# Hatchery Reform in Yakama Territories

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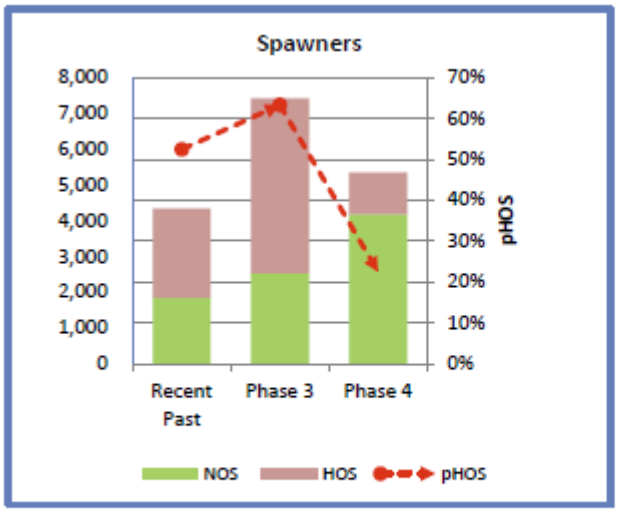


Figure 1. Estimated pHOS, natural-origin (NOS) and hatchery-origin spawning coho for the recent past, Phase 3 and Phase 4 of the Yakama program.

# Acknowledgements

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McMillen & Associates

# From Hatchery Reform in WA State, Fisheries 2005

**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

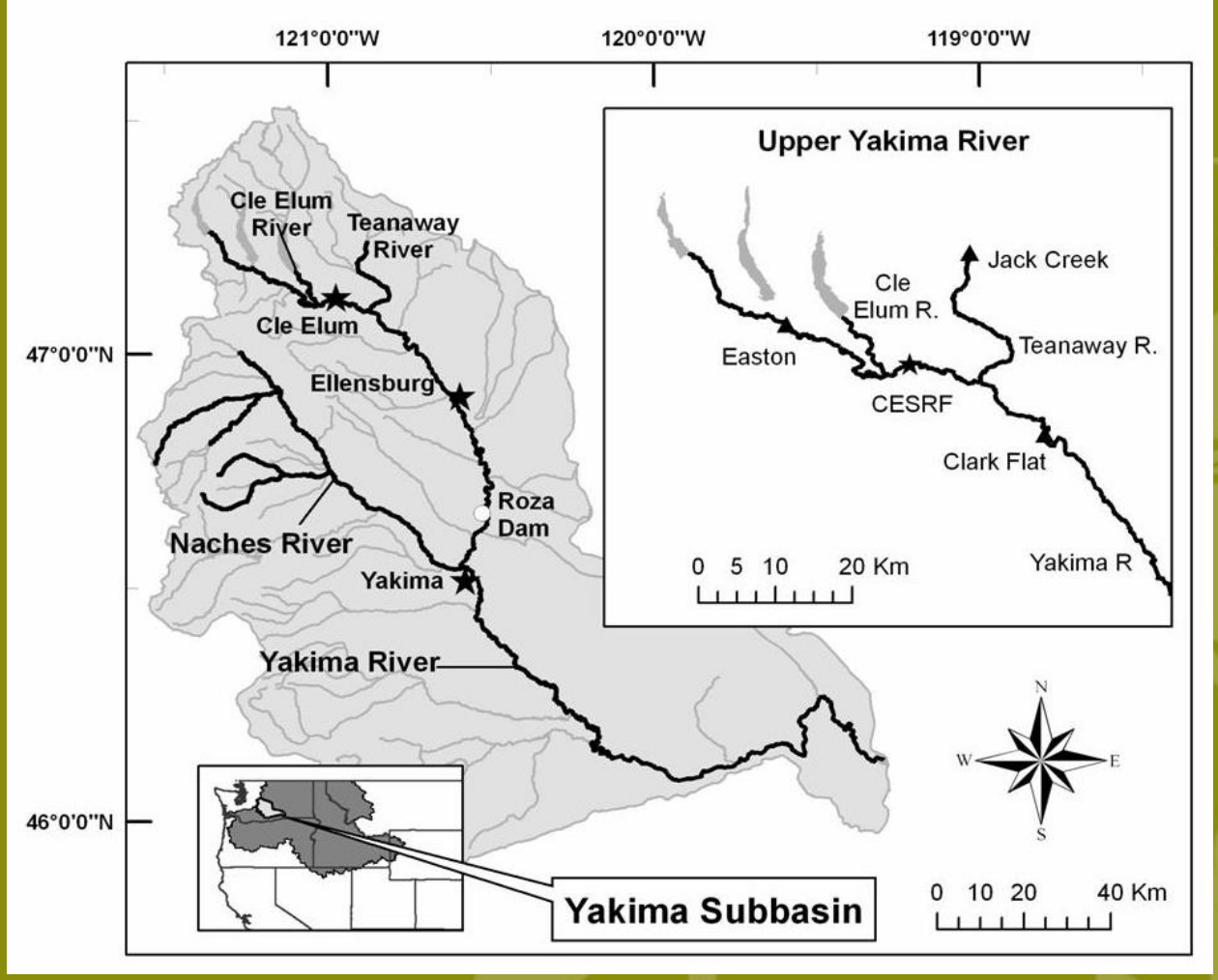
# Cle Elum Spring Chinook Supplementation and Research Facility

## 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)

- 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 — 1997

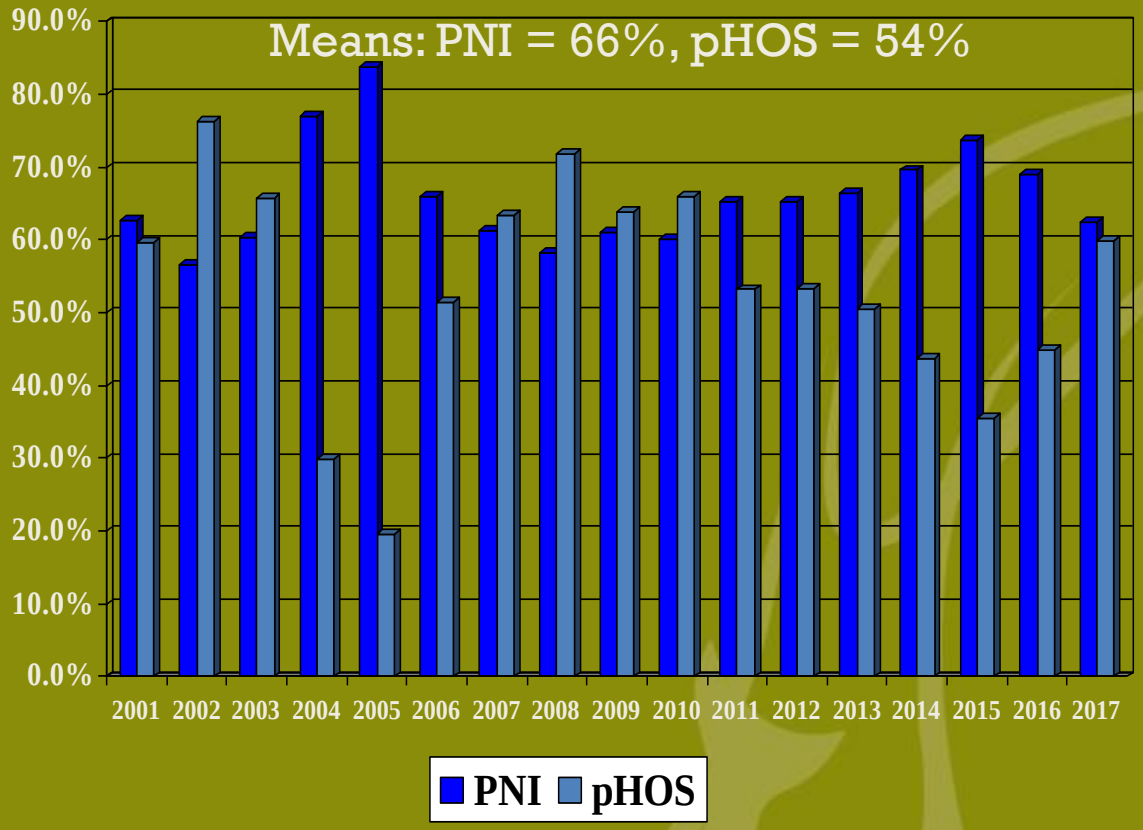
Integrated HxW spawning in the wild — 2001

Integrated F1 progeny return — 2005

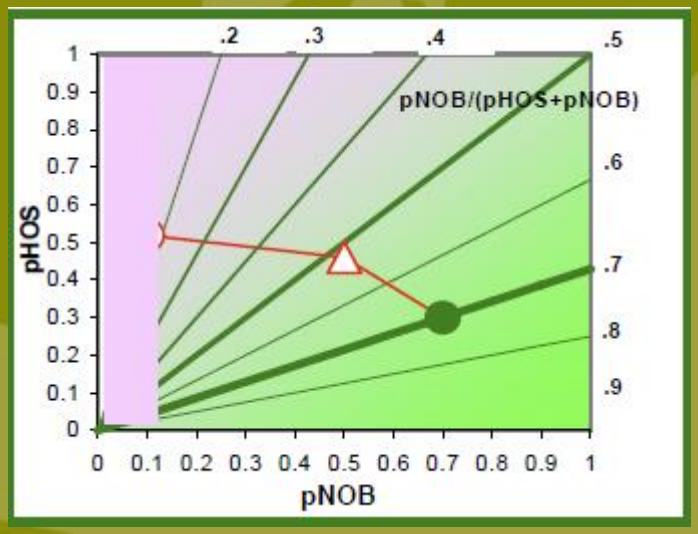
Integrated F2 progeny return — 2009

Integrated F3 progeny return — 2013

# Gene Flow: Proportionate Natural Influence

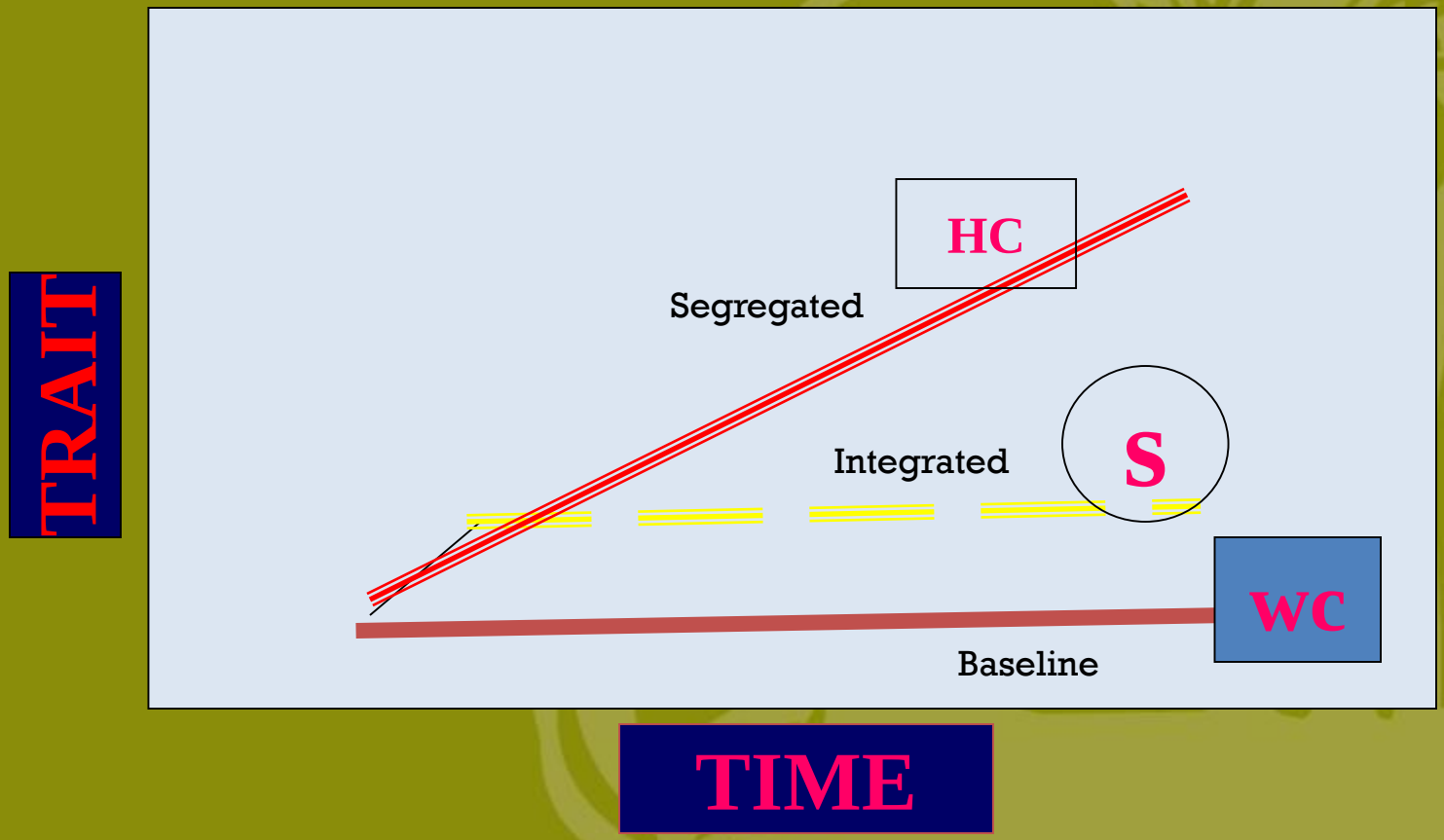



$$PNI = \frac{pNOB}{pNOB + pHOS}$$




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

# DOMESTICATION –
## HYPOTHETICAL OUTCOMES



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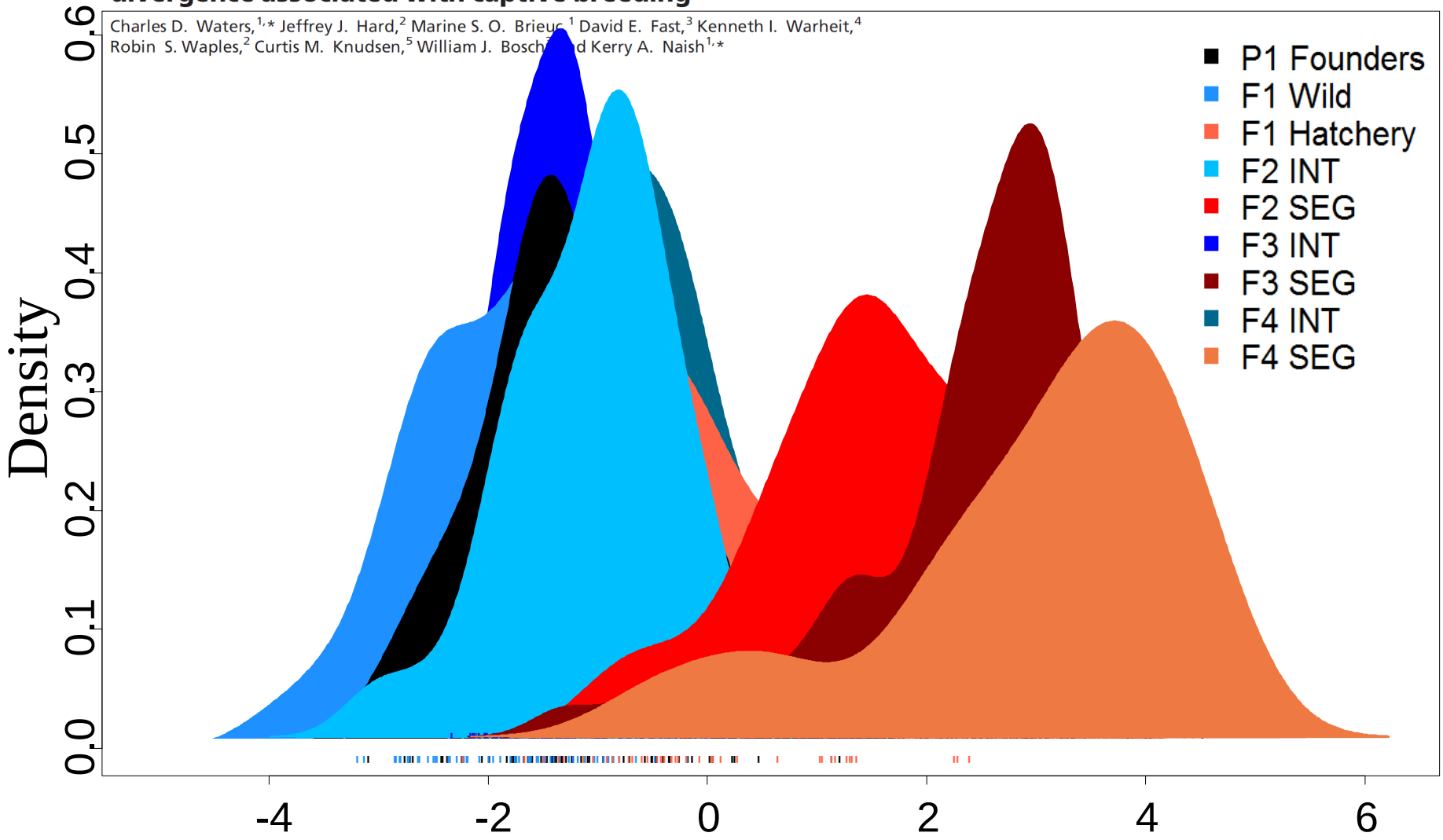
ORIGINAL ARTICLE

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

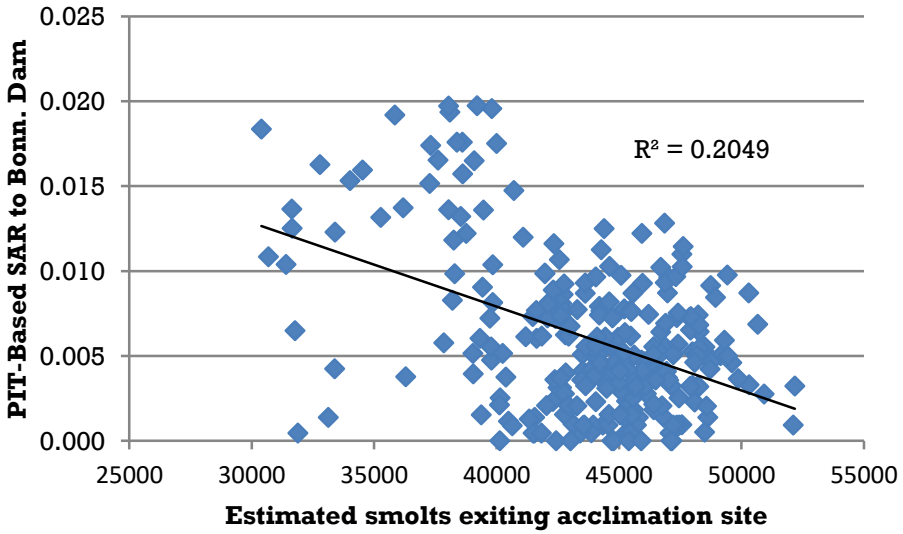
Charles D. Waters,[1,*] Jeffrey J. Hard,[2] Marine S. O. Brieuc,[1] David E. Fast,[3] Kenneth I. Warheit,[4] Robin S. Waples,[2] Curtis M. Knudsen,[5] William J. Bosch[3] and Kerry A. Naish[1,*]

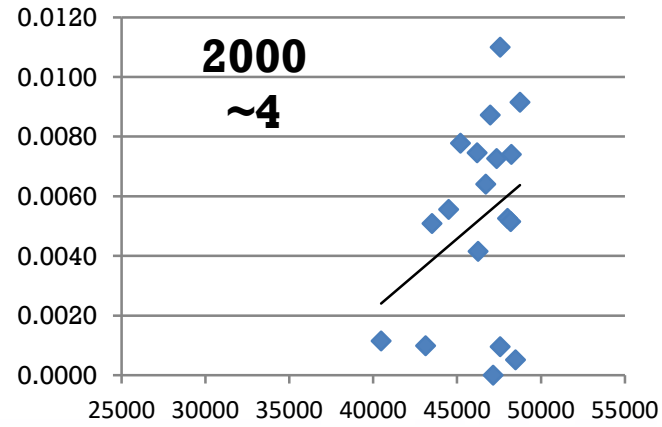


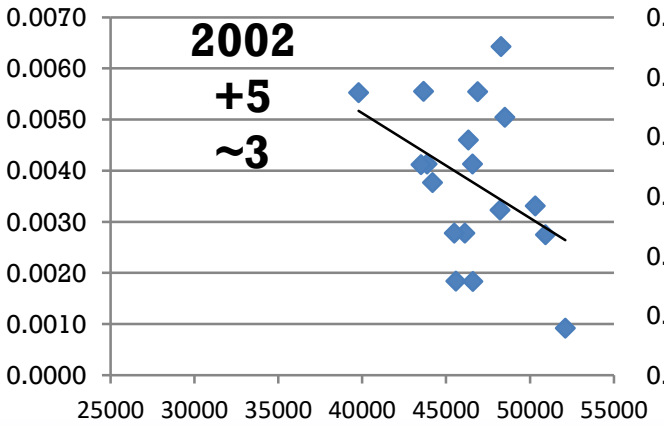
# Fish Quality vs Number Released

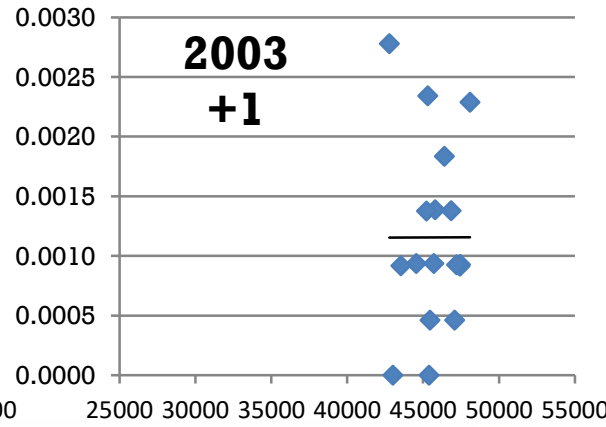
## ANOVA Summary

| 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% |



# 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

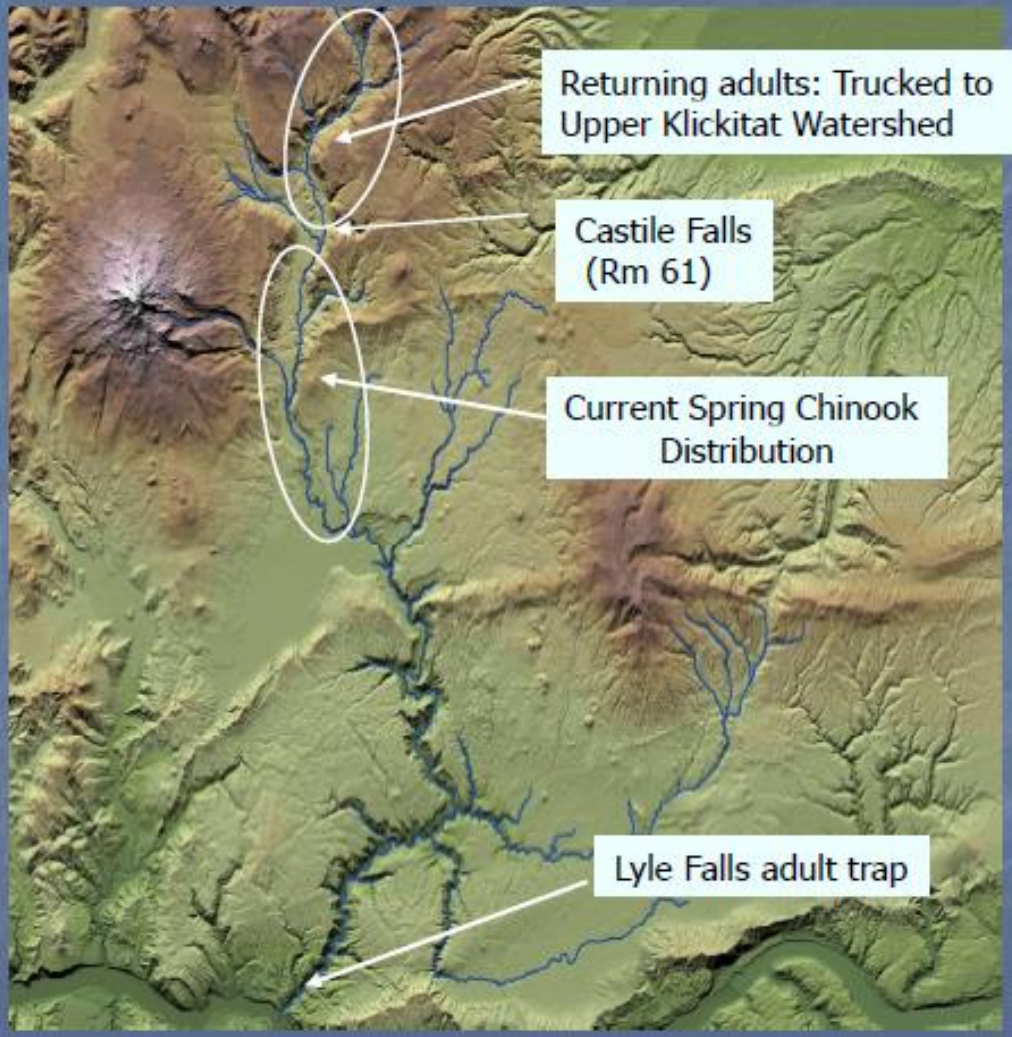
# Klickitat Hatchery Reform

# 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

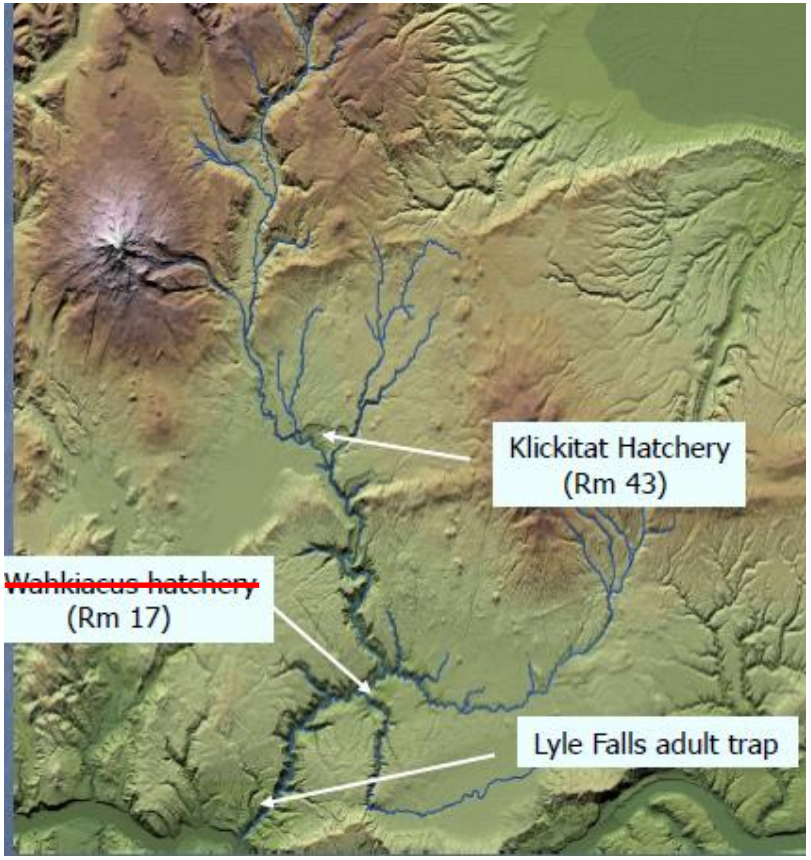
Conservation benefits

- 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



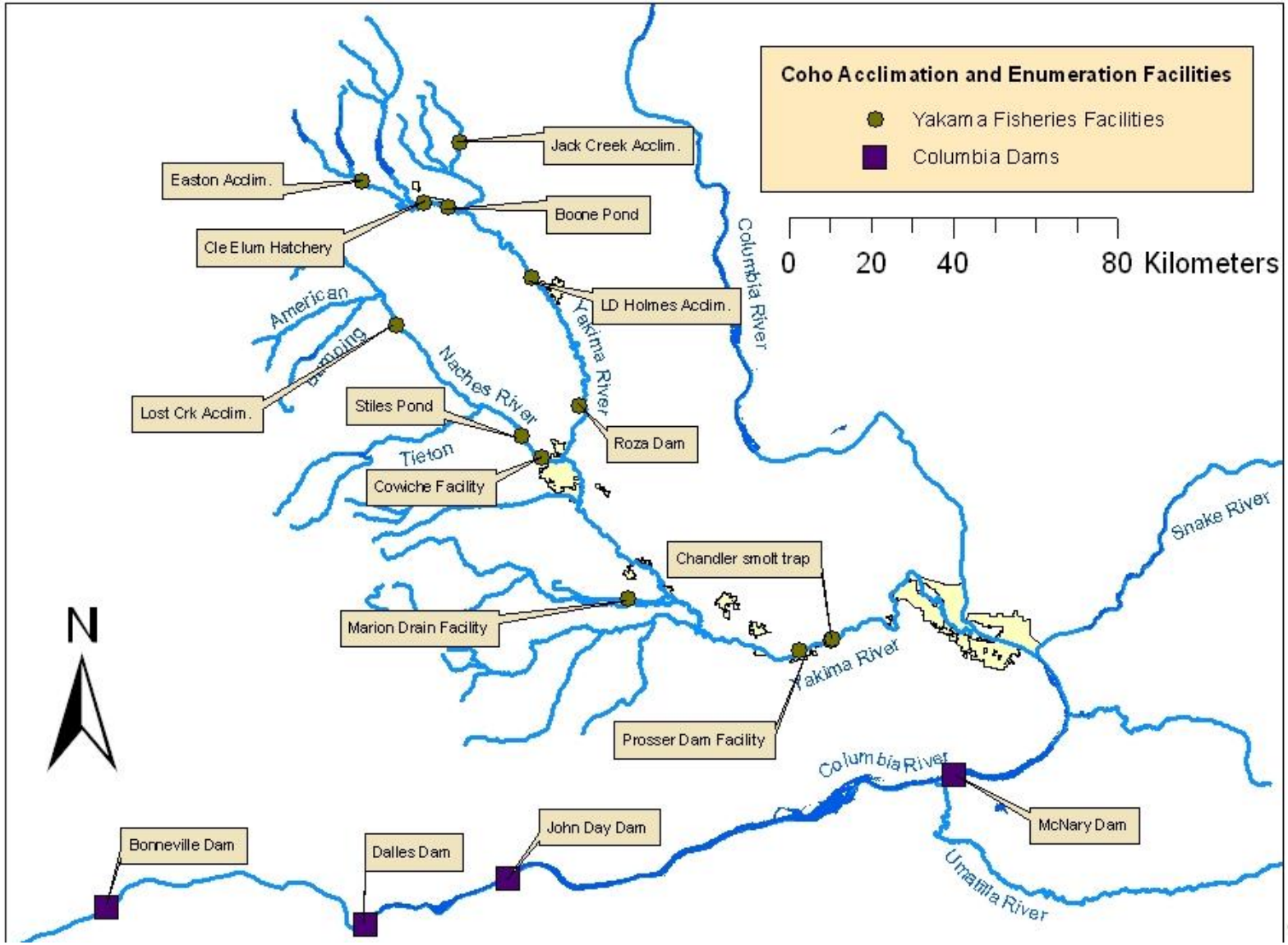

## Future Programs

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

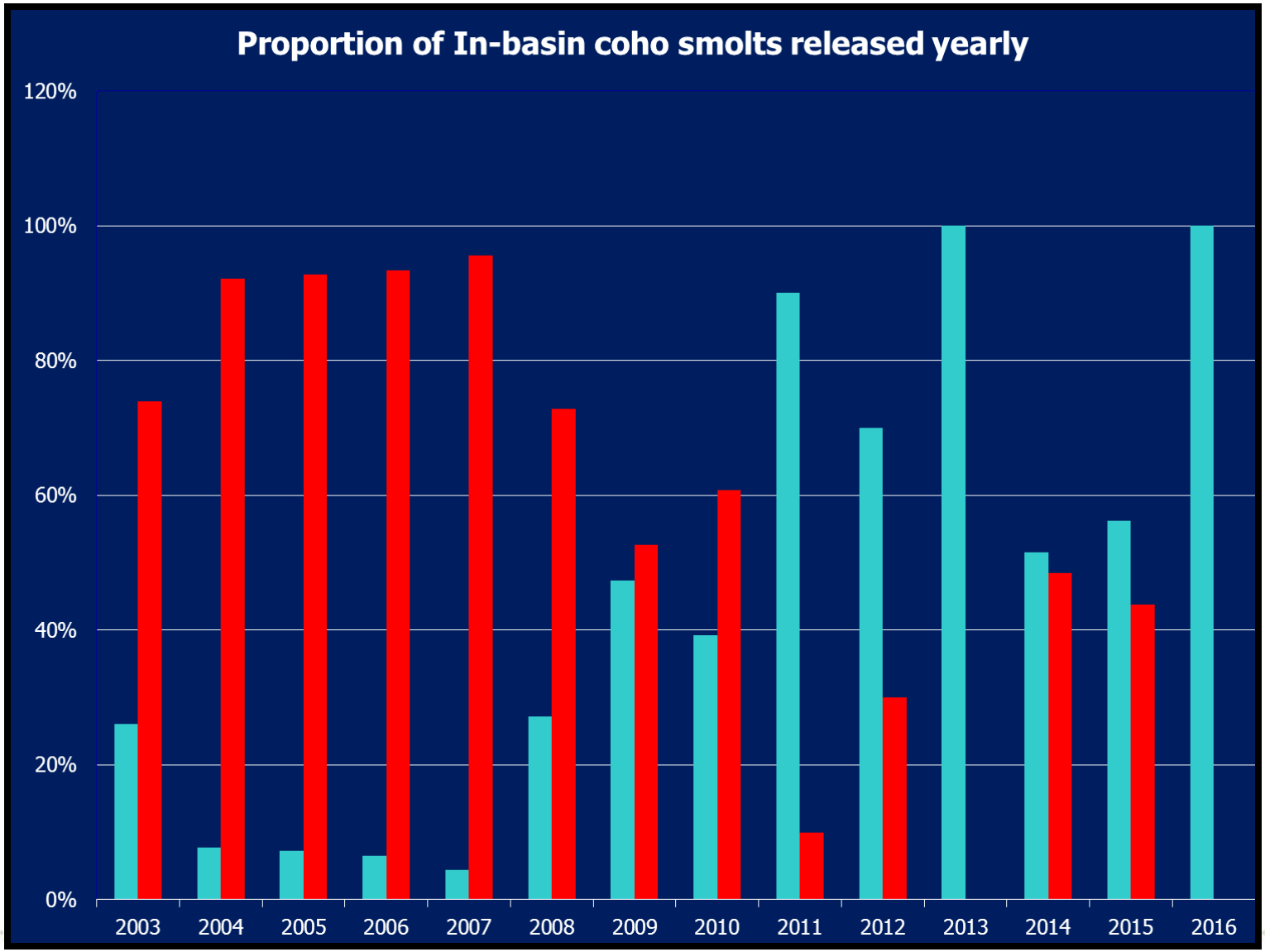
# Yakima Basin Coho - History

- 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

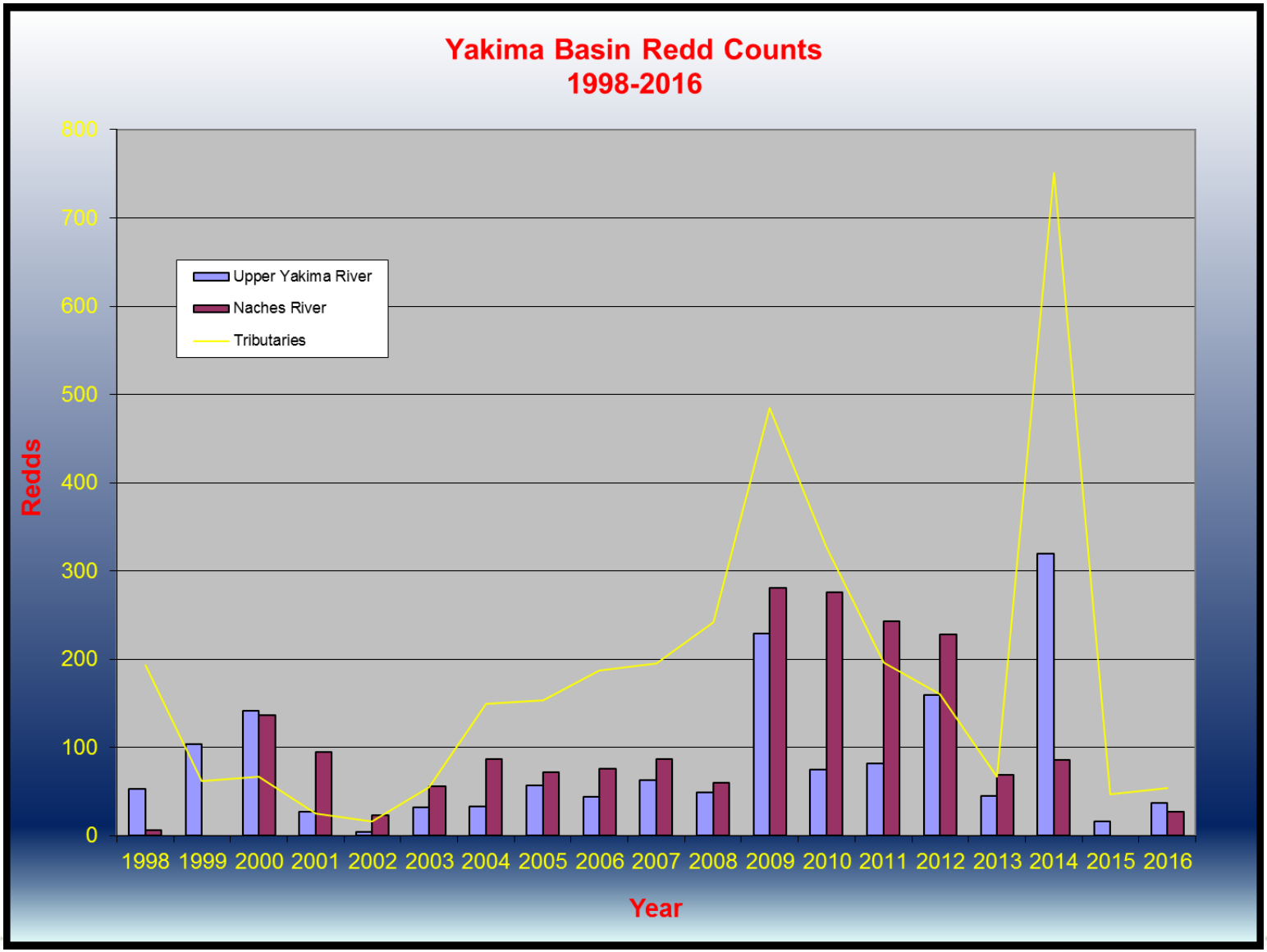
# Yakima Basin Coho - Geography



# Yakima Basin Coho - Progress



# Yakima Basin Coho - Progress

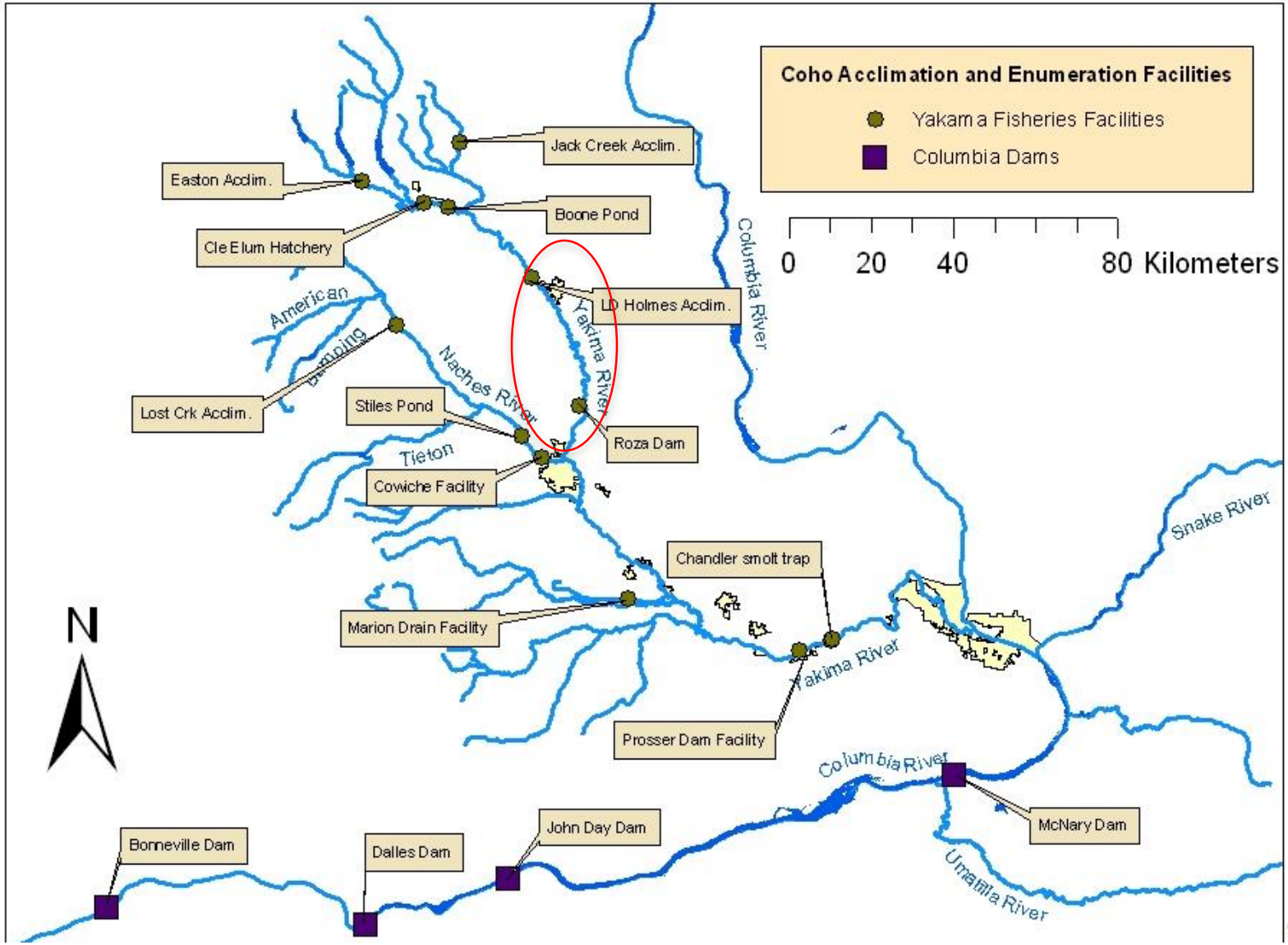


# Yakima Basin Coho - Future

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



# 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