Assessing Aquatic Life Use Support on a Great River

Peter Tennant, Erich Emery, Jason Heath, Eben Hobbins
OHIO RIVER/ BASIN FACTS

- 20 dams and 49 power-generating facilities
- 230 million tons of cargo transported annually
- 981 Miles long from Pittsburgh, PA, to Cairo, IL
- Drainage basin covers 204,000 sq. miles in 14 states
- Basin home to 25+ million people
- Drinking water for 3 million people
- 120+ species of fish live in the Ohio River
THE OHIO RIVER

Beaver Falls, PA

Greenup, KY
ABOUT ORSANCO

- Interstate Compact agency
- 3 Commissioners per state plus 3 federal
States have assigned responsibility for monitoring the Ohio River to ORSANCO.
ORSANCO prepares 305(b) assessment for the Ohio.
ORSANCO activities are overseen by work groups of state and federal agency personnel.
Support of four uses assessed

- Public Water Supply
- Contact Recreation
- Fish Consumption
- Aquatic Life Habitat

Methodology for first three uses relatively consistent; Aquatic Life assessment has evolved over time.
AQUATIC LIFE ASSESSMENT

  + Impairments due to low dissolved oxygen, high metals concentrations.
- 1992-2000: Development of fish-based biological criteria
Critical Steps
- Selecting Method
- Building Database
- Defining Reference (least impacted) Condition

Developing Index
- Testing & Calibration
- Setting Expectations (predictive model)
  - Removing natural variability – *(signal –vs- noise)*

Defining Assessment Units
- River reach; pool; segment; local; area targeted for specific restoration activity

Determining number of sites needed to make assessment

Developing strategy for determining when/where impairment exists (or how to mark significant improvements following restoration)

Define corrective actions necessary to improve condition
- CWA Process
- Restoration Process
BWQSC RECOMMENDATION

2006 Pool Assessments

- 90% CI
- % Fail

Assessed as Passing

Unassessed: Too few sites

- Montgomery 2/15: 0.0%
- Willow Island 0/15: 0.0%
- Greenup 3/15: 3.0%
- Cannelton 3/11: 5.2%
Seven Miles listed as Not Supporting
Impairment based on ORFIn scores
2004 - 16 mi. impaired; 2002 - 7 mi. impaired

- Very few chemical criteria violations.
- Impairments based on biological – ORFin.
- ORFin used in a highly conservative manner – impairment required multiple negative scores.
- States indicated some concern for TMDL-listings based on ORFin data.
### 2006 ASSESSMENT

<table>
<thead>
<tr>
<th>State</th>
<th>River Miles</th>
<th>Aquatic Life Impairments</th>
<th>Public Water Supply Impairments</th>
<th>Contact Recreation Impairments</th>
<th>Fish Consumption Impairments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>0-40.2</td>
<td>0</td>
<td>0</td>
<td>40.2</td>
<td>40.2</td>
</tr>
<tr>
<td>OH-WV</td>
<td>40.2-317.1</td>
<td>0</td>
<td>0</td>
<td>88.8</td>
<td>276.9</td>
</tr>
<tr>
<td>OH-KY</td>
<td>317.1-491.1</td>
<td>0</td>
<td>0</td>
<td>41</td>
<td>174</td>
</tr>
<tr>
<td>IN-KY</td>
<td>491.1-848.0</td>
<td>0</td>
<td>0</td>
<td>277</td>
<td>356.9</td>
</tr>
<tr>
<td>IN-IL</td>
<td>848.0-981.0</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0</td>
<td>0</td>
<td>475</td>
<td>981</td>
</tr>
</tbody>
</table>

Executive Summary Table (pg. 5)
AQUATIC LIFE
2008 ASSESSMENT

- 72 miles assessed as Impaired due to High Temperatures
- 70 miles assessed as impaired due to low Dissolved Oxygen
Biological data indicates impairment for Dashields & Montgomery pools based on recommendation of the Biological Subcommittee.

Dissolved Oxygen data at Cannelton >10% exceedance indicates impairment.

States’ Iron criteria >10% exceedance at 12 of 19 water quality monitoring stations.
  PA – 1500 ug/L  
  WV – 1500 ug/L  
  KY – 3500 ug/L  
  IN – 2490 ug/L

- ORSANCO has no criterion.

- Inconsistencies could not be resolved; assessment will not make conclusions on aquatic life use support.
INTEGRATED ASSESSMENT OBJECTIVES

- Provide data for evaluating water quality monitoring results from fixed stations
- Begin integration of water quality and biological monitoring
WATER QUALITY/BIOLOGICAL INTEGRATION

- Provide chemical data to support results of biological surveys
WILLOW ISLAND POOL

- 35 miles long
- New Martinsville, WV to St. Marys, WV
- No major tributary inputs.
- Industrial complexes at upstream and downstream ends of pool.
PRELIMINARY ASSESSMENT
WILLOW ISLAND POOL

- All fish sites passed ORFin criteria with fair to excellent scores
- No violations of Water Quality Criteria were found
Total Phosphorus- highly variable concentrations across pool

Integrated Assessment Project
Willow Island Pool Survey September 1, 2005
Total Phosphorus (mg/L) Lockwall and Cross-section Results
Total Phosphorus- lateral tributary influence

Integrated Assessment Project
Mississippi to Smithland L&D Survey Sept 16, 2009
Total Phosphorus(mg/L) Lockwall, Cross-section and Tributary Results

<table>
<thead>
<tr>
<th>Location</th>
<th>Right Bank</th>
<th>Center</th>
<th>Left Bank</th>
<th>Tribs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smithland L&amp;D Lockwall Sample</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L&amp;D 52 Lockwall Sample</td>
<td>0.10</td>
<td>0.12</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Olmstead L&amp;D Lockwall Sample</td>
<td></td>
<td>0.04</td>
<td>0.06</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Total Phosphorus (mg/L)

- Tennessee River Sample
- Cumberland River Sample

Ohio River Mile

918.5 926.2 935.6 950.4 965.3
Dissolved Aluminum – lateral tributary influence

Integrated Assessment Project
Mississippi to Smithland L&D Survey May 19, 2009
Dissolved Aluminum (ug/L) Lockwall, Cross-section, and Tributary Results

- Smithland L&D Lockwall Sample
- L&D 52 Lockwall Sample
- Olmstead L&D Lockwall Sample

Dissolved Al (ug/L)

Tennessee River Sample
Cumberland River Sample

Ohio River Mile
Lockwall Right Bank Center Left Bank Tribs

918.5 926.2 935.6 950.4 965.3
OBSERVATIONS

- Single point sample appears to represent water quality conditions in pools without major tributary inputs.
- Biological criteria do not appear to respond to occasional water quality perturbations.
- Biological criteria respond to habitat, hydrologic conditions.
- Additional pool surveys are needed to draw conclusions.