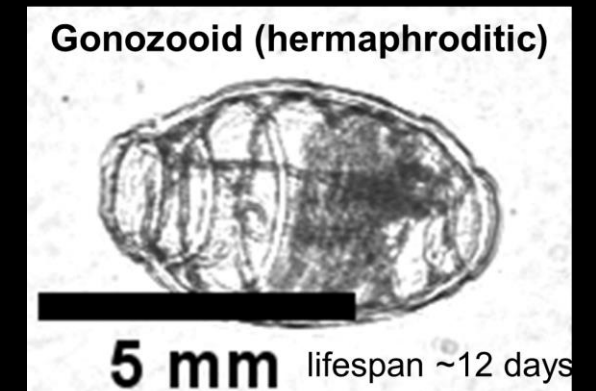
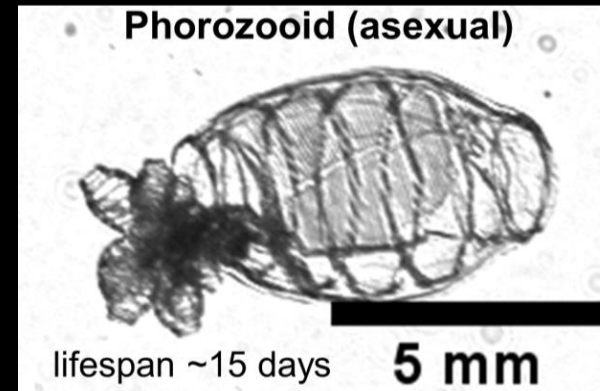


Investigating life-stage specific doliolid distributions in relation to water column structure in the South Atlantic Bight

Patrick I. Duffy¹, Marc E. Frischer¹, Laura M. Treible², Emily E. Gipson¹, and Adam T. Greer¹

¹ Skidaway Institute of Oceanography, University of Georgia

² Savannah State University



A snorkeler is seen from above, surrounded by a dense, swirling cloud of small, brownish, barrel-shaped organisms called salps. The water is a clear, light blue-green color. The salps are concentrated around the snorkeler's head and upper body, creating a thick, textured barrier. The snorkeler's dark wetsuit and fins are visible against the lighter water.

**Asexual life stages allow pelagic tunicates to rapidly
proliferation in favorable conditions**

Salps surrounding a snorkeler off New Zealand. Photo: Paul Caiger

Doliolids Are Pelagic Tunicates

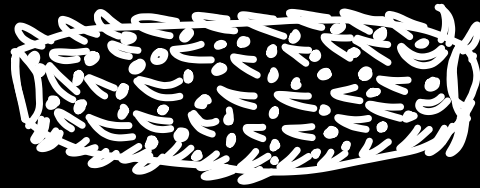
Appendicularia

Appendicularians

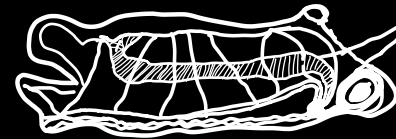


Thalia

Pyrosomes



Salps



Doliolids



Doliolids Life Cycles Are Very Rapid

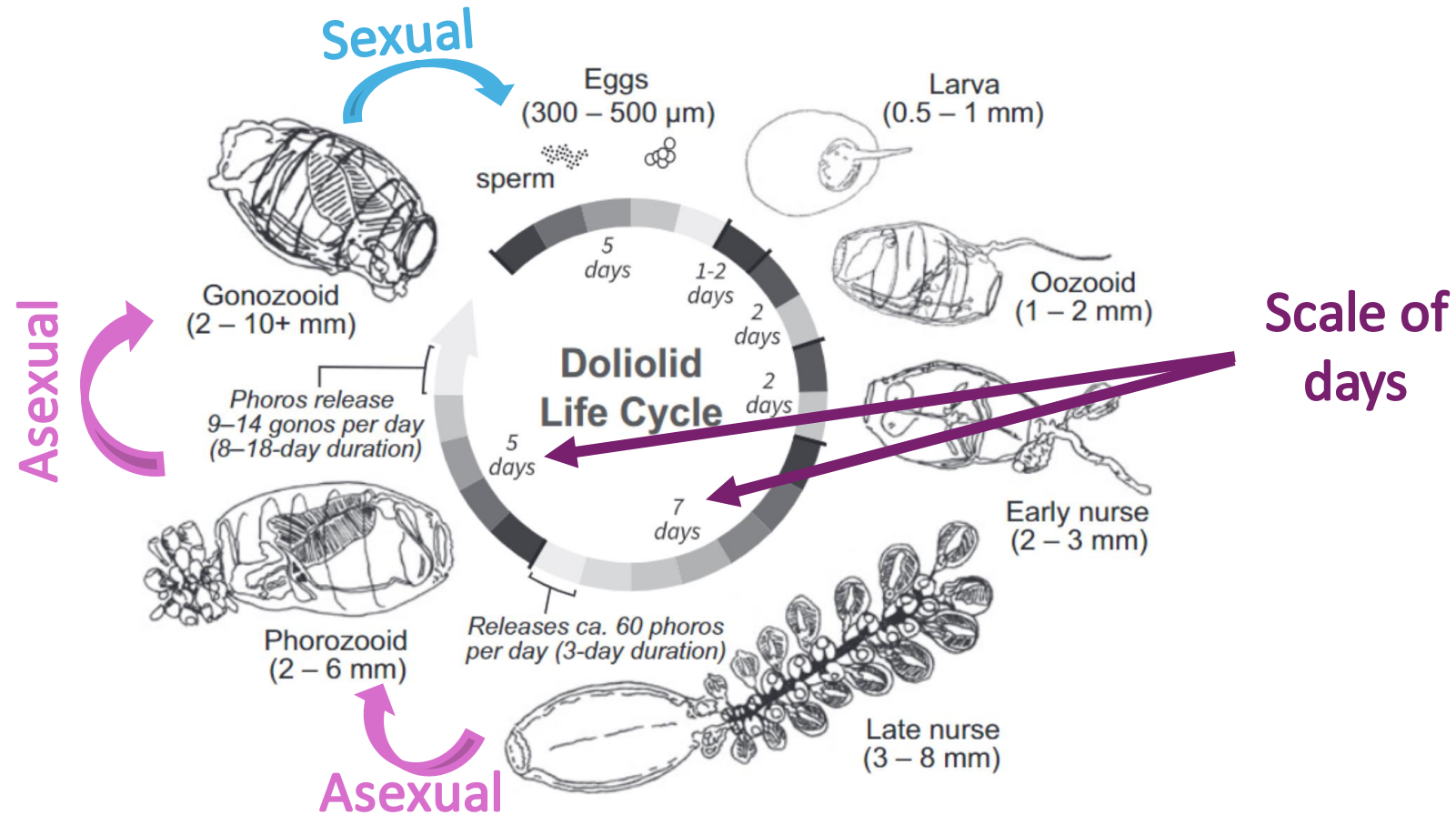
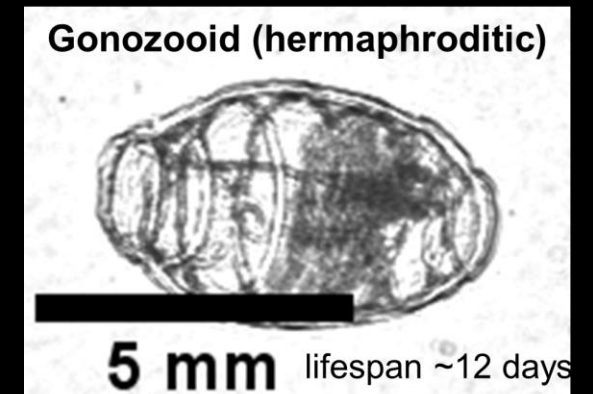
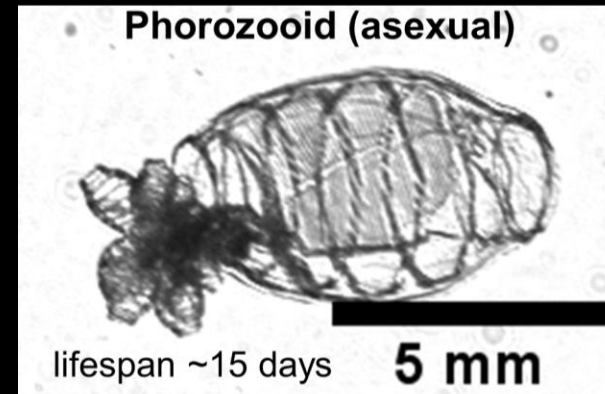


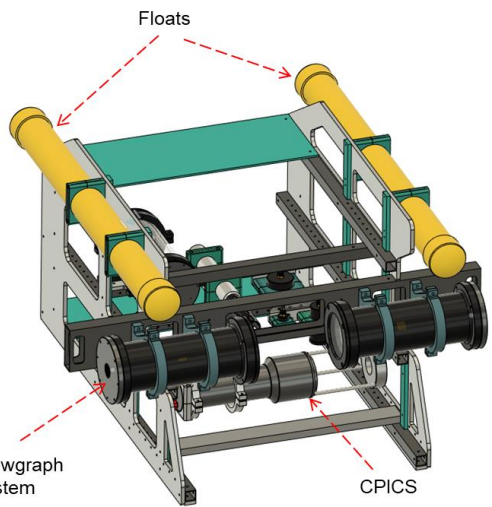
FIGURE 1 Life history of *Dolioletta gegenbauri*. Figure redrawn based on Braconnot (1971), Deibel (1998), Deibel and Lowen (2012), Paffenhöfer and Köster (2011) and Paffenhofer and Gibson (1999) **Walters et al. 2019**

Research Question

Do environmental variables differently influence life stages?

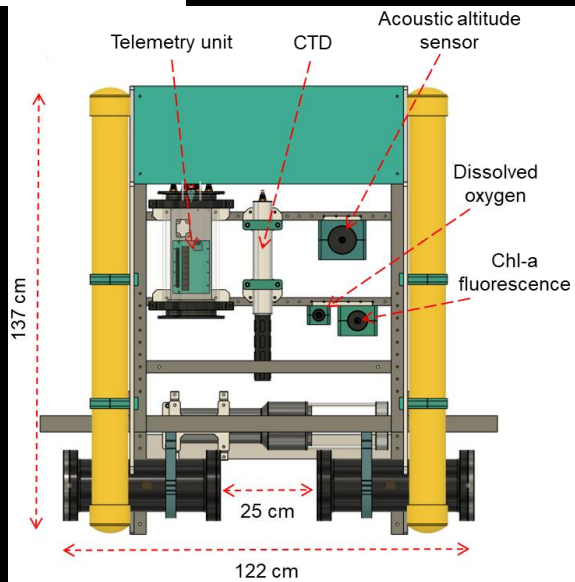


In situ Shadowgraph Imagery



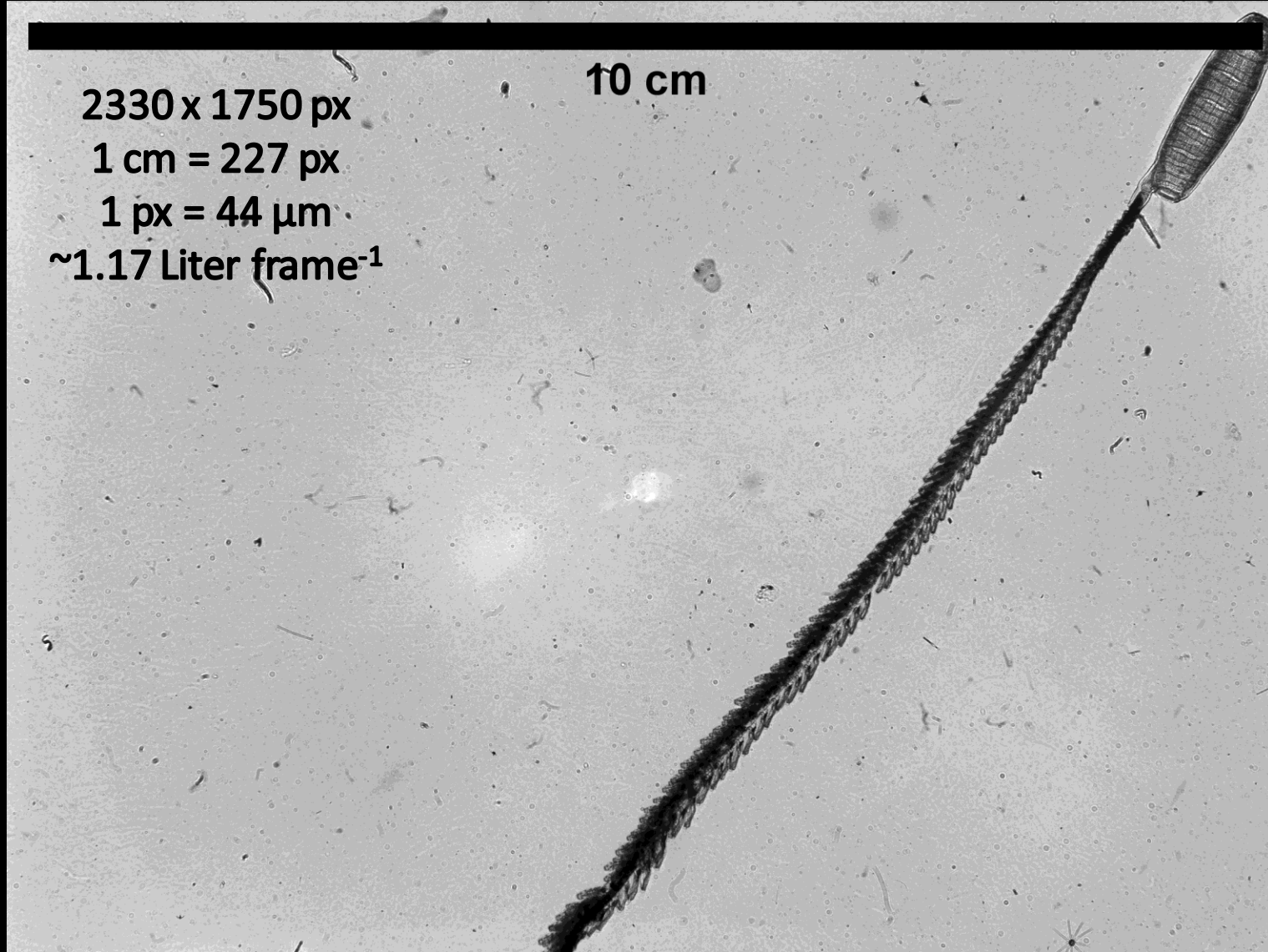
Sensors

Chl-*a*
Diss. Oxygen
Salinity
Temperature
Depth

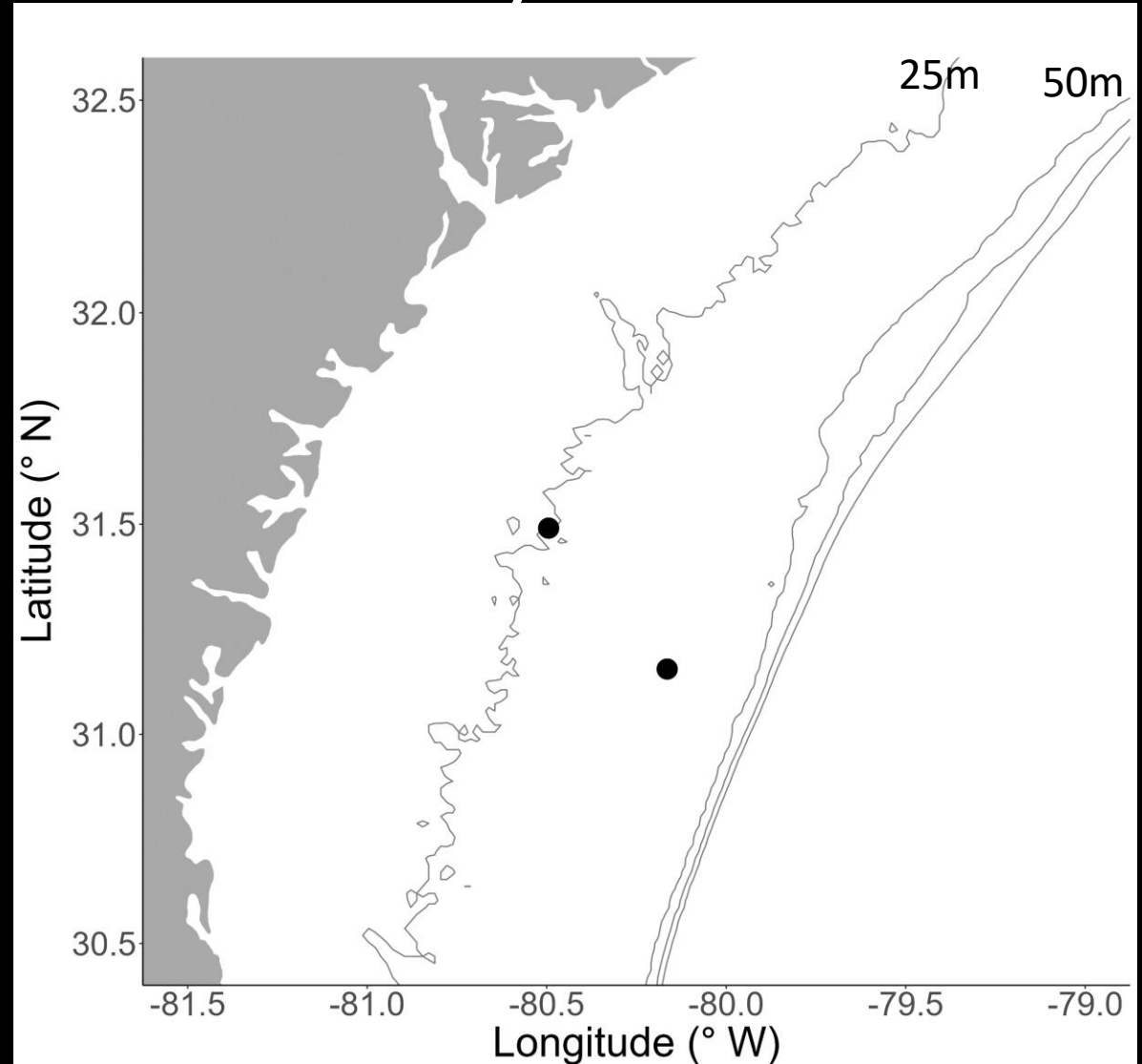


2330 x 1750 px
1 cm = 227 px
1 px = 44 μm
 ~ 1.17 Liter frame⁻¹

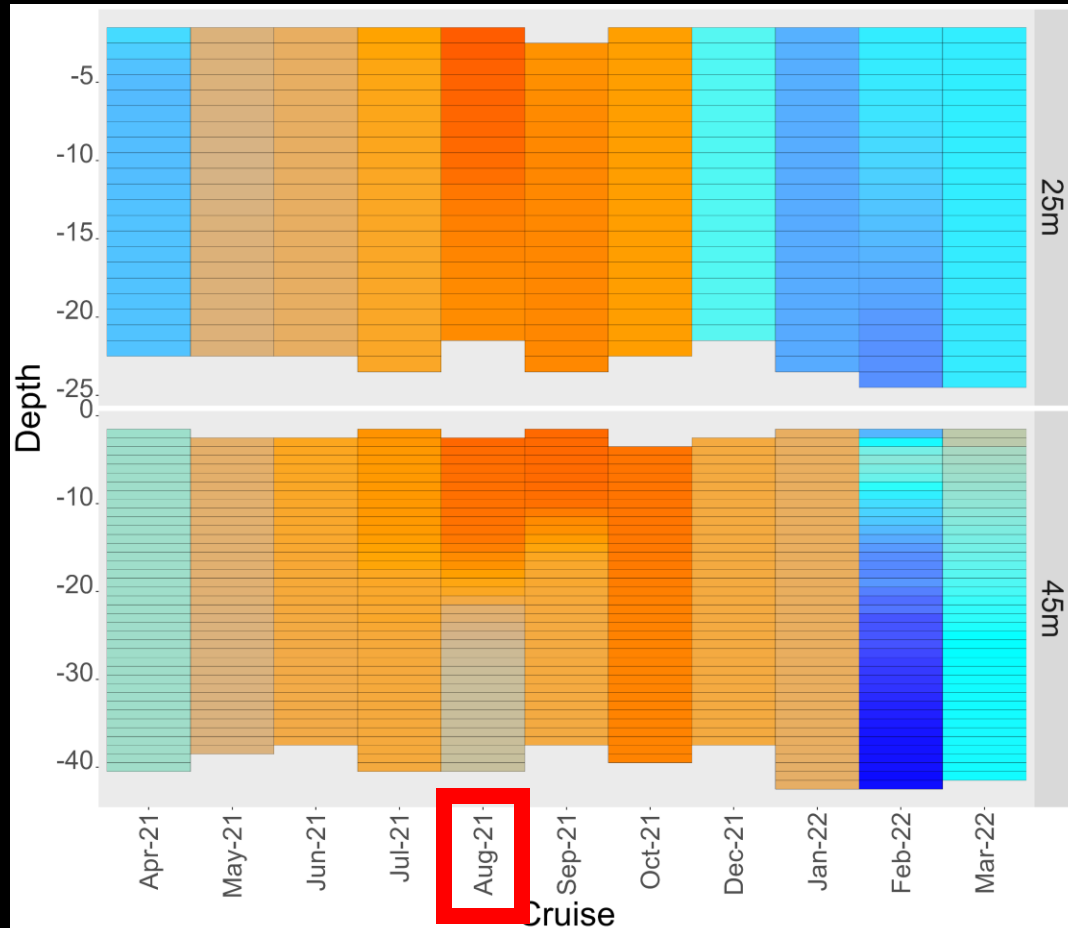
10 cm



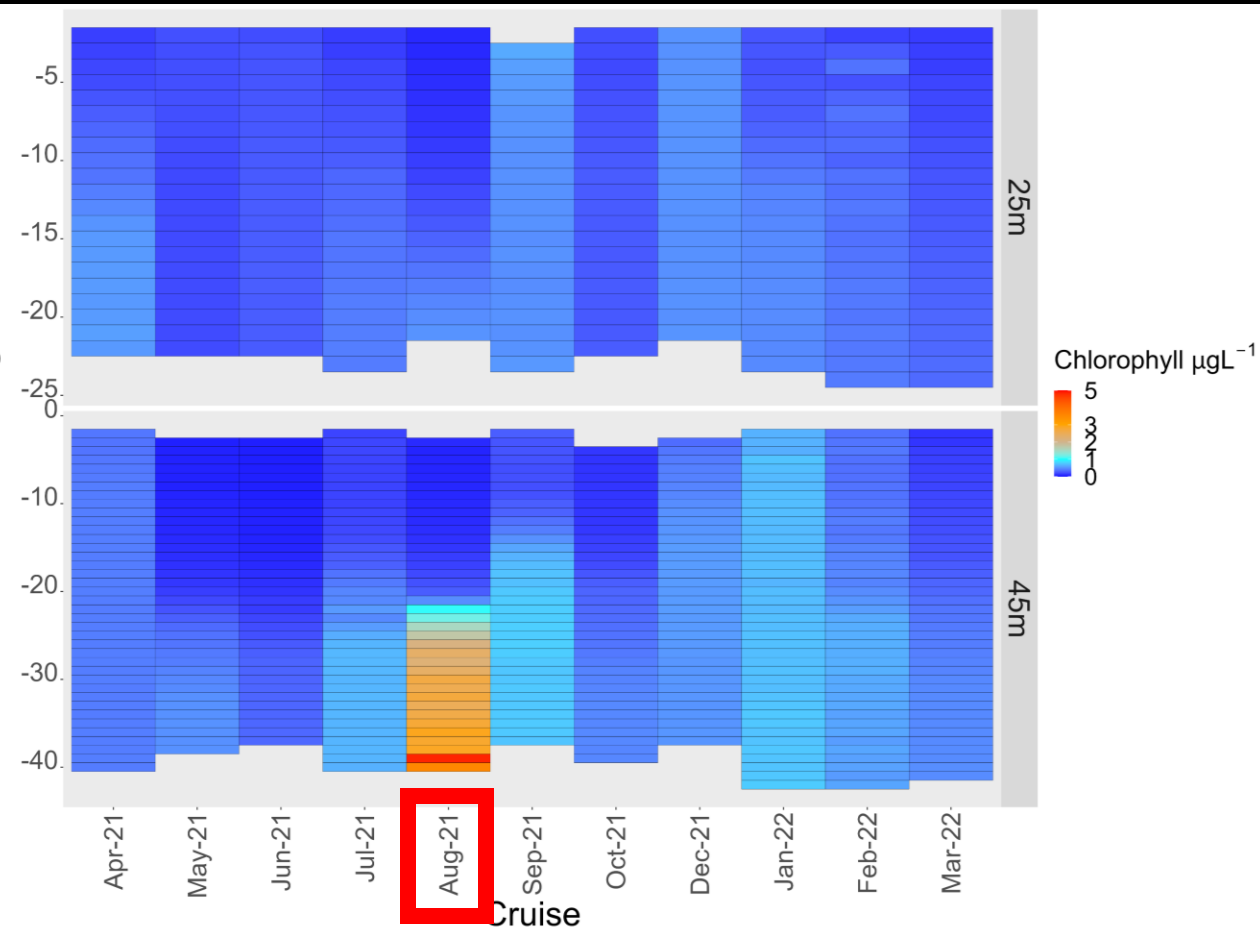
Doliolids Are Associated with Sporadically Productive Shelf Ecosystems



Mid-shelf Physical & Biological Drivers

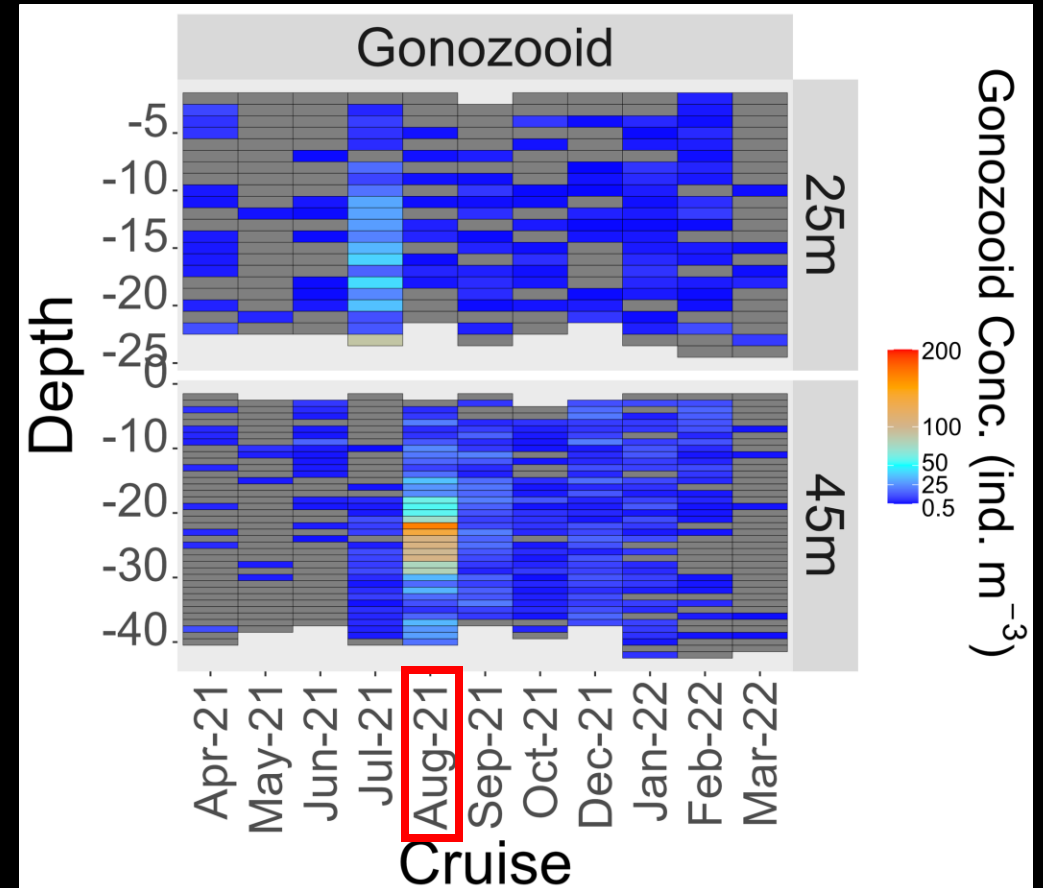
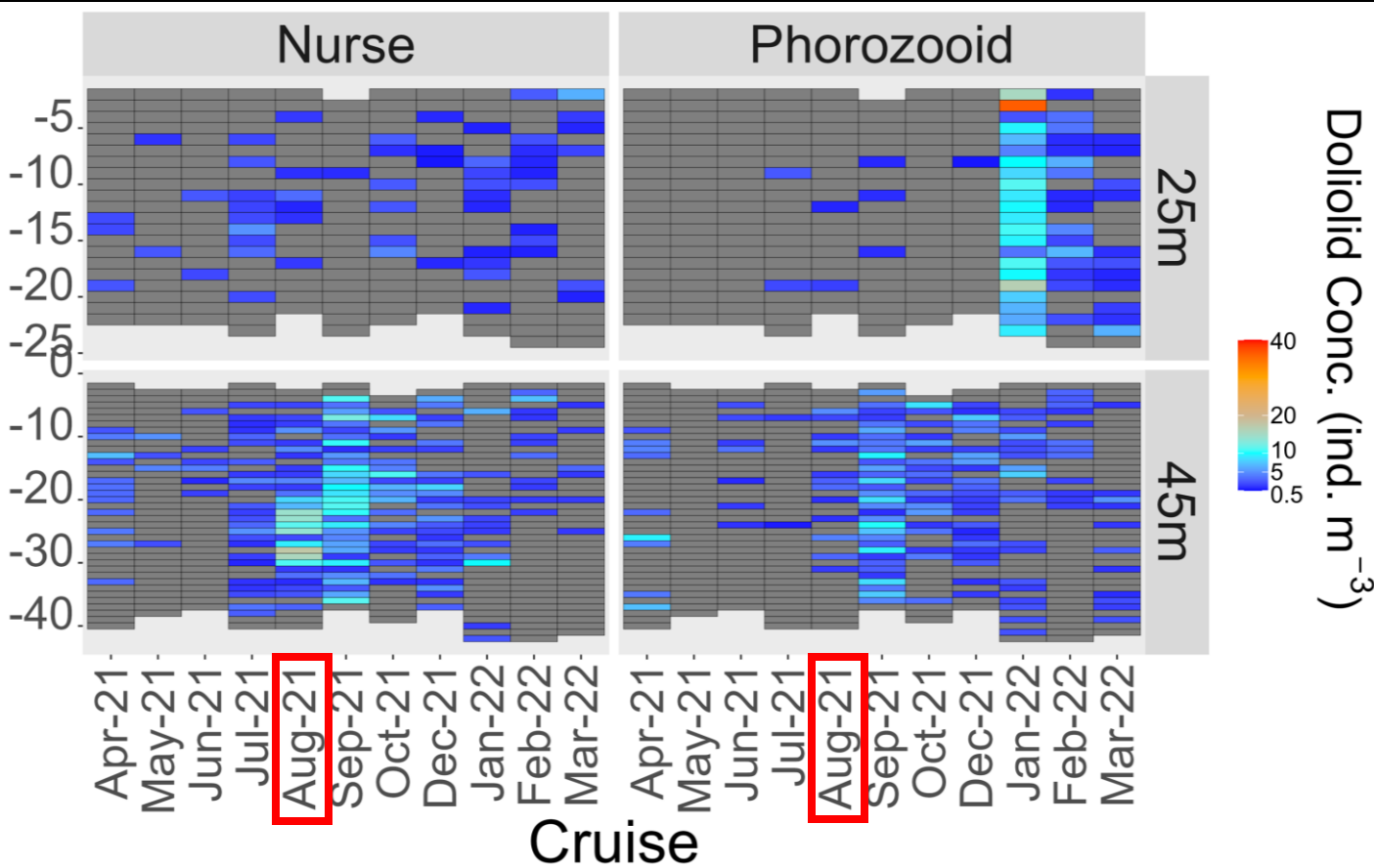


Cool, deep water in Summer is upwelling driven



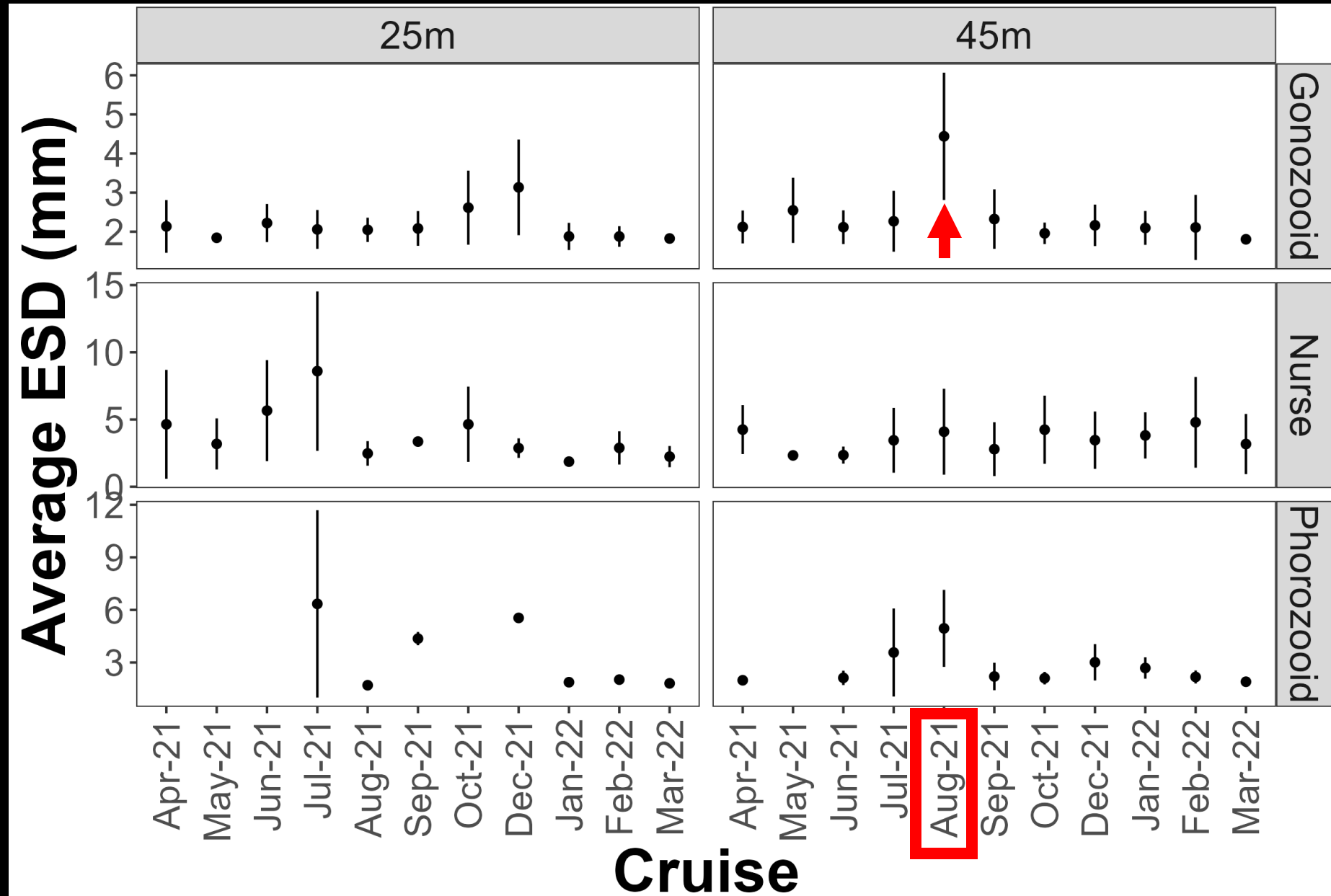
Summer layered Productivity boom

Life Stage Specific Response to Environment



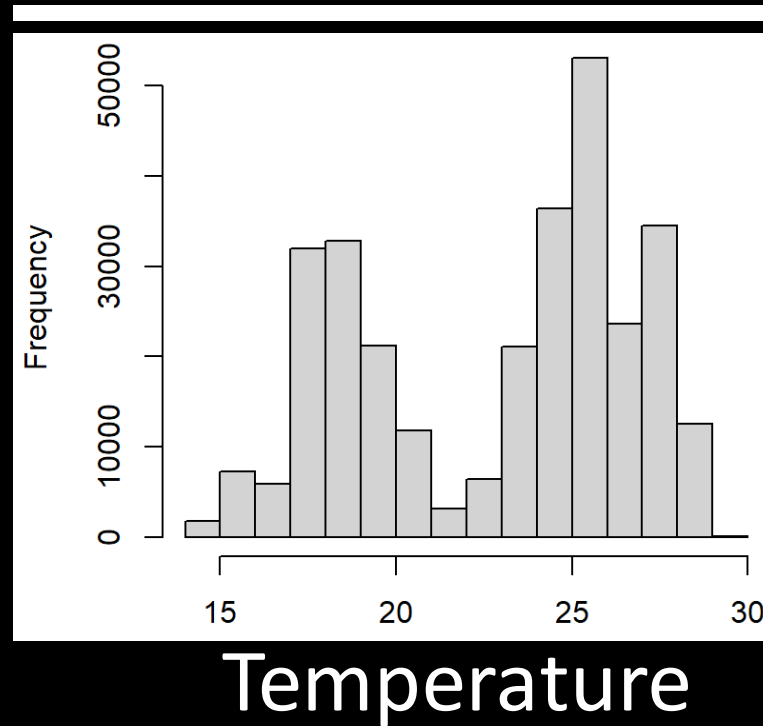
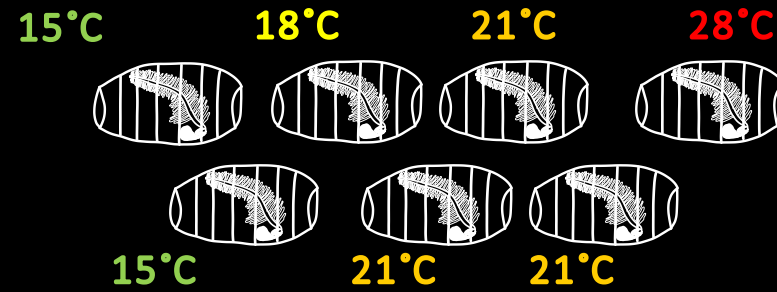
Gonozoid response to upwelling had steep vertical gradients
Only a few Asexually-budding individuals need to succeed

Size of life stages varied across environmental regimes

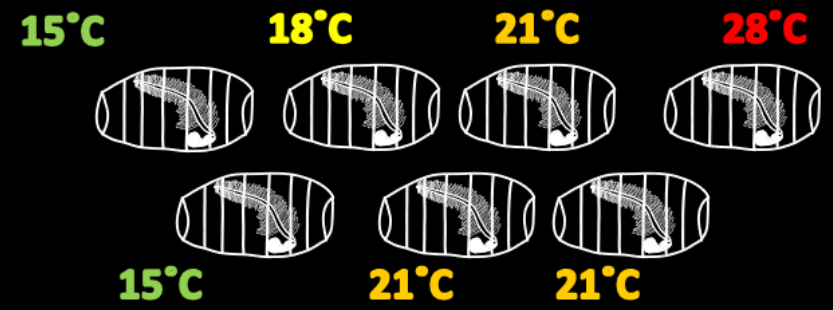


Gonozoids largest when most abundant

Describing Environmental Influence on Life Stages



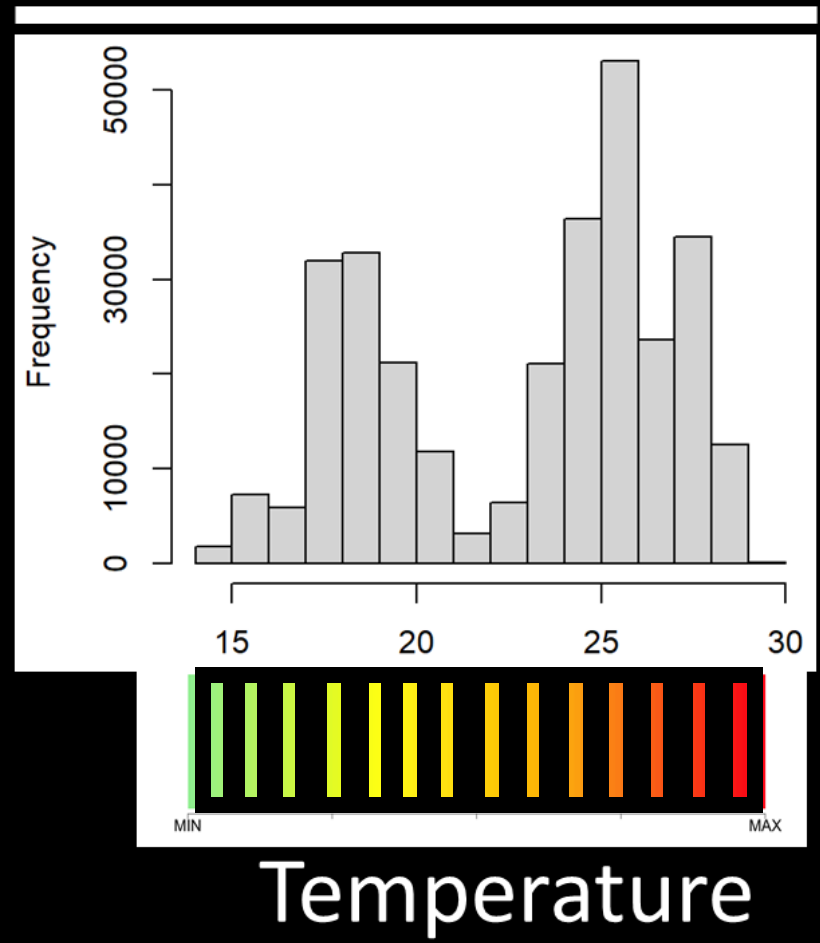
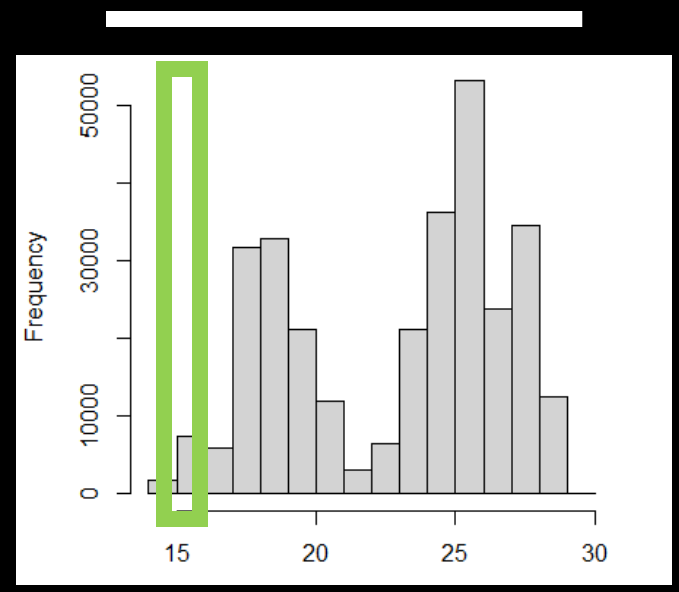
Single Parameter Quotient



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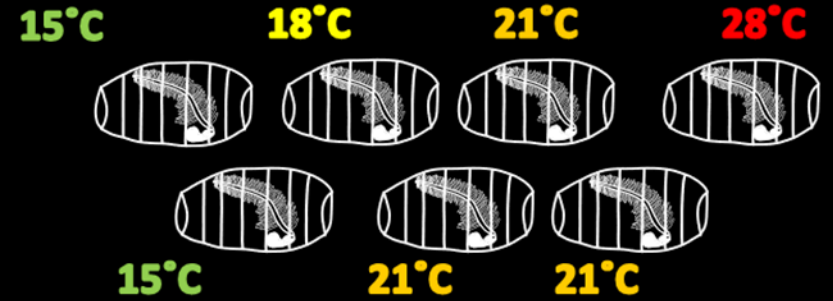


SPQ 15°C =



Repeated 1000x w/ resampling for 95% CI

Describing Environmental Influence on Life Stages

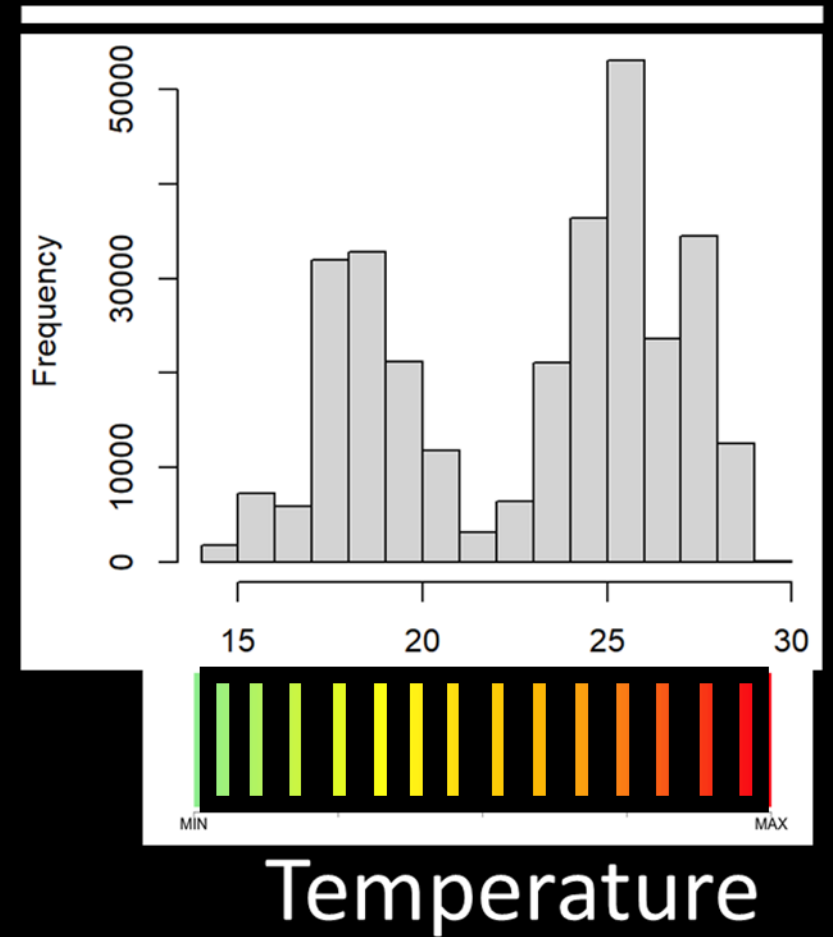


Selected > 1

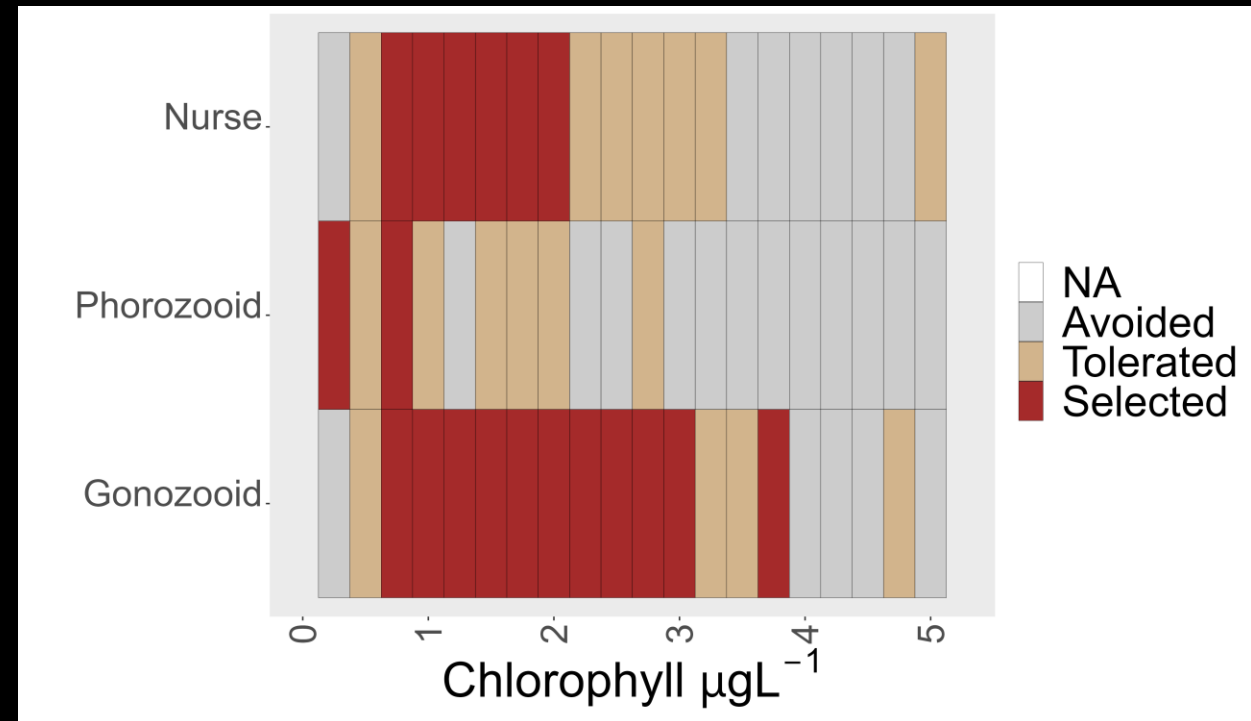
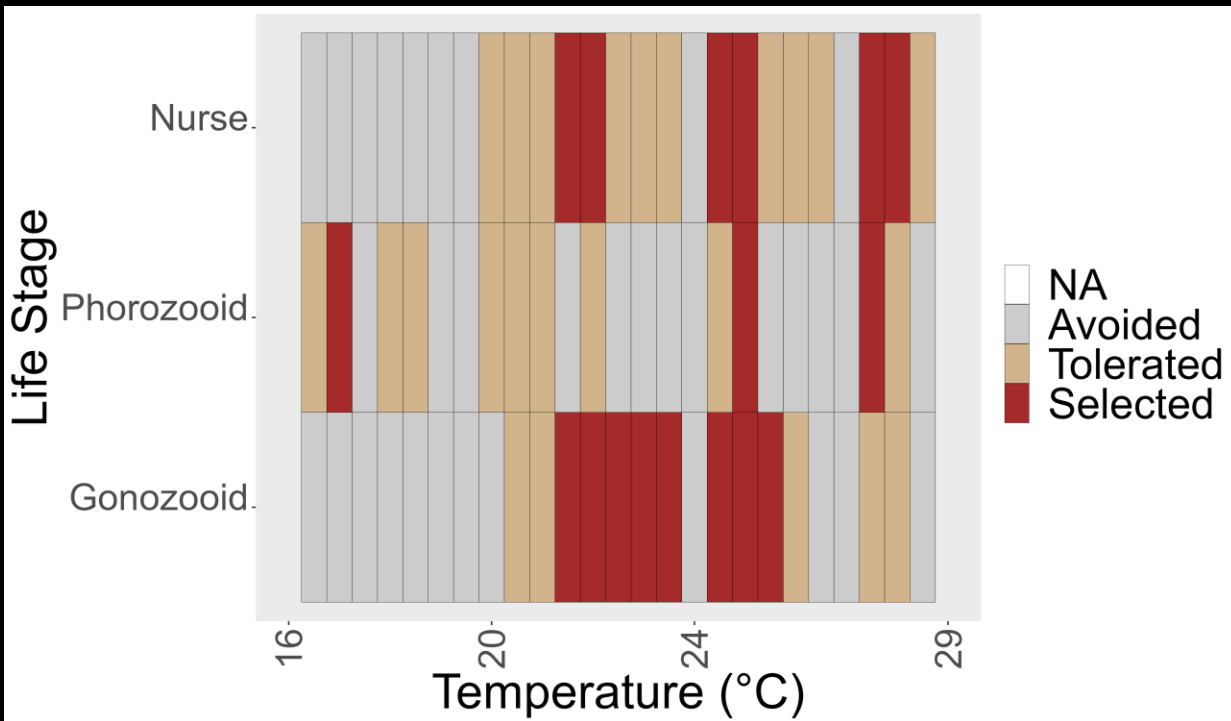
Tolerated \approx 1

Avoided < 1

$$SPQ = \frac{\% \text{-organism associated}}{\% \text{-environmental occurrence}}$$



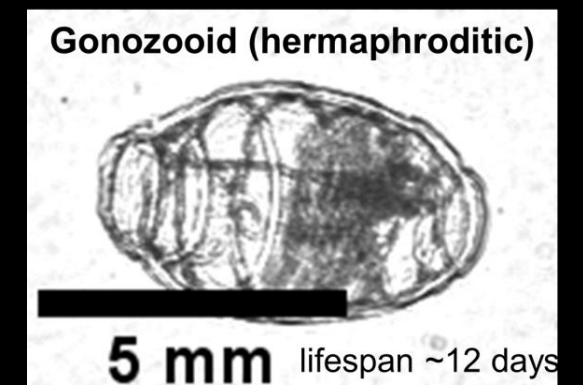
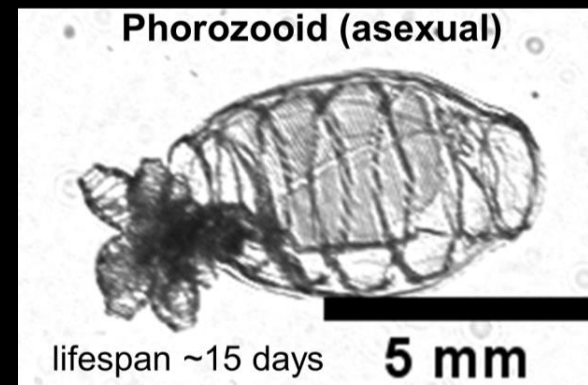
Temperature & Chlorophyll Association Over Time Series



Range of 'Selection' differed

Conclusions

- (1) Nurses select for a range of moderately productive conditions
- (2) Gonozoid abundance had steep vertical gradients centered on top-layer of upwelling-induced productivity; Also larger → Prey quality?
- (3) Fewest Phorozoid observations makes interpretation difficult



Acknowledgements

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