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Can we attract lake sturgeon to a fishway?

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Can We Attract Sturgeon to a Fishway?

Efficacy of Attraction Flows

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Fish Passage Conference
Madison 2014
Special Thanks to the Partners!

- James Fossum, Denny Caneff – River Alliance of Wisconsin
- Michael Donofrio – Wisconsin Department of Natural Resources
- Jessica Mistak, Kyle Kruger – Michigan Department of Natural Resources
- Todd Jastremski – WE Energies
- Rick Loeffler, Rory Alsberg – Eagle Creek Renewable Energy
- Robert Elliott, Kevin Mann, Tim Strakosh – U.S. Fish and Wildlife Service
Current Lake Sturgeon Population

- **Why is the Menominee River important to the sturgeon in Lake Michigan?**
  - Major tributary to Lake Michigan and historically one of the Lake’s larger spawning and rearing areas.
  - Nearly half of the sturgeon currently in Lake Michigan attempt to spawn below the lower most dam on the Menominee River.
  - The sections of the Menominee River upstream on the dams contain large populations of sturgeon.
Benefits of Sturgeon Passage on the Menominee River

- **Currently Available**
  - 2.75 miles of river
  - Approx. 240 acres of habitat
  - Currently produces few fish

- **Passage at lower two dams**
  - Would open 21 miles of river
  - Approx. 1,700 acres of habitat

- **Passage throughout historical range**
  - Would open 87 miles of river
  - Approx. 5,000 acres of habitat
How do we get Sturgeon Upstream?

- Passage facilities have typically been developed for “athletic” fish (e.g., fish ladders for salmon).

- Fish ladders have not been effective for sturgeon.

- Trap and Transport Facilities (e.g., Fish Elevators) may be a good alternative for “non-athletic” fish, such as lake sturgeon.

- How well can we attract and trap sturgeon?
Research and Planning

• We conducted two studies to evaluate how well we can attract and trap lake sturgeon below dams on the Menominee River.

• Study #1: Evaluate sturgeon attraction to different flow rates delivered into an empty turbine flume. Observe number of sturgeon entering turbine flume based on flow rate.

• Study #2: Evaluate a prototype fishway entrance channel using attraction flow from a hydroelectric powerhouse. Quantify sturgeon attracted into a prototype fishway channel and see how long we can hold them with different trap configurations.
Study Locations

Menominee River

Study 1

Study 2

Madison
Attraction Flow Study #1
Menominee Dam Turbine Flume Testing

Active Turbine Flumes
Empty Flumes Used for Study
Attraction Flow Study #1: Methods

- Siphon tubes constructed to deliver flow into an empty turbine flume.
  - Three siphon tubes constructed
  - Each tube approximately 15 cfs

- Underwater lights and cameras used to count sturgeon present at different flows.
  - Four flows tested: 0, 15, 30, and 45 cfs
  - Sturgeon were observed in cameras and counted for each test flow.
Attraction Flow Study #1: Results

2008
- Powerhouse at Full Capacity: 2700 cfs
- 15.5°C

2010
- Powerhouse at Half Capacity: 1200 cfs
- 19.0°C

Number of Sturgeon Observed per Minute

Attraction Flow (cubic feet per second)
Non-sturgeon fishes (such as bass, crappie, and walleye) were abundant at low flows but decreased as flows increased.

Sturgeon observations increased with flow.

Sturgeon were absent at no flow.

Hundreds of sturgeon entered the flume within minutes of flow delivery.

As flow increased, the number of sturgeon increased.

When flows were shut off, sturgeon left the turbine flume quickly.
Attraction Flow Study #2
White Rapids Dam
Prototype Fishway Channel
Study 2

Project Location

Menominee River
Madison

Michigan

Sturgeon Falls Dam
River km = 132.5

Menominee Co

N

Madison
Fishway Channel deployed 50 feet downstream of White Rapids Dam Powerhouse.

Attraction flow provided by Turbine Unit #1.
Fishway Channel Dimensions

Antenna 3
Camera
Adjustable Opening
Antenna 2
Antenna 1

Flow

- Antenna 3: 8 ft
- Camera: 1 - 2 fps
- Antenna 2: 6 ft
- Adjustable Opening: 5 ft
- Antenna 1: 5 ft
- Flow: 3 - 4 fps
Attraction Flow Study #2: Methods

Questions:
1. Can we attract sturgeon up into the prototype fishway channel?
2. How long can we keep these sturgeon “trapped”?

Data Collection and Evaluation:
1. Continuous PIT and video data were recorded from April – November.
   • Data collected from 2009 - 2012
   • PIT data were enumerated by year and season.

2. Video data were reviewed for each spring migration.
   • One hour segments of video were randomized.
   • 30 random daytime and 30 night segments selected for review (N=60).
   • Fish were identified and counted.

3. Two trap configuration were tested to evaluate trapping potential of lake sturgeon.
   • Traps were set to either full open or 18 inches.
Attraction Flow Study #2: Results

PIT Data

- PIT Tags Detected* by Year:
  - 2009 = 86 sturgeon (21 during spring)
  - 2010 = 112 sturgeon (41 during spring)
  - 2011 = 50 sturgeon (17 during spring)

- * Some of the detections may have been outside of the entrance structure
Attraction Flow Study #2: Results

Video Data

• Sturgeon observed in the spring of each year:
  – Spring of 2009 = 26 sturgeon
  – Spring of 2010 = 10 sturgeon
  – Spring of 2011 = 17 sturgeon

• Nearly all sturgeon observed in video samples did not have a PIT tag

• Observations were equally distributed between night and day.

• Sturgeon did not avoid the 18 inch wide trap opening.

• Non-sturgeons (such as bass, crappie, and walleye) made up a majority of the observations during the daytime.
  – Only sturgeon and suckers were observed at night.
## Attraction Flow Study #2: Results

### Trapping Data from 2012

<table>
<thead>
<tr>
<th>Condition</th>
<th>Average per Week</th>
<th>Sturgeon Detected</th>
<th>Detected Inside Trap</th>
<th>Duration in Trap (minutes)</th>
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</thead>
<tbody>
<tr>
<td>Trap Closed to 18 inches</td>
<td></td>
<td>6</td>
<td>5</td>
<td>947</td>
</tr>
<tr>
<td>Trap Open</td>
<td></td>
<td>7</td>
<td>6</td>
<td>77</td>
</tr>
</tbody>
</table>
Key Findings

• **Lake sturgeon are strongly attracted to flow.**
  – Even a modest flow in an empty turbine flume can attract hundreds of sturgeon within minutes.

• **Flow can be used to attract wild sturgeon into an artificial structure.**
  – Important criterion for trap and transport facilities (e.g., fish elevator).

• **A trap integrated into a fishway may be used to hold sturgeon for several hours.**
  – Useful concept for trap and lift facilities (e.g., fish elevator).
  – Large sturgeon do not seem to avoid an 18 inch trap opening.