Session B2- Building a fishway for Lake Sturgeon: Successful testing of a prototype upstream fishway on the Menomine River in Northern Wisconsin

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Building a Fishway for Sturgeon

Successful Testing of a Prototype Upstream Fishway in Northern Wisconsin

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Project Partners

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- Jim Fossum  River Alliance of Wisconsin
- Michigan Hydro Relicensing Coalition
- Todd Jastremski  WE Energies
Project Location

Menominee River
Status of Lake Sturgeon

- **State of Michigan**
  - Threatened

- **State of Wisconsin**
  - Species of Concern

- **U.S. Fish and Wildlife Service**
  - Species of Special Concern
Lake Sturgeon Decline
Lake Michigan

- **Historical abundance**
  \[ \approx 2 \text{ Million adults} \]

- **Current abundance**
  \[ \approx 3,000 \text{ adults} \]

- **< 0.002\% of the historical abundance**
Harvest (Millions of Pounds)

Year

1870 1890 1910 1930 1950 1970

Superior
Michigan
Huron
Erie
Ontario

Photo Courtesy of Saskatchewan River Sturgeon Management Board

Commercial Harvest Closed
Reason for the Decline

- **Commercial overharvest**

Combined with:
- **Habitat loss**
  - Construction of Dams
  - Destruction of spawning areas
- **Pollution effects**
  - Further hindered reproductive success
- **Protracted reproductive cycle**
  - Late maturation
  - Spawning periodicity

Photo courtesy of USFWS
Current Adult Abundance

Historical Adult Abundance ≈ 1 - 2.4 million

Current Adult Abundance ≈ 3,000
(< 0.01% of historical abundance)
Sturgeon Management Needs

1. **Improved growth and recruitment**
   - Menominee River currently has an existing population of sturgeon that can contribute significantly to the Lake Michigan population.
   - Downstream passage and protection facilities are needed to allow Menominee River sturgeon to contribute to the lake population.

2. **Access to quality spawning and juvenile rearing habitat**
   - Menominee River has available habitat upstream and between the dams within their historical spawning route.
   - Upstream passage facilities are needed to allow access to this high quality habitat.
Benefits of Sturgeon Passage

- **Currently Available**
  - 2.75 miles of river
  - 238 acres of sturgeon habitat
  - Produces few fish

- **Passage at lower two dams**
  - Will open 21 miles of river
  - 1,668 acres of sturgeon habitat

- **Passage throughout historical range**
  - Would open 87 miles
  - 4,797 acres
Can We Pass Sturgeon?

- Passage facilities typically developed for “athletic” fish such as salmon.

- Can we effectively attract and pass “non-athletic” fish like sturgeon?
Prototype Fishway Study
Upstream Fish Entrance Channel

Photo courtesy of USFWS
Prototype Fish Entrance Channel

- Designed by FWS fishway engineers
  - Simulates an actual fishway entrance
- Constructed at We Energies expense
  - Placed downstream of the powerhouse

Photo courtesy of We Energies
2009 Entrance Channel Parameters

Concrete Retaining Wall (Top View)

- Flow: 3 – 4 fps
- Antenna
- Water Line

Powerhouse (Top View)

- Flow: 3 – 4 fps
- Antenna
- Water Line

Powerhouse (Side View)

- Flow: 3 – 4 fps
- Antenna
- Water Line
PIT Tag System

- Submerged pass-through PIT tag antenna
- Multiplexing transceiver
  - Continuous data recording
    (April – October)
Video System

- Underwater cameras with infrared LED lights

- Record continuous video data during the spring spawning season
  - April 15 – May 31

- Video divided into 1-hour segments
  - Segments randomized
    - 30 random daytime and 30 night segments (N=60)
  - Fish identified and counted
    - Fish behavior and orientation also evaluated
2009 Study Layout

Concrete Retaining Wall (Top View)

Flow

Powerhouse (Top View)

Turbine Bay 1

Flow

Turbine Bay 2

Flow

Flow

PIT Antenna

Camera 1

Camera 3
2009 PIT Tag Results

- **Study period:** April 15 – October 7

- **Antenna system recorded:**
  - 86 different sturgeon
  - Each sturgeon was detected an average of 4 times
  - Sturgeon passed through antenna field quickly (≈ 3 seconds)

- **During spawning season (April 15 – June 2)**
  - 21 different sturgeon
  - Average length 44.9 inches

- **During the remainder of the year (June 3 – October 7)**
  - 75 different sturgeon
  - Average length 37.8 inches

- Approximately 20% of the tagged sturgeon were detected by the pass-through PIT tag antenna
2009 Video Results

- **Study period:** April 15 – May 31

- **Random Video Review:**
  - 26 lake sturgeon passed through the structure
    - 14 during the day and 12 during the night
    - Average time in camera view (≈ 3.5 seconds)
    - Only 3 sturgeon had PIT tags
  - 318 smallmouth bass passed through the structure
    - All during the day
  - 130 suckers, 7 carp, and 1 crappie passed through the structure
  - No fish were observed in 22 of the 60 video segments (37%)
2010 Study

- Installed an adjustable V-trap gate
  - Test opening widths of 18, 24, and 30 inches

- Installed 2 additional underwater cameras
  - 2 in the current position and 2 more upstream of the new V-trap
2010 Entrance Channel Parameters

Concrete Retaining Wall (Top View)

- Flow: 1 - 2 fps
- 15 – 32 in
- 45°
- 4.5 ft
- 5 ft
- 9 ft
- 25 ft
- 59 ft

Powerhouse (Top View)

- Flow: 3 – 4 fps
- 1 - 2 fps
- 45°
- 8 ft
- 1 - 2 fps
- 4.5 ft
- 3 – 4 fps

Powerhouse (Side View)

- Flow: 1 - 2 fps
- 3 – 4 fps
- 15 – 32 in
- 45°
- 5 ft
- 6 ft
- 5 ft
- 4.5 ft
- Water Line
- Antenna
Study Layout Comparison

Powerhouse (Top View) 2009

Flow
Camera 2
Camera 3
PIT Antenna

Powerhouse (Top View) 2010

Flow
Camera 2
Camera 4
Adjustable V-gate

Camera 1
Camera 3
PIT Antenna
2010 PIT Tag Results

- **Study period**: April 1 – October 18

- **Antenna system recorded**:
  - 112 different sturgeon
  - Each sturgeon was detected an average of 5 times
  - Sturgeon passed through antenna field quickly (≈ 3 seconds)

- **During spawning season (April 1 – May 31)**
  - 41 different sturgeon
  - Average length 41.2 inches

- **During the remainder of the sample period (June 1 – October 18)**
  - 72 different sturgeon
  - Average length 31.7 inches

- Approximately 24% of the tagged sturgeon were detected by the pass-through PIT tag antenna
2010 Video Results

- **Study period:** April 15 – May 15

- **Random Video Review:**
  - 10 lake sturgeon passed through the structure
    - 5 during the day and 5 during the night
    - Average time in camera view (1 - 3 seconds)
    - None of these sturgeon had PIT tags
  
  - 290 smallmouth bass passed through the structure
    - Mostly during the day
  
  - 4 suckers and 1 walleye passed through the structure
  
  - No fish were observed in 25 of the 60 video samples (42%)
2011 Preliminary Data

- **Study period:** April 15 – June 3

- **Antenna system recorded:**
  - 21 different sturgeon

- **Video data for the Spring spawn is currently being reviewed**

- **Will review PIT tag and video data for the Autumn migration (September 1 – October 31)**
Wild sturgeon can be attracted into an artificial structure
   - This effectively simulates the hardest part of fish passage

Nearly 20% of the tagged sturgeon population were detected by the pass-through PIT tag antenna

Sturgeon moved through antenna and past cameras quickly (≈ 3 seconds) and multiple times

Larger sturgeon were detected during the spring spawning period
   - On average 10 inches larger than during the post spawn period

Video data from 2010 and 2011 suggests sturgeon will move through a narrow V-trap opening
   - Important concept for trap and lift facilities
Questions?