Hatchery Reform in Yakama Territories

Yakama Nation Fisheries

Presented by:
Bill Bosch, YN
Yakima-Klickitat Fisheries Project
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Kelowna, BC

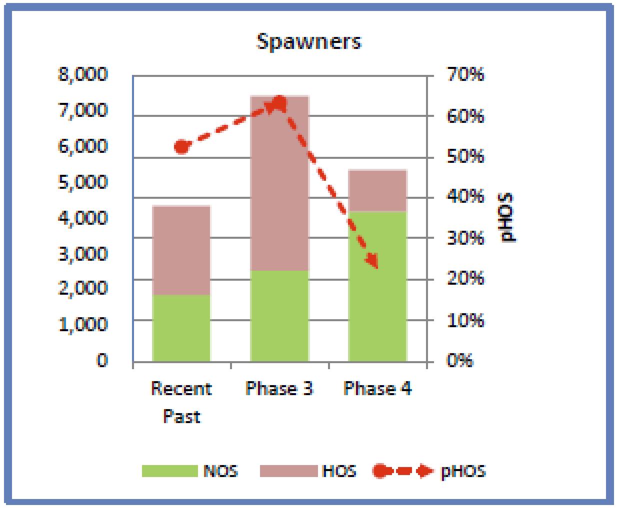

Figure 1. Estimated pHOS, natural-origin (NOS) and hatchery-origin spawning coho for the recent past, Phase 3 and Phase 4 of the Yakama program.

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Warren & Associates
McMillen & Associates

From Hatchery Reform in WA State, Fisheries 2005

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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

Cle Elum Spring Chinook
Supplementation and Research Facility

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)

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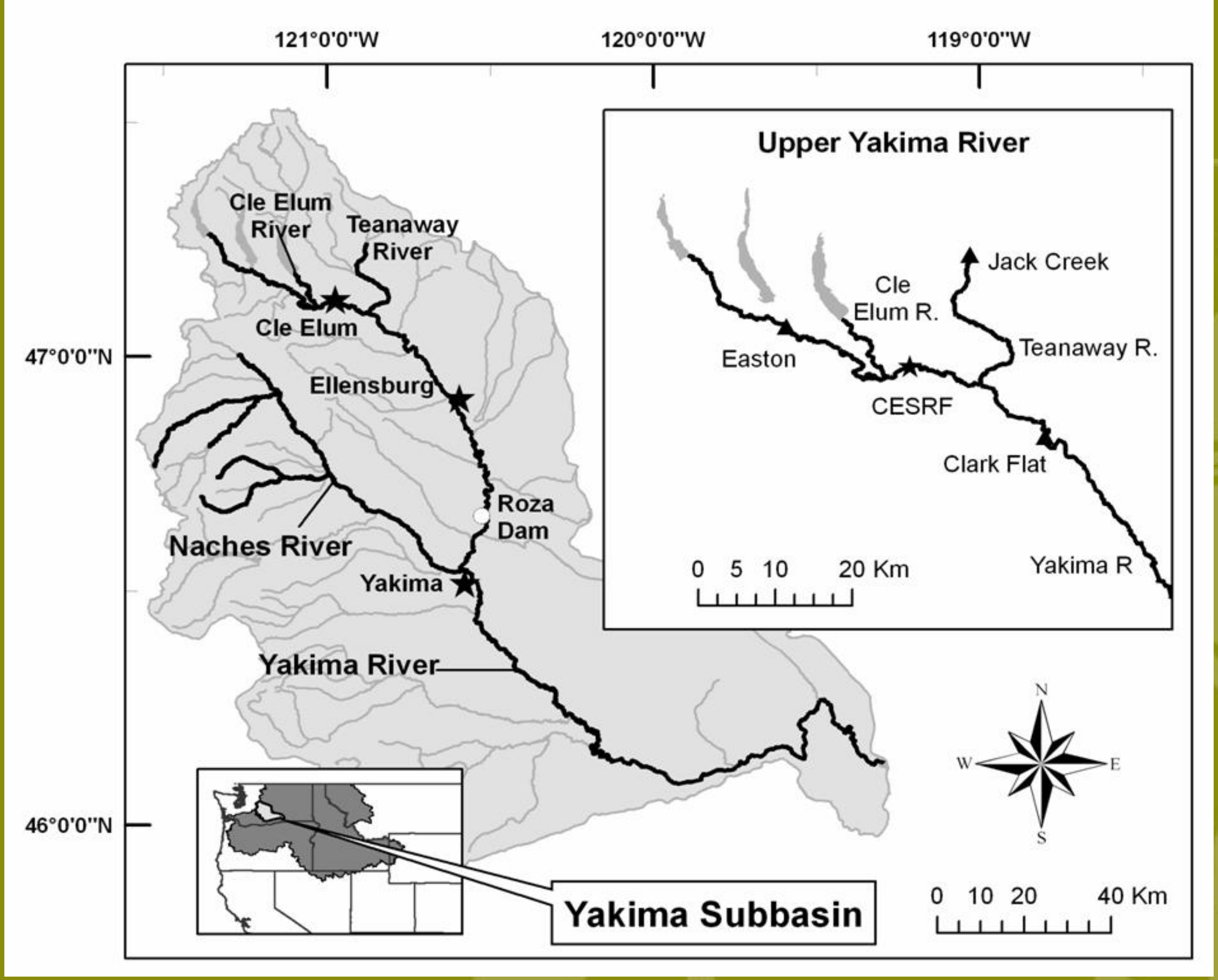
- Spawner Abundance, Spatial Distribution, and Harvest increased
- Natural-origin returns were maintained
- **Managed gene flow reduced genetic divergence**
- Ecological Interactions parameters were maintained within established guidelines
- Habitat and water management factors continue to limit natural 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

Integrated F1 progeny return

Integrated F2 progeny return

Integrated F3 progeny return

1997

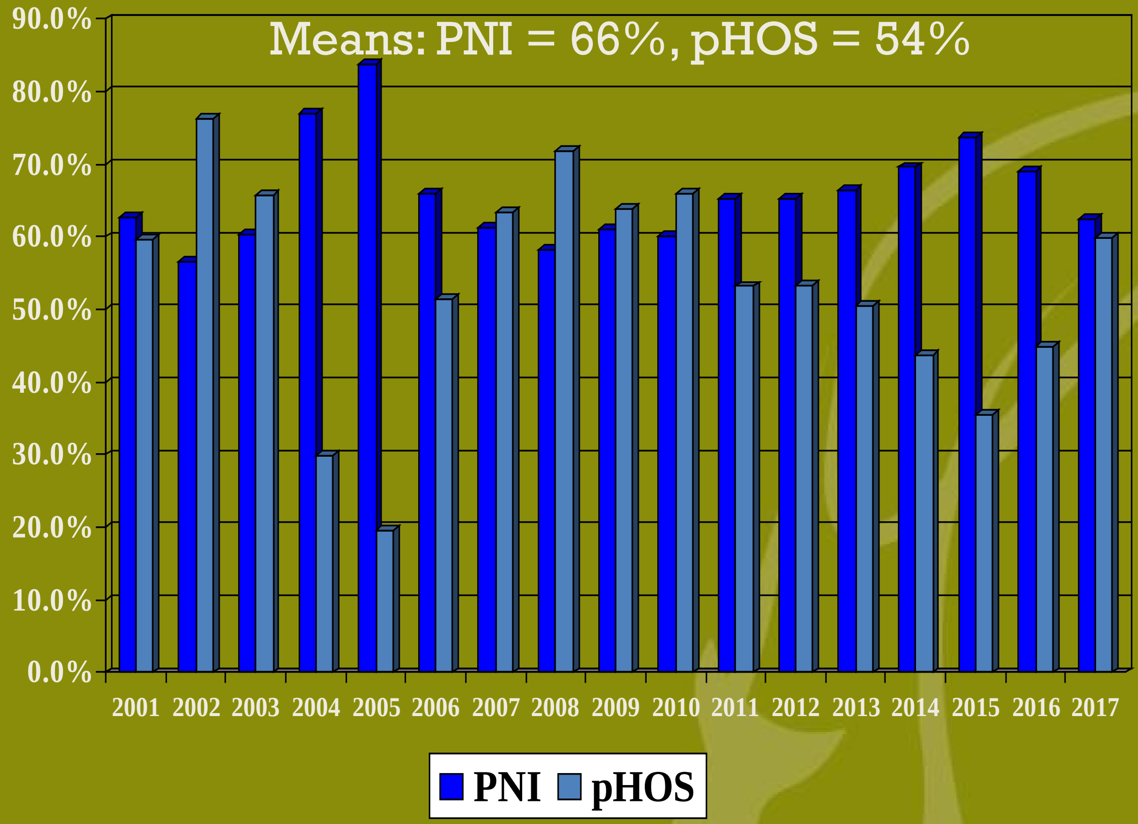
2001

2005

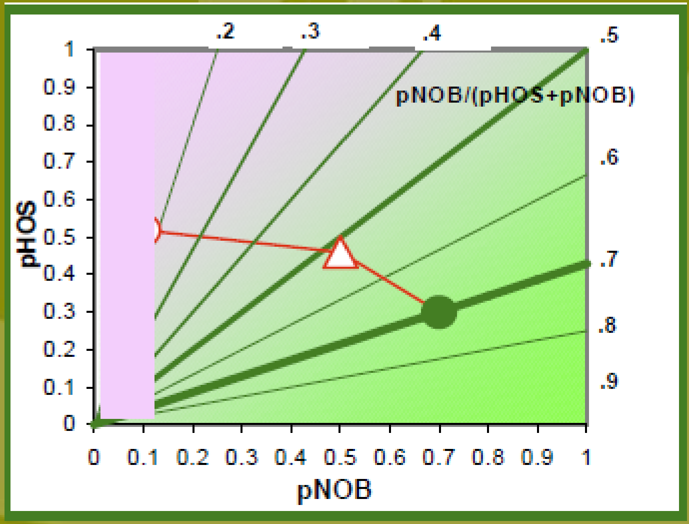
2009

2013

Gene Flow: Proportionate Natural Influence

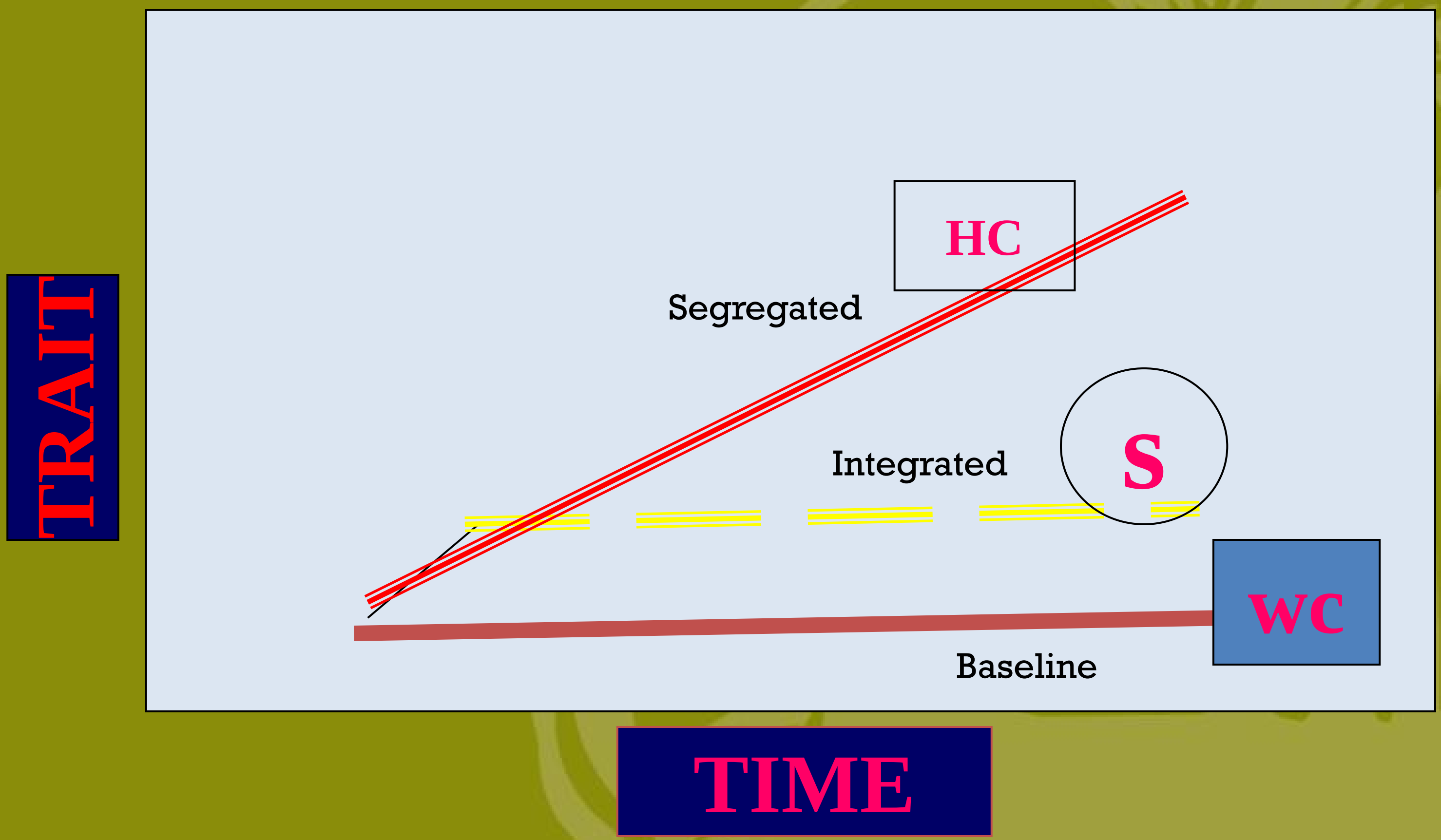


$$PNI = \frac{pNOB}{pNOB + pHOS}$$



pNOB: proportion natural-origin broodstock
pHOS: proportion hatchery-origin spawners

DOMESTICATION – HYPOTHETICAL OUTCOMES



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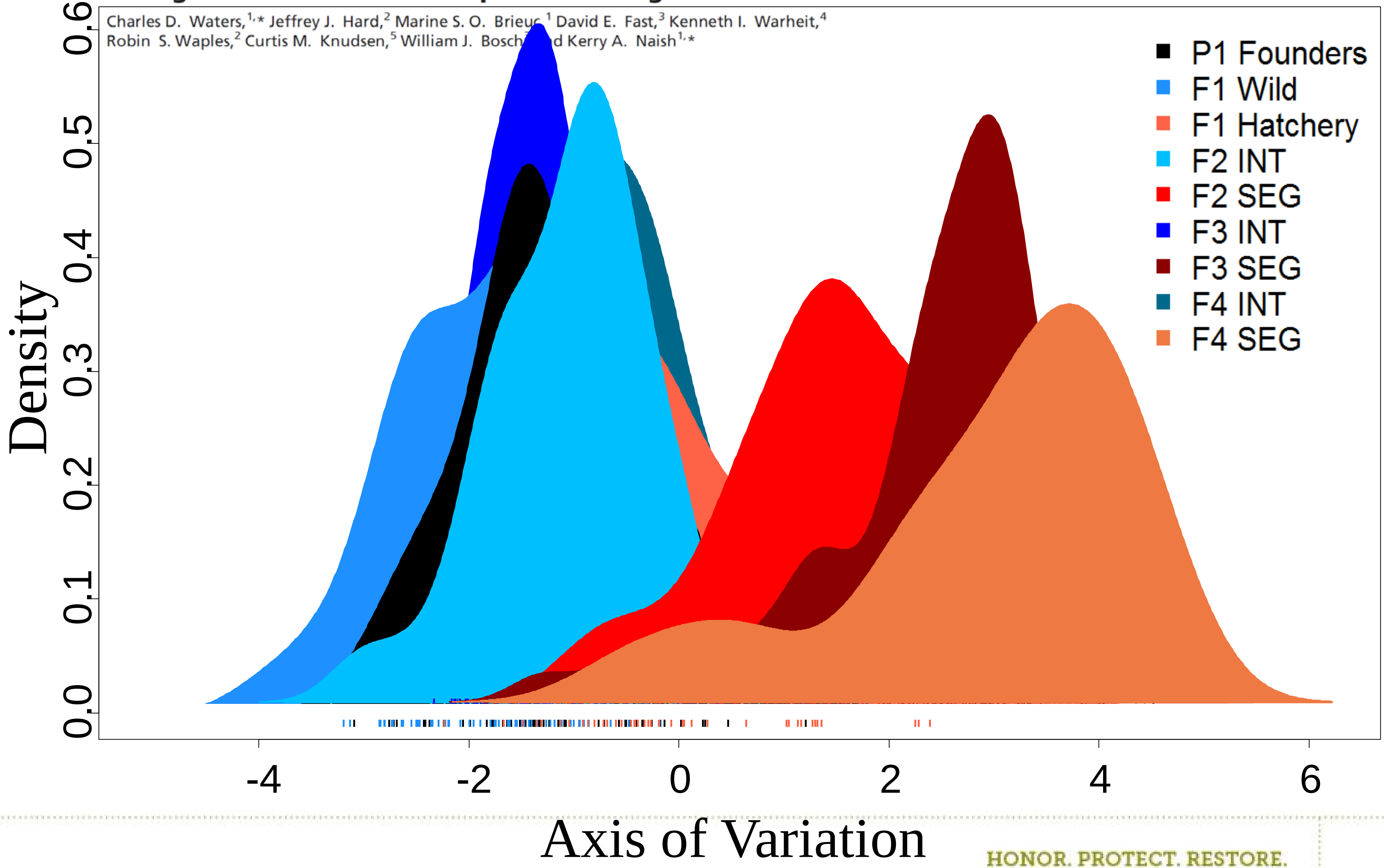
ORIGINAL ARTICLE

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

Charles D. Waters,[1,*] Jeffrey J. Hard,[2] Marine S. O. Brieuc,[1] David E. Fast,[3] Kenneth I. Warheit,[4] Robin S. Waples,[2] Curtis M. Knudsen,[5] William J. Bosch[5] and Kerry A. Naish[1,*]

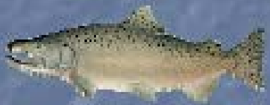


HONOR. PROTECT. RESTORE.

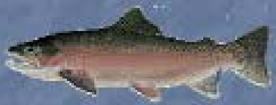
Klickitat River Anadromous Species Overview

Native Stocks:

I. Spring Chinook

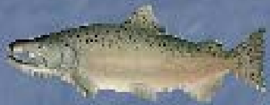


II. Steelhead

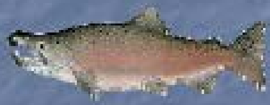


Introduced Stocks:

I. Fall Chinook



II. Coho



- All stocks have existing artificial (hatchery) production

  - Programs designed for harvest augmentation

Klickitat Hatchery Reform

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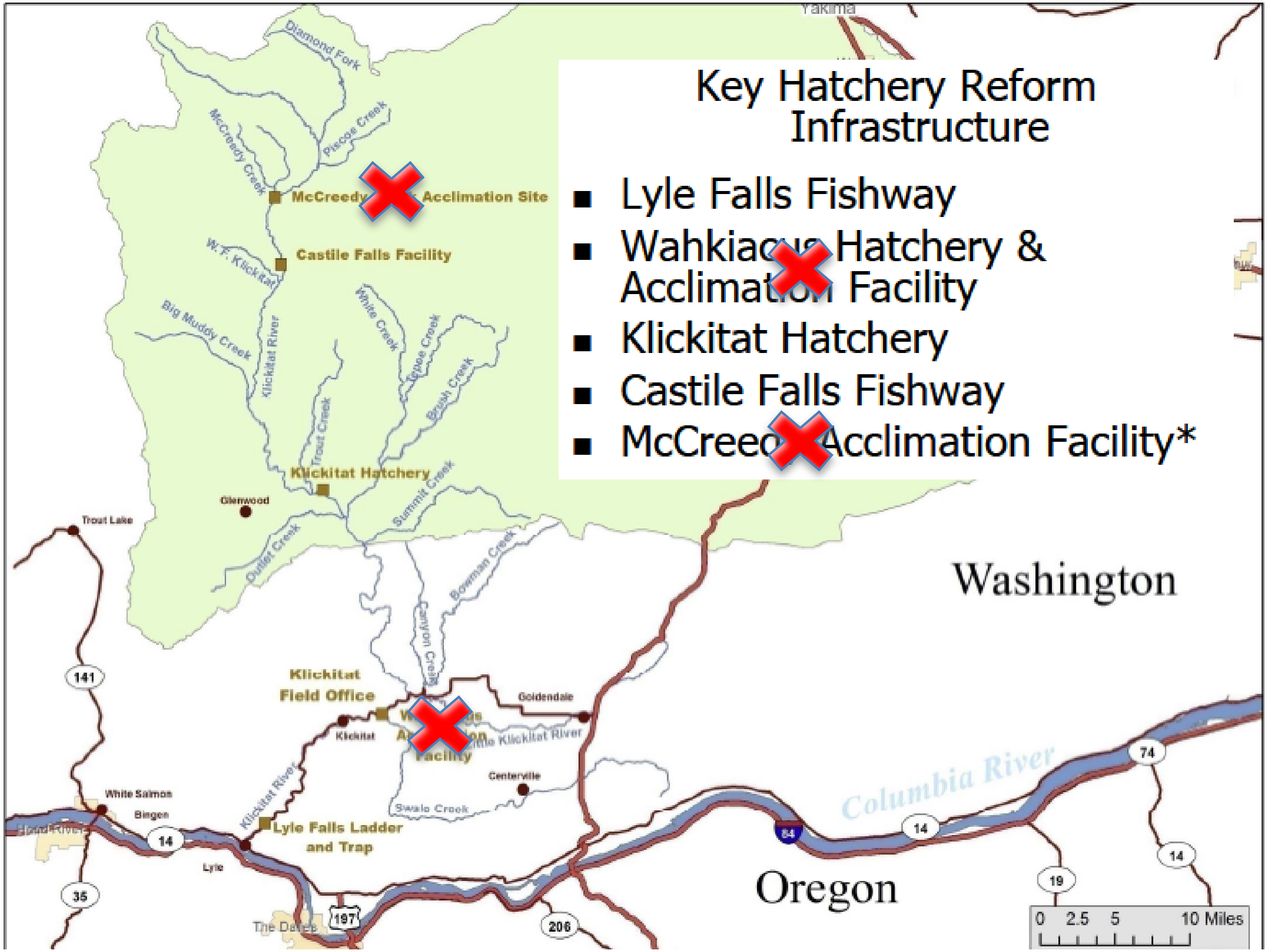
Original Goals

- 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

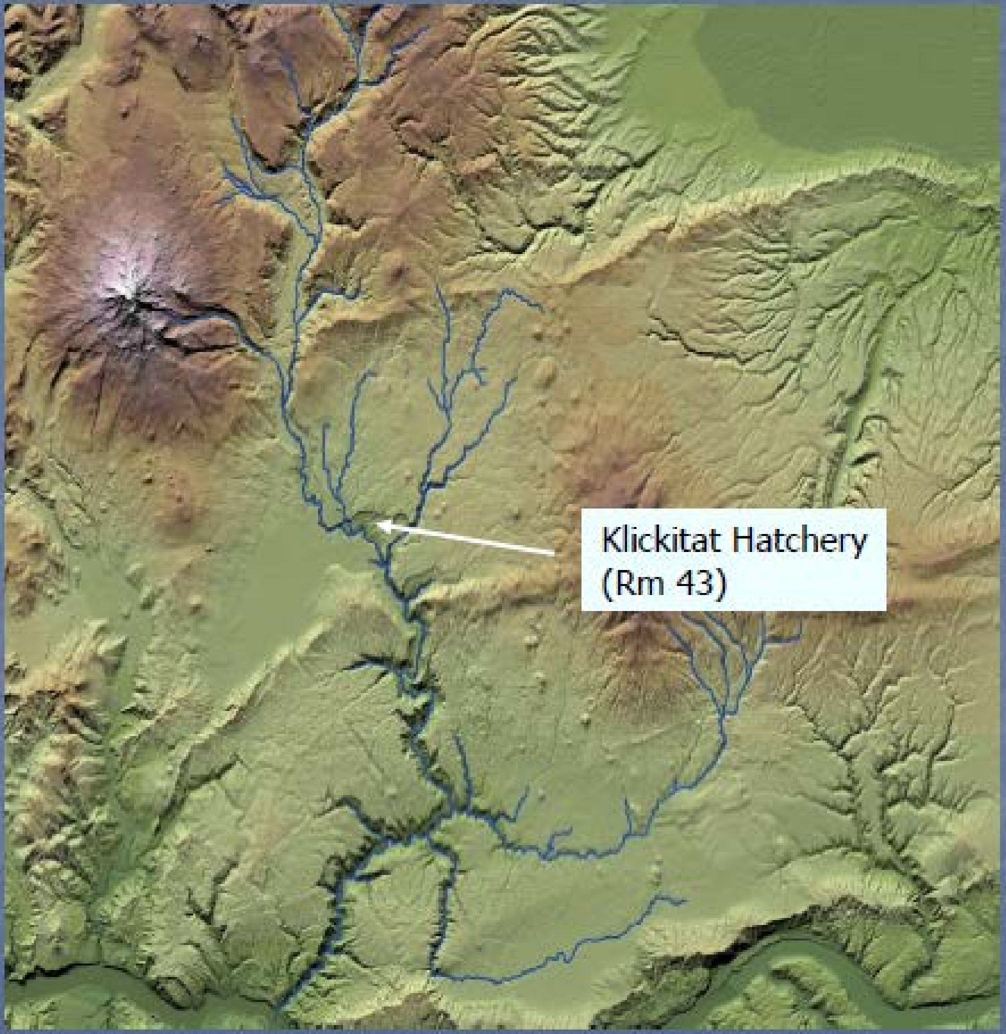
Klickitat Hatchery Reform



Key Hatchery Reform Infrastructure

- Lyle Falls Fishway
- Wahkiacus Hatchery & Acclimation Facility
- Klickitat Hatchery
- Castile Falls Fishway
- McCreedy Acclimation Facility*

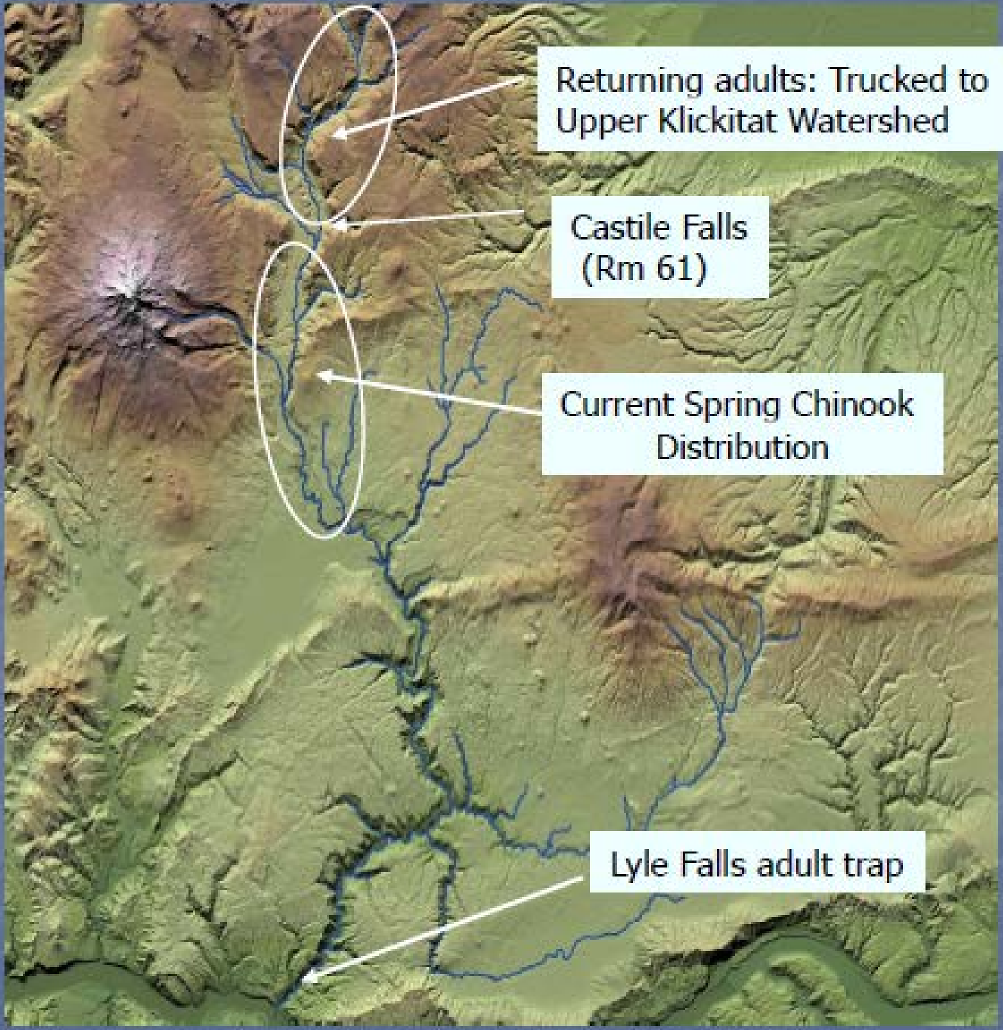
Spring Chinook



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

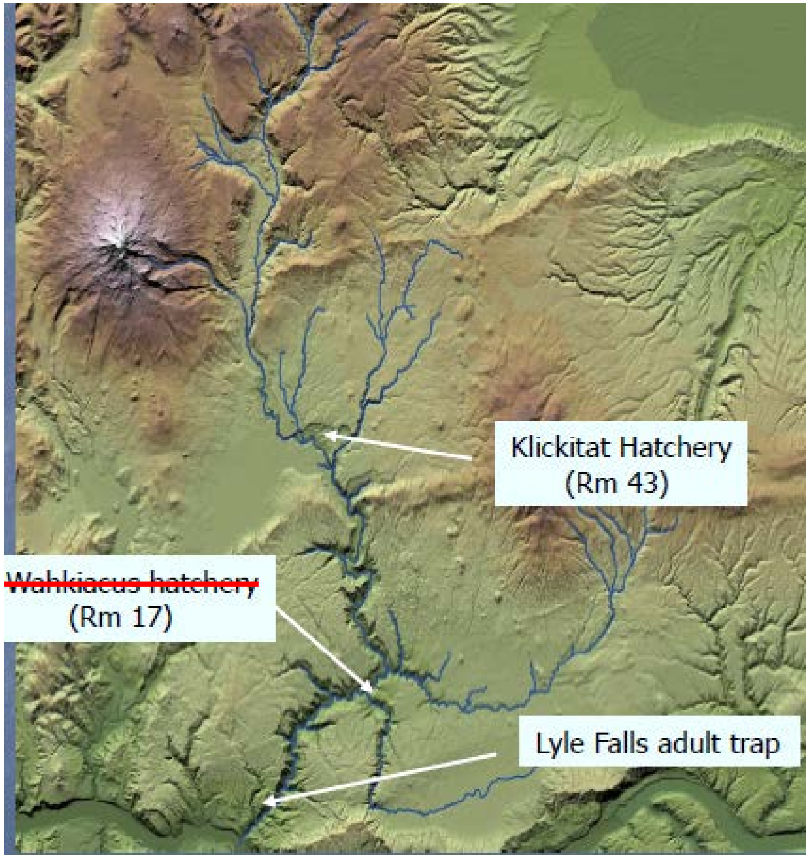
Conservation benefits

- 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



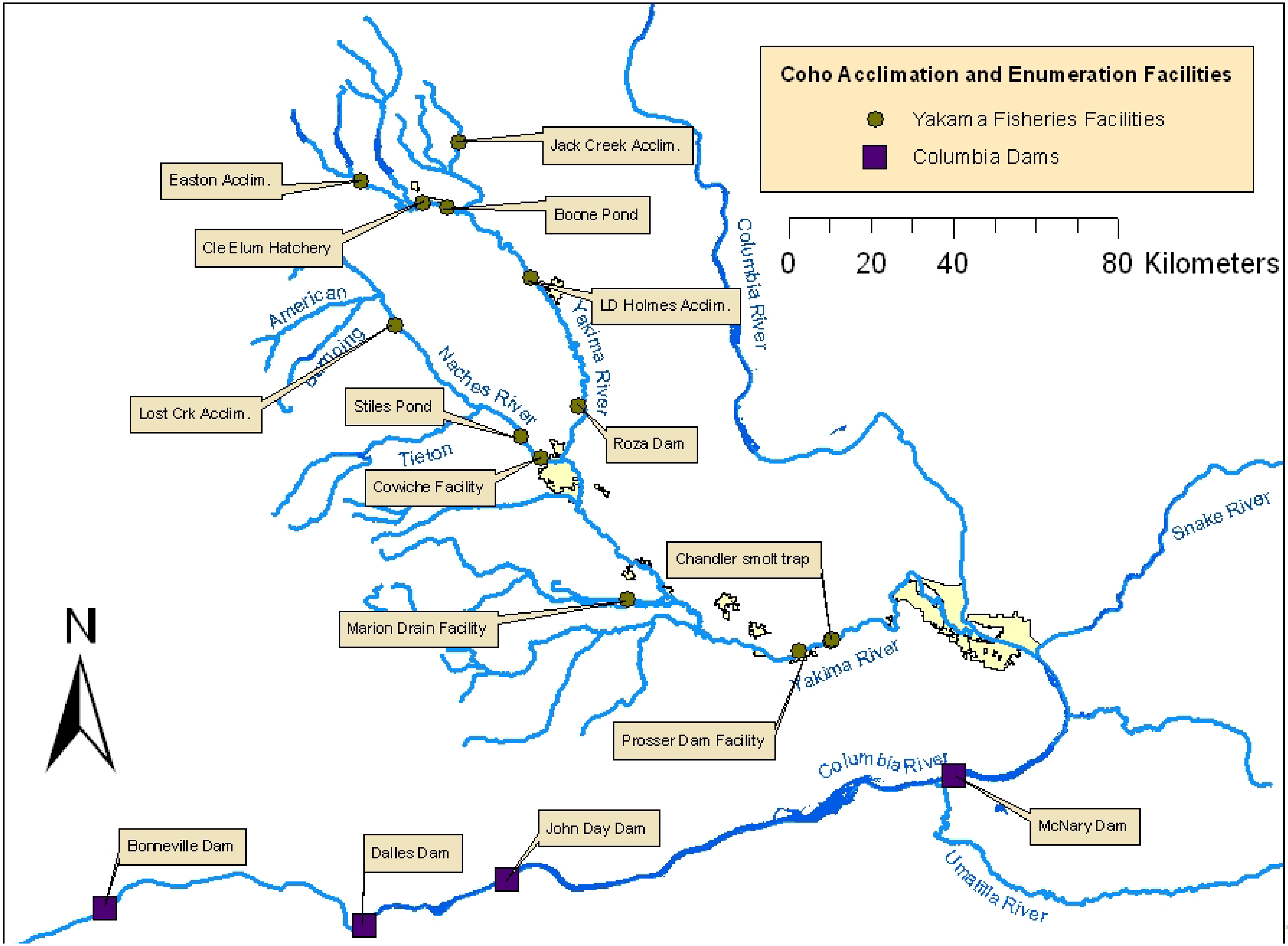
Future Programs

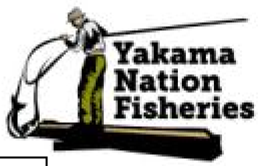
- Maintain Fisheries contributions
- Develop local brood stocks from collections at Lyle Falls
- Develop lower river acclimation sites (below Rm 17)
- Move releases downriver

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
- Harvest Augmentation (1985-1995)
  - 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 - Geography





Yakima Basin Coho - Progress

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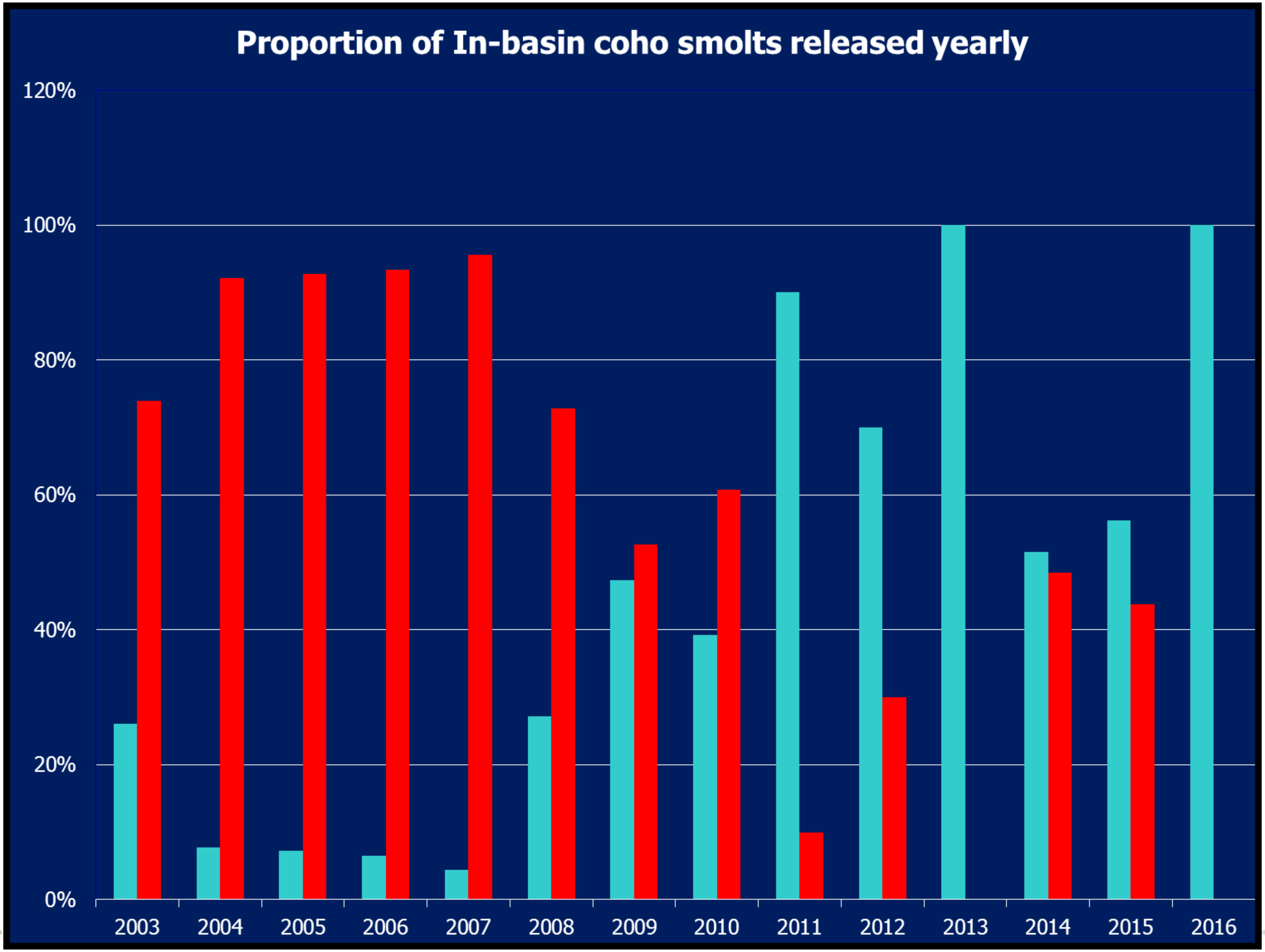
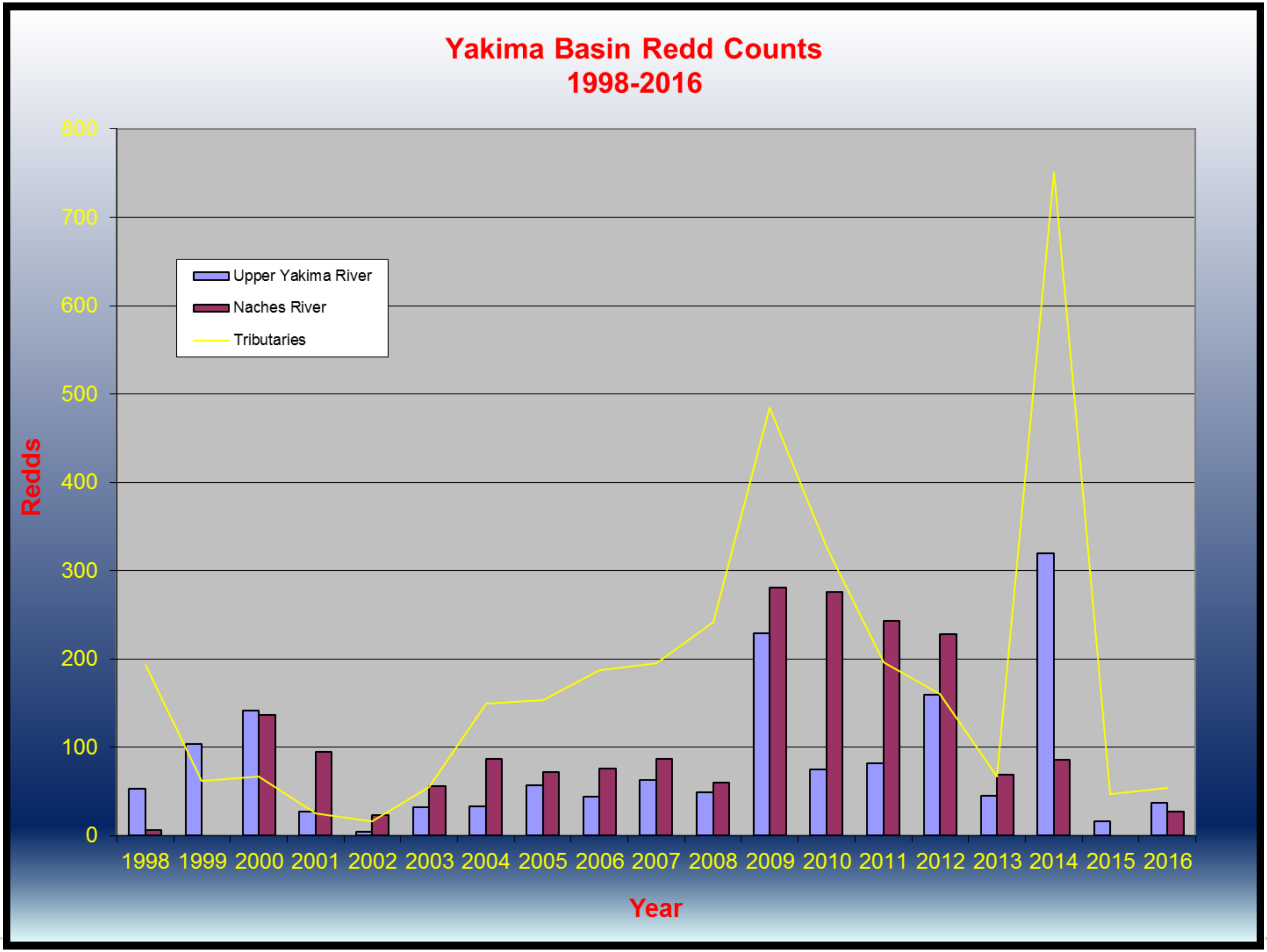


Yakima Basin Coho - Progress

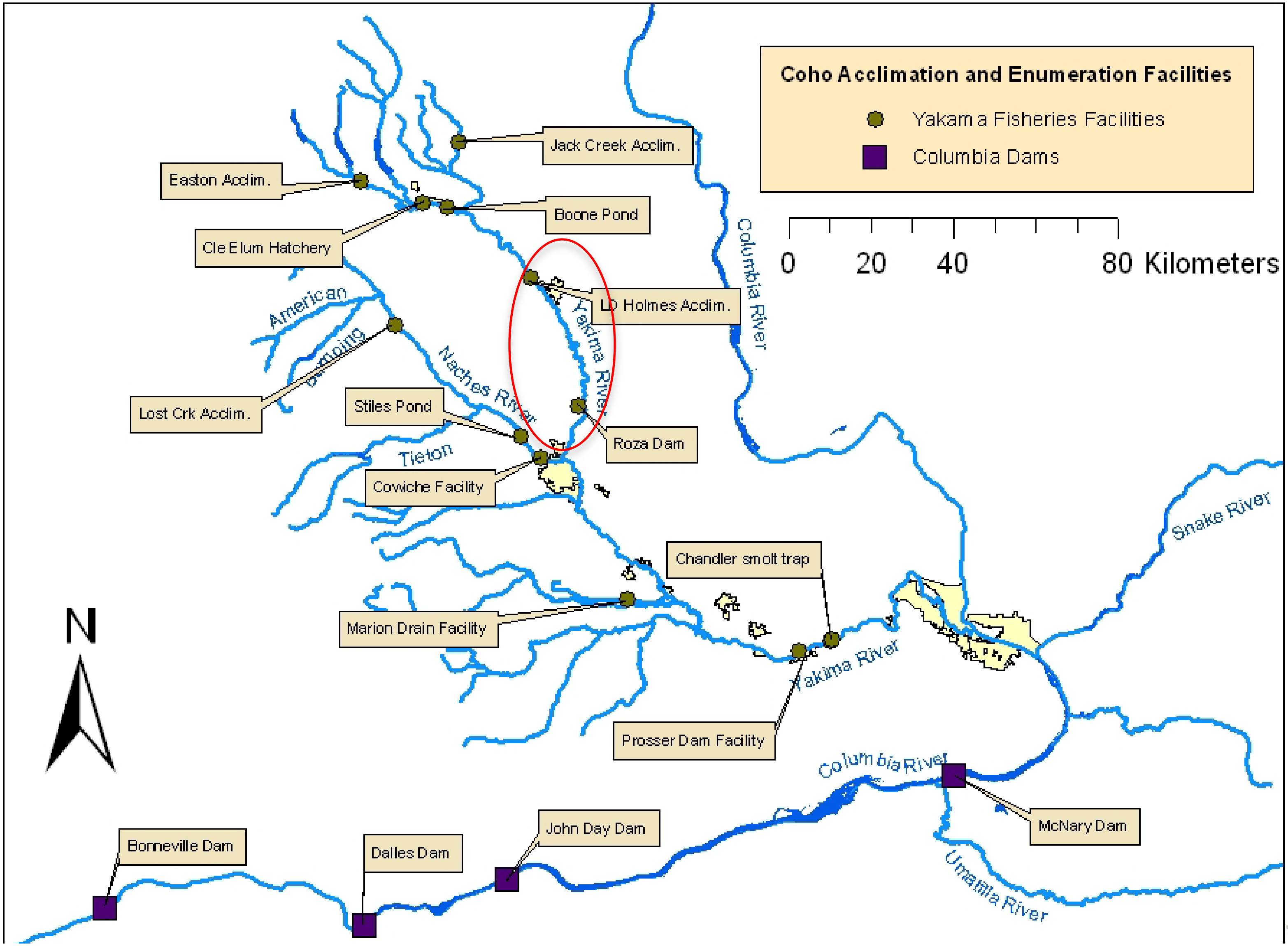


Yakima Basin Coho - Future

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

Yakima Basin Coho - Future



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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

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