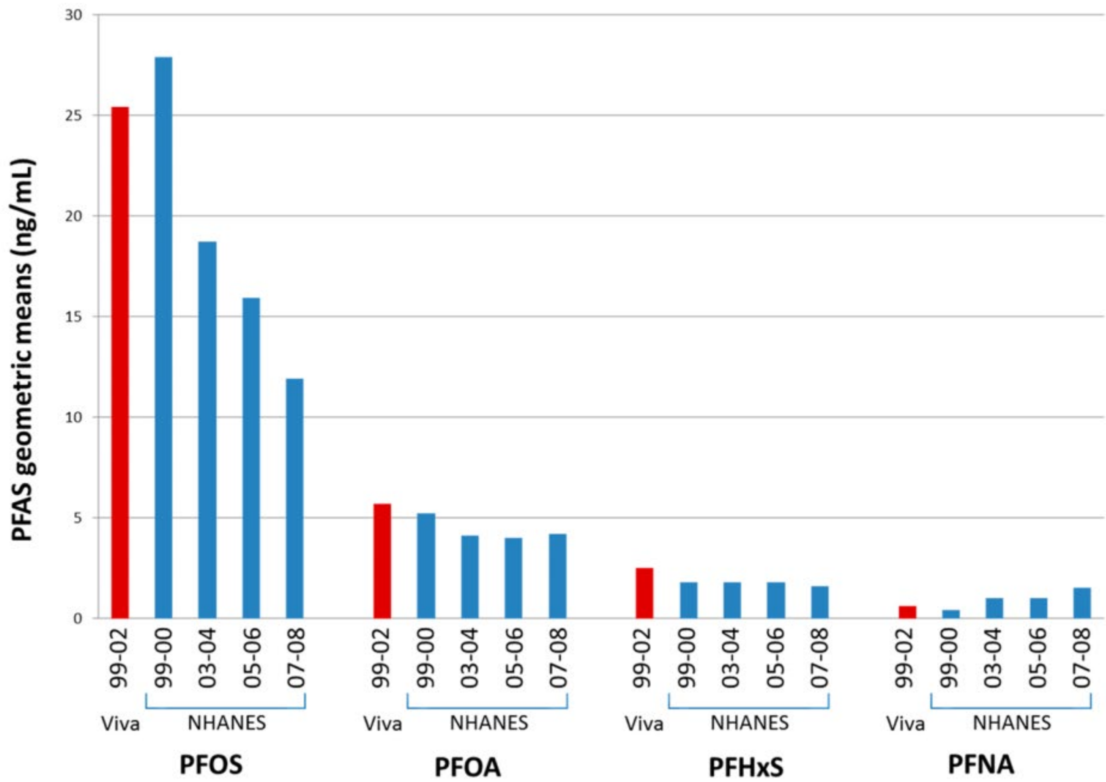
- Agreement to voluntarily reduce factory emissions and product content of PFOA and related compounds* on a global basis by 95% no later than 2010

- Agreement to work toward total elimination of emissions and product content of these compounds by 2015

- Based on emissions and content determinations made for 2006

* Includes PFOA, precursor chemicals that can break down to PFOA, higher homologues (C9 and larger)

Trends in PFAS Serum Levels in US

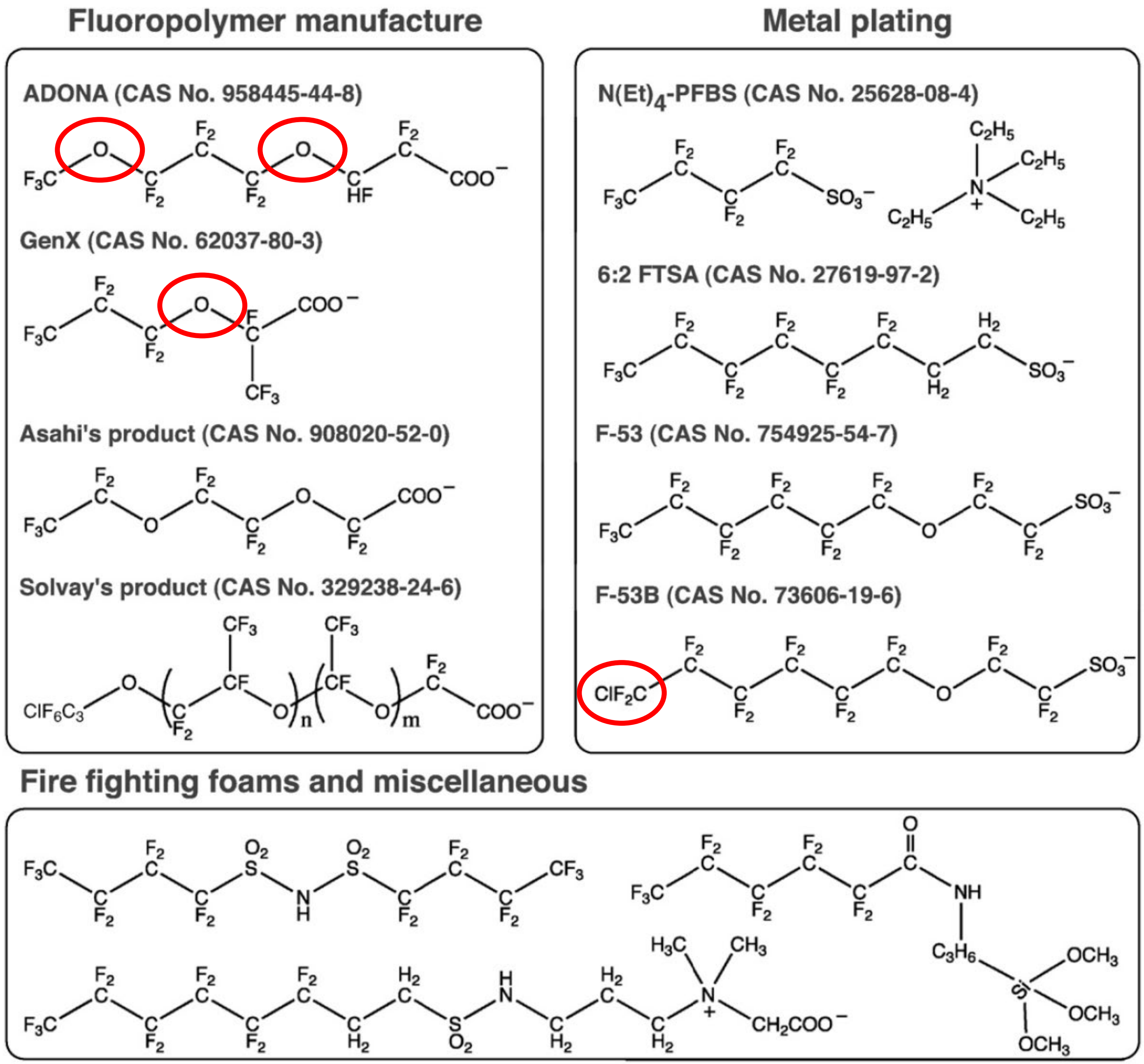


Sagiv et al. *Environmental Science & Technology* 2015, 49, 11849−11858

Table 2. Geometric mean and 95% confidence interval and selected percentiles of PFOS, PFOA, PFHxS, and PFNA serum concentrations (ng/mL) for the U.S. population 12 years of age and older: Data from NHANES 2011-2012 [a]

	Geometric Mean (95% Confidence Interval)		Selected Percentiles			
			50th	75th	90th	95th
PFHxS	1.28	1.15-1.43	1.27	2.26	3.81	5.43
PFOS	6.31	5.83-6.82	6.51	10.48	15.62	21.68
PFOA	2.08	1.95-2.22	2.08	3.02	4.35	5.67
PFNA	0.88	0.80-0.97	0.86	1.30	1.95	2.54

[a] CDC (2015)


Fluoropolymer manufacture
ADONA (CAS No. 958445-44-8)
GenX (CAS No. 62037-80-3)
Asahi's product (CAS No. 908020-52-0)
Solvay's product (CAS No. 329238-24-6)
Metal plating
N(Et)4-PFBS (CAS No. 25628-08-4)
6:2 FTSA (CAS No. 27619-97-2)
F-53 (CAS No. 754925-54-7)
F-53B (CAS No. 73606-19-6)
Fire fighting foams and miscellaneous

Unknown Characteristics of “Emerging” Fluorinated Compounds

- Actual identities of alternatives unknown in industrial sectors and geographical regions that are not well regulated

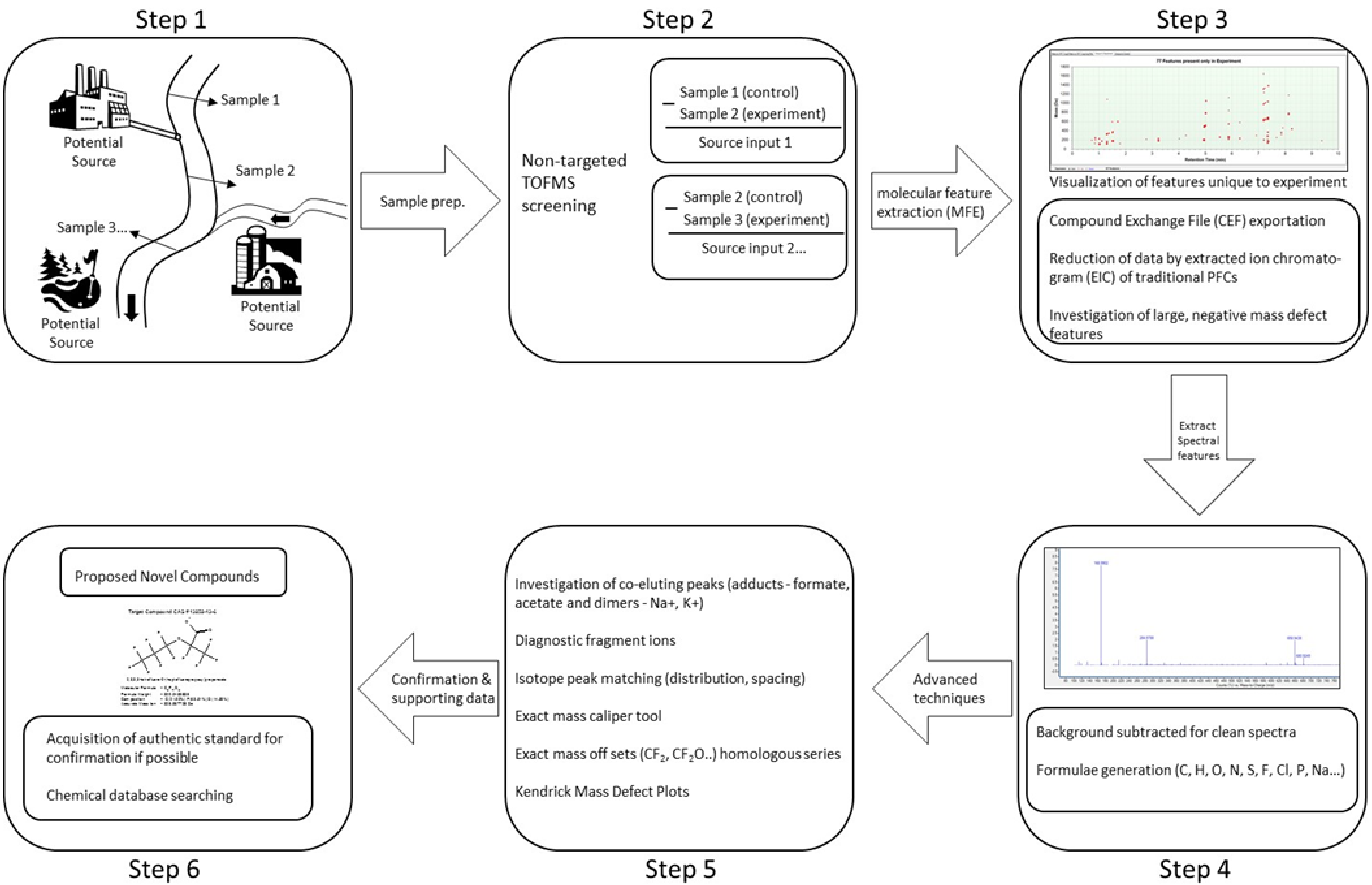
- Data on environmental and human health effects are incomplete (at best) and more often nonexistent

- Data on degradability, bioaccumulation, and toxicity (environmental and human) are incomplete (at best) or completely lacking

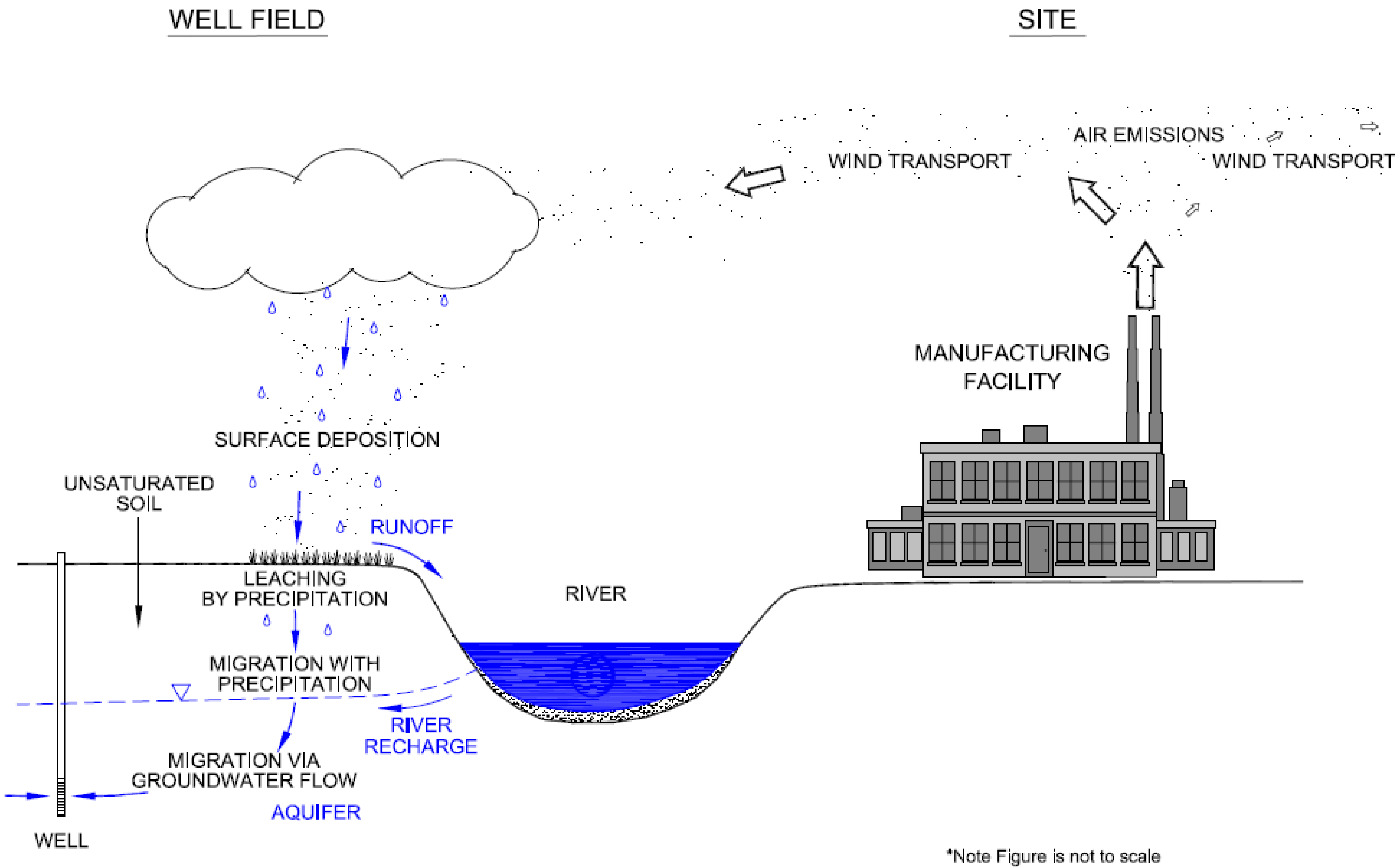
- Information on production volume and environmental emissions not available

Wang et al. *Environment International* 2013, 60, 242−248

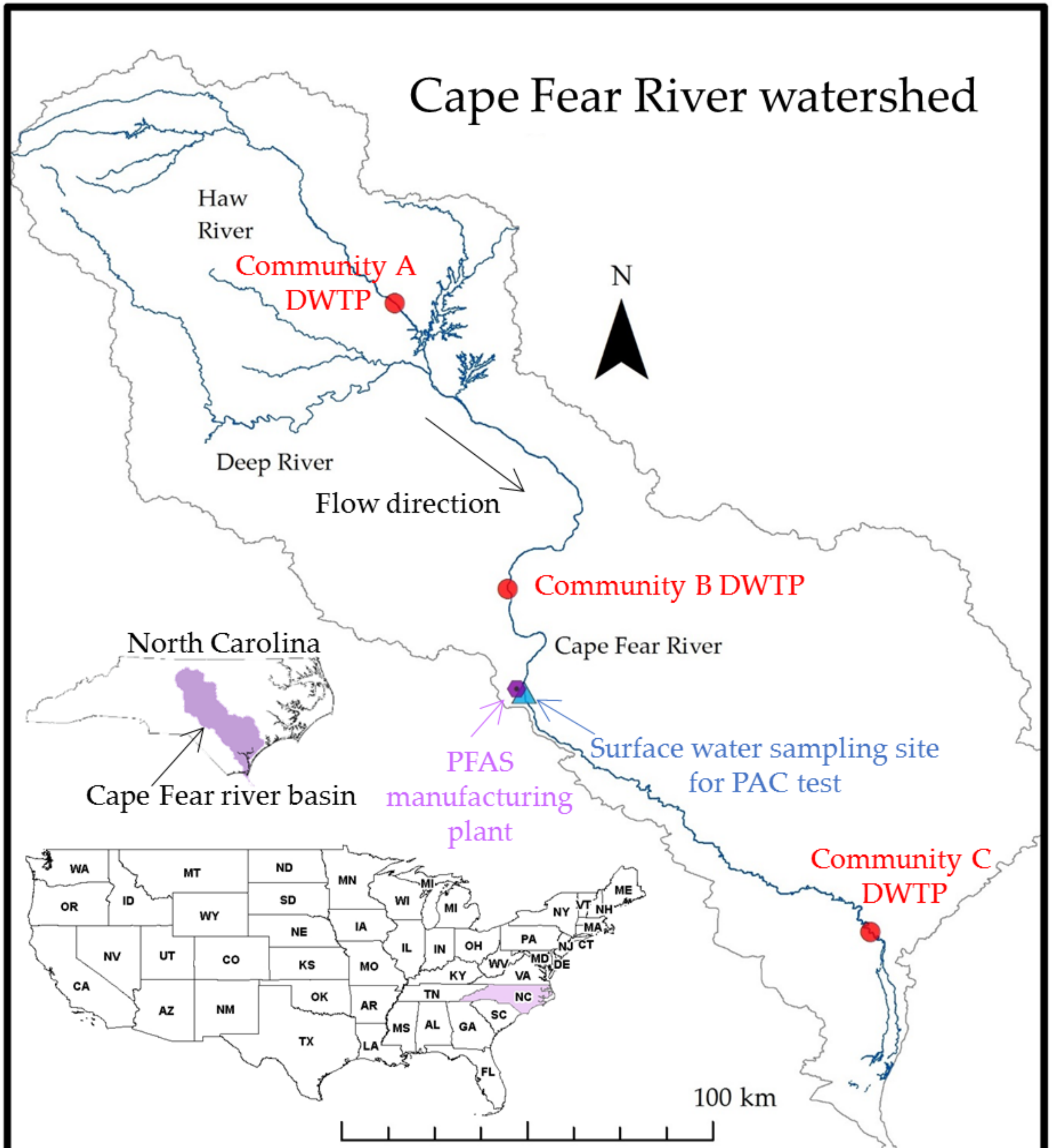
High Resolution Mass Spectrometry to Find “Emerging” PFAS



Strynar et al. *Environmental Science & Technology* 2015, 49, 11622−11630

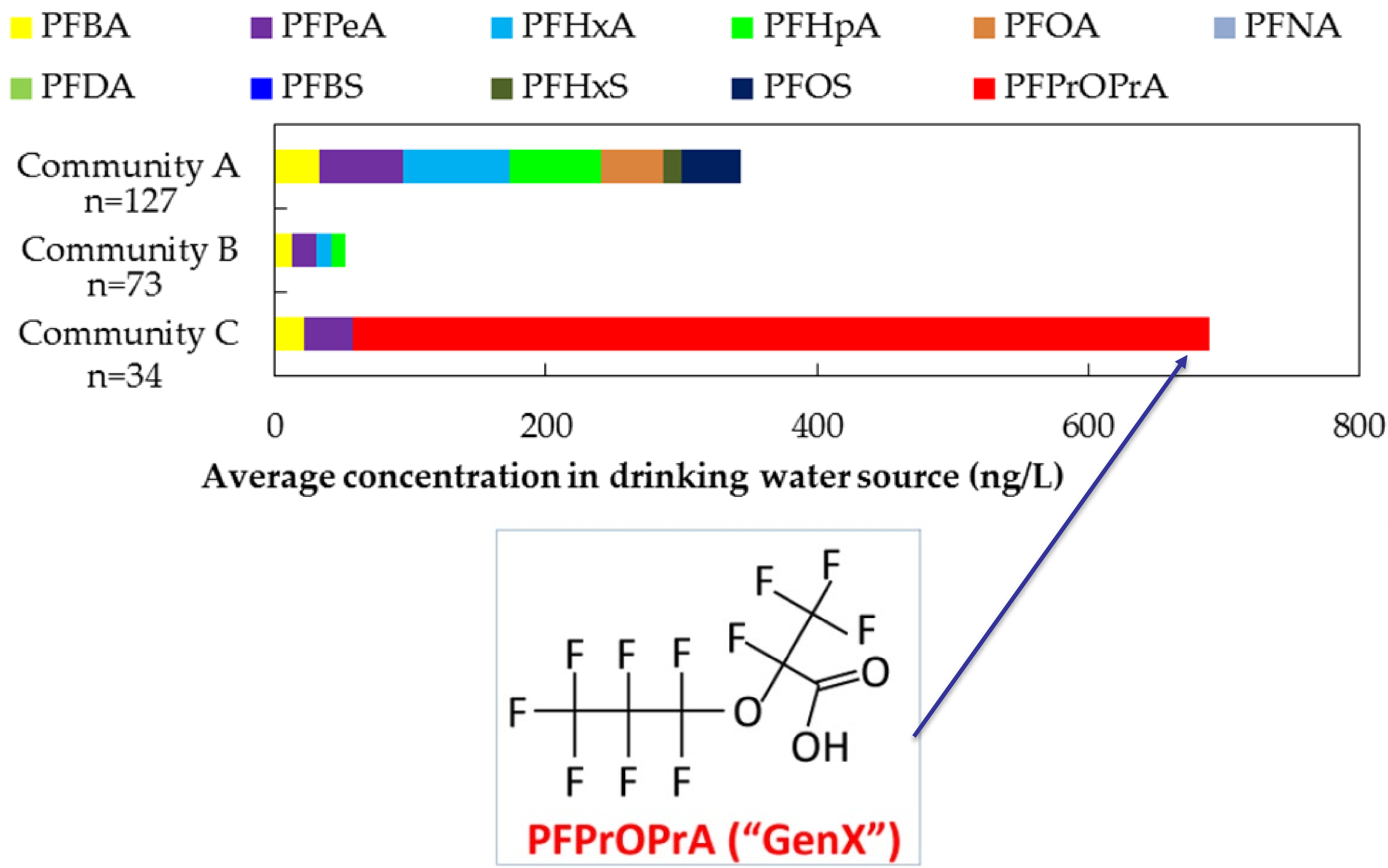


Davis et al. *Chemosphere* 2007, 67, 2011–2019



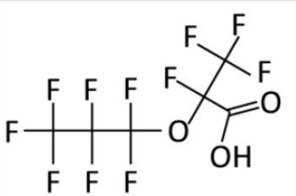
Sun et al. *Environmental Science & Technology Letters* 2016, 3, 415−419

Legacy PFAS with GenX in Cape Fear River Basin

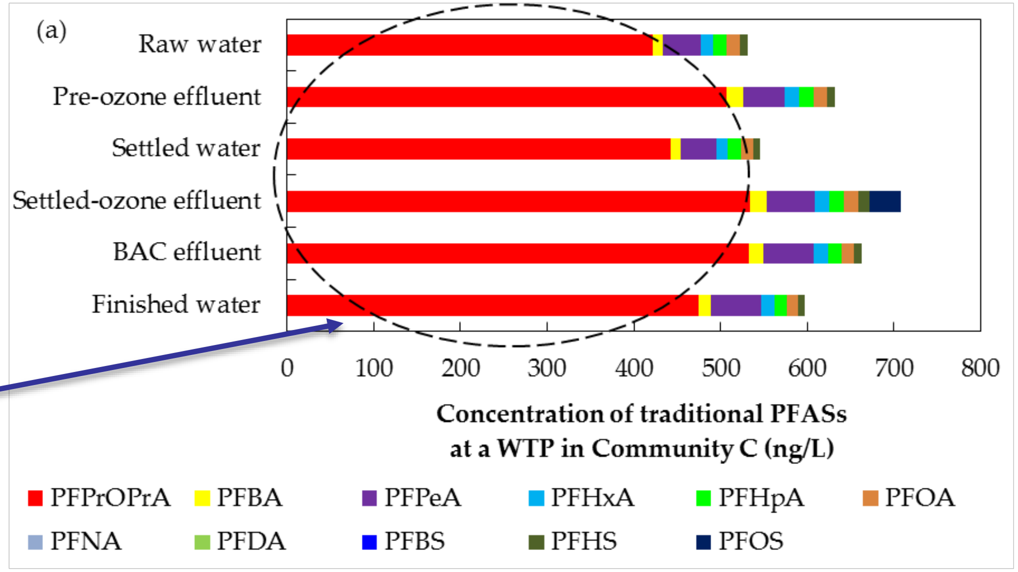


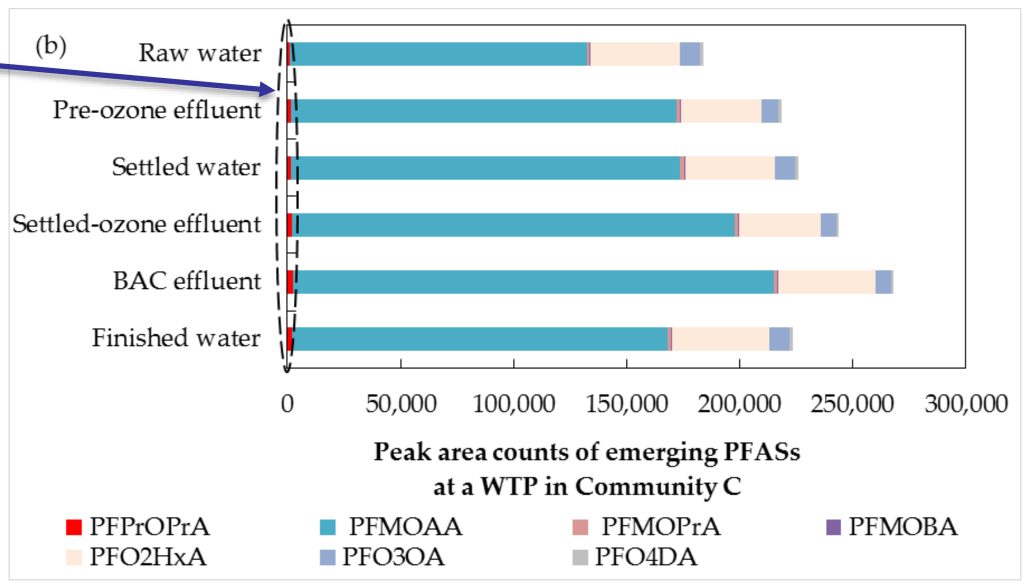
Sun et al. *Environmental Science & Technology Letters* 2016, 3, 415−419

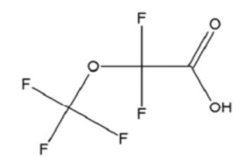
Emerging PFAS in Cape Fear River Basin



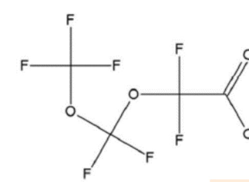
PFPrOPrA ("GenX")



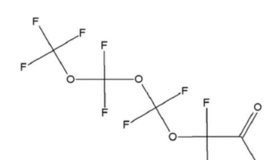




PFMOAA

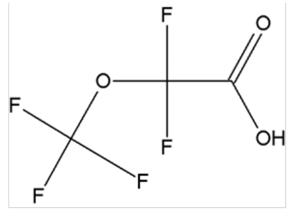


PFO2HxA

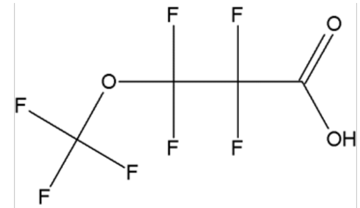


PFO3OA

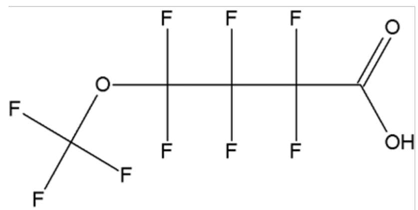
Sun et al. *Environmental Science & Technology Letters* 2016, 3, 415−419



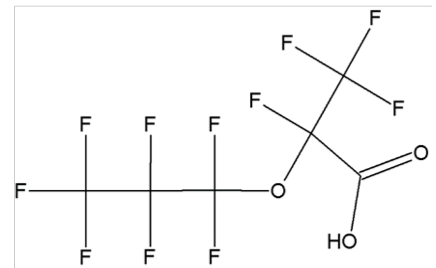
PFMOAA



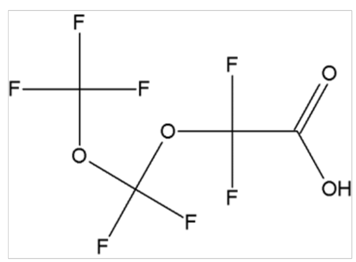
PFMOPrA



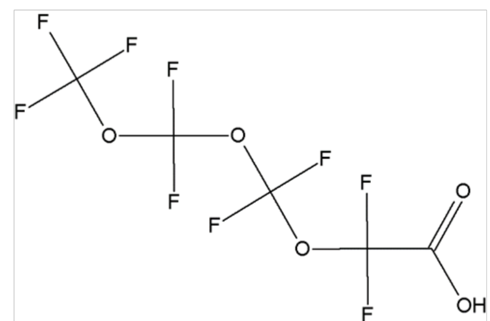
PFMOBA



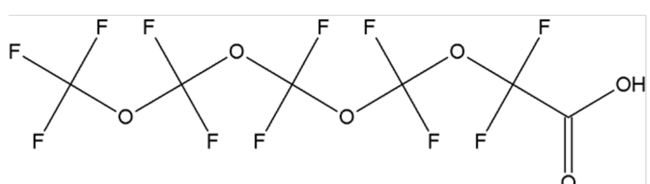
PFPrOPrA



PFO2HxA



PFO3OA



PFO4DA

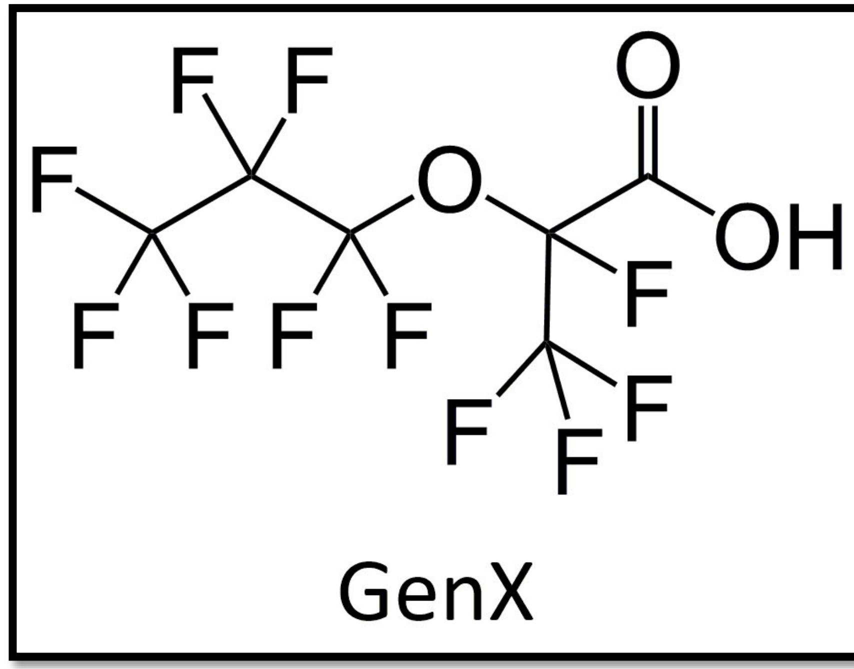
Sun et al. *Environmental Science & Technology Letters* 2016, 3, 415−419

GenX

- Identity originally protected as Confidential Business Information (CBI)

- Still persistent, still toxic, but less bioaccumulative than C8

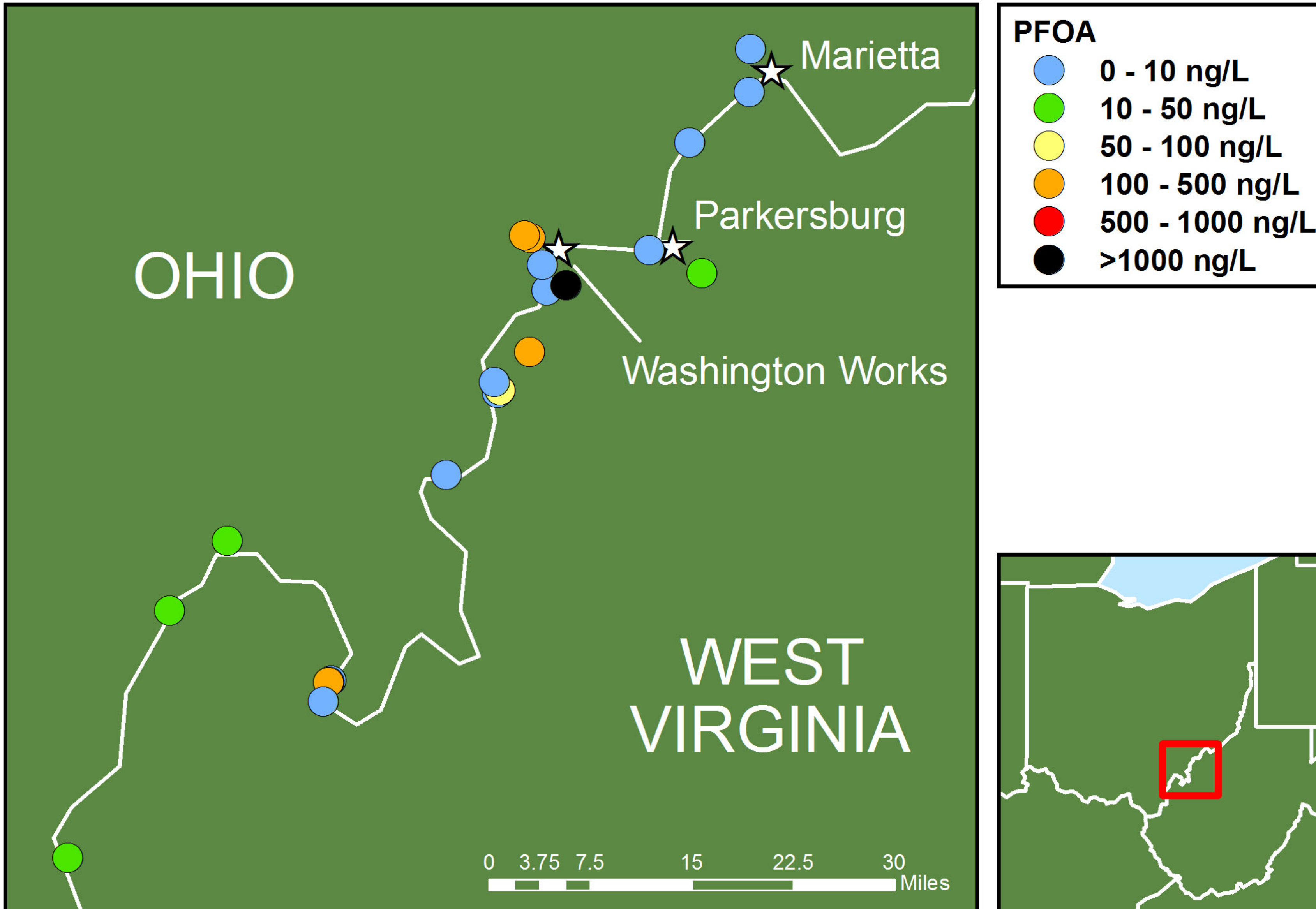
- DuPont studies found effects on rats similar to C8, including possible endocrine/immune disruption, enlarged livers and kidneys, and cancer



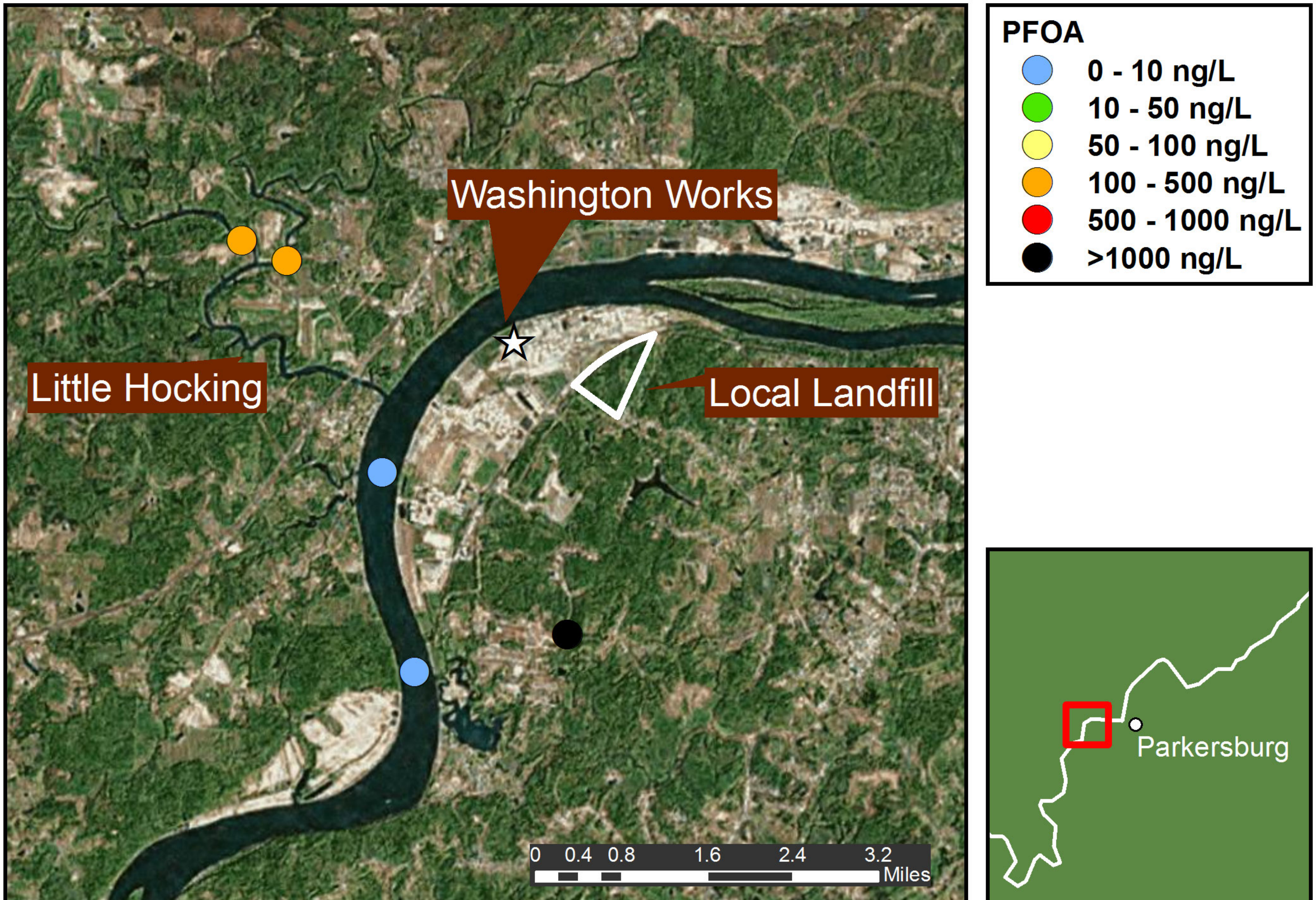
- Approved by the EPA, no further testing required

Trip #1 – Ohio River

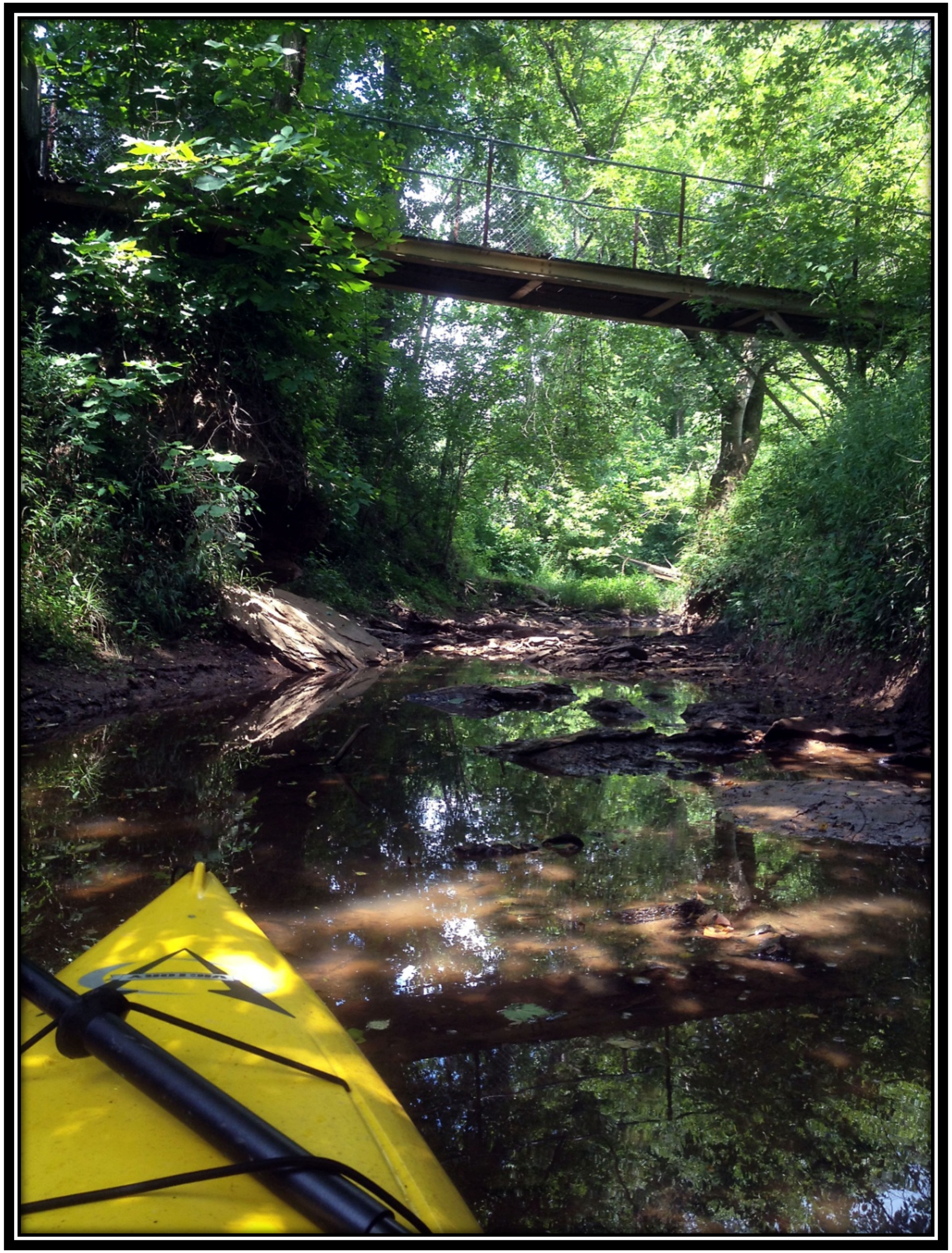
Ohio River Results



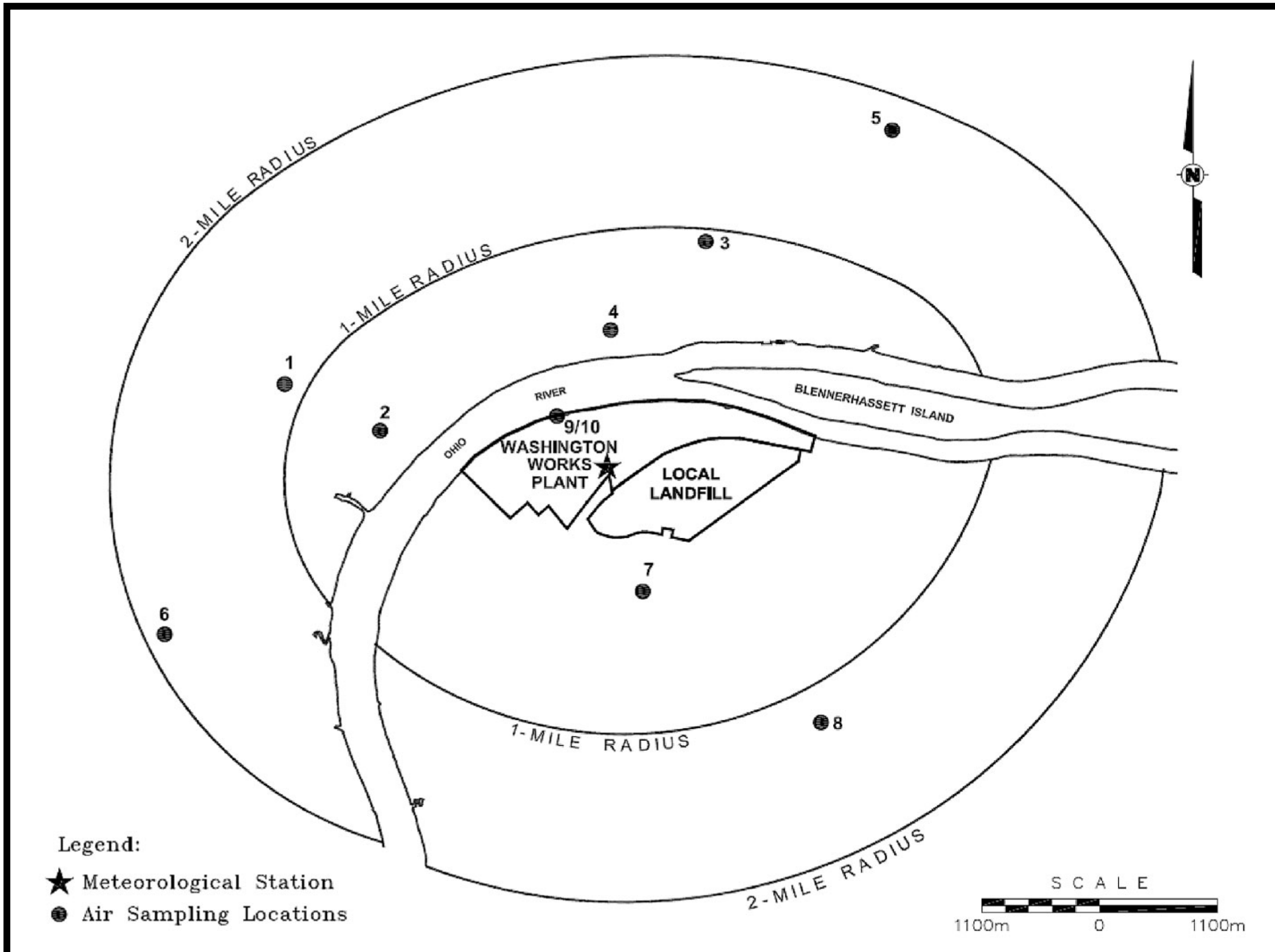
Ohio River Results (Detail)



Trip #2 – Little Hocking River

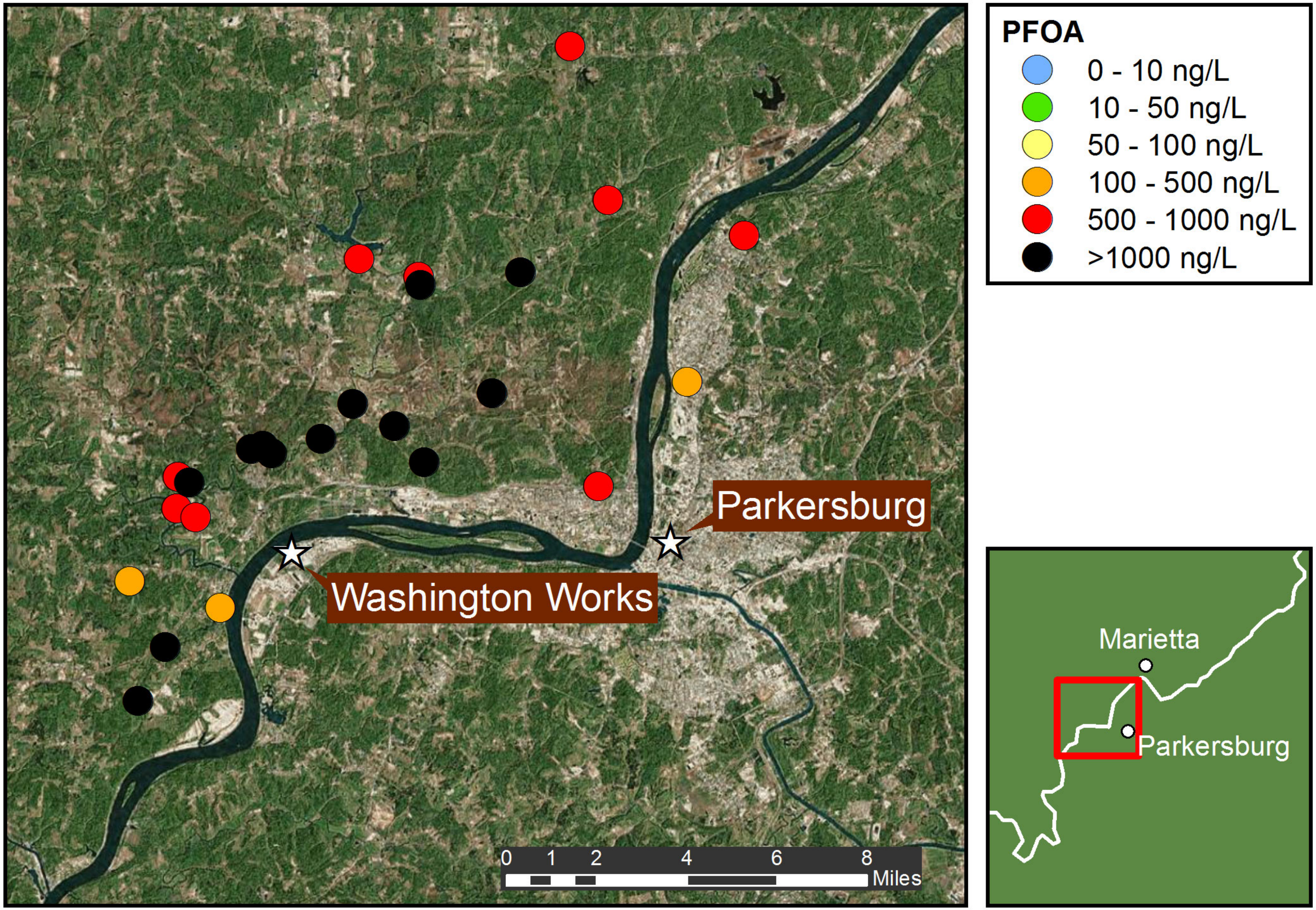


Air Monitoring Around Washington Works



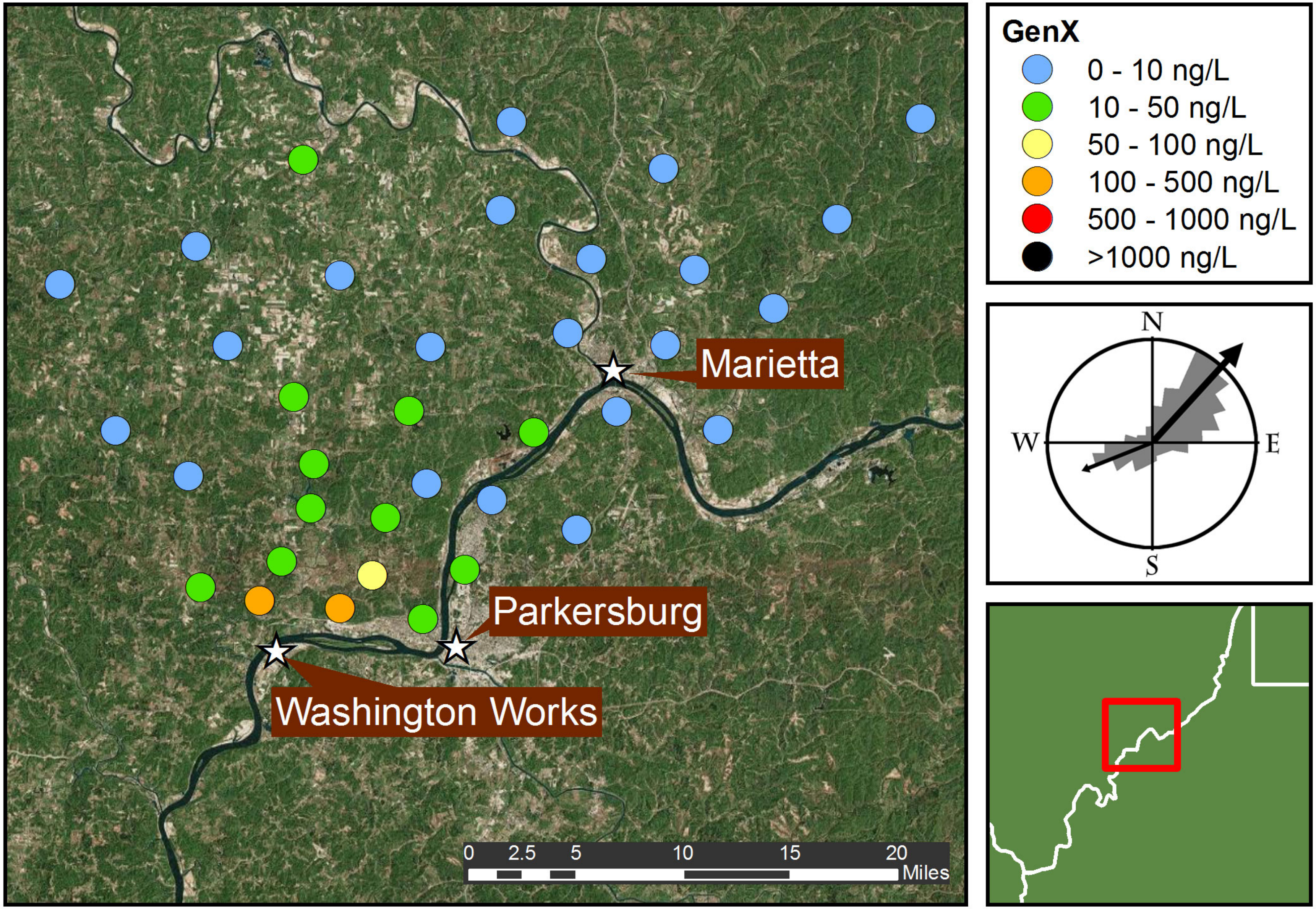
Barton et al. *Journal of the Air & Waste Management Association* 2010, 60, 402–411

Little Hocking Results



Trip #3 – Little Hocking and Beyond

Extended Sampling Results



Conclusions

- The presence of significant levels of PFOA (>100 ng/L) in surface water more than 15 miles from the facility and quantifiable levels (>10 ng/L) more than 25 miles away suggest local contamination may be more extensive than originally thought

- The discovery of GenX at many of the collection sites suggests the replacement PFAS is contaminating the local environment via air deposition as well

- More testing is needed – especially private well water between the boundaries of the Little Hocking Public Water district and the Muskingum River

Questions?

Email: lindstrom.andrew@epa.gov
galloway.18@osu.edu

Ohio River PFAS Study

SURVEY DESIGN

Study Objective

- Characterize present ambient concentrations of PFASs in Ohio River at multiple locations (approx. 20 sites).
- 2 separate events – attempt to get 1 higher flow & 1 lower flow condition.
- Results may inform states, EPA, utilities & other interested parties on Ohio River ambient water quality conditions.

Project Scope

- USEPA research lab will analyze water samples for PFASs.
- They have indicated 20 samples would be doable, but possibly more.
- ORSANCO will collect samples.
- Begin survey in Fall 2019.

General Workplan

- 1) Establish Work Group to develop work plan specifics.
  - Ask TEC members to appoint representative.
  - Workgroup will propose:
    - Monitoring locations.
    - Sample collect methodology and all that goes with it.
    - Suite of PFAS compounds to be analyzed for (GenX).
- 2) Selection of Sampling Sites
  - Good spatial coverage.
  - Look at probabilistic approach.
  - Reflect ambient conditions.
  - Represent range of flows.

General Workplan (cont.)

- 3) Establish Sample collection protocol
  - Grab sample versus USGS “IDE” method.
  - Minimization of sample contamination potential.
  - Determination of field QA samples.

- 4) Analyte selction ie. GenX? Other PFASs.

PFAS Workgroup Met January 15

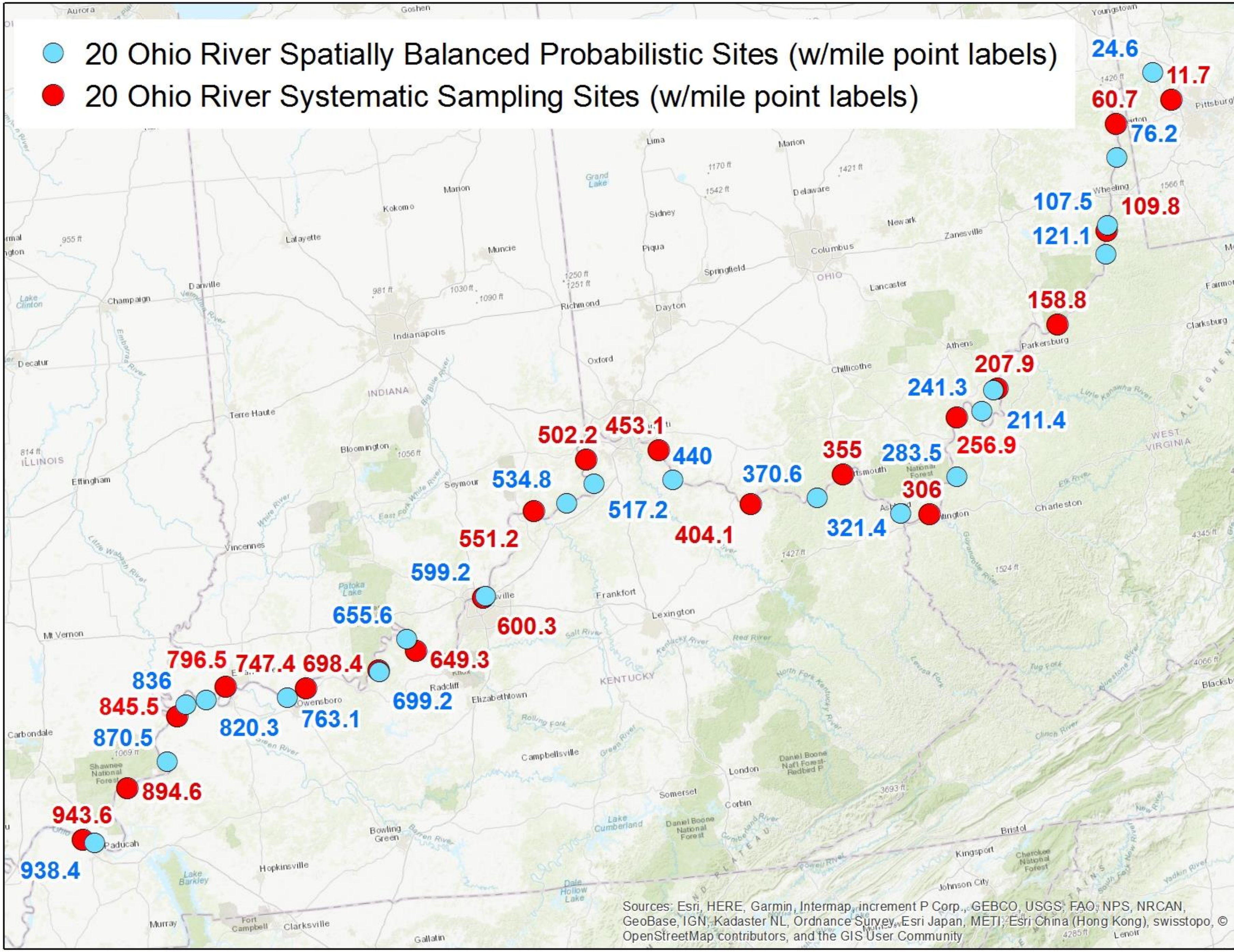
- Bruno Pigott – Commissioner/TEC Chairman
- Ron Potesta – Commissioner/Commission Chairman
- Eileen Hack, Ally Miles – IDEM
- Erich Emery – USACE
- Bruce Whitteberry – WUAC
- Katie McKone – KYDOW
- Kevin Halloran – PADEP
- Mike Profitt, Jeff Lewis, Erin Sherer, Audrey Rush – OEPA
- Amy Kramer – NKY Water
- Chris Tavenor – OH Environmental Coalition
- John Wirts - WVDEP

Outcomes from Workgroup Call

- Where to Sample
- What to Sample
- How to Sample
- When to Sample

Where to Sample

- 2 Options for Probabalistic Site Selection Based on Sample Size of 20
  - Spatially Balanced – 20 equal length segments; random selection in each segment.
  - Systematic – 20 equal length sements; random selection of most upstream segment; then equally-spaced.
  - Workgroup had no strong preference.
- Add 2 sites to bracket Parkersburg area – after review of EPA study results.
- Ambient = Fully Mixed.
  - Every site reviewed
  - Consider discharges, tribs inflows, dams (gate openings).


20 Ohio River Spatially Balanced Probabilistic Sites (w/mile point labels)
20 Ohio River Systematic Sampling Sites (w/mile point labels)
24.6
11.7
60.7
76.2
107.5
109.8
121.1
158.8
207.9
241.3
211.4
256.9
283.5
306
321.4
355
370.6
404.1
440
453.1
502.2
517.2
534.8
551.2
599.2
600.3
649.3
655.6
698.4
699.2
747.4
763.1
796.5
820.3
836
845.5
870.5
894.6
943.6
938.4
INDIANA
ILLINOIS
OHIO
KENTUCKY
WEST VIRGINIA
Indianapolis
Columbus
Dayton
Frankfort
Lexington
Pittsburgh
Wheeling
Parkersburg
Charleston
Paducah
Owensboro
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

What to Sample

- EPA has a couple of analytical methods – both include 24 PFAS compounds.
- Workgroup asked to see detection levels on both methods.
- Rely heavily on EPA expertise for method selection.
- Workgroup recommends including Gen-X compounds – EPA can do this.
- Flow measurements at every site with ADCP (Acoustic Doppler Current Profiler) instrumentation considers full X-sectional flows.

How to Sample

- USGS Equal Discharge Increment Method
  - Width & depth integrated sample - 5 verticals across river.
  - Collects a flow-weighted sample.
  - This is the most comprehensive method.
  - Need to determine if sampling equipment contributes and PFAS to samples – EPA bench study.
  - Need to consider exposure to potential atmospheric contamination by this method.
- Simple grab sample benefits are reduced potential for contamination, time & staff resources.
- Multiple options for hybrid of these 2 methods.
- Question is still under consideration.
- Compiling multiple sample collection QC protocols.
- Work in progress.

When to Sample

- Sample collection to begin approx. Sept. 2019; Spring 2020 second event.

- Proposed 2 sampling events – higher and lower flow events.
  - Workgroup suggested establishing flow conditions.
  - Problems associated with this:
    - Entire survey will span a month; flows change.
    - If we don't get specific flow conditions could delay the project 6 months or more.

- Suggest work plan specifies 2 separate sampling events accounting for seasonal differences with an attempt to collect under higher & lower flows.

Other Issues/Next Steps

- Use and communication of results.
- All Ohio River PFAS data has been compiled and provided to the work group.
- Next Steps:
  - Determine if preferred EDI method can be used.
  - Refine site selection & confirm "Ambient" location or move site several miles to a fully mixed location.
  - Add detection levels to EPA analytical methods and re-review by work group.
  - Propose sample collection QA protocols.
  - Prepare QAPP.

Office of Research and Development

SAFE AND SUSTAINABLE WATER RESOURCES RESEARCH PROGRAM

EPA Method Development: Per- and Polyfluorinated Alkyl Substances

2019 ORSANCO Meeting
February 12, 2019
Covington, KY

Christopher A. Impellitteri-EPA-Office of Research and Development
Schatzi Fitz-James-EPA-Office of Land and Emergency Management
Cynthia Caporale-EPA-Region 3

Drinking Water Method 537

- Six per- and polyfluorinated alkyl substances (PFAS) under the 3rd Unregulated Contaminants monitoring rule (UCMR3)

- Eight additional PFAS not listed on UCMR3

- Finished (treated) drinking water samples

Drinking Water Method 537

- Update: External lab validation for additional analytes by 537
  - Perfluoro-2-propoxypropanoic acid (GenX, CAS 13252-13-6)
  - Potassium 9-chlorohexadecafluoro-3-oxanone-1-sulfonate (9Cl-PF3ONS, CAS 73606-19-6)
  - Potassium 11-chloroeicosafluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OUdS, CAS 83329-89-9)
  - Sodium dodecafluoro-3H-4,8-dioxanonate (ADONA, CAS 958445-44-8)
- Recruit external labs, ship samples, run multi-lab validation (end of September, 2018)
- Draft method revision for peer review (end of October, 2018)
- Final published method (end of November, 2019)

Drinking Water-New Method

– Solid phase extraction/internal standard method targeting C4 compounds
  - Method 537 generally performs poorly for C4 compounds (e.g. PFBA, PFBS)
  - New method is under development
  - Office of Water targeting June 2019 for draft method for public comment

Non-DW Sample Methods-Direct Injection

– **SW-846 Draft Method 8327**
– **Focuses on:**
  - **Simplicity**
  - **Robustness**
  - **Maximizing throughput for production lab use**
  - **Minimizing sample transfers, extractions, filter steps, chemical additions (e.g. pH adjustments)**

– **Find a balance among sensitivity, ease of implementation, and monitoring requirements**

Non-DW Sample Methods-Direct Injection

- **24 PFAS (including all target analytes in EPA Method 537)**
  - **Commercially available standards (“neat” and isotopically labeled)**
- **Direct injection based on EPA Region 5/Chicago Regional Laboratory Method**
  - Similar to draft American Society for Testing and Materials (ASTM) Method D7979
  - Phase 1: 6 internal (EPA) lab validation
    - Completed December 2017
  - Phase 2: 10 external lab validation (ongoing)
    - Initial demonstration of capability complete
      - 8 labs “in”
      - 2 labs “out”
    - Shipped samples (60 unknowns: surface, ground, and waste waters) August 2018
    - March 2019 for draft method for public comment
- **Target Quantitation Limits: 10 nanogram/L**

Non-DW Sample Methods-Isotope Dilution

– **SW-846 Draft Method 8328**
– More complex method relative to direct injection, however 8328 will
  - Likely be more robust for complex matrices (e.g. wastewater, biosolids)
    – Account for matrix effects (e.g. sorption) through isotopically marked standard recoveries
  - Afford options to meet DoD requirements
  - Allow users to perform a deeper dive based on screening (e.g. 8327) results

Non-DW Sample Methods-Isotope Dilution

– SW-846 Draft Method 8328

- Same 24 PFAS analytes plus GenX chemical HFPO-DA
- Based on existing SOP that meets DoD Quality Systems Manual (QSM) 5.1 Table B-15 requirements
  - Many DoD requirements are optional for users that wish to use isotope dilution at non-DoD affiliated sites
- Surface, ground, and waste water plus solids (soils, sediments, biosolids)
- Target Quantitation Limits: 10 nanogram/L
- Build in flexibility
  - Columns
  - Elution schemes
- 2 lab internal validation started, 10 lab external validation study planned but…
  - Process is too slow. Exploring collaborative effort with DoD to jump start external laboratory validation. Target Summer 2019 for draft method.

Development of a CyanoHAB Risk Model for the Ohio River:

EPA RARE Grant

Prepared by Chris Nietch and Leslie Gains-Germain

Disclaimer: ***This slide deck documents updates and discussion points for active research effort to better characterize and manage the risk from HABs on the Ohio River. All data presented shall be considered preliminary. The information in this presentation does not necessarily reflect the views or policies of the U.S. EPA or other Agencies who may have representatives that contributed to its content.***

Project Overview

- Main objective: Develop a risk characterization model for CyanoHABs on the Ohio River based on the conditions that produced the record-setting bloom in 2015
- Research Approach
  - Determine data availability (variables and time and spatial characteristics) – *Ended with a focus on flow and temperature*
  - Prepare Ohio River water level/flow and water temperature data for analysis
  - Attempt a binary logistic regression model to describe the uniqueness of the 2015 conditions
    - Conduct EDA to determine and derive appropriate predictors
    - Assign “begin” and “end” dates to the bloom at each site
    - Model Development

    Difficulty in defining conditions probabilistically with only one year of data for widespread bloom conditions
  - Attempt statistical distance method (e.g., Mahalanobis Distance)
  - Develop visualization application using R Shiny for demonstration
    - A simple tool for a river stakeholder to visualize relative risk
    - Establish a strategy for making this tool real-time

QAPP Approved - Experimental Design/Hypothesis

- **Experiment Design:**
  - **Use historical time series data for flow on the Ohio River to characterize the unique hydrologic conditions that coincided with the record-setting HAB in the late summer of 2015**
- **Hypothesis:**
  - **Flow conditions in the summer of 2015 will prove unique enough to parameterize a significant statistical model that can be used to characterize the relative difference between the flow conditions in real-time at a site and the conditions that existed in 2015 when the HAB occurred**
  - ***Hypothesis supported if a significant statistical model can be developed***
  - ***Important: We are NOT predicting the probability of a HAB, rather characterizing river flows in terms of their similarity to the conditions that coincided with the past HAB and presenting it as a probability!***

Historic Ohio River Data

1995 – 2016

Abram DeSilva and Brian Astifan

Photo: Wikipedia commons

Data Source

http://www.lrd-wc.usace.army.mil/OhioRiver/OhioRiverNavData.html

- **Ohio River mile to location name**

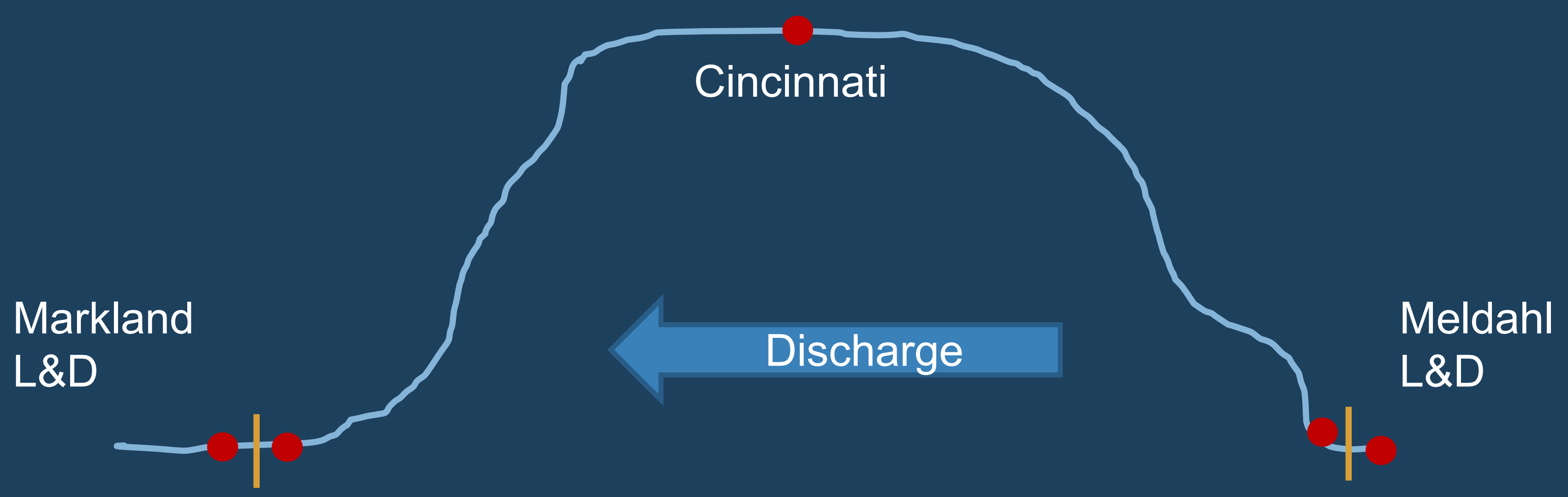
OH.471 = Cincinnati

River Mile	Location (on Ohio R.)
OH.000	Pittsburgh
OH.006	Emsworth
OH.013	DaShields
OH.032	Montomery Island
OH.054	New Cumberland
OH.084	Pike Island
OH.091	Wheeling
OH.126	Hannibal
OH.162	Willow Island
OH.172	Marietta
OH.185	Parkersburg
OH.204	Belleville
OH.238	Racine
OH.265	Pt. Pleasant
OH.279	R.C. Byrd
OH.312	Huntington
OH.322	Ashland
OH.341	Greenup
OH.436	Meldahl
OH.471	Cincinnati
OH.532	Markland
OH.607	McAlpine
OH.721	Cannelton
OH.776	Newburgh
OH.792	Evansville
OH.846	Dam 49
OH.919	Smithland
OH.935	Paducah
OH.939	Dam 52
OH.963	Grand Chain
OH.964	Dam 53
OH.980	Cairo

Real-time Data
Which hydrologic data to evaluate?

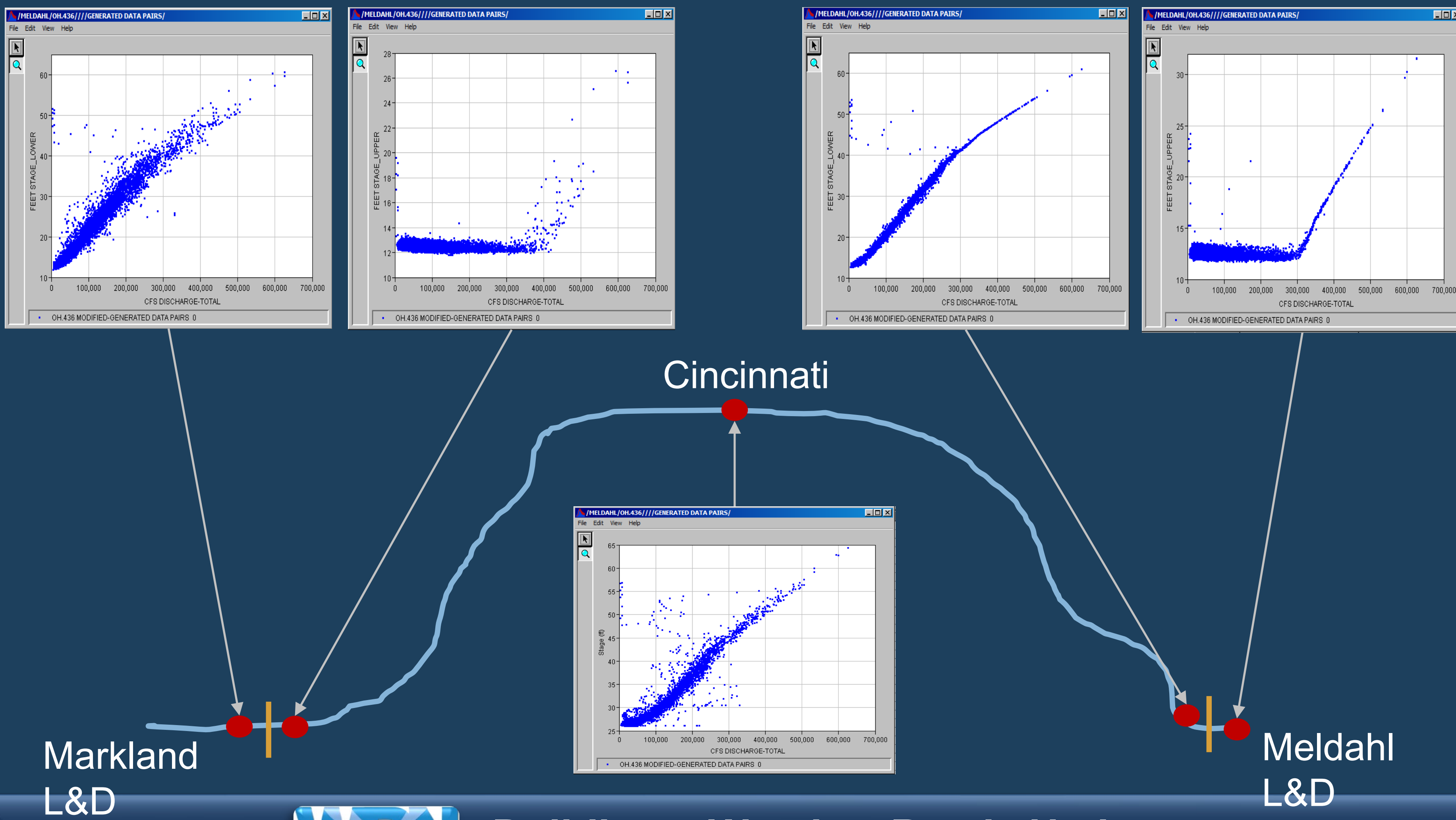
EXAMPLE – which stage best represents Q?

- Discharge calculated at Meldahl L&D
- 5 potential sources for real-time stage data
- 1995-2016: How do measured stage data compare to calculated discharge?



Real-time Data
Which hydrologic data to evaluate?

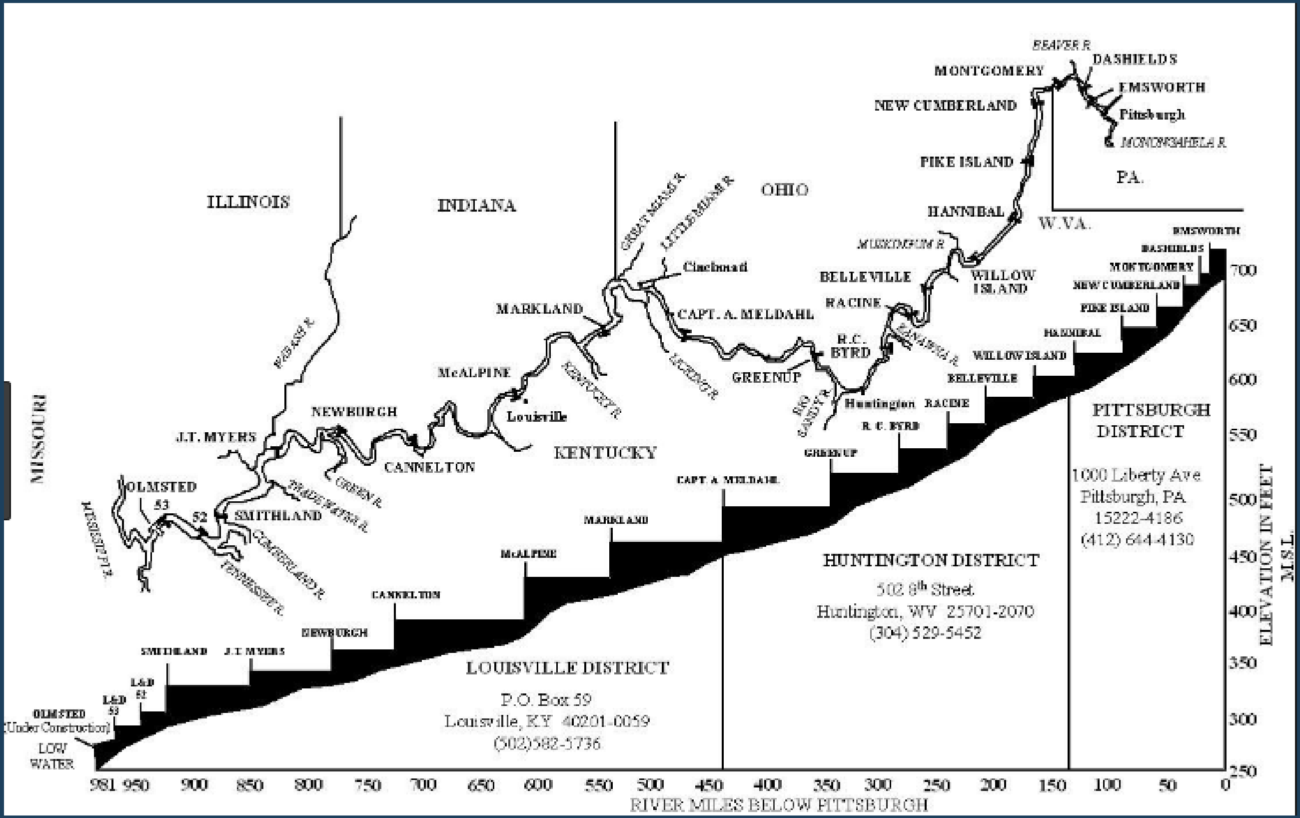
- Markland L&D tailwater (lower)



Real-time Data
Which hydrologic data to evaluate?

Tailwater (lower) stage

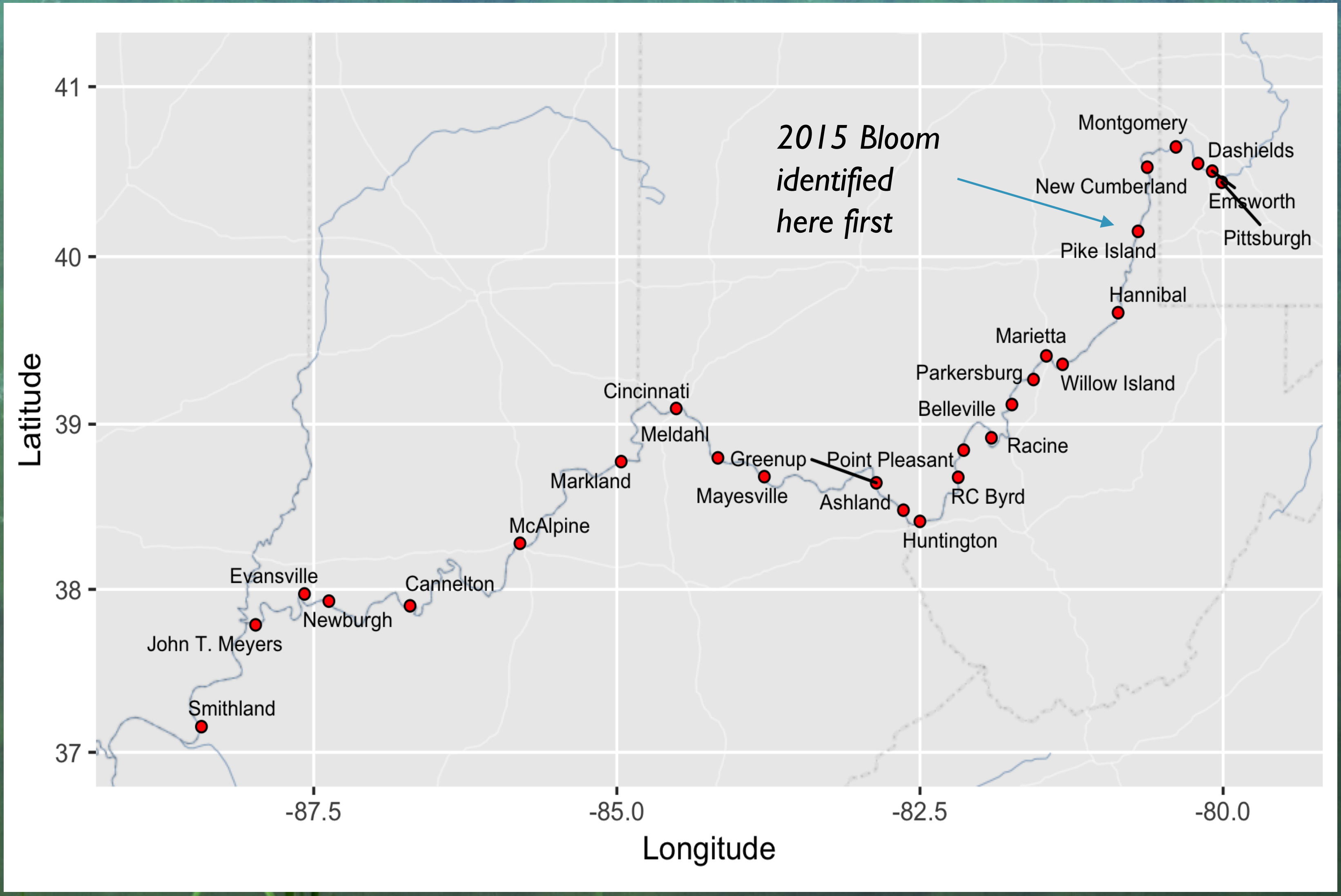
- Readily accessible
- Best approximation of Q for downstream reach (until next L&D)



FINAL DATA OVERVIEW – What we started with for modeling

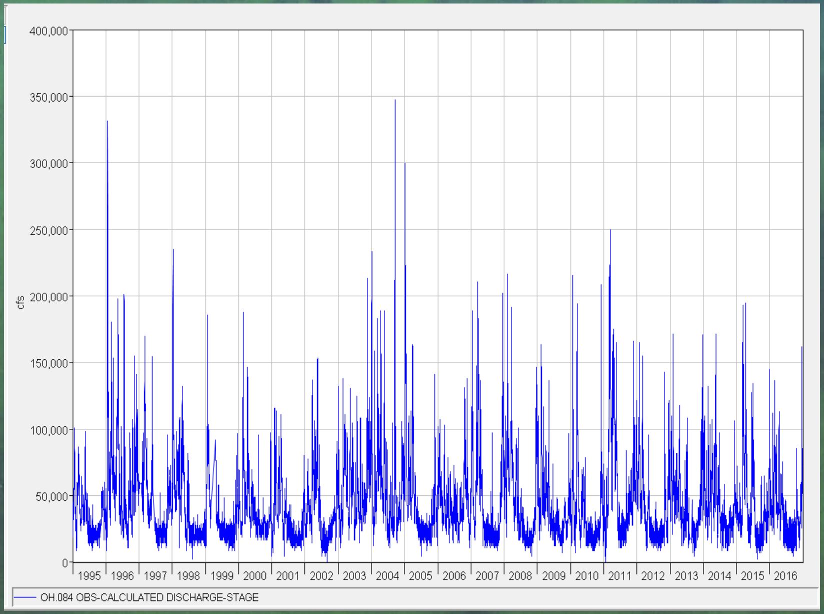
Number in DSSVue File	Gage Name	Lattitdue	Longitude	Type	River Miles Below Pittsburgh	DSSVue - Disharge File	DSSVue-Stage File	DSSVue-Temp File	2015 HAB Timeline (1st reported)	2015 HAB Timeline (Bloom "Off")	Other Bloom Report 1	Other Bloom Report 2	Other Bloom Report 3	Other Bloom Report 4	Other Bloom Report 5
1	Pittsburgh	40.43944	-80.01083	Not L&D	0	82	84	ND 2015 bloom							
2	Emsworth	40.50500	-80.08972	L&D	6.2	23	24	ND 2015 bloom			8/19/1999				
3	Dashields	40.54972	-80.20694	L&D	13.3	19	20	ND 2015 bloom							
4	Montgomery	40.64722	-80.38889	L&D	31.7	63	64	ND 2015 bloom							
5	New Cumberland	40.52806	-80.62583	L&D	54.4	70	71	Complete Series 1995 thru 2016			7/7/2003				
6	Pike Island	40.14972	-80.70167	L&D	84.2	78	79	Complete Series 1995 thru 2016	8/19/2015	10/20/2015					
7	Hannibal	39.66722	-80.86611	L&D	126.4	35	36	ND 2015 bloom	8/21/2015	10/20/2015					
8	Willow Island	39.35900	-81.32400	L&D	161.7	103	104	Not a complete series, 2015 is covere	8/24/2015	10/20/2015					
9	Marietta	39.40944	-81.45778	Not L&D	172	41/42	43/44	ND 2015 bloom	8/24/2015	10/20/2015					
10	Parkersburg	39.26806	-81.56389	Not L&D	185	73	75	Not a complete series, some data in 2	8/24/2015	10/20/2015					
11	Belleville	39.11800	-81.74200	L&D	203.9	6	7	Complete Series 1995 thru 2016	8/24/2015	10/20/2015					
12	Racine	38.91800	-81.91100	L&D	237.5	90	91	Complete Series 1995 thru 2016	8/25/2015	10/20/2015					
13	Point Pleasant	38.84389	-82.13972	Not L&D	265	86/87	88/89	ND 2015 bloom	8/26/2015	10/20/2015					
14	RC Byrd	38.68000	-82.18500	L&D	279.2	95	96	Complete Series 1995 thru 2016	8/27/2015	10/20/2015					
15	Huntington	38.41333	-82.50056	Not L&D	312	37	39	Some data in 2015	8/27/2015	10/20/2015					
16	Ashland	38.48111	-82.63667	Not L&D	322	2	ND	Some data in 2015	8/27/2015	10/20/2015					
17	Greenup	38.64667	-82.86056	L&D	341	31	32	Complete Series 1995 thru 2016	8/27/2015	10/20/2015					
18	Mayesville	38.68389	-83.78389	Not L&D	409	49/50	51/52	ND	8/28/2015	10/20/2015					
19	Meldahl	38.79722	-84.16667	L&D	436.2	59	60	Complete Series 1995 thru 2016	9/1/2015	10/20/2015					
20	Cincinnati	39.09444	-84.51056	Not L&D	471	13/14	15/16	ND	9/9/2015	10/20/2015	8/26/2008				
21	Markland	38.77472	-84.96444	L&D	531.5	47	48	Complete Series 1995 thru 2016	9/9/2015	10/20/2015					
22	McAlpine	38.28028	-85.79917	L&D	606.8	55	56	ND	9/11/2015	10/16/2015					
23	Cannelton	37.89944	-86.70556	L&D	720.7	11	12	Complete Series 1995 thru 2016	9/15/2015	10/16/2015	7/15/1999				
24	Newburgh	37.92833	-87.37500	L&D	776.1	67	68	ND 2015 bloom	9/16/2015	10/22/2015					
25	Evansville	37.97222	-87.57639	Not L&D	792	25	27	ND	9/17/2015	10/22/2015					
26	John T. Meyers	37.78333	-87.97944	L&D	846	ND	ND	ND	9/18/2015	10/22/2015	8/7/2012				
27	Smithland	37.15833	-88.42611	L&D	918.5	97	98	Not a complete series, 2015 is covere	9/19/2015	10/22/2015	5/18/2009	6/26/2009	9/17/2012	10/30/2012	7/29/2014

FINAL SITE SELECTION

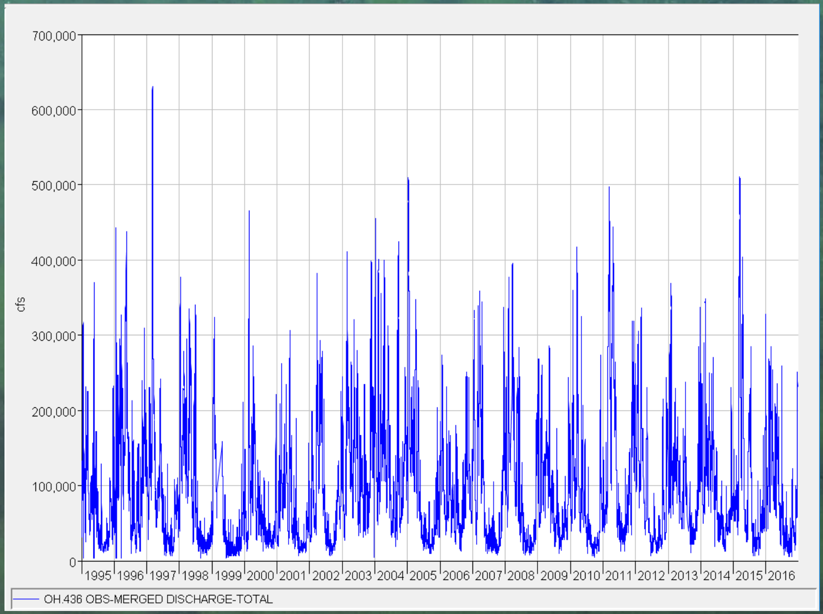


EDA – Raw Data Examples

Pike Island



Meldahl

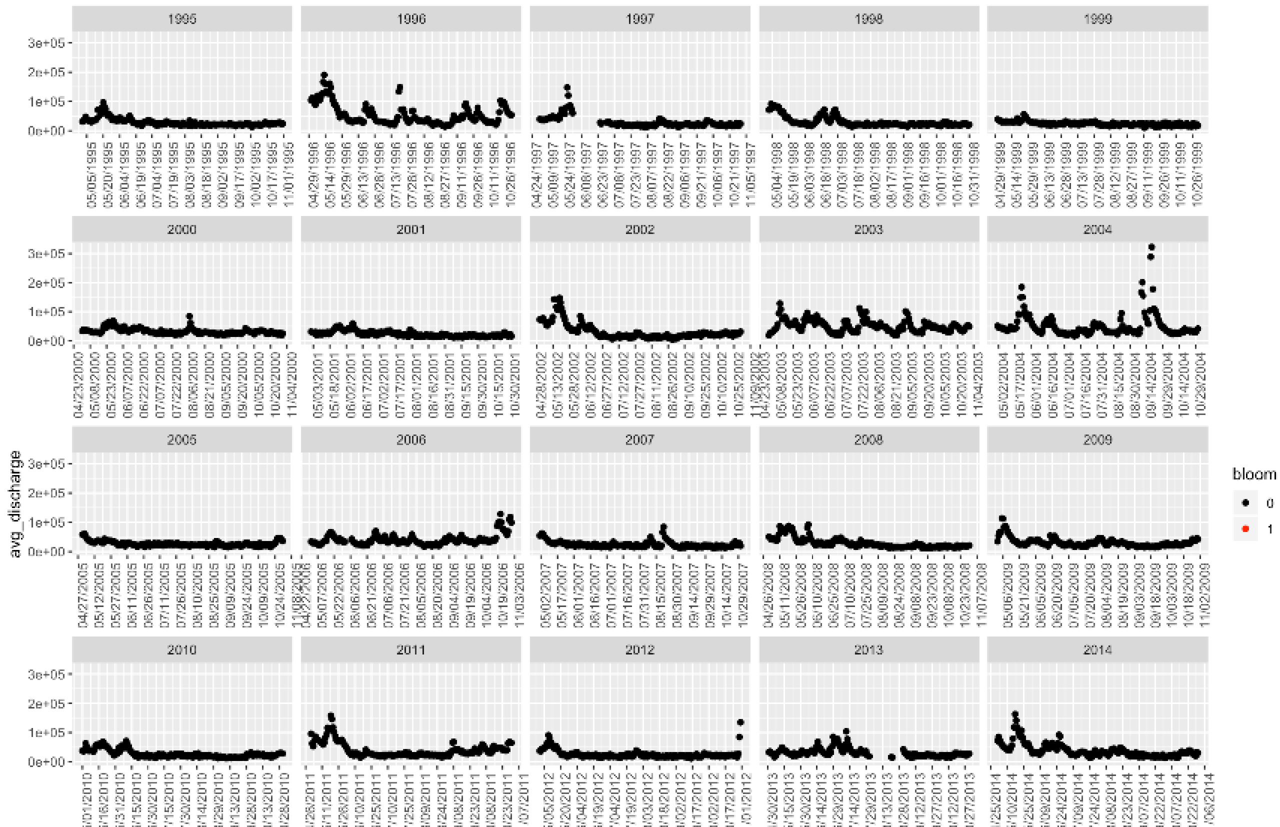


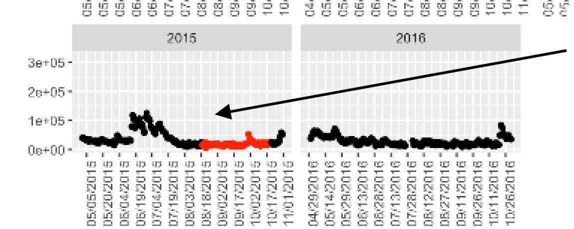
EDA- Daily Average flows: e.g., @ Pike Island

Pike Island

River Mile 84.2. Bloom start date 8/19/15.

```
myplot %+% subset(summer_avgs, location == "pike_island")
```





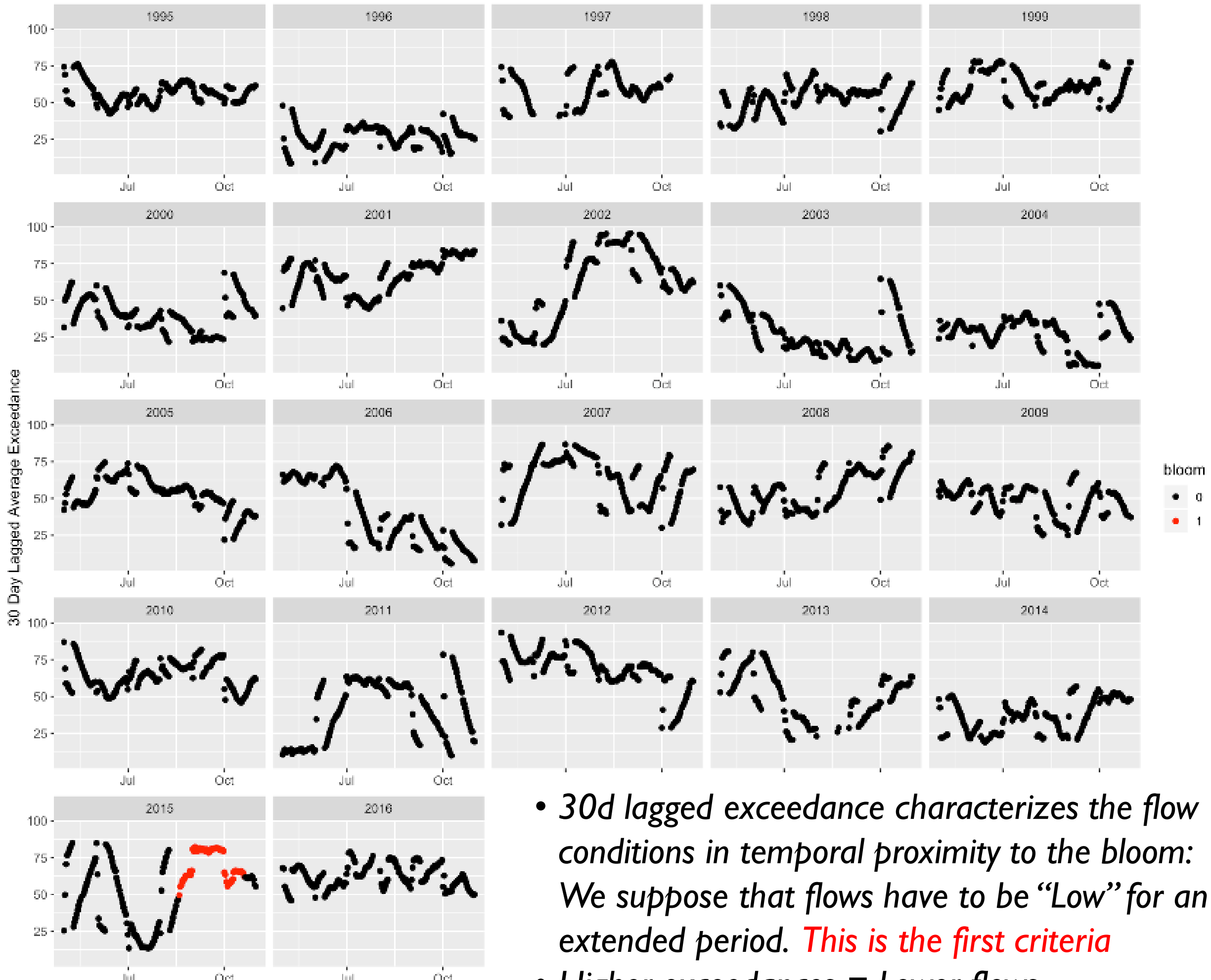
- *Red = bloom period*
- *High Flows in Late June to Mid July, followed extended period of low flow*
- *Rank Flows at each site and use Exceedances to normalize across sites*

Develop Predictor Variables – 30d Lagged Average Exceedance

Pike Island

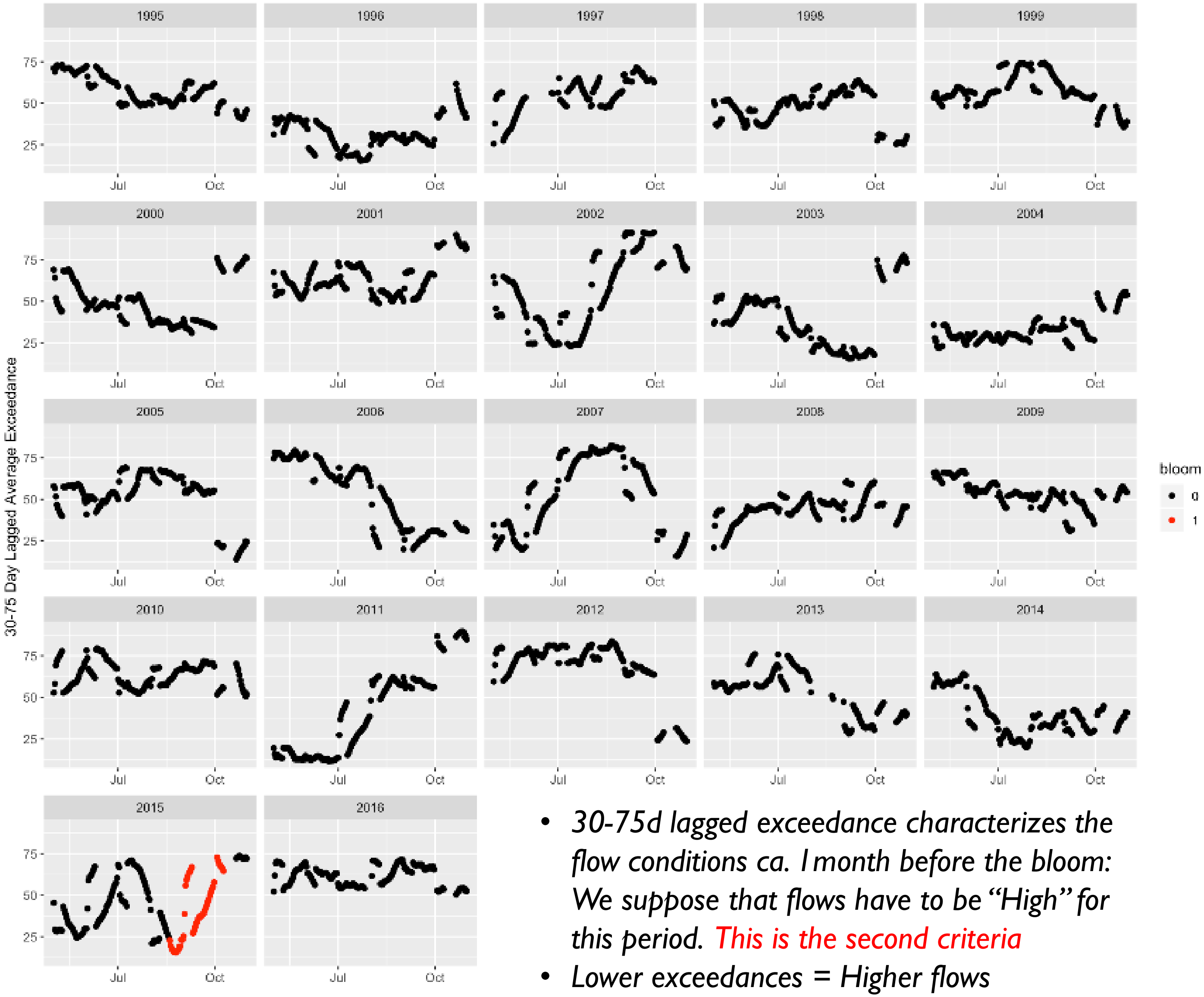
River Mile 84.2. Bloom start date 8/19/15.

```
plot30 %+% subset(summer_avgs, location == "pike_island")
```



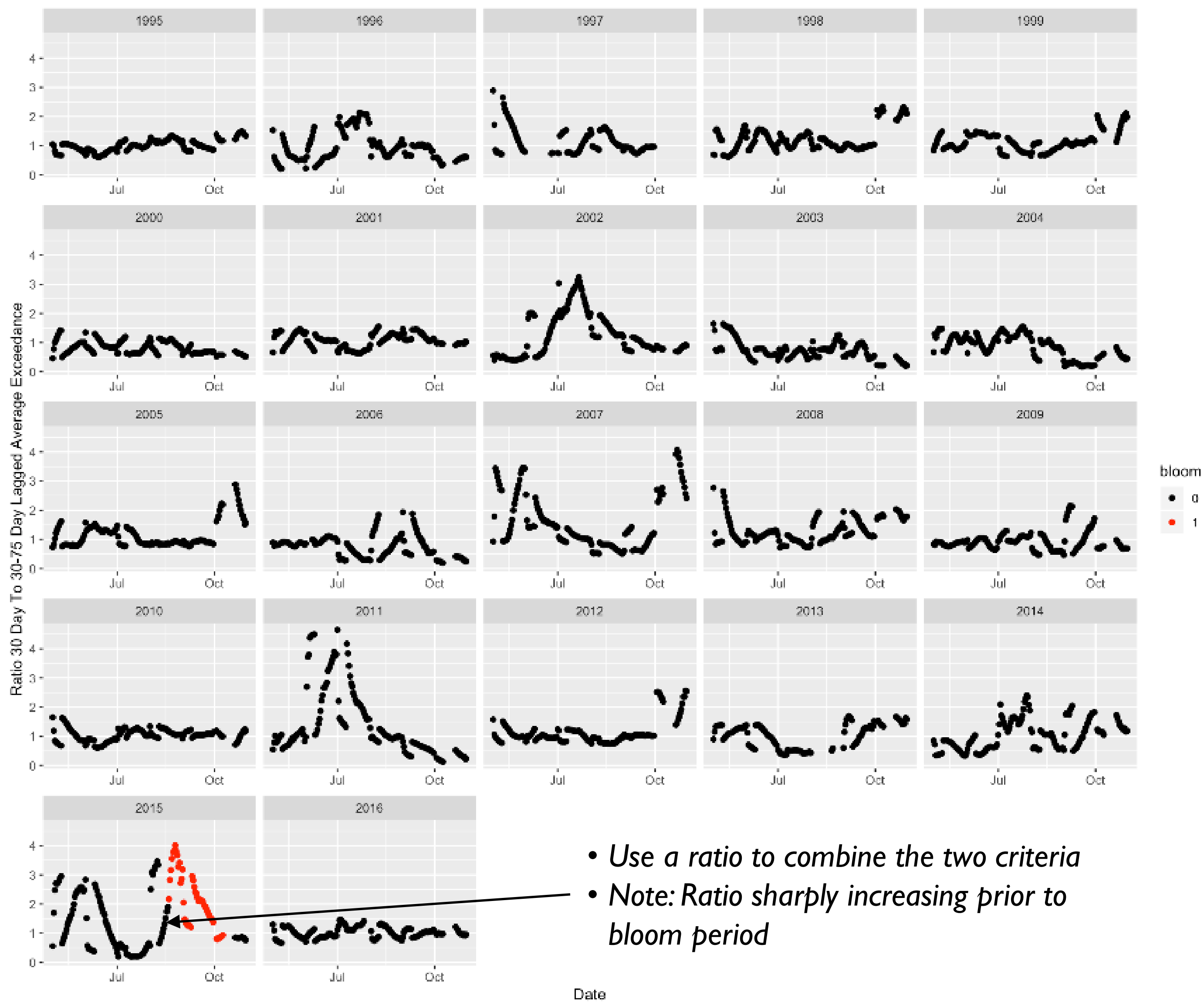
- *30d lagged exceedance characterizes the flow conditions in temporal proximity to the bloom: We suppose that flows have to be "Low" for an extended period. This is the first criteria*
- *Higher exceedances = Lower flows*

Develop Predictor Variables – 30-75D Lagged Average Exceedance



- *30-75d lagged exceedance characterizes the flow conditions ca. 1month before the bloom: We suppose that flows have to be "High" for this period. This is the second criteria*
- *Lower exceedances = Higher flows*

Develop Predictor Variables – Ratio 30D to 30-75D Lagged Average Exceedance



- *Use a ratio to combine the two criteria*
- *Note: Ratio sharply increasing prior to bloom period*

PREDICTORS

“Maximum Ratio”

- **The maximum 30 to 30-75 Lagged Average Exceedance Ratio that occurred prior to the bloom start date**
- **On other years (other than 2015), the maximum ratio is defined as the maximum ratio that occurred at any time during which a HAB is possible**
  - **Use water temperature and/or time of year to set boundary conditions**

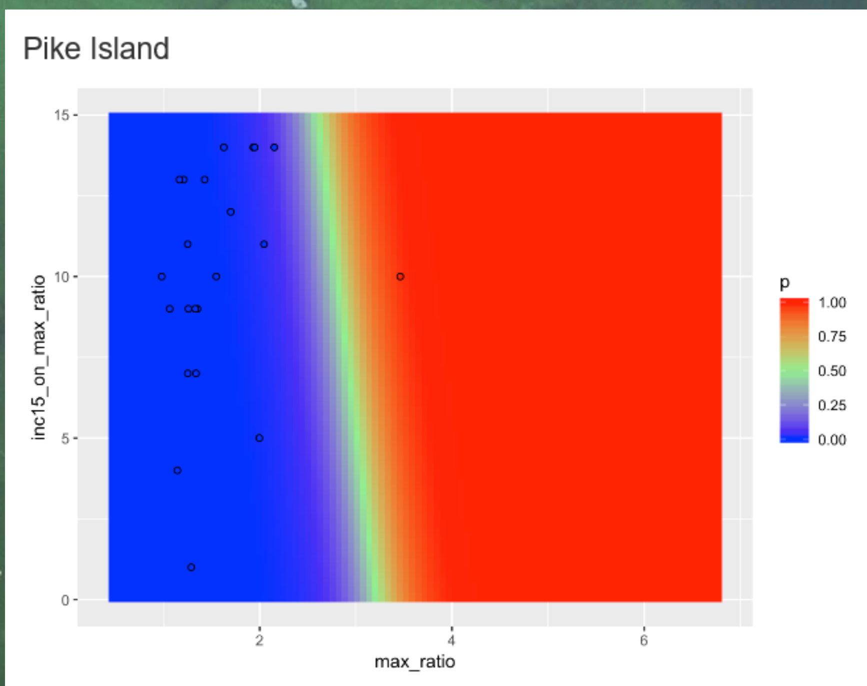
“Number of Increasing Ratio Days”

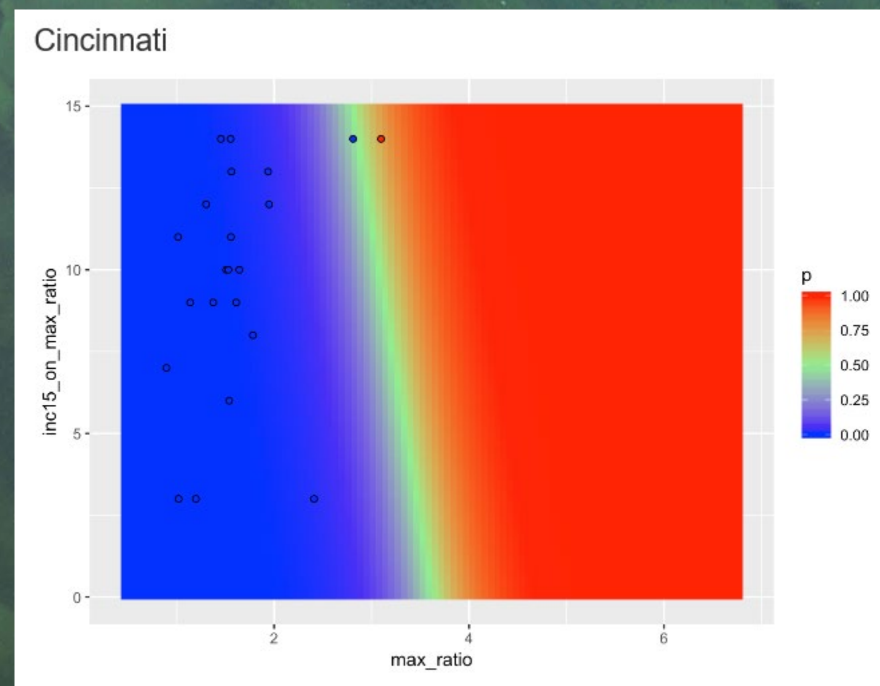
- **The number of days in the 15 days prior to the day the maximum ratio occurred in which the ratio increased**
  - ***Found to be a better predictor than average slope of the ratio over the 15-day period***
- ***predictors are summarized yearly, but probabilities will be estimated on a daily basis by using daily ratio and number of increasing ratio days***
- ***Only a probability based on similarities of flow conditions can be calculated for a given day!***

Fit Model – Mixed Effects Binary Logistic Regression Model – Preliminary!

```r
## Two way interaction with random slope for ratio, by location
max_model <- lme4::glmer(response ~ max_ratio + inc15_on_max_ratio
                         + (1 + max_ratio|location),
                data = model_dat, family = binomial(link = "logit"))
AIC(max_model)
```

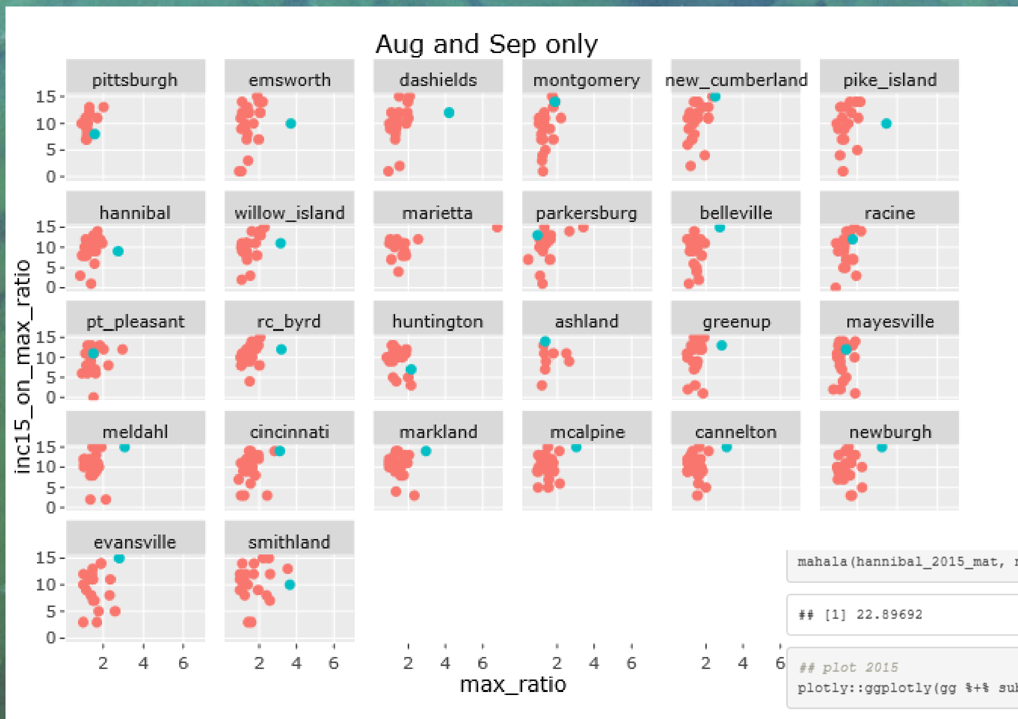
- *Information is shared across sites in a mixed effects model, allowing for probabilistic inference*





- *These results are based on a boundary condition that blooms can only occur in Aug or Sept.*

Model – Mahalanobis Distance– Preliminary!

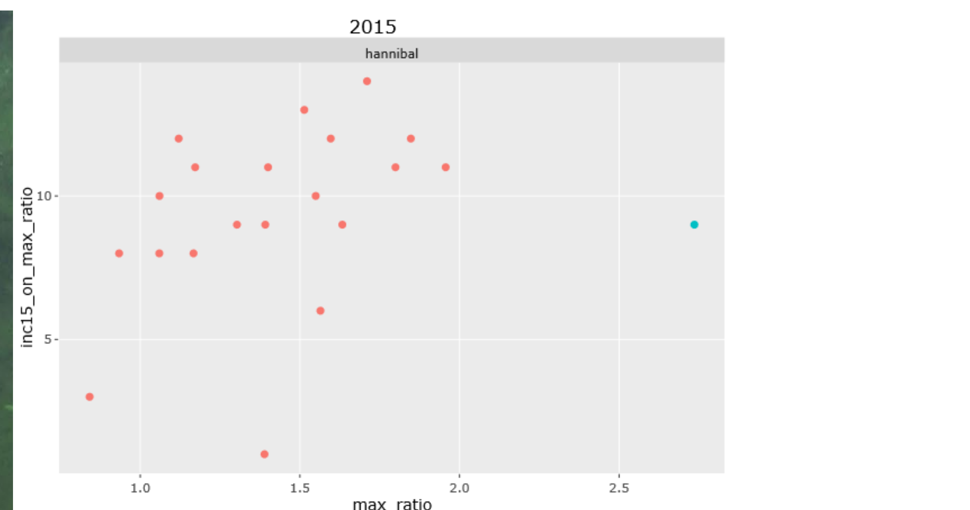


Mahalanobis Distance (Hannibal, 2015) = 22.9 indicating strong evidence that 2015 conditions differed from previous years.

```
mahala(hannibal_2015_mat, m, s) ## distances for 2015 should be very large
```

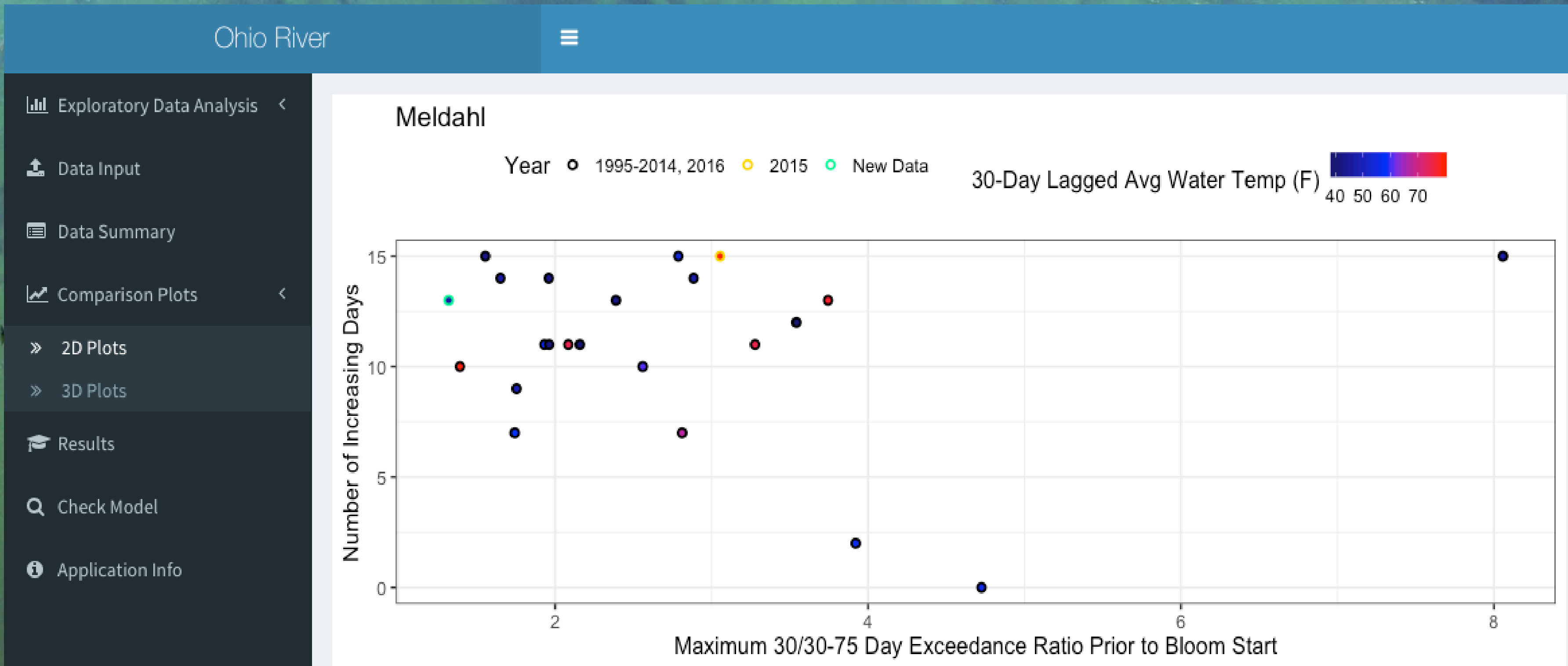
```
## [1] 22.89692
```

```
## plot 2015
plotly::ggplotly(gg %+% subset(daily_avgs_withmax, location == "hannibal" & year != "2016") + ggtitle("2015"))
```



Mahalanobis Distance can identify dissimilarity from flow conditions but can't identify similarity in a probabilistic manner without additional data.

Shiny App – Rough Cut



- *Mahalanobis Distance Plot with all months included. Water temperature captured by color gradient inside each data points*

Conclusions

- We have used historical time series data for flow on the Ohio River and developed a theoretically rational means of characterizing the unique hydrologic conditions that coincided with the record-setting HAB in 2015
- We have used two statistical techniques to derive significant models characterizing the uniqueness of the 2015 flow conditions and express flows at different times in relative terms.
  - One expresses this similarity in terms of a probability and the other a distance
- If useful to stakeholders, we could derive these similarity measures in the present time, and maybe even forecast them
- It seems likely that the real-time similarity measures could be served to river stakeholders through a password protected Shiny-App or similar
- ***Important:*** *These measures can convey risk in terms of the similarity of flow conditions in the present to those that produced a CyanoHAB in the past. However, caution must be taken to not misinterpret them as directly predicting the likelihood of a HAB*

HAB Update

Agenda Item 7b

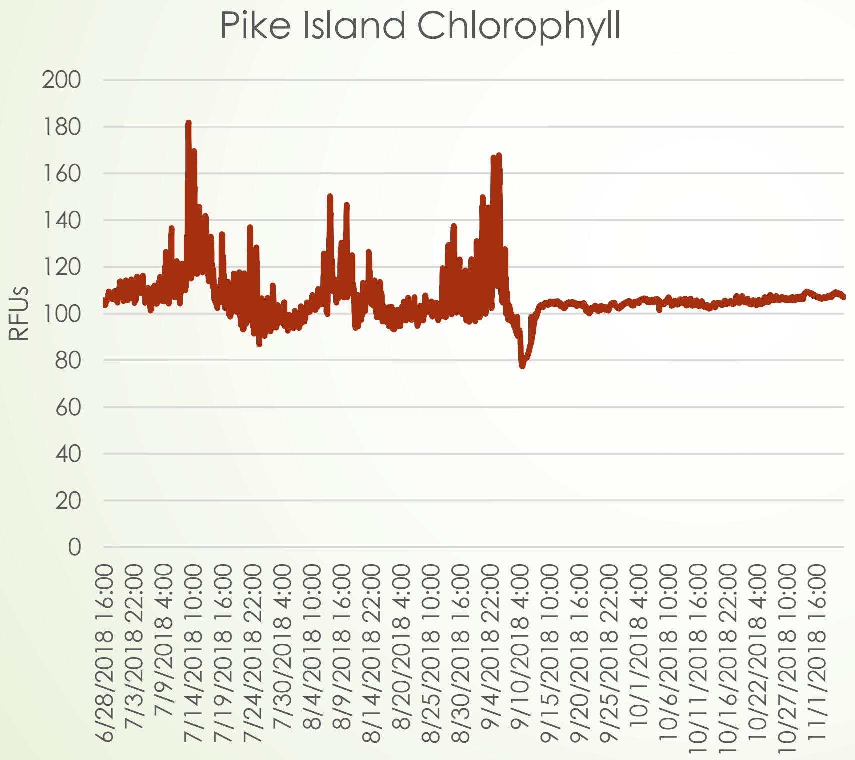
2018 HAB Investigations

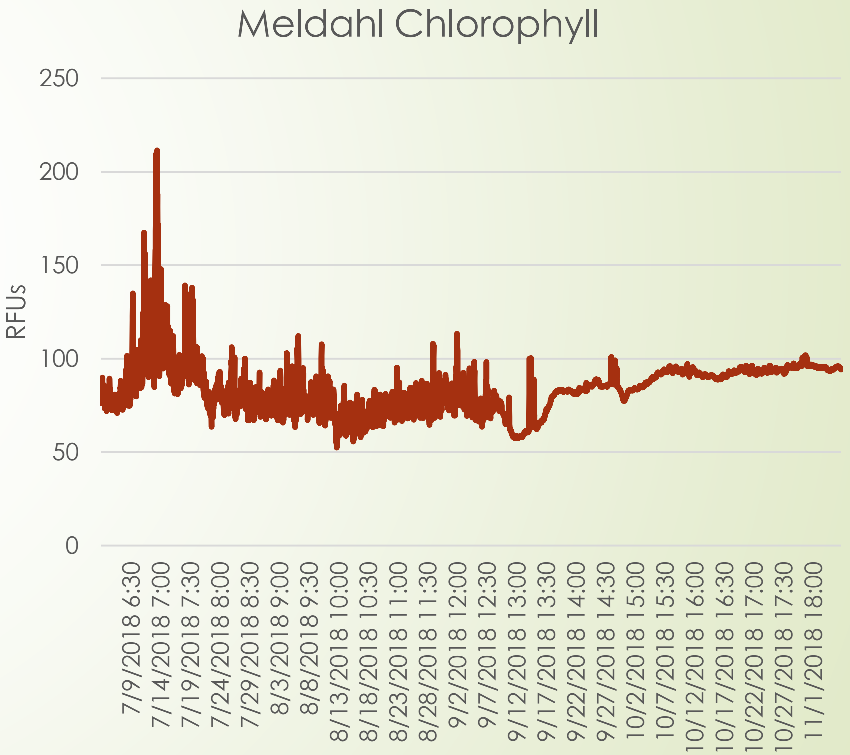
- Paint Lick Creek, KY
  - Identified by Texas A&M as *Euglena rubra*. Not a toxin producer.
- Little Beaver Creek, OH
  - Dinoflagellate *Peridineum* sp.
- 1 Positive toxin test at Portsmouth Water. Determined to be from settling basin discharge.
  - Datasonde at Greenup L&D showed no evidence of unusual algal activity.

HAB Stations

- ORSANCO stations at Pike Island L&D and Meldahl L&D
- Access to data from Marshall University – RC Byrd L&D and Greenup L&D
- YSI EXO2 datasondes
  - Temperature, pH, conductivity, turbidity, dissolved oxygen, chlorophyll a, phycocyanin
- Samples collected 2/month
  - TKN, N/N, TP, BOD, TSS, algal community
- Data downloaded daily

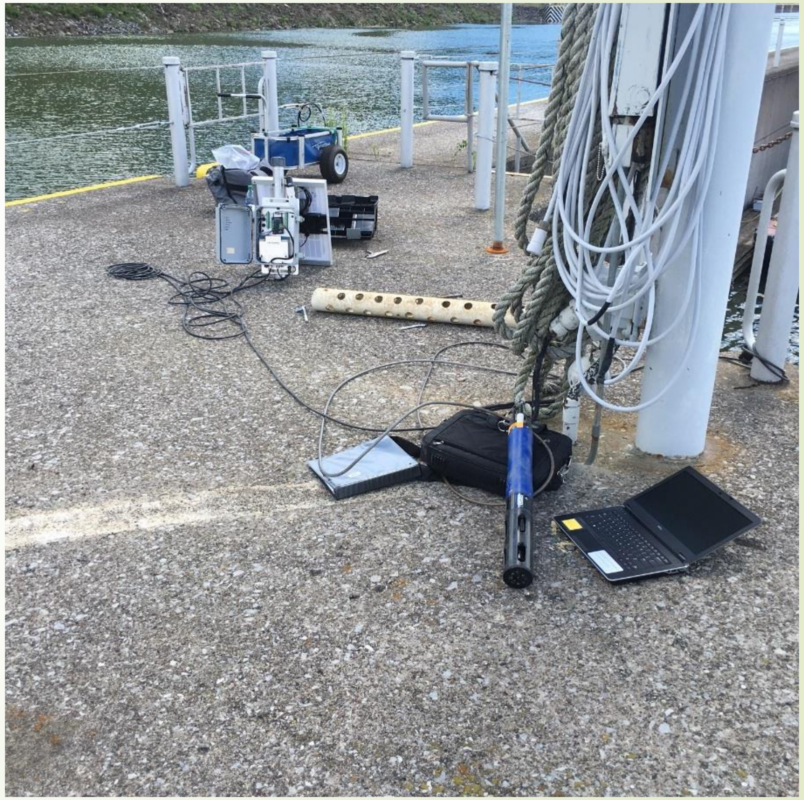
Example Data





Additional Funding for HAB Projects

- West Virginia 604(b) for analysis of 2015 HAB data.
  - Ongoing data collection
  - Supports EPA RARE Grant
- Indiana 604(b) for 2 datasondes on the Indiana section of the Ohio River.
  - Locations to be determined in consultation with IN DEP.
  - Installed in spring 2019



Algal Toxin Recreation Standards

- US EPA proposed Ambient Water Quality Criteria in December 2016
  - Microcystin – 4 ug/L
  - Cylindrospermopsin – 8 ug/L
- Additional studies reviewed during comment procedure
- Reportedly the concentrations will double in the next proposed AWQC. Also add a cell count of 100,000 cells/ml.

HAB Research Workgroup

- Met by conference call 10-25-18
- Presentation by OSU on STAR Grant
  - Watershed classification system modeling HAB risk (similar to RARE Grant)
  - 7 watersheds total. 3 Ohio, 2 Kentucky, 2 Indiana
  - Explore linking RARE Grant output
- NKU HAB app
  - Camera identifies HABs by color
  - Exploring including cameras at ORSANCO HAB stations
- Research web page
- Conference calls in spring and fall

Questions?

Preliminary Results of Mercury Ohio River Basin Mass Balance Project

Report to TEC Committee
February 12-13, 2019

Ad Hoc Mercury Committee Background

- Ad Hoc Established June, 2015.
- Held 5 conference calls & meeting Aug. ‘16.
- Charge:
  - Identify what is known and unknown about mercury.
  - Determine the value and costs of addressing the unknowns.
  - Make recommendations for studies to the Commission.

- Work completed by Mercury Ad Hoc:
  - Identified available outside data.
  - Completed literature review & background report.
  - Identified and prioritized information needs.
  - Identified a project and schedule to fill in information gaps.

Committee Membership

Stuart Bruny	OH Commissioner
Doug Conroe	NY Commissioner
~~**Jessica Dexter**~~	~~Environmental Law & Policy Center~~
George Elmaraghy	Federal Commissioner
Erich Emery	US Army Corps of Engineers
Tom FitzGerald	Federal Commissioner
Madeline Fleisher	Environmental Law & Policy Center
Toby Frevert	IL Commissioner
Eileen Hack	IDEM
~~**Tim Henry**~~	~~USEPA~~
John Kupke (Chair)	IN Commissioner
Ron Lovan	Commission Chairman (Kentucky)
Paul Novak	IDEM/TEC NPDES Chair
~~**Eric Nygaard**~~	~~OEPA~~
Ron Potesta	WV Commissioner
Rob Reash	Power Industry Advisory Committee
Martin Risch	USGS
Mike Wilson	NY Commissioner

Ad Hoc Committee Identified Information Needs

- **Priority #1:**
  - **Mass Balance to quantify and apportion sources of mercury in Ohio River.**
  - **Are point sources having an impact and what is the magnitude of the impact?**
  - **These questions could lead towards development of management scenarios.**

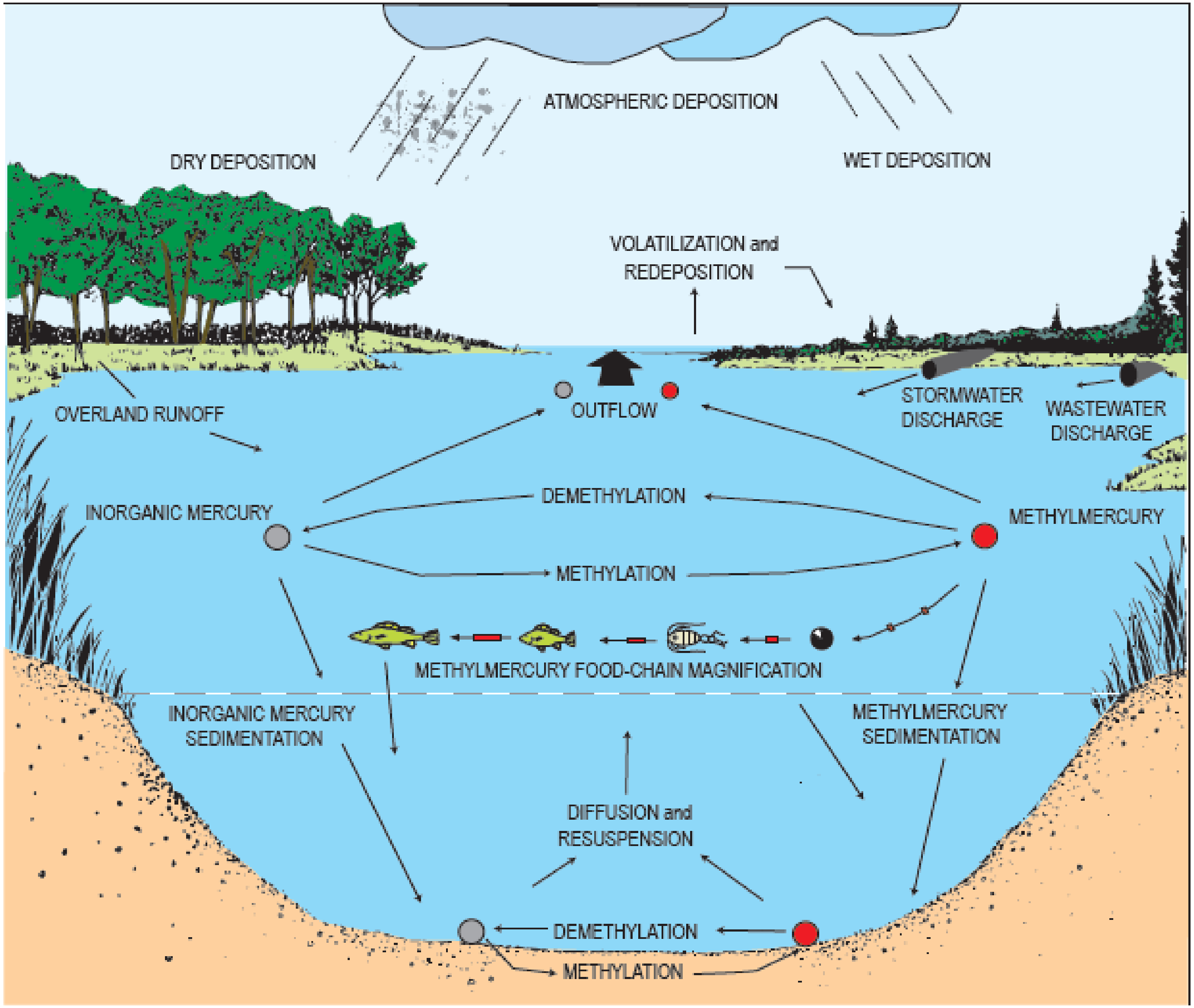
Ad Hoc Committee Recommended Study to Complete a Mercury Mass Balance for the Ohio River.

- **Considered various approaches.**
- **Decided on a point source focus.**
- **Relies heavily on existing studies and information.**
- **Very low cost project. Completed with existing staff. No special studies/surveys/projects needed to complete the effort.**
- **Project recommended Oct. 2016**

Background on Hg

- Hg is a natural, trace element found everywhere
- Global Pollutant – Atmospheric emissions.
- Has toxicological risks to humans & wildlife
  - Main exposure to humans is fish-consumption
- Hg is responsible for Fish Consumption Advisories in all 50 states

Fate and Transport within Aquatic Systems



*from Risch et al. 2010

Methylation

- ↑ temperature
- ↓ DO
- ↑ organic matter
- ↑ sulfates
- sulfides
- etc

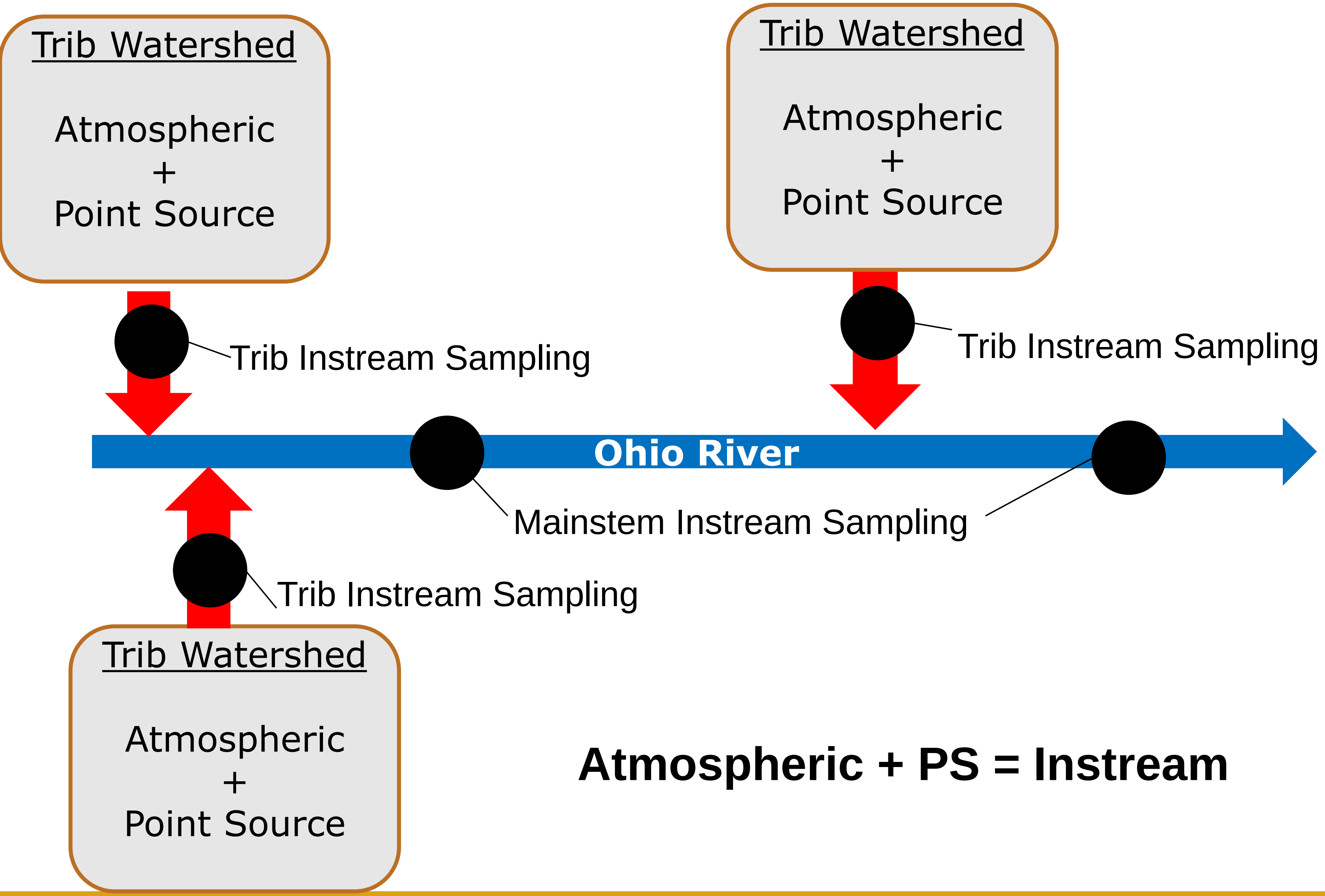
Thresholds

USEPA – 0.3ppm

FDA – 1.0ppm

1 ml/wk FCA – 0.02ppm

Mass Balance Diagram



Atmospheric + PS = Instream

Mass Balance/Source Apportionment

1) **Calculate mass loads in Ohio River.**
   - **Based on existing studies.**
   - **Adjust data to trib timeframe Nov. ‘15-Oct. ‘16.**

2) **Calculate mass loads from 15 largest tribs.**
   - **Accounts for approx. 85% of watershed.**
   - **Based on sampling effort – Nov ‘15 to Oct. ‘16.**

Mass Balance/Source Apportionment (cont.)

3) Calc. Point Source Loads.
   - Use USEPA ECHO data base.
   - Align with trib sampling Nov ‘15-Oct ‘16

4) Putting It All Together.
   - Instream = PS + Atmospheric
   - Percent source contributions to instream.
   - Nov ’15-Oct ‘16.

Study Limitations Identified & Accepted from Project Inception

1. **Atmospheric** deposition study does not account for the amount entering the waterways from the landscape. NADP (Nat'l Atmos Dep Program) & precip data.

2. **Point source** loads rely on ECHO data base does not include data for all mercury discharges. Uses discharge monitoring report data.

3. **Instream loads** used existing stream data from different periods of record (mainstem data adjusted to a common timeframe. LOADEST to calc. loads.

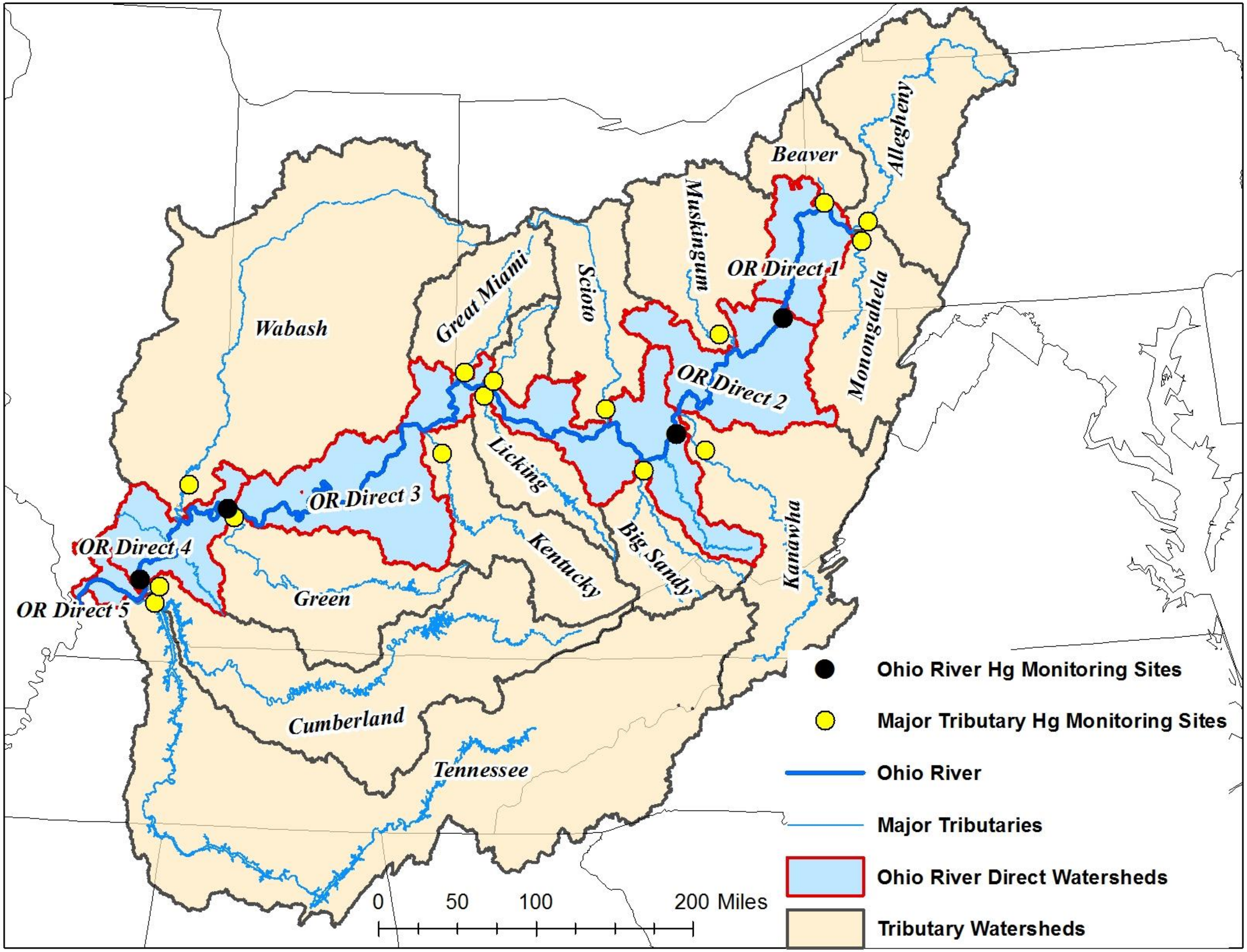
Project Components

1. Instream Loads – 4 mainstem; 15 tribs.
2. Point Source Loads.
3. Atmospheric Loads.
4. Mass Balance Accounting.

These are the 4 main components of the project.

Either one large report with a Chapter for each component, or 4 individual reports.

Geographic Scope of Project

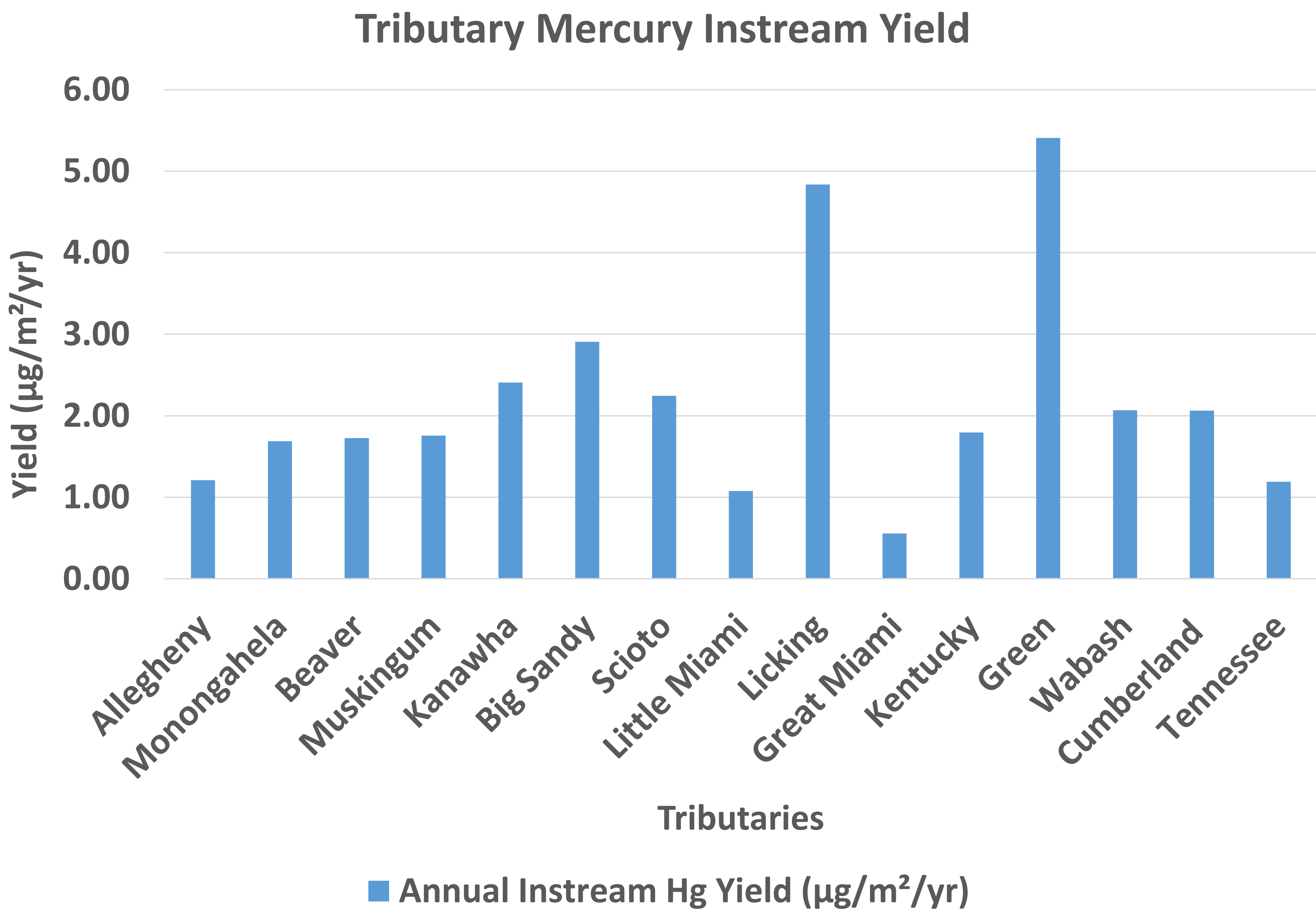


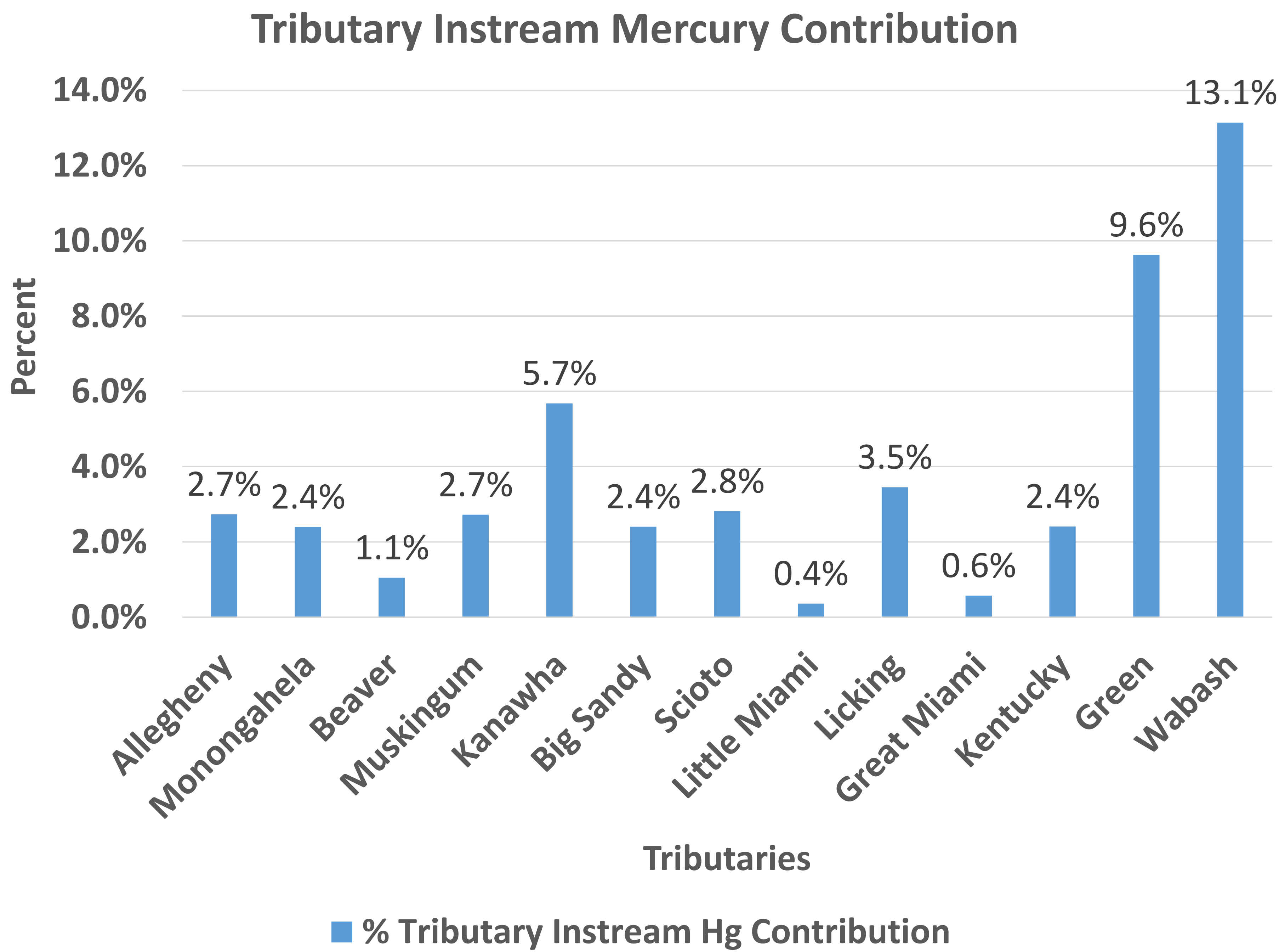
Tributary Mass Balance

Watershed	Instream Hg Annual Load (lbs)	% Atmospheric Hg Contribution (loads in pounds)	% Point Source Hg Contribution (loads in pounds)	Number of Outfalls with Hg data
Allegheny	81.1	17x (1,357)	0.3 % (0.2)	5
Monongahela	71.0	13x (901)	2.1 % (1.5)	46
Beaver	31.1	10x (322)	~0 % ~0)	31
Muskingum	80.7	10x (814)	~0 % (~0)	78
Kanawha	168.4	9x (1,530)	7.5 % (13)	41
Big Sandy	71.3	8x (557)	0.1 % (0.1)	19
Scioto	83.5	8x (687)	~0 % (~0)	57
Little Miami	10.8	18x (190)	~0 % (~0)	22
Licking	102.4	4x (423)	~0 % (0.04)	3
Great Miami	17.1	33x (560)	0.5% (0.1)	53
Kentucky	71.5	13x (894)	12.9% (9.2)	8
Green	285.1	4x (1,197)	0.4% (1.1)	13
Wabash	389.2	11x (4,088)	4.2% (16)	83
Cumberland	211.1	11x (2,299)	3.3% (7)	20
Tennessee	278.4	20x (5,482)	3.6% (10)	42

Mainstem Mass Balance

Ohio River Stations	Instream Hg Annual Load (lbs)	% Atmospheric Hg Contribution (loads in pounds)	% Point Source Hg Contribution data provided (loads in pounds)	# of Outfalls w/ Hg Data Upstream of Station (including tributaries and direct watersheds)
ORM 126	223	25x (5,552)	1.9% (4)	148
ORM 282	593	24x (14,025)	6.7% (40)	330
ORM 782	2,153	13x (28,723)	2.8% (61)	579
ORM 912	2,961	17x (51,252)	2.7% (79)	690


Tributary Mercury Instream Yield
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Yield (μg/m²/yr)
Allegheny
Monongahela
Beaver
Muskingum
Kanawha
Big Sandy
Scioto
Little Miami
Licking
Great Miami
Kentucky
Green
Wabash
Cumberland
Tennessee
Tributaries
Annual Instream Hg Yield (μg/m²/yr)


Tributary Instream Mercury Contribution
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
Percent
2.7%
2.4%
1.1%
2.7%
5.7%
2.4%
2.8%
0.4%
3.5%
0.6%
2.4%
9.6%
13.1%
Allegheny
Monongahela
Beaver
Muskingum
Kanawha
Big Sandy
Scioto
Little Miami
Licking
Great Miami
Kentucky
Green
Wabash
Tributaries
% Tributary Instream Hg Contribution

Project Timeline

Mercury Project Timeline		2017				2018	
Task #	Task Description	Q1	Q2	Q3	Q4	Q1	Q2
1A	Calc Hg Mass Load at Mainstem BAF Sites						
1B	Calc Hg Mass Load at Mainstem Clean Meals Sites						
1C	Calc Hg Mass Load for Tributaries						
2	Calc Point Source Hg Mass Load for Trib Watersheds						
3	Calc Mainstem Point Source Loads						
4	Report Development						

Completion Schedule

- At Feb TEC Meeting – Ask TEC for additions to Ad Hoc Mercury Committee membership.
- March – Convene Ad Hoc Committee. Review project results and 4 draft reports/chapters. Concurrent TEC review.
- June TEC Meeting -- Bring drafts back to TEC.
- Oct. TEC/Commission Meeting -- Finalize project/approve reports.

Source Water Protection & Emergency Response Update

Informational Item

Technical Committee
February 12-13, 2019

Program Elements

- **Harmful Algal Blooms**
  - Grant project updates
- **Emergency Response**
  - Role in Spill Response
- **Source Water Protection Planning**
  - Contaminant Source Inventory Project
- **Organic Detection System (ODS)**
  - ODS Next Generation Update

Emergency Response

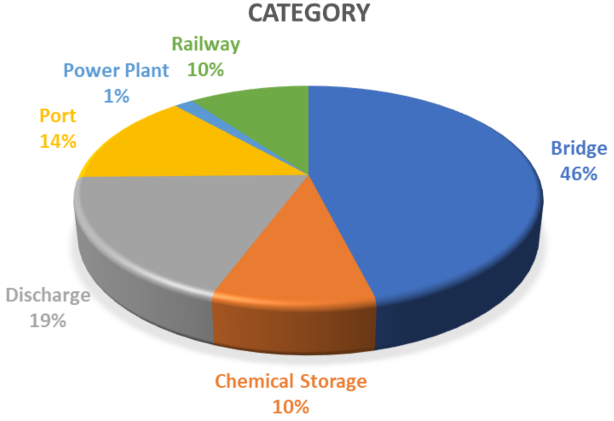
1. **Communication**
   - Initial Notifications (24/7)
   - Facilitate/coordinate communication and actions
   - Active pattern of late, though no major impacts
   - Emergency Response Directory updated

2. **Time-of-Travel Modeling**
   - US EPA funding fixes to model
3. **Water Quality Monitoring**
   - No recent incidents required additional monitoring
4. **Analytical Support**
   - Utilize ODS sites to run samples to track spill

Contaminant Source Inventory Pilot Project

Contaminant Source Inventory Project

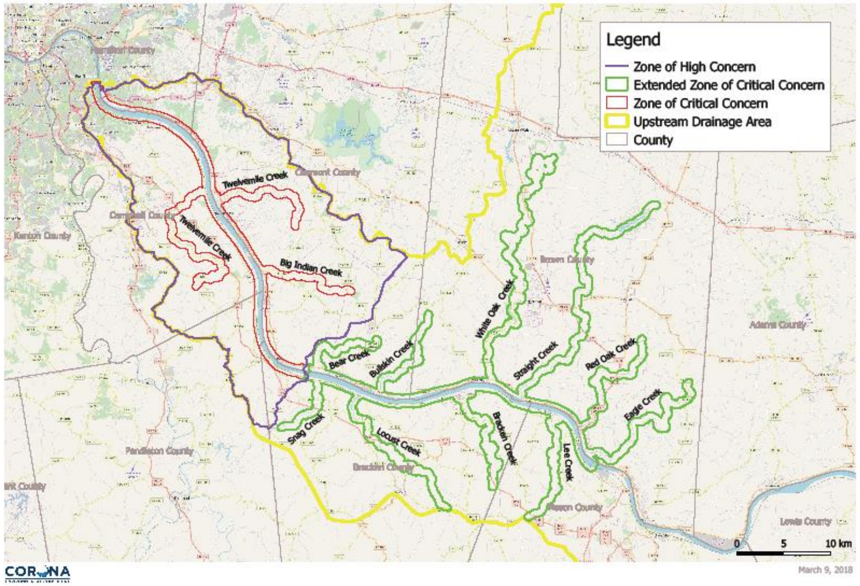
- Objective: **Develop GIS database tool to assist water utilities in assessing potential water quality risks.**
- Utilizes WaterSuite software to map contaminant threats and associated information
- US EPA, Greater Cincinnati Water Works, & Northern Kentucky Water District



Contaminant Source Inventory Project

- Phase 1 – Maysville to Cincinnati
  - Initial mapping completed Fall 2018
- Phase 2 –
  1. Extend study area to upstream of Portsmouth, OH
  2. Evaluate source water protection and emergency response priorities
  3. Update Tier II data
- Maysville and Portsmouth water utilities participating
- Time-of-travel model comparison
- Runs thru July 2019

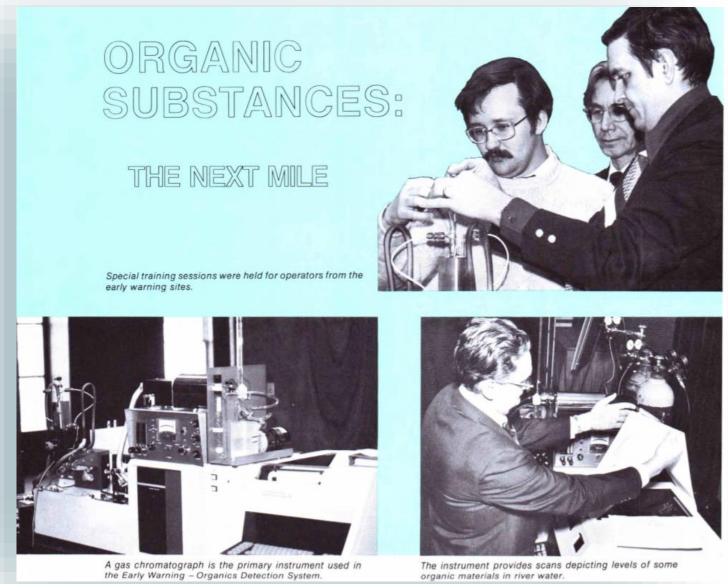
Ohio River Source Water Collaborative
Draft WaterSuite Zone Layers



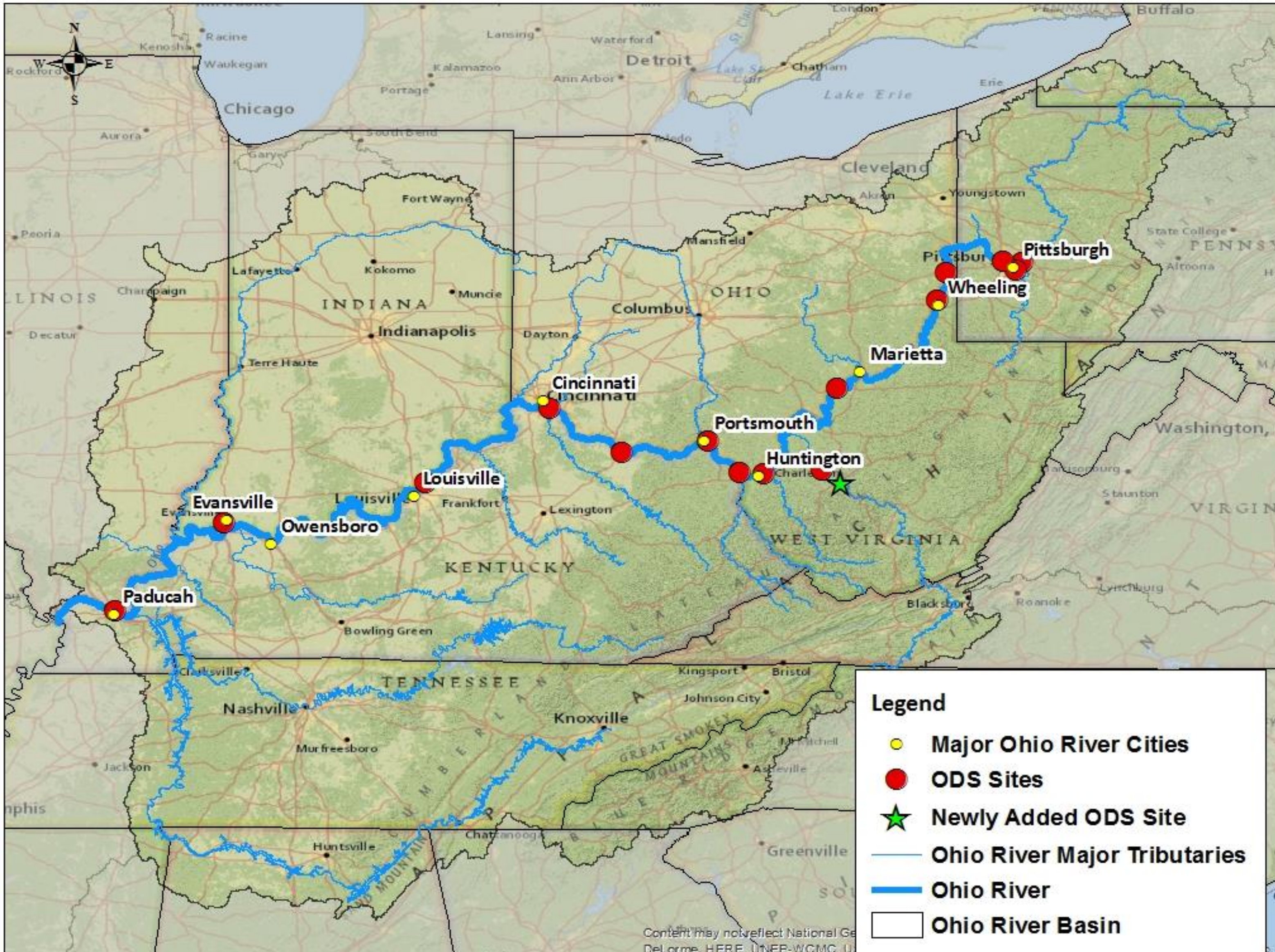
ODS Next Generation

ODS Background

- 1978 – Monitoring system developed in response to major carbon tetrachloride spill on Kanawha River
- Two key functions:
  1. Spill detection
  2. Spill tracking
- 17 stations
- Three system types
  1. GC/MS
  2. GC/FID
  3. Process GC
- Quantify 30 VOC analytes
- Detect thousands of VOCs



Volatile Organics Monitoring Network



Value of System

- Serves as a sentinel to alert water utilities

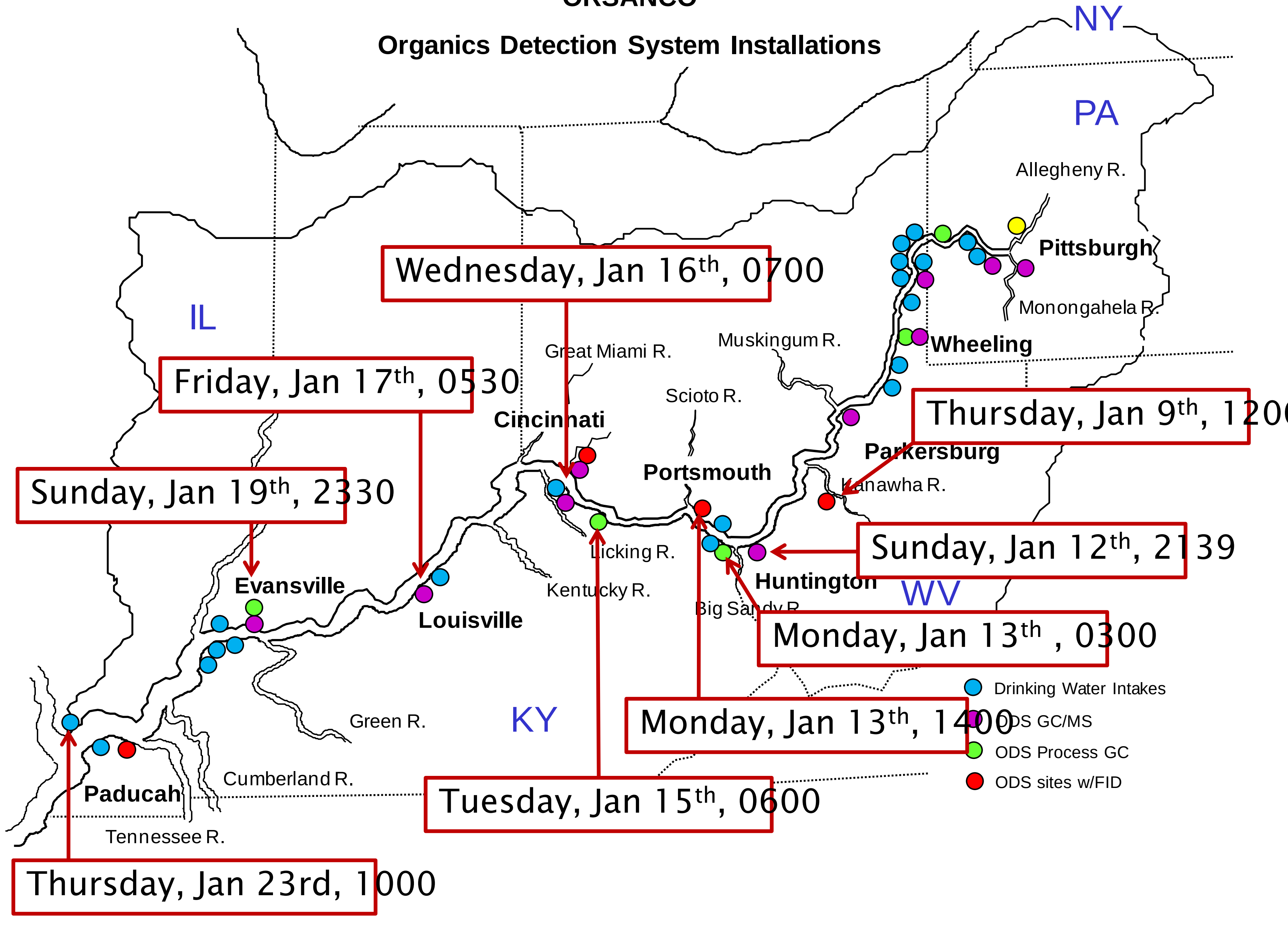
- Examples

1. 1994 – EDB from Shell Chemical fire
2. 2009 – Unreported methylene chloride release
3. 2014 – MCHM release in Charleston, WV
4. 2017 – Parkersburg warehouse fire

- Quick turn-around screening provides water utilities with key information to make informed management decisions to protect consumers

ORSANCO

Organics Detection System Installations



ODS Next Generation

- Previous renovation initiated in 2009

- Work Group Participants
  - American Water Company
  - Greater Cincinnati Water Works
  - Louisville Water Company
  - Northern Kentucky Water District
  - US EPA
  - ORSANCO

- Work Group Charge –
  1. Evaluate potential contaminants of concern.
  2. Evaluate available technologies
  3. Identify at least 3 monitoring designs
  4. Recommend preferred option

Process

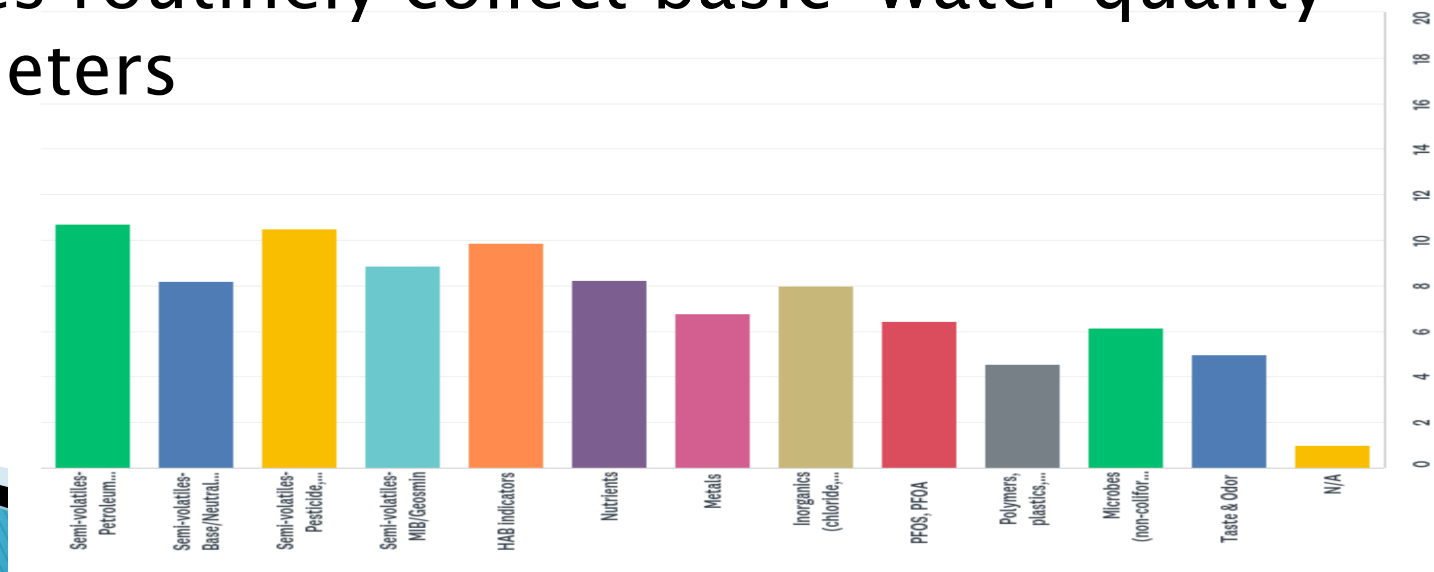
- Online Surveys:
  - Polled Ohio River water utilities to determine system needs and areas for improvement
- Researched:
  - Contaminants of concern
  - New instrument/sensor technologies
- System Configuration Options –
  - Developed list of system design options
- Scoring Matrix –
  - Developed matrix to score sites for GC/MS placement

Online Survey Results

- Great participation
  - Responses from 27 utilities
- Key Findings
  - Significant variability among utilities
    - Size, expertise, monitoring resources
  - Most desired system enhancements
    1. **Host water quality data web portal**
    2. **Broaden analytical capabilities**

Key Contaminants

- VOCs (expand list?)
- SVOCs, HAB indicators, Inorganic anion/cations, nutrients
- SVOCs most beneficial; however, costly and labor intensive
- Utilities routinely collect basic water quality parameters



ODS System Configuration Scenarios

#	Description	Instrumentation	Total Capital	Annualized Cost			
				Maintenance Labor Hours	Capital Cost*	Maintenance Cost**	Total Annual Cost
1	Current system + SVOC at 4 sites	9 GC/MS 3 GC/FID 4 CMS 4 GC/FID (SVOC) 1 Backup CMS	$2,441,000	550	$276,100	$271,500	$547,600
2	Current system	9 GC/MS 3 GC/FID 4 CMS 1 Backup CMS	$2,121,000	438	$212,100	$207,500	$419,600
3	Replace 3 GC/MS with GC/FID	6 GC/MS 6 GC/FID 4 CMS 1 Backup CMS	$2,013,000	390	$201,300	$187,000	$388,300
4	Replace 5 GC/MS with 3 GC/FID & 2 CMS	4 GC/MS 6 GC/FID 6 CMS 1 Backup CMS	$1,803,000	394	$180,300	$169,400	$349,700

* Annualized capital cost assumes 10-year replacement schedule.

** Annualized maintenance cost excludes staff labor and travel expenses.

Scoring Matrix

- Developed matrix to score ODS sites for possible GC/MS placement
- Scoring factors

1. Facility ODS performance metrics
2. Potential for spill occurrences
3. Enhanced monitoring capacity during spills
4. Population served

- Wild Card – Geographic distribution

Matrix Results

- Prioritization of GC/MS Sites

Rank	Site	Composite Score
1	Huntington	1.4
2 (tied)	Louisville Wheeling	1.5
4 (tied)	Evansville Hays Mine	1.8

- Cincinnati owns their GC/MS; therefore, was excluded from scoring

Summary of Recommendations

1. Maintain VOCs as primary focus for routine monitoring. Expand VOC analyte list
2. Trial SVOC analysis at 2-3 sites with existing equipment to evaluate cost and time implications
3. Evaluate possible web-portal for utilities to share routinely-collected water quality results

Summary of Recommendations

4. The three GC instrument system types currently employed remain the preferred instrument choices.
5. Four configuration options presented provides decision tool to optimize system to available resources.
6. Network with 5 GC/MS units considered minimum required to meet monitoring needs.
7. Scoring matrix established to prioritize placement of GC/MS instruments.

Questions?

2018 Review of
Pollution Control Standards for Discharges to the Ohio River

Background

- The current review began with the appointment of a Commission Ad-Hoc Committee to review its role in water quality standards implementation on June 30, 2015.
- The Ad-Hoc Committee developed 5 alternatives for consideration.
- The 5 alternatives were distributed for comment to the Commission's advisory committees & TEC.
- The Ad Hoc Committee recommended a preferred alternative #2.
- An expanded version of Alternative #2 was developed.
- A minority report was developed along with the expanded preferred alternative.

Background (cont.)

- At October 2017 Commission meeting, the Commission authorized PCS Committee to initiate a public review of the alternatives.

- 1st Public review held Jan. 10 thru Feb. 24 to solicit input on the 5 alternatives:
  - 783 -- "Third-Party" emails not in favor of Alternative#2.
  - 14 -- Detailed comments from entities not in favor of Alternative #2.
  - 17 – Detailed comments from entities in favor of Alternative #2.

Background (cont.)

- At June 2018 Commission meeting, the Commission authorized PCS Committee to initiate a second public review of specific revisions to the standards based on Expanded Alternative #2.

- 2nd Public review held June 26 thru Aug 20, 2018 and hearing on July 26.
  - 10 detailed comments in favor of Alternative #2.
  - 38 detailed comments from entities not in favor of Alternative #2.
  - 5,728 comments from the general public not in favor of Alternative#2.
  - Hearing results – 92 attendees; 48 commenters all opposed to proposed revisions.

October 2018 Commission Mtg

- Commission deferred action on proposed revised standards to allow the PCS Committee additional time to consider public input.
- PCS Committee met Oct. 20 and designated subcommittee to continue review.
- PCS Subcommittee held calls on Nov 2, Nov 8, Nov 15.
- PCS Subcommittee met in-person on Nov 30.

Key Tenants of PCS Committee Proposal

- 1) Any proposal should be consistent with the Compact;
- 2) Any proposal should provide for a cost effective use of ORSANCO and State resources;
- 3) Any proposal should provide for the PCS to be available for States to use if desired;
- 4) Any proposal should not be mandated to the States;
- 5) Any proposal should preserve the PCS to be available for specific mainstem Ohio River problems that may arise in the future;
- 6) Any proposal should ensure that the uses identified in the Compact are maintained.