Abundance and Distribution of Spring Chinook Salmon Redds in the Yakima River Basin Before and After Supplementation

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Photo: Jon Goin

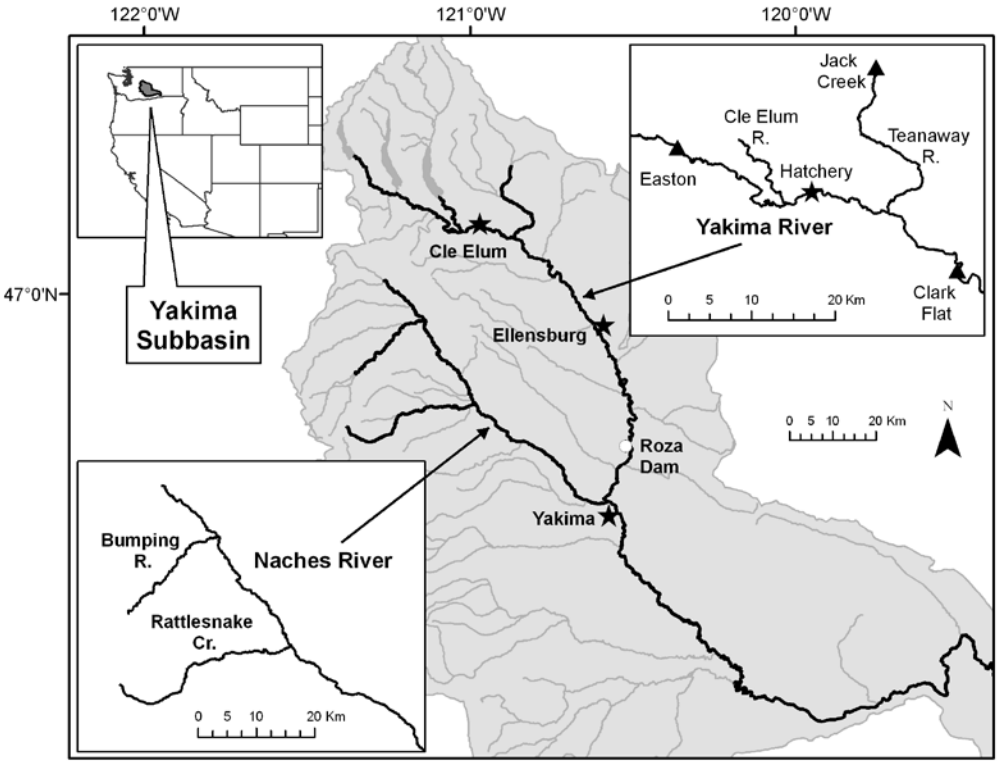
Spatial Structure of Spawning

- McElheny, et al. 2000 _ Evaluating population status
  - 4 key parameters
    - Abundance
    - Population growth rate
    - **Population spatial structure**
    - Diversity
- Abundance and spatial distributions of a supplemented and a wild control population of Chinook salmon before and after the implementation of the hatchery supplementation program.

Outline

- **Study Area & Background**
- Research questions
- Comparison: Pre and Post Supplementation
  - Redd Abundance, Density and Distributions
  - Wild / Natural Origin Carcass Distribution
- Conclusions

Study Area– Yakima River Basin



Yakima River Basin – South central Washington state.

- Drainage ~ 16,000 Km^2

Yakima River

- Major trib. of Columbia River
- ~ 350 Km
- Tributary: Naches River

•Supplemented Upper Yakima River population

•Control Naches River population

Upper Yakima River System

"..Prior to the settlement and development of the Yakima valley this system was unquestionably a tremendous fish producer, owing to extensive spawning and rearing areas for chinook……and has considerable potential value…"
(Bryant and Parkhurst, 1950)

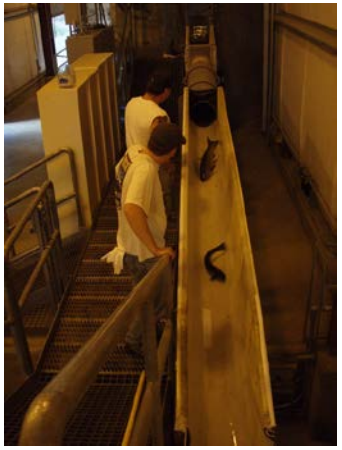
EDT Model Capacity – 200,000 spawners.

Redd Counts – 20yr avg. 820 Redds

1997 - YKFP Chinook Salmon Supplementation Program: Increase natural production and harvest opportunities while minimizing genetic and ecological risks.

YKFP Spring Chinook Supplementation Program

Collect wild / natural origin broodstock
3 – 5 yr. old



Artificially spawned
egg – fry - parr
Rearing (~16 mths)

Acclimation sites (~6 – 12 wks)
parr - smolt
Volitional release (~2 mths)
smolt

Ocean (~1 – 3 years)

Return to spawn naturally
3 – 5 yr. old adults

Monitoring –Redd & Carcass Surveys

Redd Surveys (1981-2008)

- Weekly redd Surveys
- Float or walk reaches
  - 1-5 times during season
- Marked with flagging
- Georeferenced to reaches

Carcass Surveys (2002-2008)

- Float or walk reaches
  - 1-2 times during season
- Carcass origin (markings)
- GPS location (3 – 5 meters)

Goals

- Compare redd abundance before and after supplementation.

- Evaluate spatial distributions of redds by analyzing density and distribution before and after supplementation.

- Investigate distributions of wild and “natural origin” carcasses before and after supplementation.

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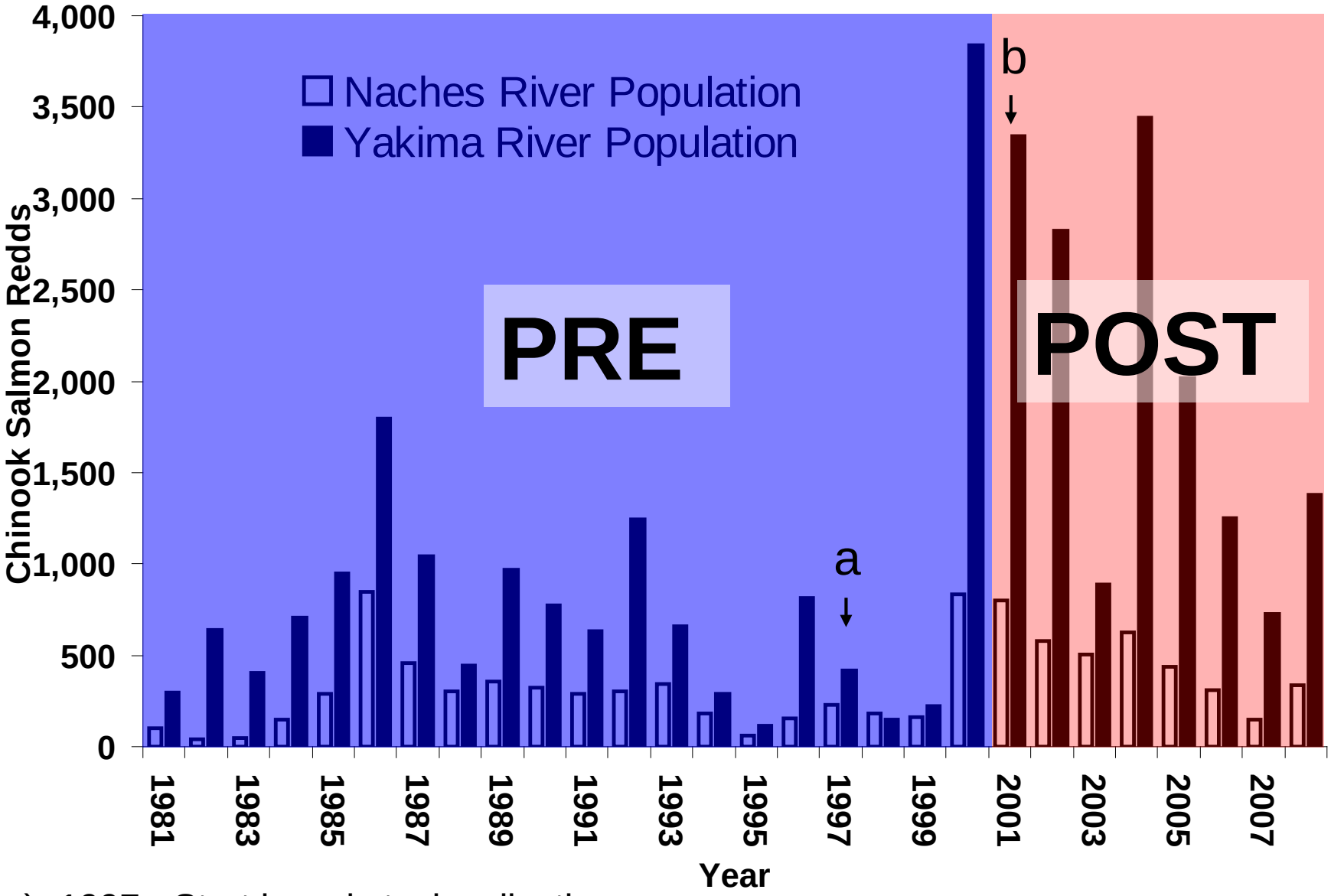
Redd Abundance

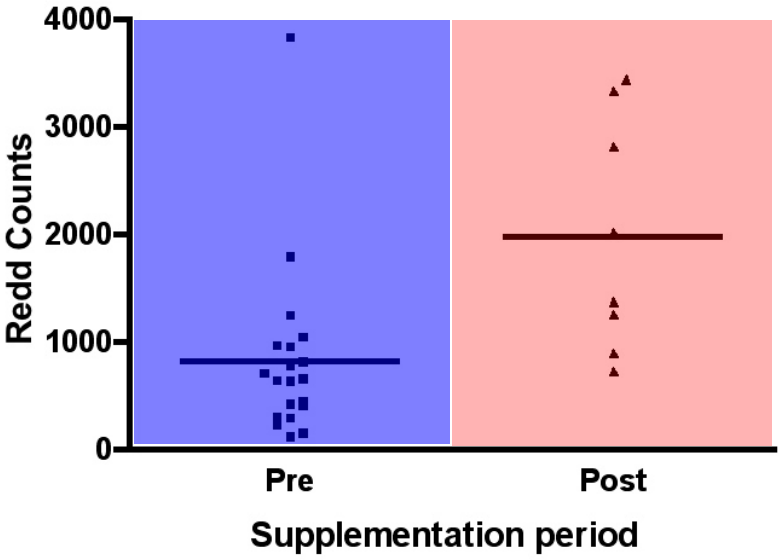


a) 1997 - Start brood stock collection

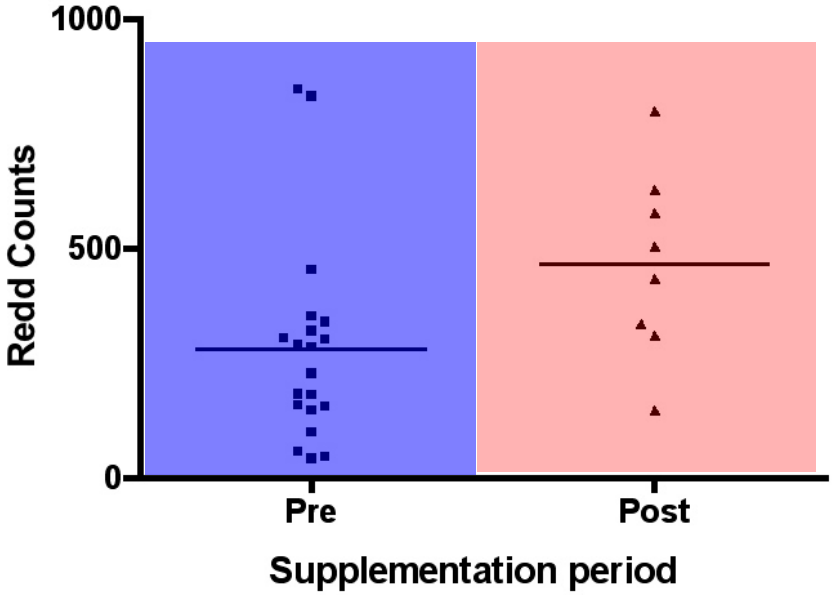
b) 2001 - 1st naturally spawning hatchery females

Redd Abundance: Pre and Post supplementation

Supplemented
Upper Yakima R. Population.



Wild Control
Naches R. Population.



Pre: 819.8 ± 183.2
Post: 1984.0 ± 386.5
Increase 242%
P = .0048 **

(n=20)
(n=8)

Pre: 282.0 ± 49.60
Post: 467.5 ± 72.51
Increase 165%
P = .0517 ns

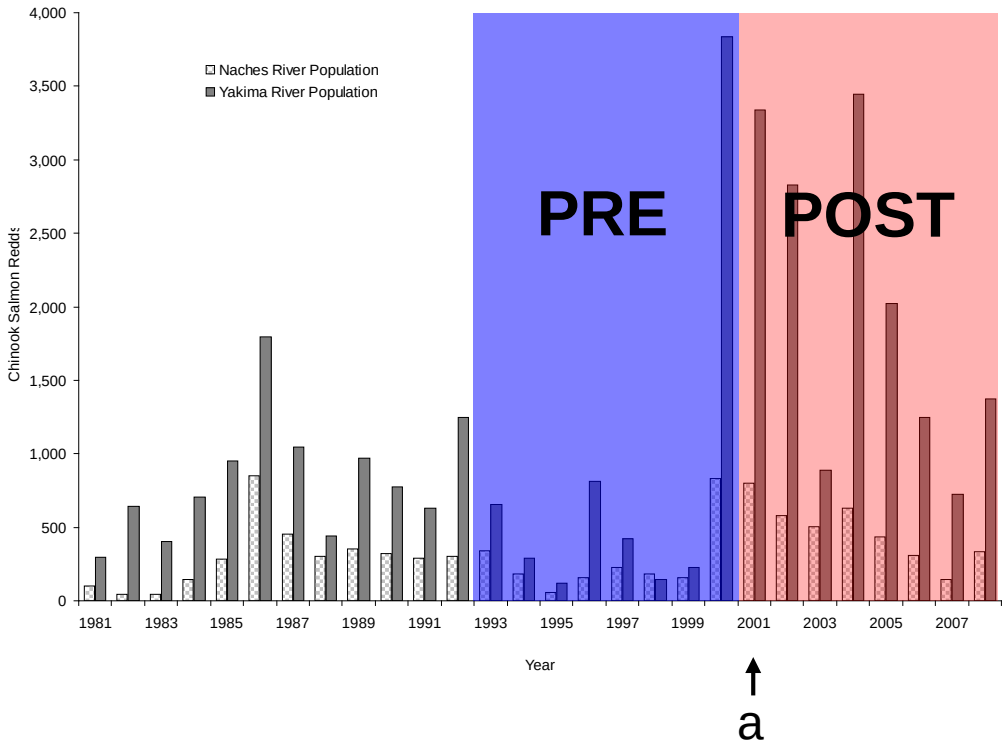
Redd Density and Distribution

1. **Unsupplemented control Naches R. population.**

2. **Supplemented Yakima R. population.**

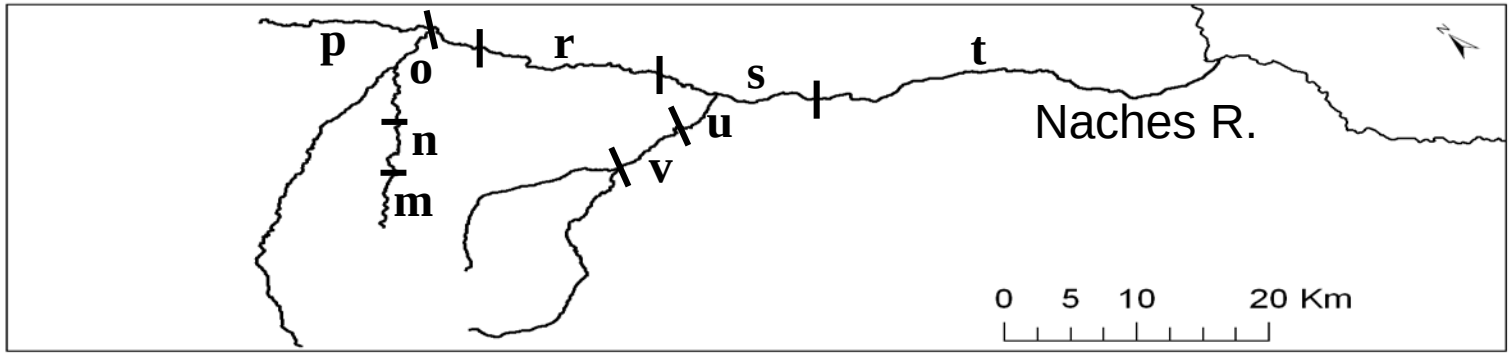
   - 2 x 8 year periods

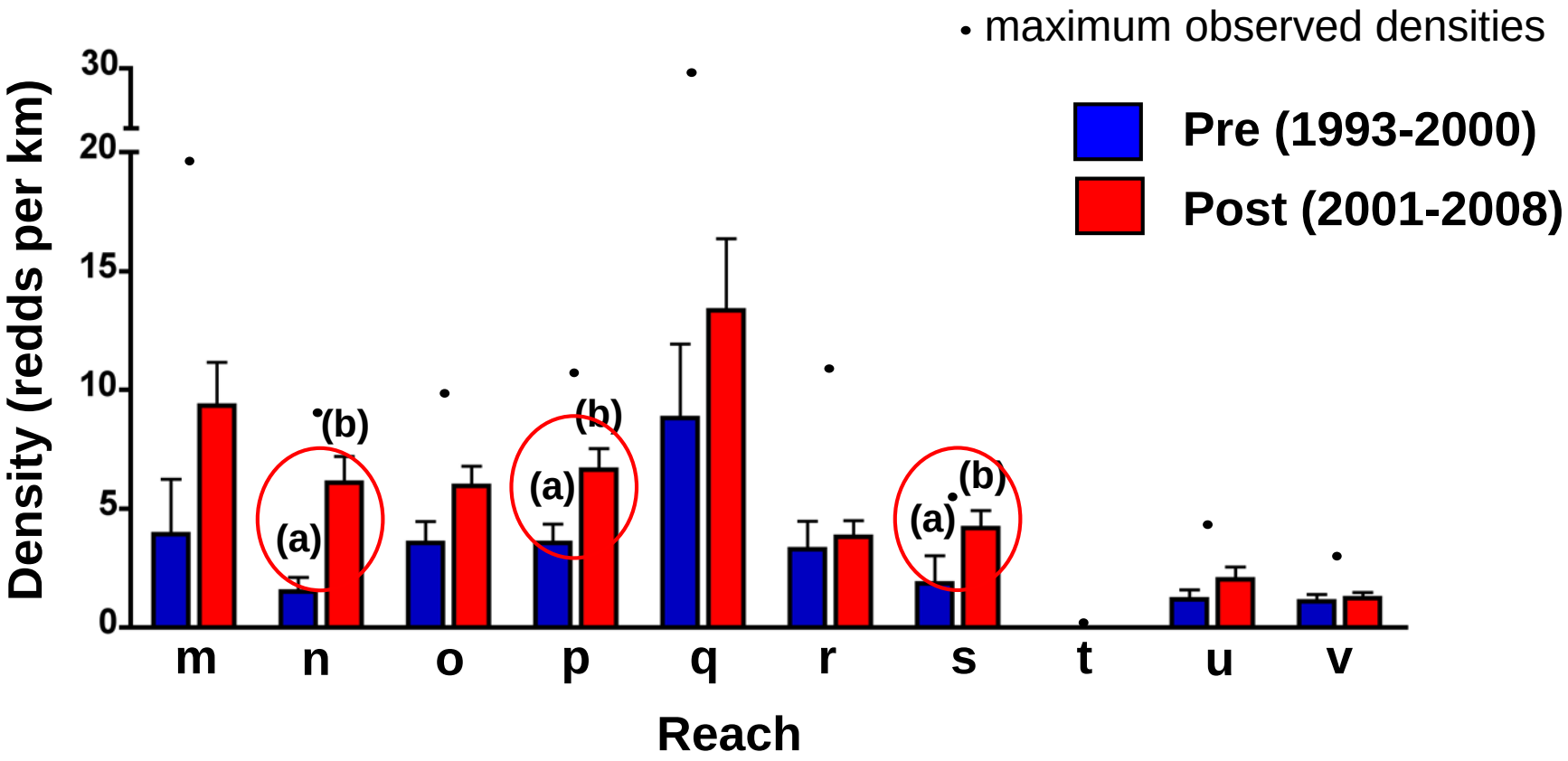
   - Pre 1993 – 2000 (blue)
   - Post 2001 – 2008 (red)



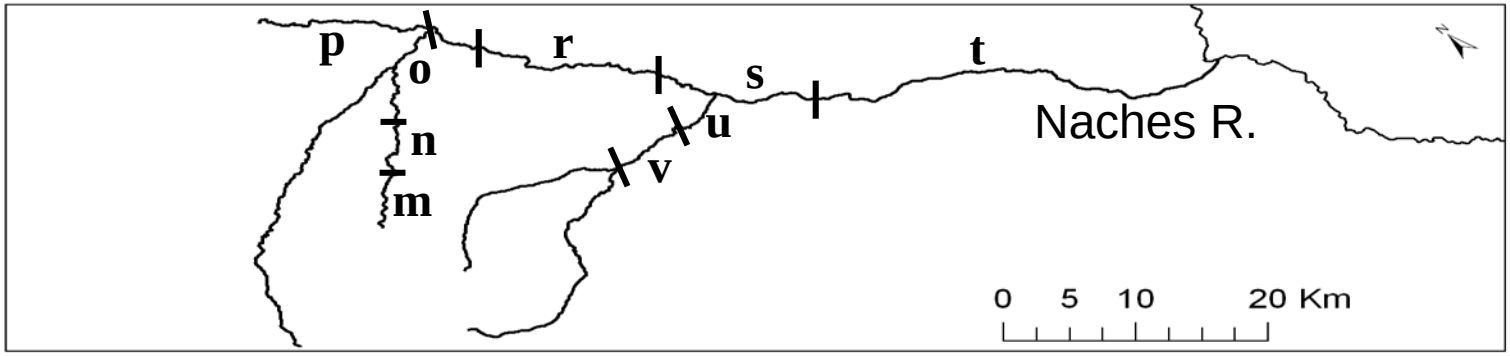
a) 2001 _ 1st returning naturally spawning hatchery females

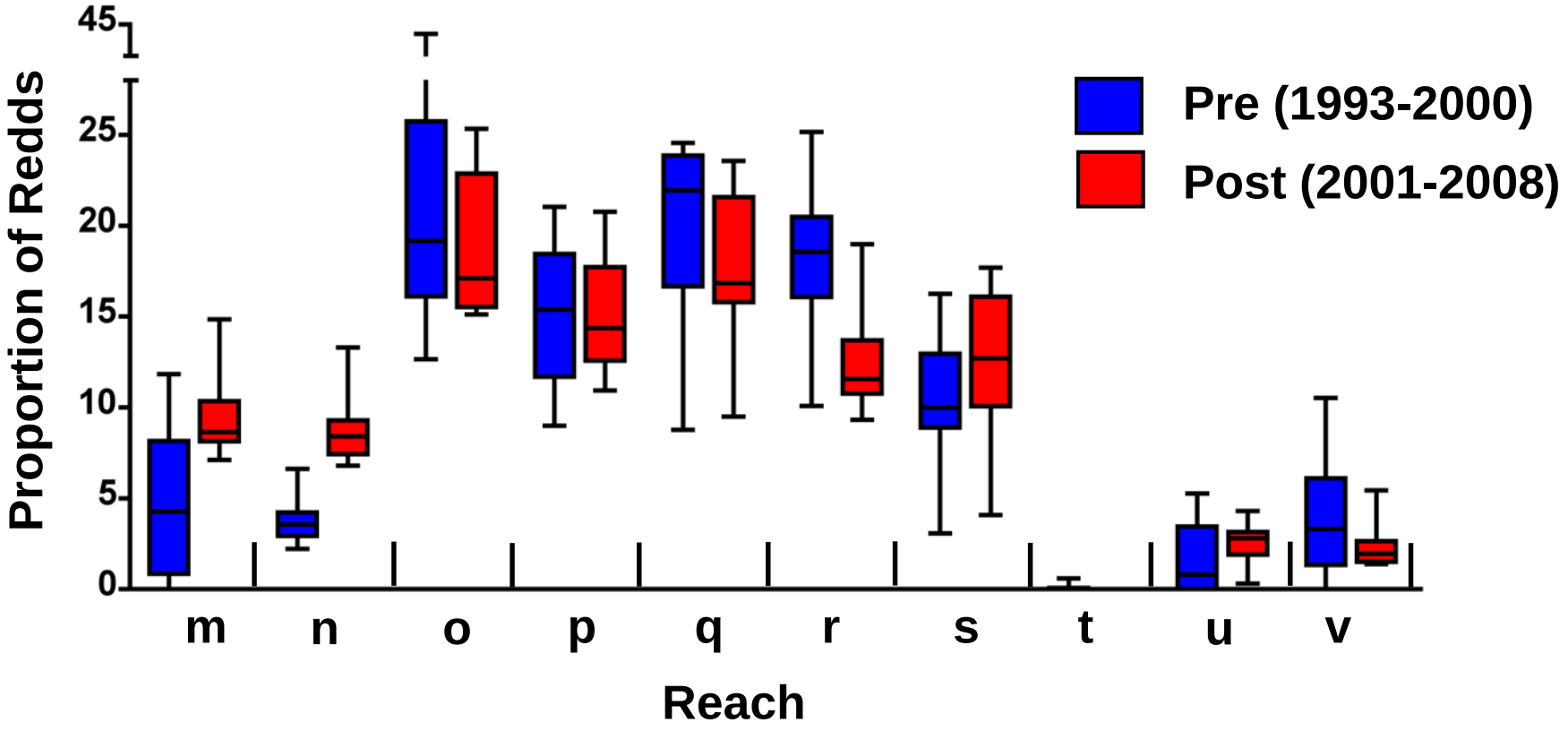
Control Naches R. Population Redd Density Data



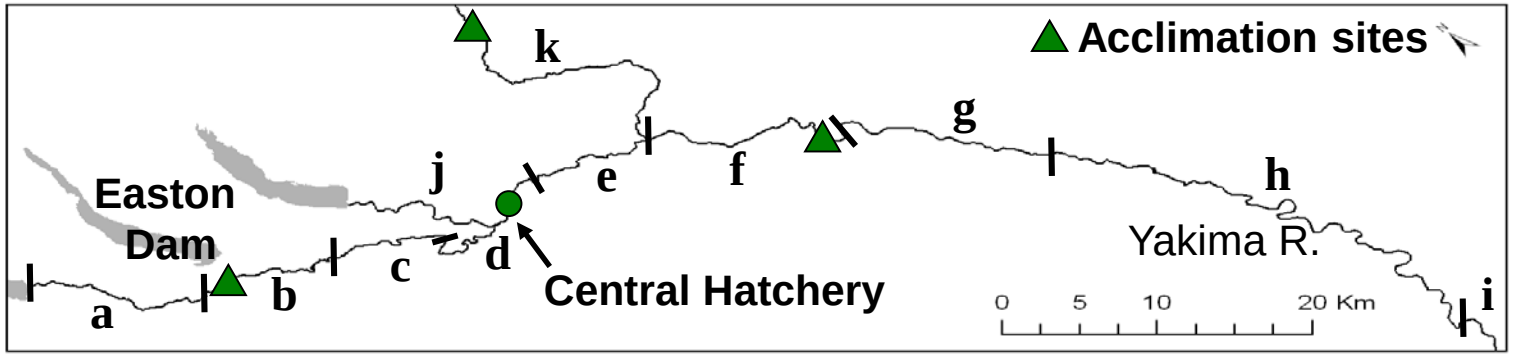


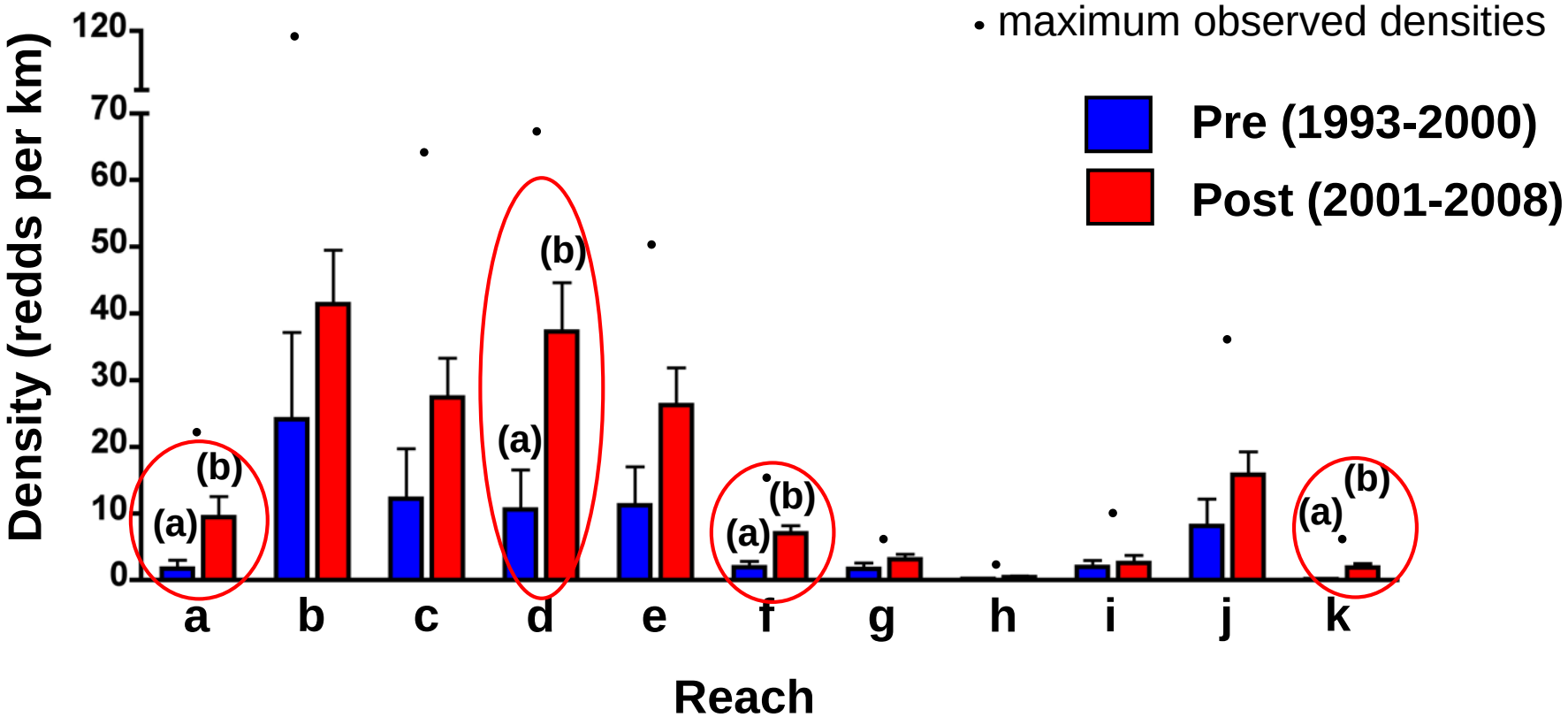
Control Naches R. Population Redd Distributions



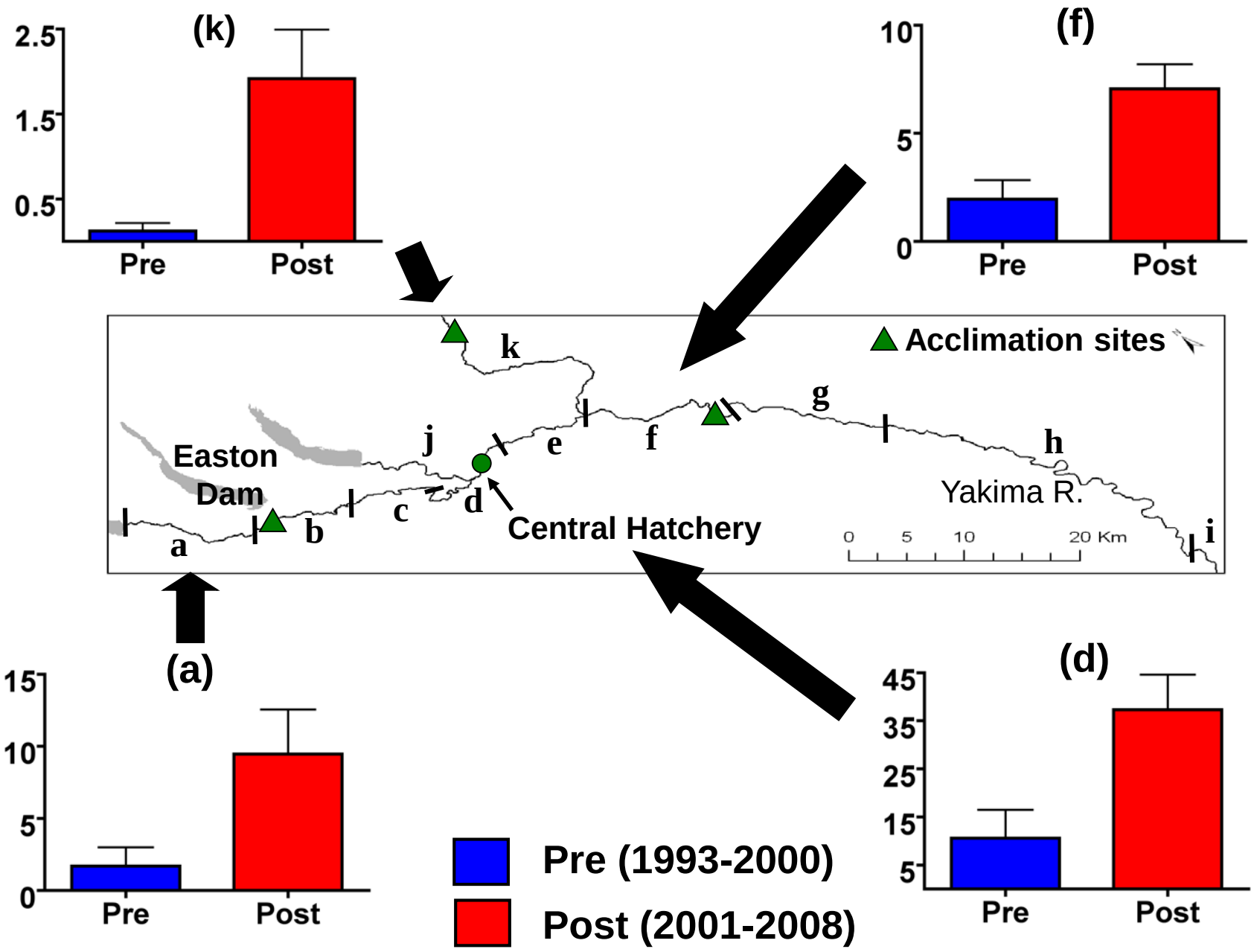


Supplemented Upper Yakima Population Redd Density Data

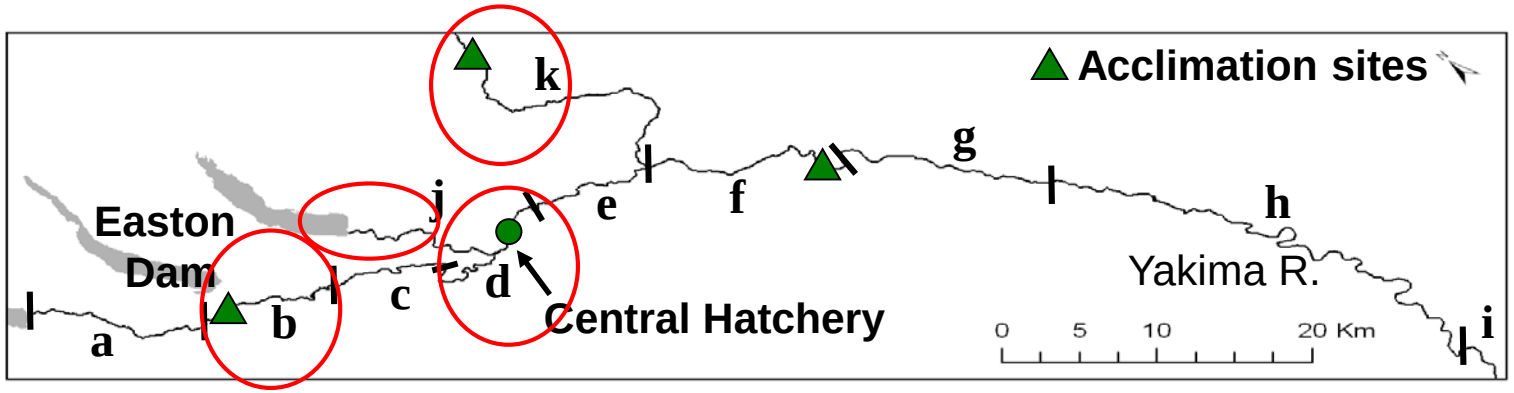


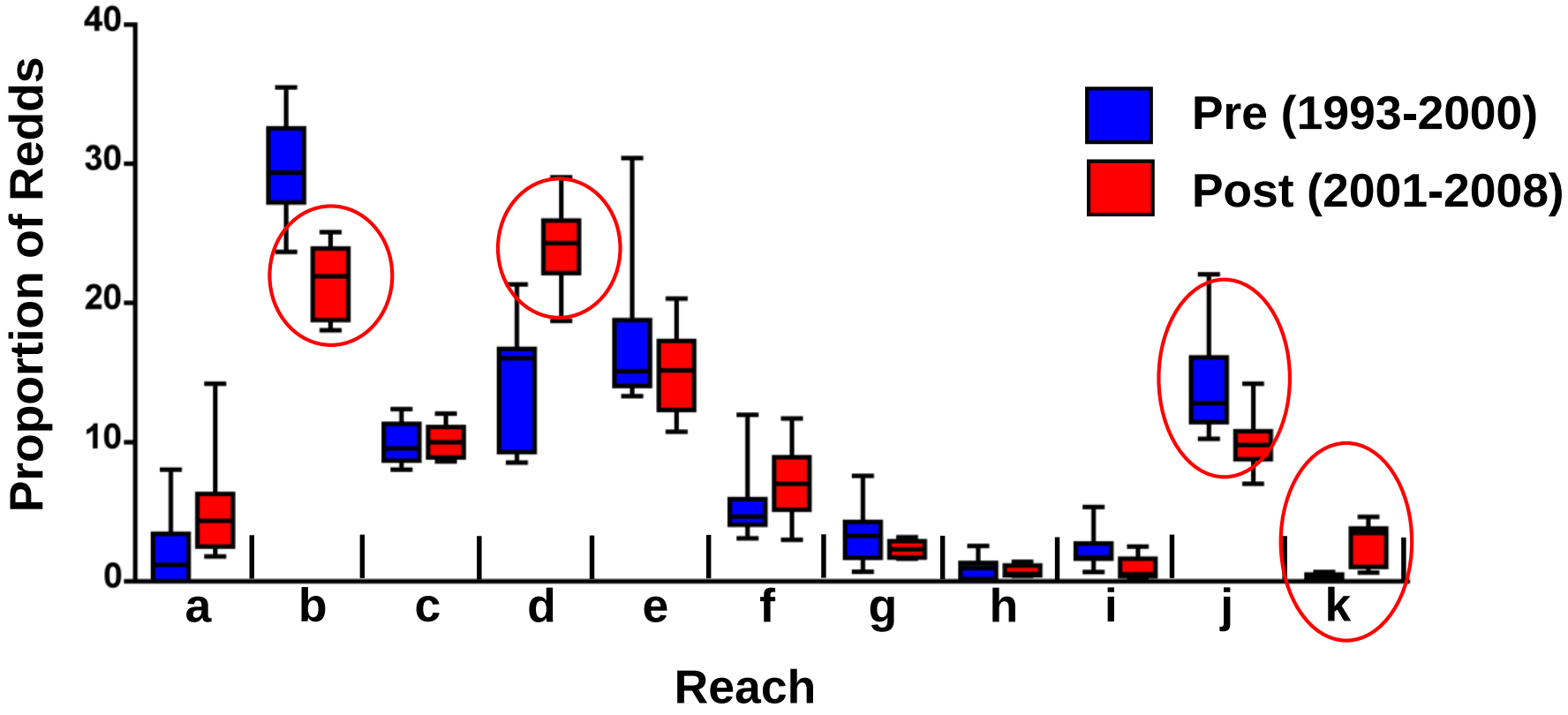


Supplemented Upper Yakima Redd Density Data



Supplemented Upper Yakima Population Redd Distributions





Redd Abundance, Density and Distribution: Pre and Post Supplementation for Upper Yakima and Naches Pops.

- Increased abundance *(both populations).*
- Increased densities in most reaches post supplementation.
- Shifts in distributions of spawning *(natural process?)* and perhaps a result of homing to hatchery facilities.

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Carcass Surveys & Wild / Natural Origin Distributions
Upper Yakima River Population

-Goal: Increase natural production

-2002 - 2008

-GPS location (3-5m)

-Marked (H)

-Unmarked (W / natural origin)

Timeline: Unmarked Carcasses

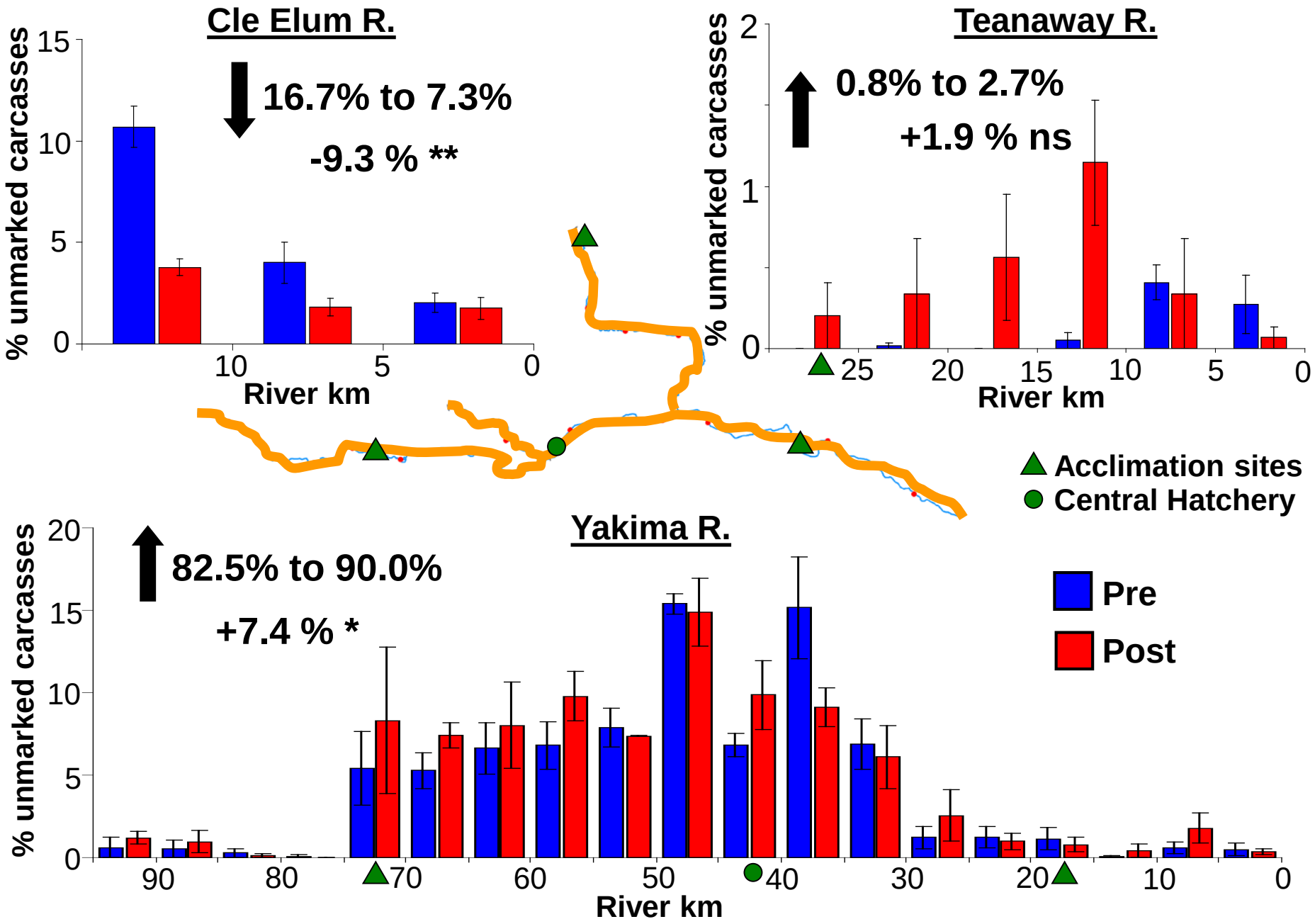
Prior to 2005 – progeny of W adults. → Pre supplementation phase (2002-2004)

Analysis: 2 three year periods

After 2005 – progeny of W or naturally spawning H adults. → Post supplementation phase (2006-2008)

Has this hatchery influence altered spawning distributions of unmarked fish in the post supplementation period?

Carcass Surveys - Wild / Natural Origin Distributions



Carcass Surveys – Wild / Natural Origin Distributions

- Proportions increased in Yakima and Teanaway Rivers
  - Teanaway – Upstream (closer to acclimation facility)
  - Yakima – Higher proportions trending upstream and around central hatchery.
- Proportions decreased in the Cle Elum River.
  - Pre supplementation period – high occurrence of wild spawners below the Cle Elum dam.
  - Post supplementation period – significant drop in the percentage of wild spawners in the most upstream 2 km section (less overall fish but distributions are the same).

Conclusions

- Does not appear to be major changes in spawning distributions before and after supplementation.

- Acclimation facilities may alter distributions of natural origin spawners and may seed under utilized habitat.

- Some natural variation in spawning distributions in both populations.

Acknowledgments

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Carcass Surveys

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