

Reproductive Development, Energy Stores, and Post-Release Migration of Long-Term Reconditioned Female Steelhead Kelts in the Yakima River

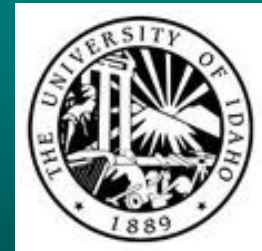
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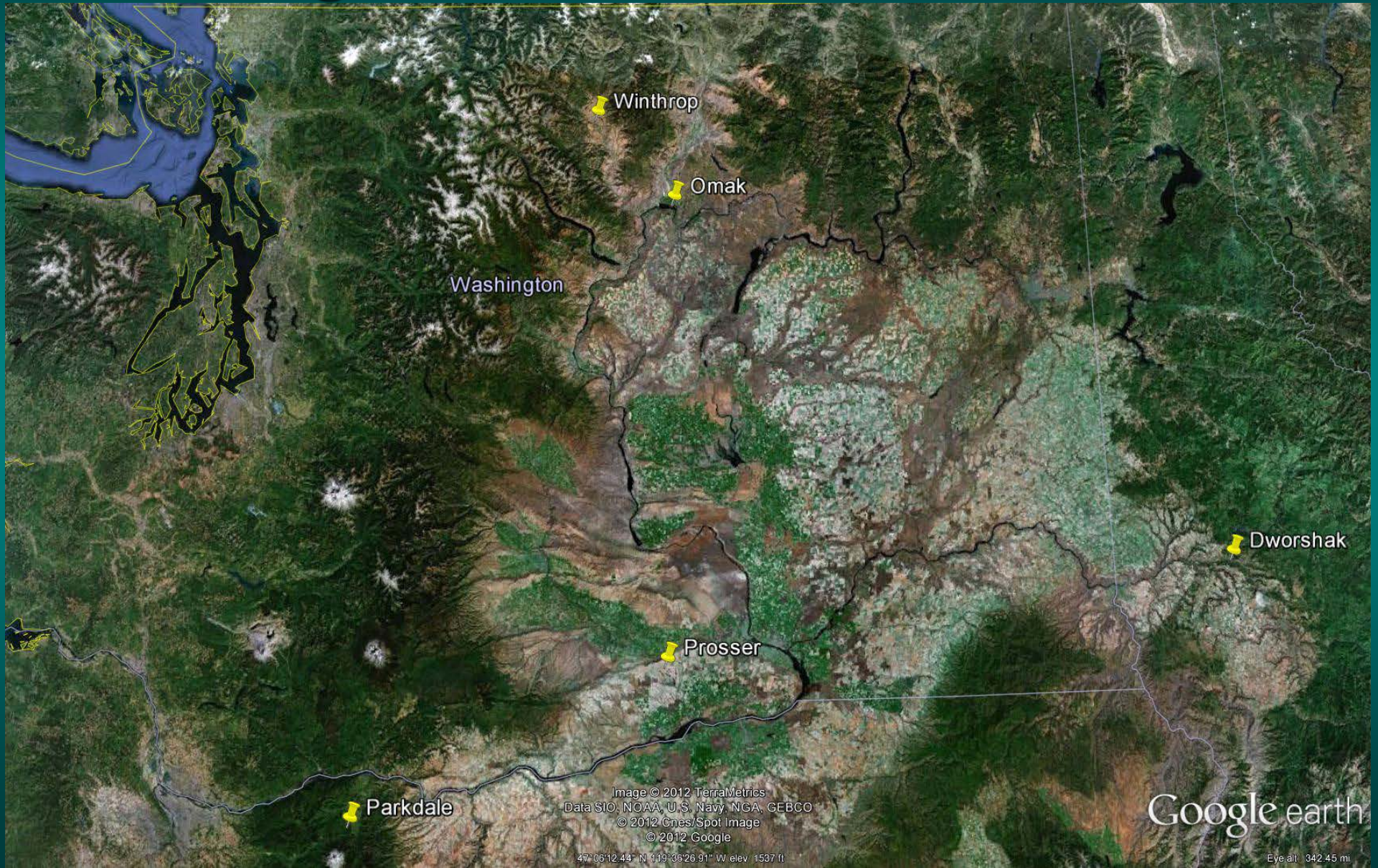
³Yakama Nation, Toppenish WA



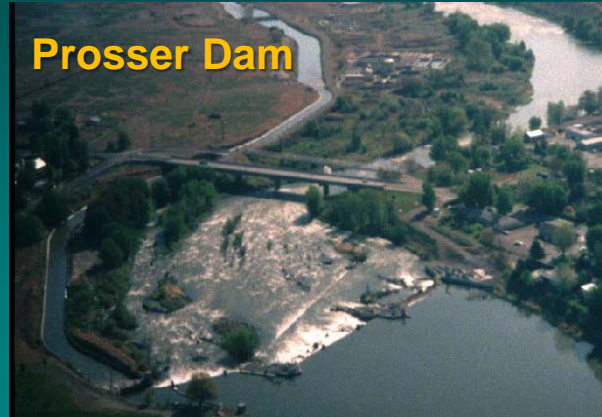
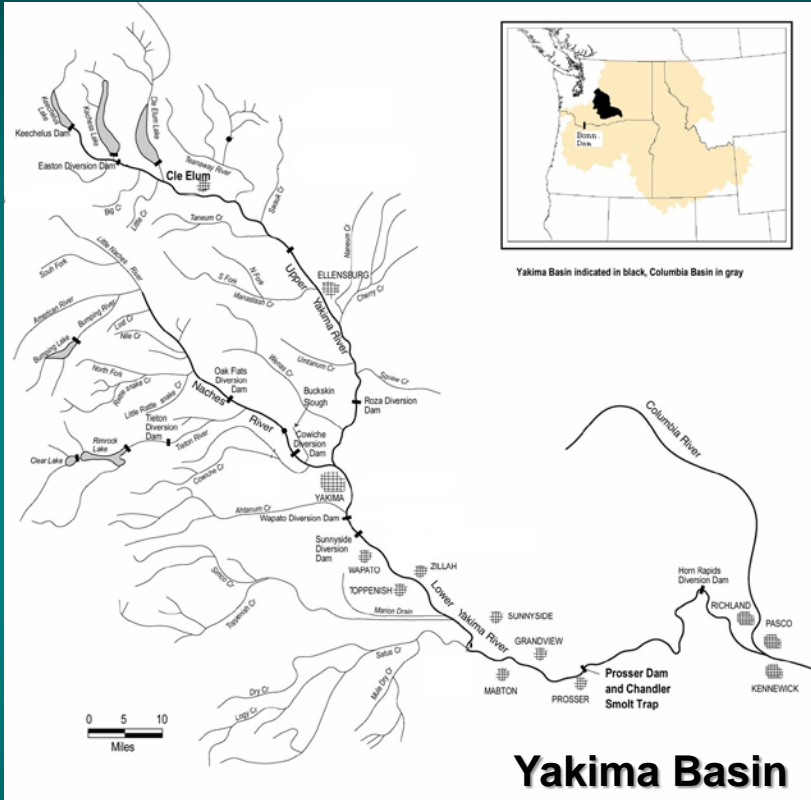
YBSM 2012



Kelt reconditioning projects are underway throughout the Columbia River Basin.



Yakima River steelhead kelts are captured and reconditioned at Prosser, WA.



Intake

Reconditioning

Release

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

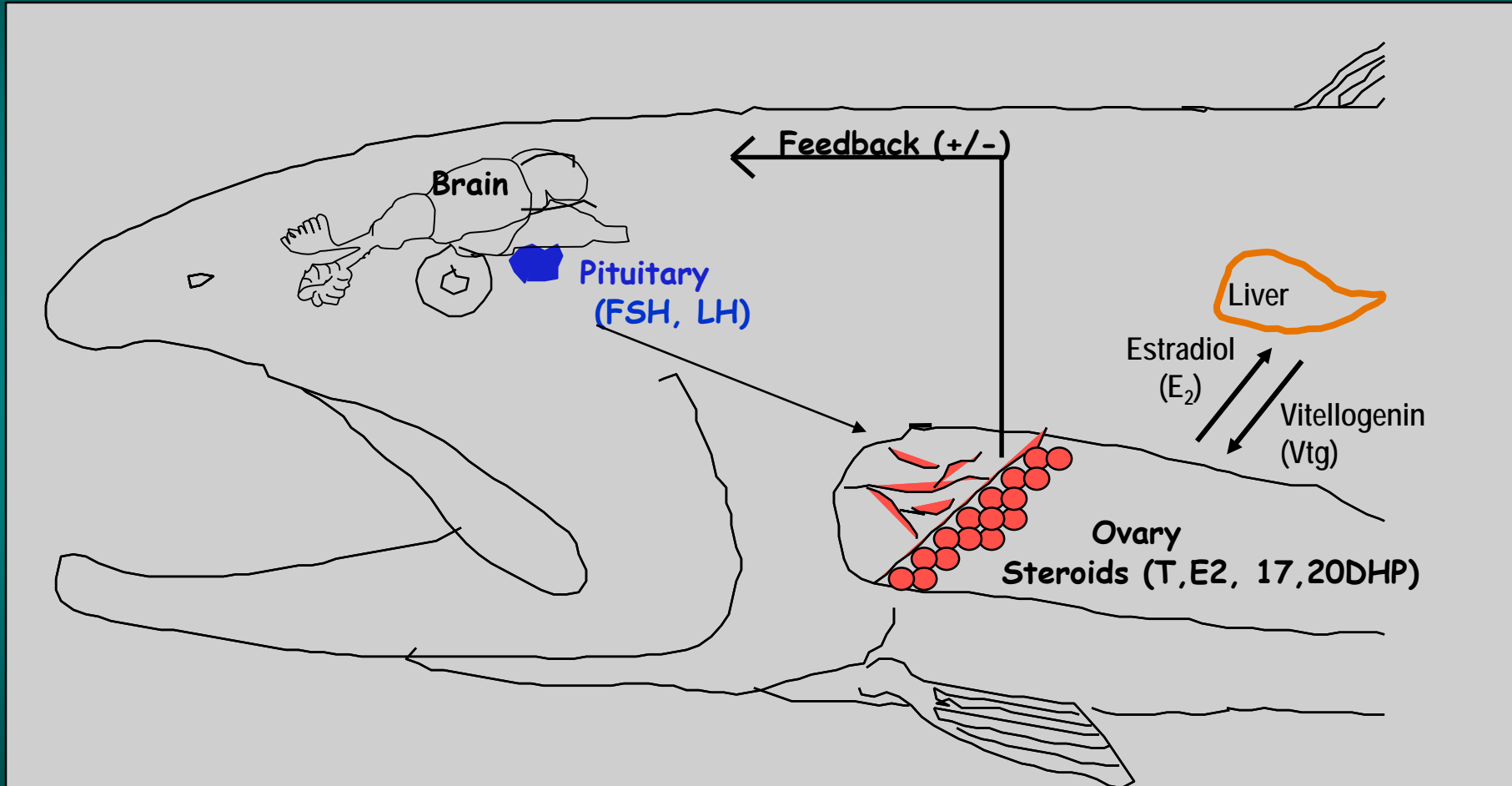
Oct

Nov

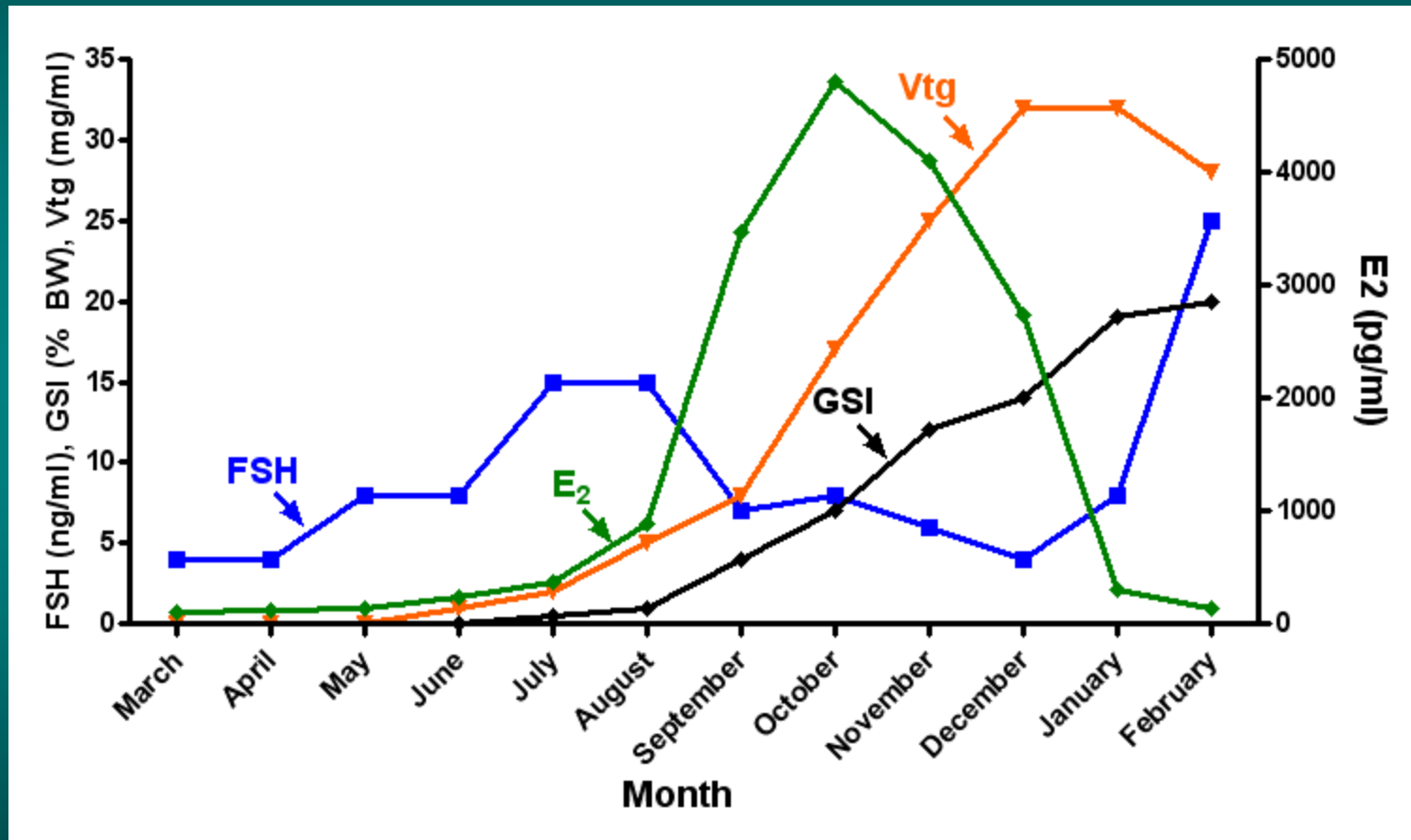
Female steelhead have two major post-reproductive life histories.



The Reproductive Endocrine Axis regulates reproductive maturation in female salmonids.



Plasma FSH, E₂, and Vtg increase during ovarian maturation in rainbow trout.



Bromage, Whitehead & Breton 1982 Gen Comp Endocrinol; Whitehead, Bromage & Breton 1983 Gen Comp Endocrinol; Tyler, Sumpter & Witthames 1990 Biol Reprod; Prat, Sumpter & Tyler 1996 Biol Reprod

Objectives. Use nonlethal techniques to:

Assess the maturation status of reconditioned female kelts released from Prosser.

Establish methods for determining maturation status of female kelts prior to release.

Investigate factors associated with maturation status at release.

Explore relationships between maturation status at release and post-release migration.

In reconditioned female kelts, plasma Vtg levels were bimodally distributed at release.

10/29/2009

76 female kelts w/Vtg

128 female kelts total

64% rematuration

10/13/2010

101 female kelts w/Vtg

381 female kelts total

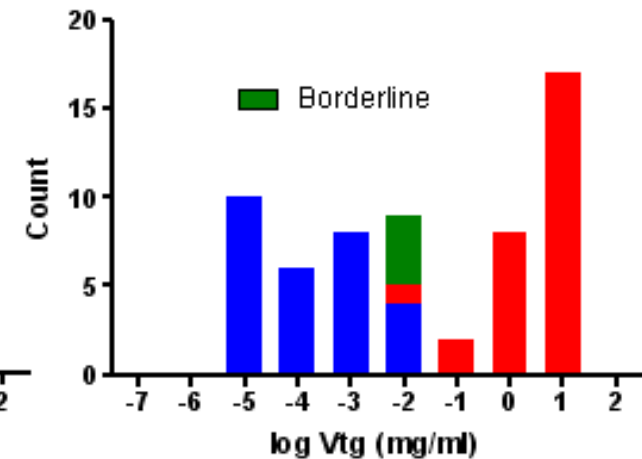
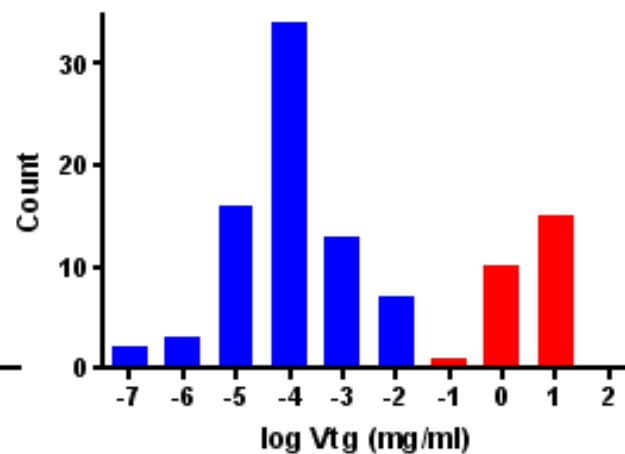
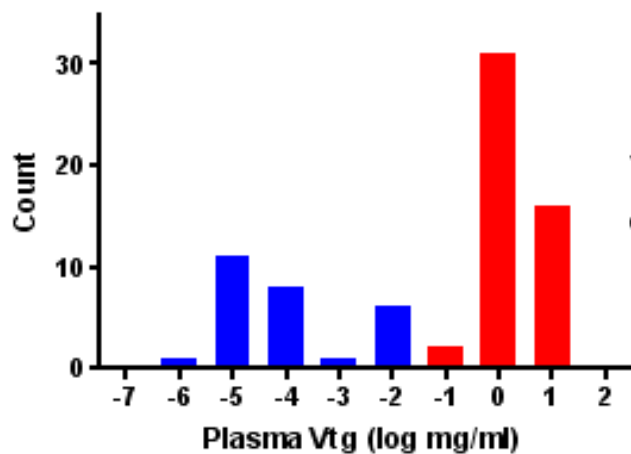
26% rematuration

9/8/2011

56 female kelts w/Vtg

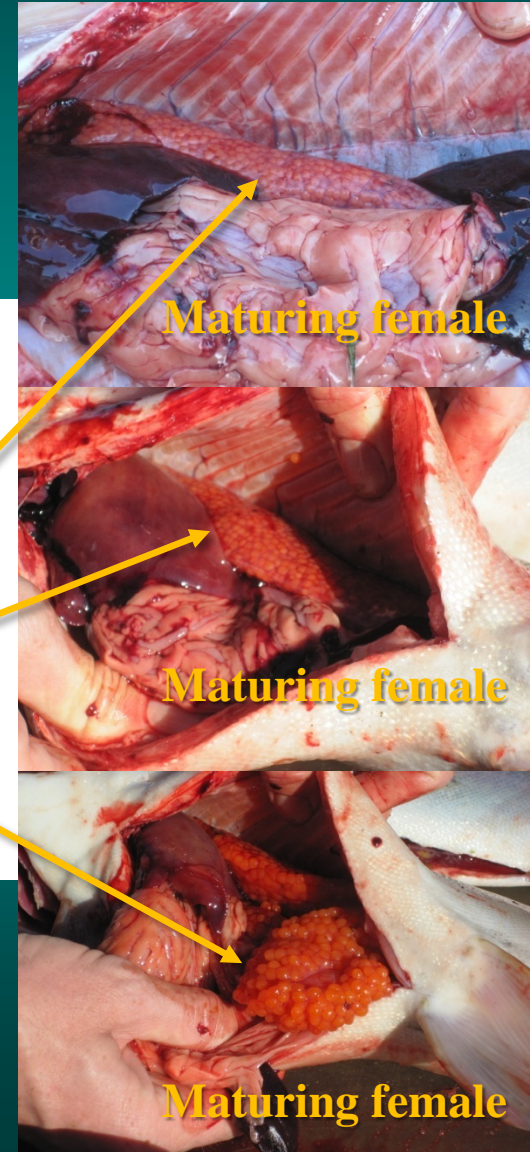
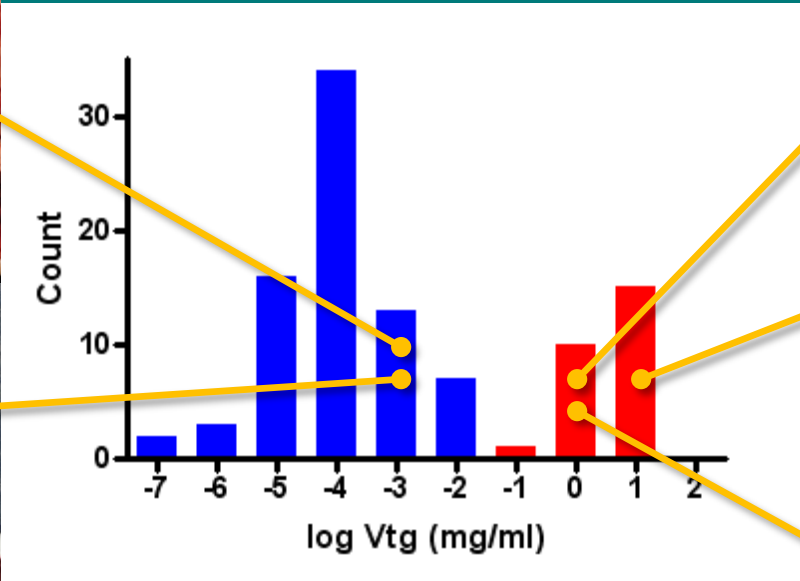
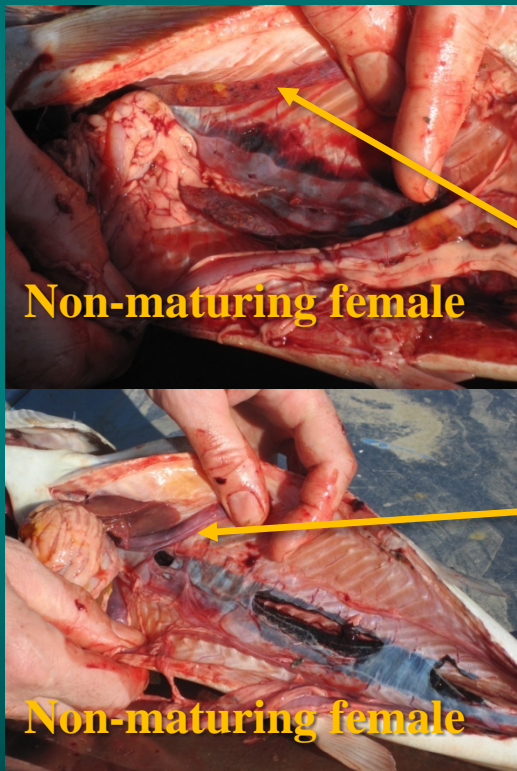
212 female kelts total

50% rematuration

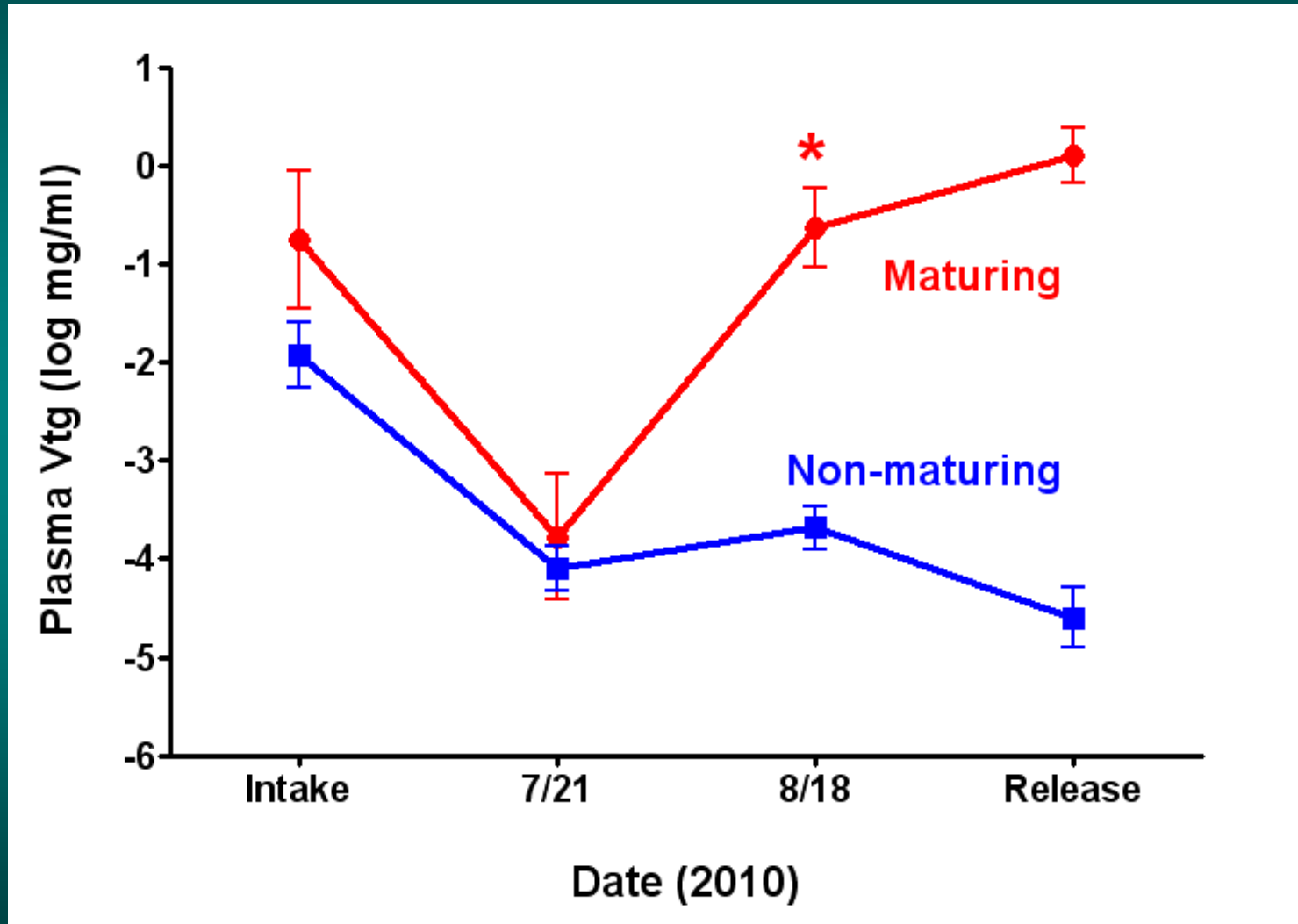


Plasma Vtg was assayed using a commercially available ELISA kit for rainbow trout Vtg (Cayman Chemicals, Ann Arbor, MI). D'Agostino & Pearson normality test 2009: $p < 0.0001$; 2010: $p = 0.0003$; 2011 $p < 0.0001$.

Necropsy of post-sampling mortalities at the 2010 release confirmed maturation status of females.

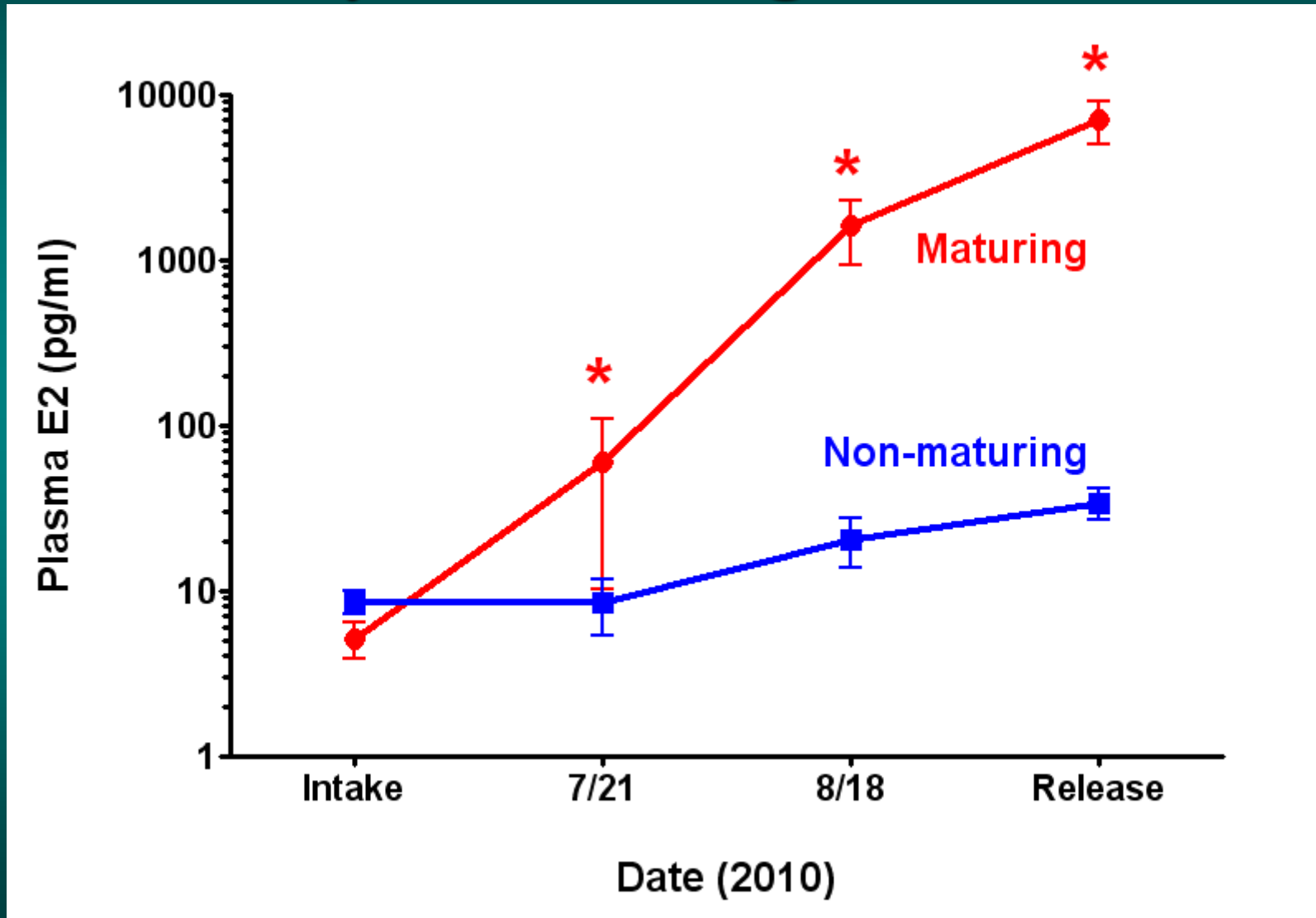


In 2010, plasma Vtg increased from mid-July to mid-August in maturing females.



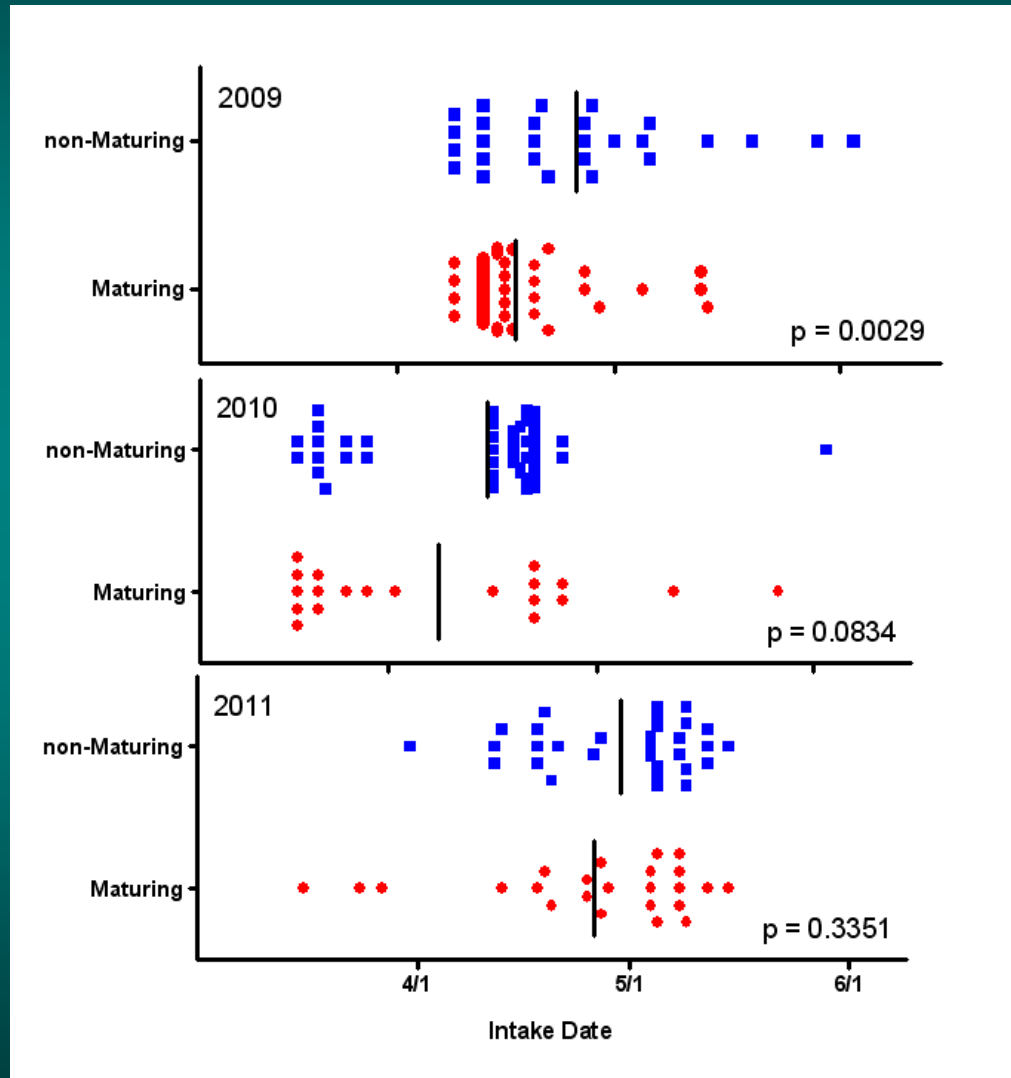
Serially sampled female kelts from 12' diameter tank. T-test on maturation status at release based on Vtg.

In 2010, plasma E2 increased from Intake to mid-July in maturing females.



Serially sampled female kelts from 12' diameter tank. T-test on maturation status at release based on Vtg.

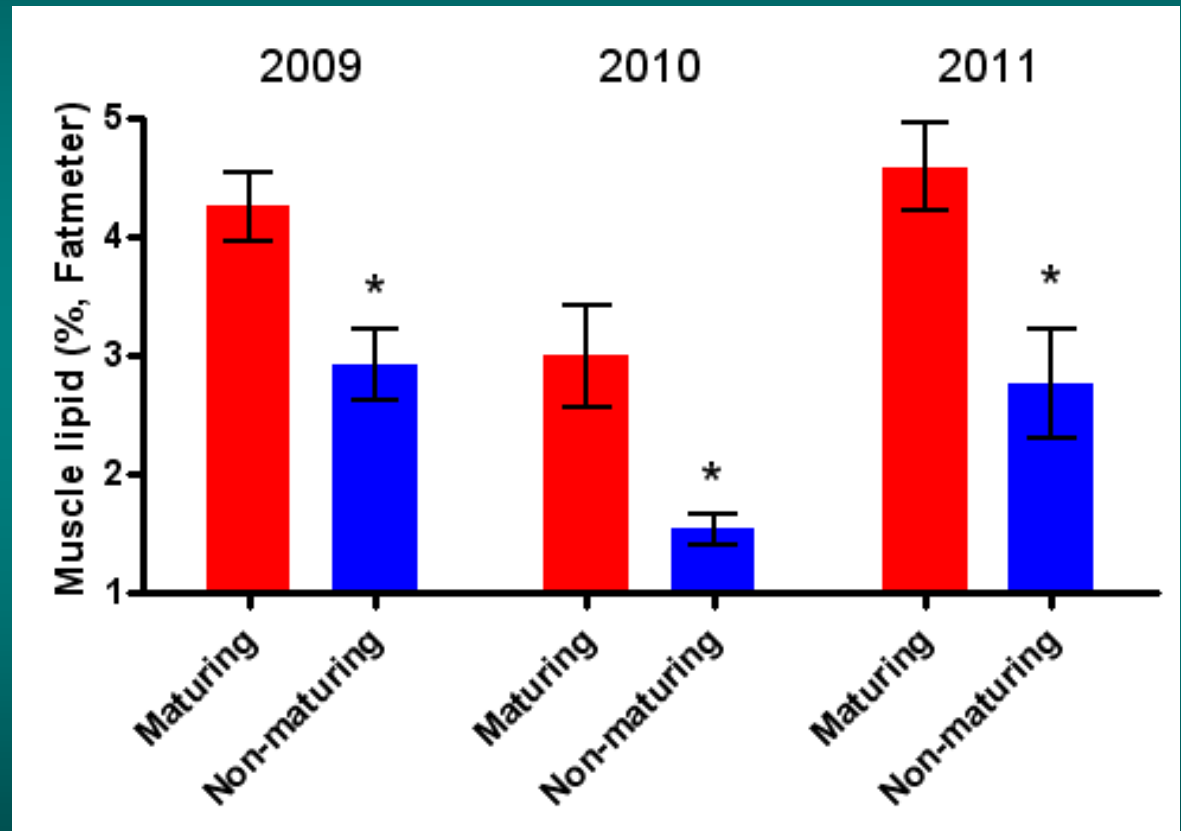
Fish that were maturing at release tended to arrive earlier in the season.



Fish that were maturing at release had higher muscle lipid levels at release.

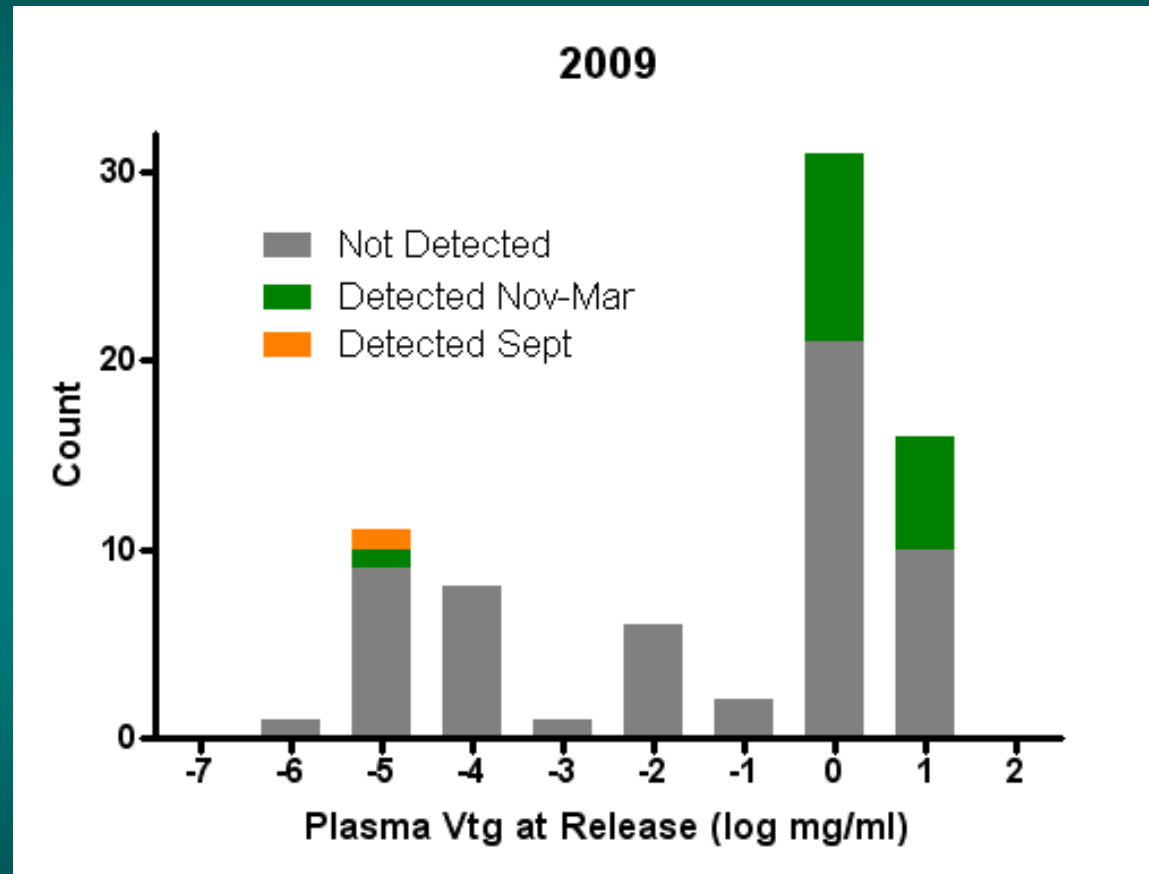


Muscle lipid level was non-lethally measured with a Distell Fish Fatmeter.



T-Test on Fatmeter data.

In 2009, mostly maturing females were detected migrating upriver after release.



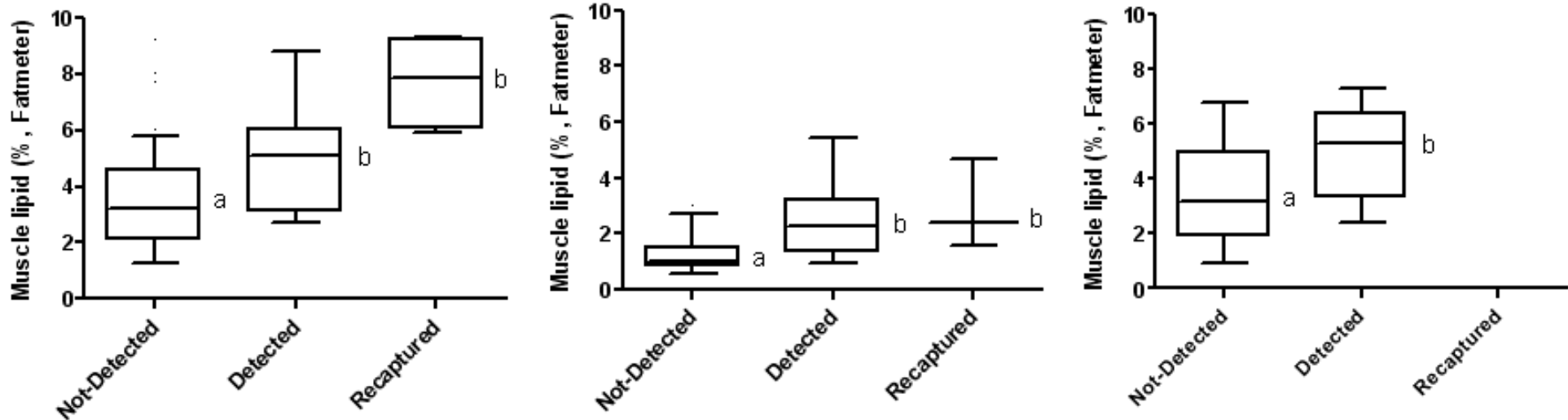
Upriver migration monitored by PIT tag detections by at Prosser Dam. Fisher's exact test Vtg mode (high or low) versus Detection (not detected or detected Nov-Mar): $p = 0.0039$. Fish detected 9/12/10 at Prosser was detected 8/1/10 at Bonneville. 1 of 27 = 3.7% low mode fish returned fall 2010.

In 2009-2011, muscle lipid levels at release predicted migratory behavior in females.

2009

2010

2011



Recaptured fish were captured as kelts migrating downriver at Prosser the following Spring. ANOVA or T-test. 2009 Detected vs Recaptured females: $p = 0.144$.

Conclusions.

The kelt reconditioning project at Prosser produces both maturing and non-maturing females at release.

Maturing and non-maturing females can be distinguished by blood vitellogenin level from August onward, by estradiol from July onward.

Maturing females arrive earlier and have higher muscle lipid at release than non-maturing females.

Mostly maturing females migrate upriver after release.

Fish with high muscle lipid levels at release show migration patterns consistent with spawning.