

The effects of domestication on predation vulnerability



The background of the slide is a dense, slightly out-of-focus photograph of many small, dark-colored fish swimming in clear water. The fish are oriented in various directions, creating a sense of movement and a natural aquatic environment. The lighting is soft, highlighting the silvery scales of the fish against the light blue-green water.

Background

- Hatcheries may increase survival of fish with certain genetic traits that are maladaptive in the natural environment (relaxation of natural selection)
- Survivors can pass on these traits to their offspring and reduce the productivity of the naturally reproducing population

Purpose

- Is there differential predation mortality between the offspring of conventional hatchery and a supplemented population of spring Chinook salmon that could be the result of domestication selection?

Supplementation

- The offspring of natural origin adults in the supplemented population of the upper Yakima
- Parents could be any combination of returning, marked hatchery adults and unmarked naturally spawned adults
- Returning marked adults that were reared in the hatchery must spawn in the river (integrated population - at least one generation of natural selection between hatchery rearing)

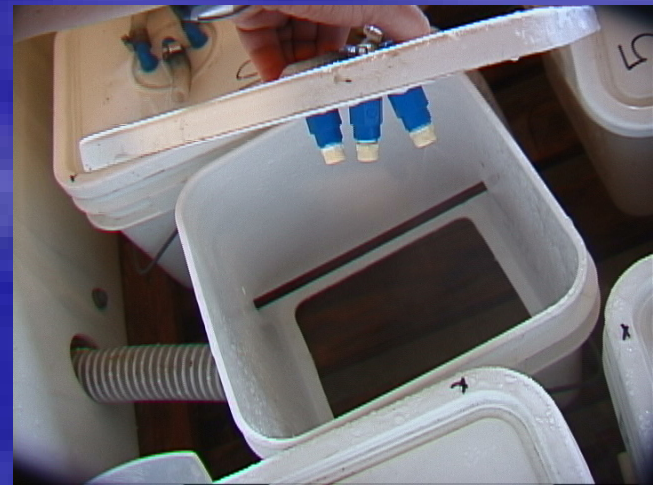
Hatchery

- The offspring of hatchery origin adults in the upper Yakima River-started with BY02 marked adults
- 2007 was 1st offspring of the 2nd generation
- Not allowed past Roza Dam to spawn (segregated - no natural selection in early life)

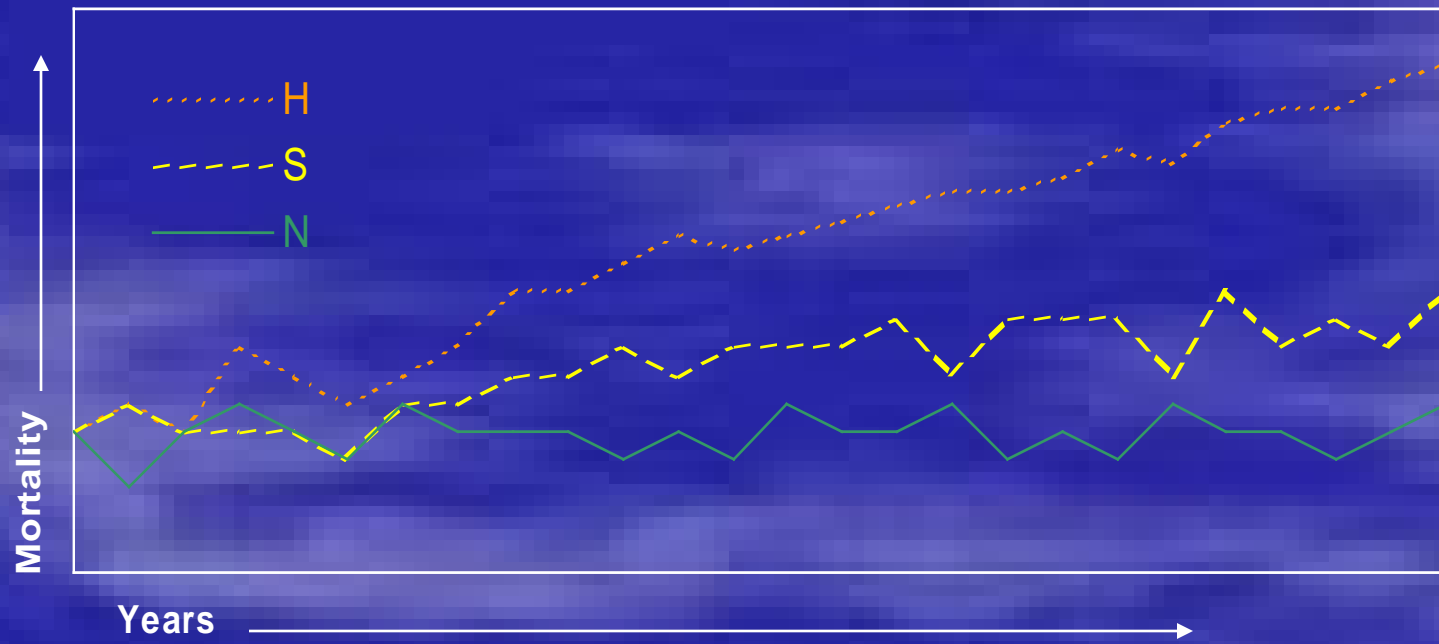
Naches



- Serve as a baseline for domestication – no history of hatchery influence
- Adults were not collected in BY 2006 due to the low number of returning adults



Hypothesis





- Used the juvenile offspring of two or three different lines of spring Chinook salmon that were reared identically in the hatchery (common garden experiment)

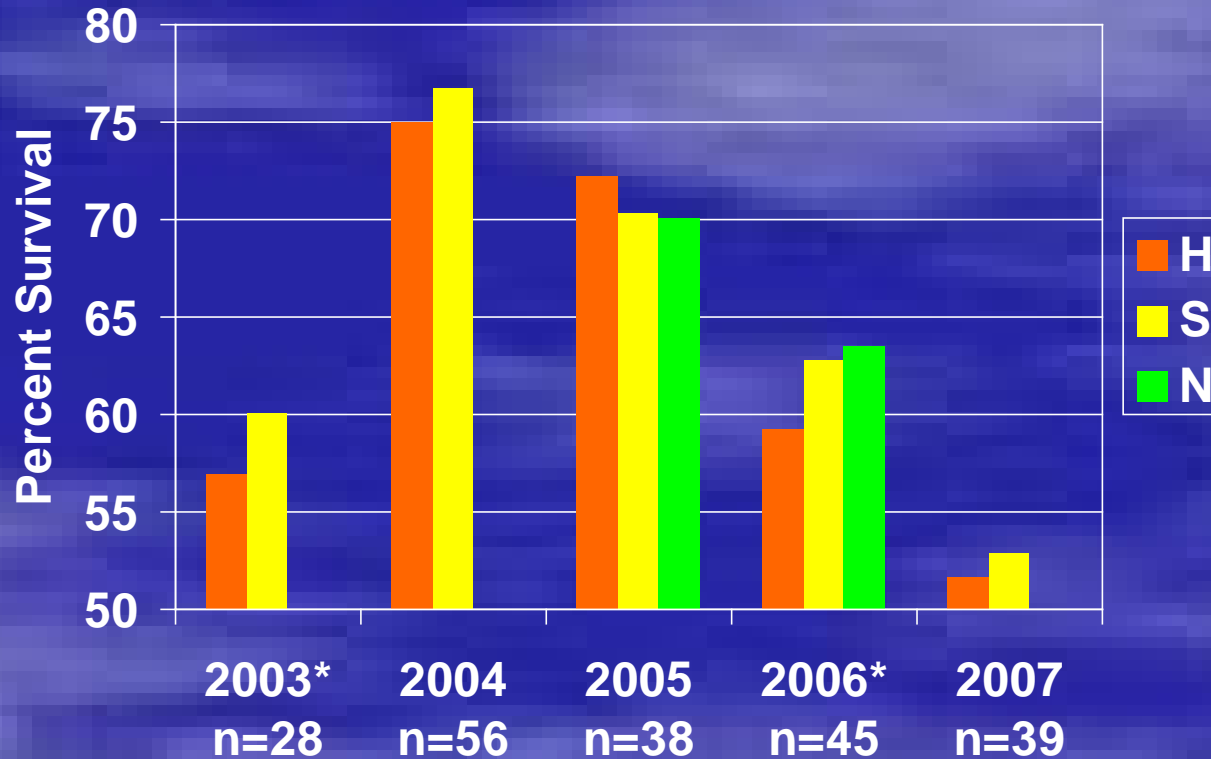
- 8 - 3m x 2.4m x 1.5m 3mm mesh net pens in a raceway were stocked with 2 rainbow trout and 2 torrent sculpins
- Size matched 50 or 75 fry of each origin, marked them, and released into each of the net pens





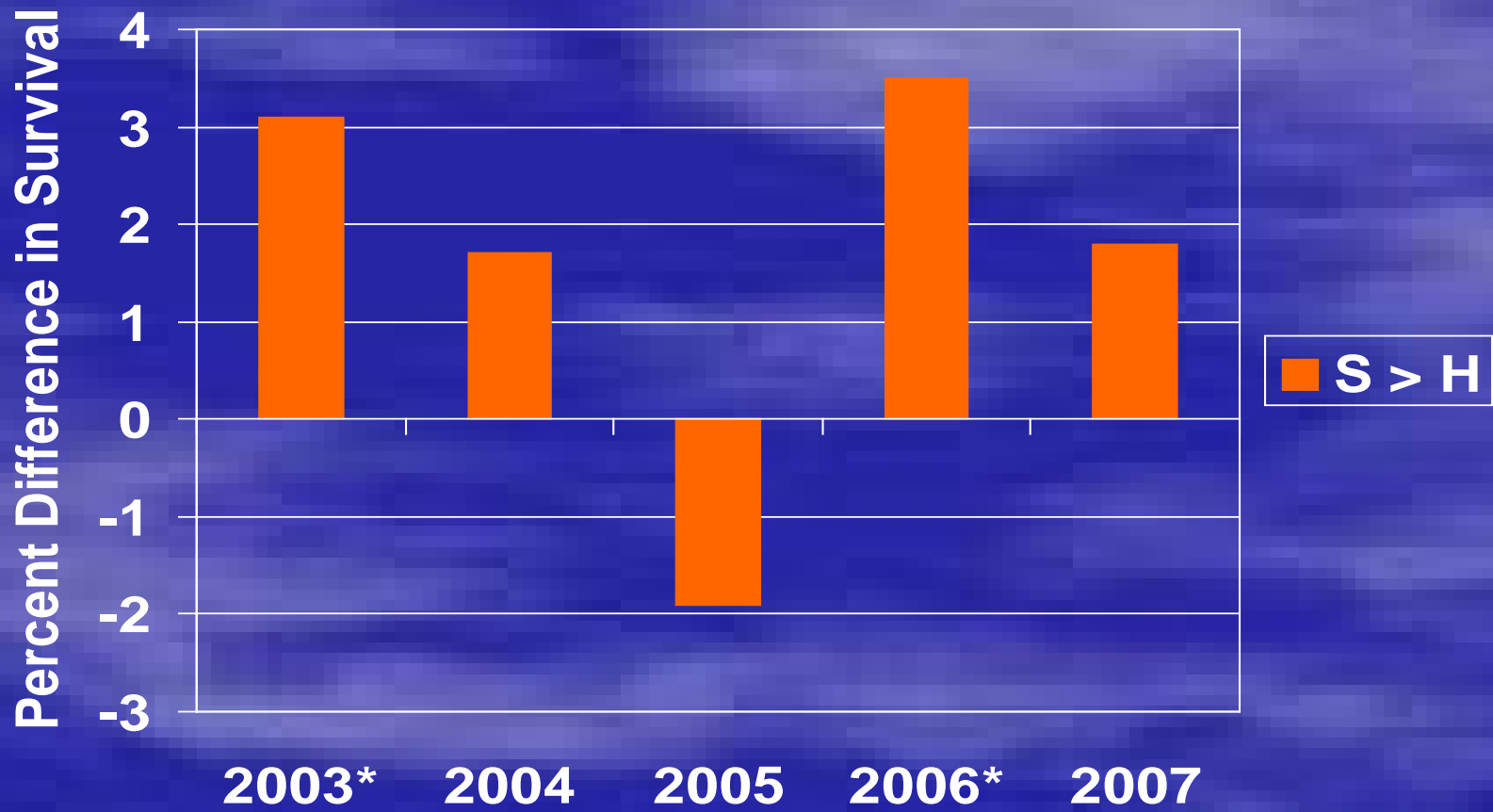
- At end of each trial survivors were recovered and enumerated
- Used the Wilcoxon matched pairs test for survival between origins (H vs. N, S vs. N, H vs. S)

Results – Net Pens



S were offspring of wild adults in 2003 and 2004

Yearly Survival Difference



H were much less aggressive in dominance trials in 2005 and much more aggressive in 2006

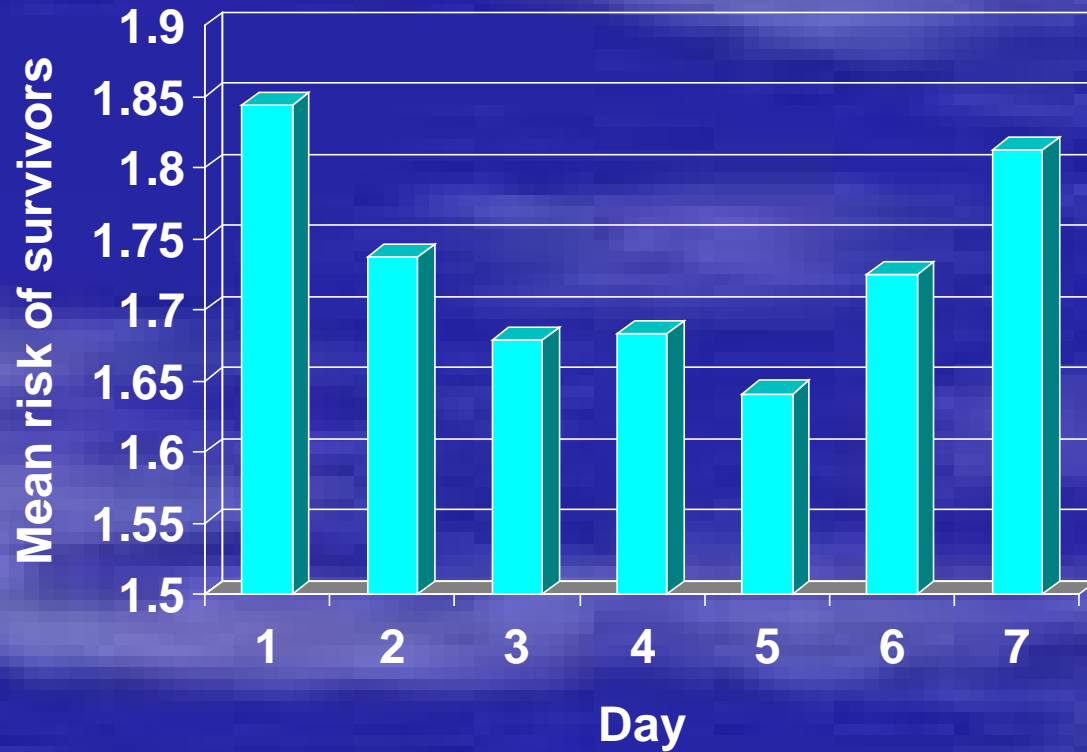
Sculpin Trials

- Stocked 1 individual from each origin (size-matched) into glass aquaria divided into a safe zone (1/2 of tank, no food) and a predator zone (1/2 of tank, food)
- Stocked 1 torrent sculpin into each tank on second day
- Fed fry for each of six days and recorded position
- Tested for differences in survival (sign test), and mean risk and percent growth by weight of the survivors (two-sample t-tests)

Results – Sculpin Trials

- 98 trials completed during 2007
- No difference in survival, growth, or risk taking detected between origins
- Surviving fry displayed significantly lower level of risk than consumed fry (1.7 vs. 2.2)
- Significant positive relationship between percent growth and level of risk

Risk Through Time



Summary

- Generally agrees with the hypothesis of domestication (survival; $N > H$, $S > H$, $N \geq S$)
- Differences are still small after 1 year of 2nd generation
- May not see the same thing each year because of annual variation (e.g. 2005)
- Will continue sculpin trials in 2008 as a backup to the net pen trials

Acknowledgements

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Literature

Study	Species	Comparison	Culture	Stock	Rearing	Years	Families	Metric
1	brown trout	Wild vs. hatchery	1-2	Same?	Different	1	5-7	Behavior
2	steelhead	Wild vs. hatchery	1-7	Same	Same	1	7-10	Mortality
3	brown trout	Wild vs. hatchery	5	Same	Same	1	9	Behavior
4	Atlantic salmon	Wild vs. farmed	7	Same	Same	1	8	Behavior
5	steelhead/ rainbow trout	Wild vs. wild/farmed hybrid	At least 5	Different	Same	1	11	Behavior
6	brown trout	Wild vs. hatchery/wild hybrid	5	Same	Same	1	Up to 64?	Behavior
7	Atlantic salmon	Wild vs. farmed	7	Same	Same	2	?	Behavior
8	masu salmon	Wild vs. hatchery vs. farmed	At least 7	Different	Different	1	?	Behavior
Present	Chinook salmon	supp. vs. hatchery w/ wild control	1+	Same	Same	4	38-59	Mortality

¹Alvarez and Nicieza (2003); ²Berejikian (1995); ³Ferno and Jarvi (1998); ⁴Fleming and Einum (1997); ⁵Johnsson and Abrahams (1991); ⁶Johnsson et al. (1996); ⁷Johnsson et al. (2001); ⁸Yamamoto and Reinhardt (2003)