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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Special Thanks to the Partners!

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- Robert Elliott, Kevin Mann, Tim Strakosh – U.S. Fish and Wildlife Service
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.
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)
Attraction Flow Study #1: Summary

- 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.
- Non-sturgeon fishes (such as bass, crappie, and walleye) were abundant at low flows but decreased as flows increased.
  - Sturgeon observations increased with flow.
Attraction Flow Study #2
White Rapids Dam
Prototype Fishway Channel
• Fishway Channel deployed 50 feet downstream of White Rapids Dam Powerhouse.

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

Flow

Antenna 3

Camera

Adjustable Opening

Antenna 2

Antenna 1

8 ft

6 ft

5 ft

10 ft

7 ft

5 ft

1 – 2 fps

3 – 4 fps

5 ft

6 ft
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

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<th>Trap Condition</th>
<th>Average per Week</th>
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<tr>
<td>Trap Closed to 18 inches</td>
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<td>Sturgeon Detected</td>
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<tr>
<td>Detected Inside Trap</td>
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<td>Duration in Trap (minutes):</td>
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<table>
<thead>
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<th>Trap Open</th>
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<tr>
<td>Detected Inside Trap</td>
<td>6</td>
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<td>Duration in Trap (minutes):</td>
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</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.
Questions?