

Assessment of Captive Broodstock Technologies

Project #1993-056-00

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Objectives

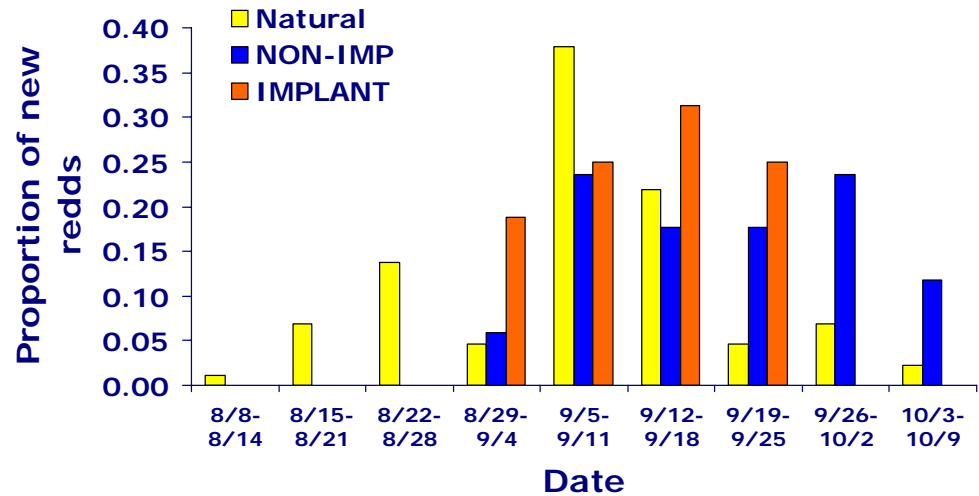
1. Improve Reintroduction Success (Berejikian)
2. Improve Olfactory Imprinting and Homing (Dittman)
3. Improve Physiological Development and Maturation (Swanson)
4. Treat and Prevent Bacterial Kidney Disease in Pacific Salmon Captive Broodstocks (Rhodes)
5. Evaluate Effects of Inbreeding and Inbreeding Depression (Hard)

Linkages to Basin Projects

1. Captive broodstock projects (BPA # 199700100, 199107200, 199204000, 199801001, 199606700, 200001900)
2. Regular participation in Technical Oversight Committees
 - Research briefings
 - Input to management decisions
3. Organization and participation in workshops and symposia on captive broodstocks
4. Research prioritization derived from captive broodstock project managers

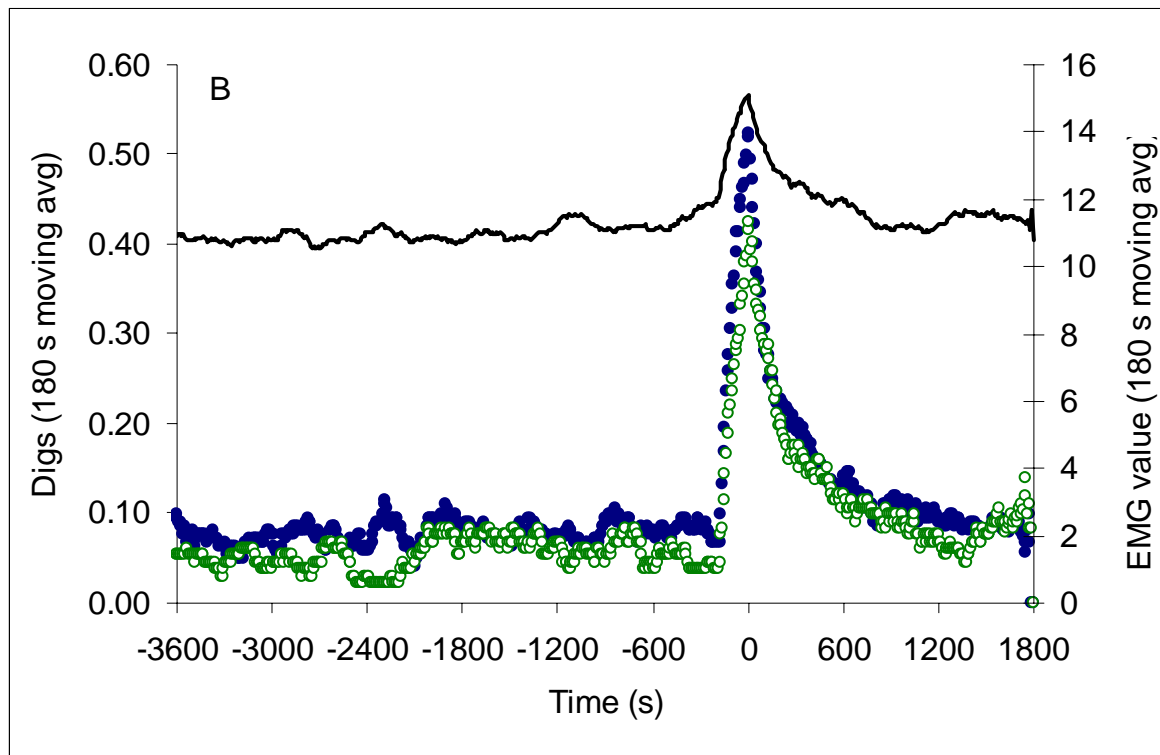
Objective 1: Improve Reintroduction Success of Chinook salmon

- Factors tested to improve chinook salmon reproductive success
 - Exercise
 - Hormone levels
 - Freshwater rearing temperature (IDF&G)
 - Seawater rearing temperature
 - Density
- Effects of captive rearing are species- specific



Objective 1

- Improved monitoring capabilities in natural streams
- Developed electromyogram telemetry methods to detect the spawn timing and spawning frequency of individual female chinook salmon.



Objective 2: Improve Olfactory Imprinting and Homing

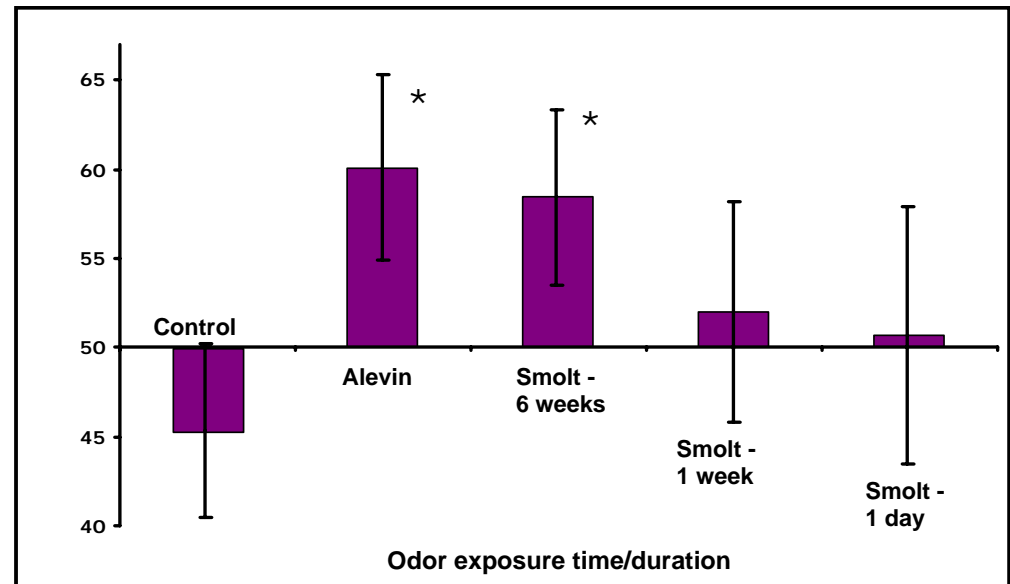
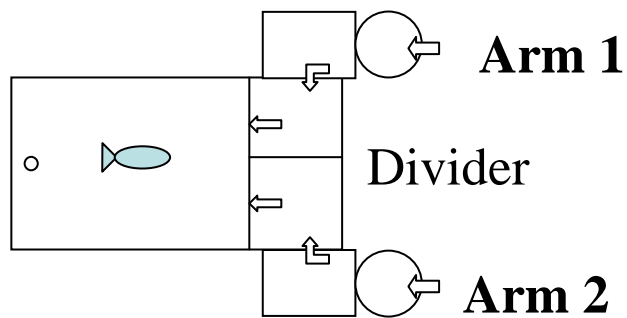
Problem: Balancing survival and homing fidelity of released Stanley Basin sockeye salmon

Goal: Maximize survival and minimize straying by determining critical period(s) for imprinting.



A. Hendry

Accomplishments:



Havey M.A and A.H. Dittman. (in prep)

Objective 2: Improve Olfactory Imprinting and Homing

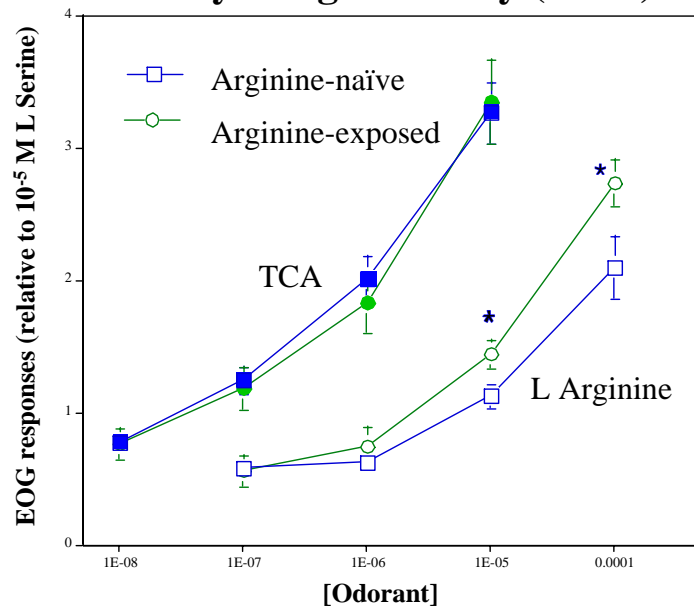
Problem: Straying by artificially produced salmon is a major problem in the Basin that requires innovative research approaches



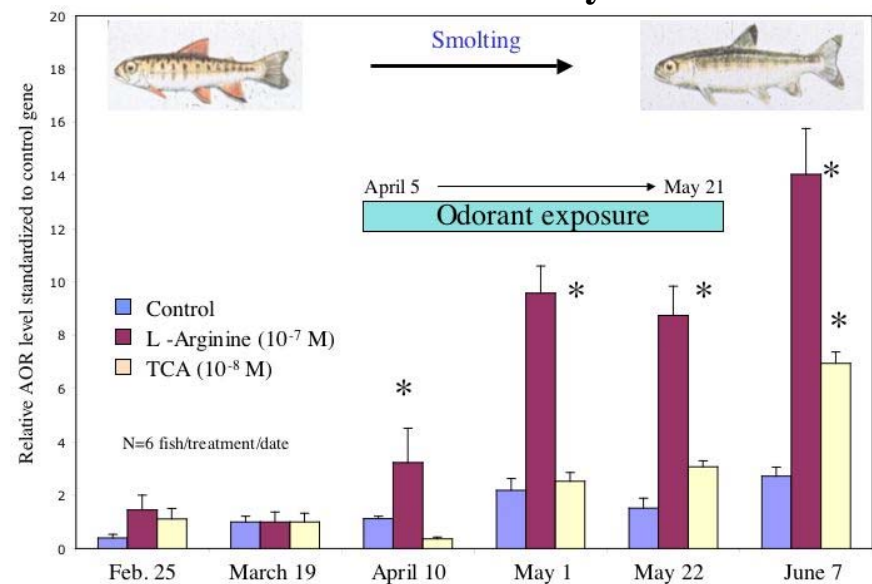
Goal: Develop simple behavioral, physiological and molecular assays for imprinting in salmon.

Accomplishments:

Physiological Assay (EOG)



Molecular Assay



Objective 3: Improve Physiological Development & Maturation

Task 3a- Determine the effects of growth regimes on incidence of 1+age male maturation and ovarian growth during first two years of rearing in spring Chinook salmon.

Task 3b- Determine the effects of growth on age of maturity, fecundity and egg development (oogenesis) in spring Chinook salmon

Task 3c- Determine effects of rearing water temperature on age and timing of spawning, and gamete quality in spring Chinook salmon

Task 3d- Monitor development and fertility in Redfish Lake sockeye salmon reared at the Burley Creek Hatchery (Is variable embryo survival due to poor fertilization &/or developmental problems? What are effects of male versus female parent on embryo survival?)

Age of Maturity

Problem:

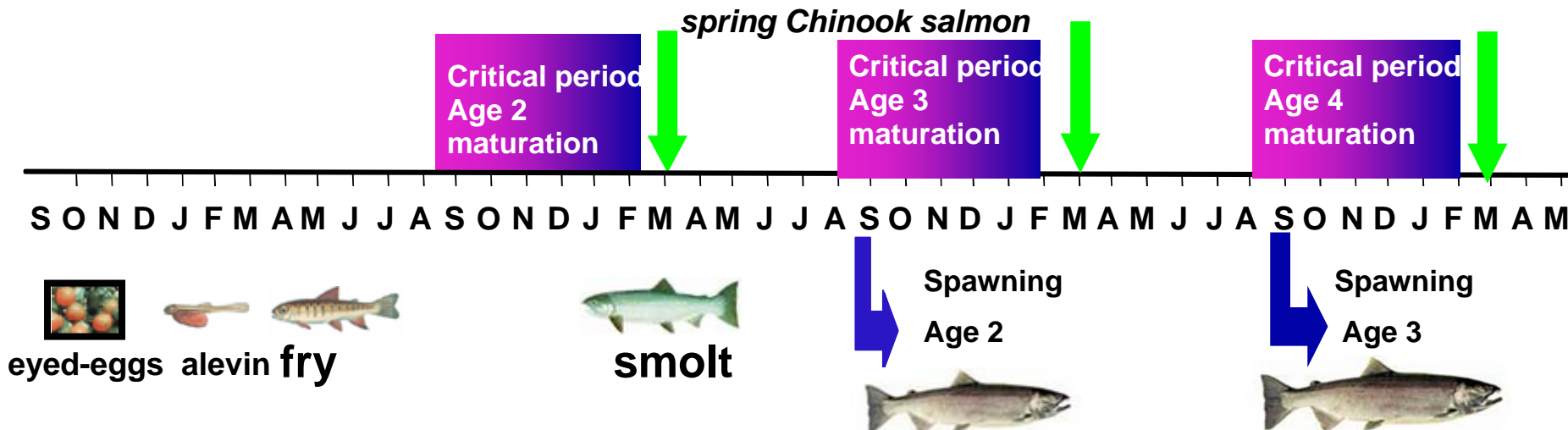
- Asynchronous age of maturity in captive broodstock
- High rates of early male maturation in hatchery fish
- Reduced adult body size of cultured spring Chinook salmon

Goal:

Develop diets/growth regimes to match natural life history patterns
(reduce age 2 male maturation, but also support appropriate ovarian development, smoltification and adult growth)

Key Findings:

- Body size/growth rate during a critical period affects onset of maturation the following year; body fat levels affect maturation rates only in smaller size fish
- Ovarian development is strongly influenced by growth prior to yolk incorporation



Seasonal Timing of Spawning

Problem:

- Asynchronous timing of males and females
- Seasonal delay in captive broodstock spawning relative to wild fish
- Variable egg quality (is delay linked to egg fertility)

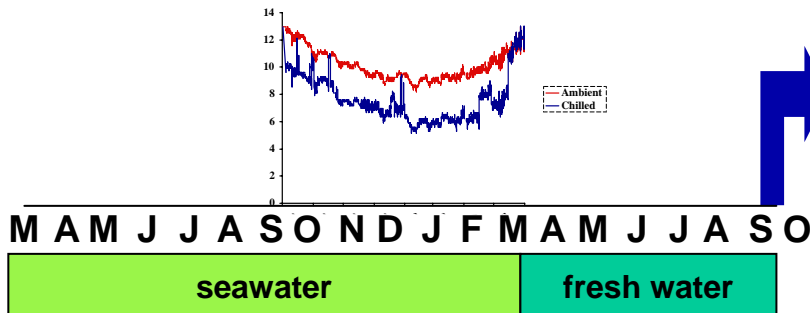
Goal:

Determine effects of rearing temperature on seasonal timing of spawning, fertility and fecundity (compared ambient seawater to 4°C below ambient)

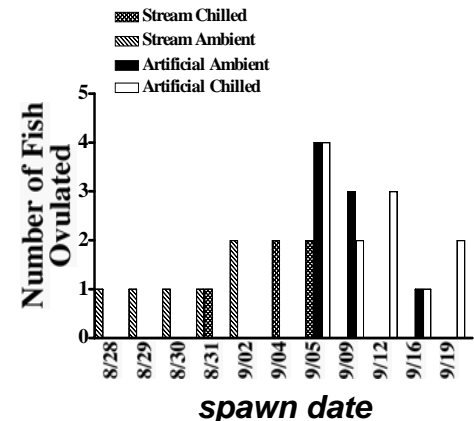
Key Findings:

- Delay in maturation occurs prior to transfer of adults to FW before spawning
- No significant effect of SW temperature treatments on spawning timing, fecundity or survival of embryos to eyed-stage

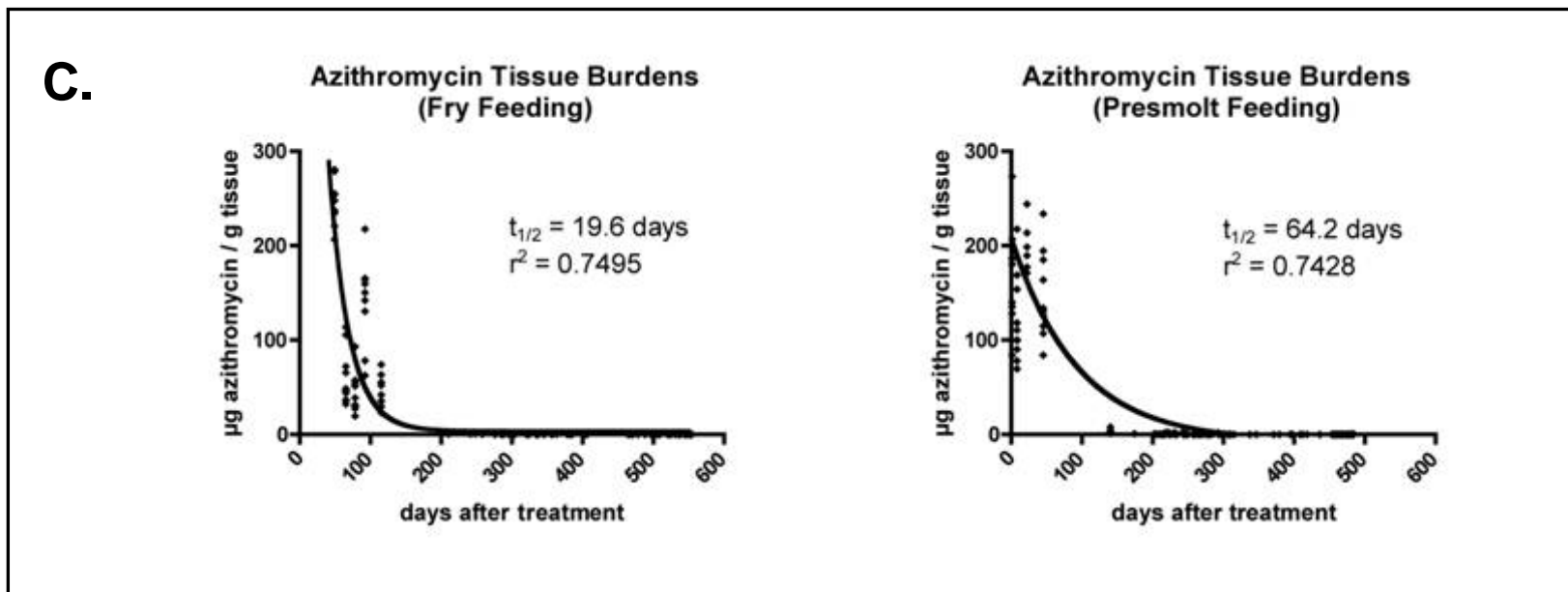
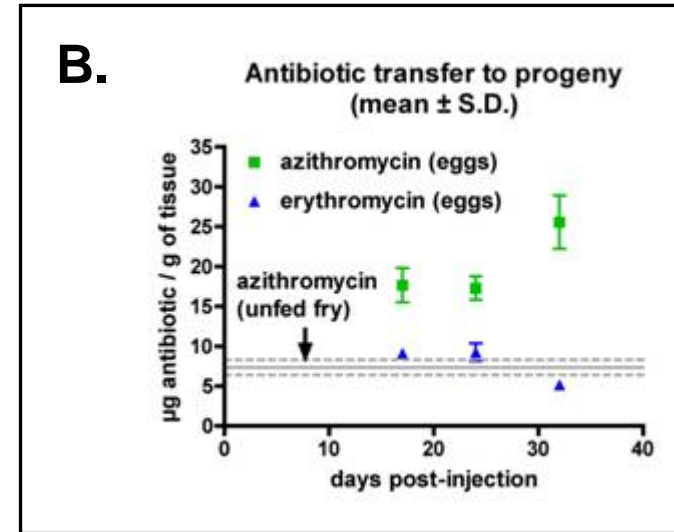
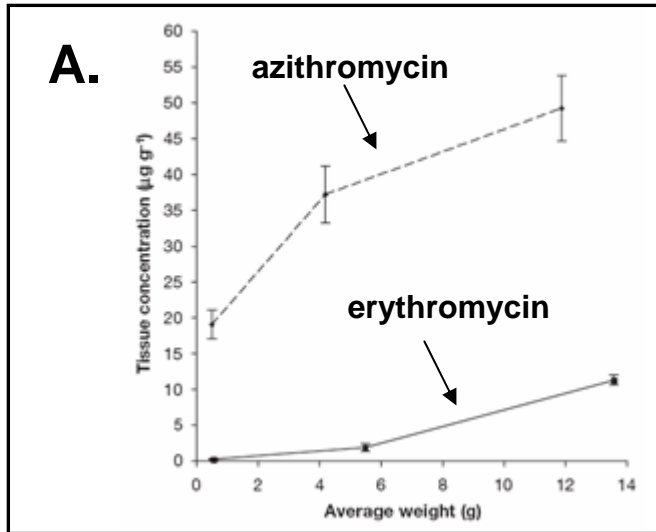
spring Chinook salmon- temperature study



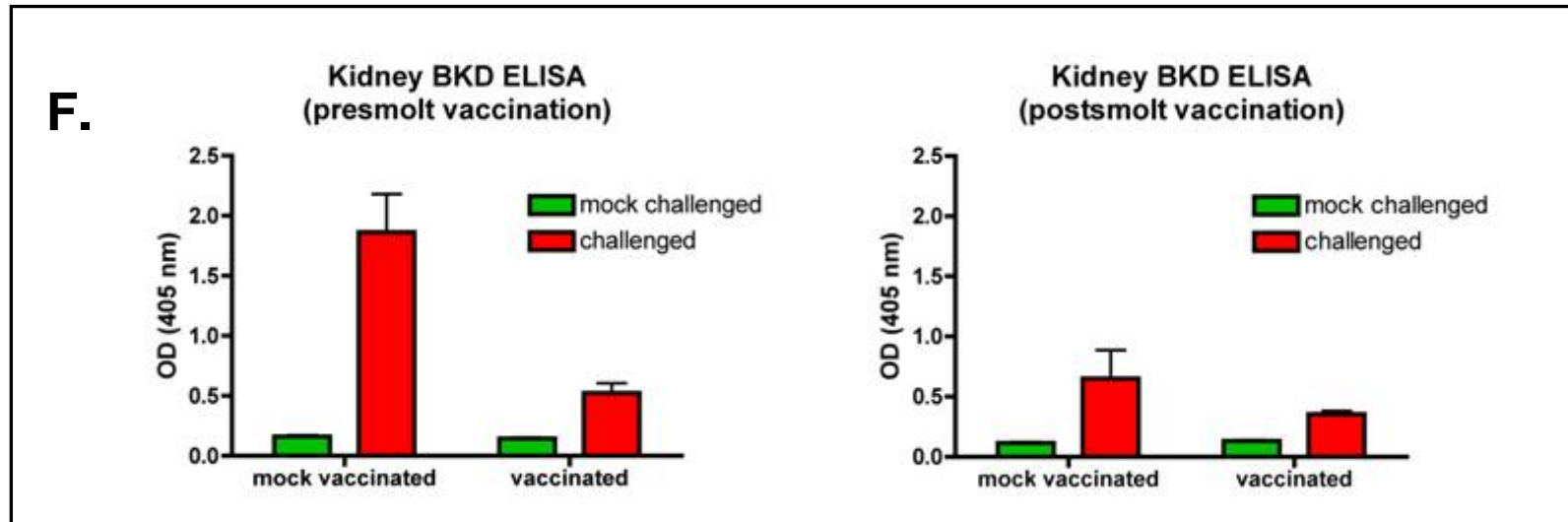
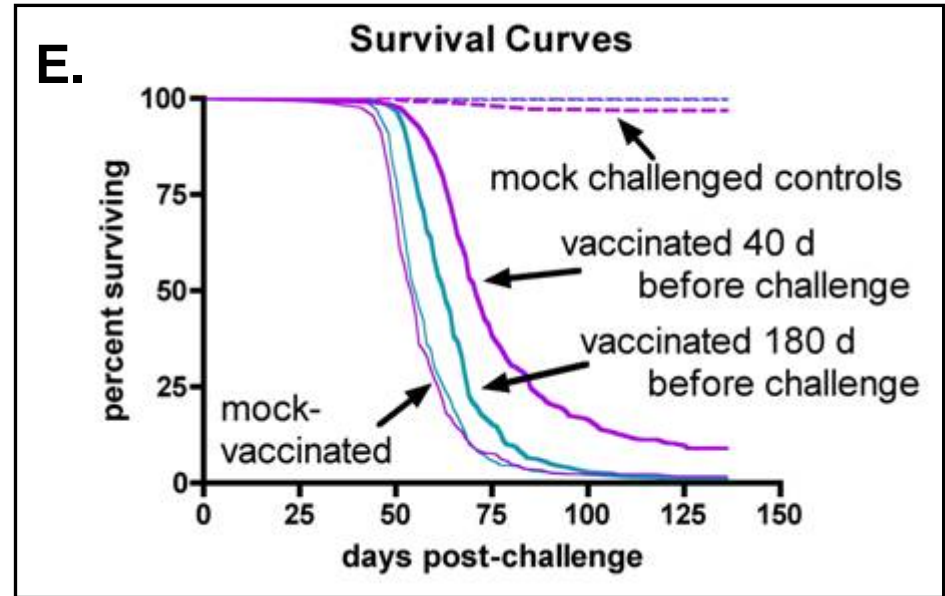
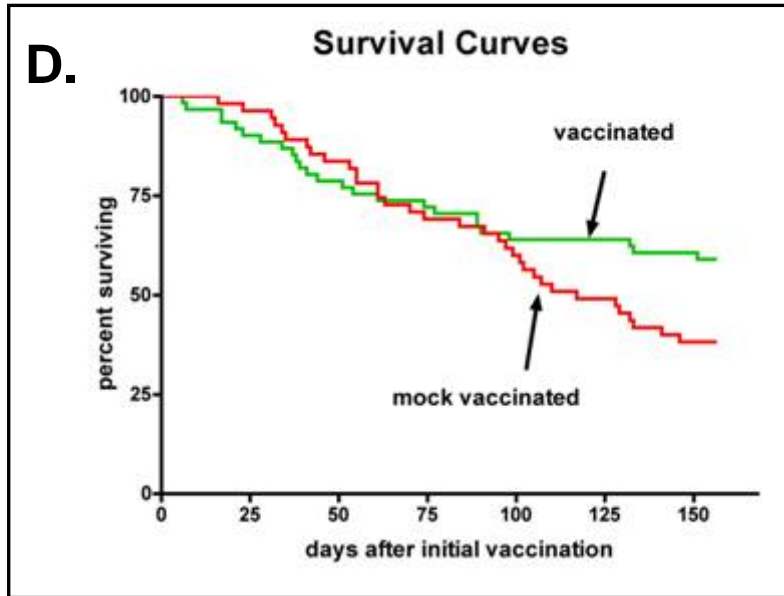
Spawning: Stream channel
Manual stripping



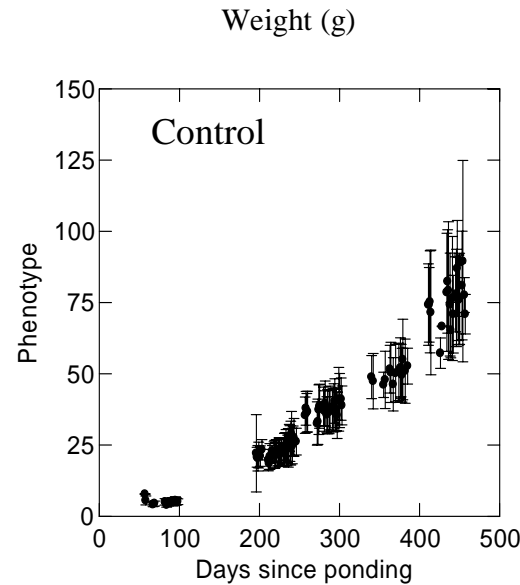
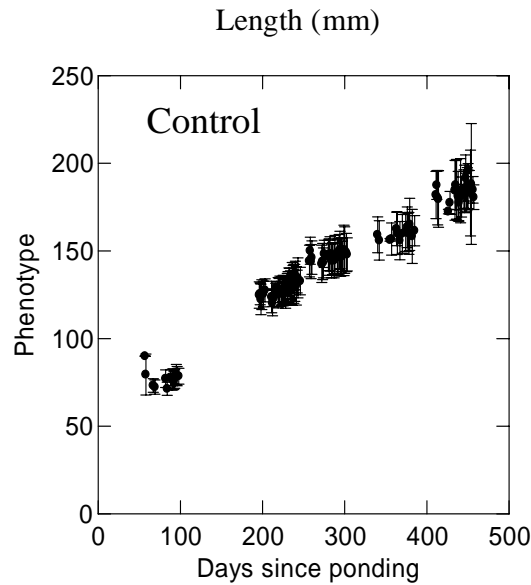
Objective 4. Treat and Prevent Bacterial Kidney Disease in Pacific Salmon Captive Broodstocks



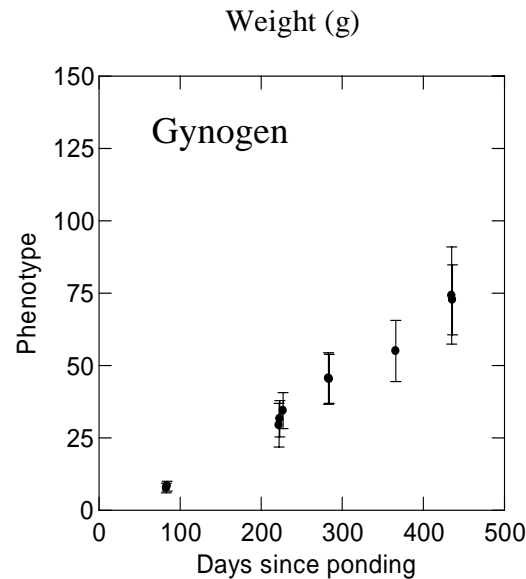
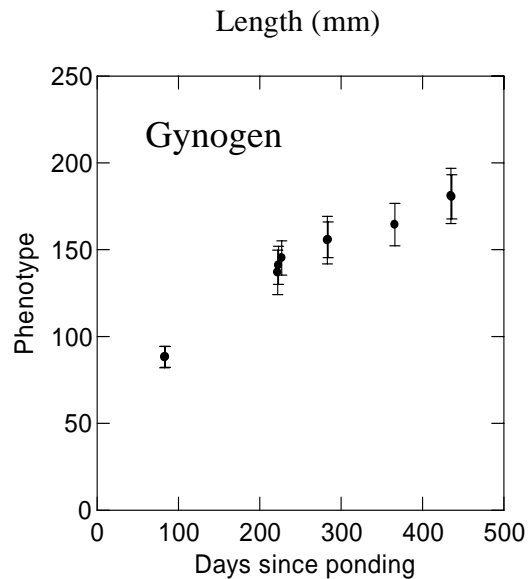
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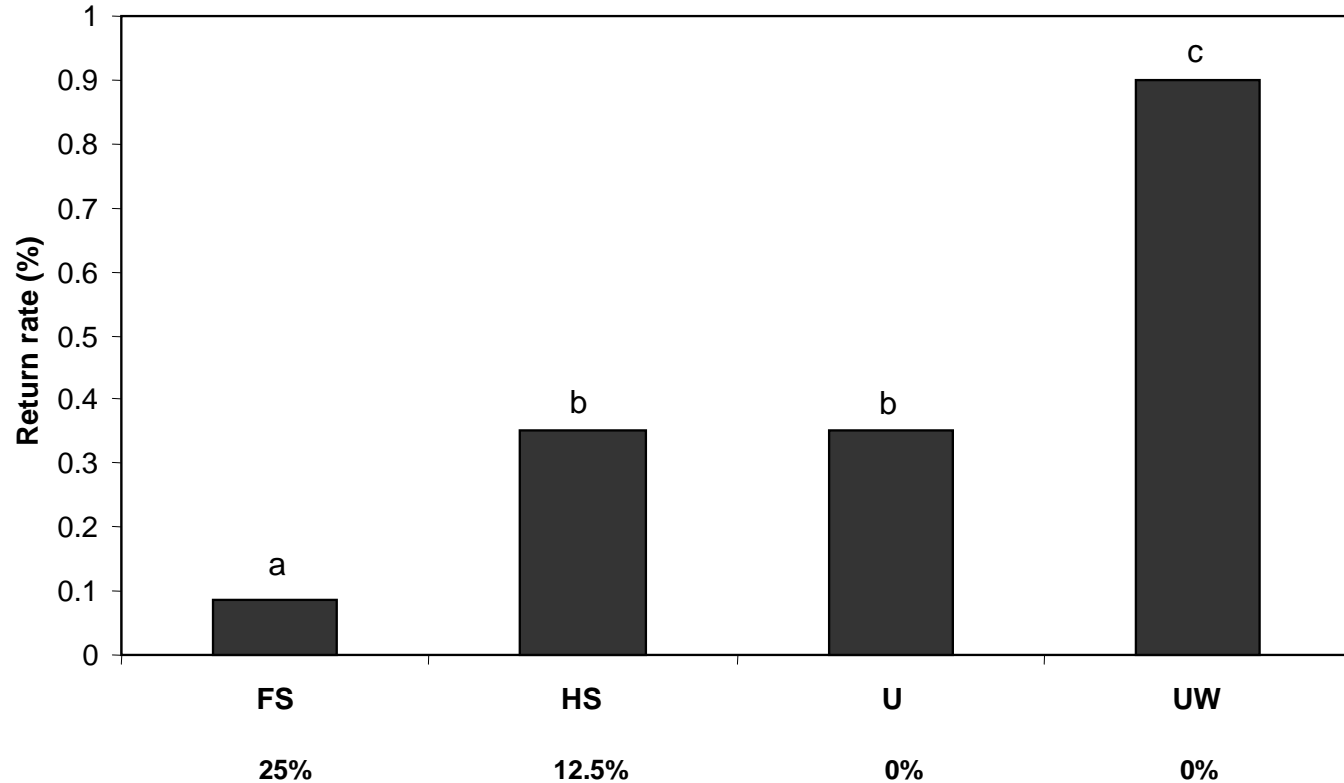
Objective 5: Effects of Inbreeding



Growth of juvenile inbred (gynogen) fish is slightly lower than that of outbred (control) fish



Objective 5: Effects of Inbreeding



Depression of survival over entire life cycle in free ranging hatchery fish is evident after one generation of brother-sister mating, but the effect is not linear and survival is higher in locally adapted fish

Other Project Accomplishments

- 11 peer-reviewed publications from current (FY03 – FY05) cycle, and 45 since beginning of the project.
- Facilities
- Expertise
- Coordination with broodstock programs

Changes in captive broodstock implementation programs

- Phase-out of adult release strategy for chinook salmon in Idaho
- Phase down of Oregon captive broodstock and increase in conventional program
- Phase-out of Tucannon captive broodstock
- Increased emphasis on smolt rearing for RFL sockeye

Future directions

- Broaden efforts to hatcheries in general
- Tackle i) broodstock management, ii) fish quality, iii) genetic management
- Provide the Basin with a core research program to forward hatchery reform