Concurrent Sessions C: Tracking and Evaluating Passage - Downstream Passage Tracking of Post-Spawning American Shad at The York Haven Hydroelectric Project, Susquehanna River, PA

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Sears, Michael; Arnold, Stephen; and Royer, Doug, "Concurrent Sessions C: Tracking and Evaluating Passage - Downstream Passage Tracking of Post-Spawning American Shad at 'The York Haven Hydroelectric Project, Susquehanna River, PA'" (2013). International Conference on Engineering and Ecohydrology for Fish Passage. 32.
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York Haven Hydroelectric Project
2012 American Shad Radio Telemetry Study

Study conducted by HDR and Normandeau for York Haven Power Company, LLC

Michael Sears, Stephen Arnold, Doug Royer
Background- Project Location

York Haven Project located on Susquehanna River in Pennsylvania.

4th dam on lower river

Currently in FERC relicensing process.

Historic American shad runs – 2 million shad

American shad passage improvement - primary relicensing objective of resource managers
Background - Previous Studies

Three decades of American shad passage studies

Upstream vertical slot fishway built in 2000

2010 upstream passage telemetry study performed (Fish Passage 2012)
  - Led to decision to improve upstream passage with a new nature-like fishway.

2012 Study focus changed to downstream passage of post-spawning American shad
Study Goals

Evaluate the effectiveness of current facilities and operations for downstream passage

Evaluate downstream passage route utilization and migration timing (e.g., time of day, flow, temperature, etc.)

Evaluate the success of migration downstream past the Project
Spillage Over Dam In Spring

Powerhouse hydraulic capacity of 17,000 cfs

May spillage 90% of time

June spillage 55% of Time
Sluice Gate in Powerhouse Forebay

Opened to provide passage for shad that do not pass over the dam spillway
Methodology
Methodology- Shad Capture and Tagging

Upstream migrating adult American shad collected at the Conowingo Dam and radio-tagged

Coded radio tag properties - gastric implantation

- 48 mm length
- 2 second burst rate
- Operational life of 172 days
- Each tag propagated a unique code
- Two radio frequencies
Methodology - Transport and Release

Tagged shad transported 60 miles upstream
Released in Harrisburg at City Island
Approximately 15 miles upstream of York Haven
Methodology – Two Release Dates

Total 64 American shad tagged and released:
- 32 released on April 26, 2012
- 32 released on May 23, 2012

Shad description:
- 36 females
- 28 males
- total length between 381 mm to 500 mm
April 26, 2012 Release Date
- Water temperature at Conowingo 17°C
- Water temperature at City Island 14°C
- Max. river flow 46,800 cfs

May 23, 2012 Release Date
- Water temperature at Conowingo 19°C
- Water temperature at City Island 18°C
- Max. river flow 38,900 cfs
Methodology - Receivers

Receivers positioned to monitor downstream passage at:
- Powerhouse turbines
- Forebay sluiceway
- Spillways (Main Channel, East Channel)

Check station placed in the main channel below York Haven at Haldeman Island to monitor continued downstream migration

Bi-weekly data downloads

Weekly data analysis and summary
Figure 1. Remote Monitoring Stations 1, 2, 3, and 7 in the vicinity of the York Haven Powerhouse for the 2012 American shad emigration study.
Methodology - Monitoring Station East Channel

Figure 2. Remote Monitoring Station No. 4 located below the East Channel Dam for the 2012 York Haven American shad migration study.
Methodology- Monitoring Stations Below Dam

Figure 3. Remote Monitoring Station Nos. 5 and 6 on Brunner Island monitoring the area immediately upstream of Haldeman Island for the 2012 York Haven American shad emigration study.
Methodology- Mobile Tracking

Conducted to determine presence of shad not detected at remote stations
  Upstream on June 3-4 and July 12-13
  Downstream on July 20th, between Project and Haldeman Island

Regular monitoring of forebay
  Sluiceway gate opened when shad detected in forebay
Results
Results - Flows

Flows ranged from approximately 100,000 to 5,800 cfs between April 26 and August 2.

Higher than average flows in most of May, and 1st half of June.

Lower than average flows in 2nd half of June and most of July.

Spill occurred over Main Dam from April 26 through June 20.
Results - Flows

USGS 01570500 Susquehanna River at Harrisburg, PA

Discharge, cubic feet per second


- Provisional Data Subject to Revision -

△ Median daily statistic (121 years)  ★ Measured discharge

Discharge
Results – Passage & Timing

92.2% (59 of 64) shad released were detected at the Project

Most moved downstream soon after release

96.6% (57 of 59 shad) passed downstream at flows exceeding Project’s turbine capacity (17,000 cfs)

Most passage occurred at river flows between 30,000 and 50,000 cfs

- Downstream movement strongly correlated with release date - water temperature and flow triggers not evident
Results - Passage Timing, Flow, & Temp

Release Dates: April 26 and May 23

<table>
<thead>
<tr>
<th>Time of Passage</th>
<th>Daily Max Flow (cfs)</th>
<th>Hydraulic Capacity (cfs)</th>
<th>Temperature (°C)</th>
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<td>120,000</td>
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<td>10.0</td>
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</tbody>
</table>

Flow (cfs): Daily Max Flow, Hydraulic Capacity; Temperature (°C):
Results – Passage Routes

59 Shad Arrived at York Haven

<table>
<thead>
<tr>
<th>Downstream Passage Route</th>
<th>Number of Shad</th>
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</thead>
<tbody>
<tr>
<td>Main Dam Spillway</td>
<td>30</td>
</tr>
<tr>
<td>Turbines</td>
<td>15</td>
</tr>
<tr>
<td>Sluice Gate</td>
<td>13</td>
</tr>
<tr>
<td>East Channel</td>
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</tbody>
</table>

1 (1.7%)
Results – Mobile Tracking and Passage Survival

Two tags detected as stationary upstream during mobile tracking – mortality or regurgitation?

Three tags never located after release – predation?

83.1% of the 59 shad that reached the Project continued downstream alive past Haldeman Island

One shad was detected below Project and was moving but never passed Haldeman Island – considered a survivor.

Conservative estimate of survival is 85%
Conclusions

Fall-back behavior apparent (tagging or transport?)

75% of shad passed downstream through preferred passage routes (non-turbines)

Good response to sluice gate openings (10 of 17 passed immediately, 13 of 17 total)

Overall downstream passage survival likely > 85%
   Consistent with desktop model estimating total Project downstream survival
QUESTIONS?