Susquehanna River Water Quality Monitoring & Assessment 2012-13

May 28, 2014

Dial in no. for audio: 1-877-668-4493
Access code: 647 130 494
WebEx Technical Support: 866-229-3239
AGENDA

1. Welcome
2. Review of 2012 & 2013 Studies
3. Preview of 2014 Study
4. Questions & Comments

Note: WebEx Technical Support is available at 866-229-3239
The lower Susquehanna River was a world-class Smallmouth Bass (SMB) fishery.

Wide-scale, disease-related mortality of young-of-year (YOY) SMB was first documented in 2005.

Poor SMB recruitment.

Lesions, tumors, and other deformities were becoming common.

Pathology of adult SMB detected a high degree of intersex conditions suggesting endocrine disruption.
Alarmed, local stakeholders called for listing the Lower Susquehanna River mainstem as 303d impaired.

Listing the Lower Susquehanna as impaired is not currently possible nor defensible:

- Long-term ambient water chemistry was compliant.
- Designated uses were being attained.

In order to assess the Susquehanna River and its SMB fishery in a scientifically defensible manner, DEP launched this very rigorous three-year study of the Lower Susquehanna River and its major tributaries.
2012-13 Water Quality Monitoring

- Discrete Water Quality Transect Characterization
- Continuous Instream Water Quality Monitoring (data sondes)
- Water Chemistry Grab Sampling
- Periphyton Monitoring (Fixed Transect & Random)
- Benthic Macroinvertebrate Surveys
- Semi-Quantitative Fish Surveys (Fish Health)
- Mussel Surveys
- Passive Sampler Deployment (Androgenicity/Estrogenicity)
- Sediment Contaminant Sampling
- Routine Fish Tissue Sampling
Large River Core Sample Locations

The large river effort includes 9 intensively sampled sites (4 repeats from 2012 plus 5 new sites including 3 additional out-of-basin controls).
• Susquehanna River at Marietta (New 2013)
• Susquehanna River at Harrisburg
• Susquehanna River at Sunbury
• Juniata River at Newport
• Juniata River at Lewistown Narrows (New 2013)
• Delaware River at Trenton (Out-of-basin control)
• Allegheny River at Franklin (Out-of-basin control, New 2013)
• Youghiogheny River at Sutersville (Out-of-basin control, New 2013)
• Connoquenessing Creek @ Zelienople (Out-of-basin control, New 2013)
2013 Susquehanna River @ Harrisburg

2013 Harrisburg East
2013 Harrisburg Middle
2013 Harrisburg West

2013 Water Quality Transects

2012 Random Site
2012 Harrisburg East
2012 Harrisburg Middle
2012 Harrisburg West
Susquehanna River Harrisburg North Transect – DO (mg/l)

- 2.73 mg/l
1.97 mg/l
Dissolved Oxygen, Susquehanna at Harrisburg Sample location – 6/14/12-8/31/2012
Minima Dissolved Oxygen, Susquehanna at Harrisburg Sample location – 6/27/12-7/15/2012
Juniata @ Newport North vs. Susquehanna @ Harrisburg West
Minima Dissolved Oxygen, Susquehanna at Harrisburg West and Juniata River at Newport
Sample location – 6/25/12-7/15/2012

Newport North DO = 4.79
Harrisburg West DO = 5.45
Figure 12. pH, Susquehanna at Harrisburg Sample location – 6/14/12-8/31/2012
Figure 26. Maxima pH, Susquehanna at Harrisburg Sample Location – 6/15/12-6/29/2012
Certain standards must be met in order to properly assess data from CIMs.

• Quality assurance protocols must be followed.

• Instruments must be periodically calibrated and the final readings corrected for drift.

• The analytical uncertainty is the ability of the instrument to discriminate between small differences in a measurement. This uncertainty must be considered when an ambient measurement is compared to a numeric WQS criterion.

• The CIMs must be placed in an area that is representative of the stream segment as a whole.
• Dissolved Oxygen and pH criteria are defined in Pennsylvania’s water quality standards in 25 Pa Code §93.7.

• These criteria must be met 99% of the time as defined in Chapter §96.3(c) of the water quality standards.

• CIM data is unique in that data can be continuously recorded at 15, 30 or 60 minute intervals.

• Period of evaluation is one year. If a CIM is not deployed for an entire year, then there **must be justification for extrapolating the available results to a year**. In this case, the CIMs were deployed during the critical time of year (low flows and warm temperatures) when dissolved oxygen is lowest and pH highest.
The table below characterizes common sampling rates or how often data is recorded and the number of criteria exceedances that would be expected for impairment of a water.

<table>
<thead>
<tr>
<th>Sample Rate</th>
<th>Sample Exceedances Expected for Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Minutes</td>
<td>351</td>
</tr>
<tr>
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<td>176</td>
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Summary of CIM Data 2012

Percent Criteria Exceedances for pH and Dissolved Oxygen CIM data. **Percentage greater than 1.00 is impairment.**

<table>
<thead>
<tr>
<th>Sample Site 2012</th>
<th>Parameter</th>
<th>% Criteria Exceedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delaware East</td>
<td>pH</td>
<td>1.81</td>
</tr>
<tr>
<td>Delaware East</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Delaware West</td>
<td>pH</td>
<td>0.23</td>
</tr>
<tr>
<td>Delaware West</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Juniata Newport</td>
<td>pH</td>
<td>0.7</td>
</tr>
<tr>
<td>Juniata Newport</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Harrisburg West</td>
<td>pH</td>
<td>0.36</td>
</tr>
<tr>
<td>Susquehanna Harrisburg West</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Harrisburg Middle</td>
<td>pH</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Harrisburg Middle</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Harrisburg East</td>
<td>pH</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Harrisburg East</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Sunbury West</td>
<td>pH</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Sunbury West</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Sunbury East</td>
<td>pH</td>
<td>0</td>
</tr>
<tr>
<td>Susquehanna Sunbury East</td>
<td>Dissolved Oxygen</td>
<td>0</td>
</tr>
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</table>
Figure 26. Maxima pH, Susquehanna at Harrisburg Sample Location – 6/15/12-6/29/2012
Specific Conductance, Susquehanna at Harrisburg Sample Location 6/14/12-8/31/2012
This is just downstream of a PFBC YOY Site
Added Turbidity to Harrisburg Sites in 2013
Susquehanna River Rockville Transect - Turbidity (NTU)

North Branch Contribution

North Branch Mixing with West Branch
(atypical discharge ratio)

Juniata River Contribution

Monitoring Location
2013 turbidity CIM data did not meet “usable criteria” after review.
Discharge at Harrisburg 2012 vs. 2013
Juniata @ Newport North vs. Susquehanna @ Harrisburg West
• Total Suspended Solids
• Ammonia Dissolved as Nitrogen
• Ammonia Total as Nitrogen
• Kjeldahl Nitrogen, Dissolved
• Kjeldahl Nitrogen, Total as Nitrogen
• Nitrate & Nitrite, Total as Nitrogen
• Nitrate & Nitrite, Dissolved as Nitrogen
• Phosphorus, Total as P
• Phosphorus, Dissolved as P
• Phosphorus Ortho Dissolved
* Bay Loading Suite

- Total Suspended Solids
- Total Dissolved Solids
- Nitrogen, Total and Dissolved
- Ammonia, Total & Dissolved as N
- Nitrate & Nitrite, Total & Dis. as N
- Phosphorus, Total and Dissolved
- Phosphorus Ortho, Total & Dissolved
- Total Organic Carbon
- Hardness
- Calcium, Total
- Magnesium, Total
- Sodium
- Chloride
- Sulfate
- Barium
- Boron
- Copper, Total
- Iron, Total
- Lead, Total
- Manganese, Total
- Nickel, Total
- Strontium
- Zinc, Total
- Aluminum, Total
- Selenium
- Osmotic Pressure
- Bromide
Periphyton (Algal/Diatom) Sampling
Periphyton (Algal/Diatom) Sampling

Very good indicator of nutrient inputs and associated in-stream production.

Algae and diatoms have the ability to luxury uptake and store nutrients for later use. This can characterize nutrient loading over a period of time more efficiently than standard water chemistry grab samples.
Total Chlorophyll in Large Rivers Systems: Preliminary 2012 TMDL Periphyton Sampling Results

Total Chlorophyll (average +/- one Std error)

Slide by Hunter Carrick, Dept. of Biology
Central Michigan University
Algal Composition in Large Rivers Systems:
Preliminary 2012 TMDL Periphyton Sampling Results

Algal Group % Biovolume

- Cyanophyta (Bluegreen Algae)
- Chlorophyta (Soft Algae)
- Bacillariophyta (Diatoms)

**Cladophora glometata**
Filamentous green alga
Grows under high nutrients
Modifies benthic habitat

**Coleochaete sp.**
Parenchymous green alga
Grows under high nutrients
Modifies benthic habitat

**Homeothrix janthina**
Filamentous bluegreen alga
Grows under low nutrients
Modifies benthic habitat

Slide by Hunter Carrick,
Dept. of Biology
Central Michigan University
Benthic Macroinvertebrates

2012 Sampled Core Locations = 7 sites

2013 Sampled Many More Locations = approx. 37 sites
2012 Preliminary Macroinvertebrate Results

![Graph showing IBI*, Richness, and Mod. May. values for different locations.]

**Sus. Hbg. West**

**Sus. Hbg. Mid.**

**Sus. Hbg. East**

**Jun. Newport South**

**Jun. Newport North**

**Delaware West**

**Delaware East**

*IBI*:
- Sus. Hbg. West: 60
- Sus. Hbg. Mid.: 70
- Jun. Newport South: 60
- Jun. Newport North: 50
- Delaware West: 50
- Delaware East: 40

Richness:
- Sus. Hbg. West: 20
- Sus. Hbg. Mid.: 25
- Sus. Hbg. East: 25
- Jun. Newport South: 30
- Jun. Newport North: 20
- Delaware West: 20
- Delaware East: 15

Mod. May.:
- Sus. Hbg. West: 35
- Sus. Hbg. Mid.: 30
- Sus. Hbg. East: 30
- Jun. Newport South: 25
- Jun. Newport North: 20
- Delaware West: 20
- Delaware East: 15
# Mussel Surveys

## Susquehanna River

1. Wilkes-Barre 2012
2. Danville 2012
3. Sunbury 2013 – 3 Sites (1 zebra mussel found)
4. Liverpool 2012
5. Harrisburg 2013 – 3 Sites
6. Goldsboro 2012

## West Branch Susquehanna River

1. Jersey Shore 2013 – 2 Sites
2. Williamsport 2012
3. Lewisburg 2013 – 2 Sites (Young Elliptio Complanata found, Possible eel stocking success)

## Juniata River

1. Lewistown 2013 – 2 Sites
2. Newport 2013 – 2 Sites
## Current Advisories – Susquehanna River

<table>
<thead>
<tr>
<th>Location</th>
<th>Advisory Details</th>
<th>Advised Consumption</th>
<th>Contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susquehanna River (Susquehanna Co.)</td>
<td>Entire section in PA from the NY border above Starrucca Creek to the NY border below Great Bend</td>
<td>2 meals/month</td>
<td>Mercury</td>
</tr>
<tr>
<td>Susquehanna River (Bradford and Wyoming Co.)</td>
<td>NY border above Sayre to PA Route 92 bridge at Falls</td>
<td>1 meal/month</td>
<td>Mercury</td>
</tr>
<tr>
<td>Susquehanna River (Wyoming, Lackawanna, Luzerne, Columbia, Northumberland, and Montour Co.)</td>
<td>PA Route 92 bridge at Falls to confluence with West Branch</td>
<td>2 meals/month</td>
<td>Mercury</td>
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</table>

- Smallmouth bass
- Walleye
- Channel catfish
- All suckers
- Channel catfish
- Quillback
- Carp
- Walleye
- Do Not Eat
- PCB
- Mercury
- Mercury
- PCB
# Routine Fish Tissue

## Changes for 2014 – Susquehanna River

<table>
<thead>
<tr>
<th>Section Description</th>
<th>Fish Species</th>
<th>Meals Per Month</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire section in PA from the NY border above Starrucca Creek to the NY border below Great Bend</td>
<td>Smallmouth bass, Fallfish</td>
<td>2</td>
<td>Mercury</td>
</tr>
<tr>
<td>NY border above Sayre to PA Route 92 bridge at Falls</td>
<td>Walleye, Smallmouth bass</td>
<td>1</td>
<td>Mercury</td>
</tr>
<tr>
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<td>Smallmouth bass</td>
<td>2</td>
<td>Mercury</td>
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<tr>
<td>PA Route 92 bridge at Falls to confluence with West Branch</td>
<td>All suckers</td>
<td>Do Not Eat</td>
<td>PCB</td>
</tr>
<tr>
<td>West Branch to PA/MD border</td>
<td>Channel catfish over 20”</td>
<td>1</td>
<td>PCB</td>
</tr>
</tbody>
</table>

**Susquehanna River (Susquehanna Co.)**

**Susquehanna River (Bradford and Wyoming Co.)**

**Susquehanna River (Wyoming, Lackawanna, Luzerne, Columbia, Northumberland, and Montour Co.)**

**Susquehanna River (Snyder, Northumberland, Juniata, Perry, Dauphin, Cumberland, York, and Lancaster Co.)**
## Routine Fish Tissue

### Changes for 2014 – Susquehanna River

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<td>Do Not Eat</td>
<td>PCB</td>
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<td></td>
<td>Walleye</td>
<td></td>
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## Routine Fish Tissue

### Current Advisories – West Branch Susquehanna River

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<tr>
<th>West Branch Susquehanna River (Clinton, Lycoming, Union and Northumberland Co.)</th>
<th>Bald Eagle Creek to I-80 bridge</th>
<th>Channel catfish</th>
<th>1 meal/month</th>
<th>PCB</th>
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**No Changes for 2014**
2013
Susquehanna River Fish Surveys
Methodologies

Wadeable

Nonwadeable
Fish Health Assessment

- Adapted from various Federal/State DELT assessments and USGS fish health protocol
- Designed to make a semi-quantitative assessment of fish health at a given location
- Incorporates an “observational” approach to fish health
- Potential data will be a many-to-one approach
- Still in developmental stages
Necrotic Tissue
Fungal Infection
Deformity
Many-to-One Relationships
(still evolving... but can keep evolving)

Black Grubs
Deformities
Fungal Infection
Leeches
Melanistic Areas
Eye Cloudy
Eroded Fins
Exophthalmic Eye
Eroded Gills
White Spots
Open Sores
Emaciated
White Cyst

deformity
eroded fin
lesion
tumor
parasite
Susquehanna River Monitoring and Assessment YouTube video:
http://www.youtube.com/watch?v=oYYS7Ok0eag

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Questions?