Research Proposal Defense:

The Ecophysiological Effects of Water Temperature and Ibuprofen on *Hemigrapsus oregonensis*

Jolee Thirtyacre, Jason Ray, Alexias Thao

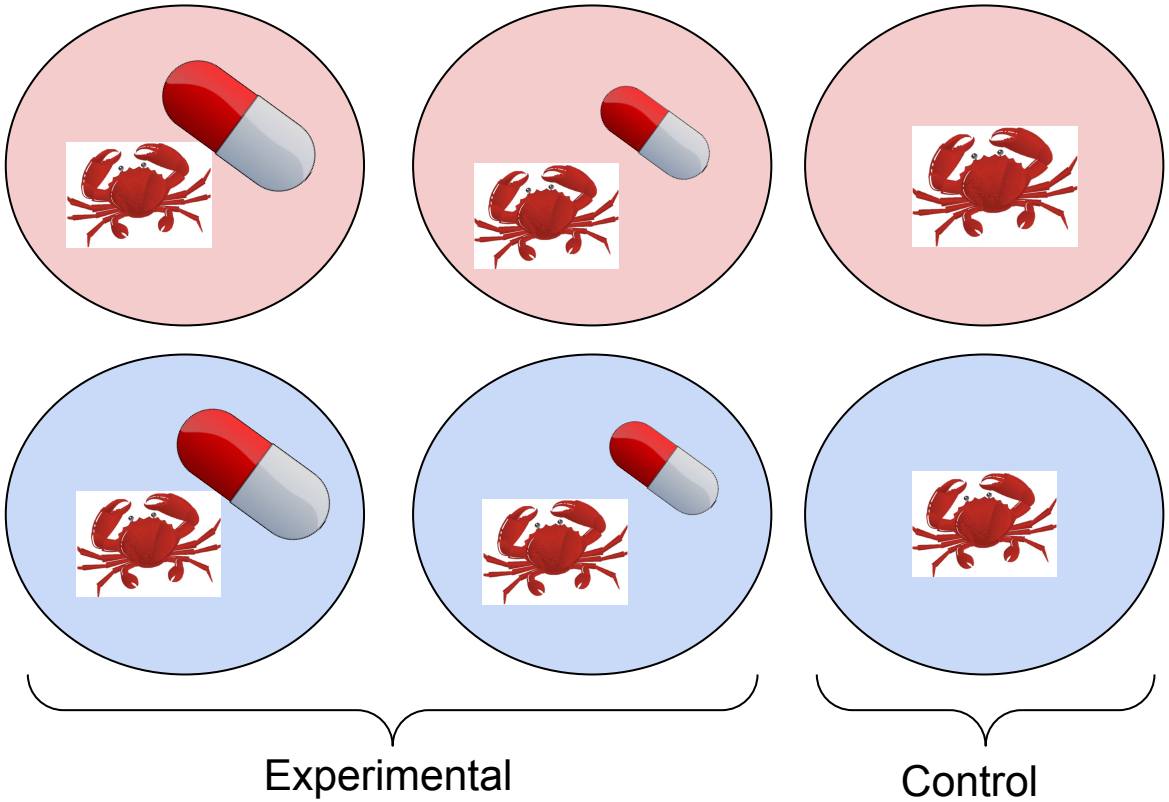
Background

- *Hemigrapsus oregonensis* as a species is known to have a broad physiological tolerance which makes it ideal for studying stress responses.
- Fernandes et al. (2021) explained that even though the presence of pharmaceuticals in aquatic environments has been known for years, only in the last 10-15 years have analytical methods had the capacity to test for environmentally relevant concentrations of the pharmaceuticals.
- Mezzelani et al. (2016) detected the presence of Non-Steroidal Anti-inflammatory drugs in wild mussel tissue in a coastal area not affected by industrial pollution.
- Berezina et al. (2021) found increased oxygen consumption in a freshwater amphipod exposed to environmentally relevant concentrations of NSAIDS.
- Blasco & Trombini (2023) found a marine invertebrate showed a decrease in respiratory rate when exposed to NSAIDS.
- Eshky et al. (1996) found that when a crab species was exposed to increased water temperature it had an increased oxygen consumption rate.
- Stress at the individual level could scale up and affect mortality, behavior and ecosystem structure.
- “If crabs can’t respire or feed–What does that mean for the rest of the ecosystem?”

Research Questions

1. How will increasing concentrations of ibuprofen affect **glucose** and **respiration** rates in *H. oregonensis*?
2. How will an increase in temperature affect **glucose** and **respiration** rates in *H. oregonensis*?
3. How will the combined effects of ibuprofen concentrations and increased temperature affect **glucose** and **respiration** rates in *H. oregonensis*?

Experimental Design



High Temperature

Ambient Temperature

Ibuprofen - environmental dose (0.02 µg/L)

Ibuprofen - high dose (0.1 µg/L)

3 replicates
6 crab in each

Hypotheses

Null Hypothesis(Ho):

Ho1: Ibuprofen has no effect on respiration and glucose levels

Ho2: Increased temperature has no effect on respiration and glucose level

Ho3: There is no interaction between ibuprofen and temperature on respiration and glucose levels

Alternative Hypothesis(Ha):

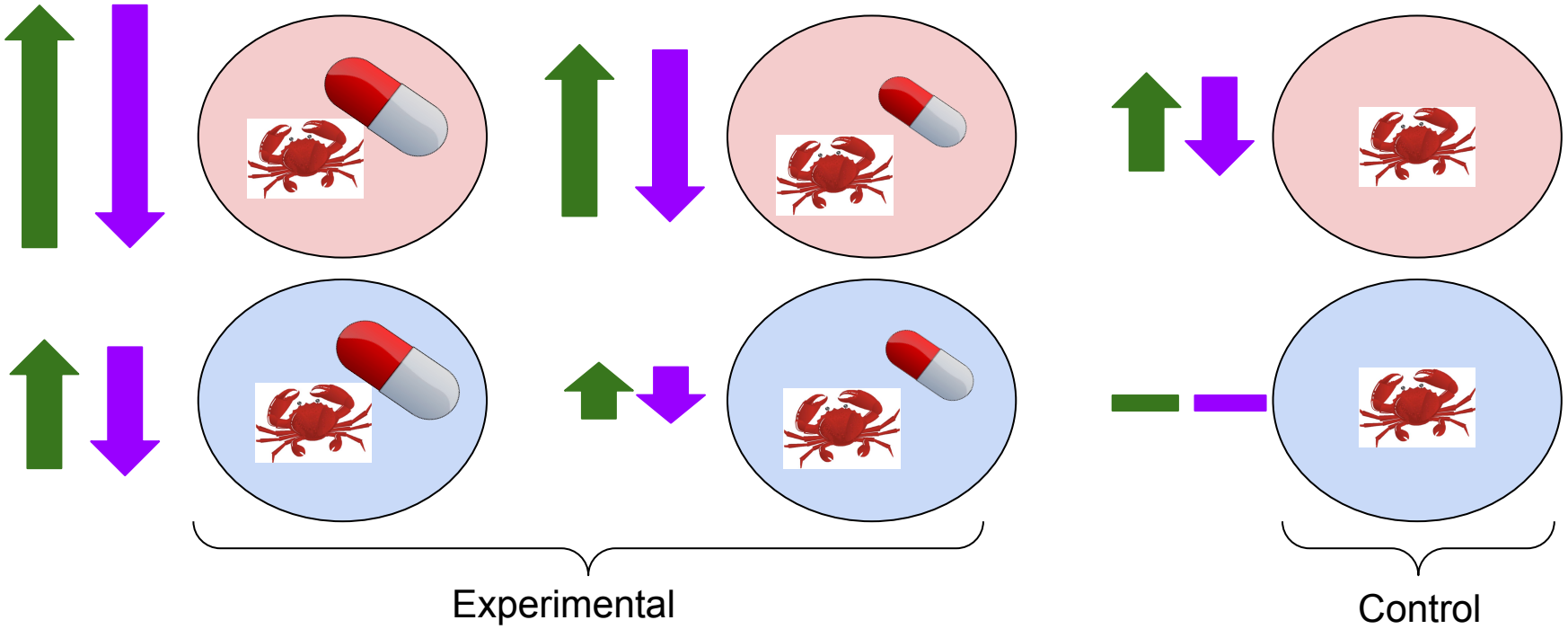
Ha1: Ibuprofen exposure causes increased respiration and a decrease in glucose levels

Ha2: Increased temperature causes increased respiration and a decrease in glucose levels

Ha3: Ibuprofen exposure and increased temperature have an additive effect on respiration and glucose levels

Glucose
Respiration

Hypotheses



Justification

- Ibuprofen
  - Affordable and accessible
  - Levels: 0.0217 µg/L (Salish Sea value) and 0.1 µg/L
- Temperature
  - Increase temperature due to climate change
  - Levels: 8.5℃ (Puget Sound SST) and 20℃
- Respiration
  - Increased temperatures raise metabolic rate → higher oxygen consumption
- Glucose
  - Will indicate change in metabolic rate and energetic cost within the different environments

Timeline

- 3 weeks of data collection
- Glucose measurements:
  - Wait until the end to gather from hemolymph – do not want to accidentally kill crabs before data gathering is done
  - Able to see difference between treatments
- Oxygen consumption/respiration:
  - Weekly data collection of water – use respirometry with resazurin
  - Able to see not only difference between treatments but possibly the change of oxygen consumption overtime within treatments

Real World Relevance

- Climate change
  - Affecting all marine organisms
  - Increasing temperature → increased metabolic demands and reduction of oxygen availability
- Pharmaceutical pollution
  - Water being put into the ocean are not being treated for NSAIDs that are affecting organisms
  - Affecting marine organisms that live on/near the shore (like crabs!) and organisms that move near the shore (like fish)
- Understanding how other organisms will be affected by NSAIDs
  - Crabs are early signals to these challenges as they are in close contact with NSAIDs and are experiencing temperature changes the fastest by living on the shore

References

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