



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

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Supplementation

Wild Fish as Parents

Natural



Hatchery

*Natural Origin
Children*

*Hatchery
Origin Children*



Natural

*Natural Origin
Grandchildren*

HATCHERY



Adult holding in hatchery



Artificial Spawning



Eggs incubate in trays



Rearing in raceways



Volitional release from acclimation site



Eggs incubate in gravel



Rearing in stream



Natural Spawning



Adult holding natural



Migration back to spawning ground

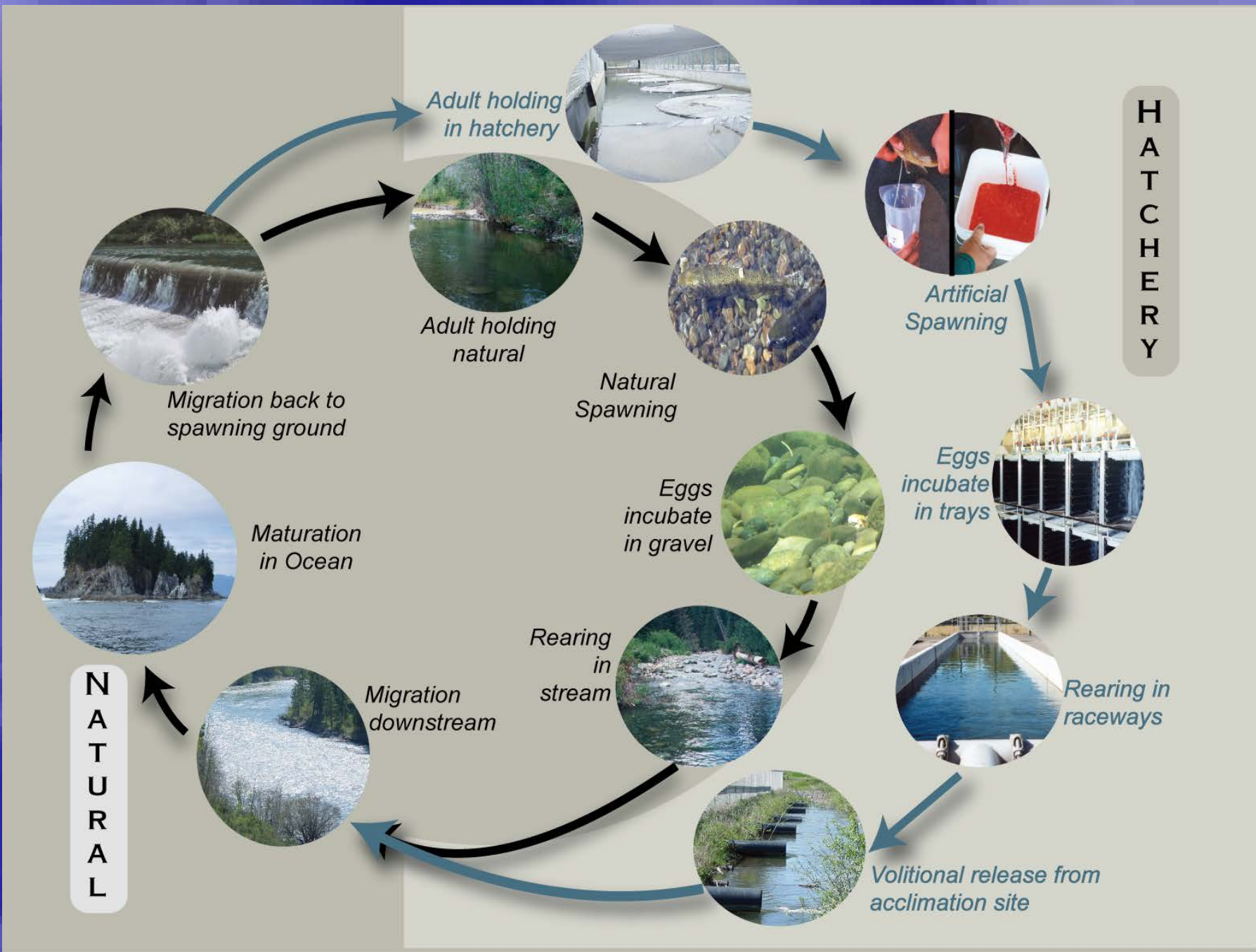


Maturation in Ocean



Migration downstream

NATURAL



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 (none in 2007)
- 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



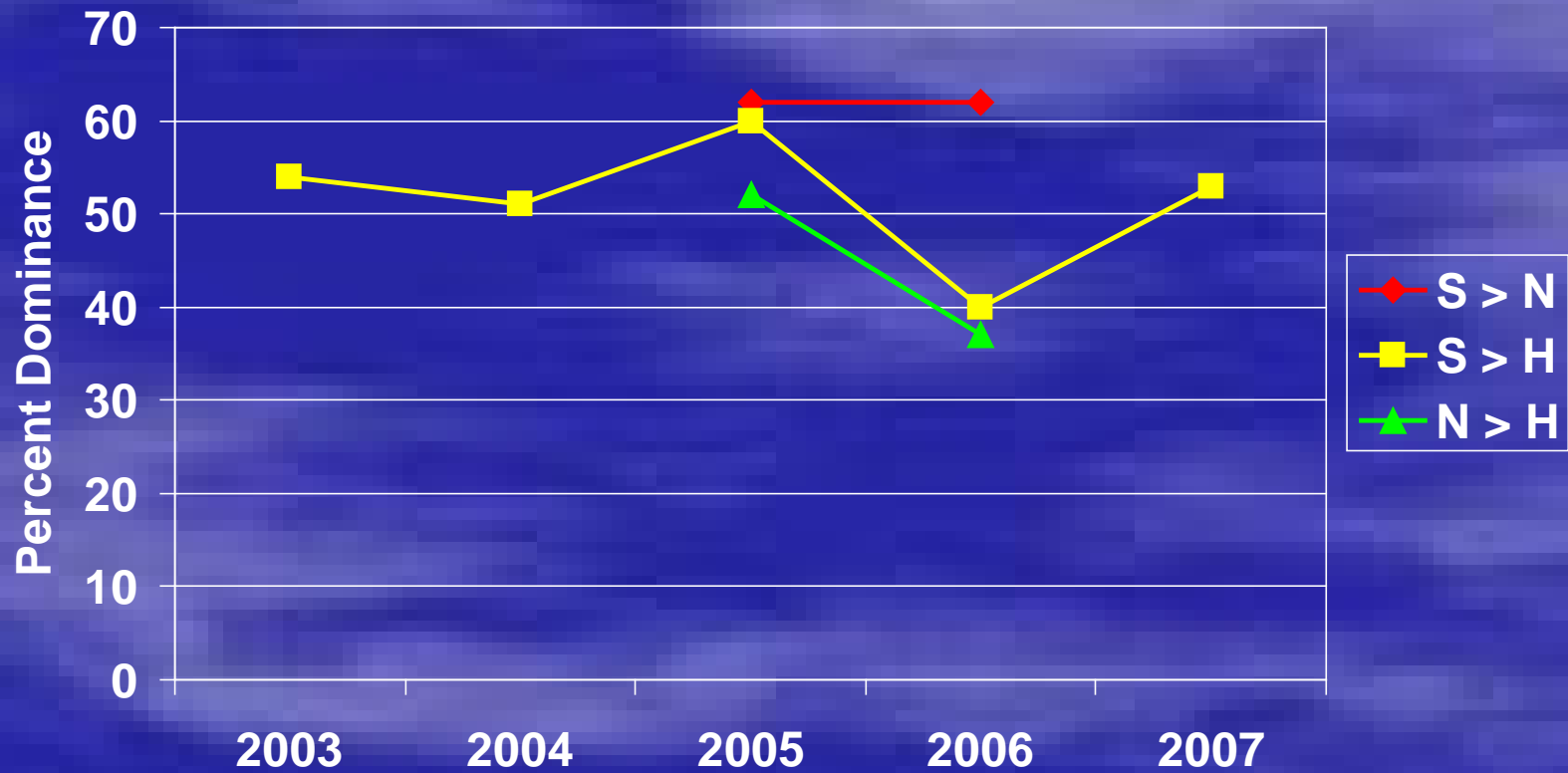
- Scramble – all spots equal



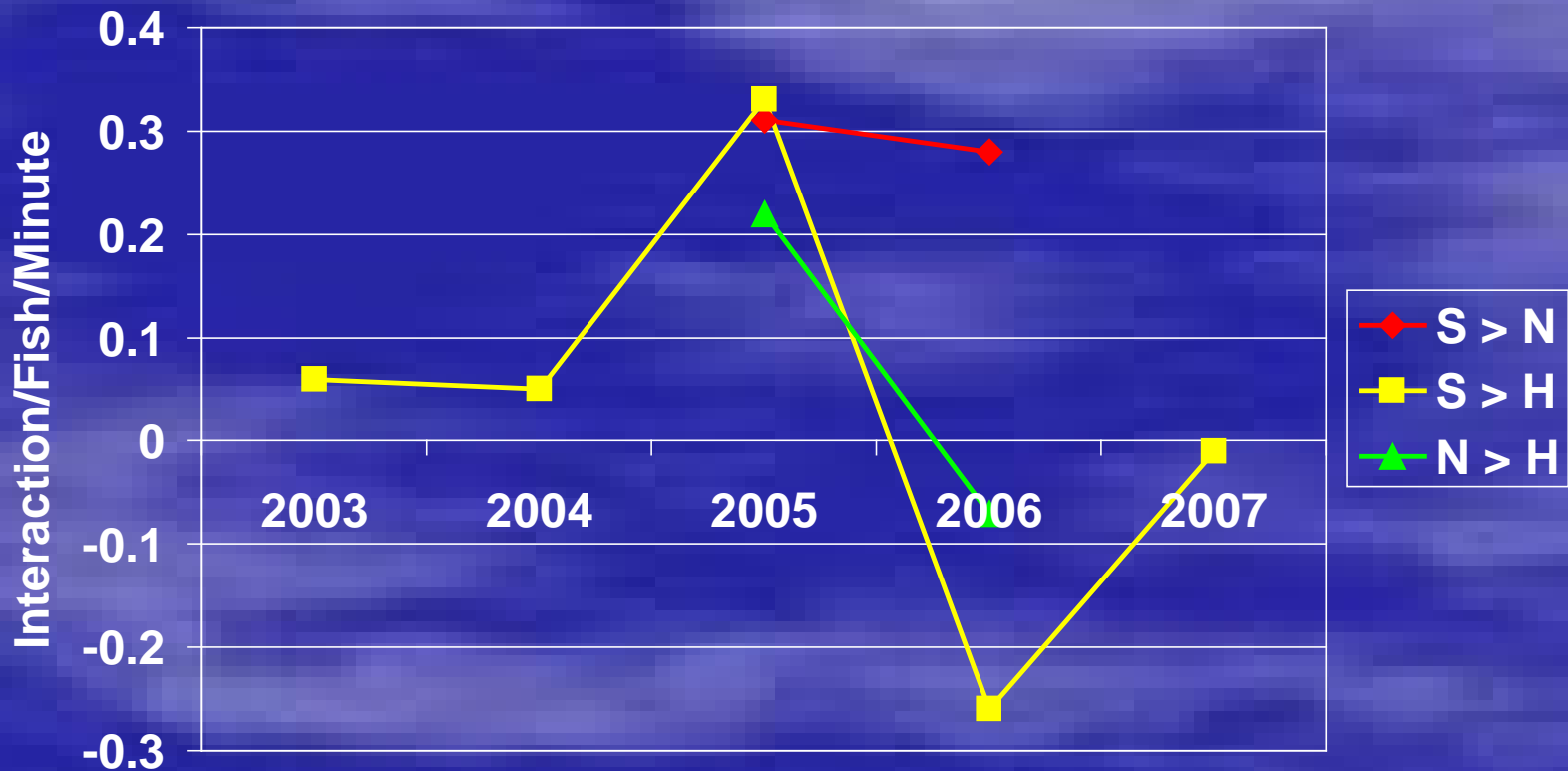
Replicates

Comp.	2003	2004	2005	2006	2007	Total
Contest (SvN, SvH, NvH)	229	276	811	617	413	2346
Scramble (SvH)	97	266	0	376	307	1046

Percent Dominance - Contest

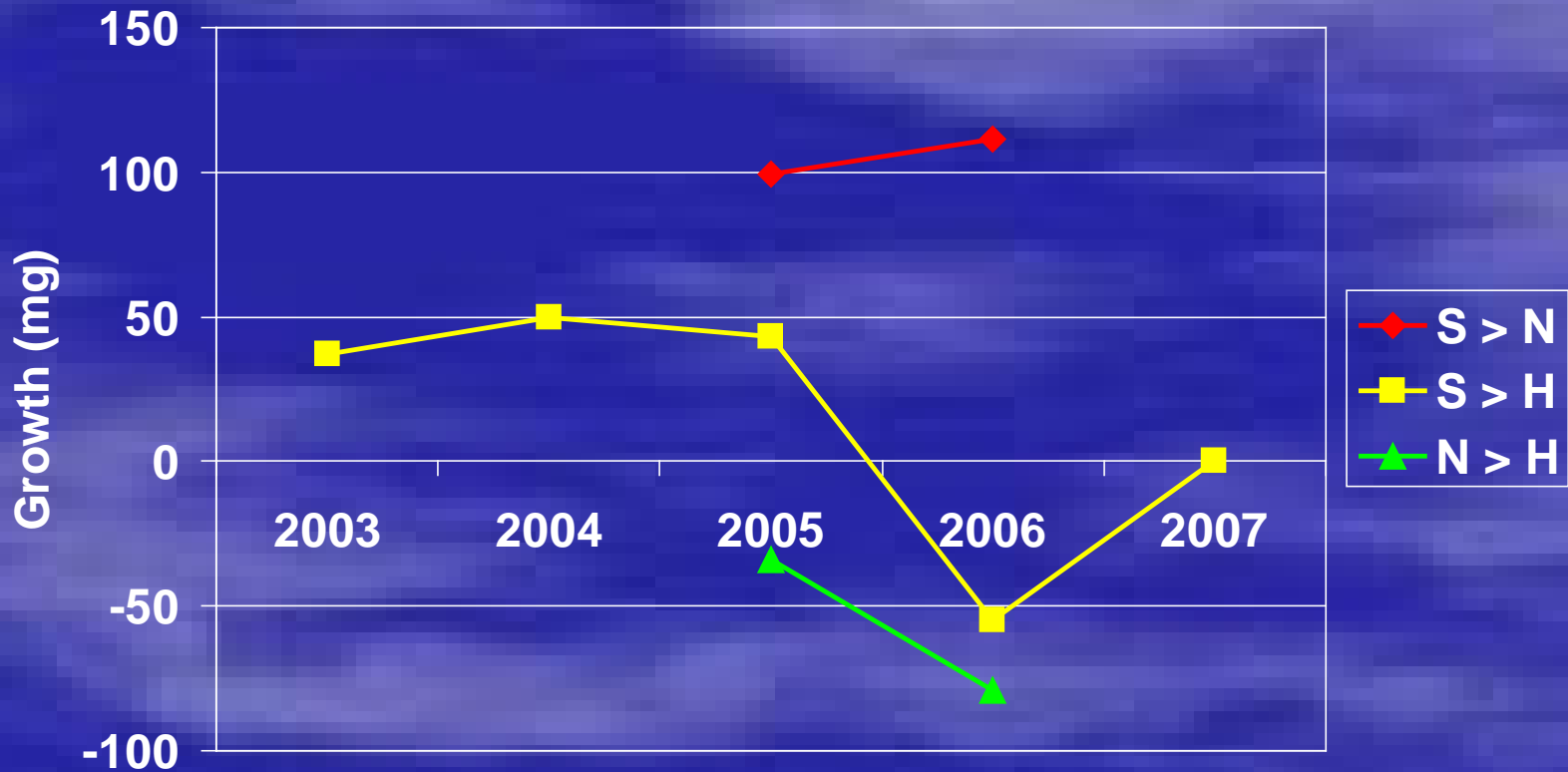


Aggression – Contest (difference in interaction rate)



Growth – Contest

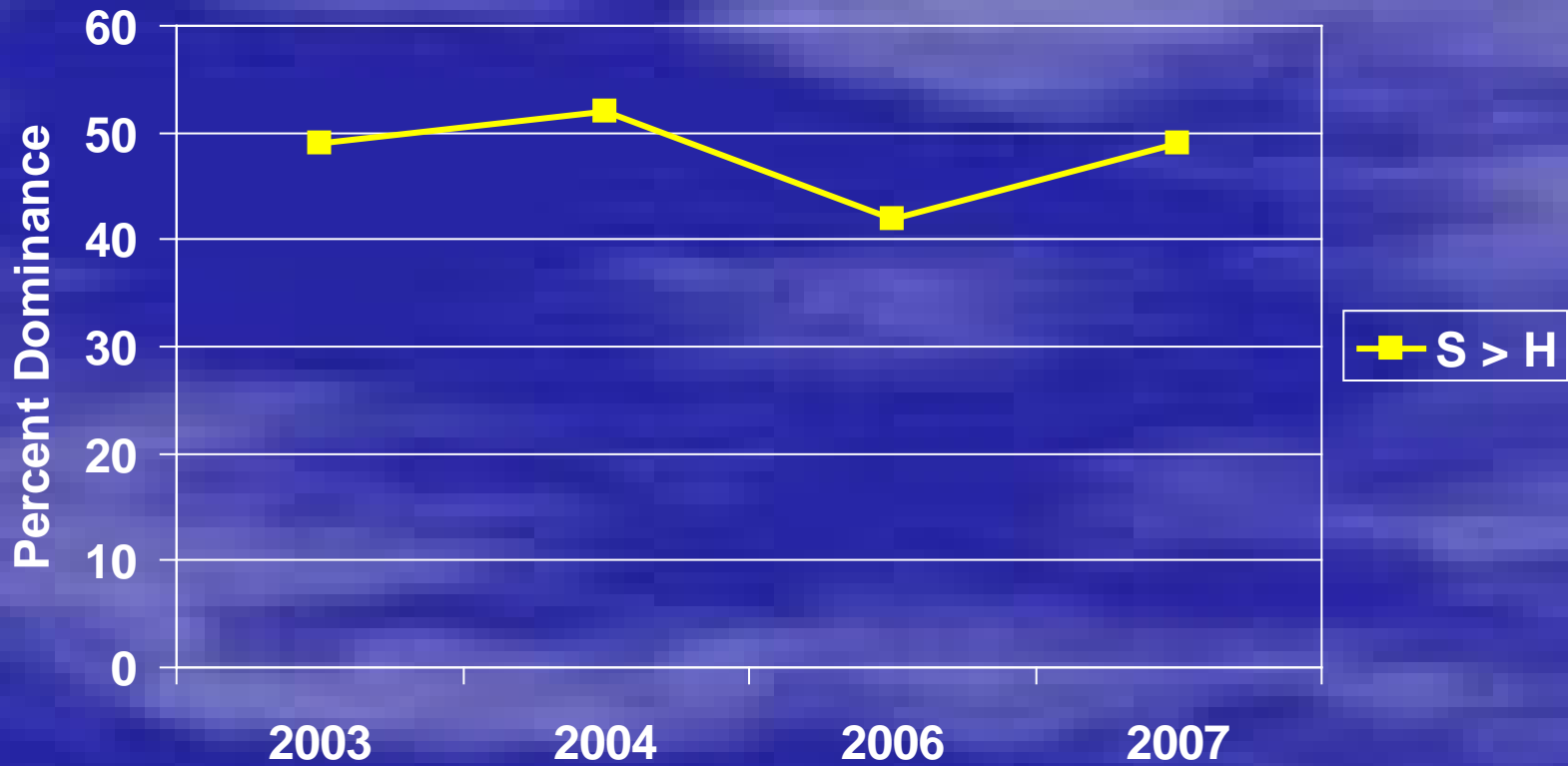
(difference in growth rate, mg)



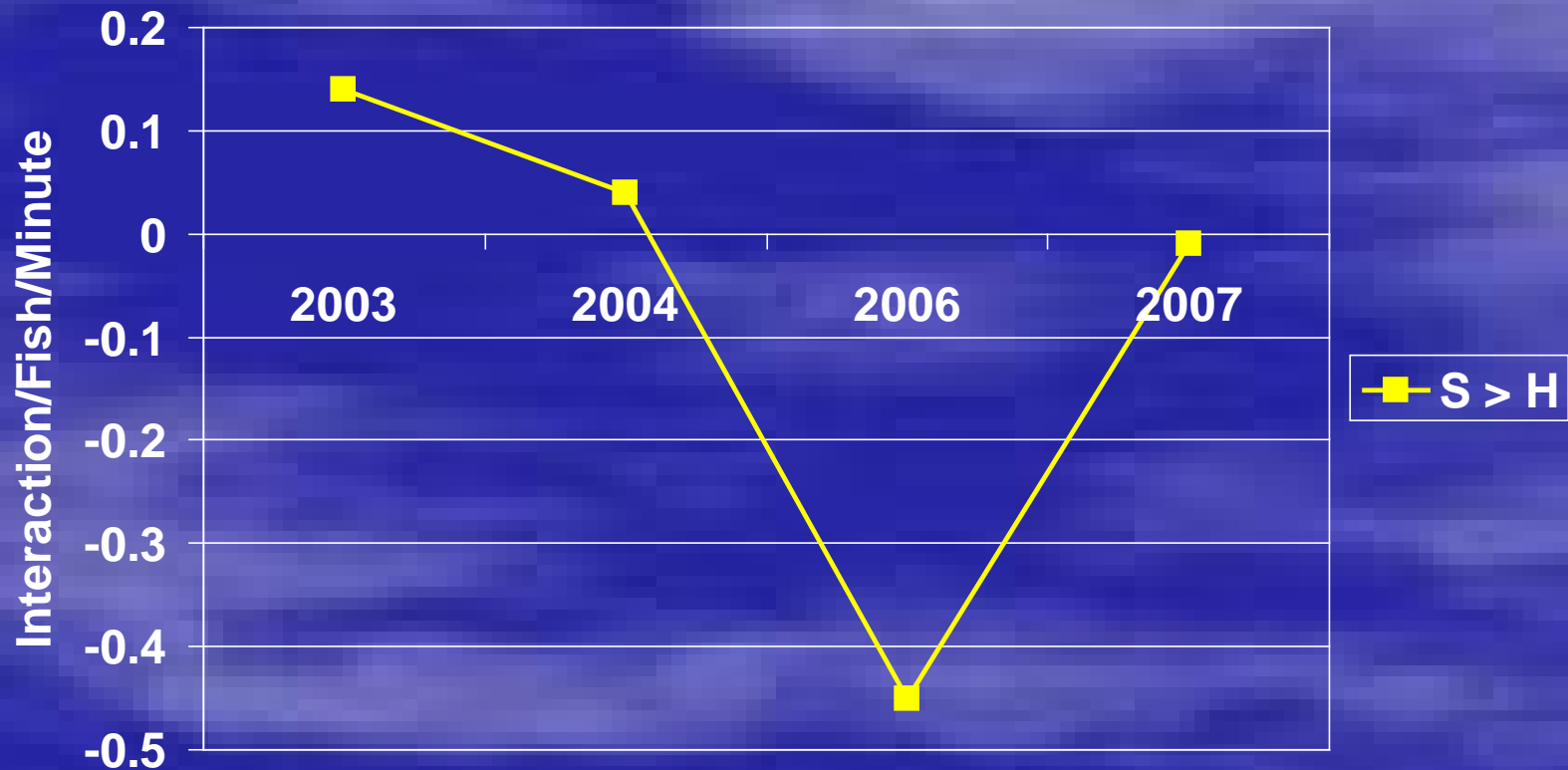
Summary - Contest

- 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
- Dominance was not significantly different in 2007 ($P=.096$) but higher in supp

Percent Dominance - Scramble

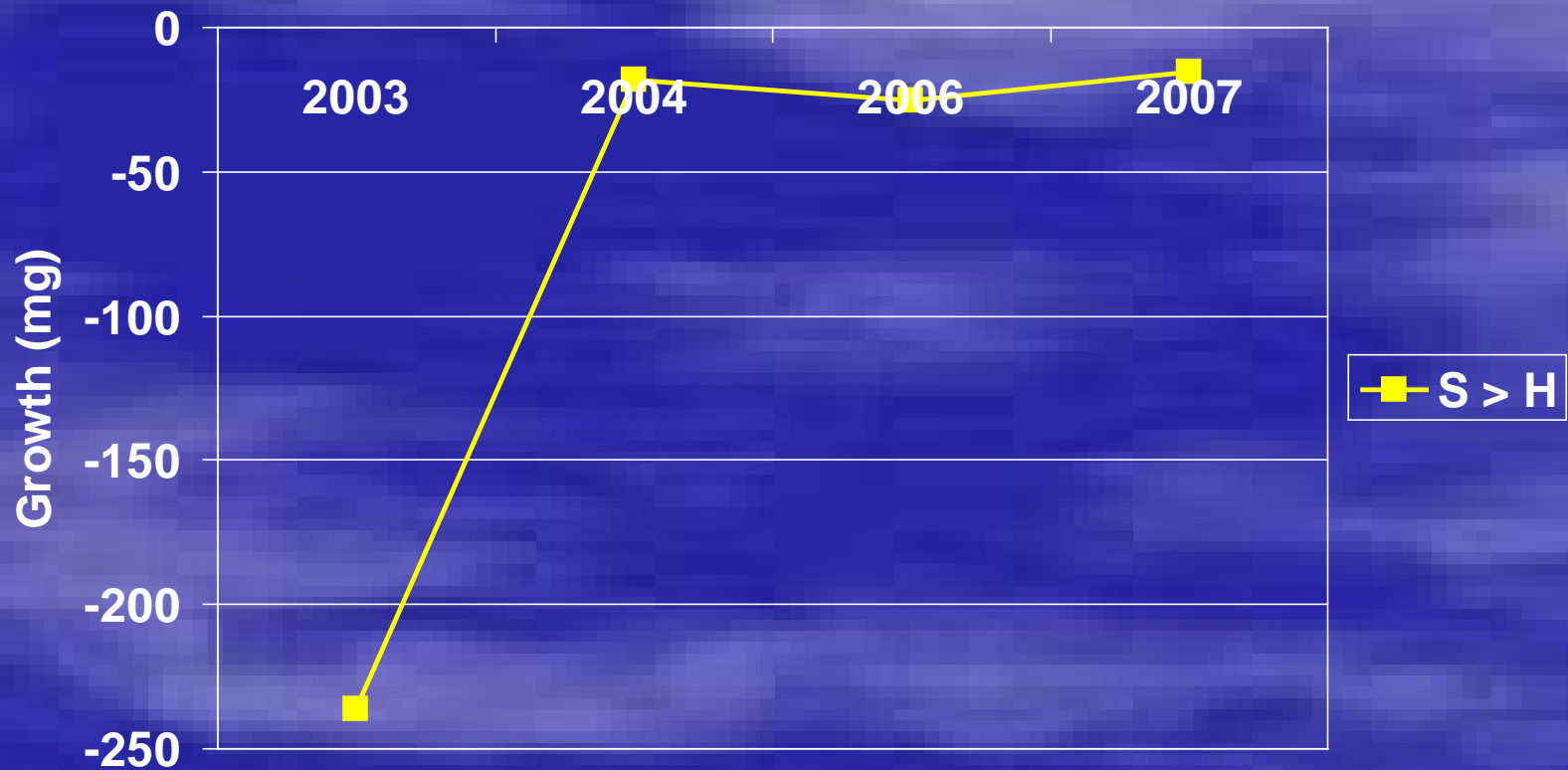


Aggression – Scramble (difference in interaction rate)



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, 2004, and 2007
- Offspring of wild fish were more aggressive in scramble replicates in 2003 and 2004, but the opposite was true in 2006, and it was similar in 2007
- hatchery origin fish grew better than wild origin fish in 2003, but not in 2004, 2006, or 2007

Implications

- 2007 was a small to no difference year in both types of experiments
- 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, likely part of a water treatment or research facility. The scene is outdoors under a clear blue sky.

- Staff at CESRF (Charles Strom et al.)
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