Hatchery Reform in Yakama Territories

Presented by:
Bill Bosch, YN
Yakima-Klickitat Fisheries Project
March 20, 2018
Kelowna, BC
Acknowledgements

Charlie Strom
Jason Rau
Joe Blodgett
Michael Fiander
Bill Fiander
Hatchery technicians
Dave Fast
Bill Sharp
Chris Frederiksen
Todd Newsome
Joe Zendt
WDFW
ISRP/ISAB/HSRG
NPCC
BPA
Warren & Associates
McMillen & Associates
2) **Scientific Defensibility:**

- Operate hatchery programs within the context of their ecosystems
- Operate hatchery programs as either genetically integrated or segregated relative to naturally-spawning populations
- Size hatchery programs consistent with stock goals
- Consider both freshwater and marine carrying capacity in sizing hatchery programs
- Ensure productive habitat for hatchery programs
- Emphasize quality, not quantity, in fish releases
- Use in-basin rearing and locally-adapted broodstocks
- Select adults randomly throughout the natural period of adult return
- Use genetically-benign spawning protocols that maximize effective population size and minimize potential artificial or domestication selection under hatchery conditions.
- Reduce risks associated with outplanting and net pen releases
- Develop a system of wild steelhead management zones (a special case)
- Use hatchery salmon carcasses for nutrification of freshwater ecosystems, while reducing associated fish health risks
We will look at how YN is addressing these HSRG principles in the following programs:

- Cle Elum Supplementation and Research Facility (CESRF)
  - Spring Chinook

- Klickitat Hatchery
  - Spring Chinook
  - Fall Chinook
  - Coho

- Yakima Basin (Holmes/Melvin R Sampson facility)
  - Coho
Goals

- Increase:
  - Harvest opportunity
  - Natural production
- Maintain:
  - Ecosystem function
- Use research to:
  - Improve hatchery practices
  - Address critical uncertainties
Summary of CESRF Integrated Program
Findings (Fast et al. 2015)

- Spawner Abundance, Spatial Distribution, and Harvest increased
- Natural-origin returns were maintained
  - Managed gene flow reduced genetic divergence
- Ecological Interactions parameters were maintained within established guidelines
- Habitat and water management factors continue to limit natural productivity; supplementation likely necessary until these factors are fully addressed
- Results very consistent with Venditti et al. (2015, 2017) Idaho Supplementation Studies final report & publication
1st Brood: Integrated HxW spawning in the wild

1997

Integrated F1 progeny return

2001

Integrated F2 progeny return

2005

Integrated F3 progeny return

2009

2013
Gene Flow: Proportionate Natural Influence

Means: PNI = 66%, pHOS = 54%

\[ PNI = \frac{p\text{NOB}}{p\text{NOB} + p\text{HOS}} \]

pNOB: proportion natural-origin broodstock
pHOS: proportion hatchery-origin spawners
DOMESTICATION – HYPOTHETICAL OUTCOMES

TRAIT

SEGREGATED

INTEGRATED

Baseline

TIME

HC

S

WC
Effectiveness of managed gene flow in reducing genetic divergence associated with captive breeding


- P1 Founders
- F1 Wild
- F1 Hatchery
- F2 INT
- F2 SEG
- F3 INT
- F3 SEG
- F4 INT
- F4 SEG

Axis of Variation

Density
Klickitat River Anadromous Species Overview

Native Stocks:
I. Spring Chinook
II. Steelhead

Introduced Stocks:
I. Fall Chinook
II. Coho

- All stocks have existing artificial (hatchery) production
- Programs designed for harvest augmentation
Klickitat Hatchery Reform

Original Goals

• Upgrade Klickitat Hatchery
  • Additional spring water
  • Upgrade rearing & adult holding
• Build Acclimation Site in Lower Klickitat
  • Move FaCh/Coho releases downstream
  • Reduce interactions with native stocks
• Develop Steelhead Facility (if needed)
• Protect and enhance habitat
• Monitor, evaluate, and adaptively manage
Klickitat Hatchery Reform

Key Hatchery Reform Infrastructure

- Lyle Falls Fishway
- Wahkiacus Hatchery & Acclimation Facility
- Klickitat Hatchery
- Castile Falls Fishway
- McCreeo Acclimation Facility

Washington

Oregon
Spring Chinook

Current program

I. Harvest augmentation
   - ~550 adults
   - 95-100% hatchery broodstock
   - ~800k on-station release
   - PHOS ~ 10-20%
     - PNI= 0.25
   - Standards:
     - Does not meet HSRG criteria
Spring Chinook

Future program

I. Conservation & Harvest

- Integrated program
  - Incorporate greater proportion natural origin fish
- Broodstock collection
  - Lyle Falls Trap
- ~550 Adults
  - 800k on-station release

Conservation benefits

- Increase spawning & rearing distribution
- Increase abundance
- Increase PNI
Fall Chinook and Coho

Current Programs

- Harvest Augmentation
- FaCh: 4+ million fish released from KH
- Coho: 1+ m from KH, 2+m direct release in lower river
- Out-of-basin stocks
- Support substantial fisheries

Future Programs

- Maintain Fisheries contributions
- Develop local brood stocks from collections at Lyle Falls
- Develop lower river acclimation sites (below Rm 17)
- Move releases downriver
Yakima Basin Coho - History

- Extirpated by early 1980s
- Reintroduction started in mid-1980s
  - Derived from lower Col. R. populations
  - In culture from 30 to >100 years
  - Average annual release ~545,000
  - Fish released in lower Yakima R.
- 1996 to Present
  - Move to local broodstock
  - Release fish in natural coho habitats
Yakima Basin Coho - Progress

Proportion of In-basin coho smolts released yearly

- Data indicates fluctuations in the proportion released annually.
Yakima Basin Coho - Progress

Yakima Basin Redd Counts
1998-2016

- Upper Yakima River
- Naches River
- Tributaries

Year

Redds

HONOR. PROTECT. RESTORE.
Melvin R. Sampson Coho Hatchery

- Capable of producing 700,000 coho smolts
- 80% Recirculation – Retrofit to 100% if needed
- 10...25X6ft circular tanks
- Photovoltaic Cells 100Kw help power facility
- Brood collection at Roza Dam
- Proposed Construction Spring 2018
Summary

- Hatchery reform takes a lot of time
- Hatchery reform costs a lot of money
- Hatchery reform requires long-term investment
- Hatchery reform can work

More info: Bill_Bosch@yakama.com
Fish Quality vs Number Released

ANOVA Summary

<table>
<thead>
<tr>
<th>Cutoff</th>
<th>N&lt;=</th>
<th>Mean&lt;=</th>
<th>N&gt;</th>
<th>Mean&gt;</th>
<th>P-value</th>
<th>BrdYr&lt;=</th>
</tr>
</thead>
<tbody>
<tr>
<td>40,000</td>
<td>47</td>
<td>0.0119</td>
<td>219</td>
<td>0.0048</td>
<td>1.32E-25</td>
<td>62.5%</td>
</tr>
<tr>
<td>42,000</td>
<td>68</td>
<td>0.0097</td>
<td>198</td>
<td>0.0048</td>
<td>3.87E-15</td>
<td>75.0%</td>
</tr>
<tr>
<td>43,000</td>
<td>97</td>
<td>0.0085</td>
<td>169</td>
<td>0.0047</td>
<td>1.94E-11</td>
<td>81.3%</td>
</tr>
<tr>
<td>44,000</td>
<td>116</td>
<td>0.0077</td>
<td>150</td>
<td>0.0048</td>
<td>1.87E-07</td>
<td>87.5%</td>
</tr>
<tr>
<td>44,500</td>
<td>133</td>
<td>0.0075</td>
<td>133</td>
<td>0.0047</td>
<td>3.4E-07</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

PIT-Based SAR to Bonm. Dam

Estimated smolts exiting acclimation site

R² = 0.2049

2000

~4

2002

+5

~3

2003

+1