

# CARRYOVER EFFECTS OF WINTER WARMING IN THE OLYMPIA OYSTER

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Roberts Lab

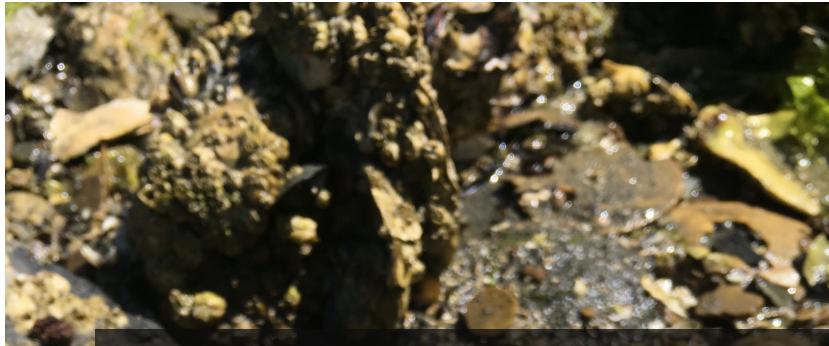
School of Aquatic and Fishery Sciences  
University of Washington

NSA-PCS & PCSGA Joint Virtual Meeting, October 2020

<https://laurahspencer.github.io/LabNotebook/>



# THE OLYMPIA OYSTER, *OSTREA LURIDA*



IMPACTS OF OCEAN WARMING?



# IMPACTS OF WARMING ON OLYMPIA OYSTERS WILL LIKELY VARY BY SEASON IN PNW

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Some dominant activities by season

## Spring

Gametogenesis, spawning, fertilization, recruitment, growth

## Summer & Fall

Spawning, gametogenesis, recovery, growth

## Winter

Metabolic depression, dormancy (?)

Effect of warming

↑ fertilization, gametogenesis, larval development, & feeding rates

(Parker, Ross & O'Connor 2009, Rico-Villa, Pouvreau & Robert 2009; Gray & Langdon 2018; Lawlor & Arellano 2020)

↓ larval duration / dispersal  
(O'Connor et al. 2007)

↑ heat stress, infection/disease, mortality  
↑ or ↓ growth rates

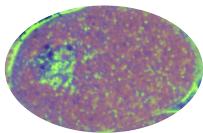
(Li, Abbott, Li & Benkendorff 2007; Green et al. 2019; Lawlor & Arellano 2020)

Early spawning in spring,  
↑ sperm development  
(Spencer et al. 2020)

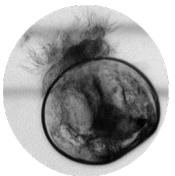
Offspring?

# How will warmer winters impact Oly offspring?

## Metrics:



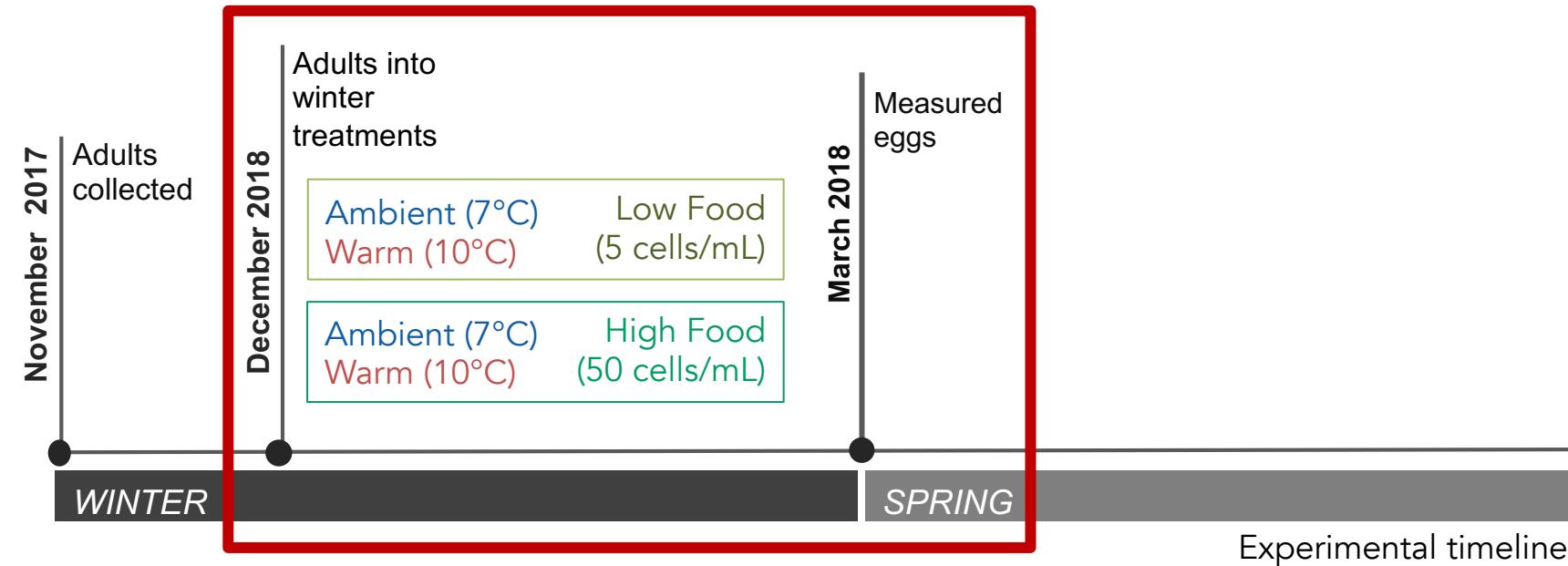
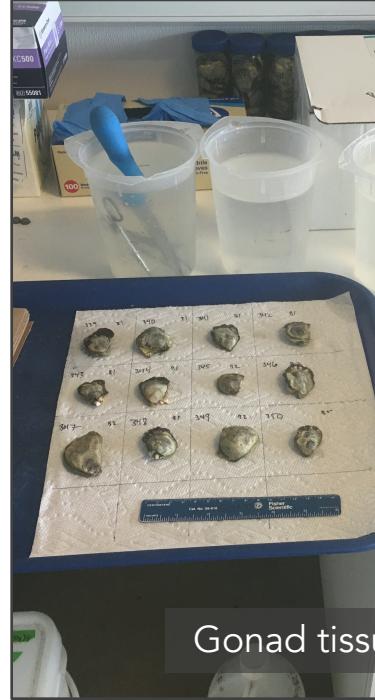
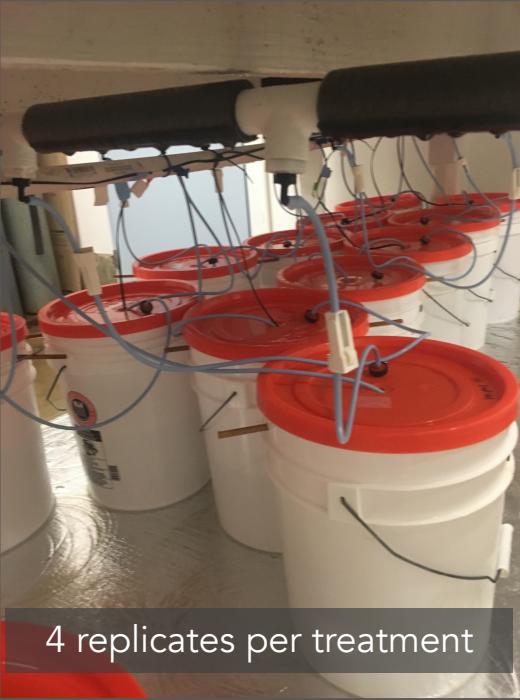
**Egg size** (Maternal investment, endogenous energy)



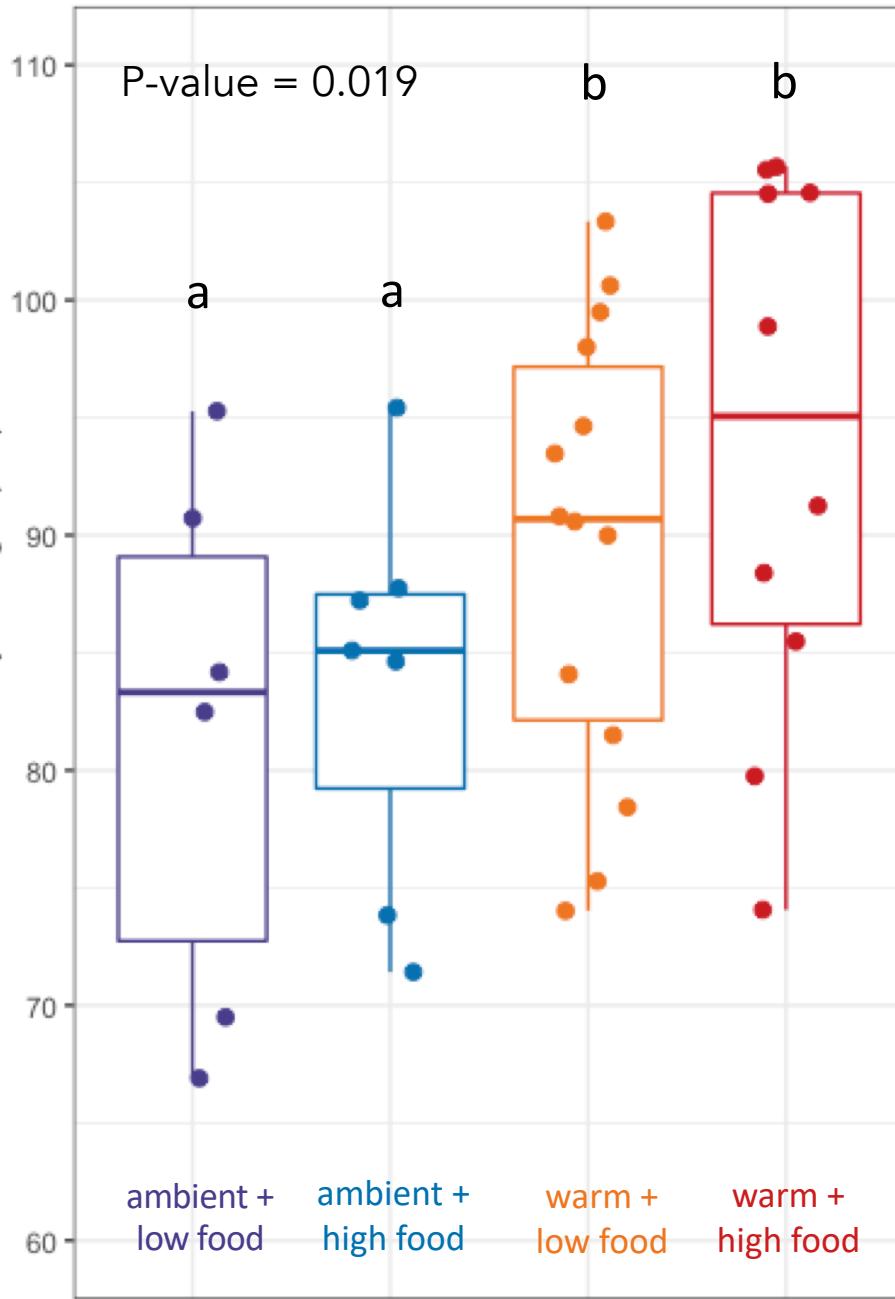
**Larval size when released** (Larval growth rate, quality)



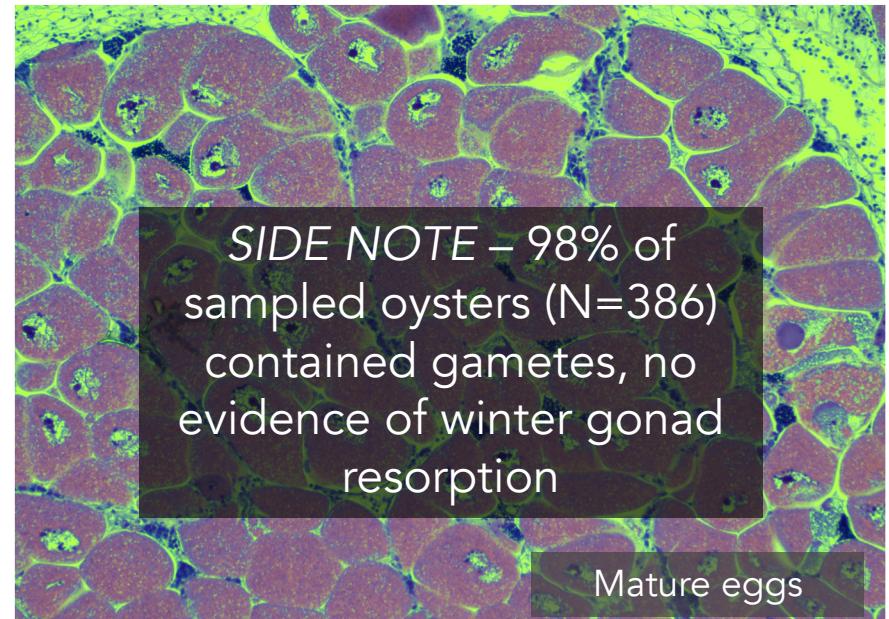
**Larval survival to post-set** (Larval viability)



## Ripe oocyte size

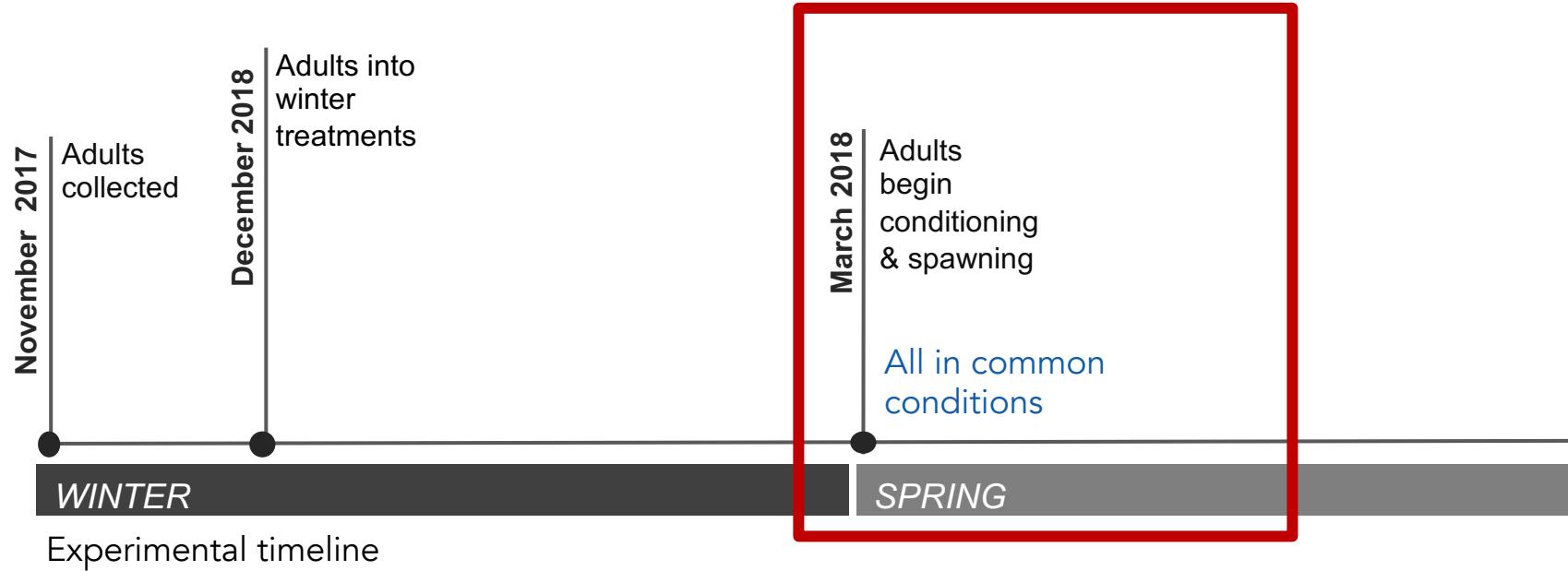


MATURE EGGS WERE LARGER  
FOLLOWING  
WINTER WARMING

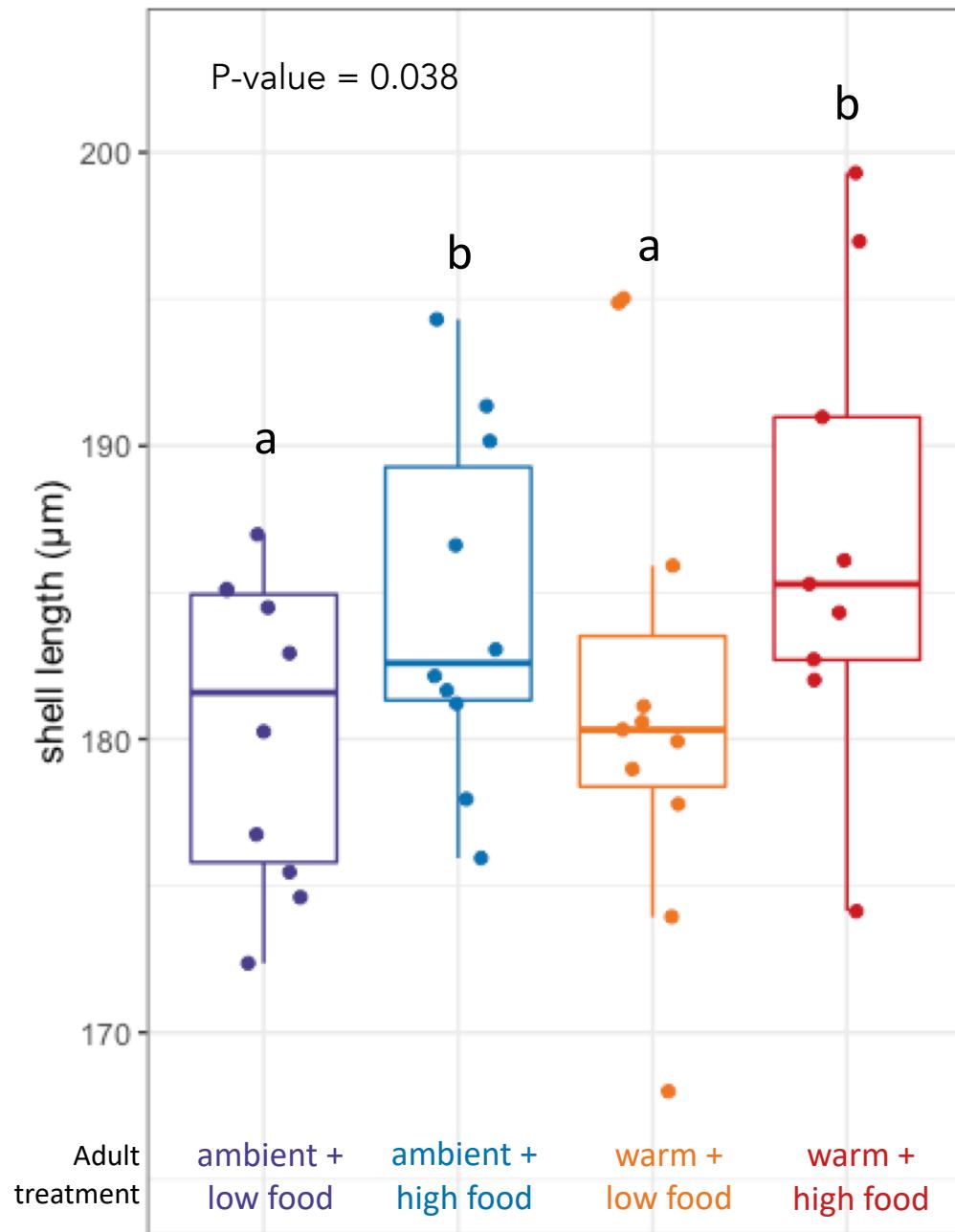


Larger eggs could mean ...

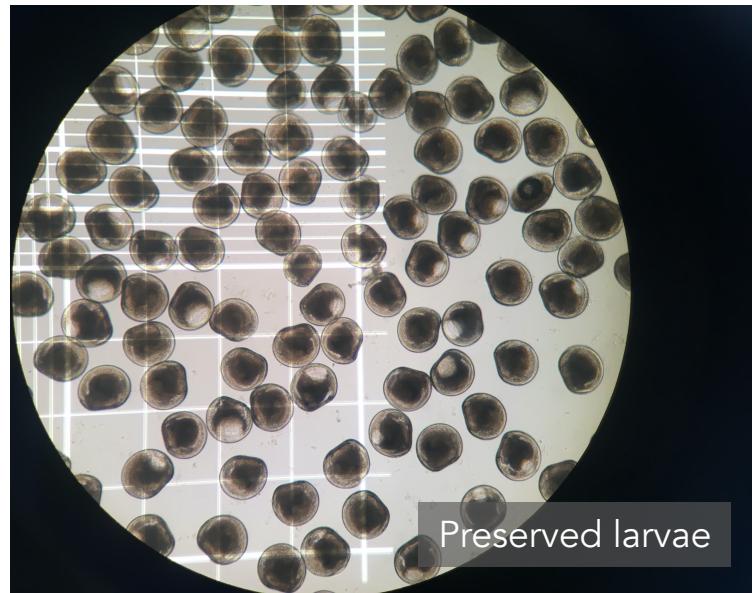
- Better provisioned eggs because warming triggered or increased yolk deposition?



## Larval shell length by parental treatment



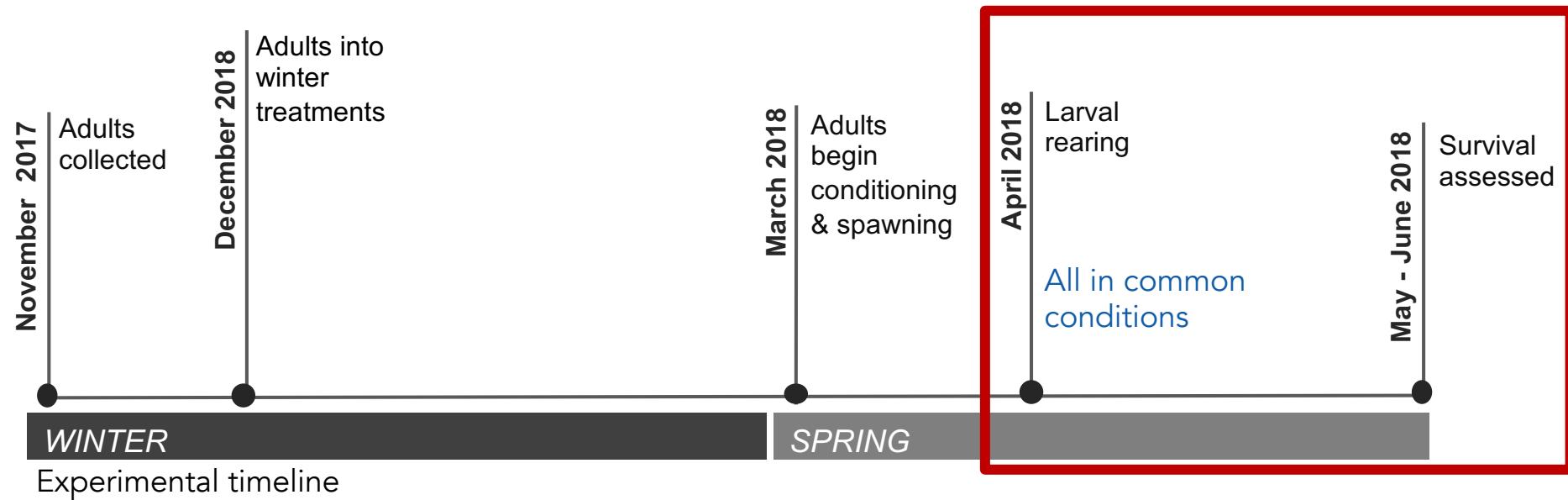
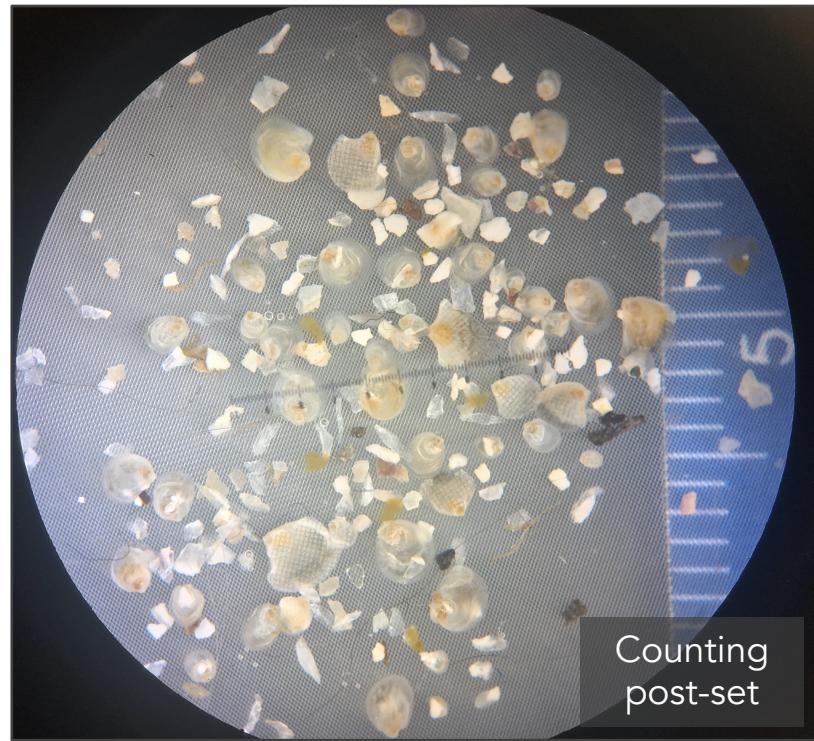
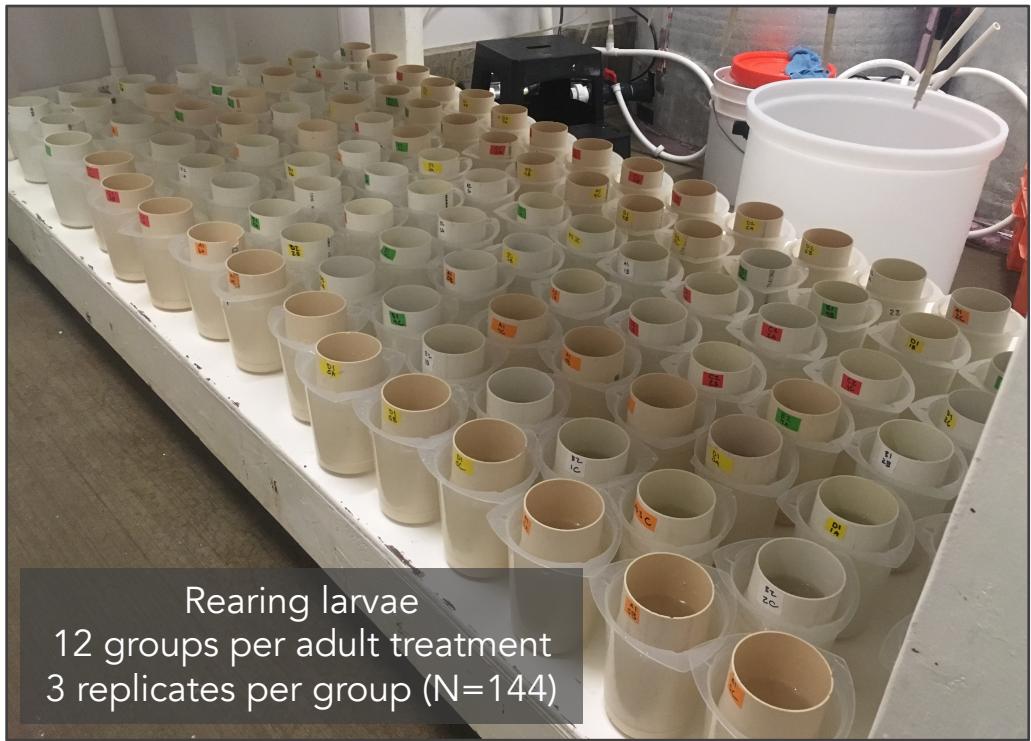
LARVAE WERE LARGER WHEN RELEASED FOLLOWING WINTER HIGH FOOD



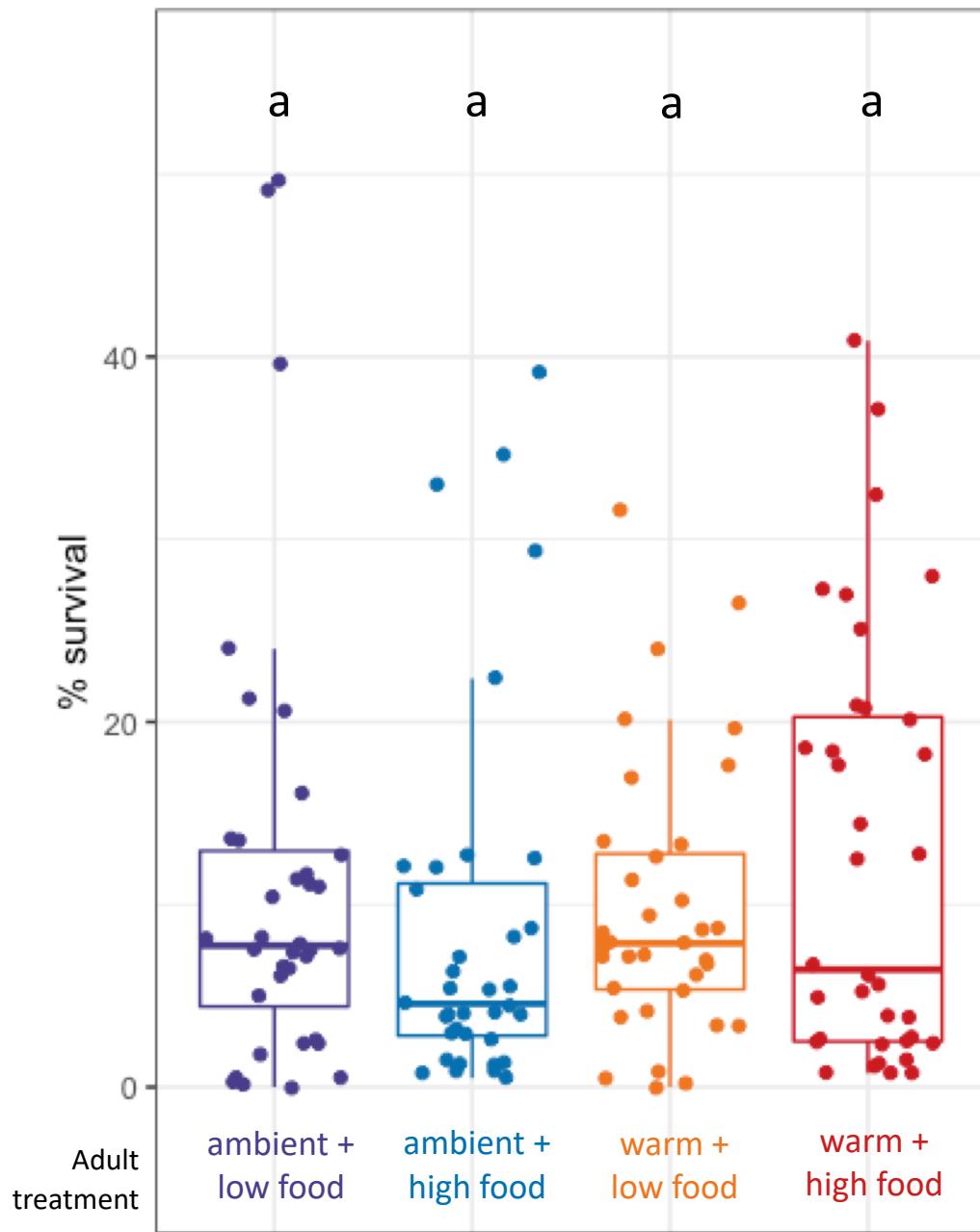
Larger larvae could mean ...

- Size / growth rate unaffected by winter temperature
- Impact of warming on egg size did not persist
- Faster larval growth due to higher quality eggs ?

NOTE: At the time of this presentation the dataset and statistical analysis were incomplete, and did not include all larvae collected nor necessary random effect factors. Please do not reference this slide/result, but instead look for the associated paper, currently in development (Spencer, Horkan, Crim & Roberts 2021)



## % survival to post-set by parental treatment



LARVAL SURVIVAL  
UNAFFECTED BY PARENTAL  
WINTER TEMPERATURE OR  
FOOD LEVEL

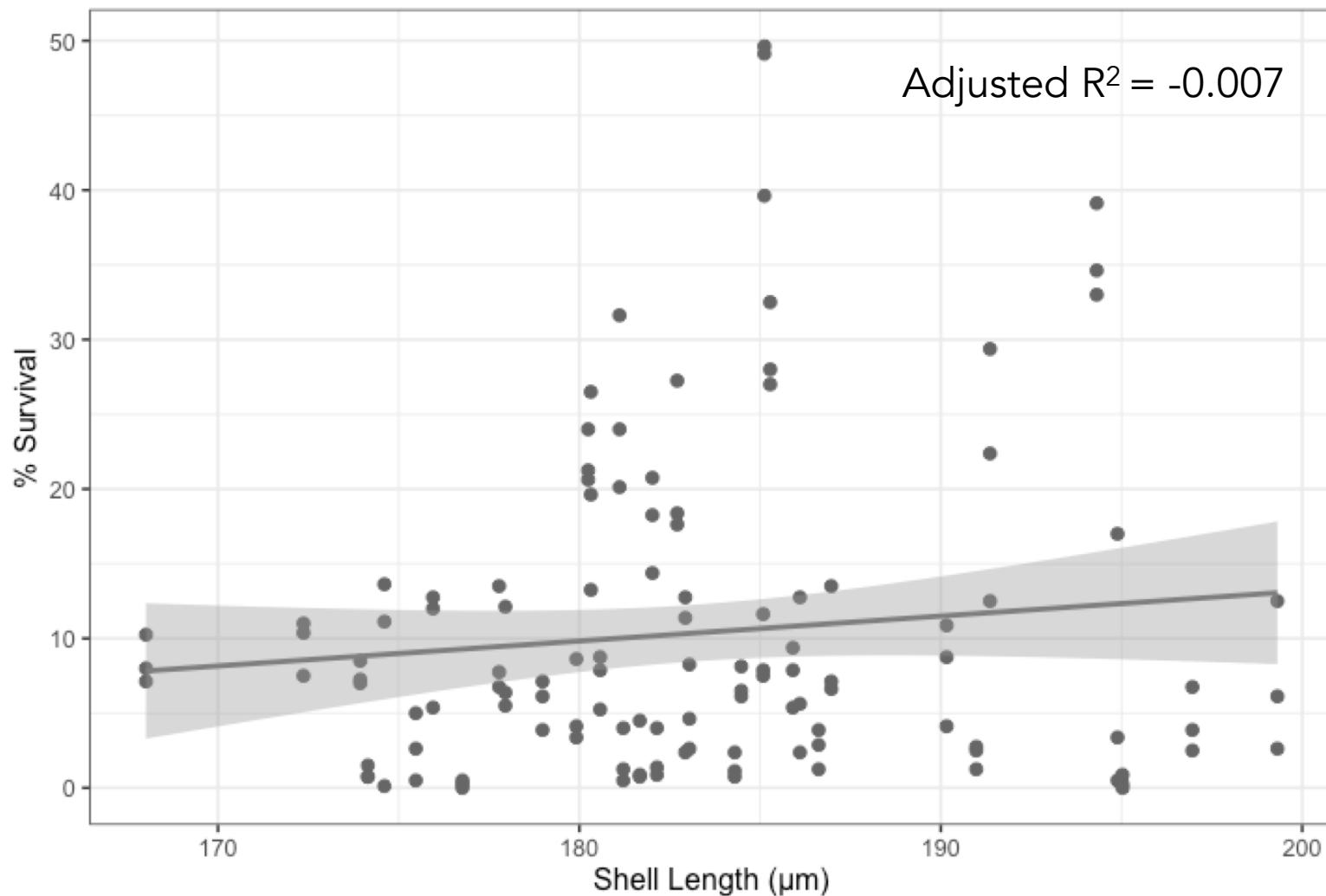


No effect could mean ...

- Egg & larvae size upon release does not correlate with survival
- Good hatchery conditions masked any effects

# SIDE NOTE – IN HATCHERY, LARVAL SIZE AT RELEASE DID NOT PREDICT SURVIVAL

Larval survival ~ shell length upon release



## RESULTS SUMMARY

- Mature eggs were larger following winter warming
- Larval survival unaffected by adult winter conditions, egg size or larval size at release

## WHAT COULD THIS MEAN?

- More evidence that *O. lurida* tolerates climate/ocean stressors, could be a future “winner” (Lawlor & Arellano 2020; Waldbusser et al. 2016; Spencer et al. 2020)
  - Good sign for restoration activities, hatchery production
- Hatchery managers needn’t worry about broodstock holding temp & food levels during winter – could reduce costs!
- In the wild, larger oocytes could mean ...
  - Improved oocyte provisioning – more endogenous energy, higher recruitment

# THANK YOU

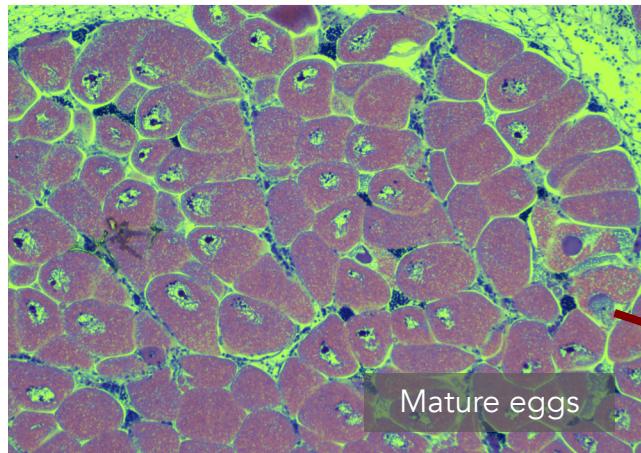
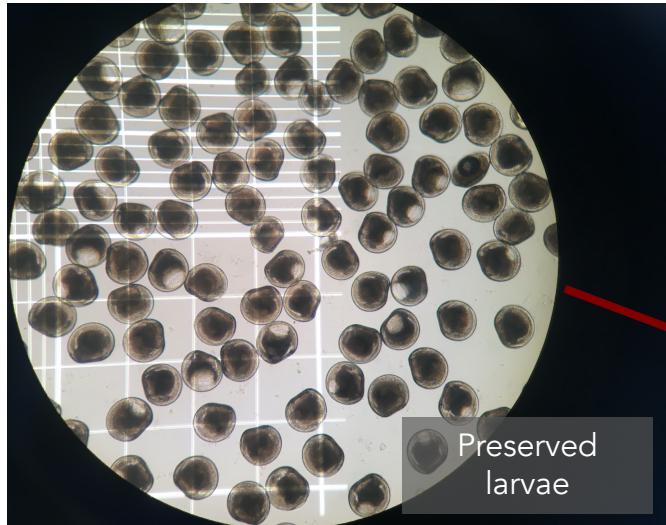
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*Hire me when I graduate in March 2021!*

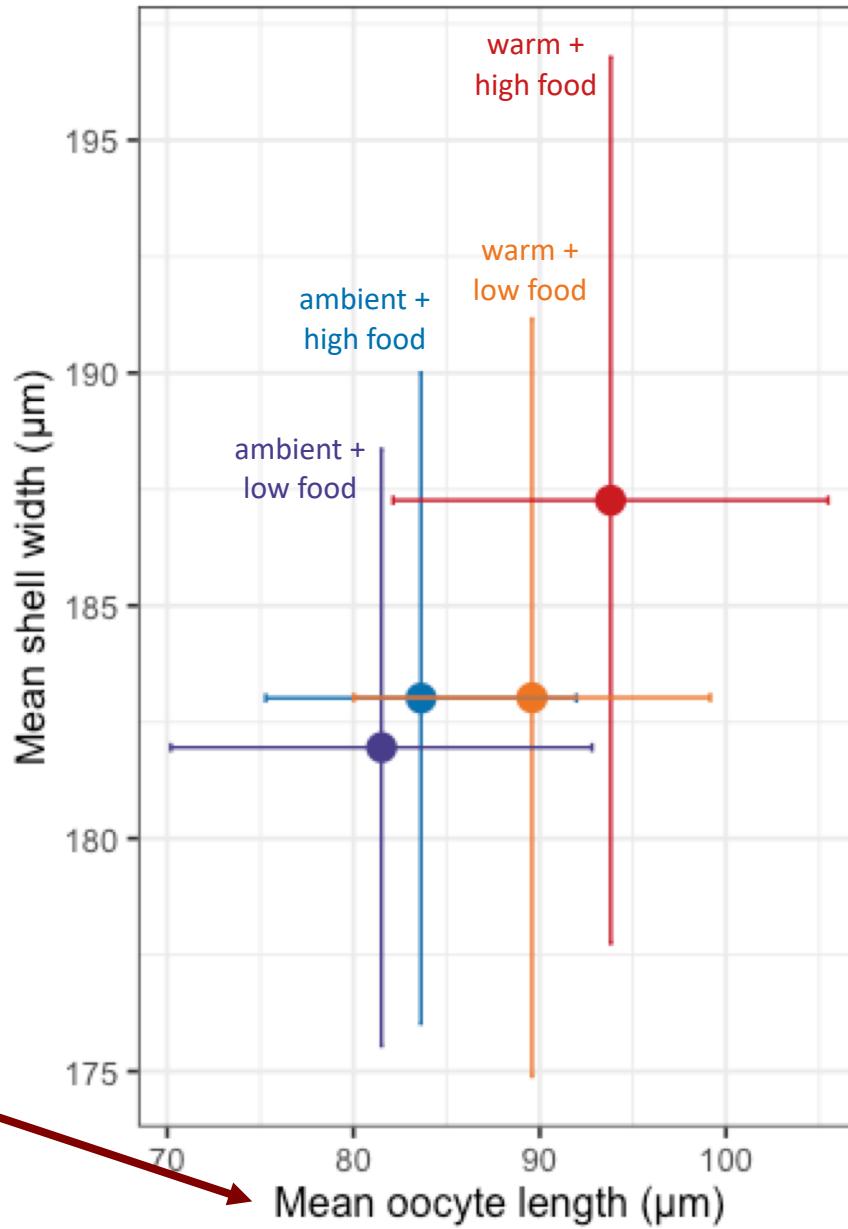


# EXTRA SLIDES

# + RELATIONSHIP BETWEEN EGG SIZE & LARVAL SIZE

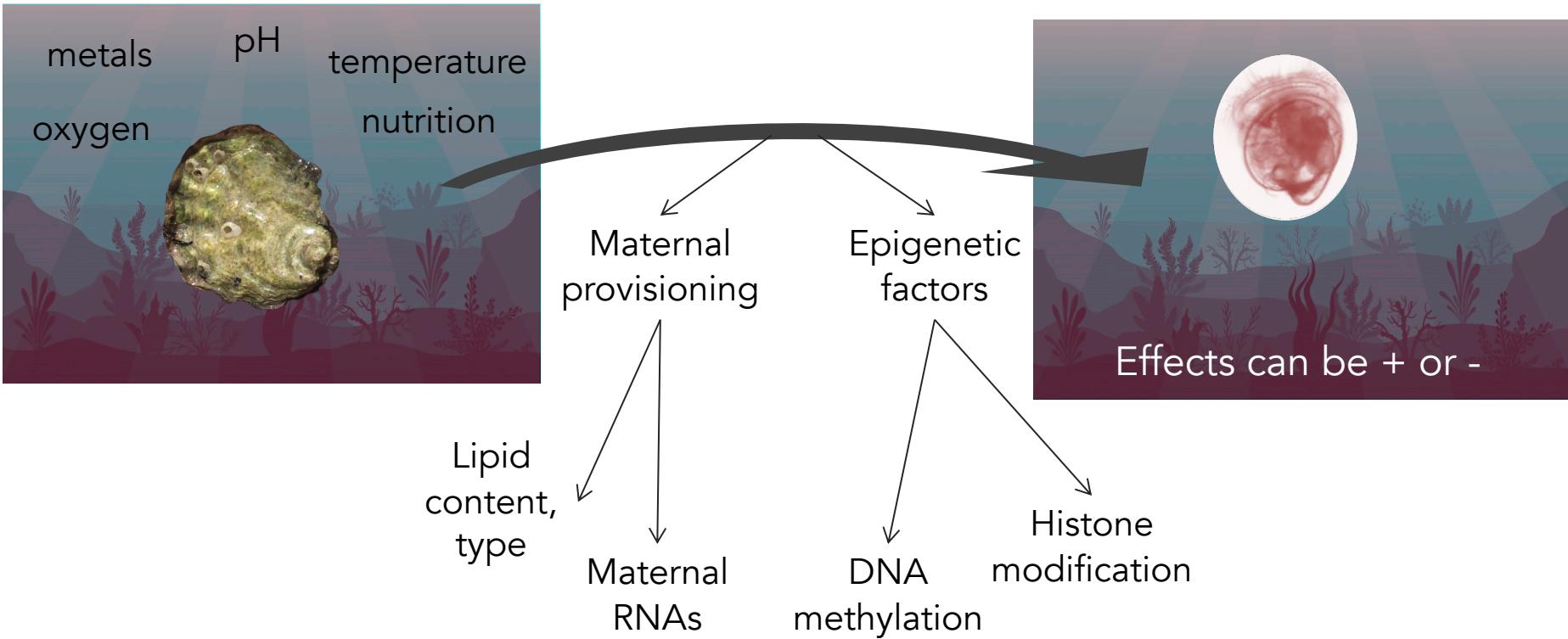


Mean larval size ~ Mean egg size



# CARRYOVER EFFECTS

*Signals of adults' environmental conditions can be detected in offspring*



CARRYOVER EFFECTS OF WINTER WARMING?