



Variation in early male maturation and smolting of juvenile summer Chinook salmon and varying over-winter temperature regimes

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OUTLINE

- Background: Chinook Life History Variation & Early Male Maturation**
- Study Objectives & Design**
- Part 1 Methods & Results: Minijack Screen**
- Part 2 Methods & Results: Intensive Monthly Monitoring**
- Conclusions**

Early Male Maturation

-Age of maturation is phenotypically plastic and can occur at:

age-1 (Precocious parr or microjack)

age-2 (Minijack)

age-3 (Jack)

age-4 or 5

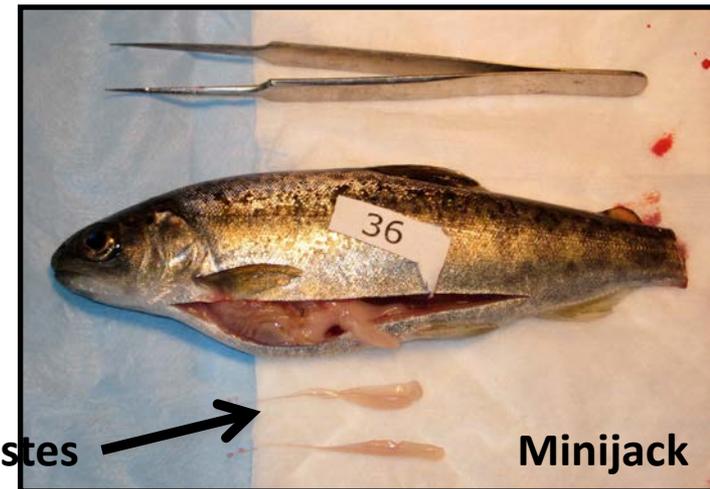
-Age of maturation is influenced by:

emergence timing

(Beckman et al. 2007)

energy stores and growth rate

(Vollestad et al. 2004; Hopkins and Unwin 1997; Silverstein et al. 1998; Shearer and Swanson 2000; Campbell et al. 2003; Shearer et al. 2006; Larsen et al. 2006)



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STUDY OBJECTIVES

Part 1: Quantify occurrence of minijacks in several populations of yearling summer Chinook salmon released in Upper Columbia Basin

Part 2: Quantify growth and smoltification profiles of same populations

*(Data originally collected as part of Reuse Study)

Two Sampling Methodologies

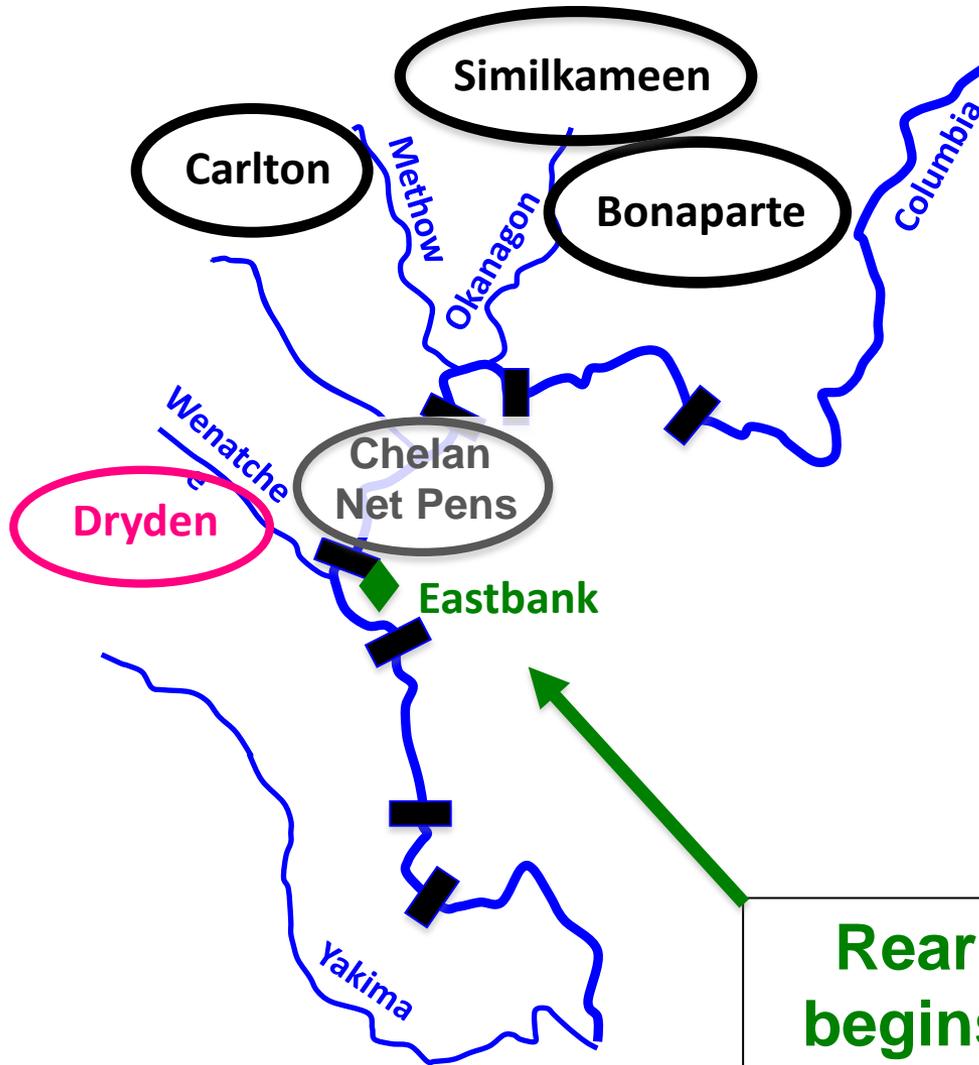
1. Minijack Screen

- Sampled in Spring just before release
 - a. Size
 - b. Maturation status

2. Intensive Monthly Monitoring

- Sampled Fall through Spring prior to release
 - a. Growth Rate (size)
 - b. Maturation status
 - c. Smoltification

STUDY LOCATIONS



3 Genetic Stocks:

- Wenatchee R.
- Wells
- Methow/Okanogan

Rearing for all populations begins at Eastbank Hatchery



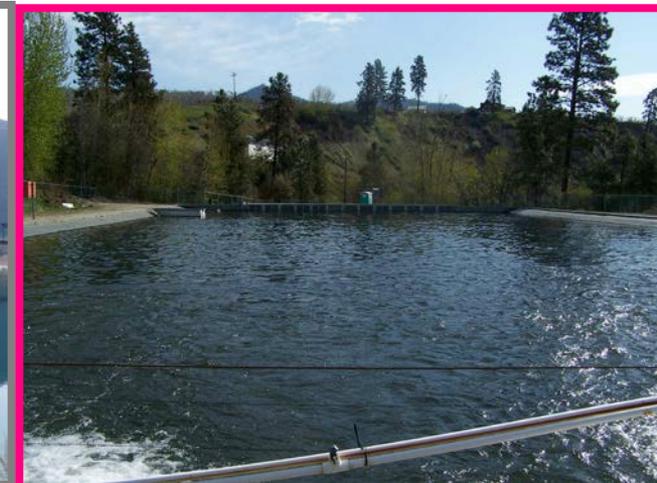
Eastbank



Chelan Net Pens
BY 2008



Dryden Pond
BY 2006-2009



Carlton Pond
BY 2006-2009

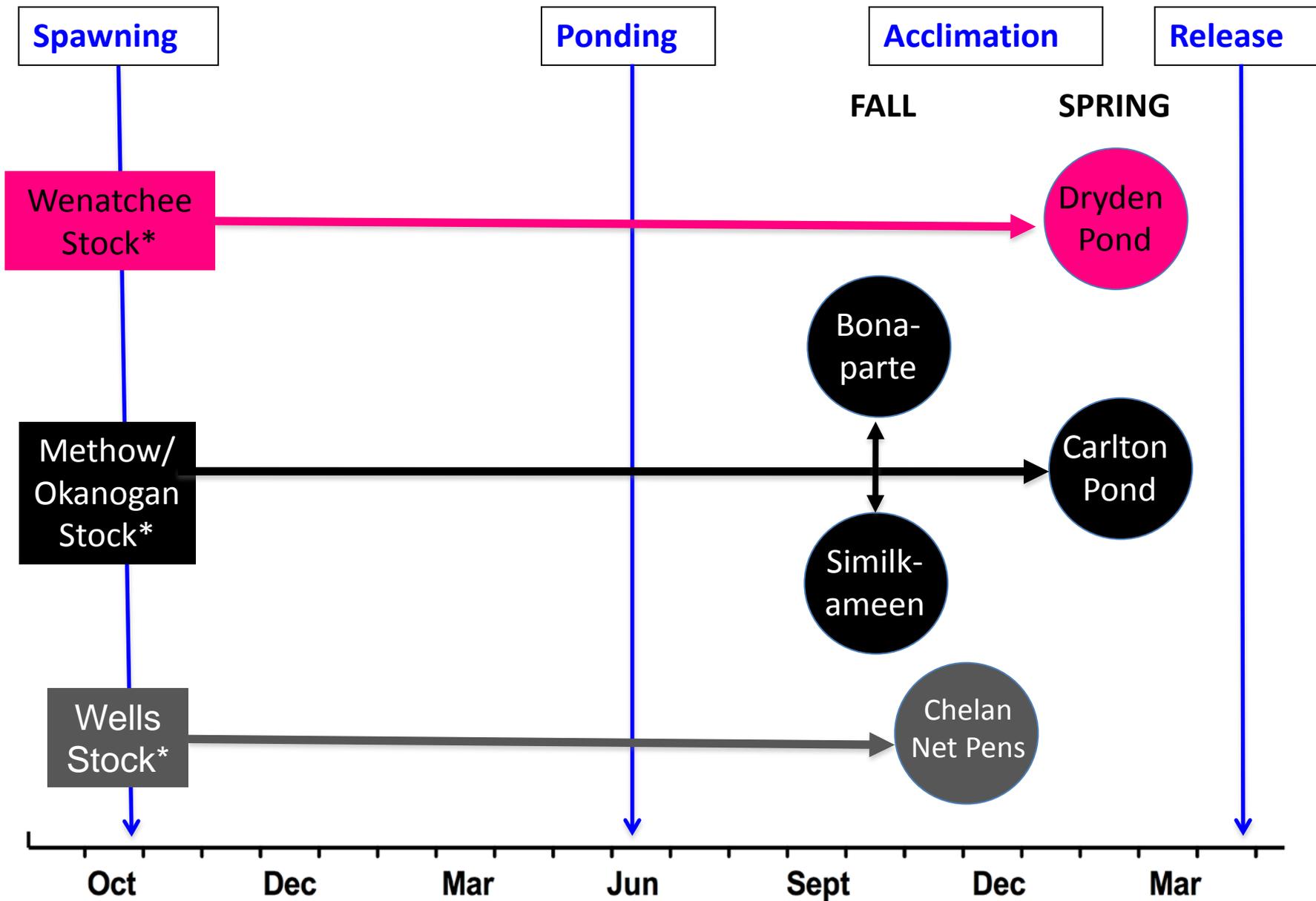


Similkameen Pond
BY 2006-2009



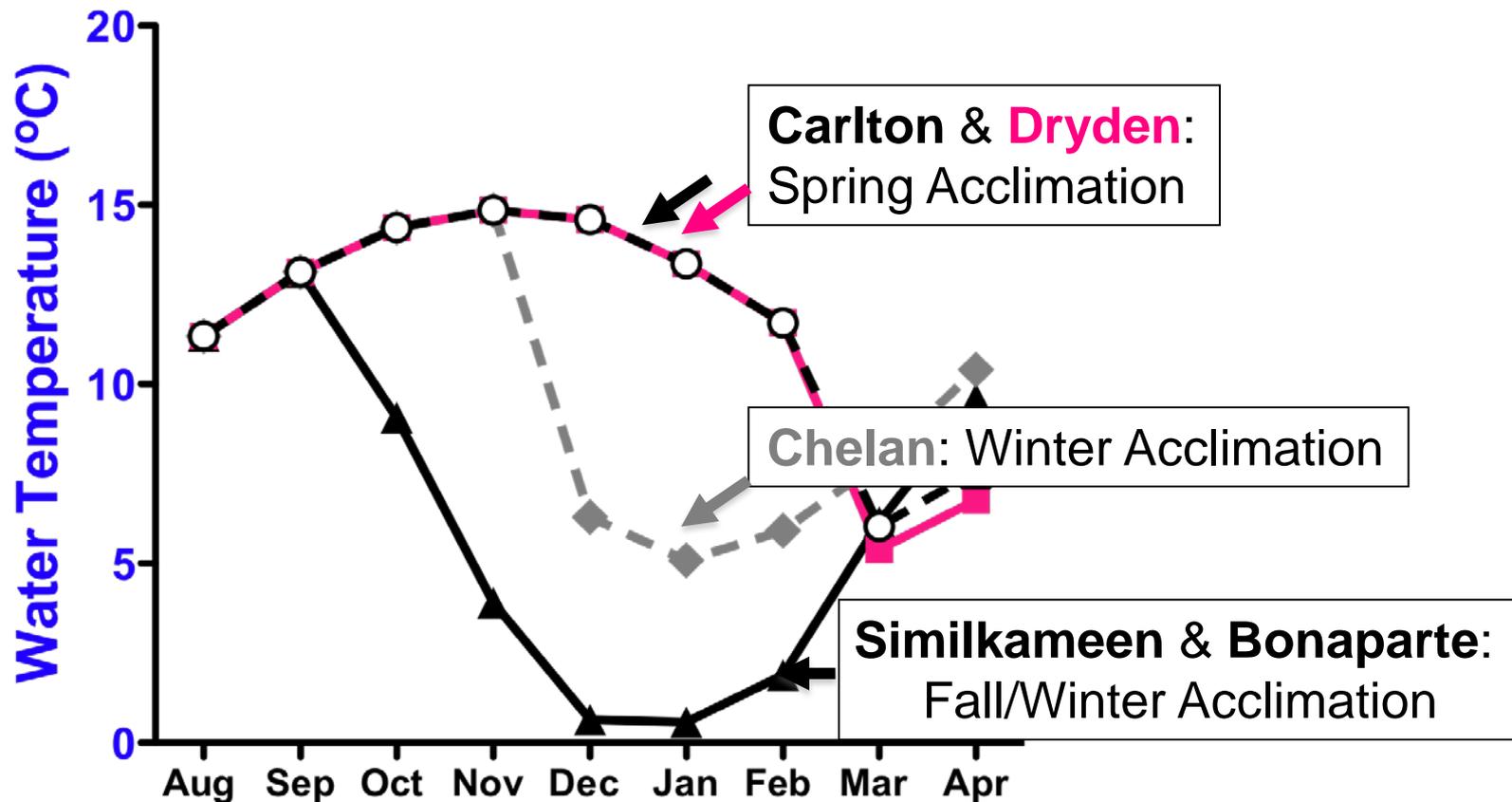
Bonaparte Pond
BY 2008-2009





* All stocks spawned and reared at Eastbank Hatchery prior to acclimation

Differences in acclimation timing and location creates differences in fall/winter growth potential



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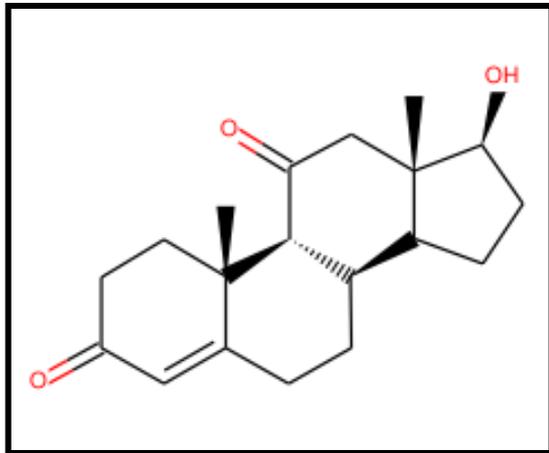
Part 1 Methods: Minijack Screen (All Locations/Brood Years Sampled)

1. Growth

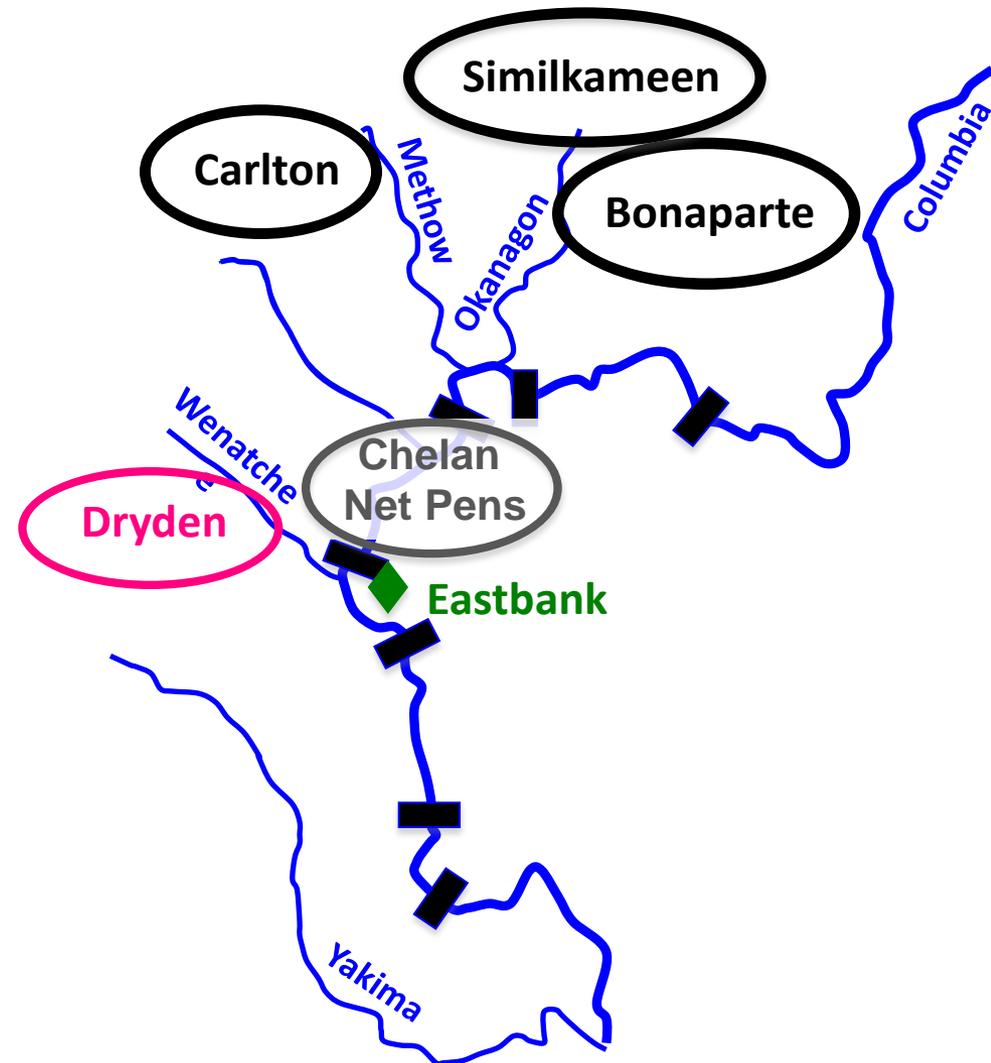
- Size at release (n=300)

1. Minijack Rates

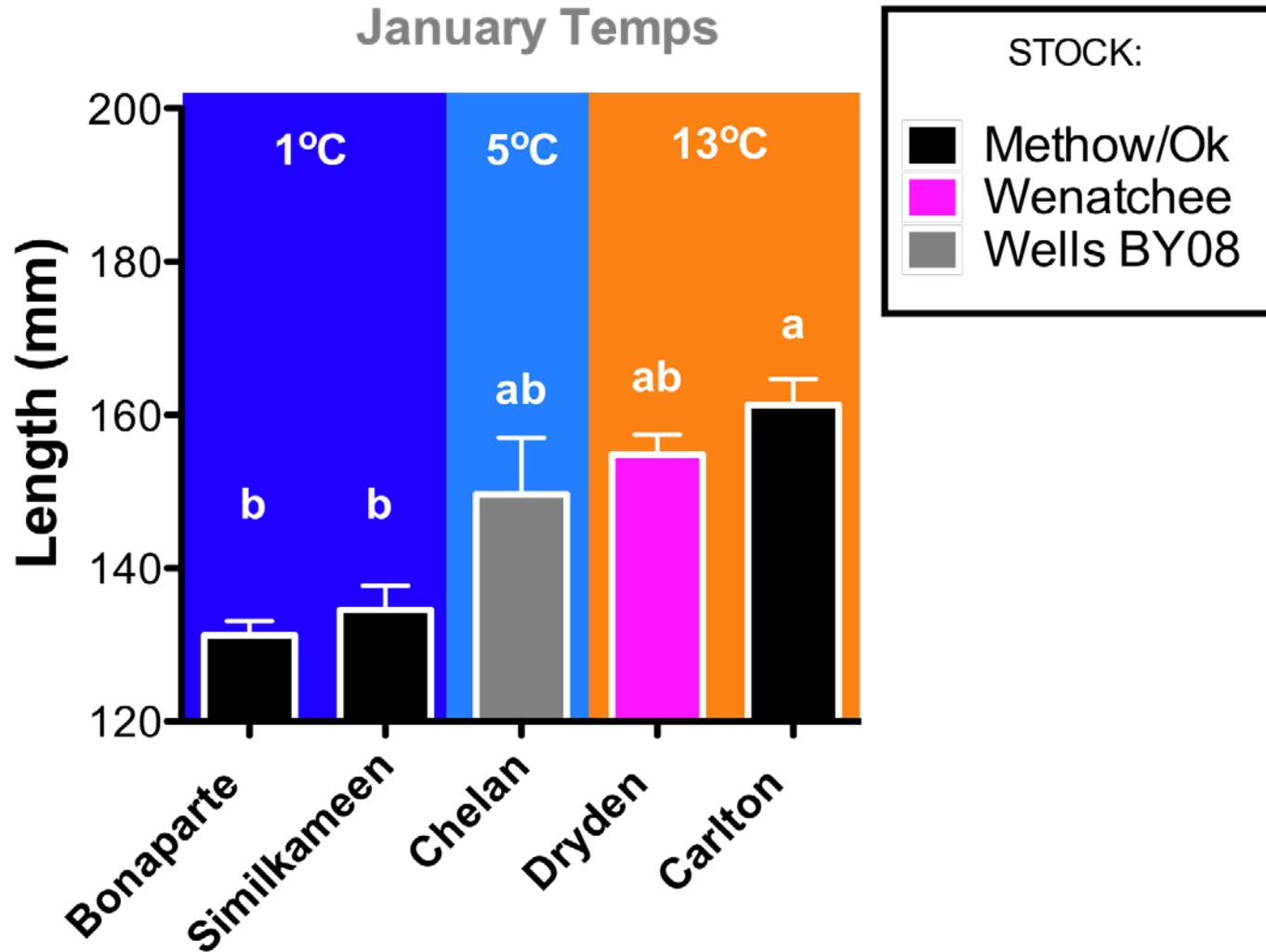
- 11-ketotestosterone
(11KT) – male androgen
found in blood plasma



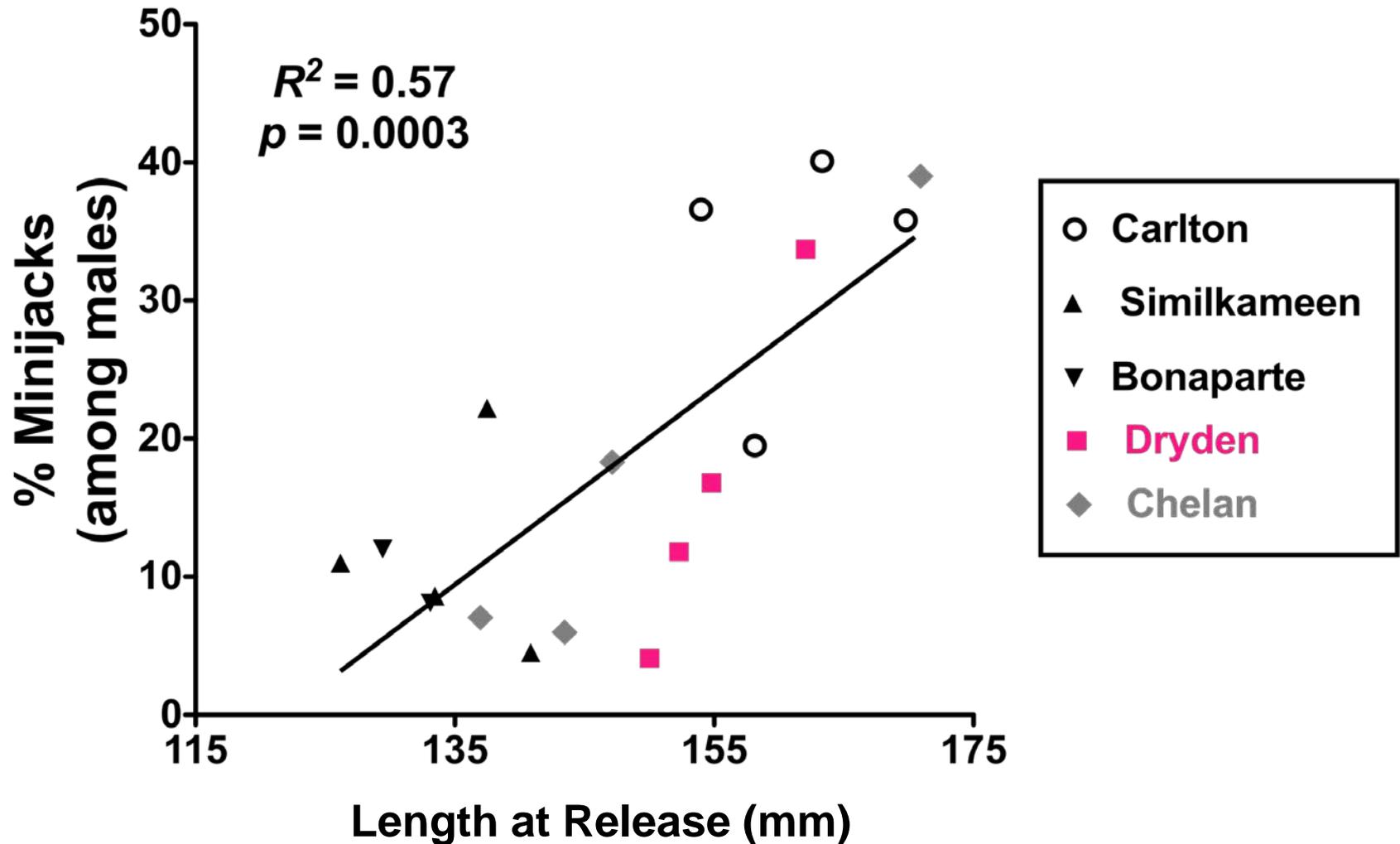
see Larsen et al. 2004 TAFS



Part 1 Results: Size at release changes with winter rearing temperatures



Part 1 Results: Size at release is correlated with minijack rate



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Part 2 Methods: Intensive/Monthly Monitoring

1. Growth

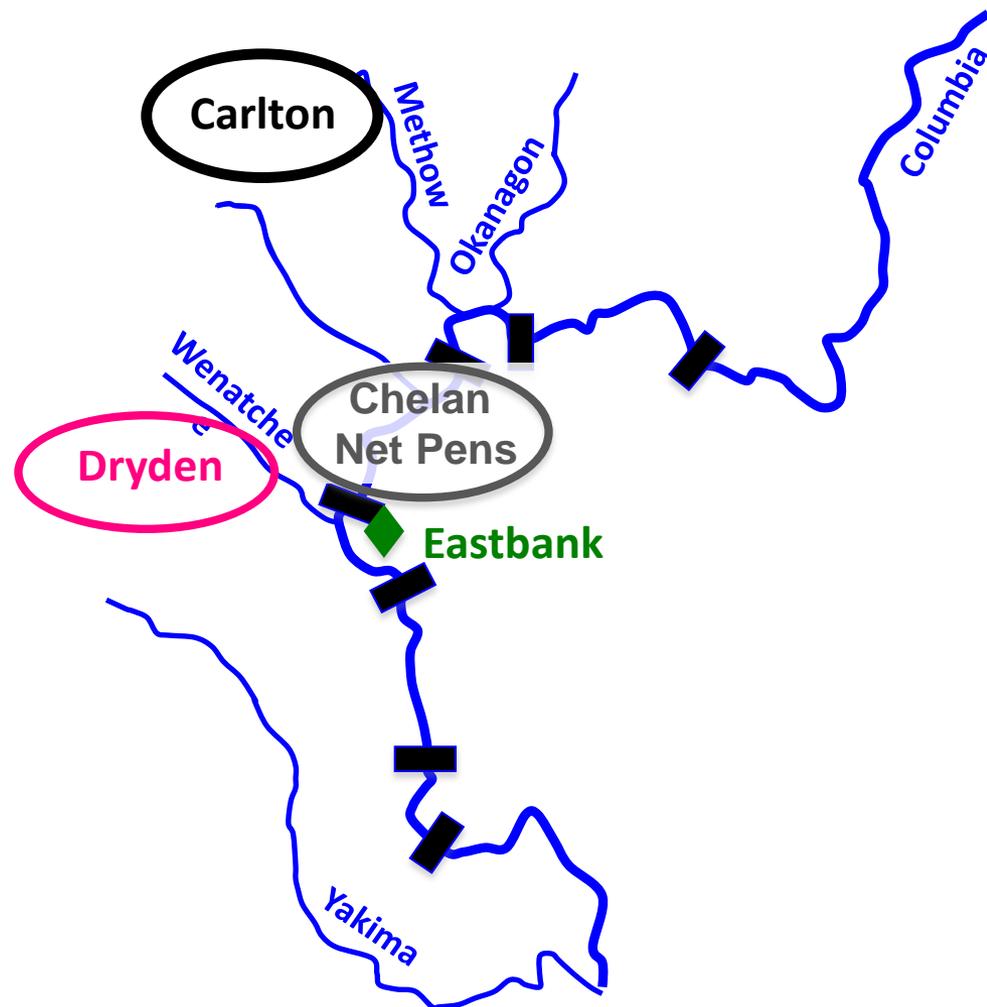
- Size at release
- **Growth Rates**

2. Minijack Rates

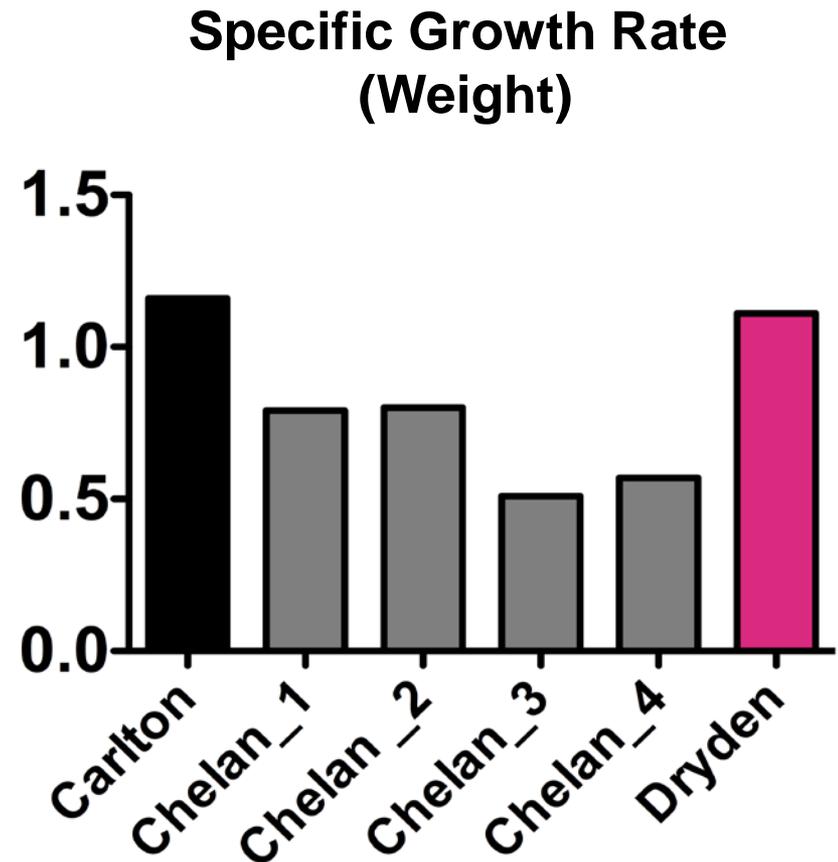
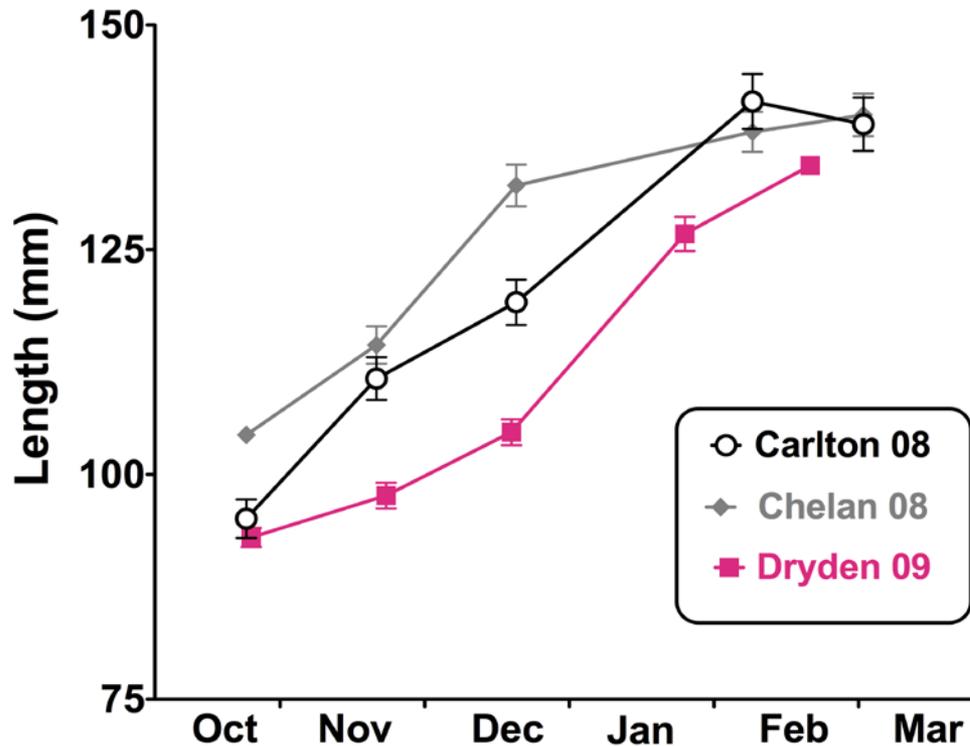
- 11-ketotestosterone (11KT)

3. Smoltification

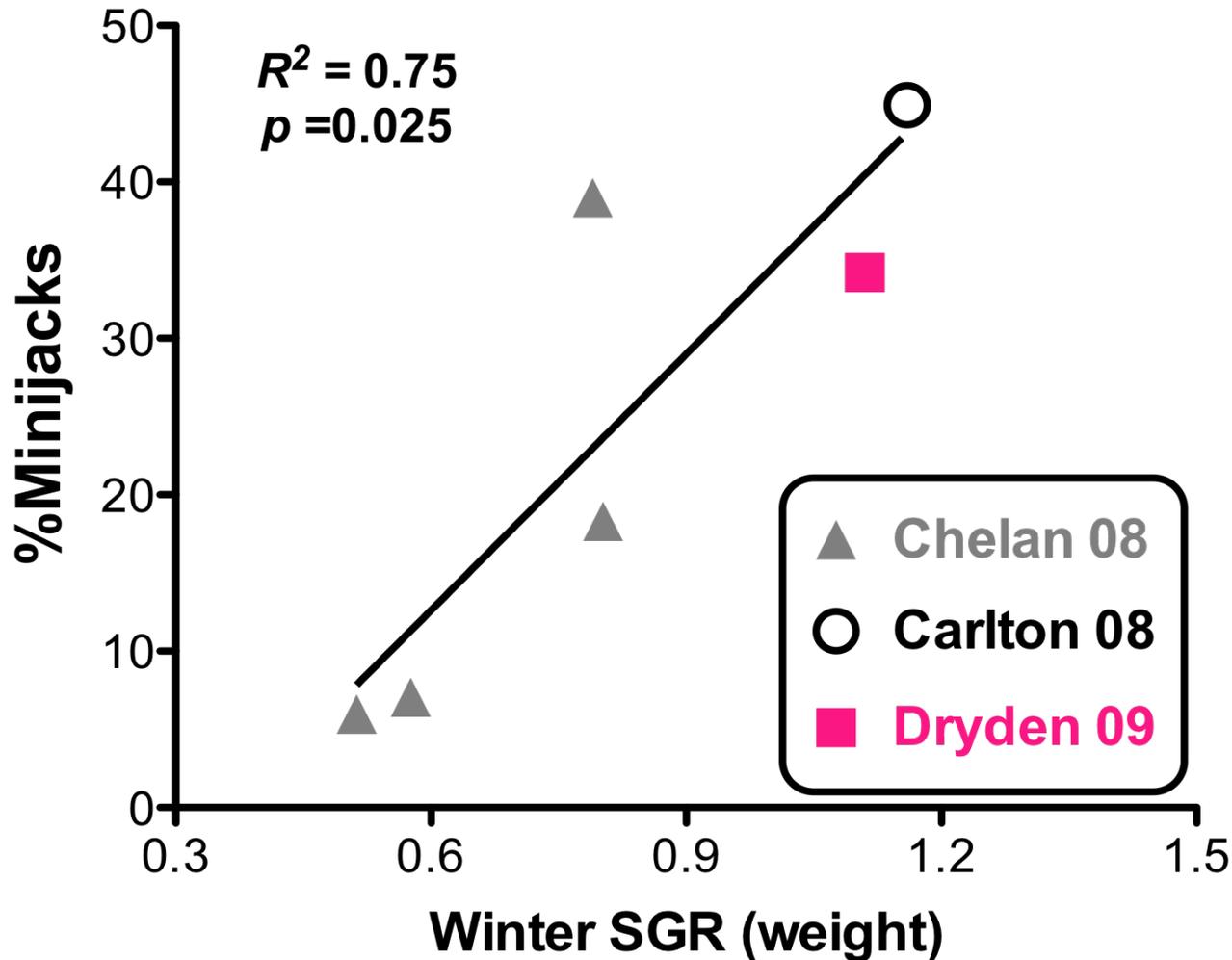
- **Gill Na/K ATPase activity**



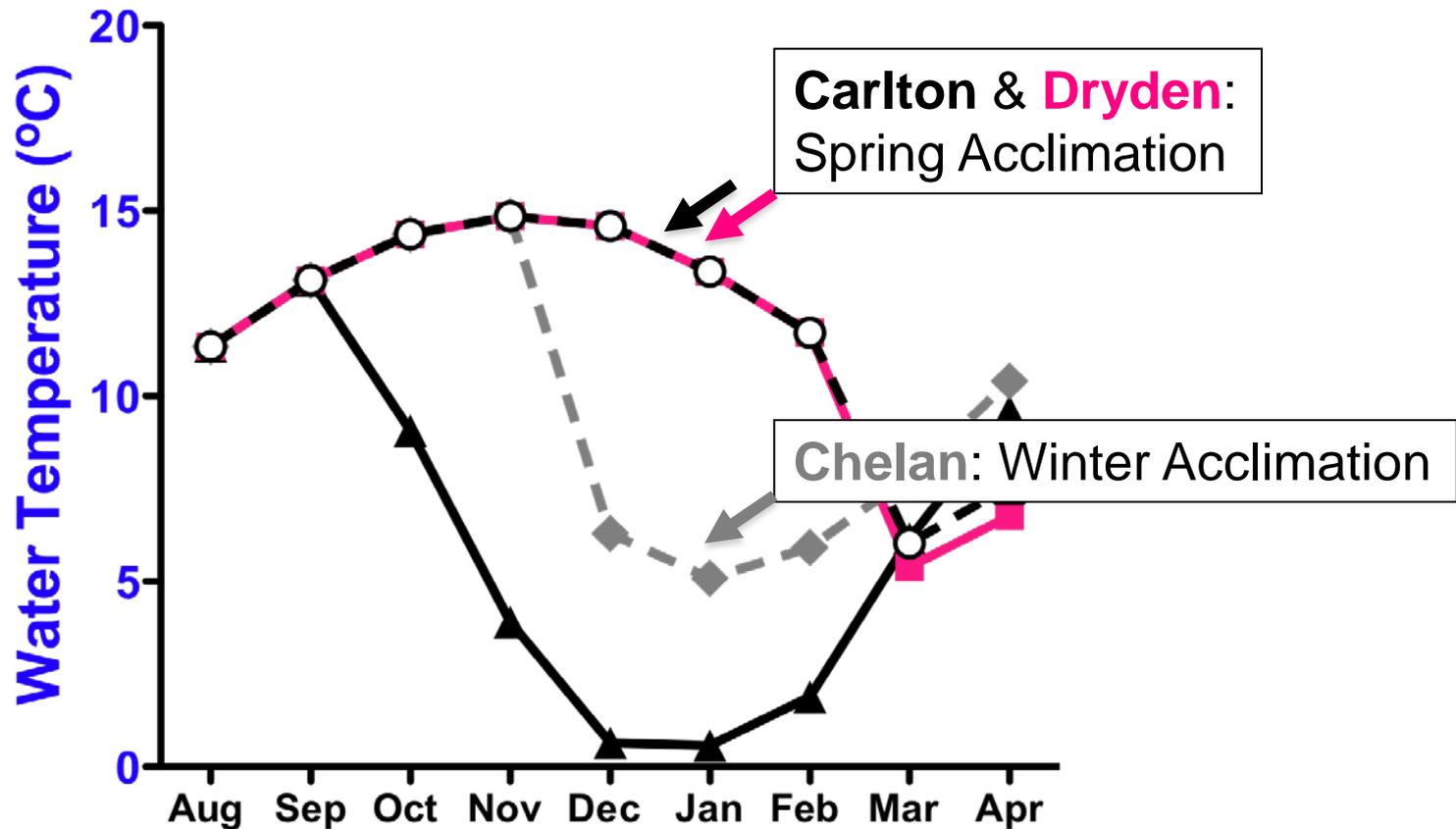
Results Part 2: Dryden had similar fall/winter growth rates to Carlton; Chelan net pens had variable growth



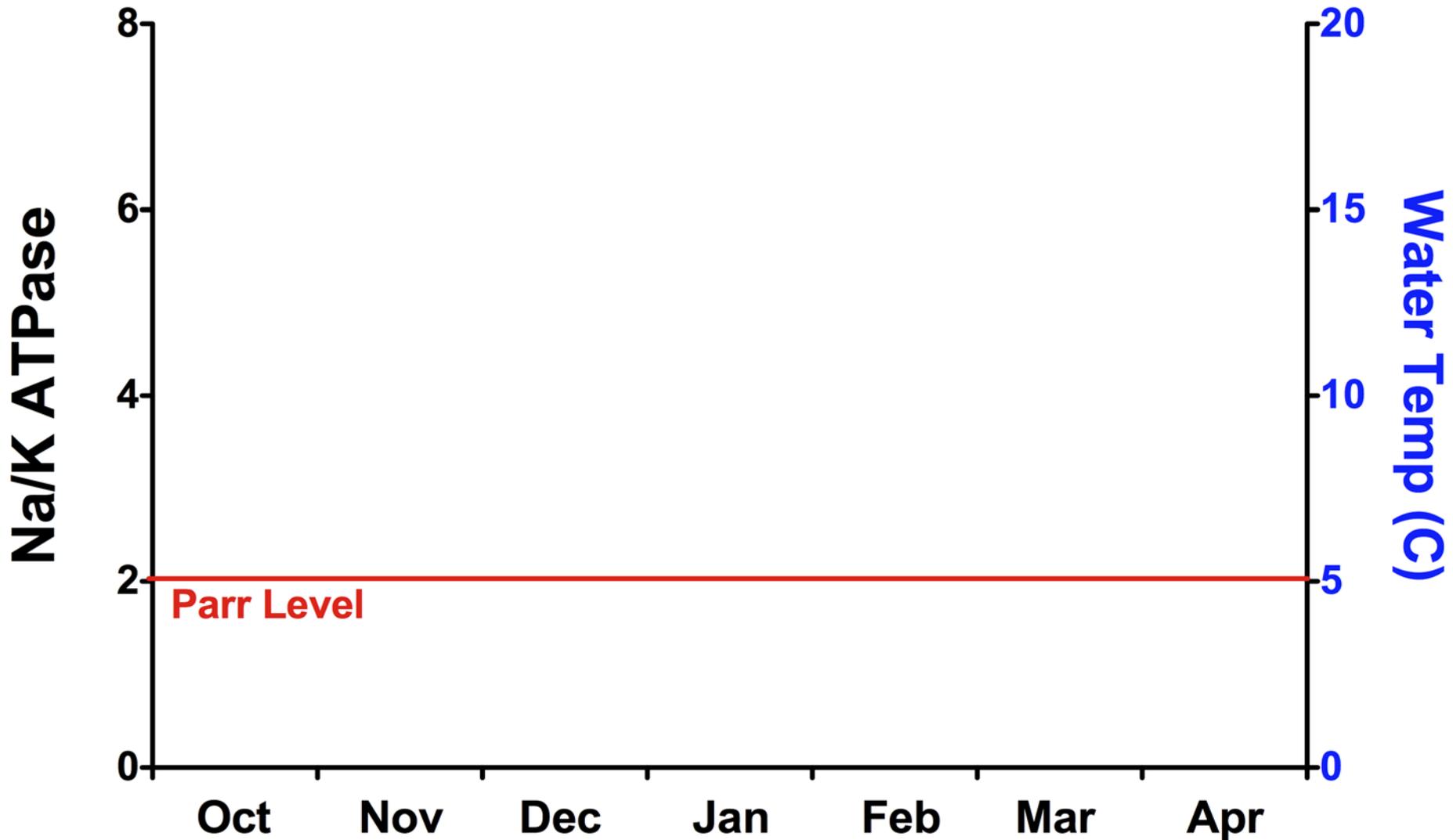
Why do we care about winter growth? Because it may trigger early male maturation



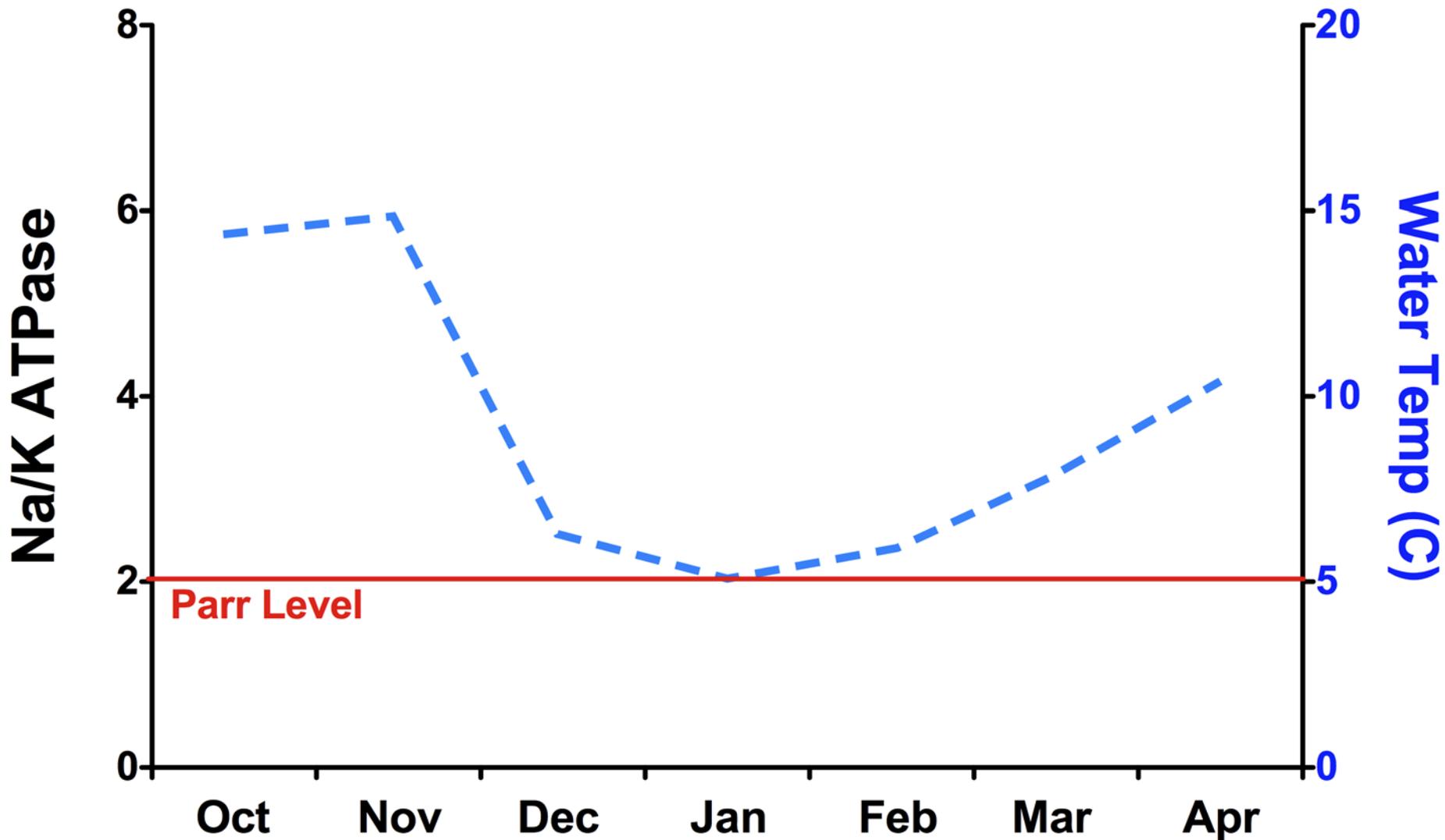
Other effects of winter rearing temperature: Smolting



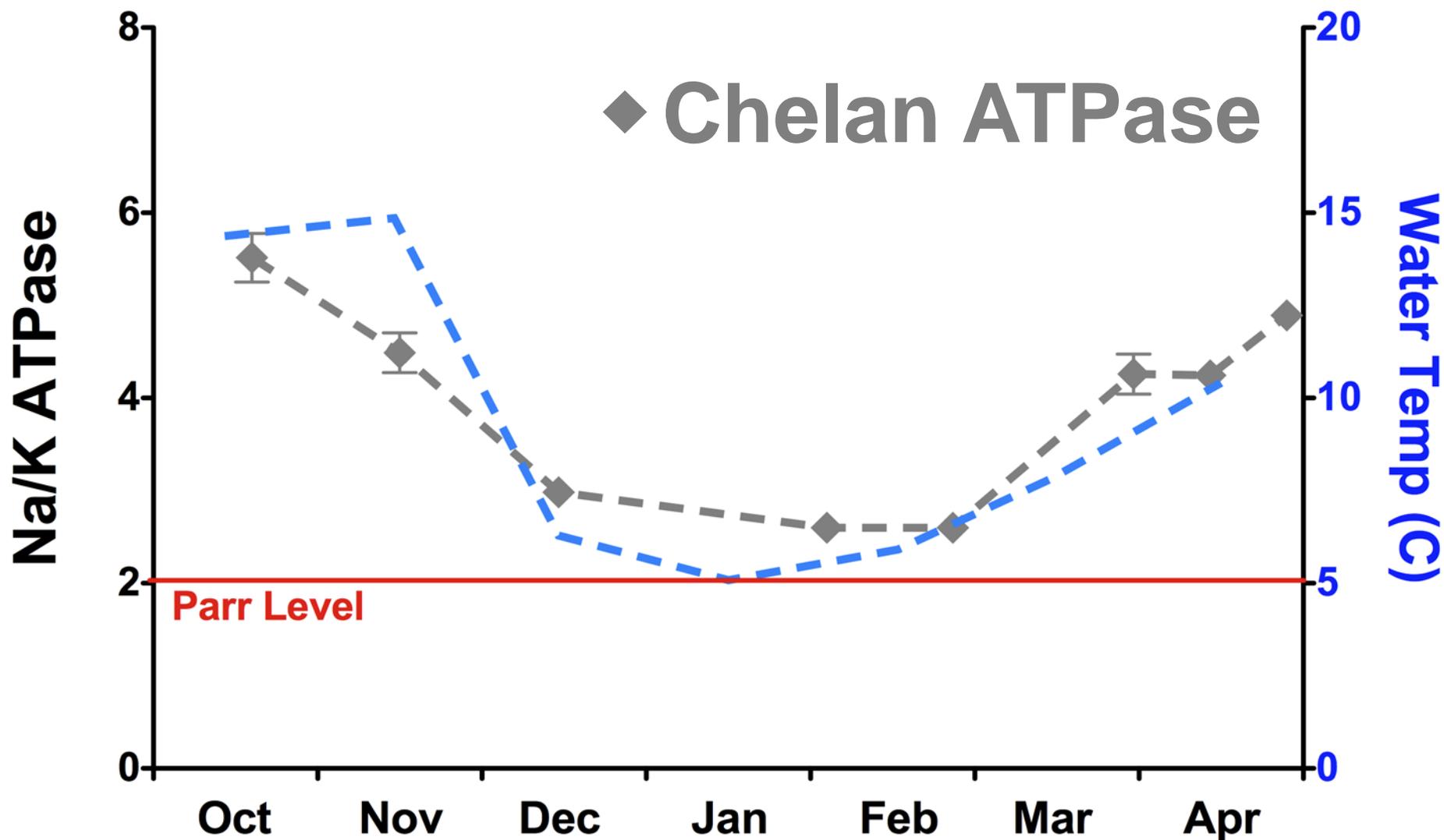
Smoltification: How does water temperature affect Gill ATPase activity?



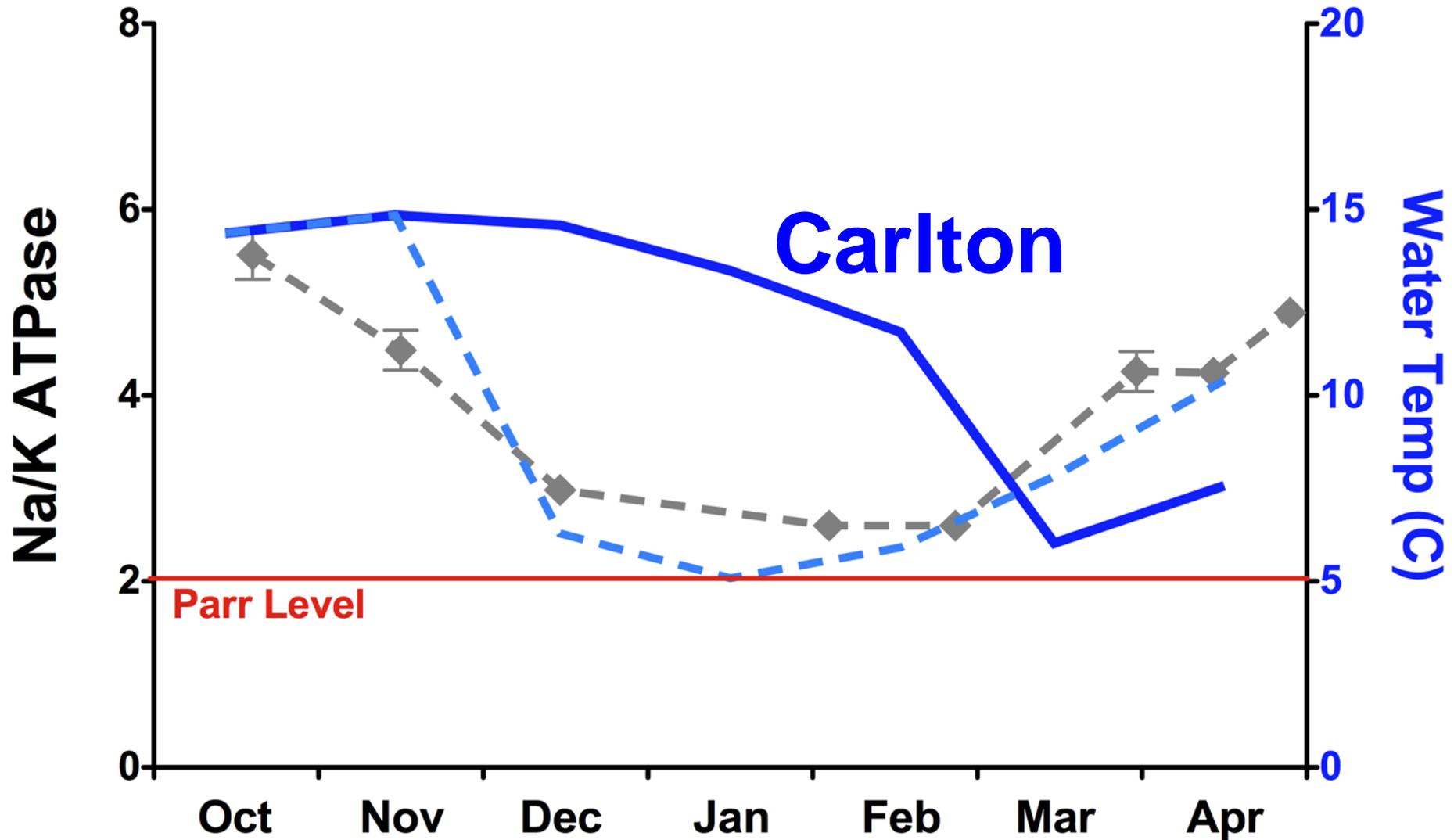
Chelan Net Pens: Intermediate winter rearing temperatures



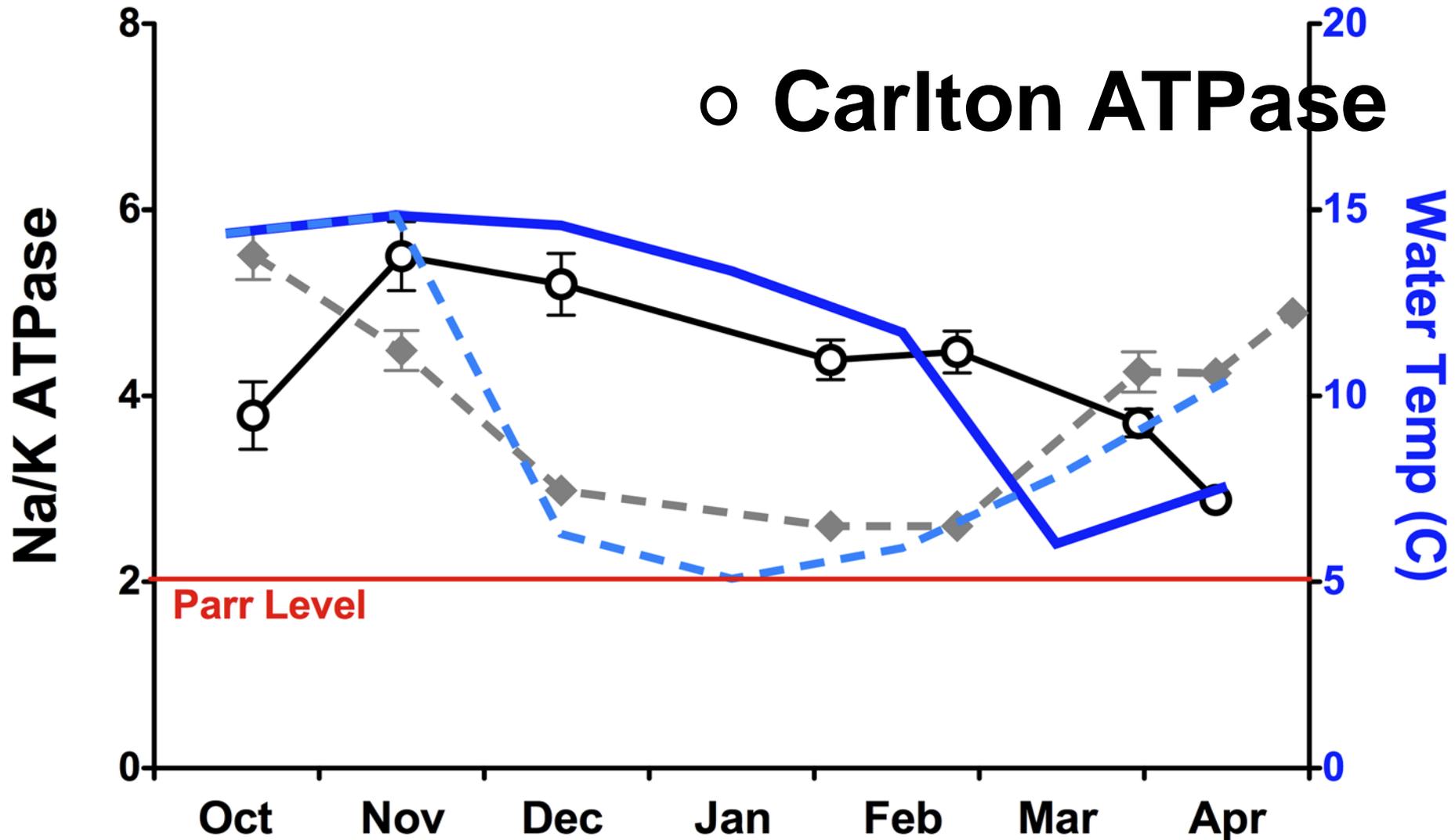
Chelan: ATPase levels mirrored the rearing temperature



Carlton Pond: An example of Out of Basin winter rearing



Carlton Pond: ATPase levels mirrored the rearing temperature



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Conclusions

- **Size at release is correlated with minijack rate**
- **Cold winter water temperatures reduce winter growth and consequently, minijack rates**
- **Timing of smoltification is affected by water temperature**

Moving Forward



Future Studies: to examine trade offs in Summer Chinook Rearing

Dryden Pond: Spring Acclimation

- Circular-Reuse vs. Raceway (at Eastbank Hatchery)
- 2 Feed Treatments

Experimental construct for BYs 2012, 2013:

| Treatment | Target Size at Release [fpp (grams)] | Pond Type | # of Fish/ Treatment |
|------------------|---|------------------|---------------------------------|
| Big-Circular | 10 (45 g) | Circular-Reuse | 50 K |
| Small-Circular | 15 (30 g) | Circular-Reuse | 50 K |
| Big-Raceway | 10 (45 g) | Raceway | 150 K |
| Small-Raceway | 15 (30 g) | Raceway | 150 K |

Future Studies: to examine trade offs in Summer Chinook Rearing

Chelan Falls: Winter Acclimation

- 4 size targets at release

Experimental construct for BYs 2012, 2013:

| Treatment | Target fish size at release [fpp (grams)] | # of fish/ treatment |
|-----------|--|-------------------------|
| A | 10 (45) | 150 K |
| B | 13 (35) | 150 K |
| C | 18 (25) | 150 K |
| D | 22 (20) | 150 K |



THANKS!



- Chelan PUD
- Eastbank Hatchery
- Chelan Hatchery
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 - Larissa Felli
- Ian Adams

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