Parental low pH exposure affects reproduction & larval gene expression in the Olympia oyster

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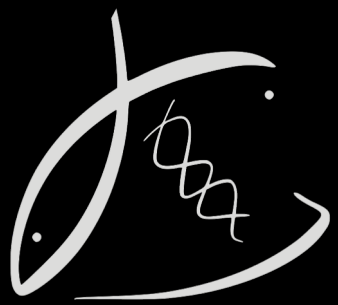
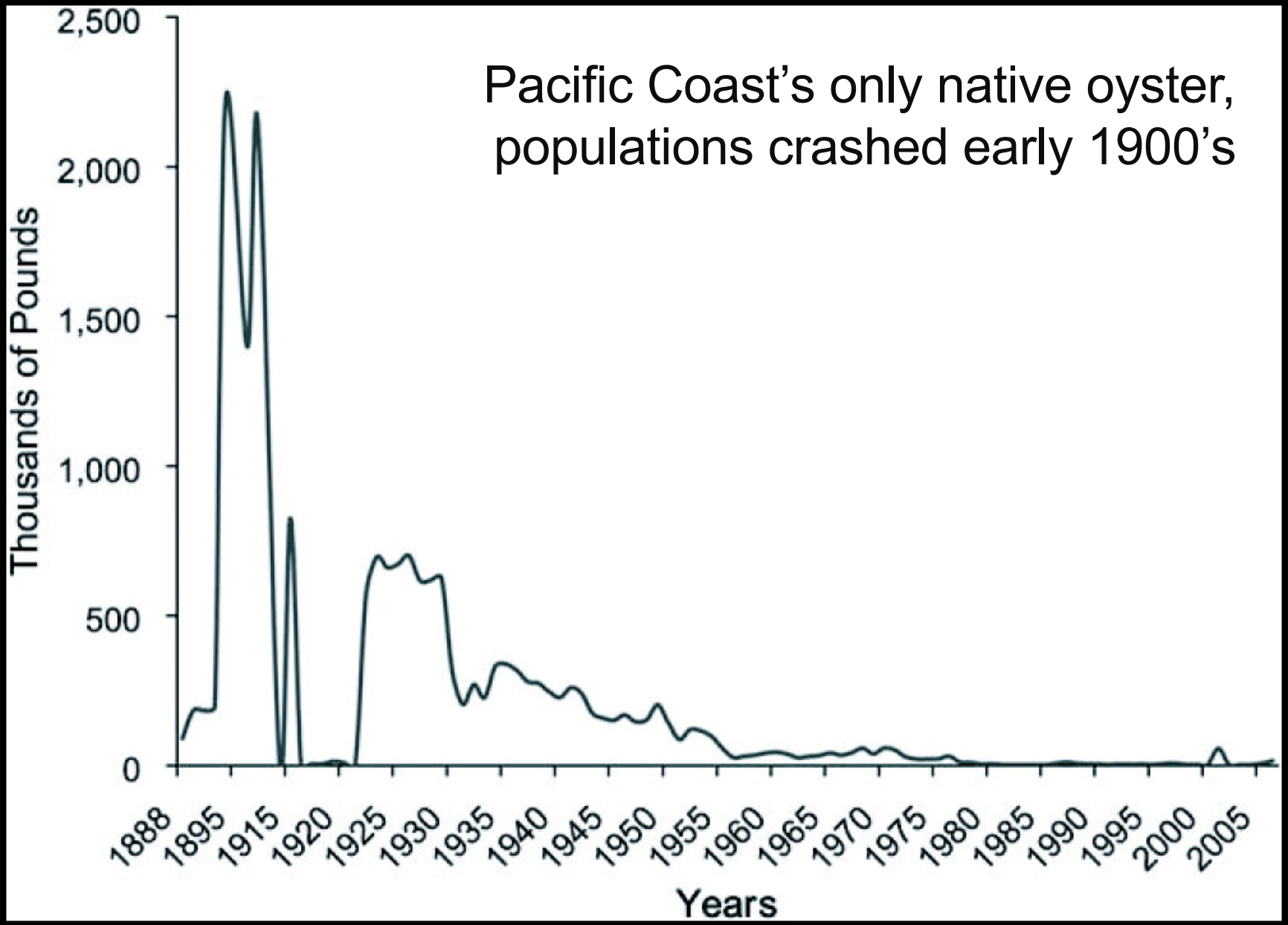


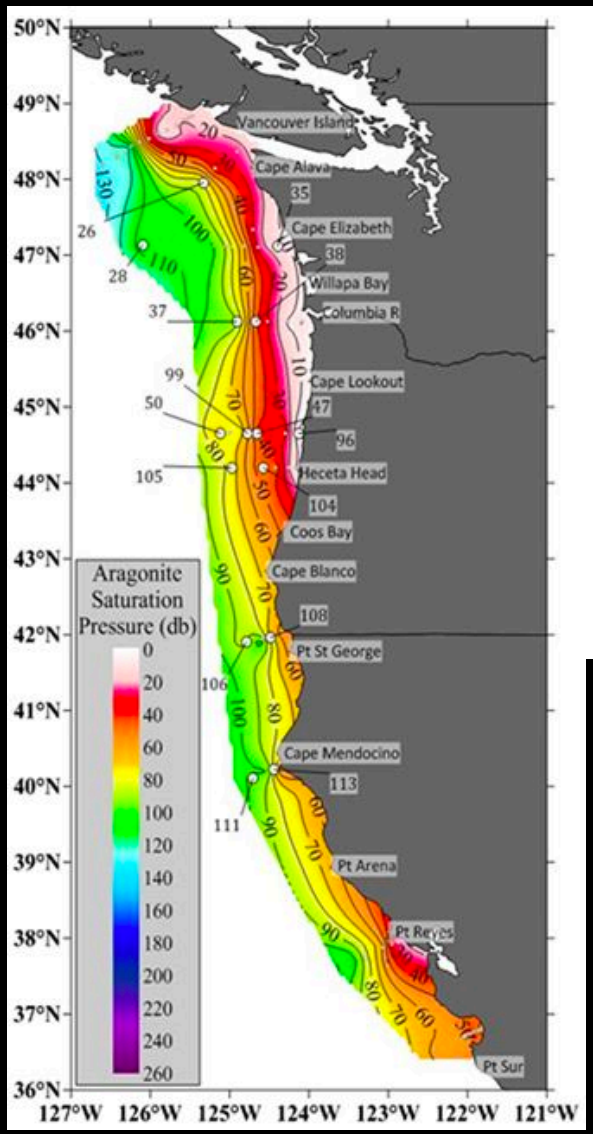
THE OLYMPIA OYSTER



White, Ruesink & Trimble, 2009

THE OLYMPIA OYSTER

Emerging threat: ocean acidification



Ocean acidification amplified along North American Pacific Coast

Shown: depth of corrosive water (Ω-undersaturated)

Feely et al 2017

Ocean acidification, Olympia oyster

Negative impacts of larval exposure

- ⬇ Larval growth, survival (Hettinger et al. 2013)
- ⬇ Juvenile growth after larval exposure (Hettinger et al. 2012)
- ⬆ Juvenile predation rate (Sanford et al. 2013)

Also evidence of larval tolerance (Waldbusser 2016)

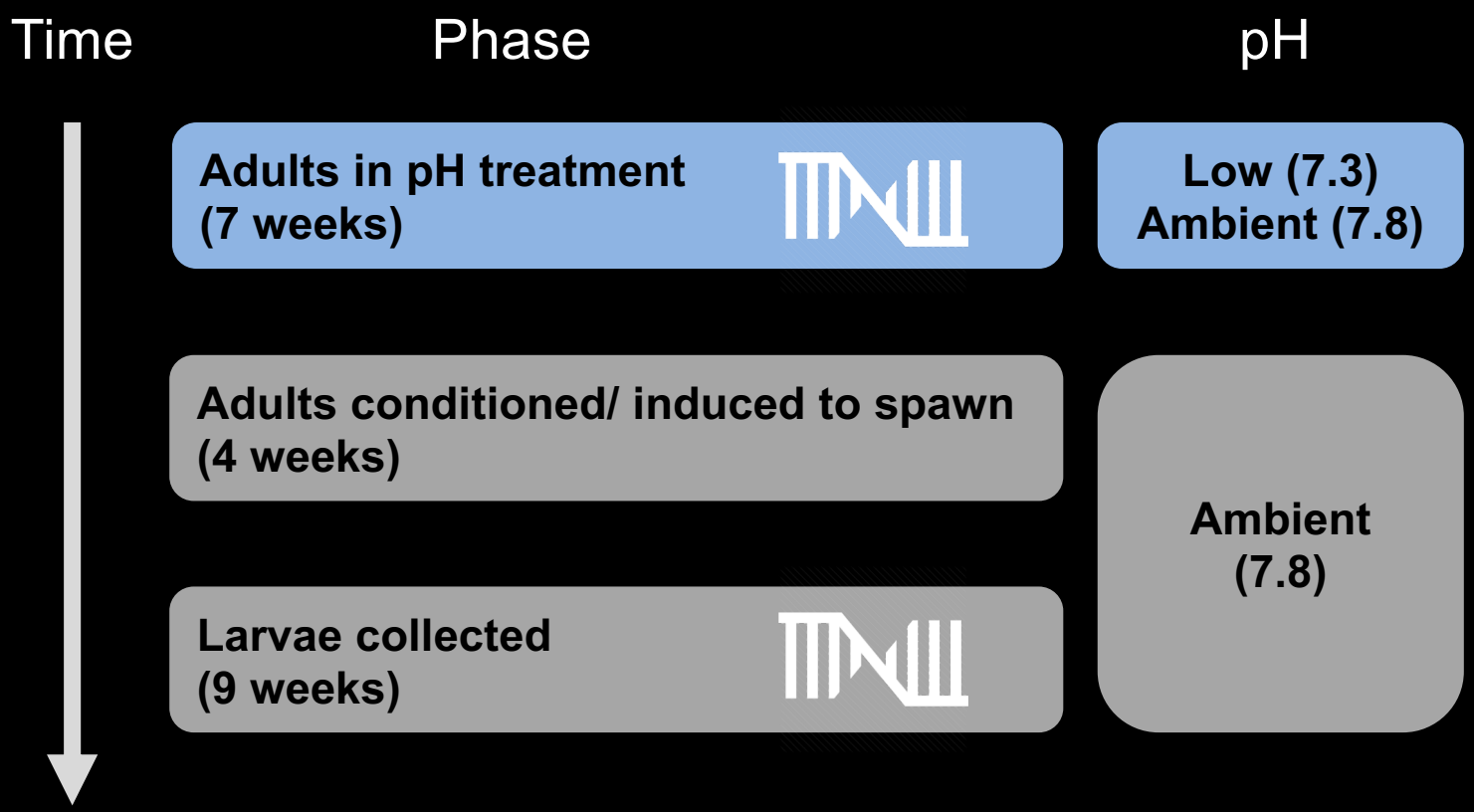
Parental carryover effects?

"Memory" of OA passed on to offspring, other oysters

- Negative carry-over:
  - ↓ larval survival (Venkataraman et al. 2019)
- Positive carry-over:
  - ↑ larval growth (Parker et al. 2012, 2015, 2017)

Olympia oyster? Mechanisms?

Design

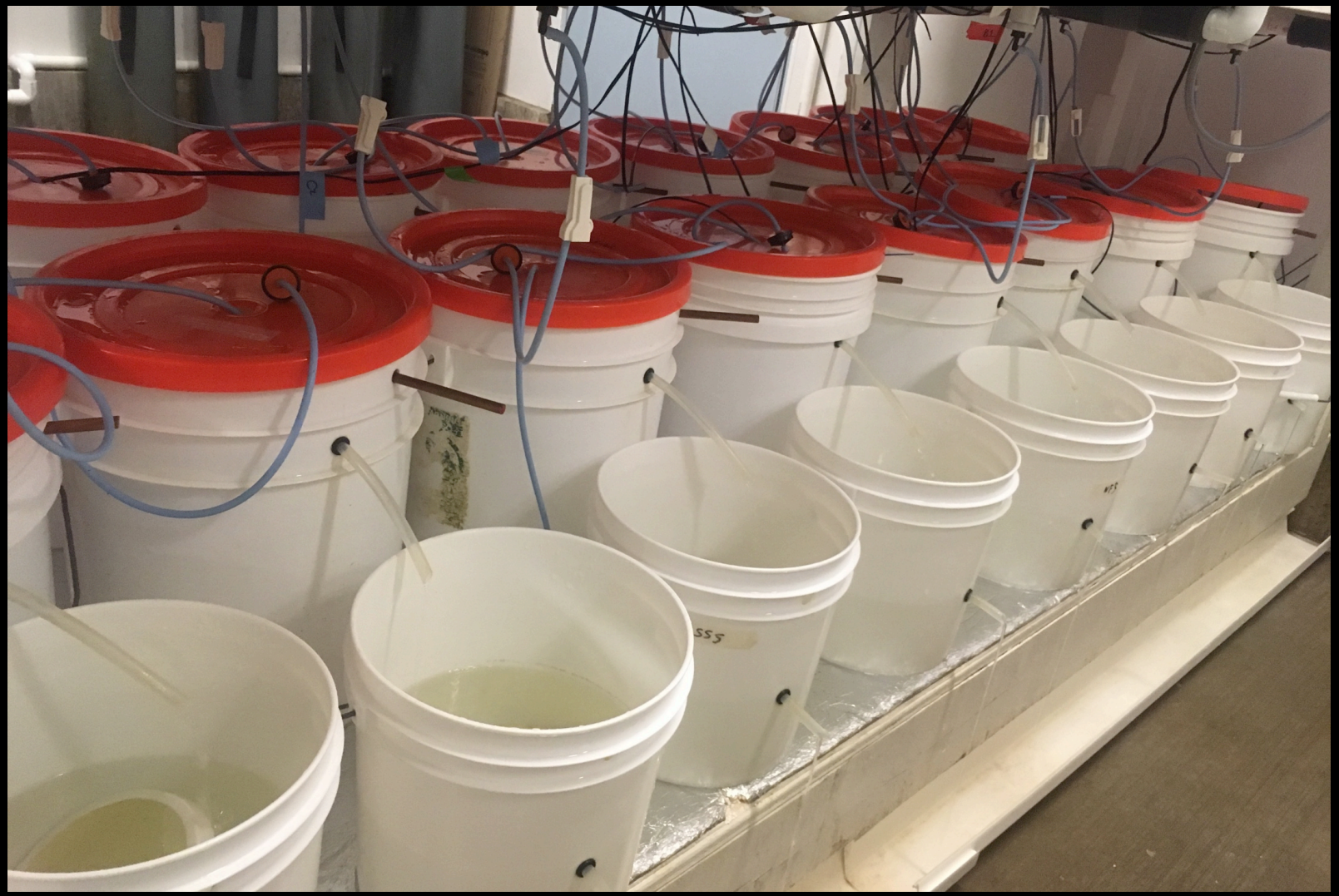

Time
Phase
pH
Adults in pH treatment
(7 weeks)
Low (7.3)
Ambient (7.8)
Adults conditioned/ induced to spawn
(4 weeks)
Larvae collected
(9 weeks)
Ambient
(7.8)

Larvae collected & counted for 9 weeks

Adults in pH treatment

Adults conditioned

Larvae collected

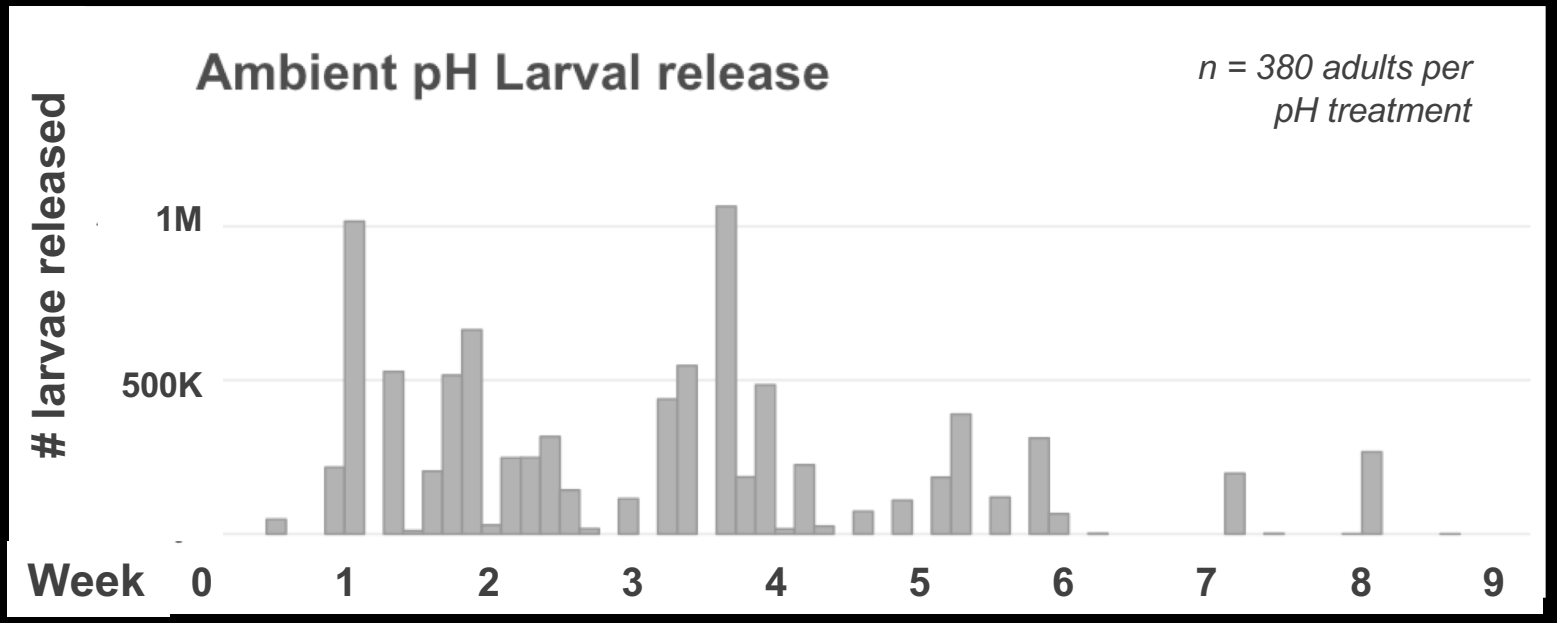


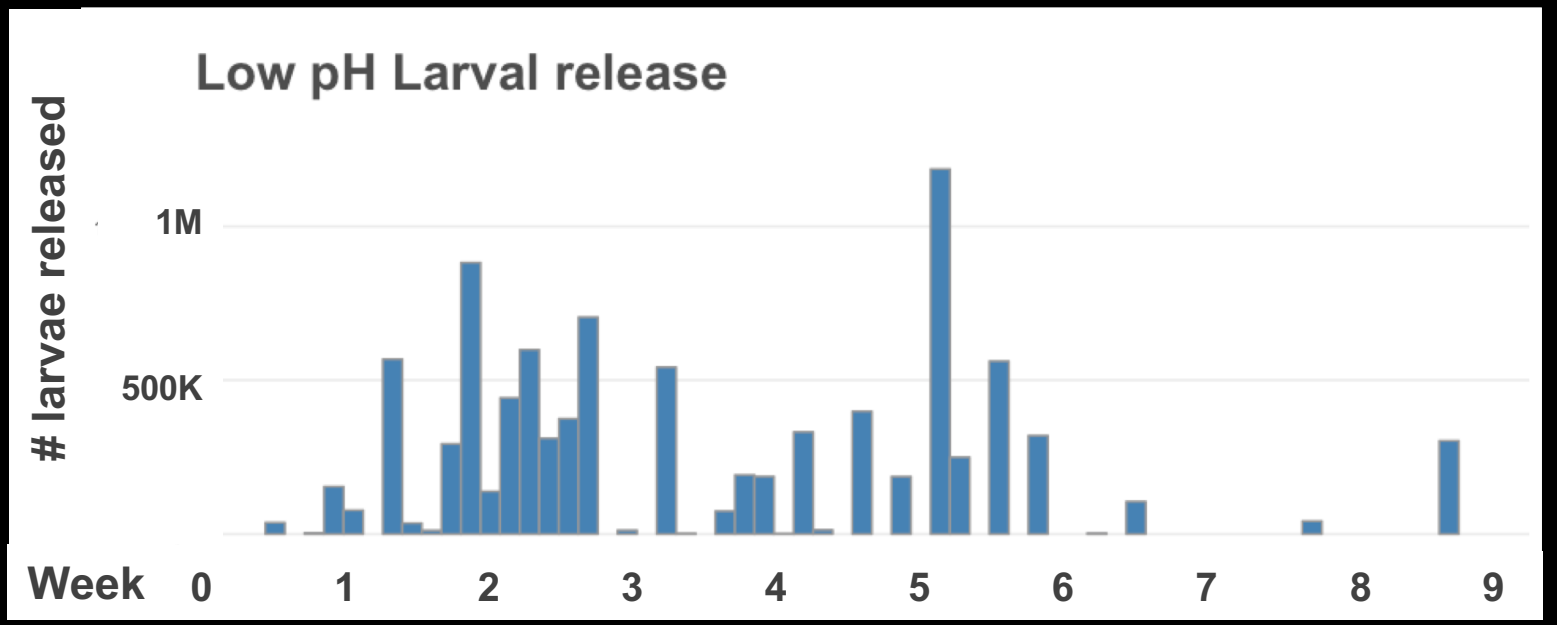
No pH effect on fecundity

Adults in pH treatment

Adults conditioned

Larvae collected



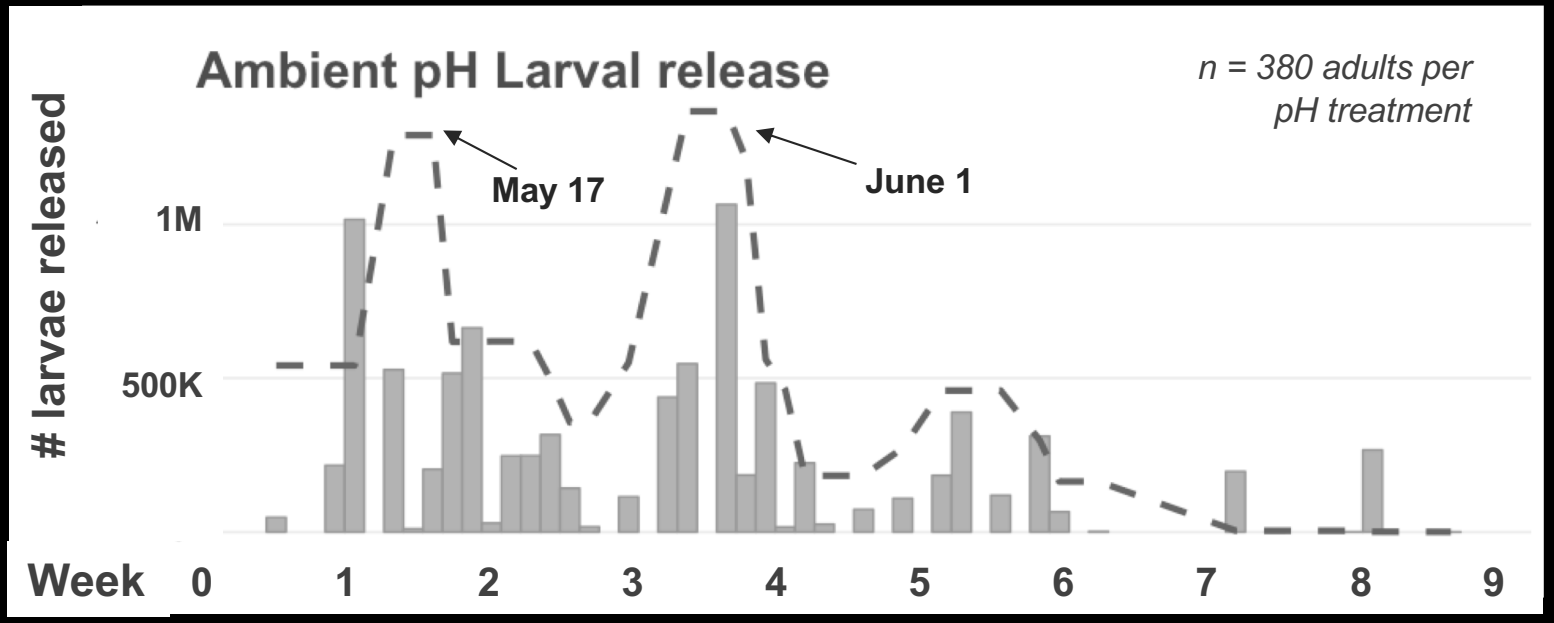


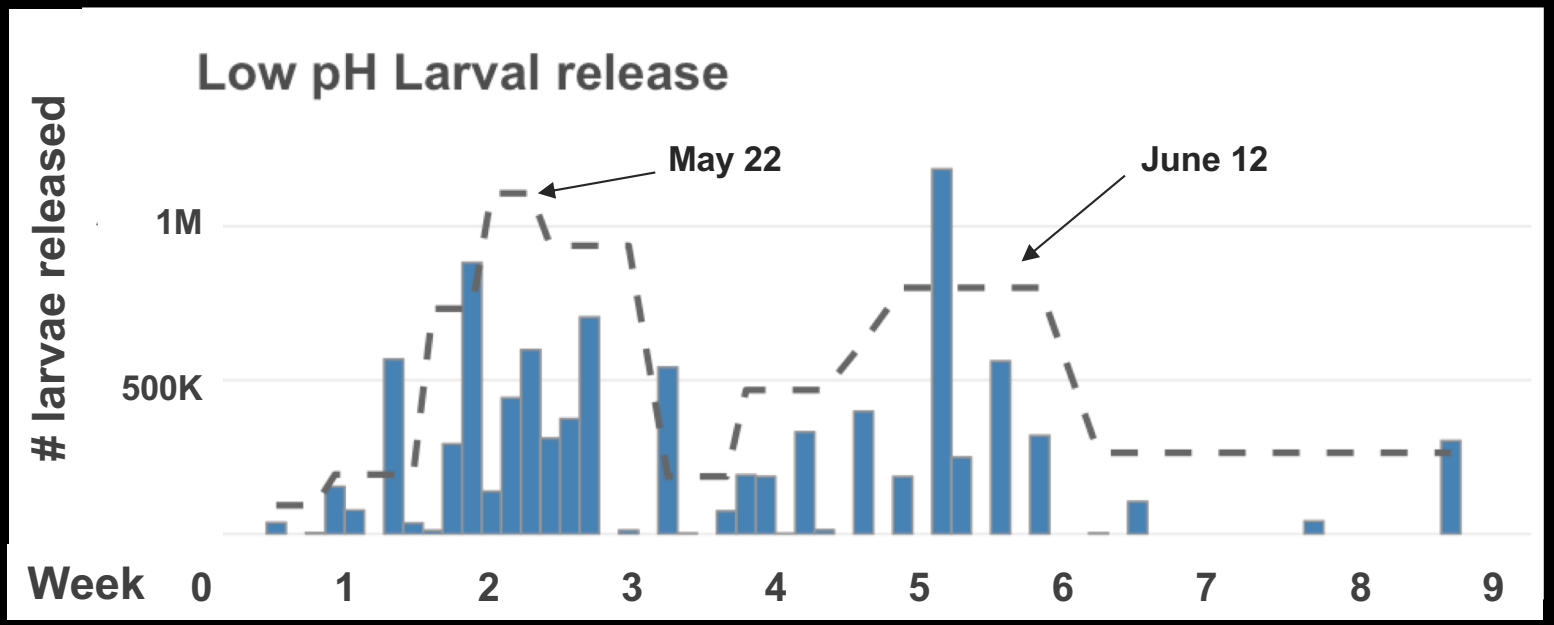
No pH effect on fecundity
Larval release delayed

Adults in pH treatment

Adults conditioned

Larvae collected





Adult gonad tissue sampled, RNA isolated & sequenced

Adults in pH treatment

Adults conditioned

Larvae collected

Adult gonad Gene expression

Adults in pH treatment

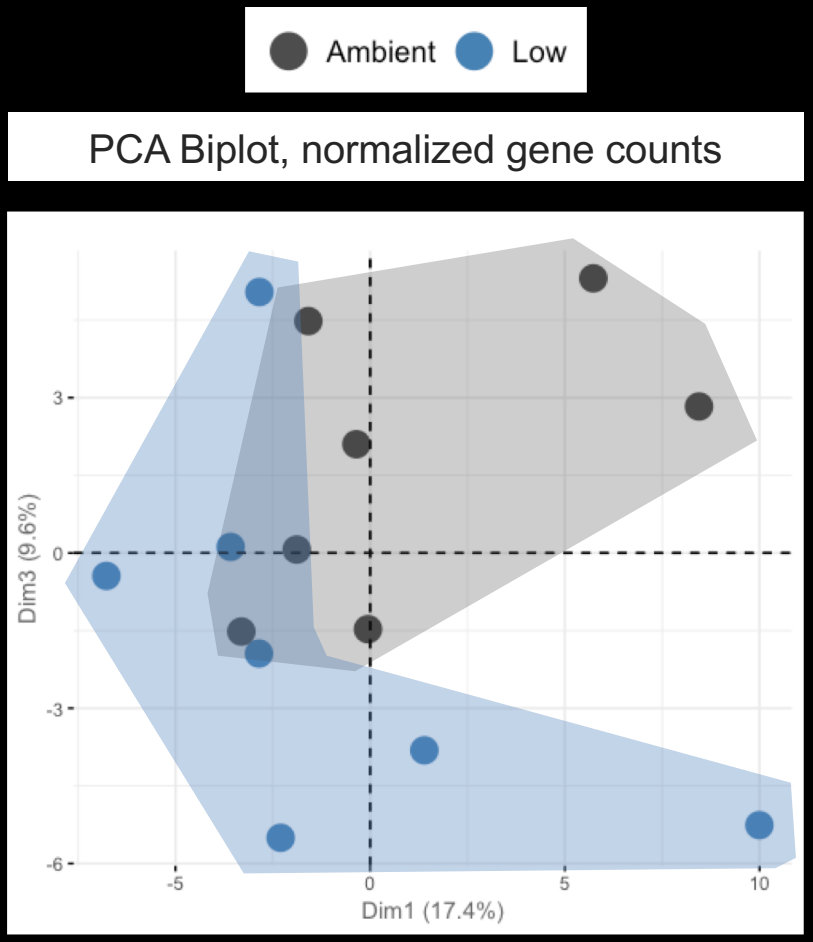
Adults conditioned

Larvae collected

RNA sequenced using QuantSeq

Processes affected by direct pH exposure:

- Aerobic respiration
- Defense response to bacteria, fungus
- Protein transport & stabilization
- Biosynthesis (DNA, protein)
- Cellulose digestion
- Intracellular signaling

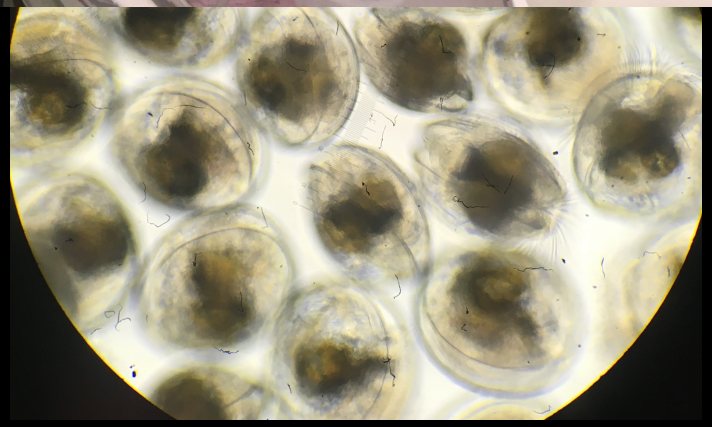


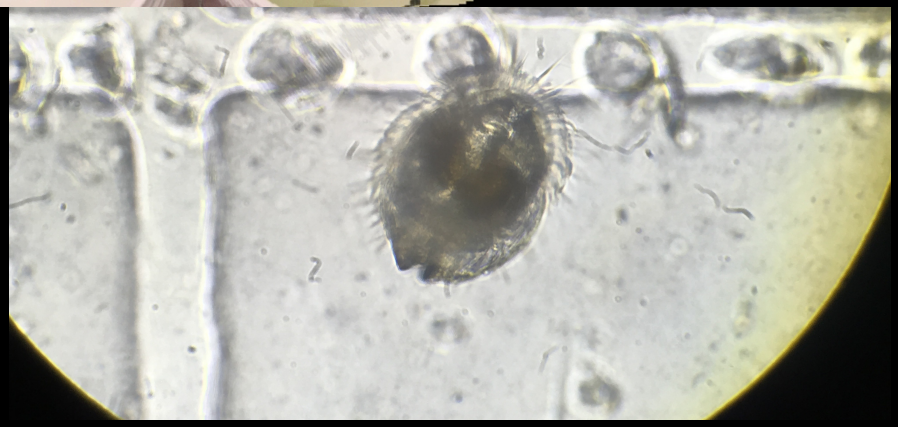
Larvae collected
Subset sequenced, reared

Adults in pH treatment

Adults conditioned

Larvae collected





Newly released larvae gene expression

Adults in pH treatment

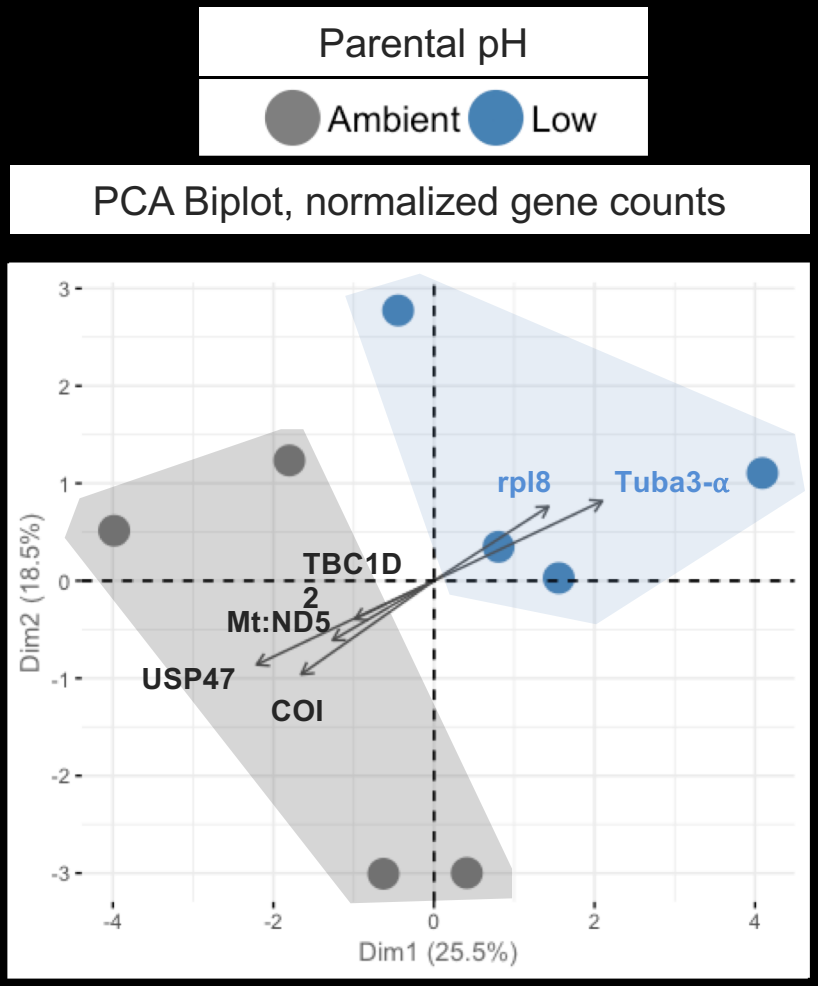
Adults conditioned

Larvae collected

RNA sequenced using QuantSeq

Processes affected by parental pH exposure

- Aerobic respiration (COI, Mt:ND5)
- DNA repair (USP47)
- Protein transport (TBC1D2)
- Cytoskeleton (Tuba3-α)
- Cytoplasmic translation (rpl8)



What does this mean?

Parental pH delays reproduction … later larval release in wild, may alter larval recruitment

Parental pH exposure alters larval physiology … Future generations more capable of surviving in low pH world?

Possible next steps

Explore offspring low pH response …

- Different response to acute low pH shock if parent was exposed? (qPCR)

Why does expression differ?…

- Epigenomes

THANK YOU

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