Supportive breeding boosts natural population abundance with minimal negative impacts on fitness of wild Chinook salmon in Johnson Creek

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Introduction

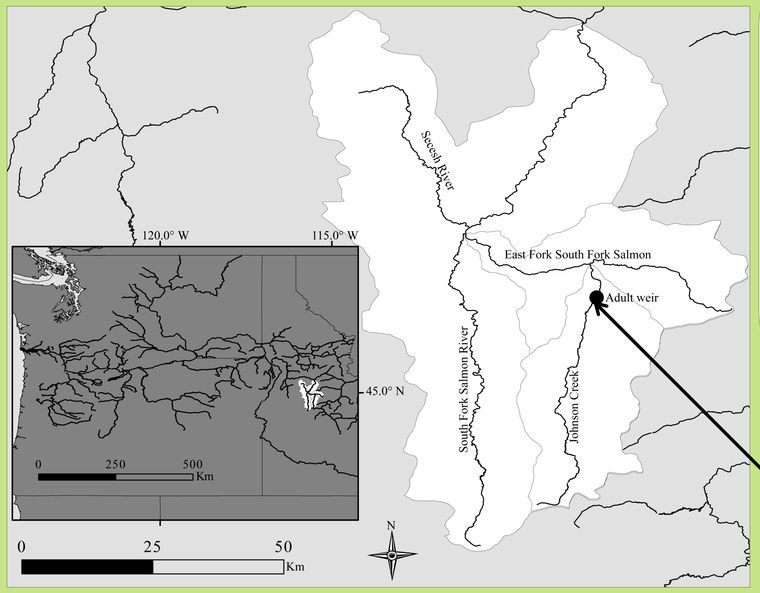
- Due to low returns, Snake River spring/summer Chinook salmon are listed as threatened under the Endangered Species Act.
- A supplementation program, using 100% natural-origin fish for broodstock, for summer Chinook was initiated in Johnson Creek in 1998 to prevent extirpation and enhance natural production.

Objectives

- i) Demographic boost provided by hatchery?
- ii) Fitness differences between successful wild and hatchery fish spawning in nature?
- iii) Do hatchery fish spawning in nature reduce the fitness of the wild population?

Methods

- Genetic data for ~7,700 returning adults to Johnson Creek (Figure 1) over 13 return years (1998-2010).
- Reconstructed genetic pedigrees to quantify reproductive success (RS).



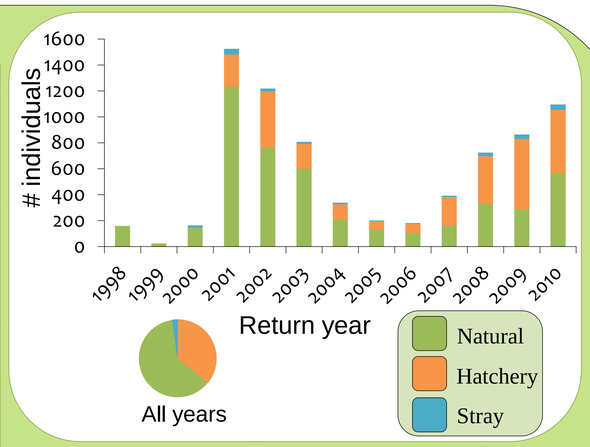


Figure 1. Inset map showing the location of Johnson Creek in the East Fork South Fork Salmon River within the Columbia River Basin. Graph: number of fish sampled by origin and return year. Photo: the adult weir; location of the adult weir in the Johnson Creek subbasin is indicated by the black point.

Brood year (BY)	Adult offspring produced relative to wild	Adult grand-offspring produced relative to wild
1998	2.77	1.37
1999	n/a	n/a
2000	1.22	1.28
2001	5.35	tbd
2002	5.48	tbd
2003	8.01	tbd
2004	5.29	tbd
2005	4.70	tbd
Mean	4.69	tbd

Table 1. Comparison of the number of returning adult offspring and grand-offspring (including jacks) produced by fish removed at the weir for hatchery brood stock and the number of returning adult offspring produced by fish allowed to spawn in the natural environment.

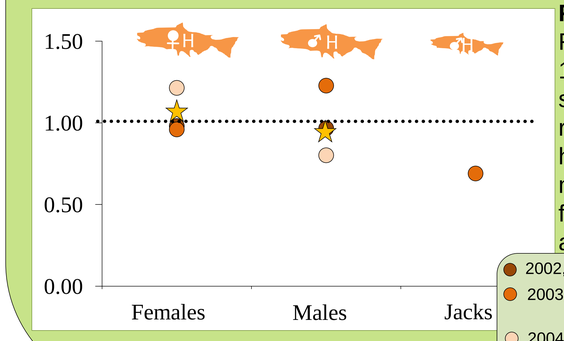


Figure 2. Relative RS (to wild, RRS = 1.0, by definition) of successfully reproducing hatchery female, male and jack F_1 fish from BY 1998 and 2000.

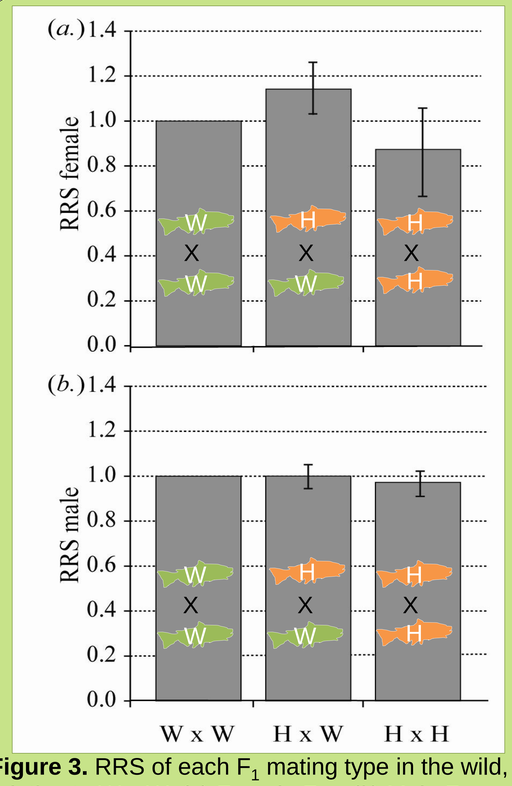


Figure 3. RRS of each F_1 mating type in the wild, relative to W x W. (*a*) Female F_1s, (*b*) Male F_1s. Weighted geometric mean RRS among return years 2003 to 2005 is plotted for H x W and H x H relative to W x W. Error bar represents 1 s.d.

Results

- On average, fish taken into the hatchery produced ~5x more adult offspring, and boost continues in second generation (Table 1).
- Mean RRS for hatchery F_1 females and males was 1.11 (p = 0.84) and 0.89 (p = 0.56), respectively (Figure 2).
- Mean RRS of H x W and H x H matings was 1.07 (p = 0.92) and 0.94 (p = 0.95), respectively (Figure 3).

Conclusions

- <u>Demographic Boost</u>: Supplementation program provides a boost to the natural population
- <u>Fitness Differences</u>: Generally, equal reproductive success of H and W fish contributing offspring to the next generation
- <u>Fitness Effects</u>: No significant difference in RS of mating types, Chinook salmon reared for a single generation in the hatchery had a limited and undetectable effect on the fitness of wild-origin fish