Where There’s a Will but Not a Way: Behavior of American Shad Approaching the Brunswick Dam Fishway on the Androscoggin River, Maine

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American Shad
Life History & Migration

- Iteroparous species
- Migrate in spring
- Migration driven by environmental conditions
  - Flow
  - Temperature
  - Prey / predators

Sea Grant Maine
Barriers to Migration

- Fishways intended to mitigate obstruction
- Essential to have information on fish behavior approaching variable flows
Androscoggin River

- Historic abundant diadromous fish populations
- 235,000 adult shad returns per year
- 1930s – sea-run fisheries decimated
Brunswick Dam

- Constructed in 1982
- Tidal influence
- FERC re-licensing 2024
Brunswick Dam Fishway

- Vertical slot
- 173 m long
- 42 pools (one switchback)
- 20 cm slot
- 2.8 m$^3$·s$^{-1}$ attraction flow
Brunswick Dam Fishway
American Shad Passage Counts

Year

Number of American Shad
Objective

Describe the behavior of migrating American Shad approaching the Brunswick Dam and using the fishway

Data

I. Video observation & turbine operation (approaching dam)
II. Telemetry study (using fishway)
Visual Confirmation
Are Shad in the River?

- Continuous recordings from 0600 – 1800 h
- Reviewed first 3 min. of every 10 min. video segment
- Total counts were recorded
Video Recorded
Observations

Entrance Pool 1
Pool 6
Entrance & Exit P 23
Video Observations
American Shad Counts
Turbine Operation and Shad Behavior
Most Frequent Turbine Operation Configuration

4 configurations
90%

1 2 3

Turbine Unit

X X X

X X X

X X X

X X X
Shad Observed in the River under Different Turbine Operations

$\alpha = 0.05$
$KW = 28.82$
$p < 0.05$
Shad Observed in the River under Different Turbine Operations

Shad are Less Attracted to Fishway when Unit 1 is Operating
Telemetry Study

- 2002 – 2005 shad angled below dam
- Received internal gastric tags
- Characterize movement and behavior of Shad approaching and using the fishway
Telemetry Antennas
Telemetry Antennas (2005)
### Telemetry Results

#### Tagged Fish by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Tagged Fish</th>
</tr>
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<tbody>
<tr>
<td>2002</td>
<td>10</td>
</tr>
<tr>
<td>2003</td>
<td>10</td>
</tr>
<tr>
<td>2004</td>
<td>20</td>
</tr>
<tr>
<td>2005</td>
<td>20</td>
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- **Stayed in River or Not Detected**: 76%
- **Approached Fishway**: 13%
- **Used Fishway**: 11%

- **Legend**:
  - Stayed in River or Not Detected
  - Approached Fishway
  - Used Fishway
Telemetry Results

Year: 2003
Fish 97
3 day period
Mean Temp: 18.9°C
Telemetry Results

Year: 2005
Fish 140
4 day period
Mean Temp: 18.4°C
Summary of Video and Telemetry Studies

- American Shad are in the river!

- Hydropower operations influence ability to locate the fishway

- Movement observations restricted to river and lower fishway, no movement observed in elevated sections
Take-Away Messages

- Brunswick dam fishway does not attract or pass American Shad well (design originally meant for salmon)

- Conditions and fish passage have stayed the same (32 shad in 2018)

- FERC re-licensing in 2024 (inform future studies)