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Session C7: An Evaluation of Eel Ladders as Traps for Migrating Sea Lampreys

Ulrich Reinhardt  
*Eastern Michigan University*

Peter J. Hrodey  
*U.S. Fish and Wildlife Service*

Scott Miehls  
*U.S. Geological Survey*

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An Evaluation of Eel Ladders as Traps for Migrating Sea Lampreys

Ulrich Reinhardt  Eastern Michigan University
Peter J. Hrodey  U.S. Fish and Wildlife Service
Scott Miehls  U.S. Geological Survey
My Objectives Today

1. Introduce eel ladders as a tool for trapping or passage of lampreys

2. Discuss possible causes and consequences of trapping bias
1. Both are passive: fish have to encounter them, get motivated to try entry, and be able/willing to complete entry/passage
Quick Background Info

A previous lab project found:

- Adult sea lampreys readily pass over eel-ladder-style ramps with limited flow (ELST)

A.k.a. “Studded Tiles”
Standard Funnel Trap used in the U.S.

Used for adult **population assessment** (mark-recapture estimate) and supply of **specimens** for research.

- Both assume **unbiased capture**
Research Objectives

- Evaluate ELST under field conditions. Compare efficiency with funnel traps, check for trapping bias, evaluate role of attraction flow rates. Analyze behavior via PIT tags and video.

Results & Discussion

Catch and Retention ELST vs Funnel:

<table>
<thead>
<tr>
<th>Location</th>
<th>Ocqueoc</th>
<th>Cheboygan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch 2012</td>
<td>31% in ELST</td>
<td>64 % in ELST</td>
</tr>
<tr>
<td>Catch 2013</td>
<td>31% in ELST</td>
<td>71% in ELST</td>
</tr>
<tr>
<td>24hr Retention</td>
<td>100% in both</td>
<td>100% ELST, 0-5% Funnel</td>
</tr>
</tbody>
</table>

Field trials
• ELST can catch lamprey
• Performance is site specific
• Passage success is variable
• 100% retention
• No by-catch
• Do they catch a different type of lamprey?

Total catch in 2 years:
13,000 in Ocqueoc River and 10,000 in the Cheboygan River. Catch fluctuates daily.

Discussion: ELST is a viable alternative to the Funnel trap. Perfect retention and species selectivity. Tweaking of parameters (angle, flow, etc.) should improve catch rate further.
Success Rate of Lamprey climb on the ELST varies greatly from year-year and site-site.

Discussion: Observation suggests that abortion of entry attempts is largely voluntary. Motivation of lamprey to finish climb seems to
Results & Discussion

Sex Ratio in the Catch: females dominate catch by ELST in one river

Discussion: Reason for the sex skew is a mystery to us. Effect of sex-biased entry in trap or escape from
Results & Discussion

Only in the Cheboygan River: ELST caught fish are smaller (5-15% less weight) and have lower female maturity level (6% lower GSI)

Discussion: Size bias in the catch suggests lower motivation and/or lower ability of heavier individuals to climb the ELST ramp.
ELST-caught fish return at significantly higher proportion to the ELST. Funnel-caught fish showed only small increase (mean: +1.5% change).

<table>
<thead>
<tr>
<th>Location/Year</th>
<th>Initial catch in ELST</th>
<th>Change in catch ratio after mark-recapture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oc/2012</td>
<td>31%</td>
<td>+10%</td>
</tr>
<tr>
<td>Oc/2013</td>
<td>31%</td>
<td>+14%</td>
</tr>
<tr>
<td>Ch/2012</td>
<td>64%</td>
<td>+12%</td>
</tr>
<tr>
<td>Ch/2013</td>
<td>71%</td>
<td>+7%</td>
</tr>
</tbody>
</table>

Discussion: ELST-caught fish appear to become “trap-happy”. Mechanism could be memory of ELST (learned preference) or result of ELST-preferring behavioral type being enriched in the initial sample.
How Can Trap Happiness Arise from Animal Personality?

- Analogy: Imagine trapping people in Groningen for population size assessment ...

Example result:
Initial catch distribution: 35% church vs. 65% train station
Recapture of church-marked folks: 45% church vs. 55% train station: Trap Happiness

Possible reason for apparent trap happiness: people who live in the neighborhood
Summary and Conclusions:

- **Specific to Lamprey Management:**
  - Modified eel ladders are viable for trapping/passage.
  - Gains in catch/passage may come from increasing **motivation** of lampreys to use the ladder.

- **General consequences of trap bias**
  - Traps yield a biased sample of the population.
    - Catch bias of the sort we found could cause:
      - Lower fecundity in the fish that passed upstream.
      - Selective pressures.
      - Wrong conclusions about the population (e.g. in CMR population estimates or sex ratio estimates).
Take-home Message

Don’t assume you can catch a representative sample.

ureinhard@emich.edu
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- Great Lakes Fisheries Commission