Consequences of egg size on growth of Hatchery and Wild steelhead trout

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General context

• Large Intra-specific diversity in salmonids
  > 30 life history types in STH (Thorpe 2007)
  sympatric morphs of AC

• What creates such diversity and how is it maintained?
Maternal effects?

Often serve an adaptive role in an organism’s life history

a large role in rapid population differentiation, and speciation

In species with no parental care egg size, i.e. the amount of yolk, can be directly linked to maternal effects and may affect important traits in the offspring.
Maternal effects and fishes

• Offspring size
• Behavior
• Disease resistance
• Environmental contaminants
• mRNA
• Survival and mortality
• Embryonic levels of hormones
Questions: Predictions

• Can egg size influence growth and behavior early in life?  Yes
• Can egg size have long term consequences on growth and life history of Salmonids?

No
positive correlation between egg size and BW/FL of fish at first feeding, will disappear after several weeks.

(e.g. Heath 1999)
Objectives

• Assess egg size differences in steelhead trout
• Assess short term consequences:
  - development
  - growth before and after first feeding
• Assess potential long term consequences:
  - absolute growth/ growth rate
  - smolting
Methods

• 10 crosses of Wild fish and 10 crosses of F1 Hatchery (Siletz stock) in 2009/2010.
• Sorted egg size: small vs large from each crossing
550 fish pit-tagged in October 2009
Egg size differences

Mean egg size in Hatchery versus Wild steelhead trout

- Egg diameter in mm
- Origin: Hatchery, Wild
- N=40
- Df=1
- P=0.000

After accounting for female body size
Egg size - Female body size

Female size versus egg size

N = 40
Df = 37
P = 0.000

$R^2 = 0.441$
Egg size – Female body size

Female size versus egg size

N=40
Df=36
P=0.828
Variance in egg size

Variance in egg size Hatchery vs Wild

N=40
Df=1
P=0.115
Long term effect of egg size on steelhead trout

Wild steelhead smolt Fall Creek
Consequences of egg size on growth Fall 09 till March 10

Body weight in grams

Origin
P<0.05

Size
P<0.001
Origin*size
P < 0.05
Consequences of egg size on growth

Body weight in grams

Time
P<0.001

Time*size
P <0.001
Conclusions:

✓ Clear differences in egg size between W fish and F1 H fish.
✓ Smaller egg size and increased variance in H fish.
✓ Positive correlation egg size/female size for both H and W.
✓ BUT Negative relationship between egg size and growth after a year for both H and W.

• Environment / growth early in life can have long term consequences in steelhead trout with potential implications in life history and evolution.
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... to come:

- Differences in specific growth rate?
- Effect of egg size on smolting
- Family effect
- Sex ratio?
- Early development
- Behavior
- ...