Adult Pacific lamprey: Known passage challenges and opportunities for improvement

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Presentation objectives

• Pacific lamprey are not Pacific salmon. . . .
• Adult passage challenges
  – What we’ve learned
  – Passage barrier types
• Adult passage solutions
  – Structural fixes
  – Operational fixes
Anadromous Fish Migrations

Natal Site Fidelity  →  Site Infidelity

Precise homing  →  Regional fidelity? Opportunistic spawners  →  Basin-scale fidelity

Basin

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Migration system and “success”

Homing

Obstruction

Natal Stream

15% Unsuccessful

85% Successful

SF Salmon River Chinook salmon
Migration system and “success”

Homing:
- Natal Stream 85%
- Breeding Population 85%
- 15% Unsuccessful

Site infidelity:
- Breeding Population 85%
- 15% Unsuccessful

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Lamprey are not salmon. . . .

- How we measure ‘success’ differs
- However, there are clear passage problems and human-created migration barriers

Research and Monitoring Programs

USFWS 2012
Passage Challenges
Main stem dams

- Research: USACE – NOAA – UI – Tribal - PUD
- Multiple strategies
  - Radio + acoustic telemetry
  - PIT tags
  - Challenge experiments

Adaptive management:
1) Identify passage problems
2) Implement, test solutions
Main stem ‘escapement’

PIT-tag monitoring project

High attrition at dams

Long-term monitoring indicates modest improvements

Keefer et al. 2009 (N Am J Fish Manag)
Bonneville passage by lamprey size

Size matters: dams present significant challenges for smaller lamprey

2005-2009 Results
Dam-wide dam passage efficiency

10 years of Radio-tagged lamprey: # Pass / # Approach

Pass / Approach

Bonneville 2684
John Day 204
Ice Harbor 21
McNary 12
The Dalles 158
McNary 665

Far lower than salmon performance

Keefer et al. 2012 (Technical Synthesis Report)
Bonneville bottlenecks (RT)

Turbulent, high velocity

Keefer et al. 2013 (CJFAS)
Tributary barriers

Small, low-head diversion dams can be lamprey barriers

Umatilla dams
7 Umatilla River diversion dams

Variable – and sometimes very low passage success

Jackson and Moser 2013 (N Am J Fish Manag)
Tributary barriers

Culverts, road crossings, hydraulic jumps
Potential Passage Solutions

• Structural fixes at dams
  – Lamprey passage system (LPS)
  – Lamprey flume system (LFS)
  – Wetted wall

• Concrete rounding, vertical step removal

• Open access to low-velocity routes

• Velocity-reducing ‘bollards’ on fishway floors

Moser et al. 2011 (Fish Manag Ecol)
Keefer et al. 2010 (N Am J Fish Manag)
Keefer et al. 2011 (Fish Manag Ecol)
>30,000 lamprey have used the BON LPS's

BON LPS

Moser et al. 2011 (Fish Manage Ecol)
Diversion dam LPS

Umatilla River

LPS is a proven structural solution

Threemile Creek
Wetted wall

Bradford Island fishway

Existing LPS
Velocity-reducing ‘bollards’

John Day Dam N Fishway Entrance

Bollard Field

Flow
Lamprey movement in the JDD bollard field

Acoustic video imagery: 100s of lamprey
Operational solutions

- Reduced night-time fishway velocity
  - Bonneville experiment was successful
  - Improved lamprey access to fishways

Johnson et al. 2012 (Trans Am Fish Soc)
Barrier removal: Boyd’s diversion dam

Before removal

After removal

Passage efficiency = 32%

Passage efficiency = 81%
Conclusions

• Lamprey passage challenges are complex
  – Many types of barriers
  – Site-specific issues and seasonal variability
  – No ‘one size fits all’ solutions

• Sustained ‘adaptive management’ effort has greatly improved our understanding

• The solution tool box has expanded

• Many opportunities for incremental change

Jeremy Red Star Wolf, Umatilla Tribe


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