

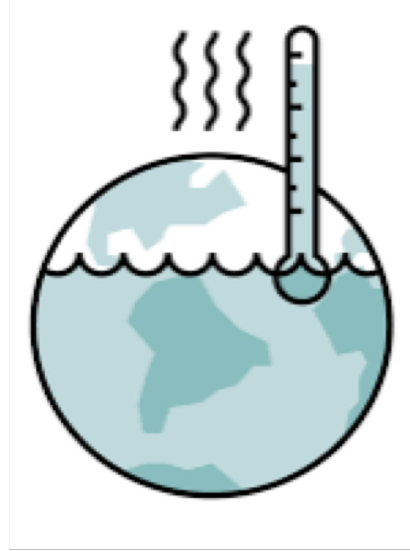
Examining the Effects of Varying pH Conditions on the Early Development of the Painted Sea Urchin, *Lytechinus pictus*

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Funding: NSF

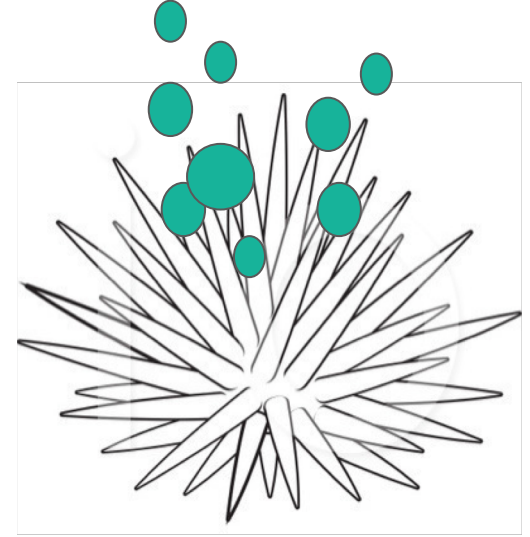
Global Climate Change Impacts Marine Organisms



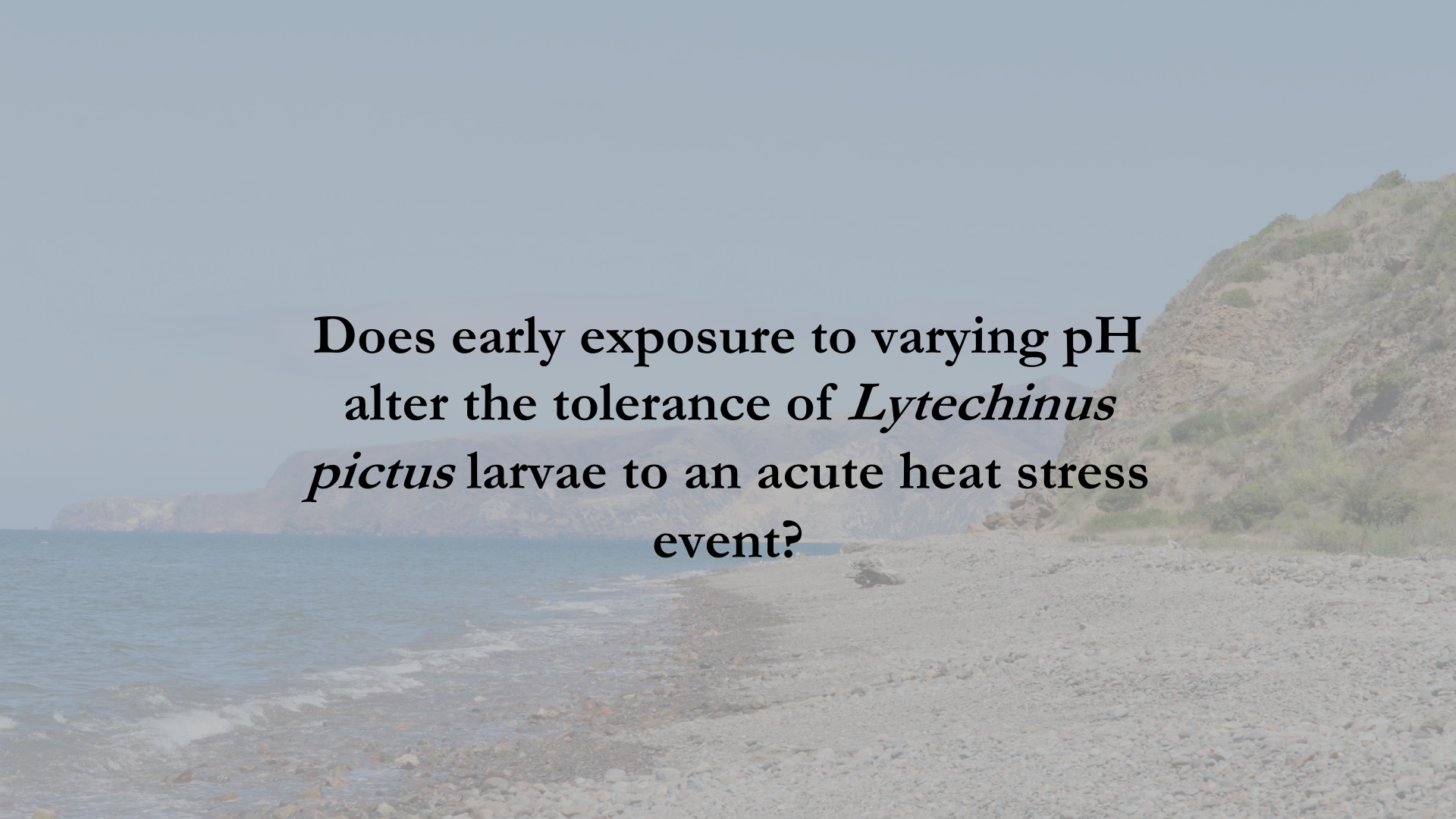
**Greenhouse Gas
Emissions**



**Ocean Acidification
& Temperature Rise**

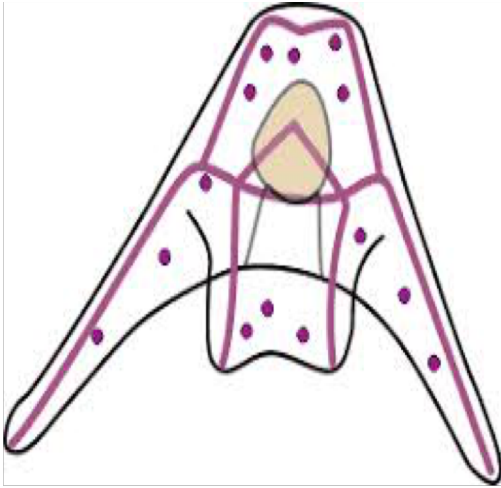


**Sea Urchin
Population Impacted**

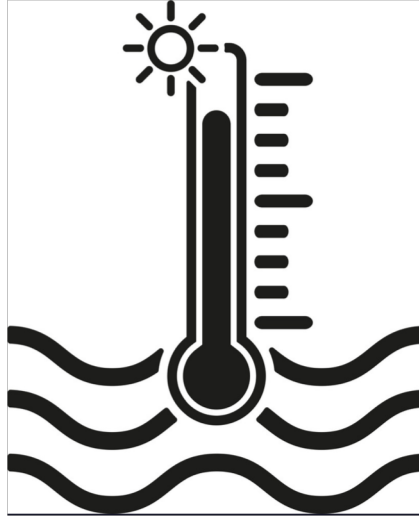


Does early exposure to varying pH
alter the tolerance of *Lytechinus*
pictus larvae to an acute heat stress
event?

Understanding the Physiological Performance of *L. pictus* Under Various Conditions



Successfully raise
viable sea urchin
offspring



Manipulate multiple
variables such as
temperature and acidity

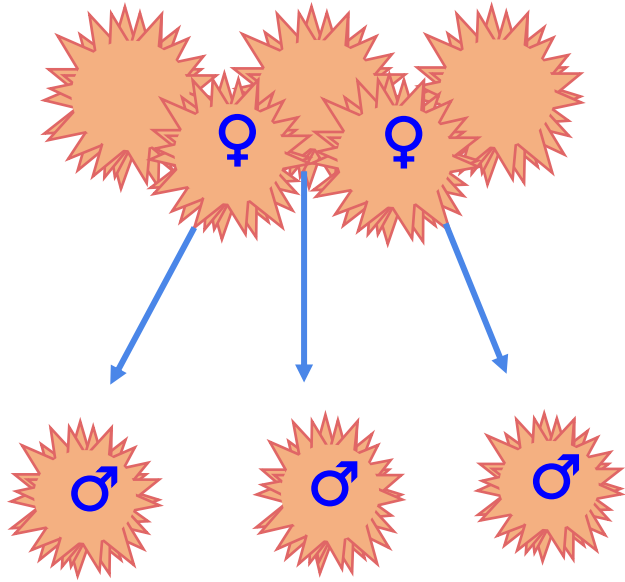


Lay down the framework
for further research of
L. pictus

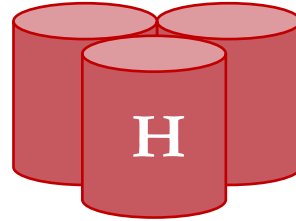
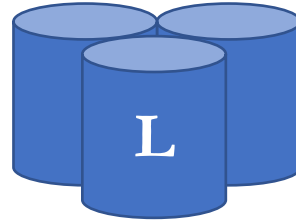
Lytechinus pictus as a Model Organism



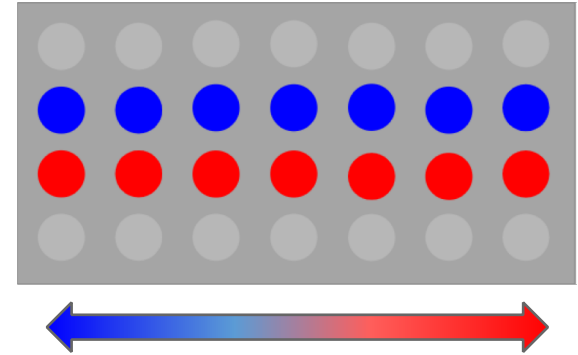
Research Methods



1. Spawn Urchins

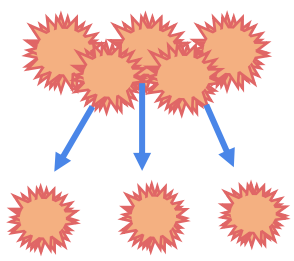


2. Raise Them in Buckets
With Varying pCO₂ levels

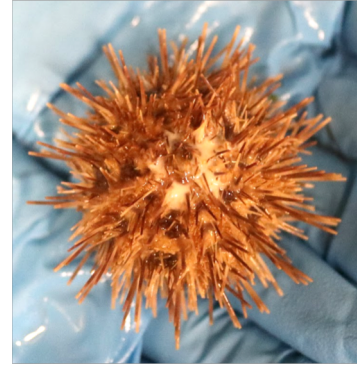


3. Introduce Heat
Stress

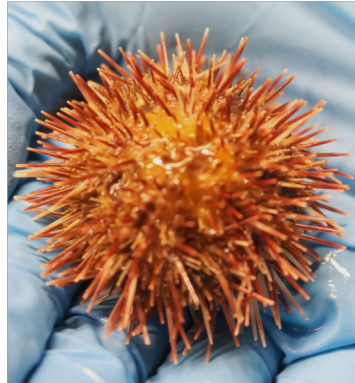
1. Spawn Urchins



**Inject Potassium
Chloride**

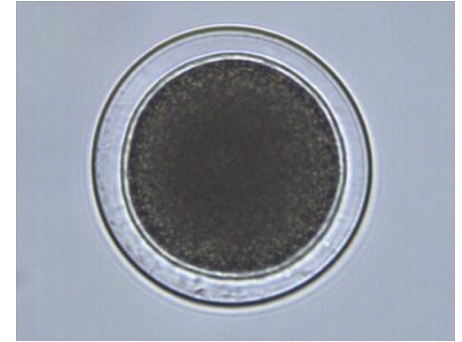


Sperm



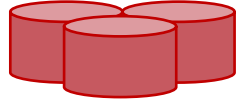
Eggs

**Successful
Fertilization**





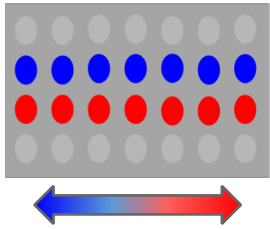
2. Raise Them in Buckets With Varying pCO₂ Levels



Treatment	pCO ₂ (μatm)	pH
High pCO ₂	1136.4	7.65
Low pCO ₂	586.2	7.91



3. Introduce Heat Stress

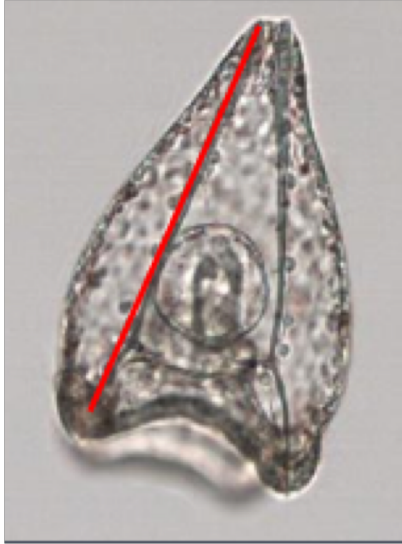


Alive / Dead?
Normal / Abnormal?

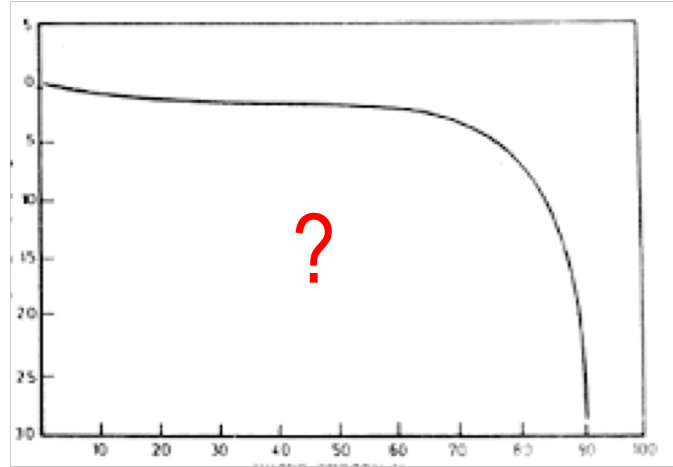


Cooler °C  Hotter °C

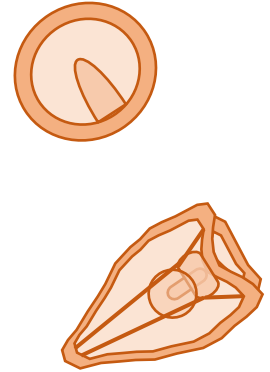
Parameters Measured



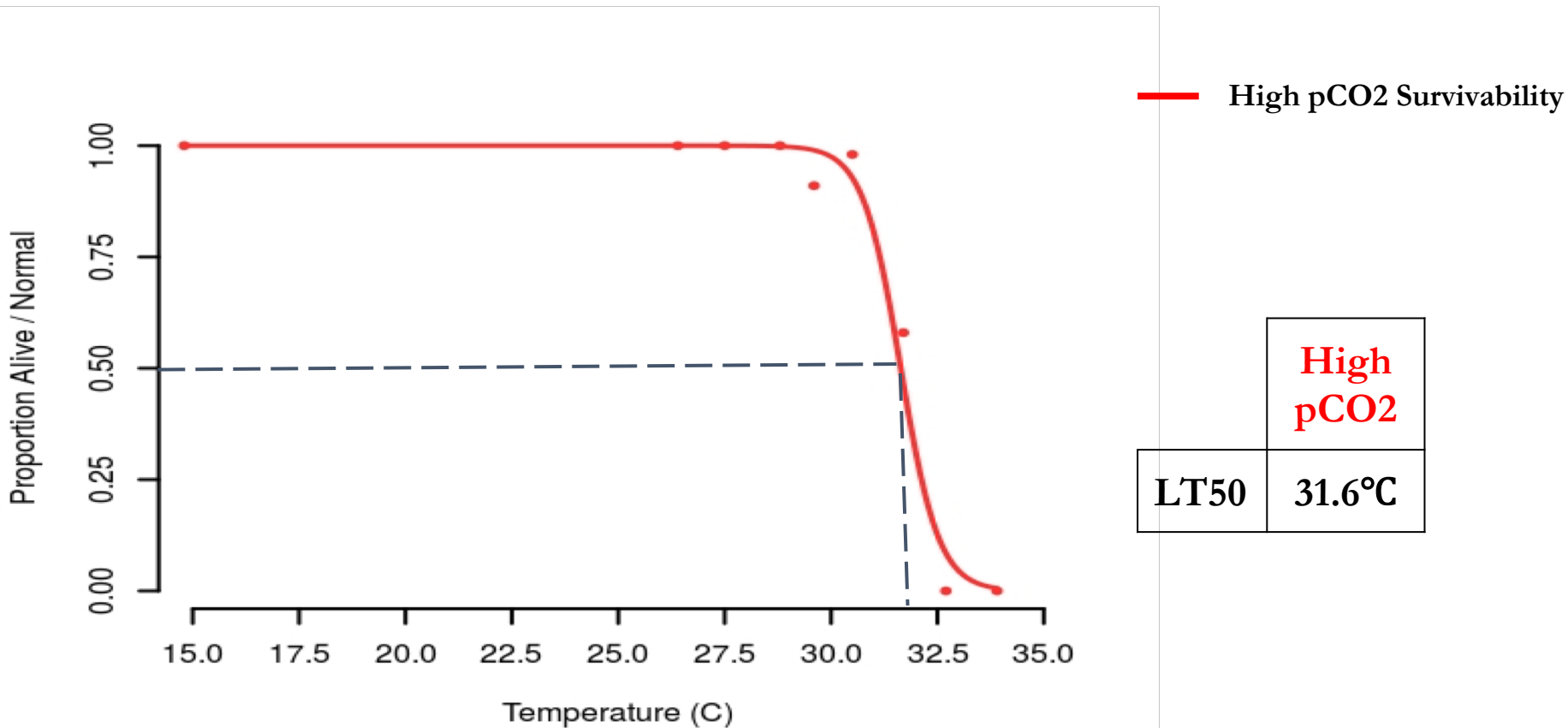
Morphology



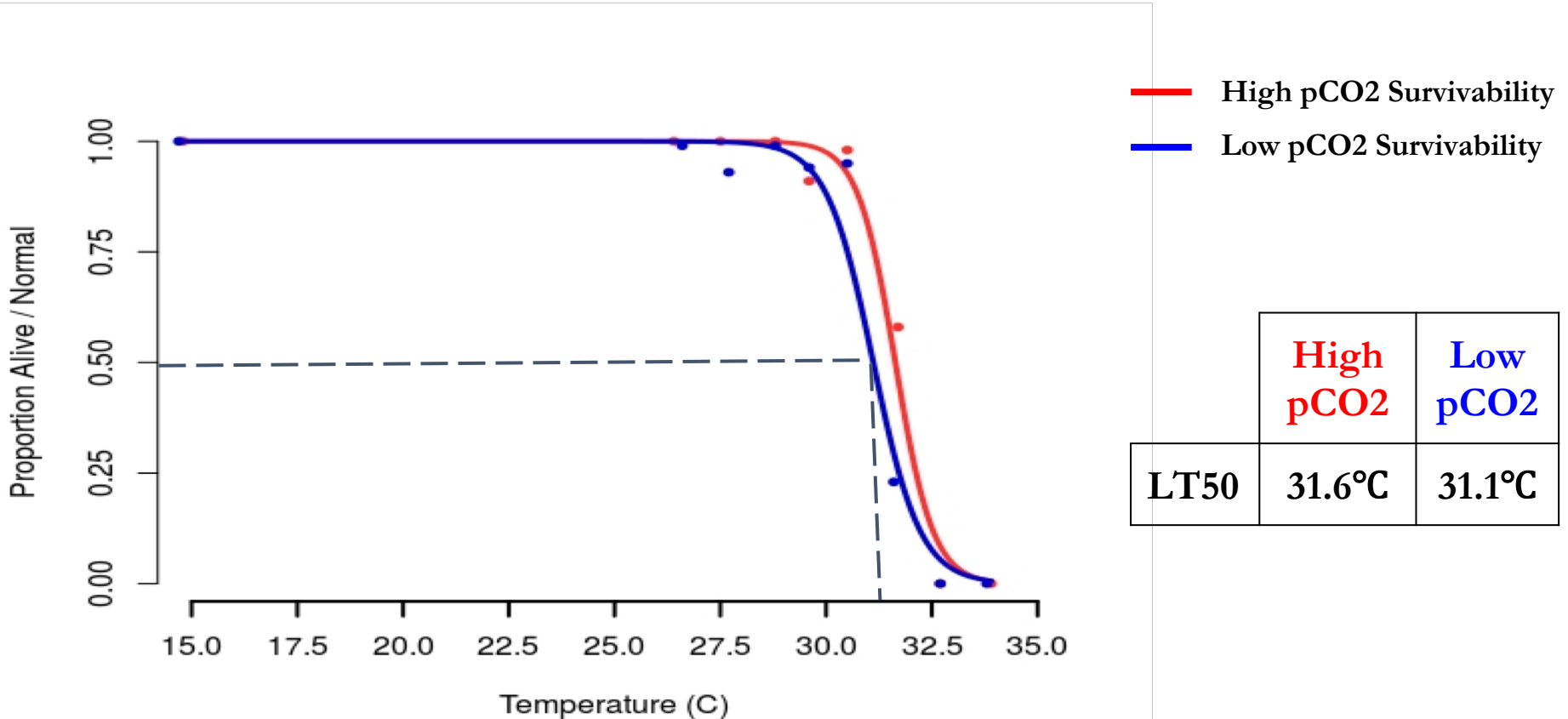
Thermal Tolerance



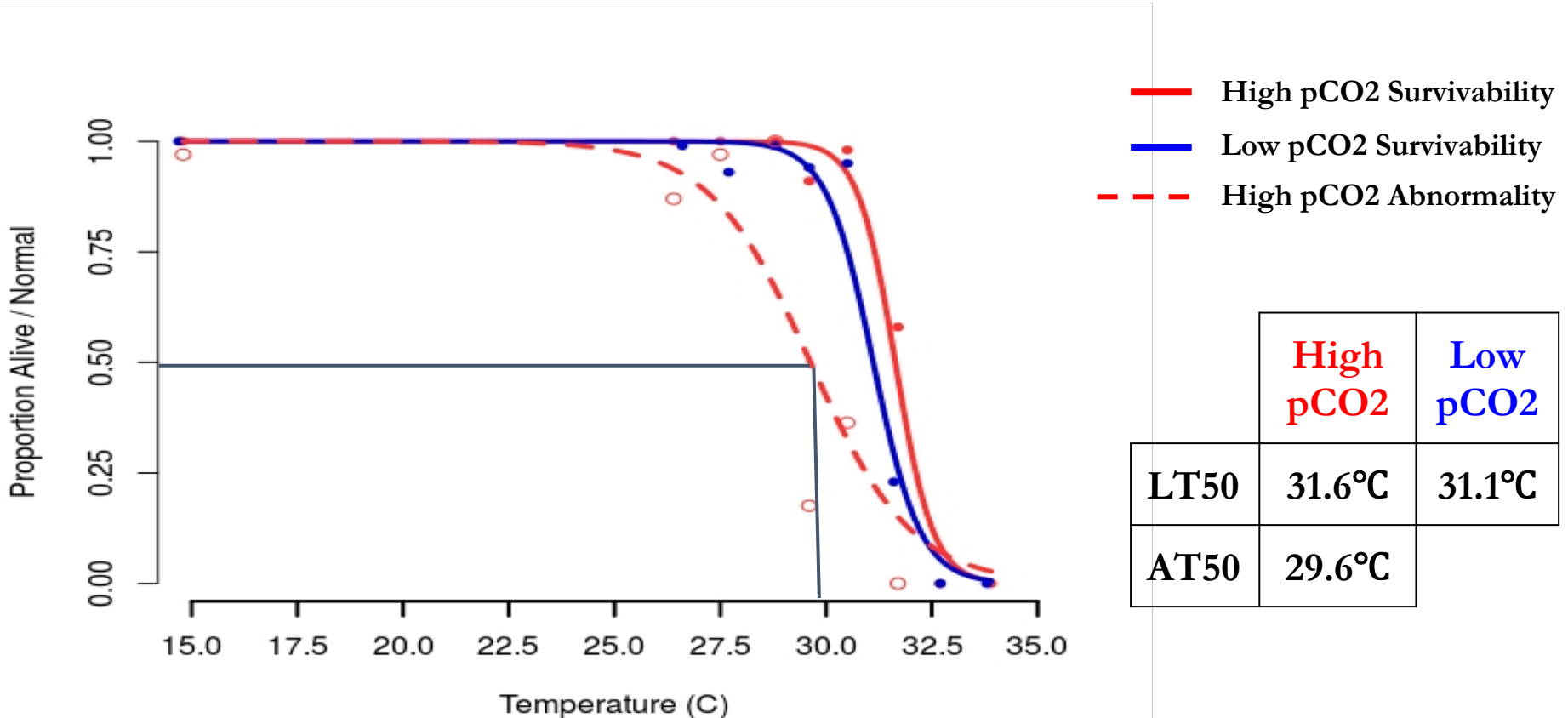
**Developmental
Success**



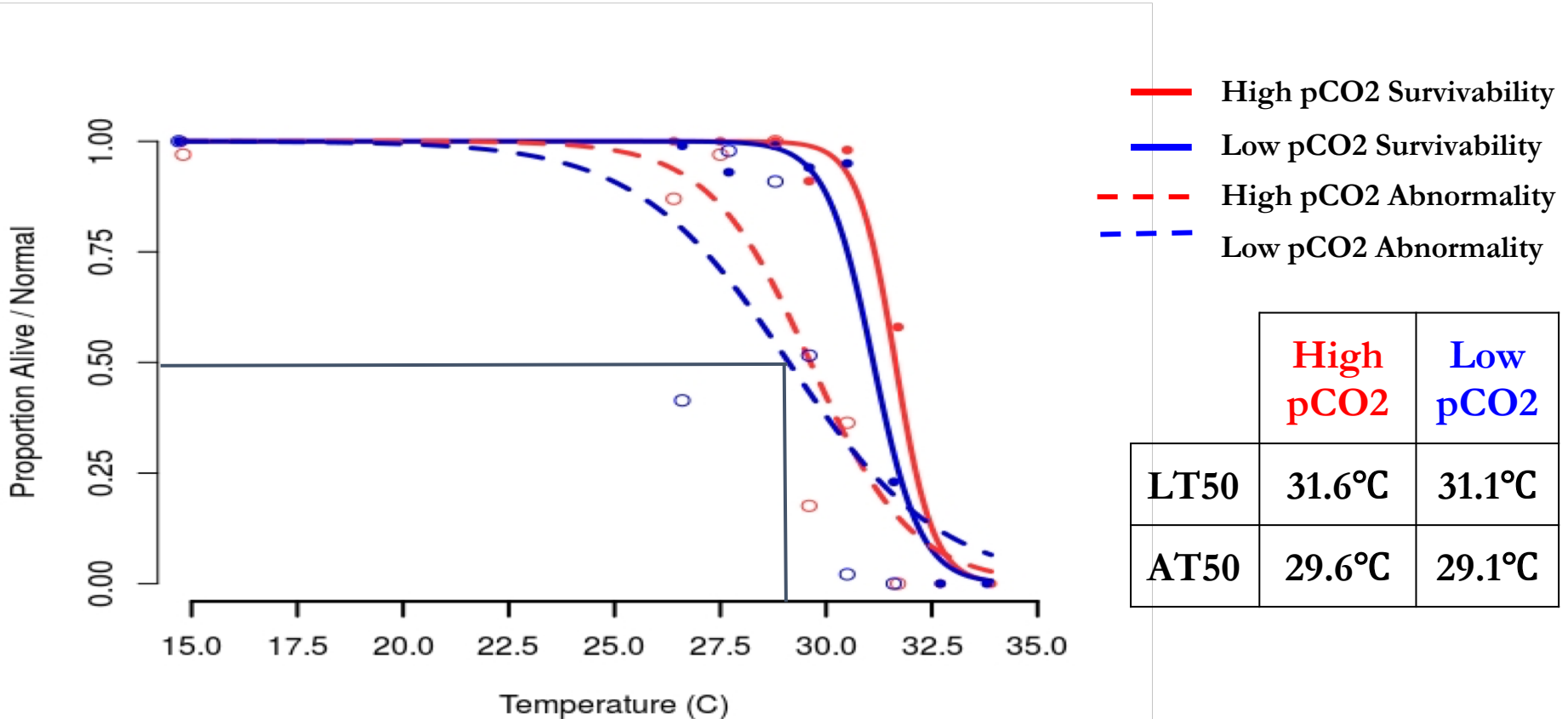
Individuals That Develop in More Acidic Conditions Show Higher Tolerance to Thermal Stress



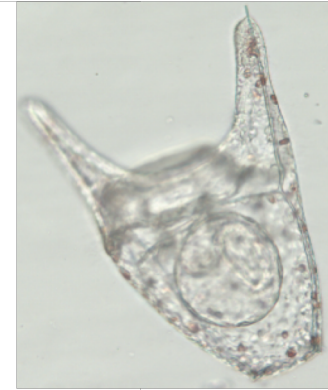
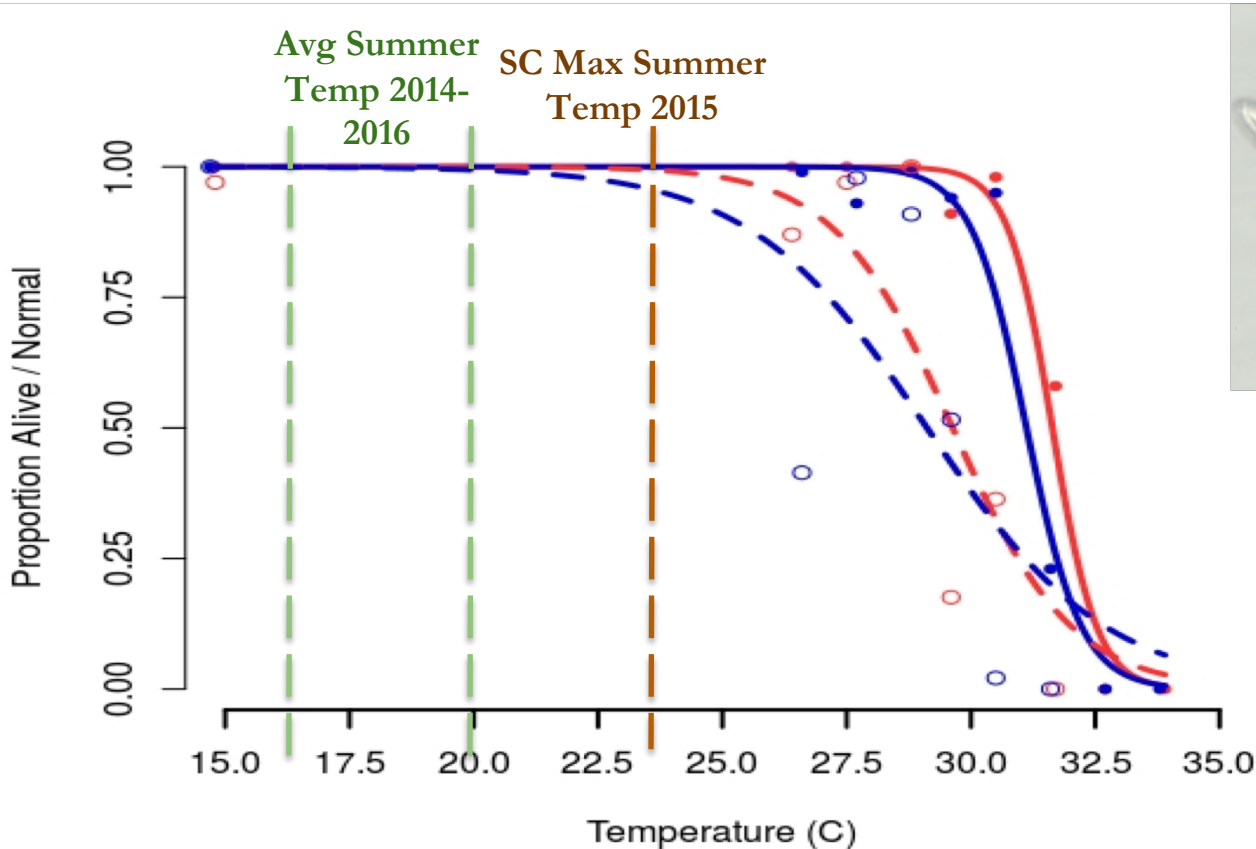
Individuals That Develop in More Acidic Conditions Show Higher Tolerance to Thermal Stress



Individuals That Develop in More Acidic Conditions Show Higher Tolerance to Thermal Stress



Relevance of Tolerance Under Warming Seas



Normal
Larvae



Abnormal
Larvae

Conclusions

- Urchins that developed under more acidic conditions had higher tolerance to a thermal stress event than those that developed under less acidic conditions
- Potential cross tolerance exhibited in urchin individuals
- Abnormal development may soon become prevalent with increase in the frequency of marine heat waves

Future Directions

- Analyze morphometrics data
- Explore other parameters such as gene expression, proteins, and lipids



Acknowledgments



Dr. Gretchen Hofmann



Terence Leach

