Survival of larval lamprey to electrofishing, suction dredging, anesthesia, and handling in the PNW

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Lamprey in the Pacific NW

- Historically abundant throughout the NW, but have been in decline for several decades.

- Strong cultural significance:
  - Yakima, Umatilla, Nez Perce, and Warm Springs nations initiated restoration and conservation movement.

- Good indicators of ecosystem health and can compose a large portion of an ecosystem’s biomass.

- Larvae are important filter feeders and spawned out adults provide essential nutrients back to the system.
Life cycle

- Resembles that of anadromous salmon, but with specific key differences;
  - Ammocoete (larval stage)
  - Macropthalmia (smolt stage)
  - Adult
- Many studies focus on the adult stage with limited attention on the larval life stage.
Techniques

Backpack Electrofishing

- AbP-2 electrofisher, ETS electrofishing
- Specifically designed for larval e-fishing.
- 2 settings: tickle and stun:
  - 3:1 pulse pattern @125 volts and 25% duty cycle
  - Standard pulse of 30 pulses/sec @125 volts and 25% duty cycle
Techniques

Deepwater Electrofishing and Suction Dredging

• The bell of the deepwater electrofisher is lowered from a boat to the river bottom.

• Settings are similar to that of the AbP-2 electrofisher’s tickle setting, with no stun setting.

• 1 min electricity, 2 mins suction.
Objectives

- As research efforts increase, concern has been given to the effects of sampling and handling on the larval life stage.
  - What is the survival rate of fish after they are subjected to deepwater or backpack electrofishing at 96hrs?
  - Does hematocrit respond to e-fishing? If so, will levels differ among treatments?
What is hematocrit?

- Blood hematocrit is the ratio of the volume occupied by red blood cells to the total volume of the whole blood after centrifugation.

- AKA “packed cell volume” (PCV).
How do we get Hematocrit?

- Blood is drawn from the caudal artery into heparinized hematocrit tubes until filled and are sealed with wax.
- Tubes are placed in centrifuge and spun for 5 mins.
Treatments

• ECNFH Population – Not e-fished, not stressed (control)

• Backpack e-fisher w/ anesthesia

• Deepwater e-fisher/suction dredged w/ no anesthesia

• Deepwater e-fisher/suction dredged w/ anesthesia

✓ = hematocrit samples taken

  All treatments consisted of a 96 hr survival holding period
Methods – ECNFH control

- Lamprey were separated from holding tanks at random (n= 27).
- 17 larvae were bled for hematocrit samples.
- 10 were transported to CRFPO and held for survival trials.
Methods – Backpack e-fisher

• Collected in N. Fork of Eagle Creek, Estacada, OR using typical e-fisher protocol & settings
  • Group 1: n=15 anesthetized using MS-222 and length was measured.
  • Group 2: n=15 placed directly into transport bucket, no anesthesia.
• All (n=30) were transported to CRFPO for survival trials.
Methods – Deepwater e-fisher

- Collected at the Wind River using usual deepwater e-fisher protocol & settings
  - Group 1: n=15 anesthetized using MS-222, length was measured.
  - Group 2: n=15 placed directly into transport bucket, no anesthesia.
  - Group 3: n=15 bled for hematocrit at time 0, 10, and 30 min after capture.
- Groups 1 & 2: (n=30) transported to CRFPO for survival trials.
Methods – Survival holding configuration

- Fish were held in treatment specific totes containing 2-3 rocks, and aerated with bubblers.
- Totes were placed inside an iced cooler for water temperature control.
- Ambient temperature was regulated at approx. 11°C.
- Daily observation for 96 hrs.
Results - survival

- Survival trials concluded at 96 hrs.
- Daily observations indicated healthy fish.

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>% survival</th>
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<tbody>
<tr>
<td>ECNFH Control</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>N. Fork Eagle creek MS</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>N. Fork Eagle creek no MS</td>
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<td>100</td>
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<tr>
<td>Wind River MS</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>Wind River no MS</td>
<td>15</td>
<td>100</td>
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</tbody>
</table>
Results - hematocrit

- Shapiro Wilk’s test: sample sizes are normally distributed.
- ANOVA: No significant difference among hematocrit means.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Average % hema.</th>
<th>Variance</th>
<th>SE</th>
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<tbody>
<tr>
<td>ECNFH Control</td>
<td>16</td>
<td>23.50</td>
<td>9.07</td>
<td>0.75</td>
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<tr>
<td>Deepwater, Time 0</td>
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<td>21.68</td>
<td>11.21</td>
<td>1.50</td>
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<td>Deepwater, Time 10</td>
<td>5</td>
<td>21.00</td>
<td>53.50</td>
<td>3.27</td>
</tr>
<tr>
<td>Deepwater, Time 30</td>
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<td>25.20</td>
<td>73.70</td>
<td>3.84</td>
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</tbody>
</table>
Results — other observations

- Some internal hemorrhaging.

- 4 individuals developed fungus (likely *Saprolegnia*) covering heads, mouths, and tails.

- 2 individuals positive for *Aeromonas hydrophila*.

- Both *Saprolegnia* and *Aeromonas hydrophila* are ubiquitous in the environment and are often considered opportunistic bacteria/fungi.

- Surface water temperature during sampling was approx. 18-20°C.
Summary and implications

- 100% survival rate.

- Stress levels from electrofishing & handling did not differ from a non-stressed control group.

- No short term negative effects.

- How sampling contributes to lamprey susceptibility to fungus and/or bacteria is unclear.

- There are other ways to measure stress in fish.

- Water temperature and stress relationships are unclear.
Thank You

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