

# Mercury Bioaccumulation Study Recommendations

ORSANCO 207<sup>th</sup> Technical Committee Mtg.

Agenda Item 9

February 10-11, 2015

# Current Study and Recommendations

- Draft Report on BAF at Mile 126
  - Comments received through 12/8/14
  - Description of General Comments and those impacting future studies follows
- Recommendation on two additional BAF studies
  - Location selection from original proposal to USEPA describing “mid” and “lower river” projects

# Current Study/Report Comments

- **Reviewers:**
- USEPA – Peggy Donnelly, USEPA Region 5
- USGS a – Barb Eikenberry, USGS Wisconsin Water Science Center
- USGS b – Karen Murray, USGS New York Water Science Center
- IDEM – Shivi Selveratnam, Indiana Department of the Environment, Water Quality Standards Program
- PIAC - ORSANCO Power Industry Advisory Committee – Rob Reash, American Electric Power
- Axial Corp – David Langseth and Carie Tuit, Gradient Corp, Cambridge, MA

# Current Study/Report Comments

- Major Comments
  - “Our comments are simple corrections in how the information is presented. There are no significant issues with the approach or conclusions.” (USEPA)
  - “Provides important information for understanding fish mercury bioaccumulation at Ohio River Mile 126” “...the entire report would benefit from an editorial review/revision for readability.” (USGS a)
  - “I found the manuscript to be technically sound and generally well-written, but I believe some additional revision will be necessary to present the findings more clearly and to provide necessary information to the reader.” Throughout use term total mercury instead of mercury to more clearly distinguish from methyl (USGS b)

# Current Study/Report Comments

- Major Comments
  - “Overall it was difficult to follow the calculations trail” Was any bootstrapping done to determine minimum number of samples to provide a 90% Confidence in BAF accuracy (IDEM)
  - “presents results of a well-designed technical study”; “The draft report is an objective analysis”; “the statement that calculated BAF values “indicate a risk for mercury concentrations in fish tissue” is not supported by actual measured MeHg levels in fish from the Hannibal Pool” (PIAC)
  - “The Draft BAF Study, and other relevant data, are in effect supportive of the US EPA conclusion that the best way to regulate human health protection related to Hg in aquatic systems is through direct regulation of the fish tissue concentrations. Any other approach is fraught with difficulty and uncertainty.” Study does not say why fish was collected mostly downstream of the dam but water was all collected upstream of the dam. (Axial Corp)

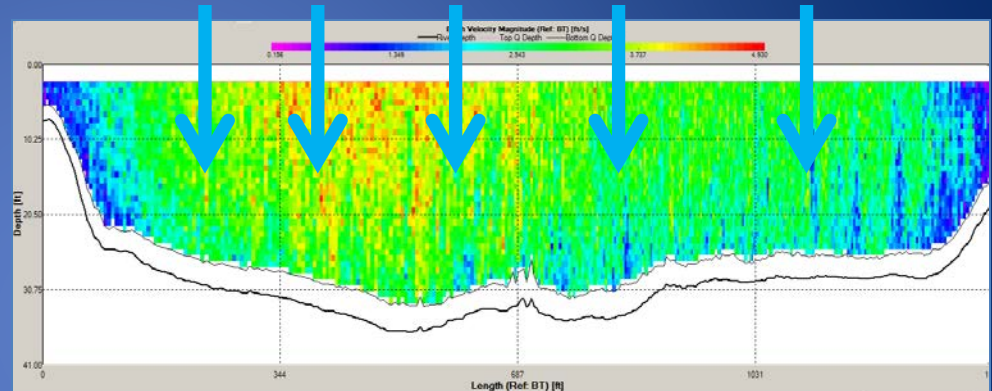
# Comments Impacting Future Studies

- “ORSANCO should consider standardizing the species that will be used for each trophic level and the number of individual samples that can be used for each species.” (IDEM)
  - This recommendation has been incorporated in to the new project QAPP
- “...monthly [water] sampling is not adequate in order to calculate defensible BAF values. For future studies, I recommend that two or three water MeHg samples per month be collected.” (PIAC)
  - The scope of the proposed projects is to analyze water under various monthly conditions for one year
- “At lower discharge rates it is likely that the average stream velocity is below the minimum stream velocity requirements for the bag samplers...For strongly adsorbed contaminants like Hg, this can lead to under sampling the total concentration. Since translation factors were used in the Draft BAF Study to estimate the dissolved phase concentrations, this issue may result in an underestimate of the F-MeHg concentration, with a consequent overestimate of the BAF.” (Axial Corp)
  - The USGS method employed states the Equal Discharge Increment sample is still recommended under non-isokinetic conditions.

# Data to be Collected for Additional BAFs

- MeHg, THg, and Se Water Data
  - 12 monthly Equal Discharge Increment (EDI) samples
  - May 2015 – April 2016

Equal Discharge Increments identified in an Ohio River flow measurement:



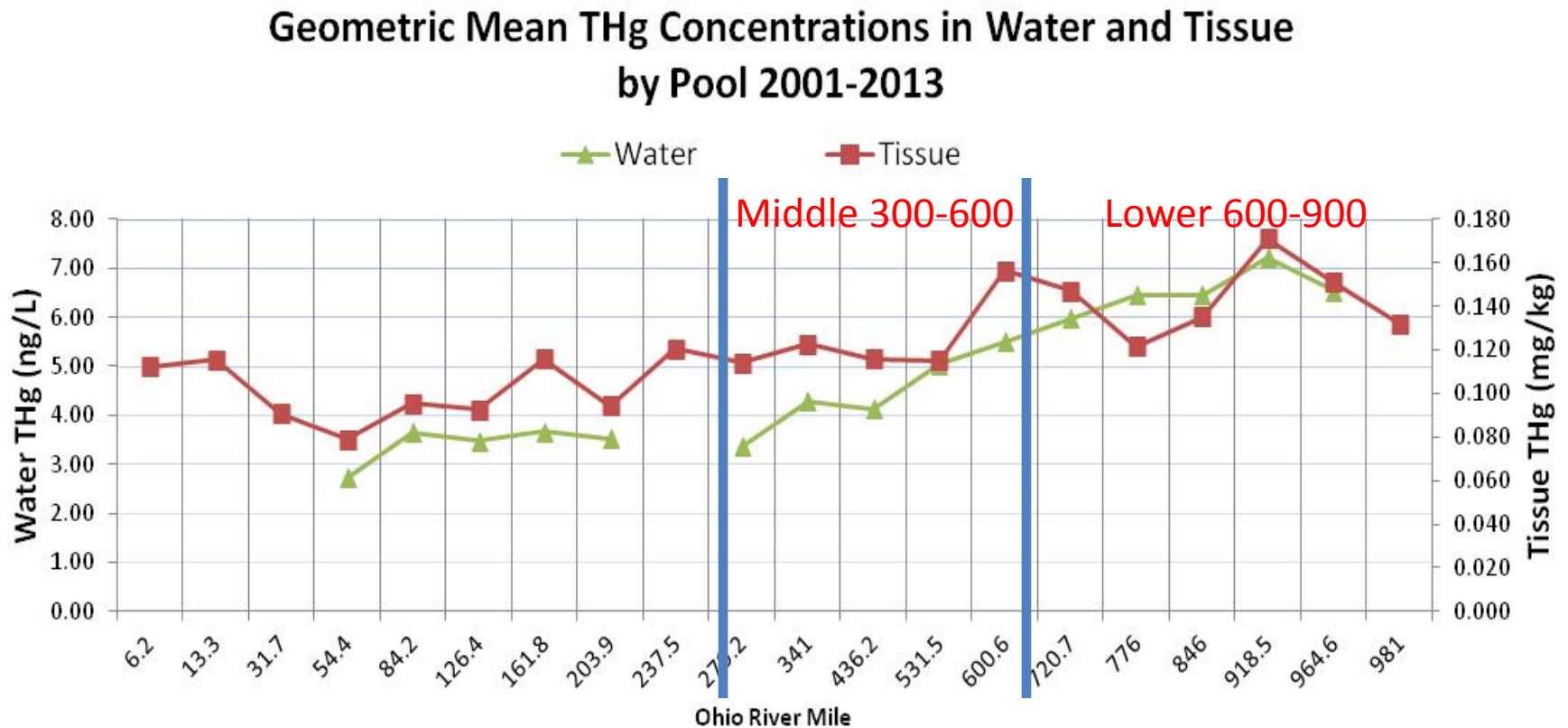
- MeHg and Total Hg Tissue Data
  - 8 composites collected Spring and Fall 2015
    - 4 Trophic Level 3
    - 4 Trophic Level 4

## Study QAPP specifies:

- Commonly consumed species for the BAF location
- Varying no more than 20% in individual length within species composite
- Size selected by the median size of all individuals of a species collected
- Targeting repetition of species collected in two rounds of tissue sampling

# Original Proposal

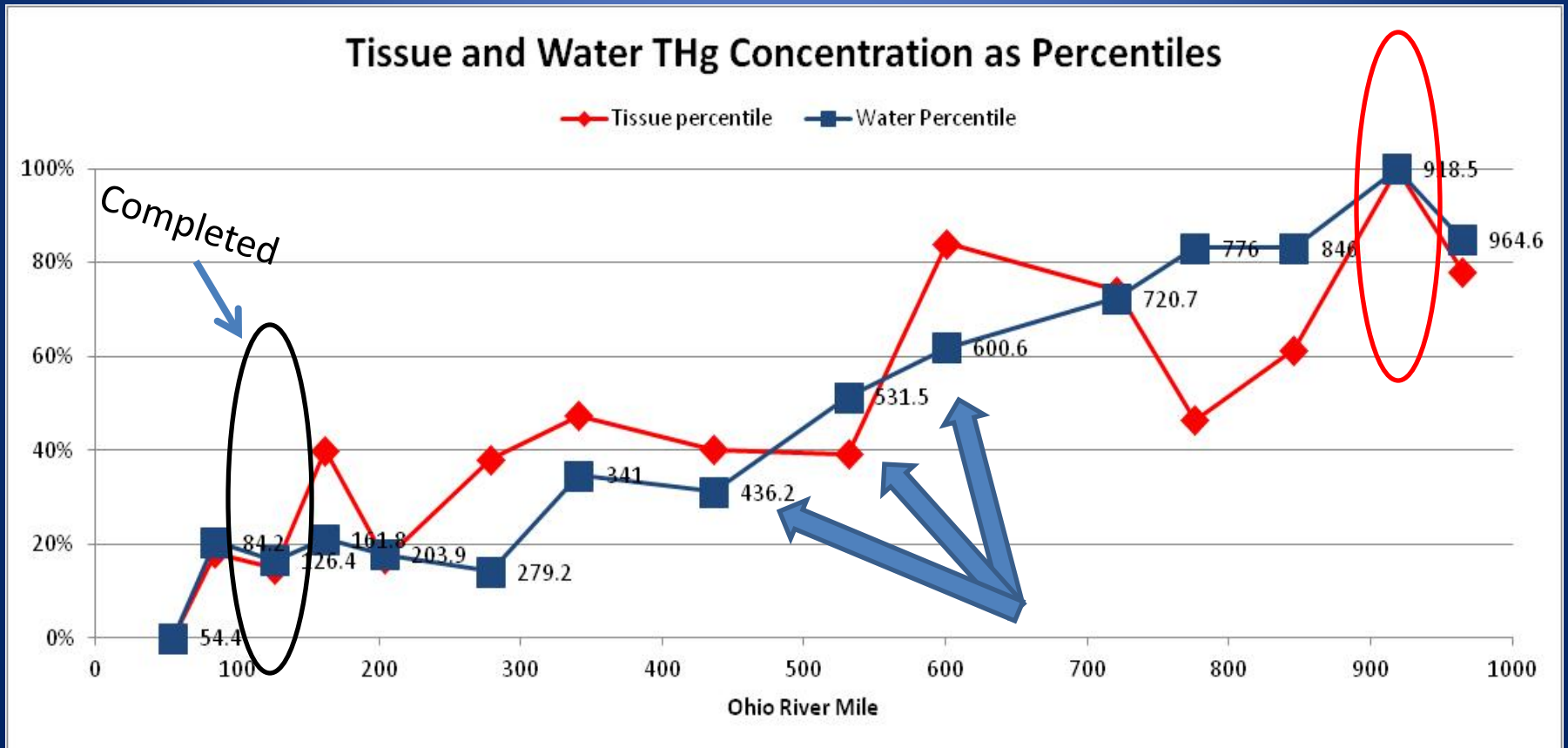
- Two Additional BAFs: \$54,800
- One Mid River, One Lower River



# Tissue and Water Concentration Percentiles

(This view makes the lines relative to each other)

- Specific Site Recommendations
  - Smithland: Highest Hg in water and tissue
  - Need Tech input on Mid River Site Selection



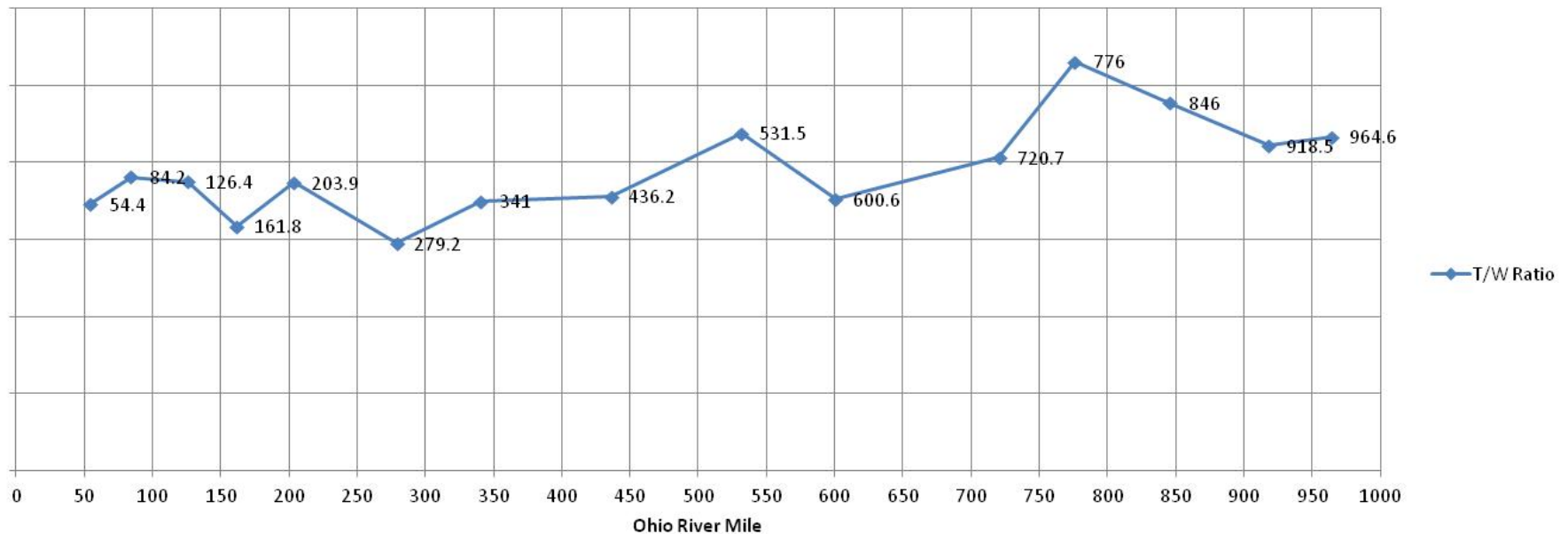
# Expected BAF Results

$$BAF = \frac{C_T}{C_W}$$

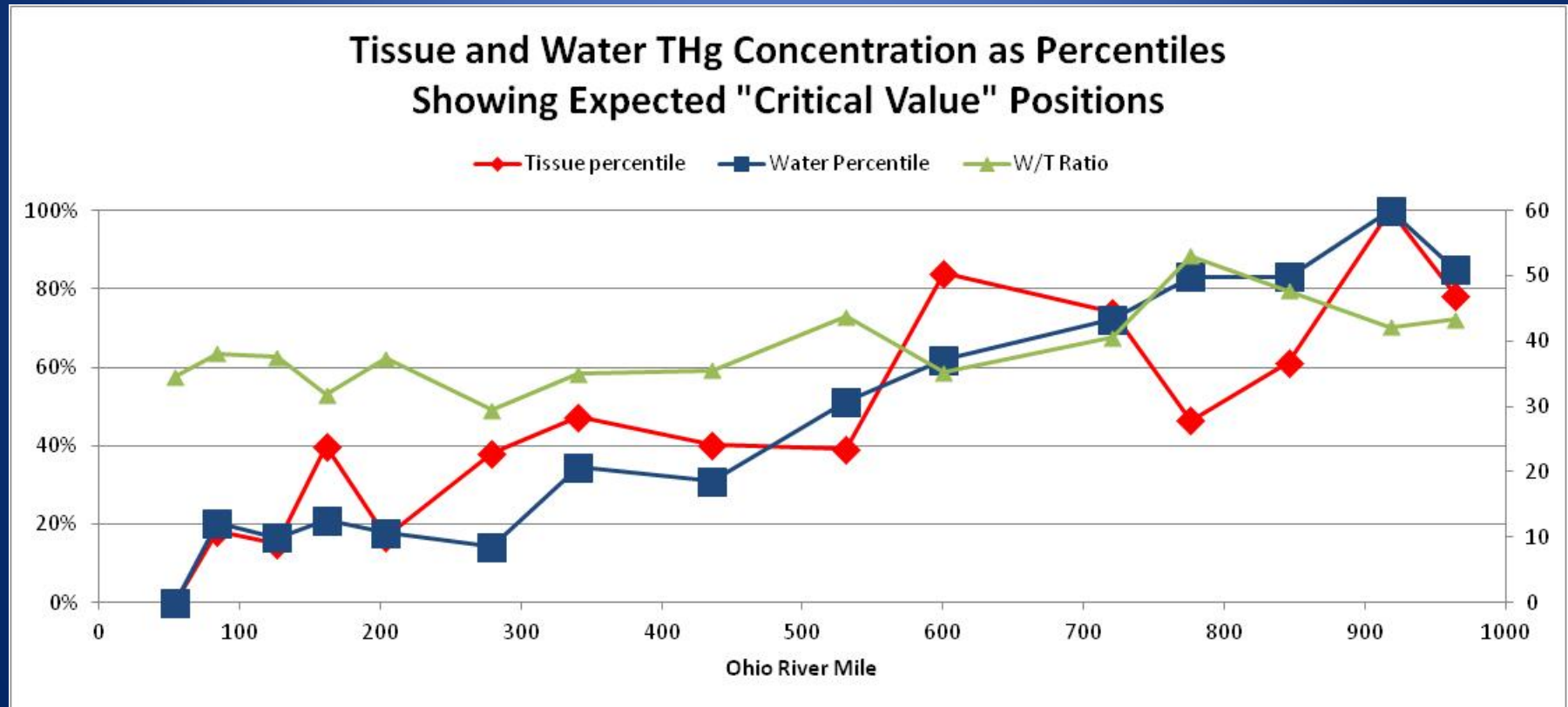
- $\uparrow C_T / \downarrow C_W = \text{High BAF}$ 
  - High BAF = Lower “Critical Water Value”
- Critical Water Value is calculated from the BAF to determine background water concentrations that create expected tissue violations

# Expected “Critical Value” Results

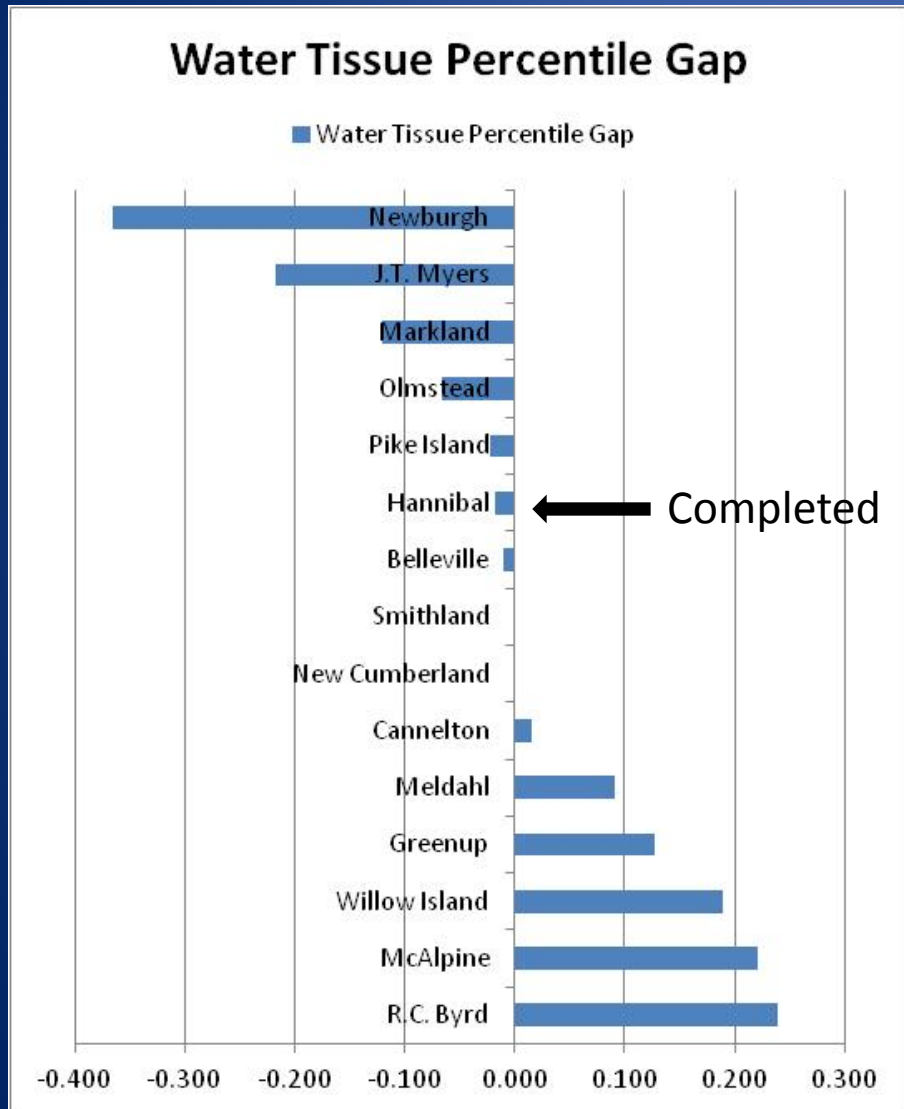
**Water THg/Tissue THg Ratio by Pool**  
**Showing Expected "Critical Value" Positions**  
Calculated from Geometric Means all tissue and Water Data 2001-2013



# Tissue and Water Relative Positions with Expected “Critical Value” Results



# Expected BAF Results

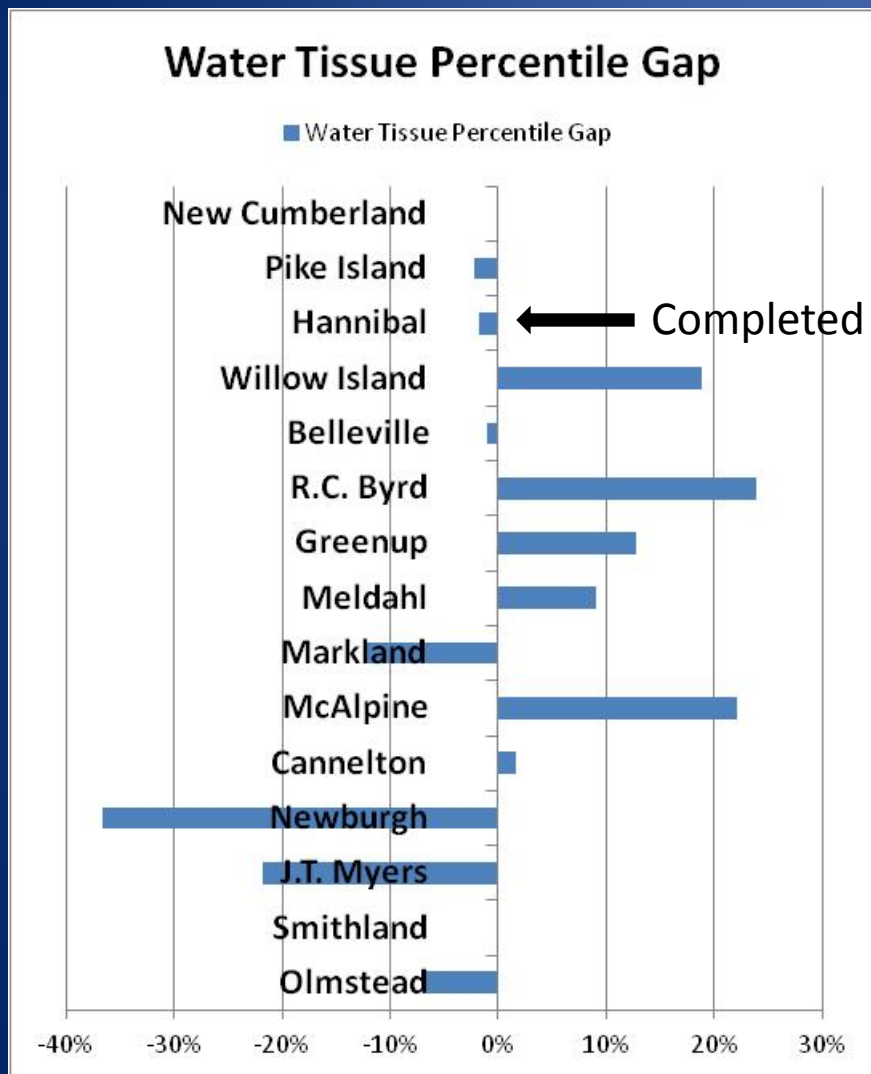


- Newburgh:  $\downarrow C_T / \uparrow C_W = \downarrow \text{BAF}$  and high “critical value”

- R.C. Byrd:  $\uparrow C_T / \downarrow C_W = \uparrow \text{BAF}$  and low “critical value”

# Expected BAF Results

Longitudinal Order



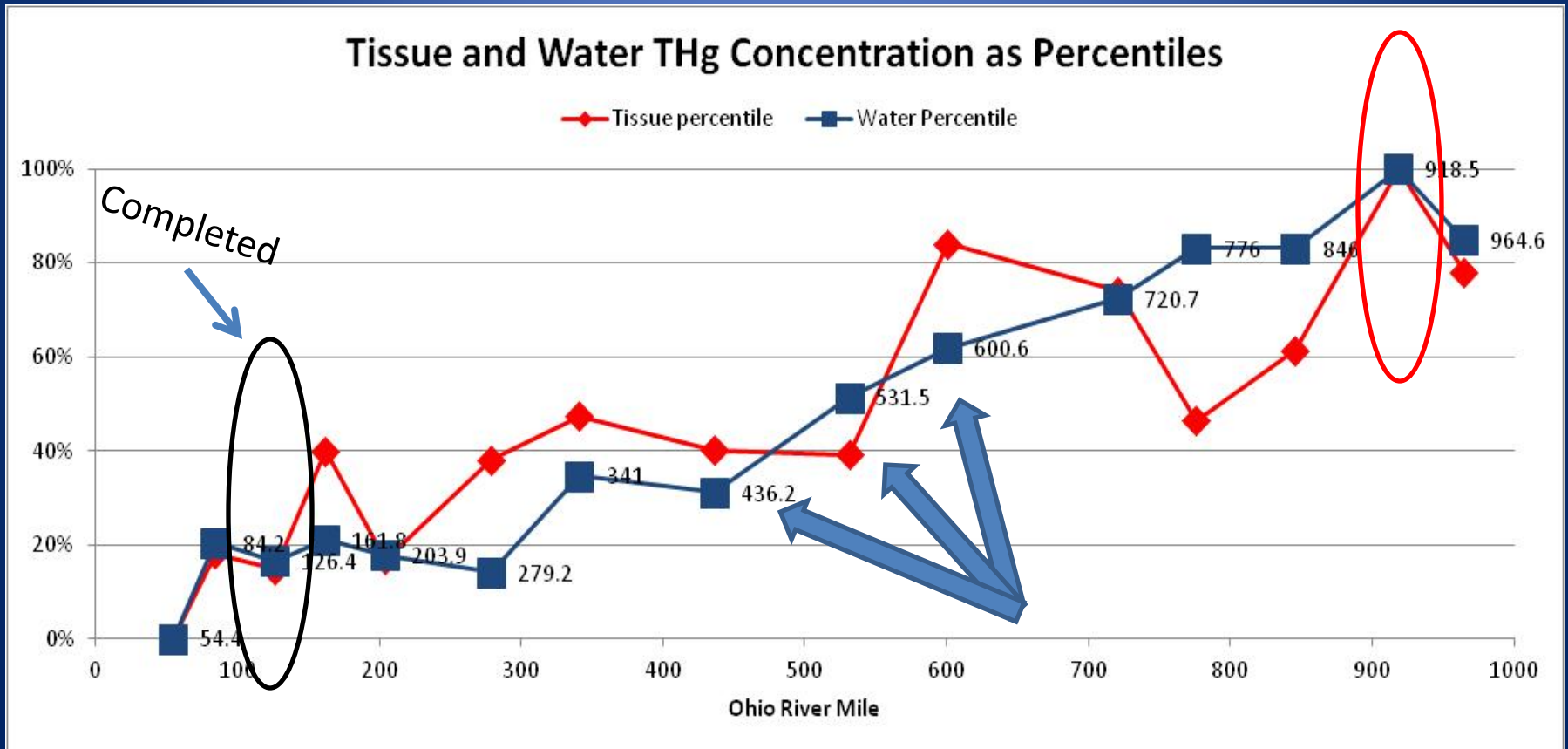
- Newburgh:  $\downarrow C_T / \uparrow C_W = \downarrow \text{BAF}$  and high “critical value”

- R.C. Byrd:  $\uparrow C_T / \downarrow C_W = \uparrow \text{BAF}$  and low “critical value”

# Tissue and Water Concentration Percentiles

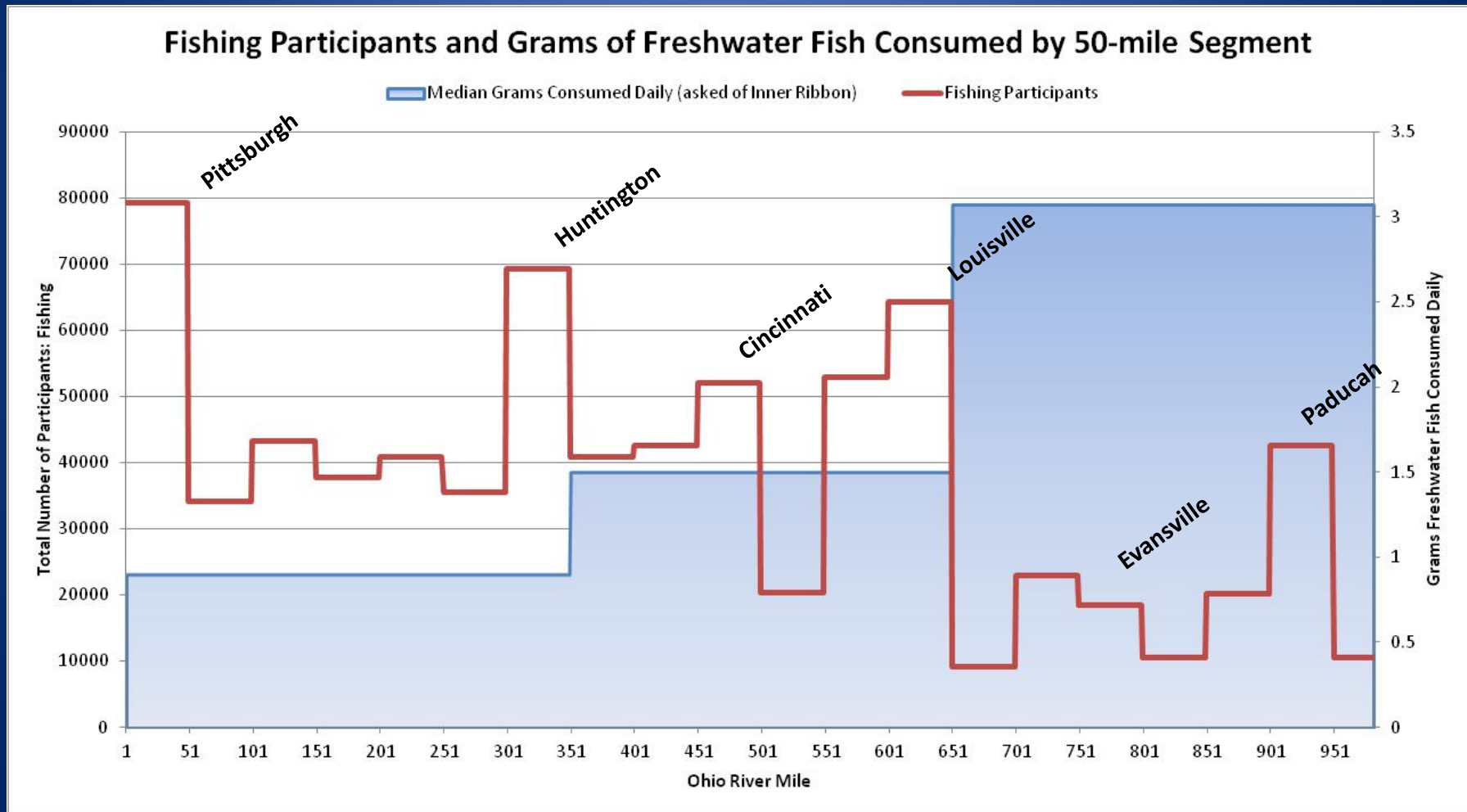
(This view makes the lines relative to each other)

- Proposal
  - Smithland: Highest Hg in water and tissue
  - Need Tech input on Mid River Site Selection



# Fishing and Consumption Intensity by River Segment

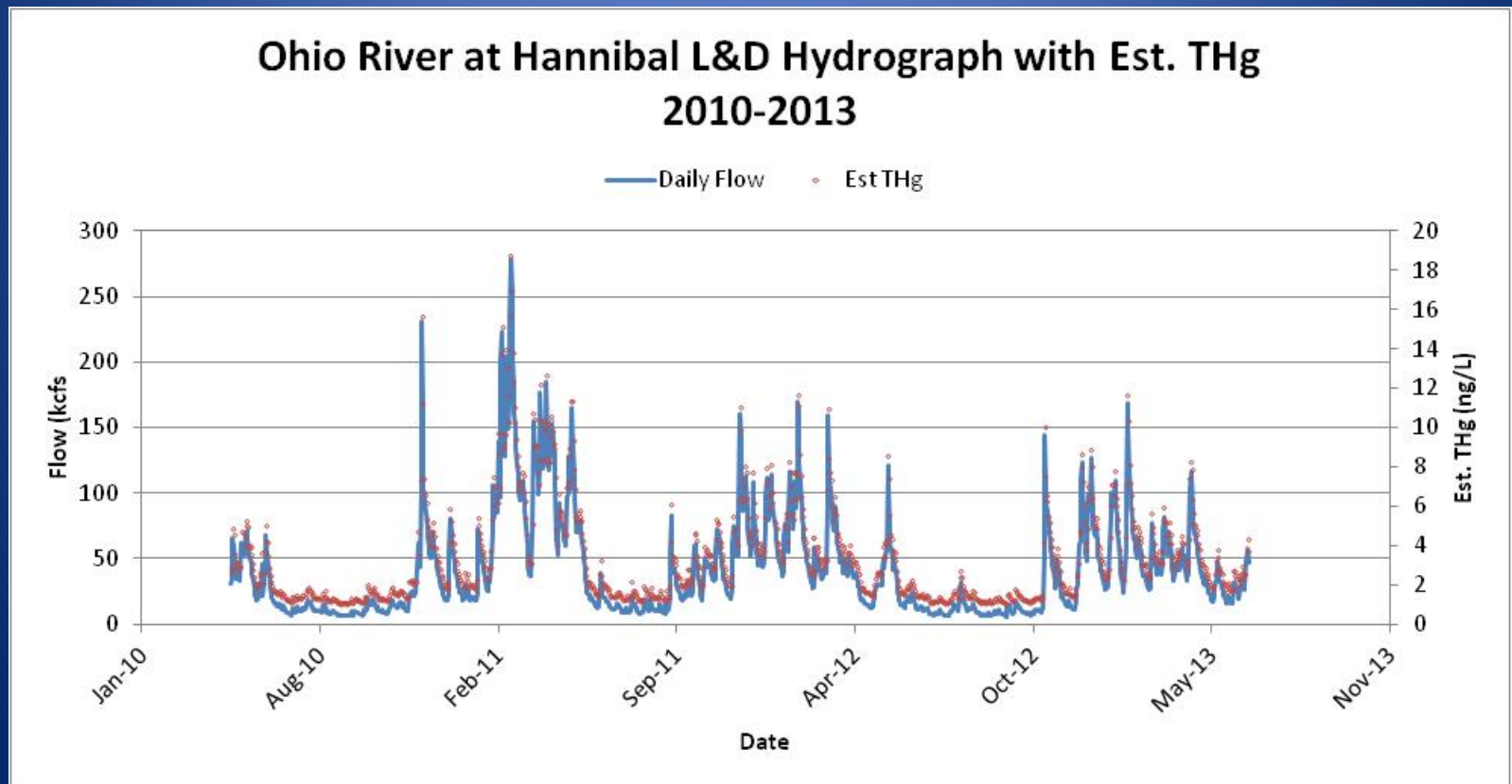
*Ohio Valley Resident's River-Based Recreation and Consumption of Freshwater Fish, Responsive Management, 2009*



# Completed BAF Comparison to Long-Term Water Conditions and Tissue Findings

Daily flows used to estimate total mercury concentrations on a daily basis for three year period:

Max 18.7ng/L, Min 1.02, Geometric mean 2.7 ng/L



# Completed BAF Comparison to Long-Term Water Conditions and Tissue Findings

- Tissue Concentration Geometric Means in Hannibal pool measured for the BAF were:
  - TL 3: 0.105 mg/kg
  - TL4: 0.189 mg/kg
  - Tissue TL3/TL4 Average: **0.15 mg/kg**
- Daily flows used to estimate total mercury concentrations on a daily basis for three year period
  - Max 18.7ng/L, Min 1.02 ng/L, Geometric mean **2.7 ng/L**

# Completed BAF Comparison

Long term average water concentrations and current tissue concentrations are about half of the “critical value” and tissue criterion:

