Variation in emergence timing promotes variability in smolting and early male maturation in Yakima River spring Chinook salmon

Yes - this is the same title as last year, Molly used the old one since I was late in sending her a new one

The talk will be different (I promise)

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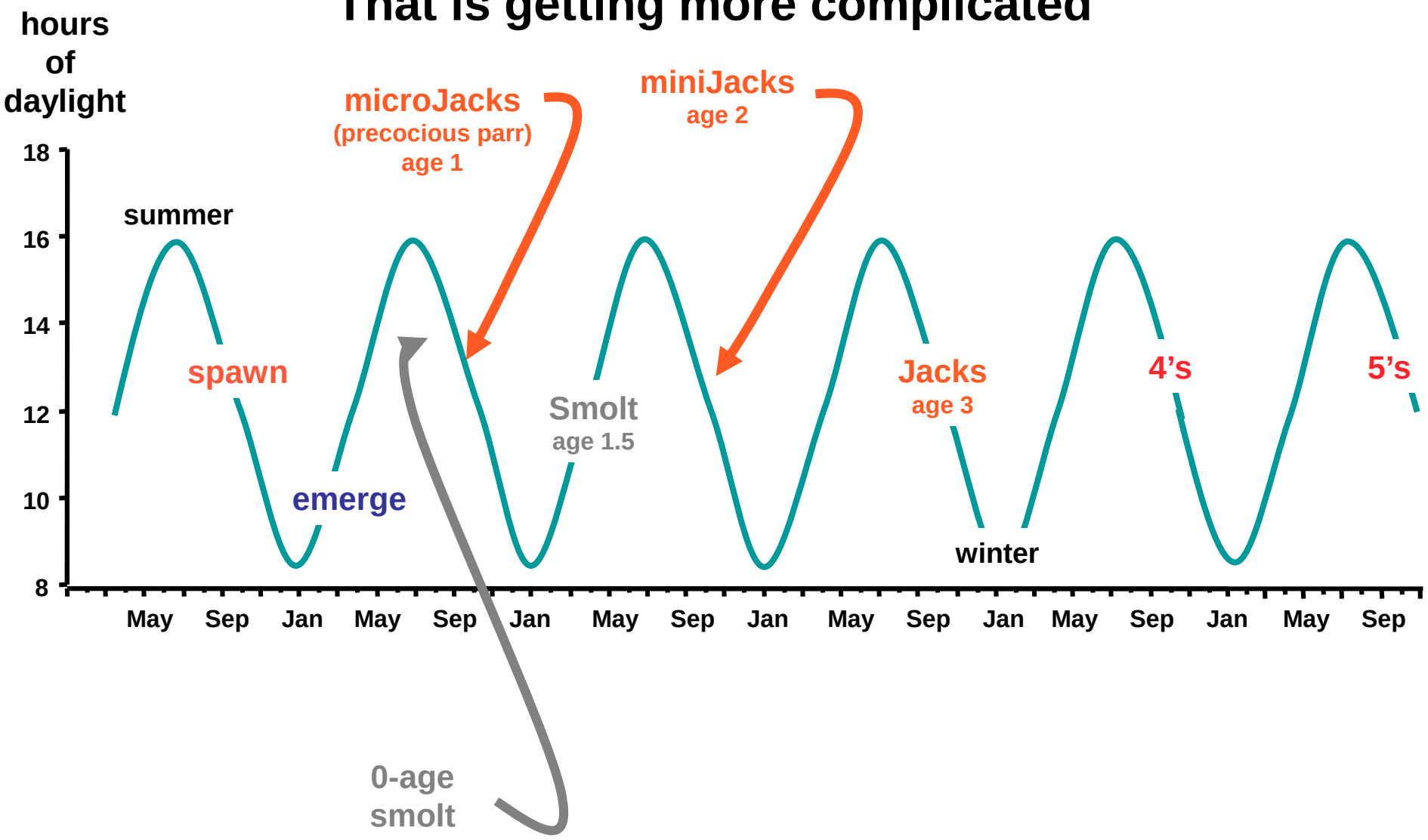
NOAA Fisheries and SAFS University of Washington

Spring Chinook salmon life cycle: A simple story

That is getting more complicated



Does this variation occur in Yakima River spring Chinook salmon?

What is/are mechanism(s) inducing variation?

Does this variation occur in the wild? (a thought experiment)

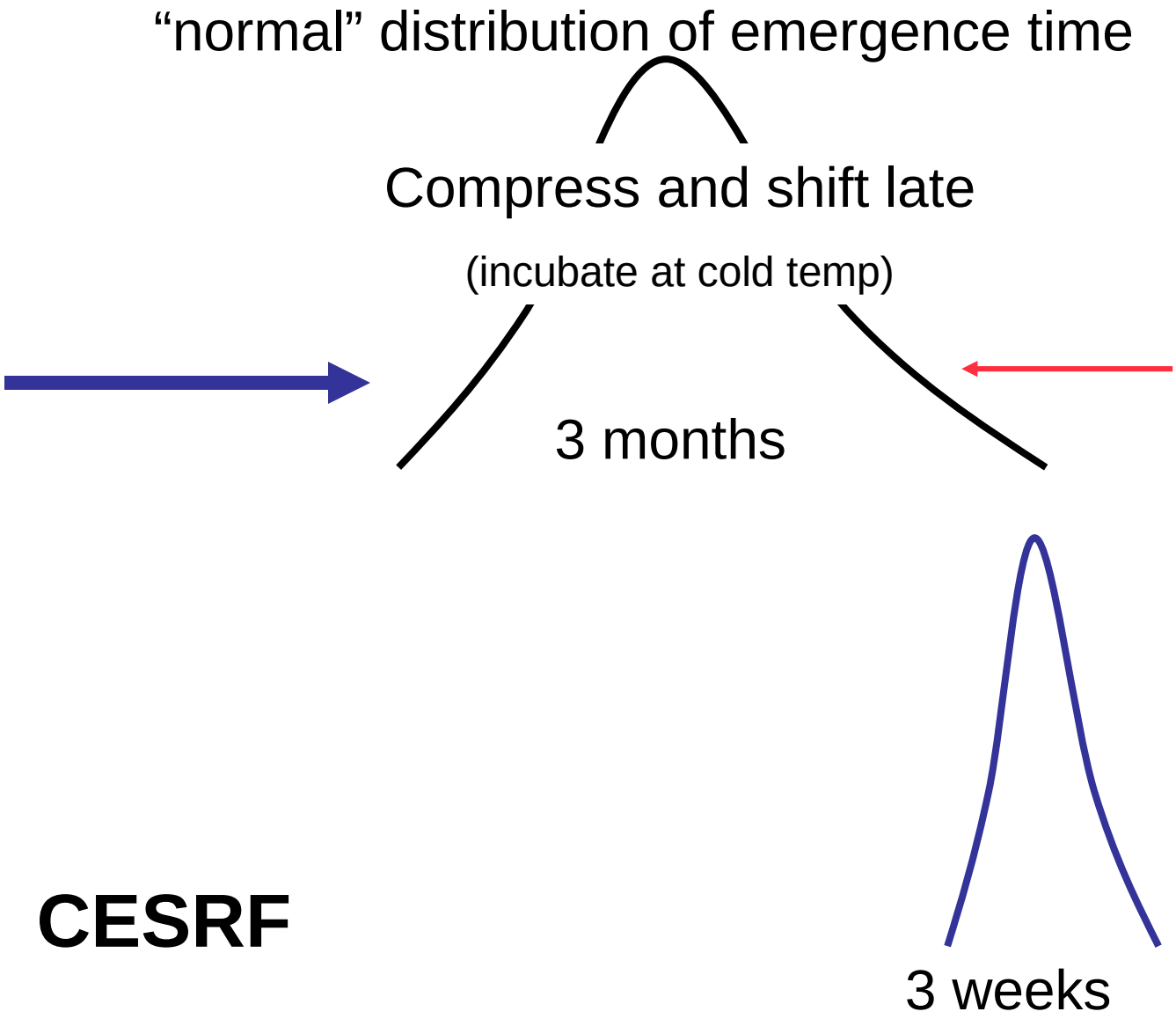
10 years of sampling, >12,000 fish
= 2 precocious parr (<0.02%)

Why so few microJacks?

One of the reasons CESRF is special: (there are many)

Seasonal timing for ponding fry

Fry are ponded “late” - avoid silting of ponds, smaller size



CESRF

Experimental Question:

What is the effect of emergence timing on life-history decisions?

Experimental approach:

Pond fry at 3 different photoperiods

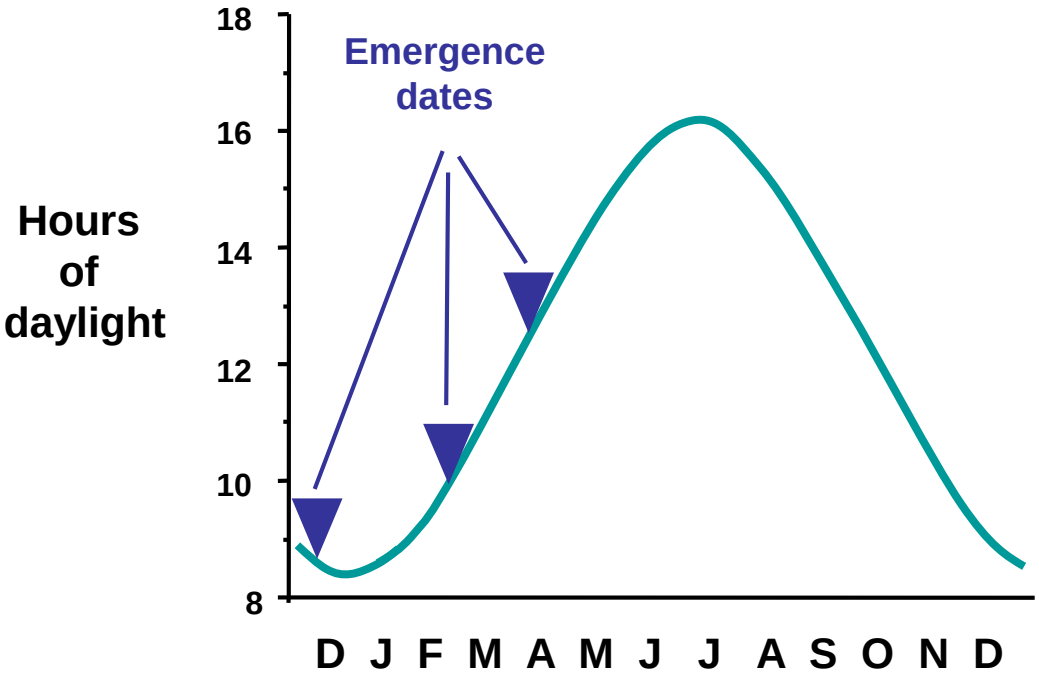
1 December (early)
15 February (middle)
1 May (late)

Experimental approach II:

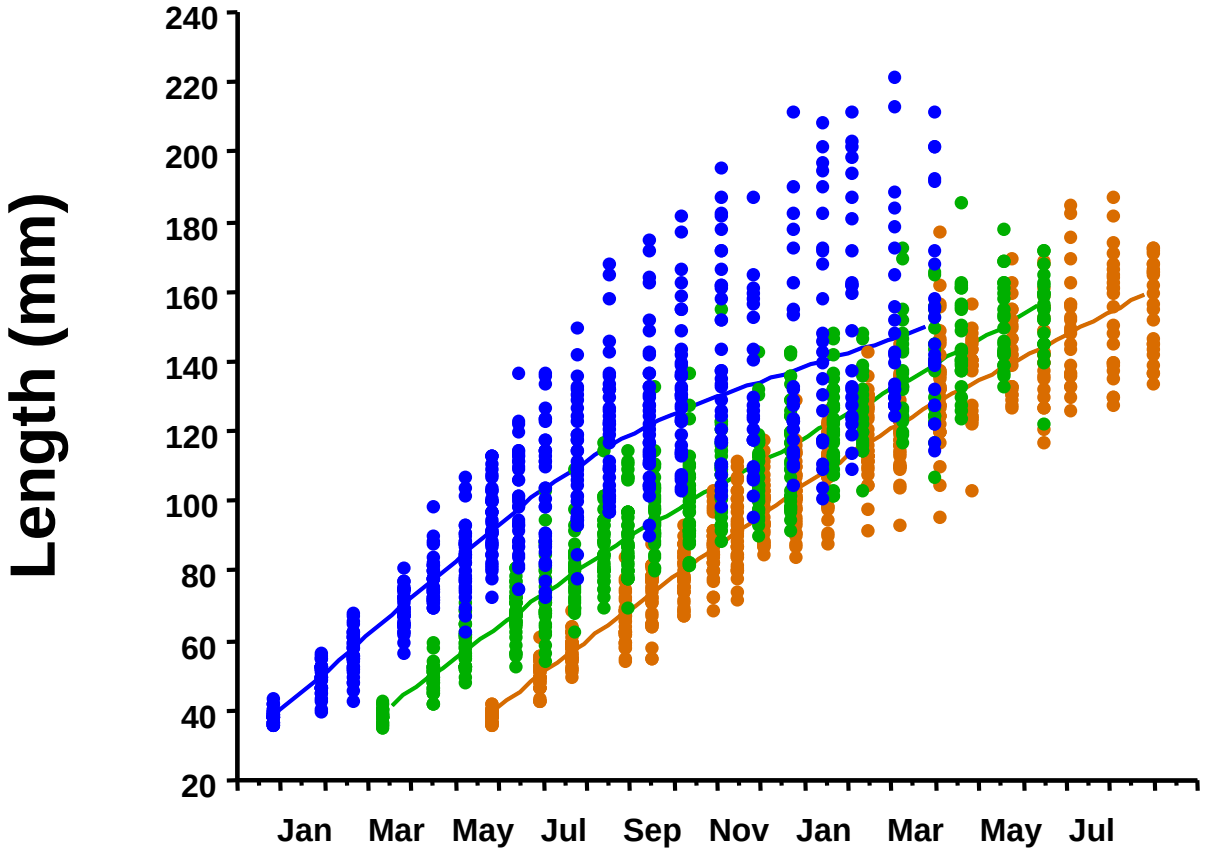
feed fry at 3 different rates

Low
High
Satiation **(1st half of experiment only)**

Experimental emergence (ponding) times spanned range from aggressive hatchery program to coldest, high elevation sites

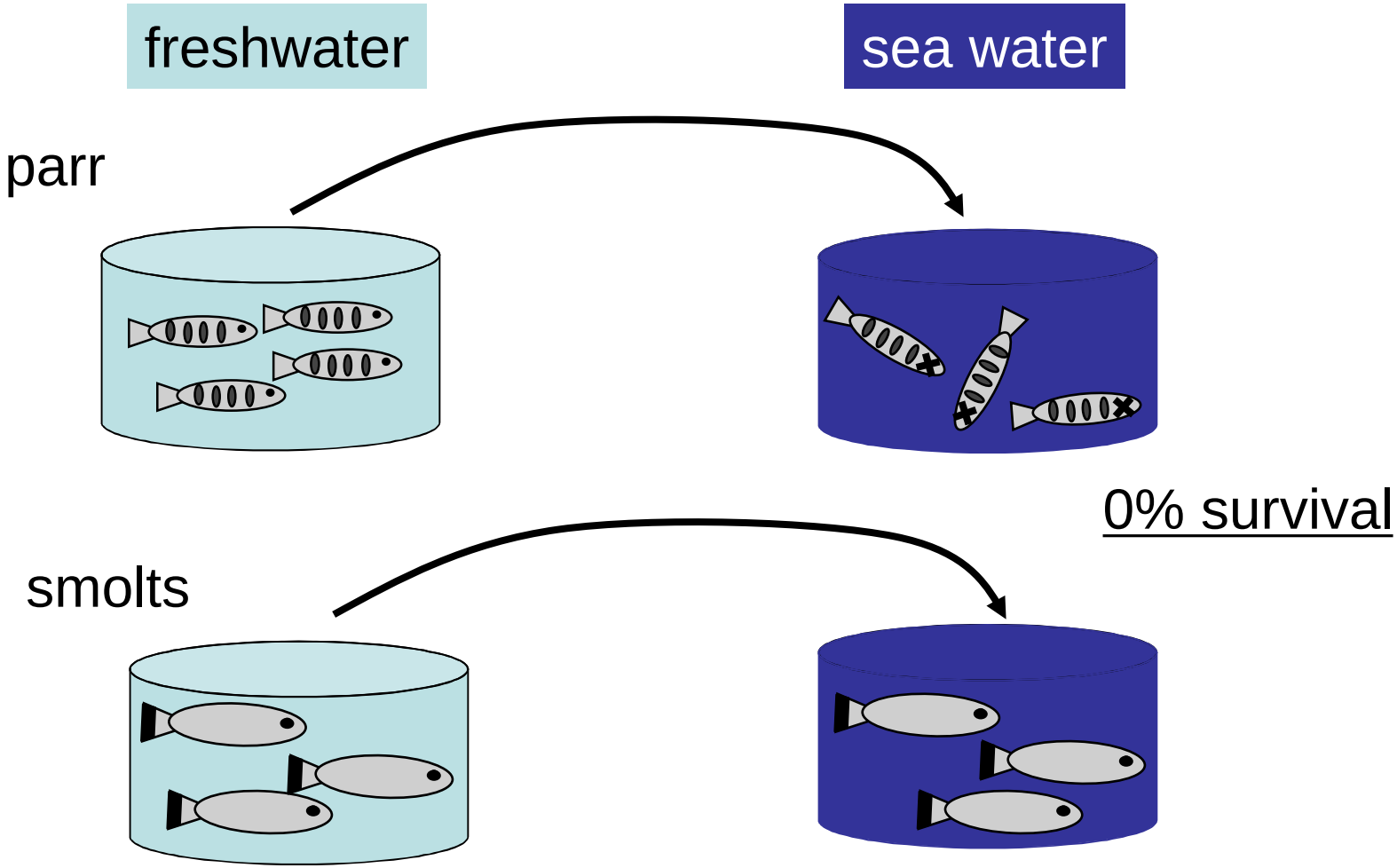


Emergence and growth of fish varied



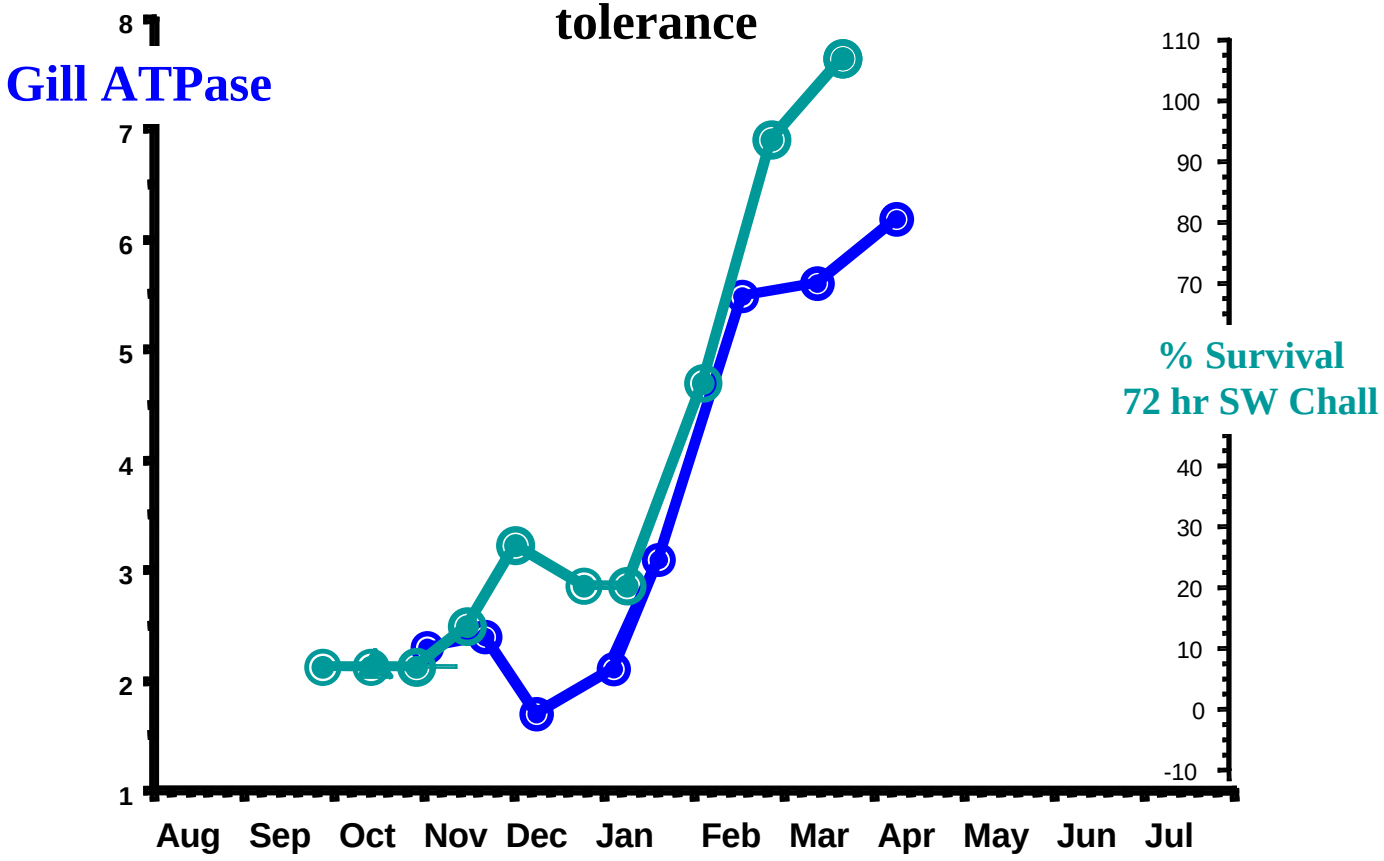
Thanks to Charlie Strom and CESRF staff for eggs

Monitoring Smolting #1:
24 hr seawater challenge



Monitoring Smolting #2:
gill Na^+ K^+ ATPase

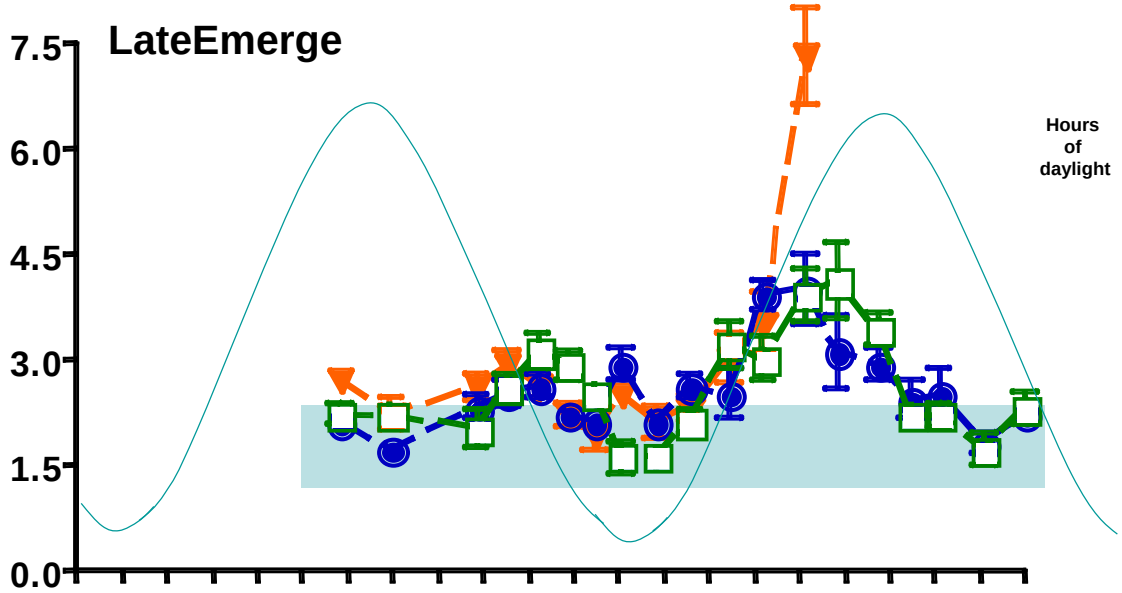
Gill ATPase changes seasonally and is correlated with changes in seawater tolerance

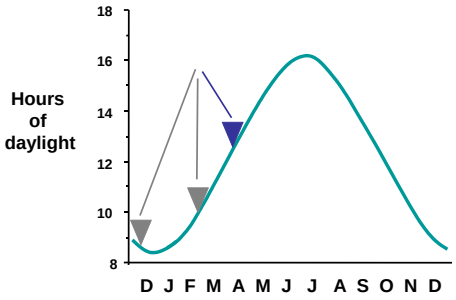


Are smolting patterns different?

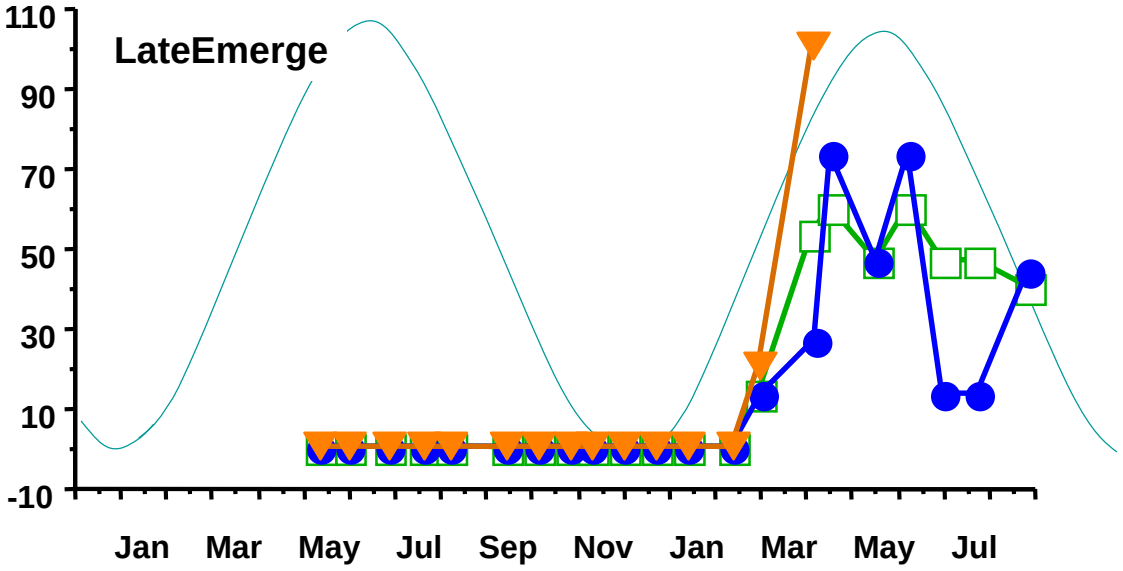
Late emerge fish smolt in the spring as yearlings

Gill Na^+ K^+ ATPase activity



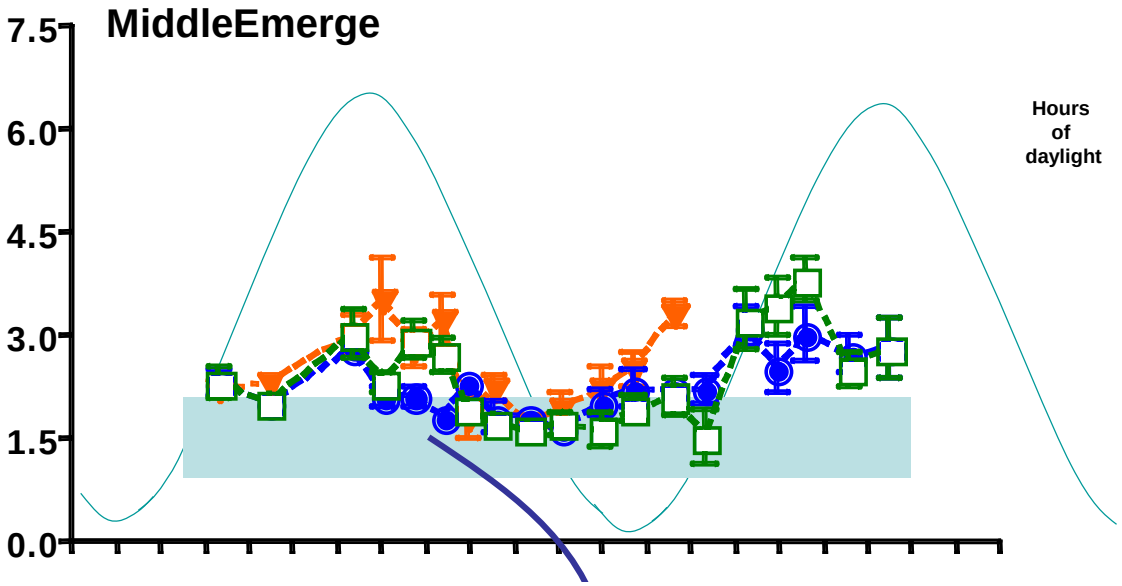


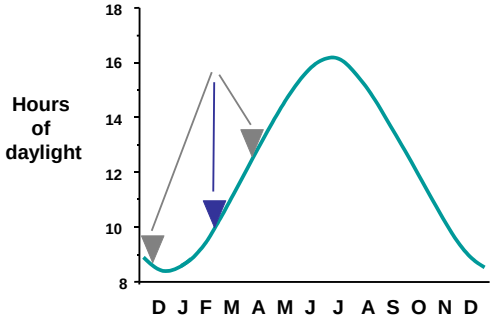
24 hr SW survival (%)



Middle emerge fish smolt in the spring as yearlings

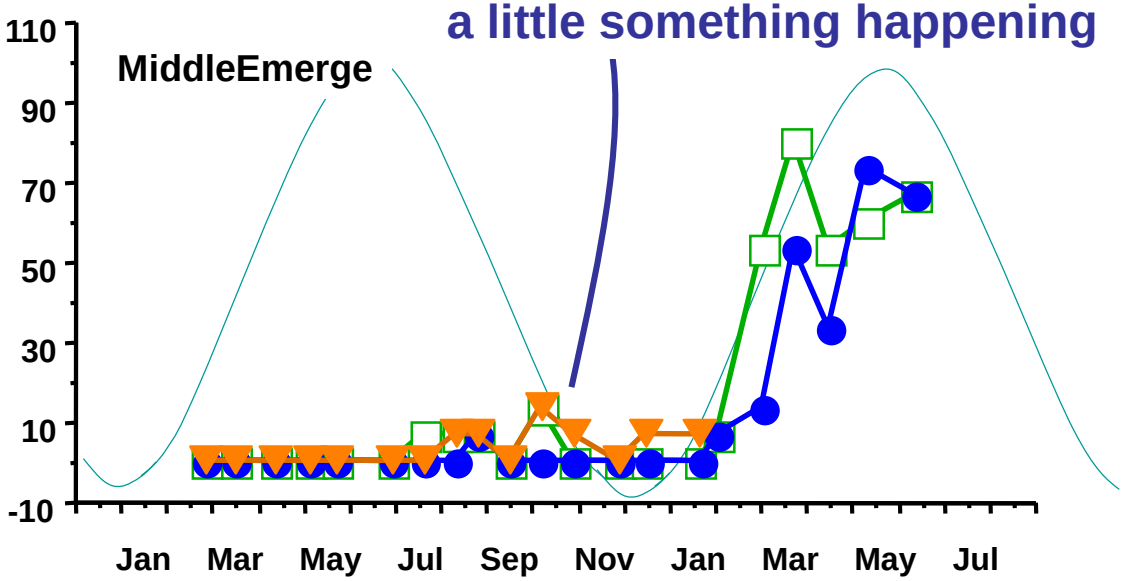
Gill Na^+ K^+ ATPase activity





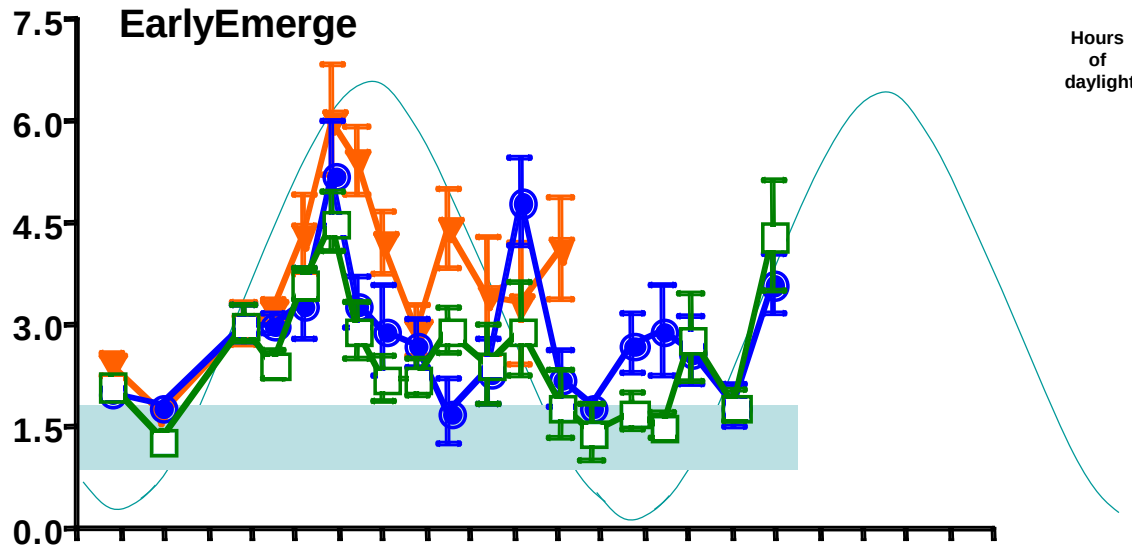
a little something happening

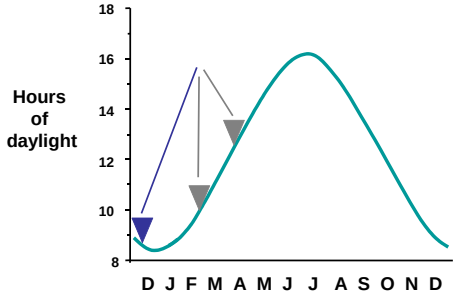
24 hr SW survival (%)



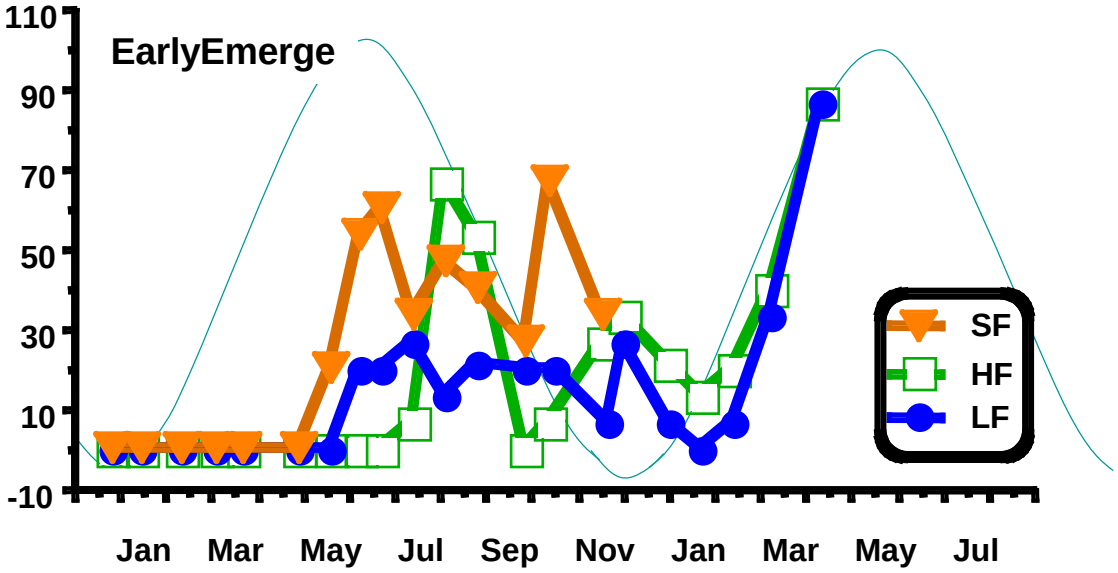
Smolting in early emerge fish is variable

Gill Na^+ K^+ ATPase activity





24 hr SW survival (%)



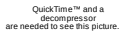
Smolting summary:

early emerging fish smolted both in the summer/ autumn (under-yearling) and spring (yearling).

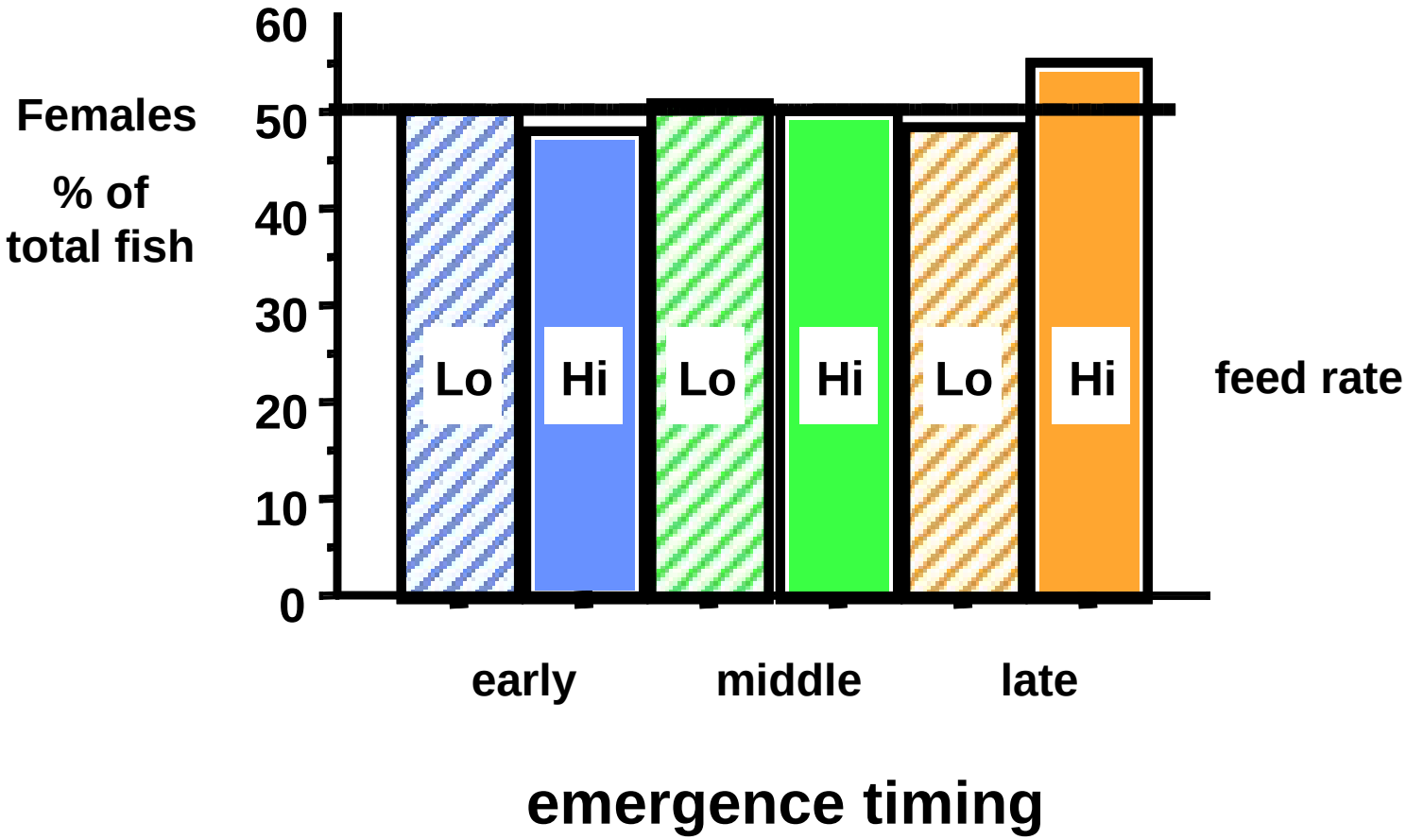
middle and late emerging fish smolted in the spring as yearlings.

Are male maturation patterns different?

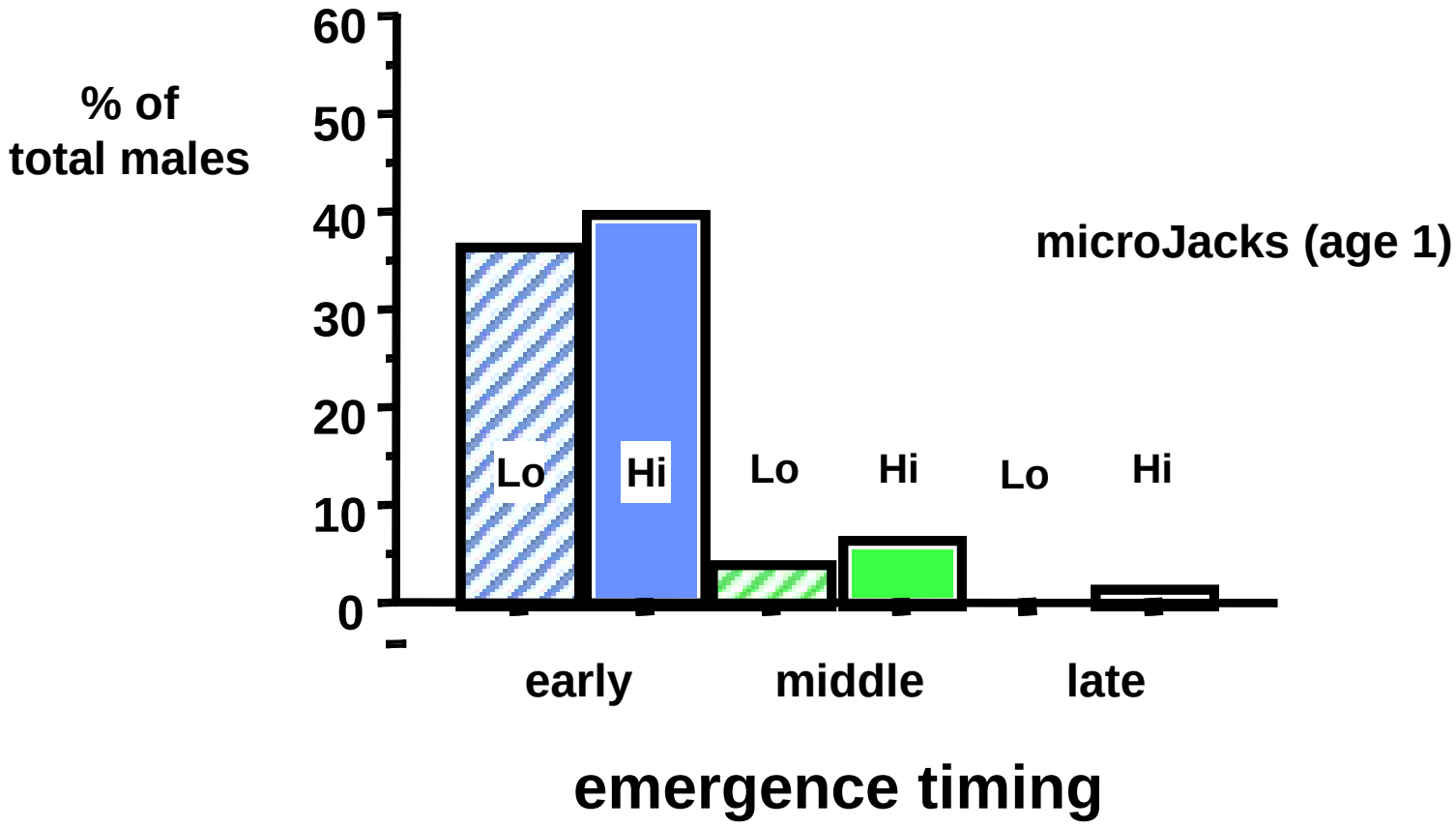
Monitor Age-1 (precocious parr) Maturation:
milt expression or simple dissection



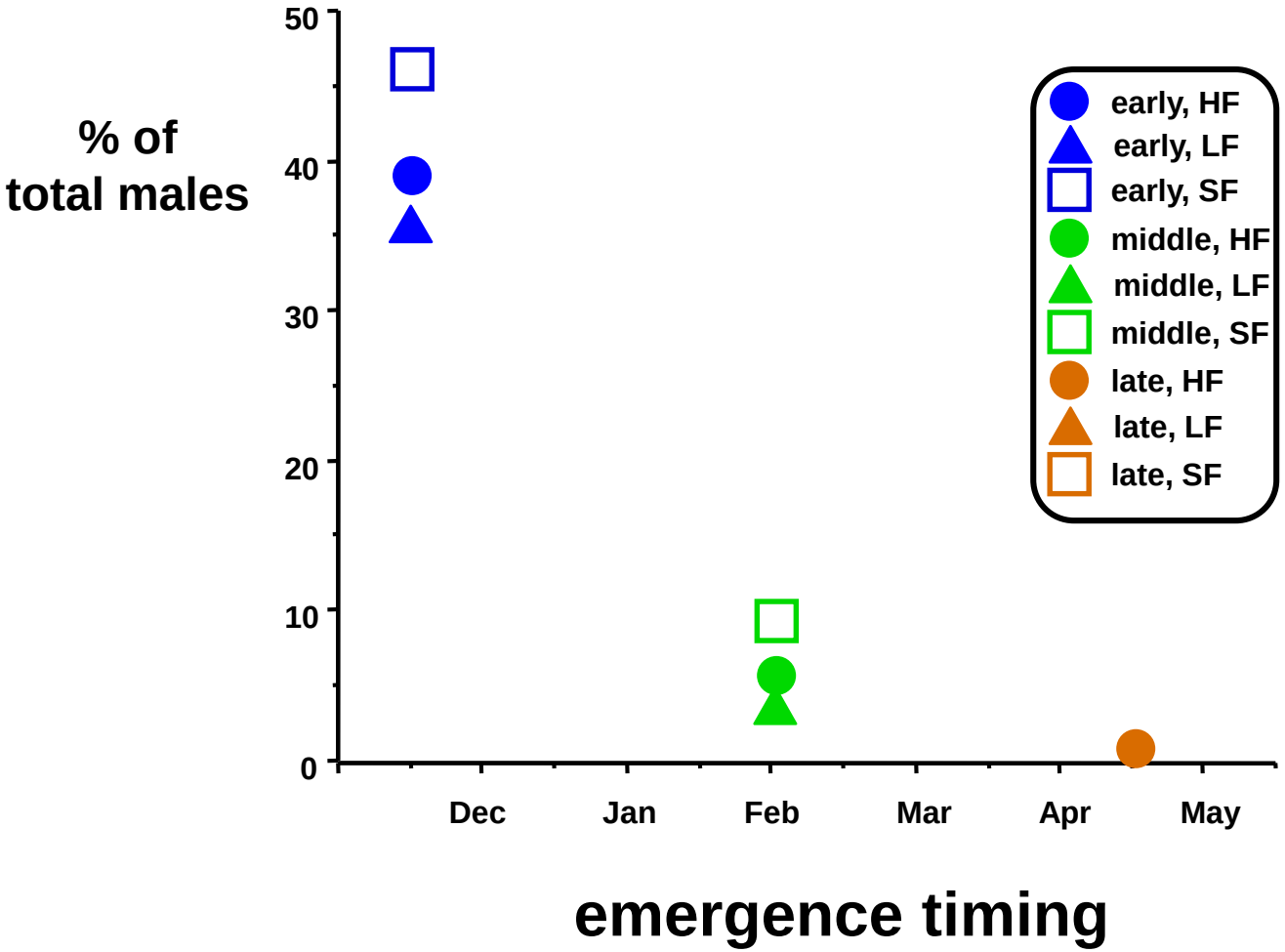
Gender ratios were similar between treatments and were not different than 50:50



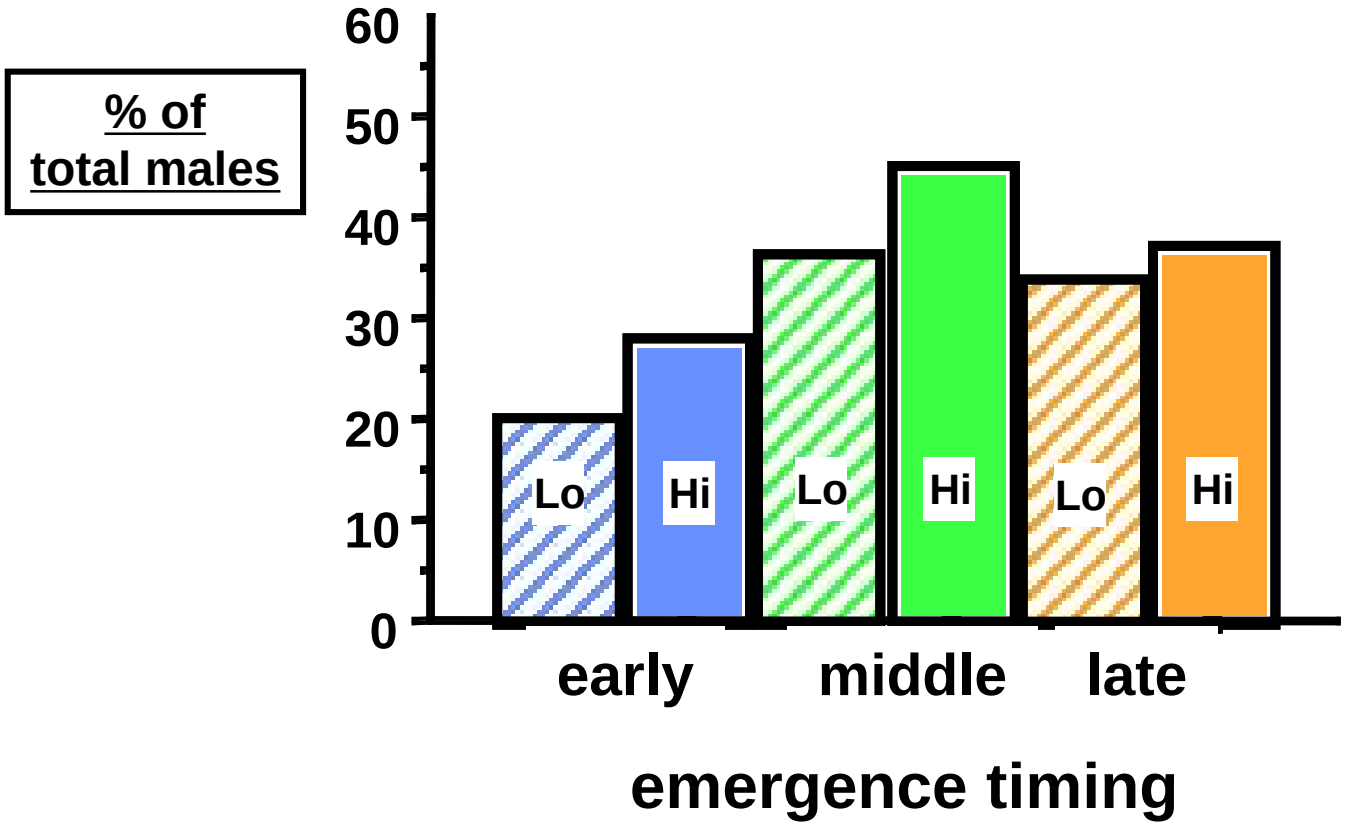
The late emergence treatment produced almost no microJacks



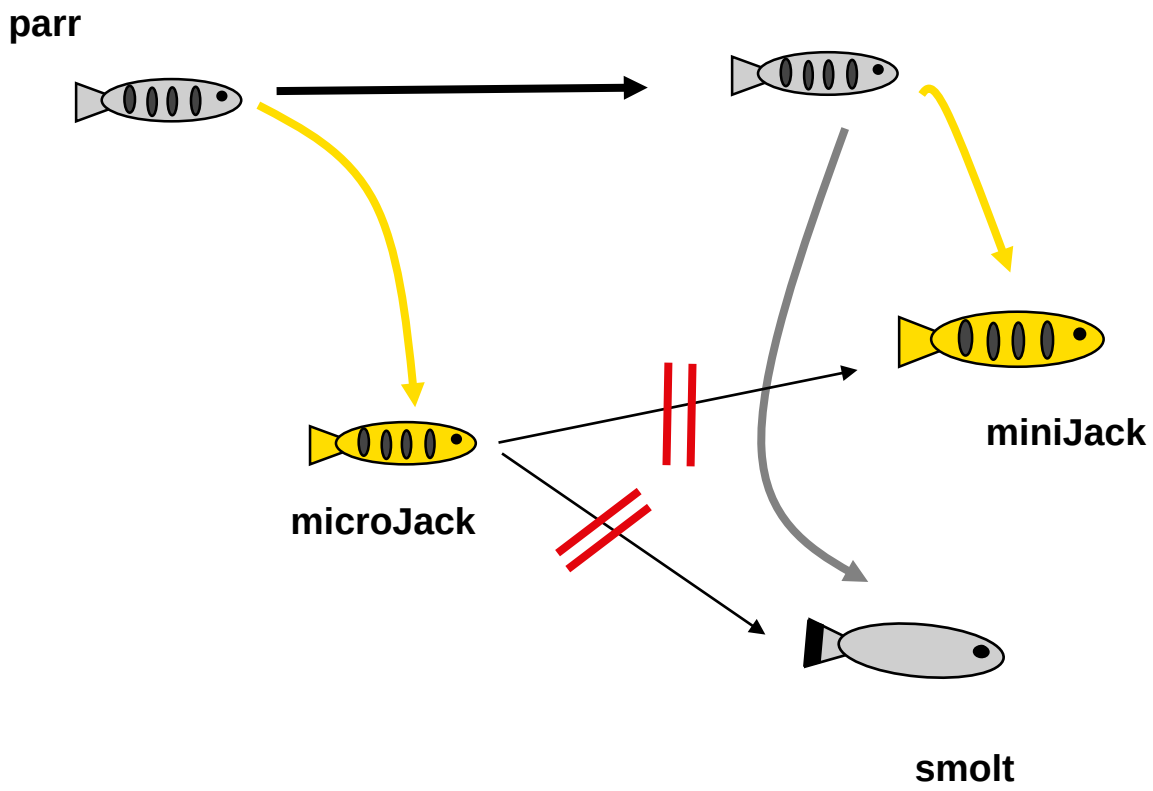
Proportion of microJacks (age 1) varies negatively with emergence timing



Proportion of miniJacks (age 2) varies with treatment



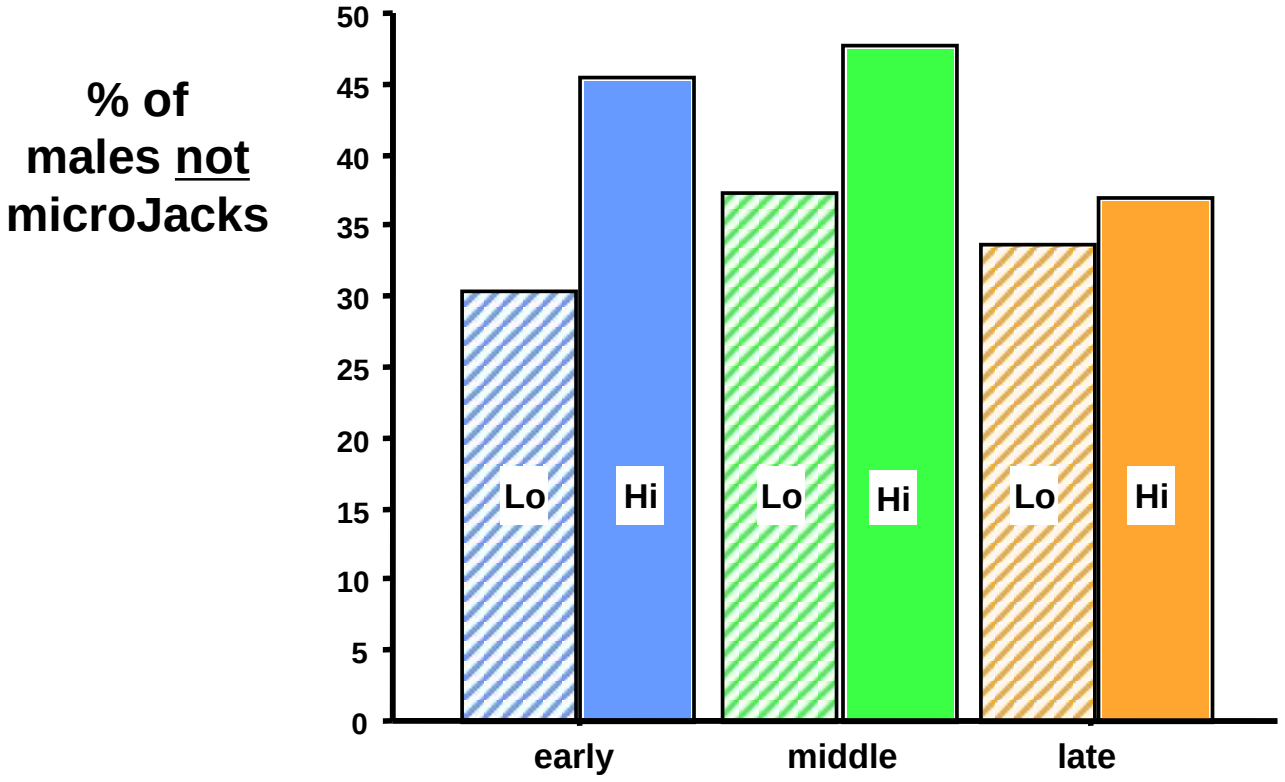
If a parr becomes a microJack there was no opportunity for that fish to subsequently become a miniJack



⇒So, need to redo the math: %miniJacks = # miniJacks/(#total males - #microJacks)

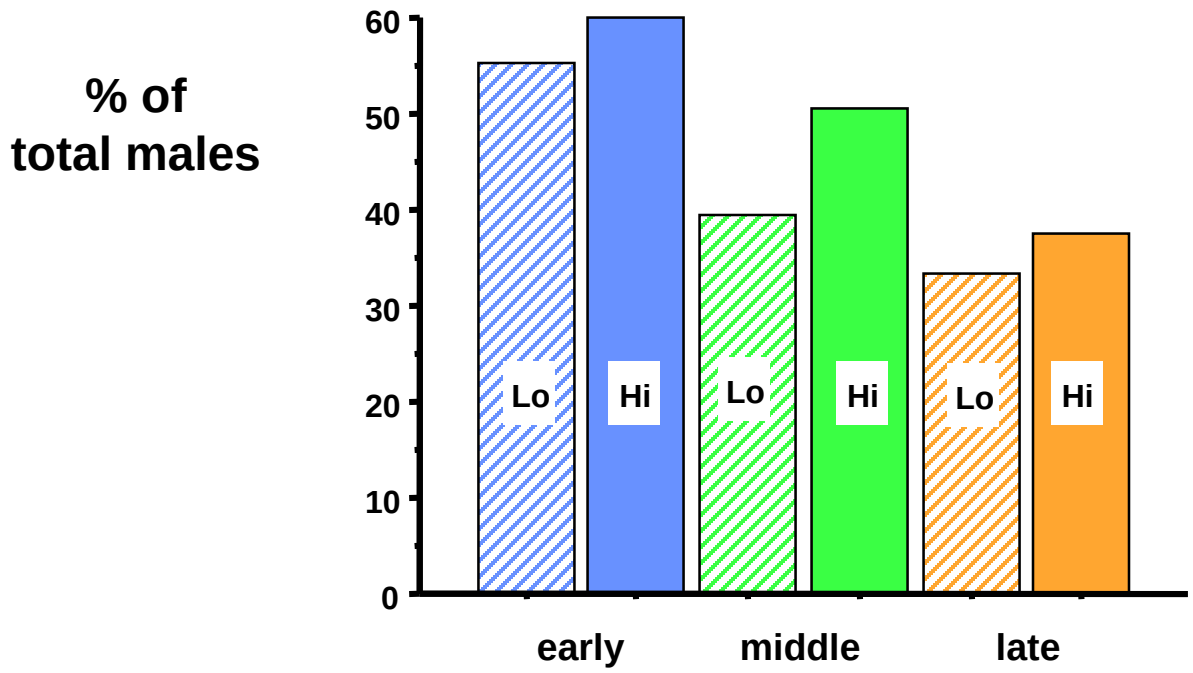
No difference in % miniJacks among emergence timing

=> Propensity to mature as a miniJack dependent on growth the previous year



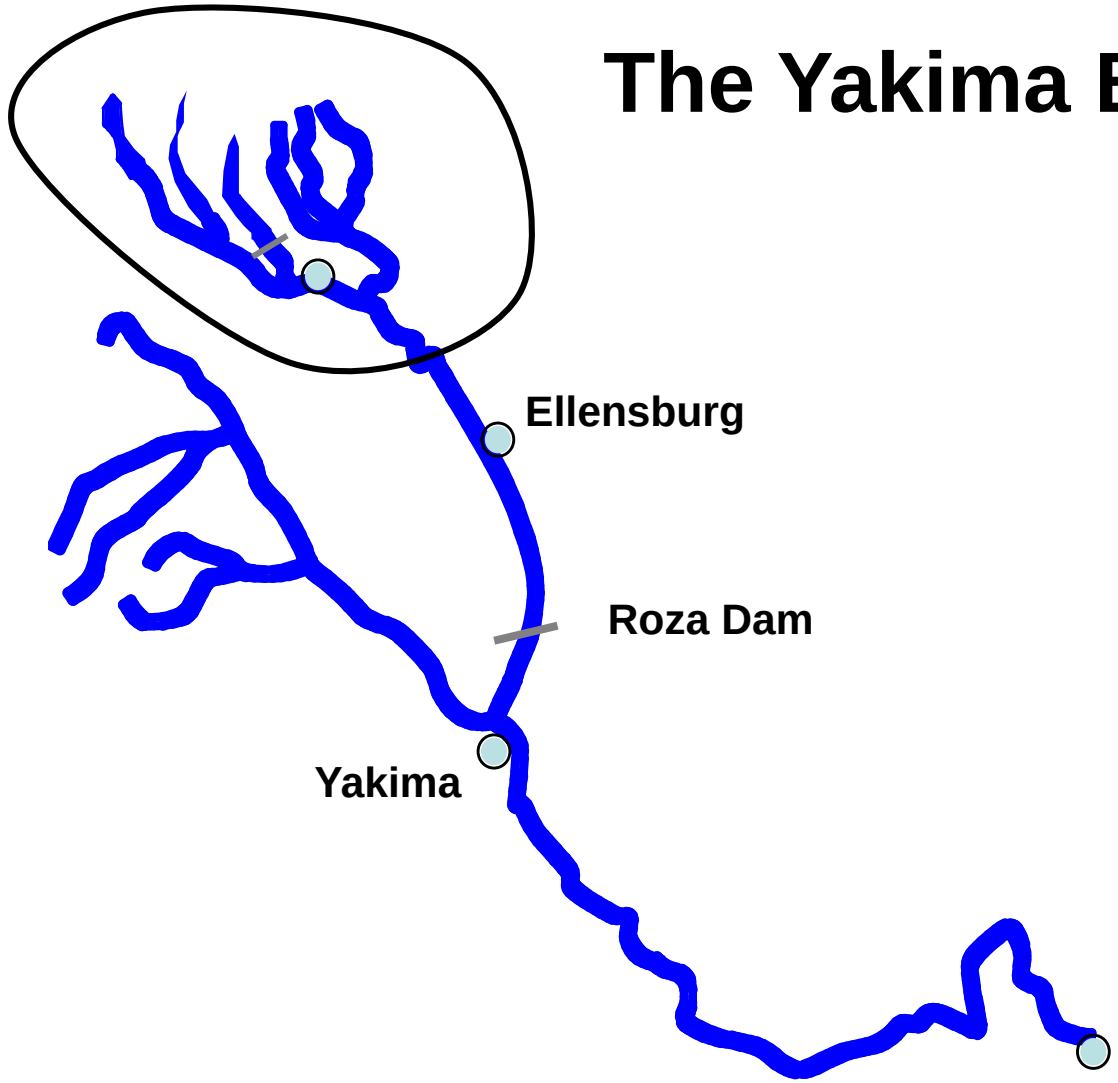
No significant differences between emergence times

The overall accounting: Total mature males (micro + mini) is higher in early emerging fish

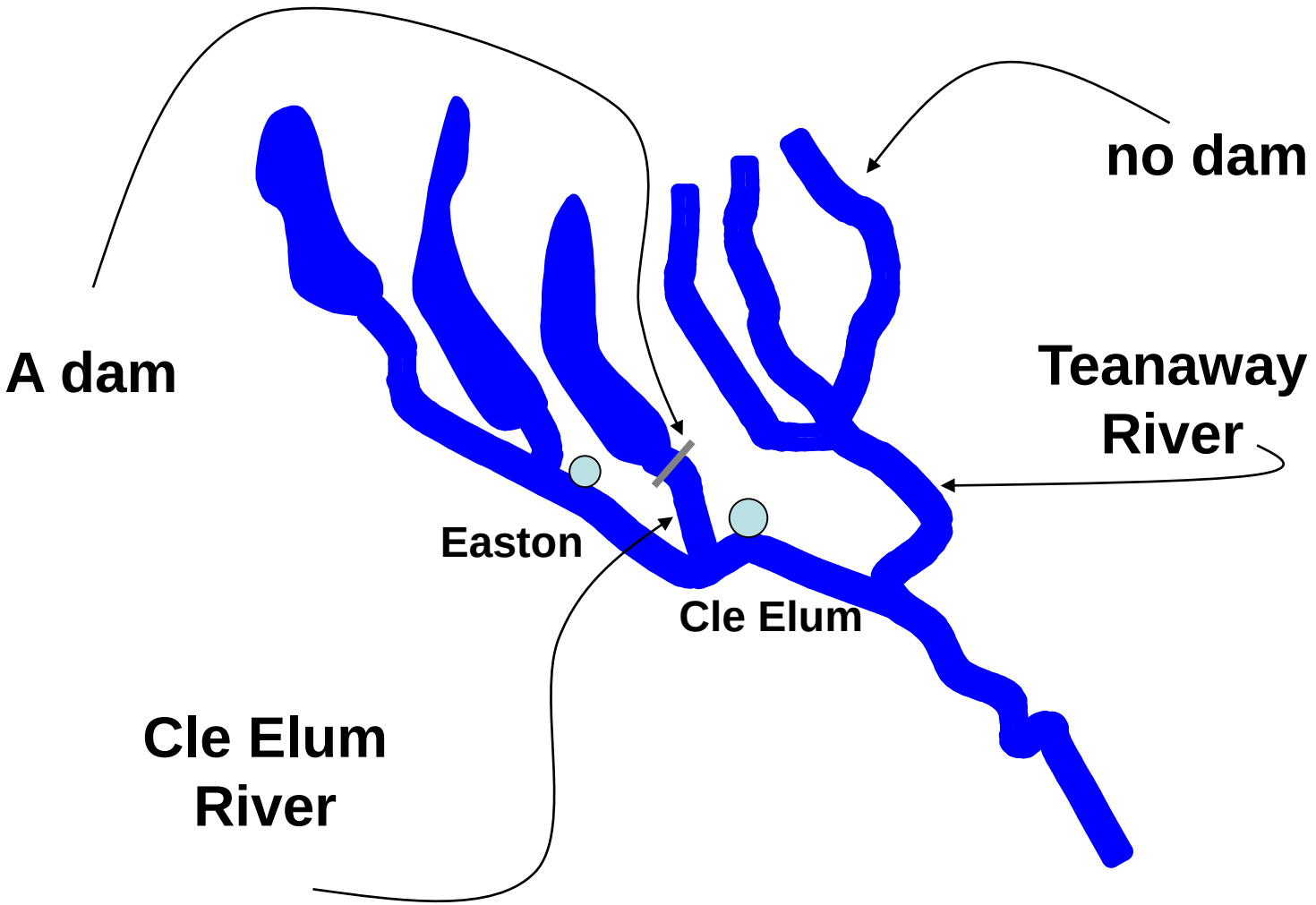


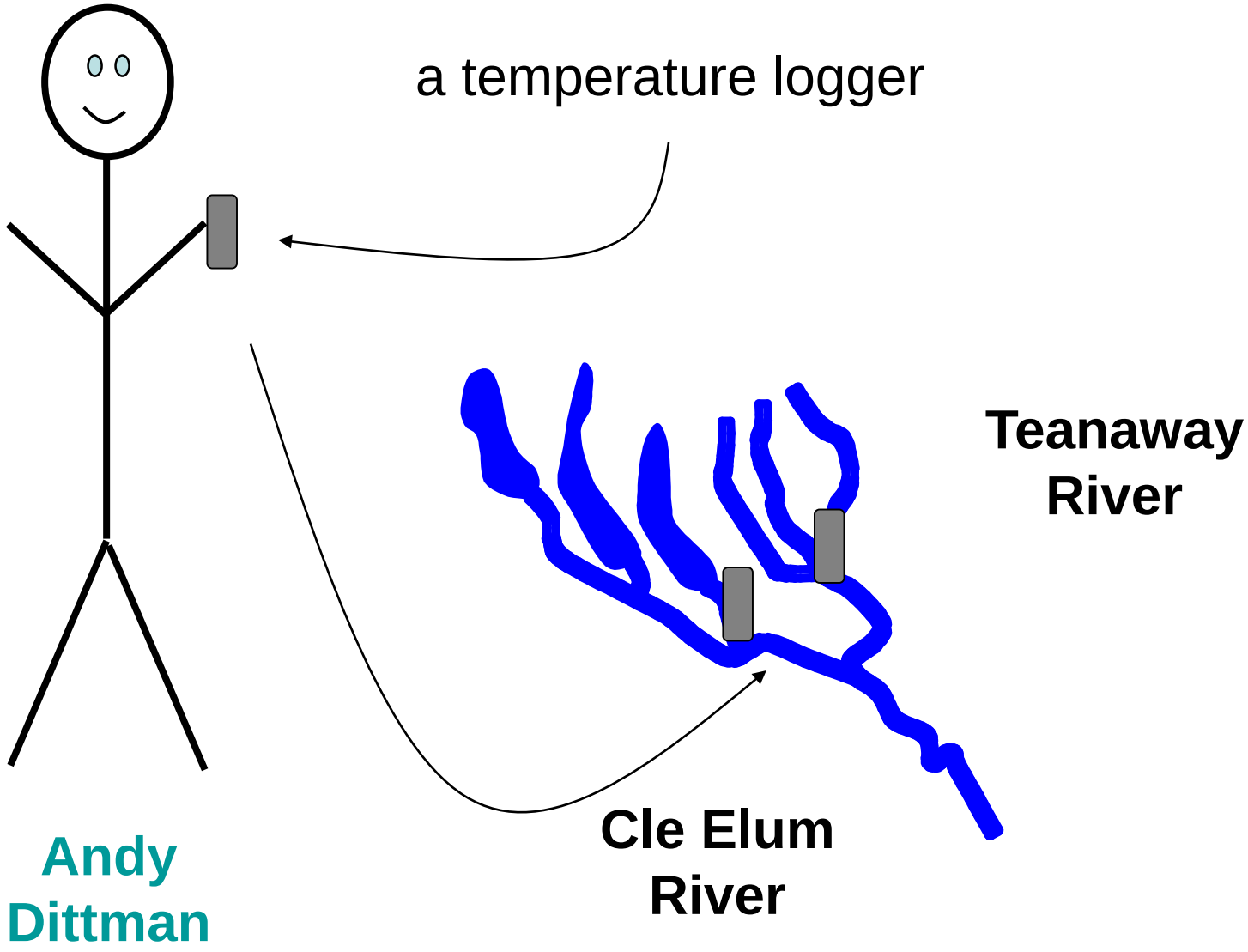
Do these results have any ecological implications?

The Yakima Basin

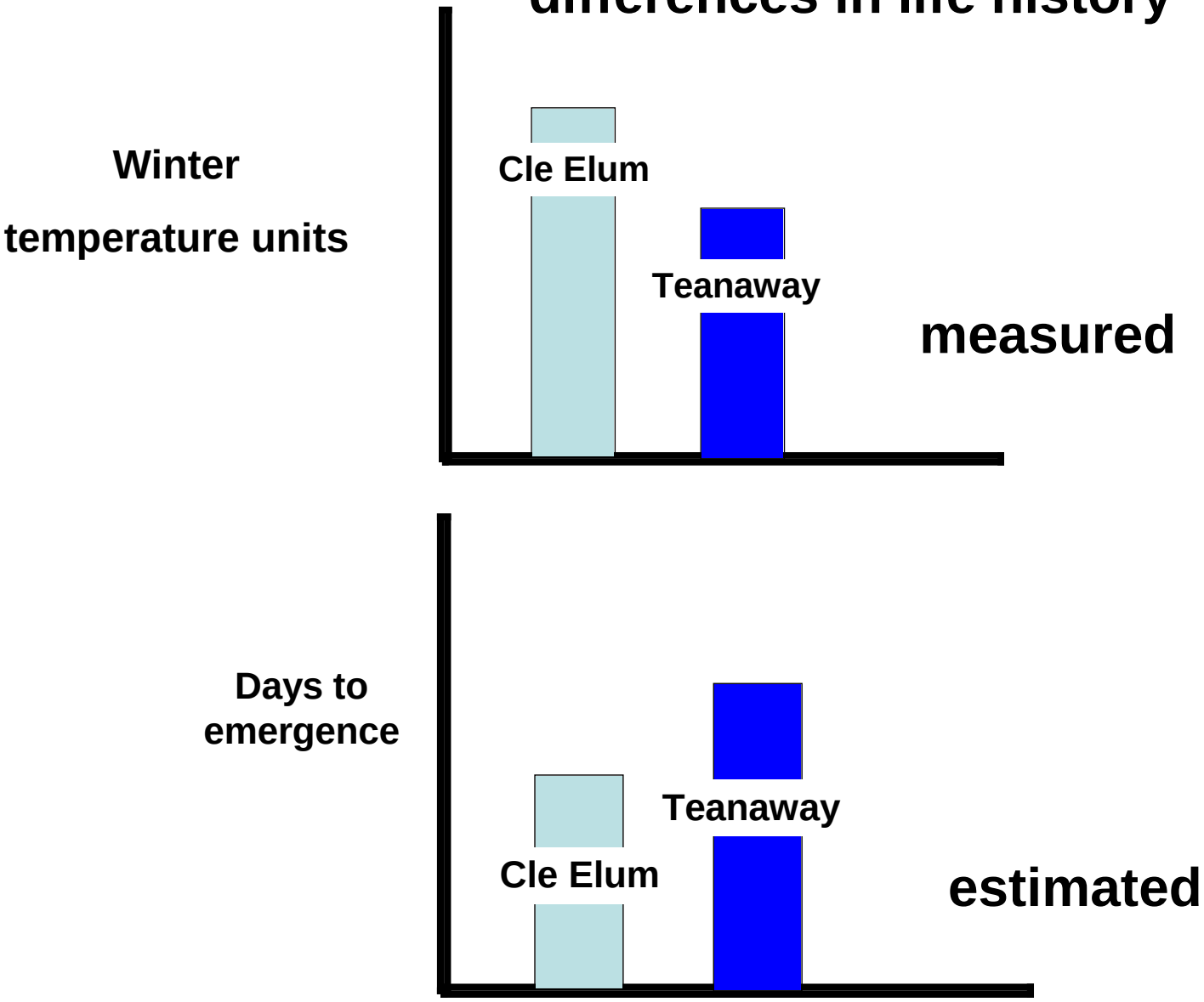


The upper Yakima Basin

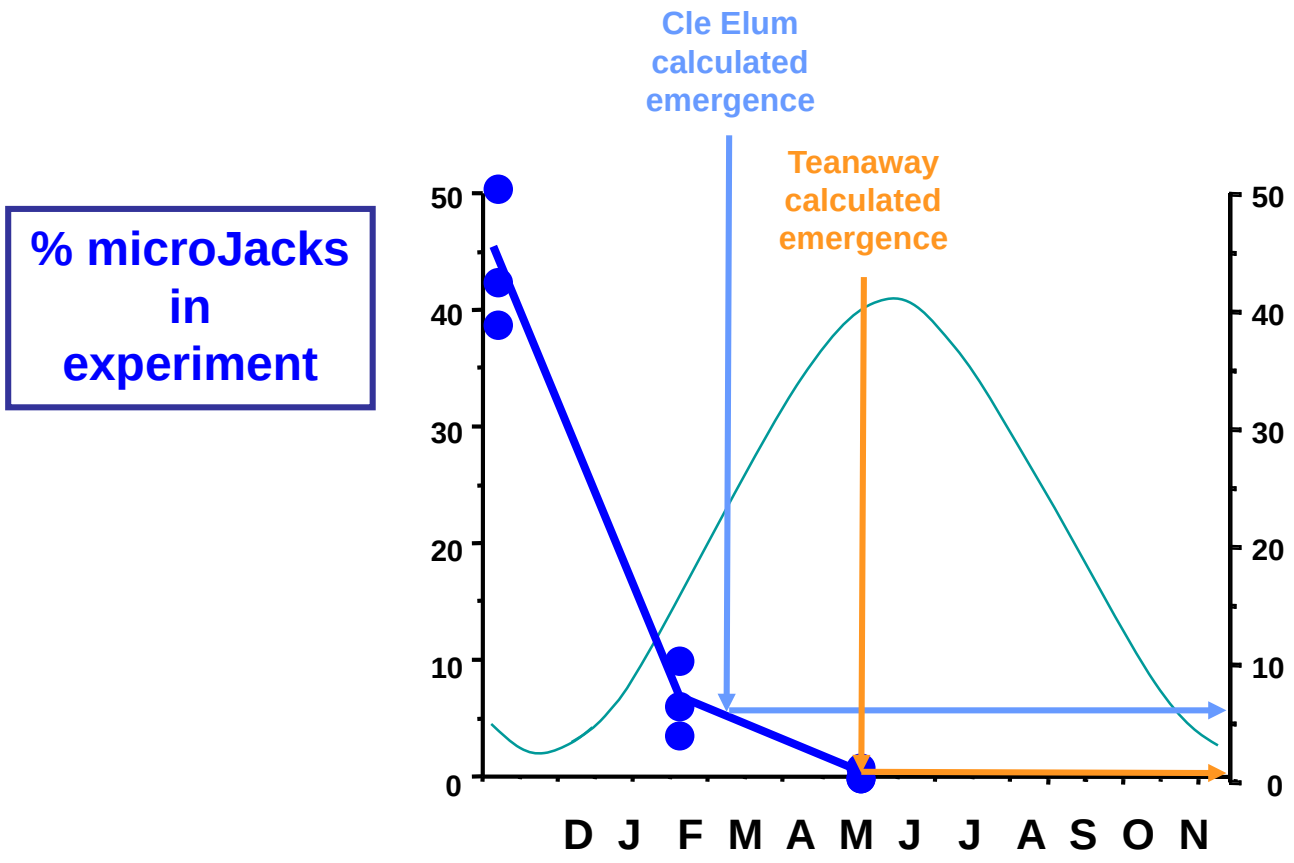



a temperature logger
Teanaway River
Cle Elum River
Andy Dittman

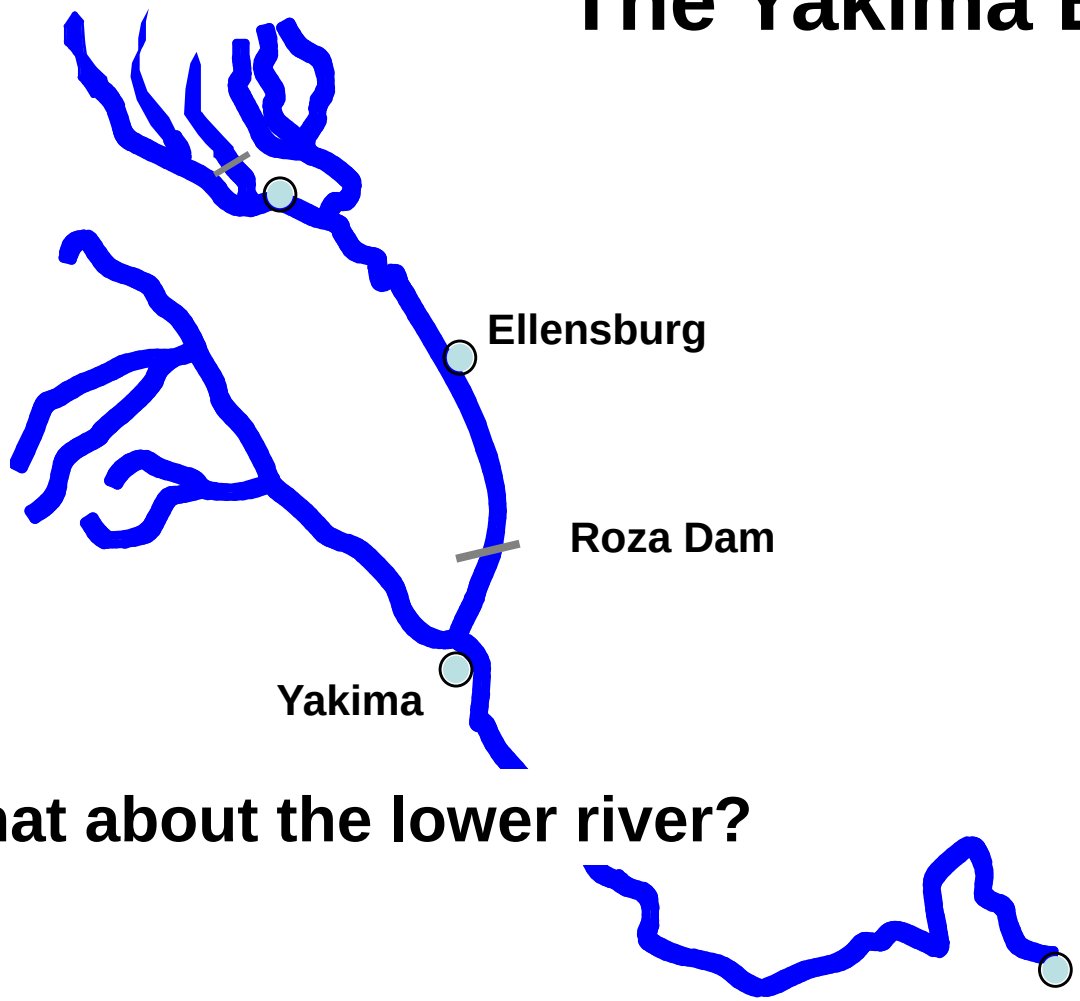
Differences in water temperature may drive differences in life history



Proportion of microJacks in the Upper Yakima Basin may differ based on differences in temperature



The Yakima Basin



What about the lower river?

Conclusions

Early life history of Yakima River spring Chinook salmon may be variable

Thermal regimes may vary regionally within the Yakima Basin

This thermal variation may have significant affects on life history variability

One of the primary mechanisms through which thermal affects may modulate life history is variation in emergence timing