



# The Effects of Domestication on Competitive Dominance of Juvenile Spring Chinook Salmon

Todd Pearsons, Anthony Fritts, Jennifer Scott, and  
Jordan Vandal

Washington Department of Fish and Wildlife

# Supplementation

*Wild Fish as Parents*

*Natural*



*Hatchery*

*Natural Origin  
Children*

*Hatchery  
Origin Children*



*Natural*

*Natural Origin  
Grandchildren*

HATCHERY

Adult holding in hatchery



Artificial Spawning



Natural Spawning



Adult holding natural



Migration back to spawning ground



Maturation in Ocean



NATURAL

Migration downstream



Rearing in stream



Eggs incubate in gravel



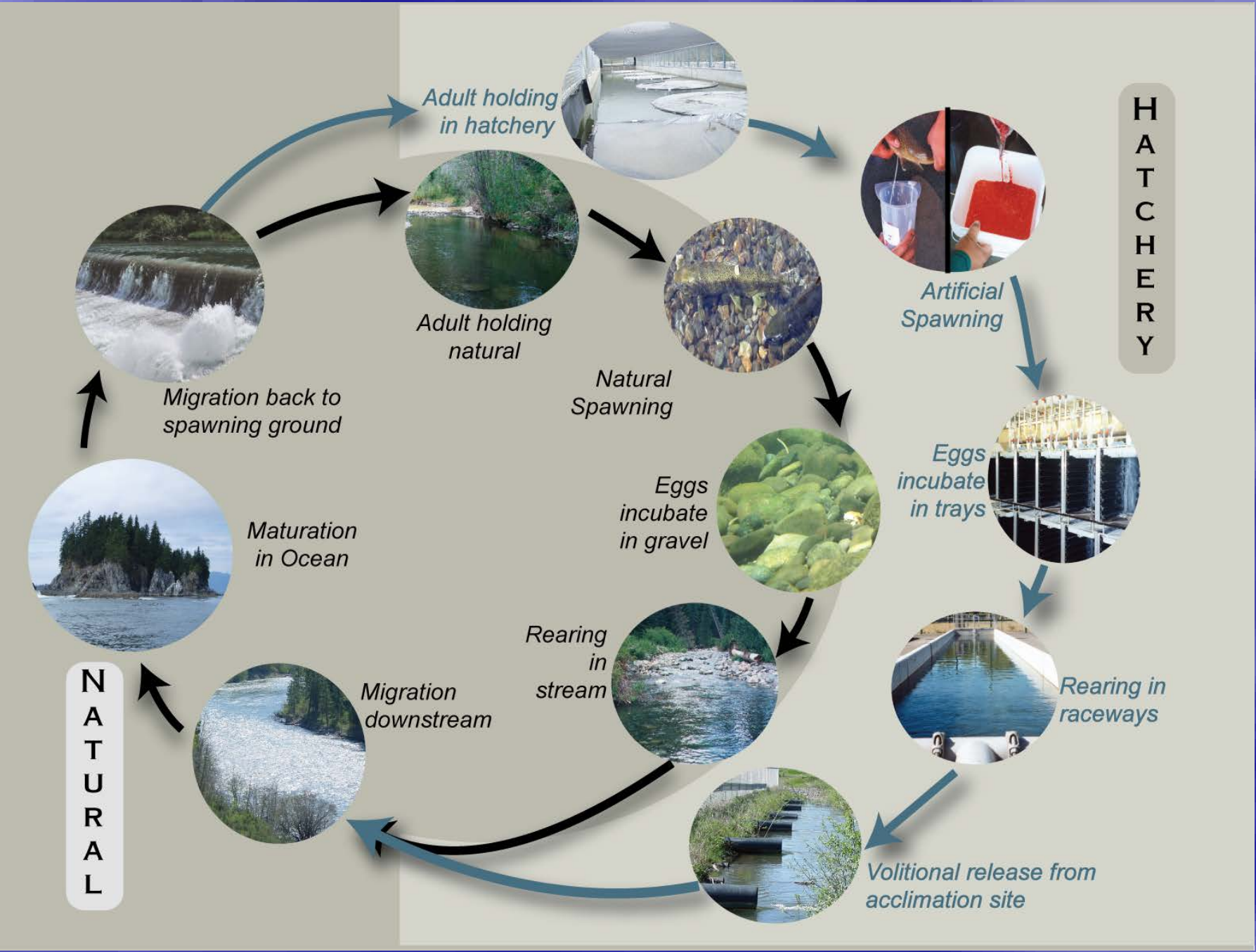
Eggs incubate in trays



Rearing in raceways



Volitional release from acclimation site



# If domestication does occur, we would expect...



- offspring of hatchery fish to be dominant in scramble competition



- offspring of wild fish to be dominant in contest competition

# Purpose

- Compare dominance, aggression, and growth among offspring of three different lines of Yakima basin spring Chinook salmon that vary in hatchery ancestry (contest and scramble competition)

# Three lines compared

- Naches (N) – offspring of adults from the Naches basin; no artificial propagation
- Supplementation (S) – offspring of natural origin adults in supplemented population of the upper Yakima (“S” fish were wild in 2003 and 2004)
- Hatchery (H) – offspring of hatchery origin adults in the upper Yakima (2007 begins the second generation)

# Methods

- Common garden experiment
- Experiments were conducted for 7 days in 80, 30 gallon glass aquaria
- Measured dominance, aggression, and growth among paired fish (S vs N, S vs H, N vs H)



# Experimental Arenas



- Contest – one good spot



- Scramble – all spots equal

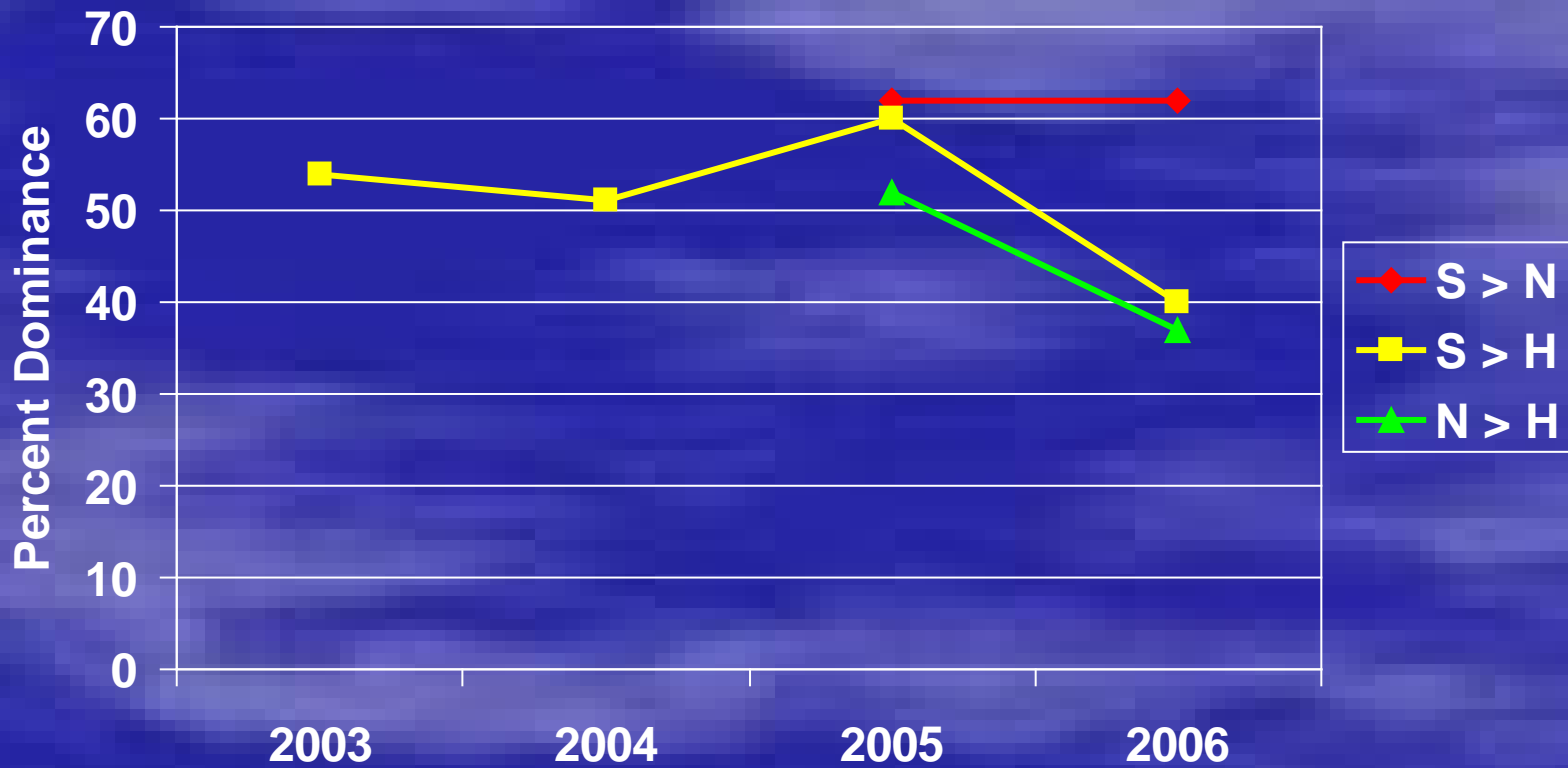




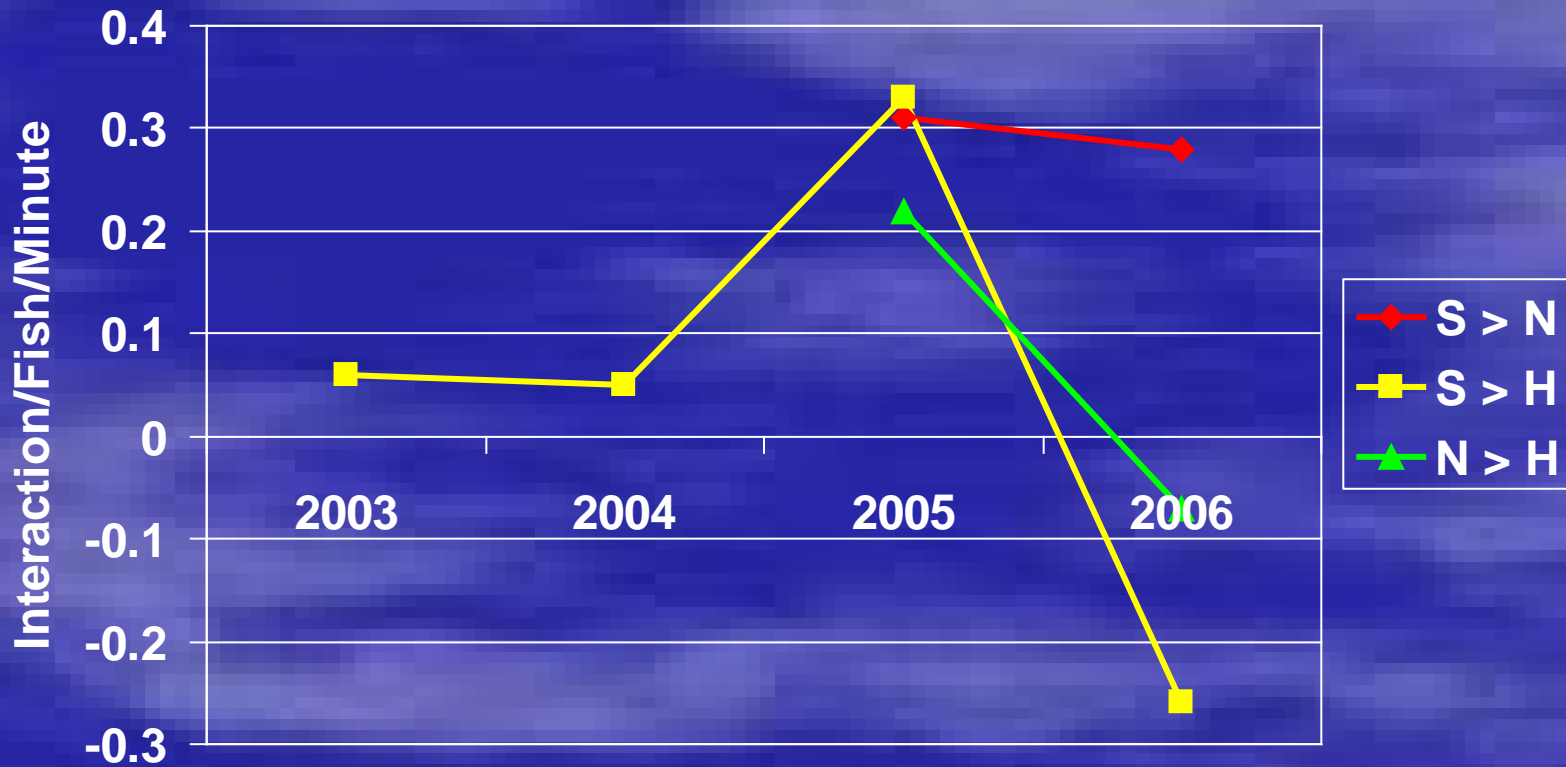
# Replicates

Comp.	2003	2004	2005	2006	Total
Contest (SvN, SvH, NvH)	229	276	811	617	1933
Scramble (SvH)	97	266	0	376	739

# Percent Dominance - Contest

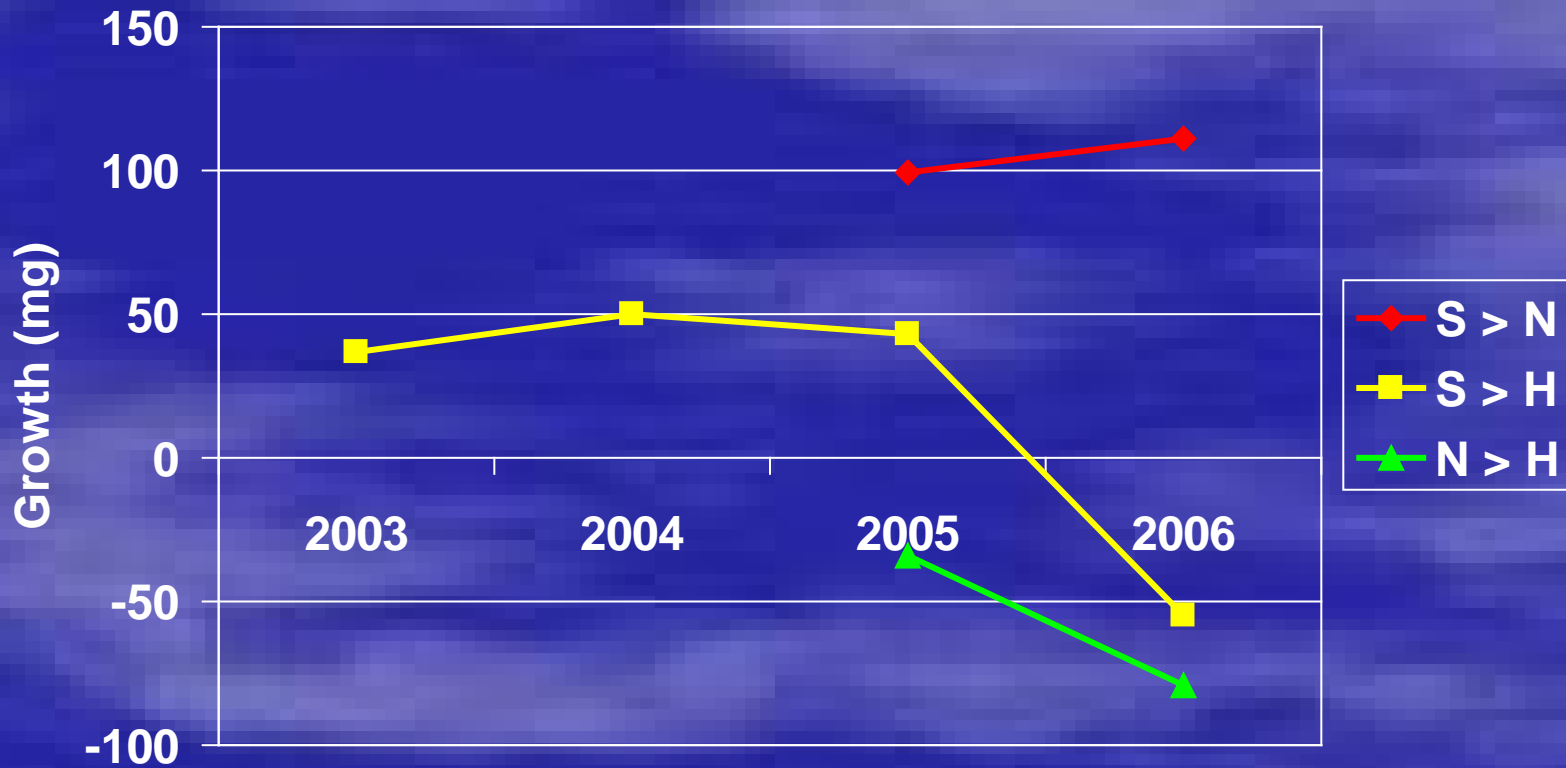


# Aggression – Contest (difference in interaction rate)



# Growth – Contest

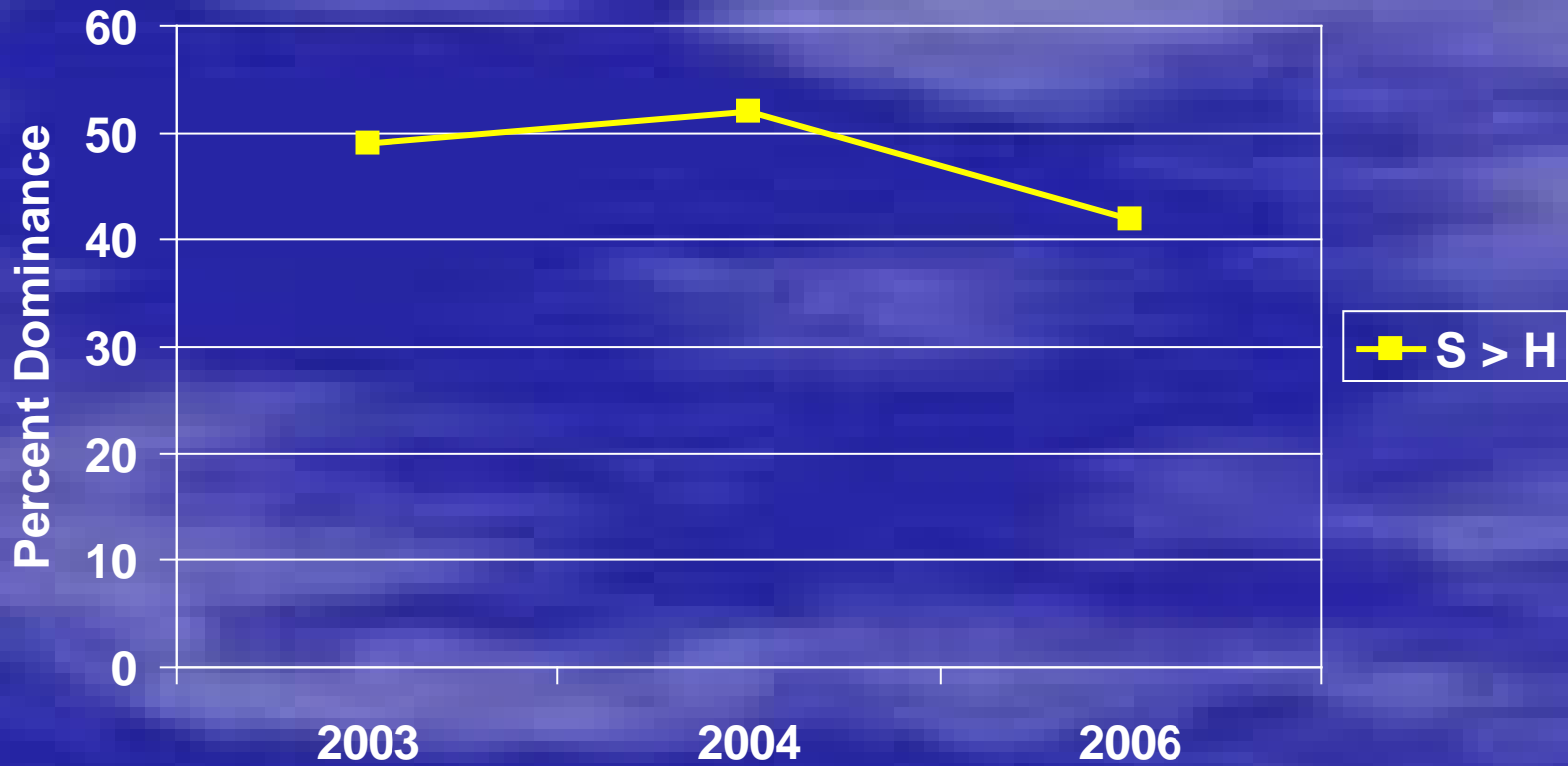
(difference in growth rate, mg)



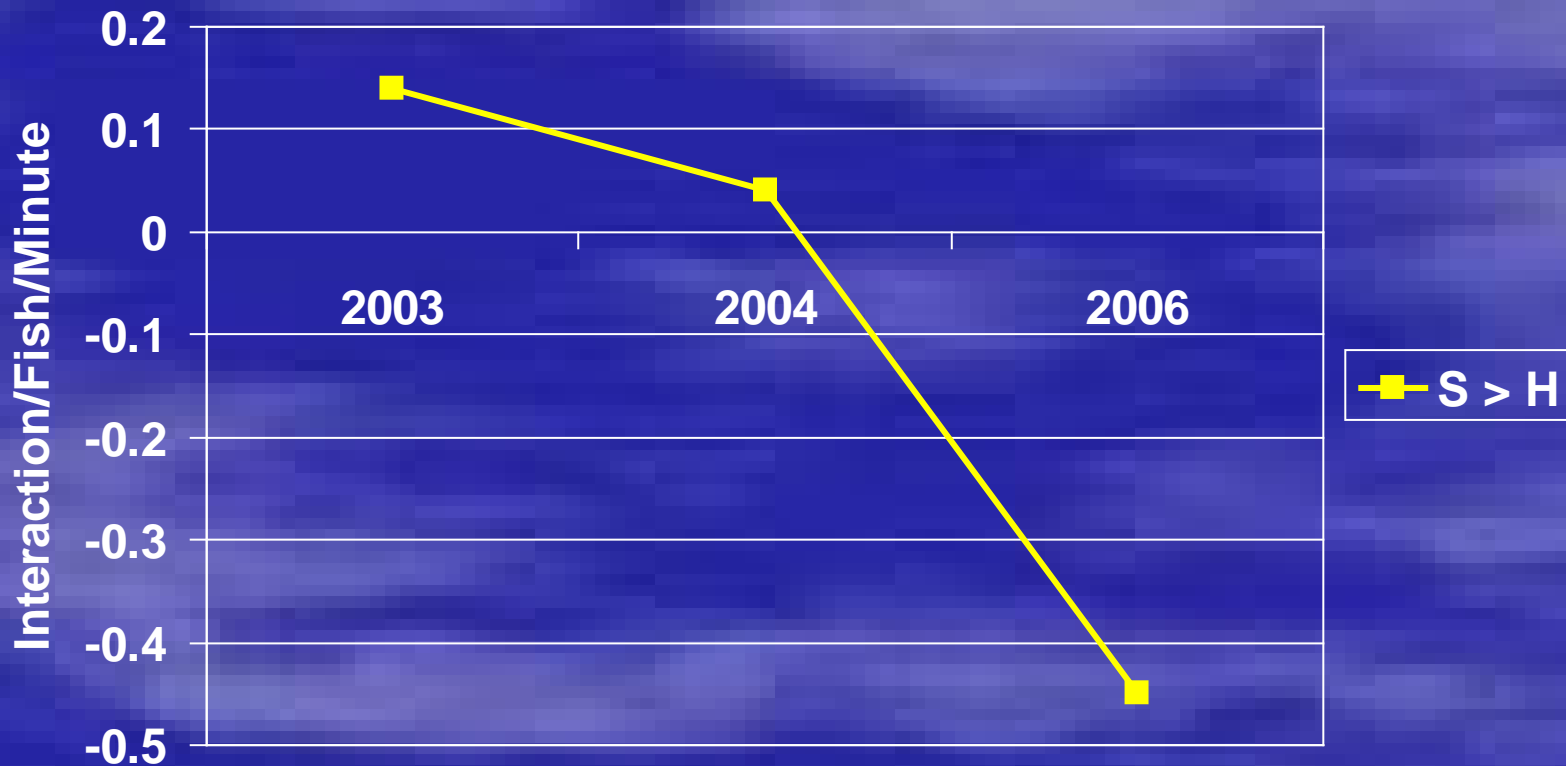
# Summary - Contest

- Results were similar between 2003-2005 and revealed that aggression and growth were significantly higher in offspring of wild/supp than hatchery origin fish
- Reversal of results in 2006 which appears to be from offspring of Hatchery line

# Percent Dominance - Scramble



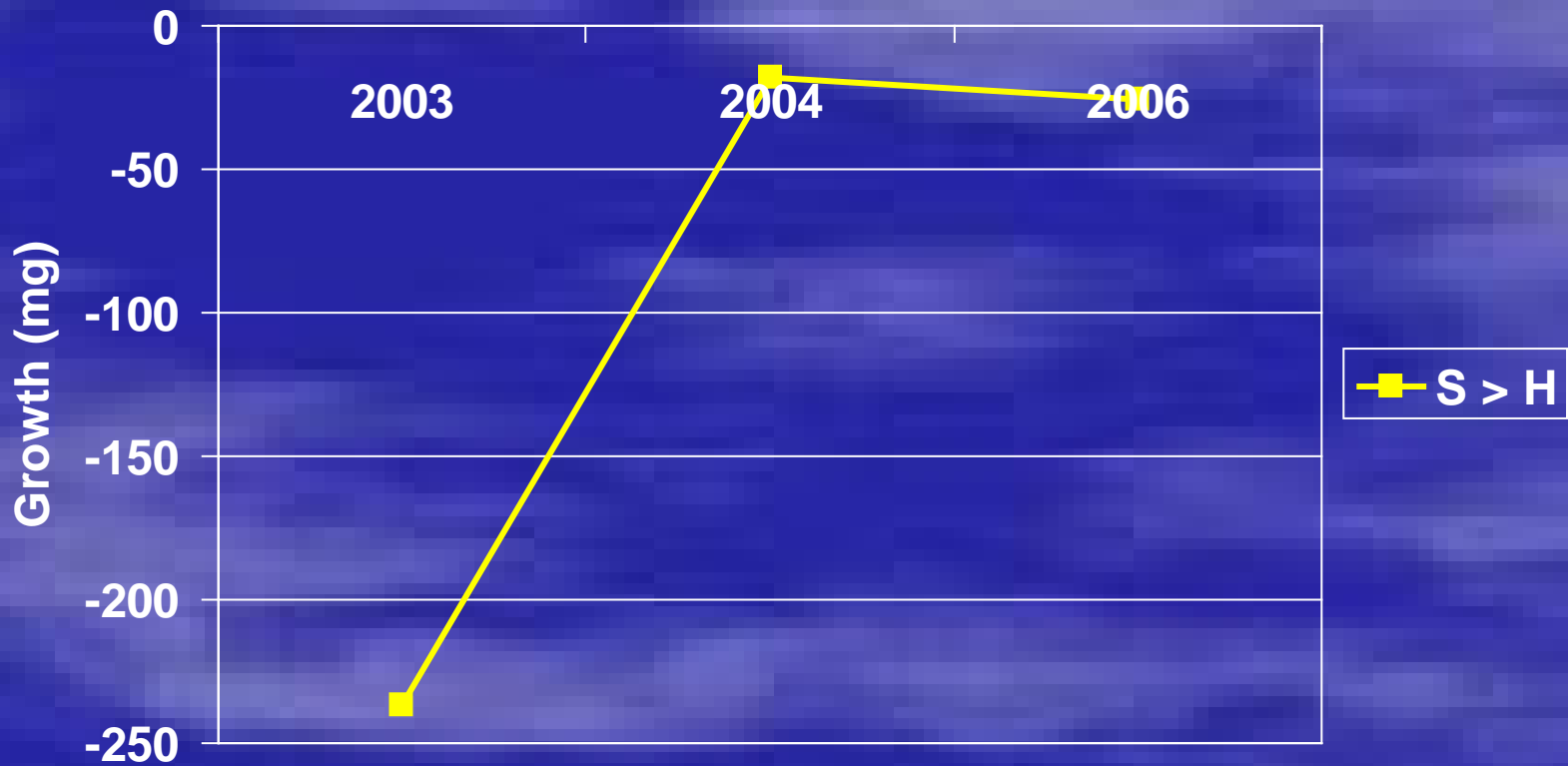
# Aggression – Scramble (difference in interaction rate)





# Growth – Scramble

(difference in growth rate, mg)



# Summary - Scramble

- Offspring of hatchery line were more dominant than offspring of S fish in 2006, but not in 2003 and 2004
- Offspring of wild fish were more aggressive in scramble replicates in 2003 and 2004, but the opposite was true in 2006
- hatchery origin fish lost less weight than wild origin fish in 2003 and 2004, but not in 2006

# Implications

- Significant deviations in behavior may occur among years which could result in more years to detect overall differences
- Few studies have reported temporal variation in behavioral dominance (assumed constant across years) or used large numbers of parents so reported differences could be due to temporal differences or family effects

# Acknowledgements

A man with short hair and glasses, wearing a white t-shirt, is shown in profile, looking down at a piece of equipment. He is holding a white cylindrical object. The background consists of a complex structure of metal pipes and black mesh, suggesting a laboratory or industrial setting. The lighting is bright, indicating an outdoor or well-lit indoor environment.

- Staff at CESRF (Charles Strom et al.)
- Marilee Webster, Josh McCarty, Germaine Hart, Charity Davidson, Keith Pitts, Natalia Pitts, Tim Webster, Kurt Saltzman, Kevin Mahoney, Bryan Johnson
- David Byrnes and Patty Smith and Bonneville Power Administration

# Domestication

- Raising fish in hatcheries can cause unintended behavioral changes in salmonids due to domestication selection
- Change in genetics due to selection in an artificial environment; Natural selection in an artificial environment