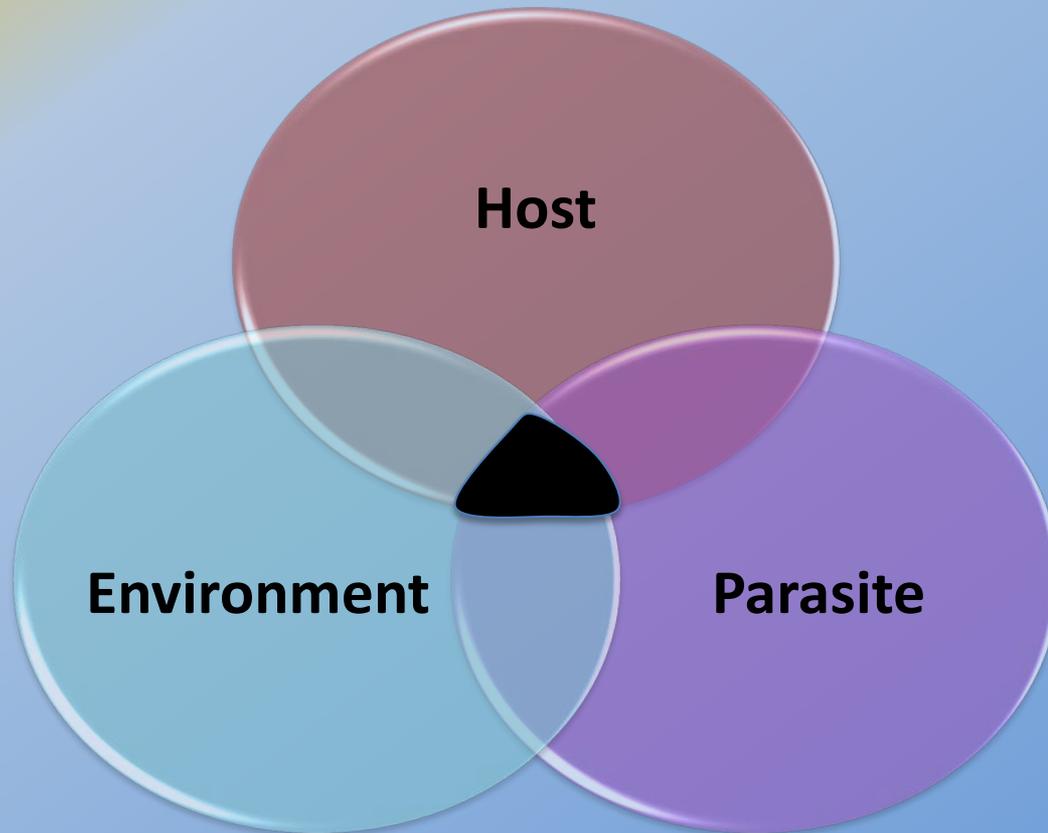


Predator effects on host-parasite
interactions in the eastern oyster,
Crassostrea virginica

Jennafer Malek, PhD
Knauss Fellow
Marine Mammal Commission

NOAA Brown Bag Seminar
December 15, 2016



Environment and Host-Parasite Interactions

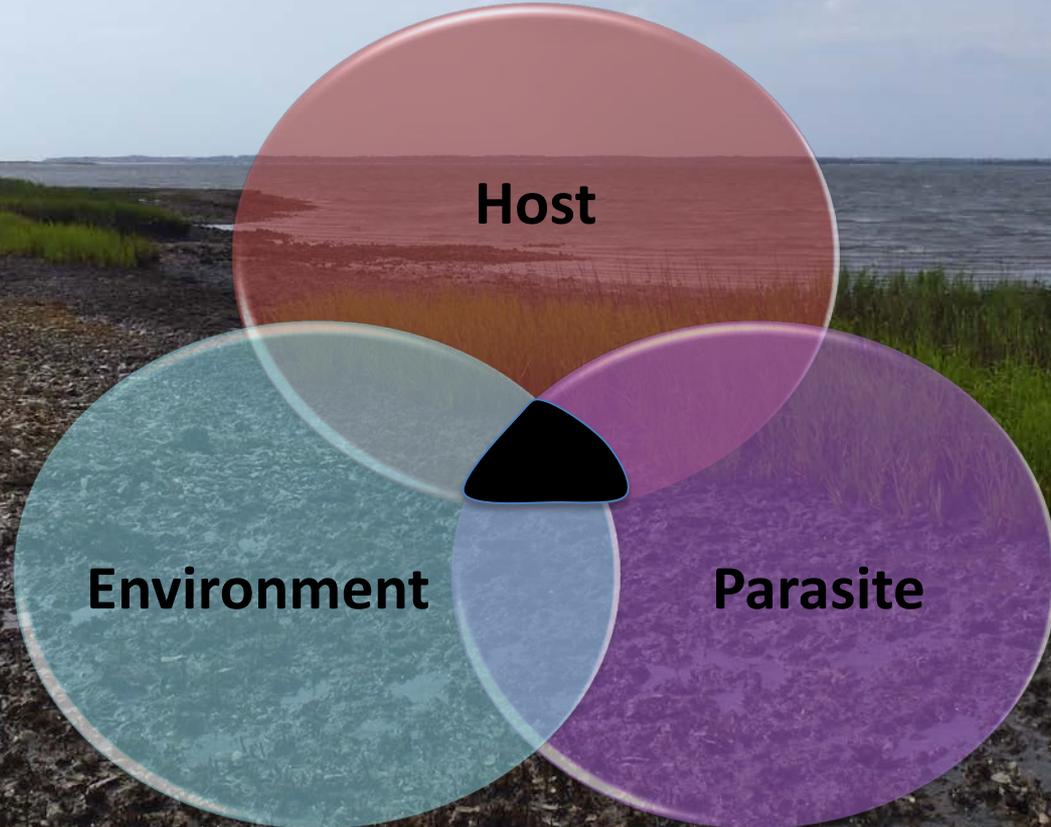
- Species ranges
 - Temperature
 - Precipitation
 - Salinity
- Biological processes
 - Metabolism
 - Immune response
 - Reproduction



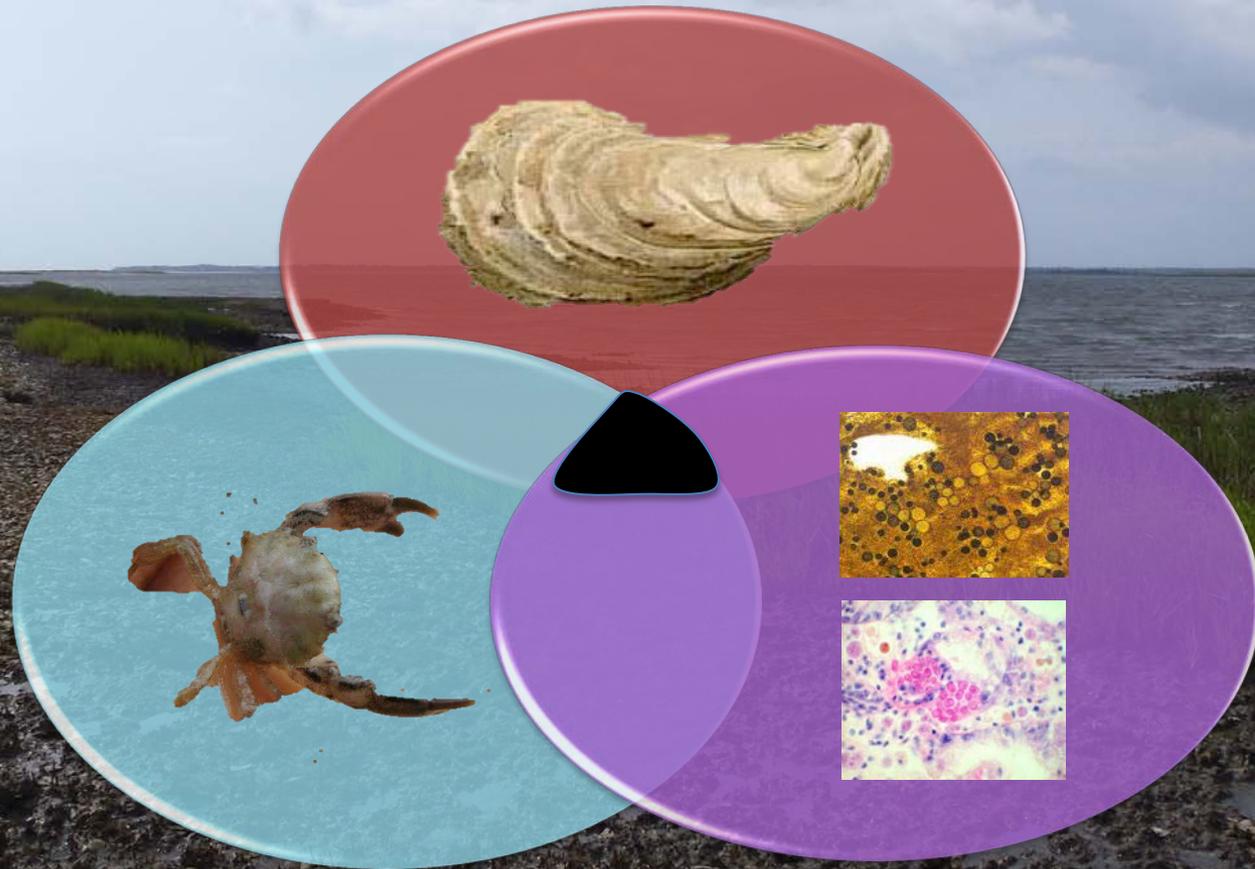
Environment and Host-Parasite Interactions



Big Picture Question: How do environmental factors influence host-parasite interactions in coastal communities?



How do environmental factors influence host-parasite interactions in coastal communities?



Predator Effects

- Direct effects
 - Effects on prey through consumption



- Indirect Effects
 - Effects on prey traits
 - Behavior
 - Growth
 - Development

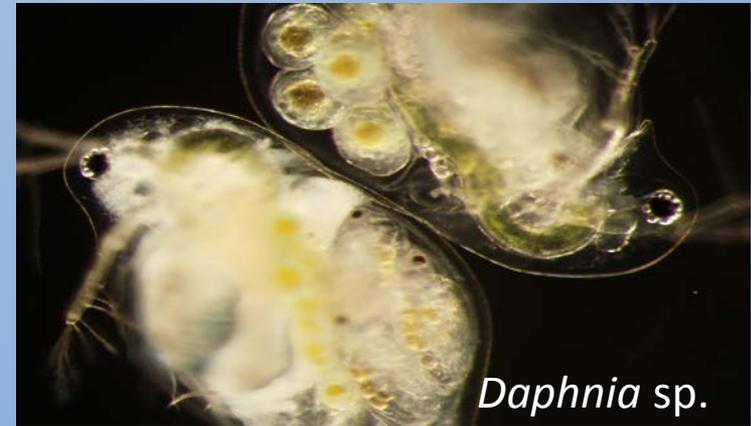


Elk & Wolves



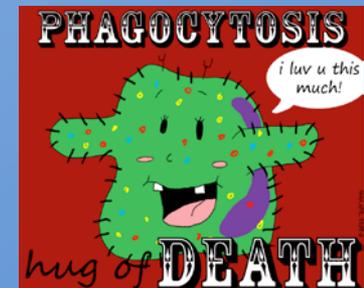
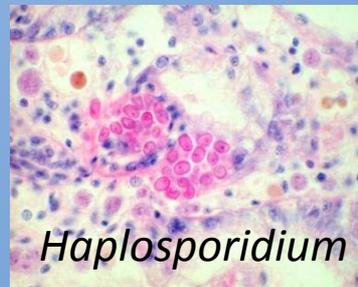
Predator Effects on Host-Parasite Interactions

- ‘Healthy Herd’
 - Predators decrease parasite prevalence by consuming infected hosts
- ‘Predator Spreaders’
 - Predators increase parasite transmission through consumption of infected hosts
- Alteration of host behavior or condition
 - Increase exposure to parasites
 - Reduce immune responses/
increase susceptibility to infection



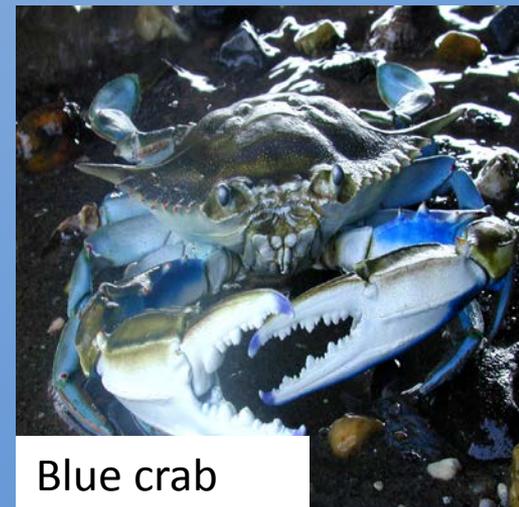
Research Questions

- Do oyster reef predators affect:
 - The probability of *Perkinsus* and *Haplosporidium* infection
 - The intensity of *Perkinsus* infection
 - Host immune response



Hypotheses

- Direct
 - Preferential feeding on oysters of a specific infection status
 - Increased or decreased parasite transmission
- Indirect
 - Reduced filtration
 - Reduced exposure to parasites
 - Increased retention of consumed parasites
 - Reduced resources for immune responses

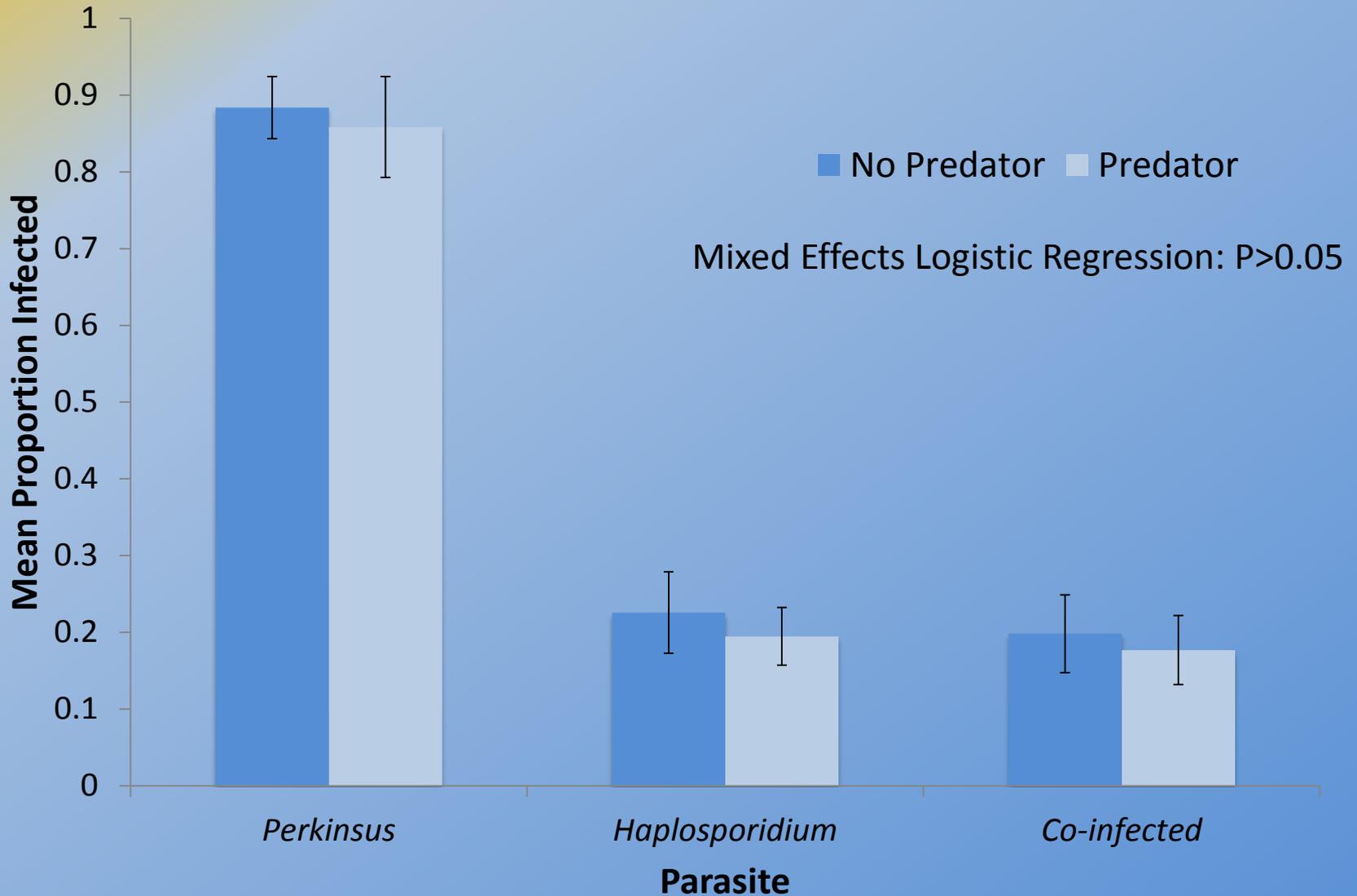


Methods: Field Experiment

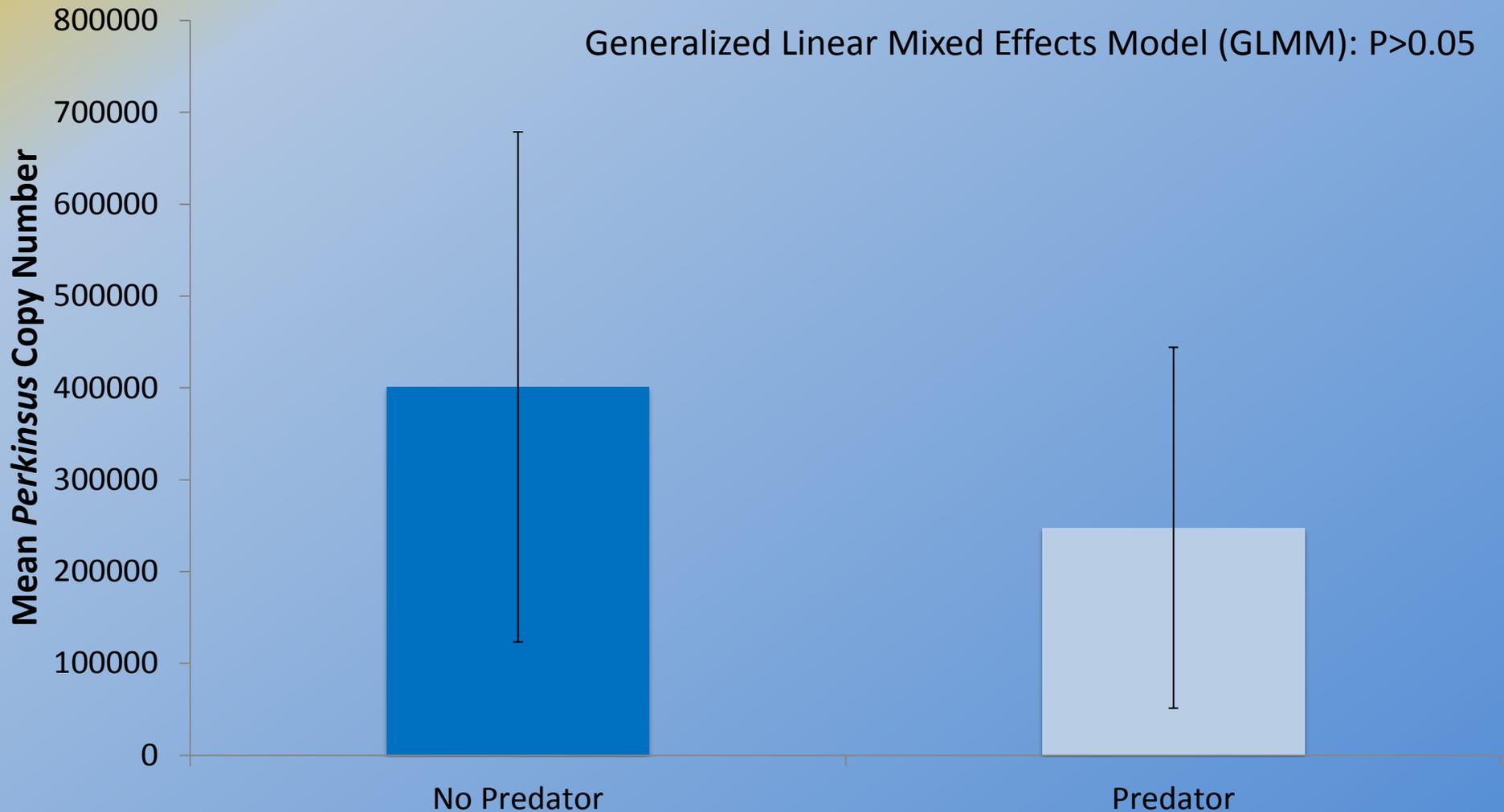
- 2 treatments:
 - ‘Predator’ – with mud crabs
 - ‘No Predator’ – without mud crabs



Do mud crabs affect the probability of parasite infection?

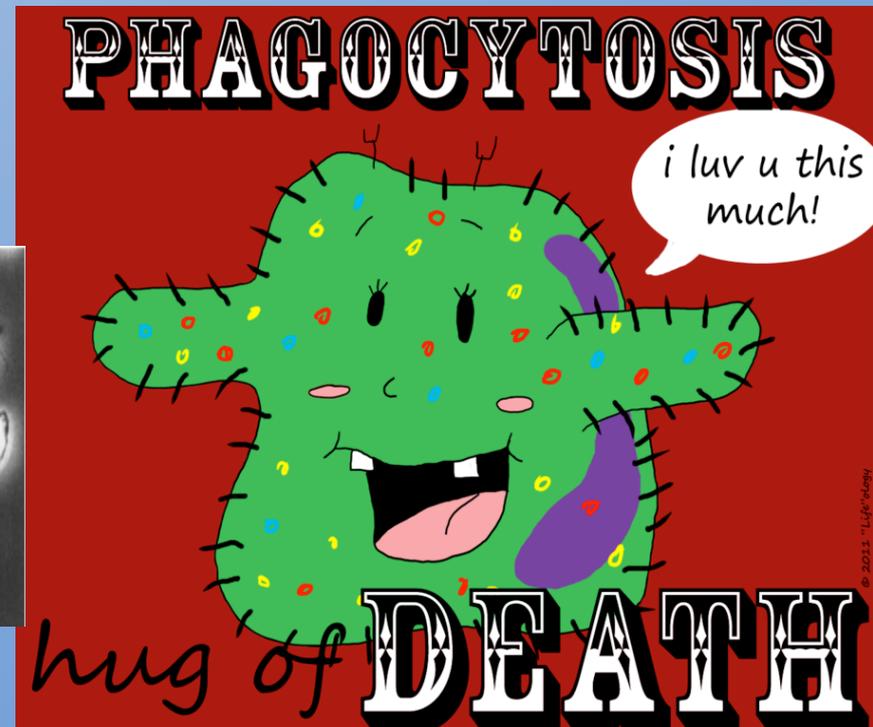
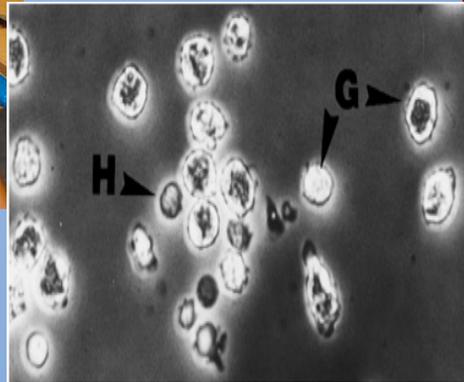


Do mud crabs affect *Perkinsus* infection intensity?



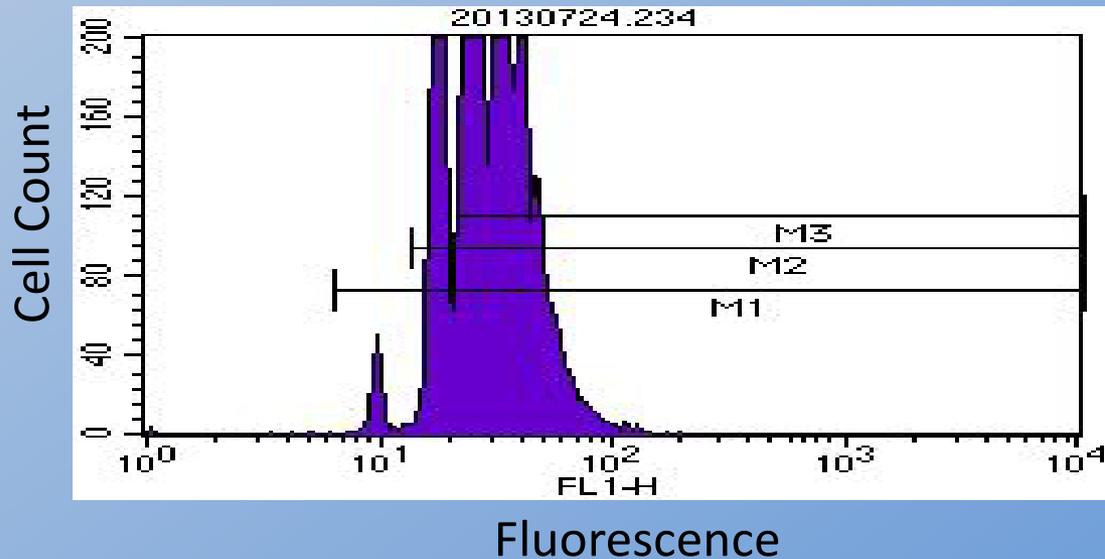
Host Immune Response

- Oyster hemolymph for phagocytic activity of oyster hemocytes: flow cytometry



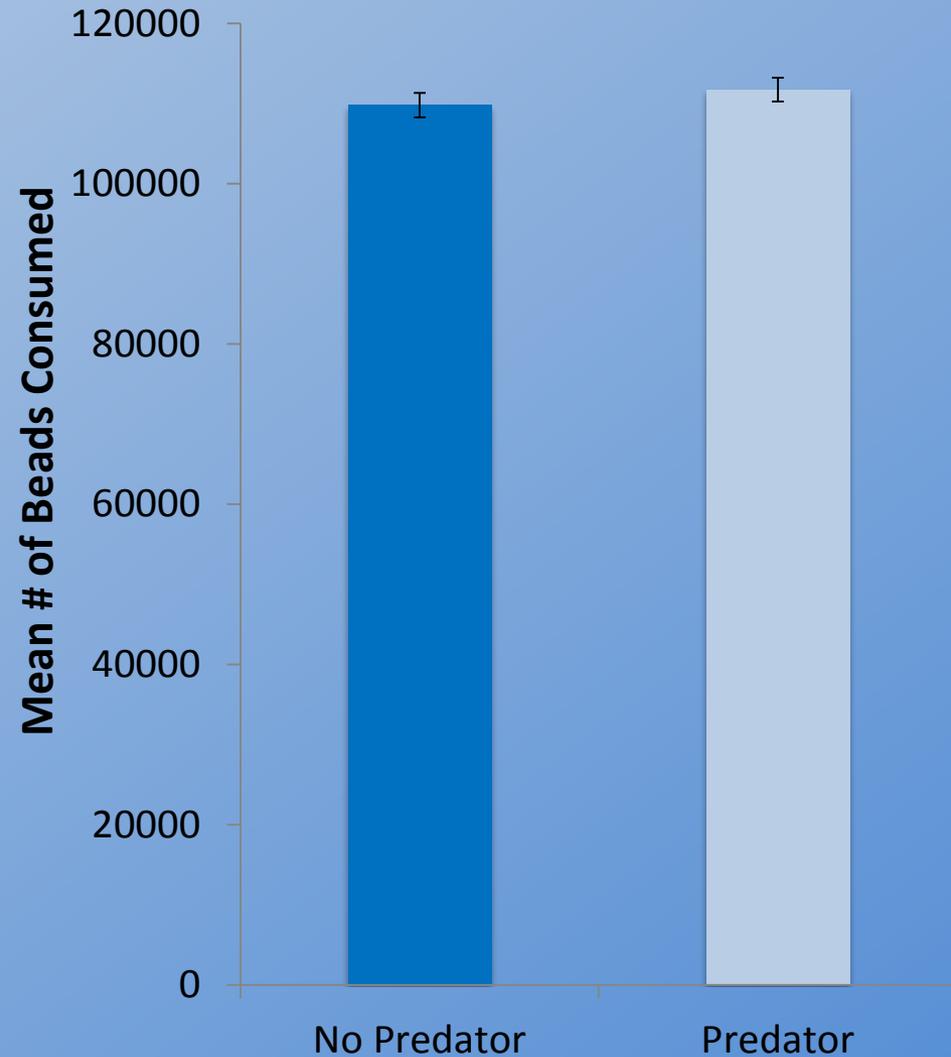
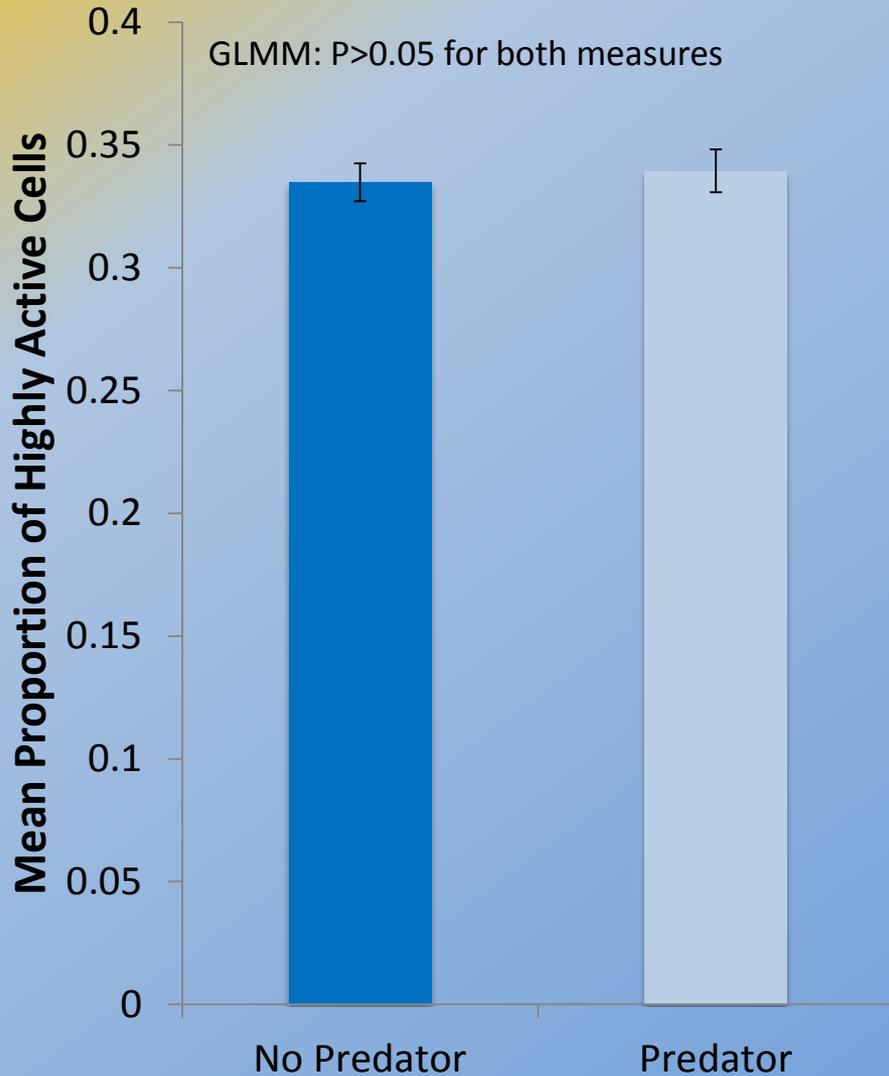
Host Immune Response

- Phagocytic activity
 - Proportion of highly active cells
 - Cells that phagocytized ≥ 3 beads



- Mean number of beads consumed

Do mud crabs affect host immune response?



Methods: Lab Experiment – Prey Choice

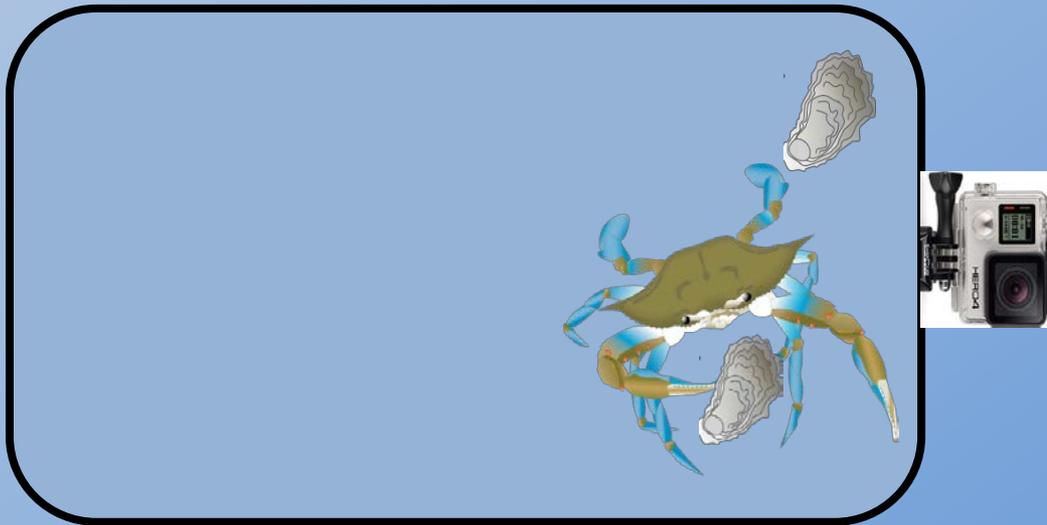
- Direct effects of blue crabs



- *Perkinsus* infection status

Methods: Lab Experiment – Prey Choice

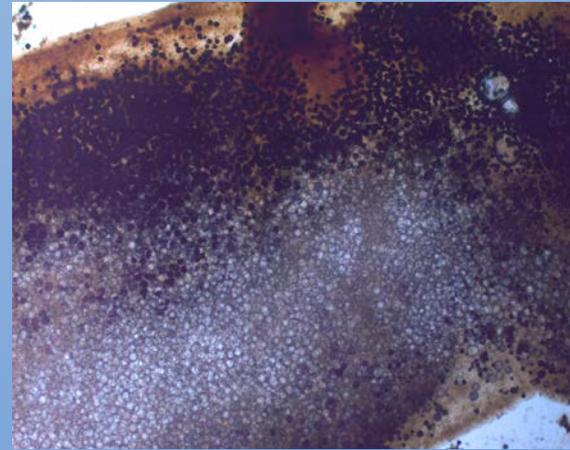
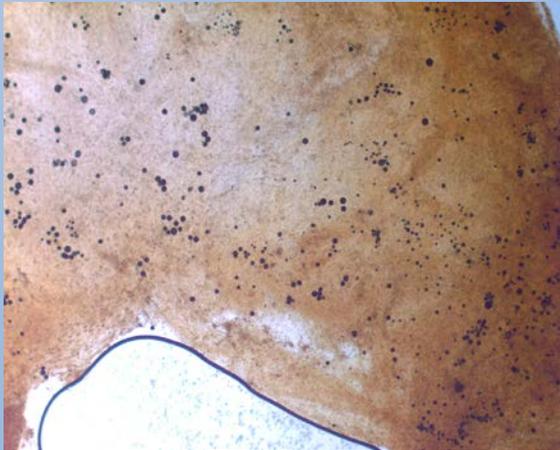
- Direct effects of blue crabs



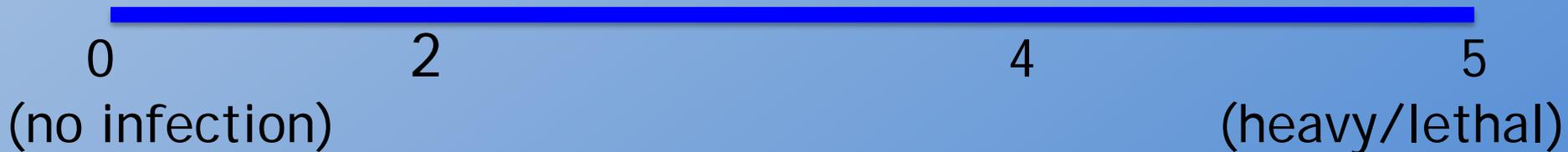
- *Perkinsus* infection status

Methods: Lab Experiment

- *Perkinsus* Assessment
 - RFTM Method: tissue collection/incubation
 - Measure of parasite prevalence and intensity



Mackin Scale



0

2

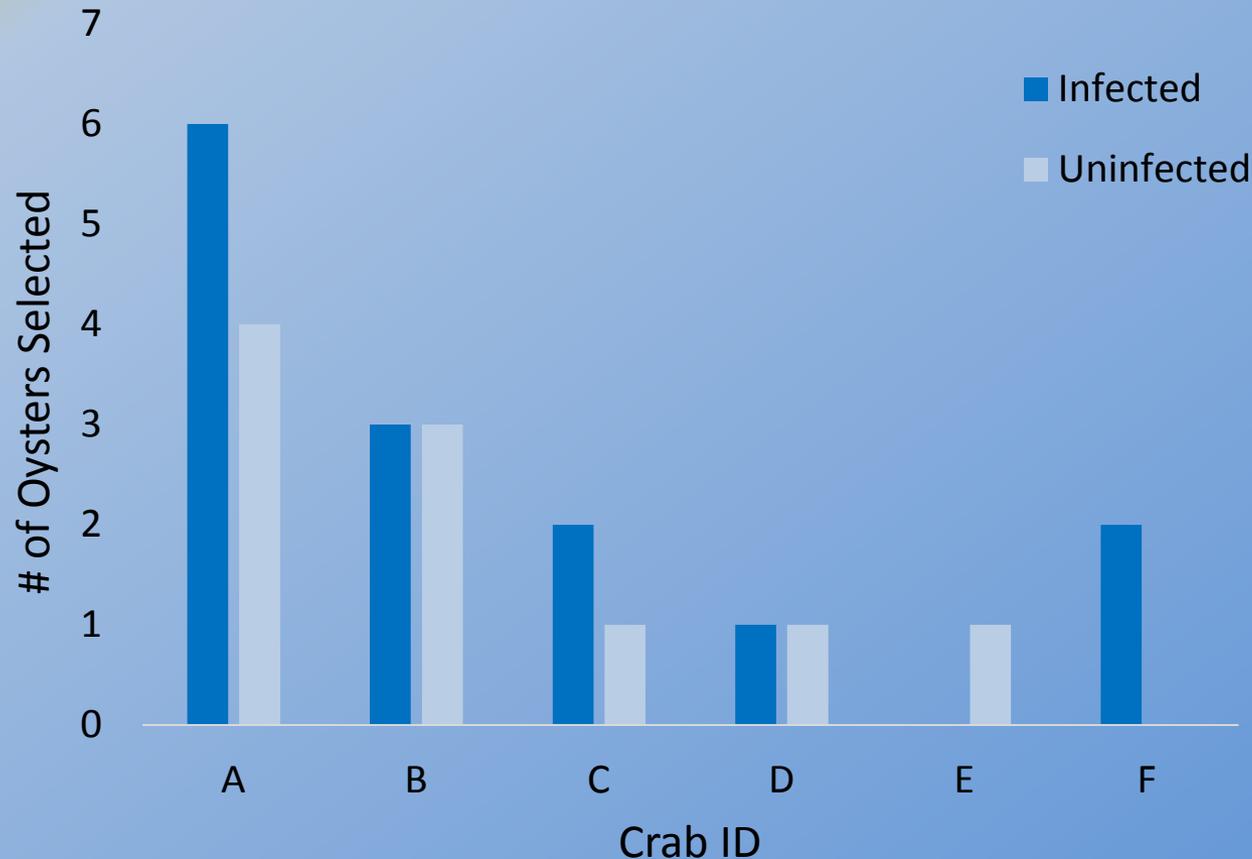
4

5

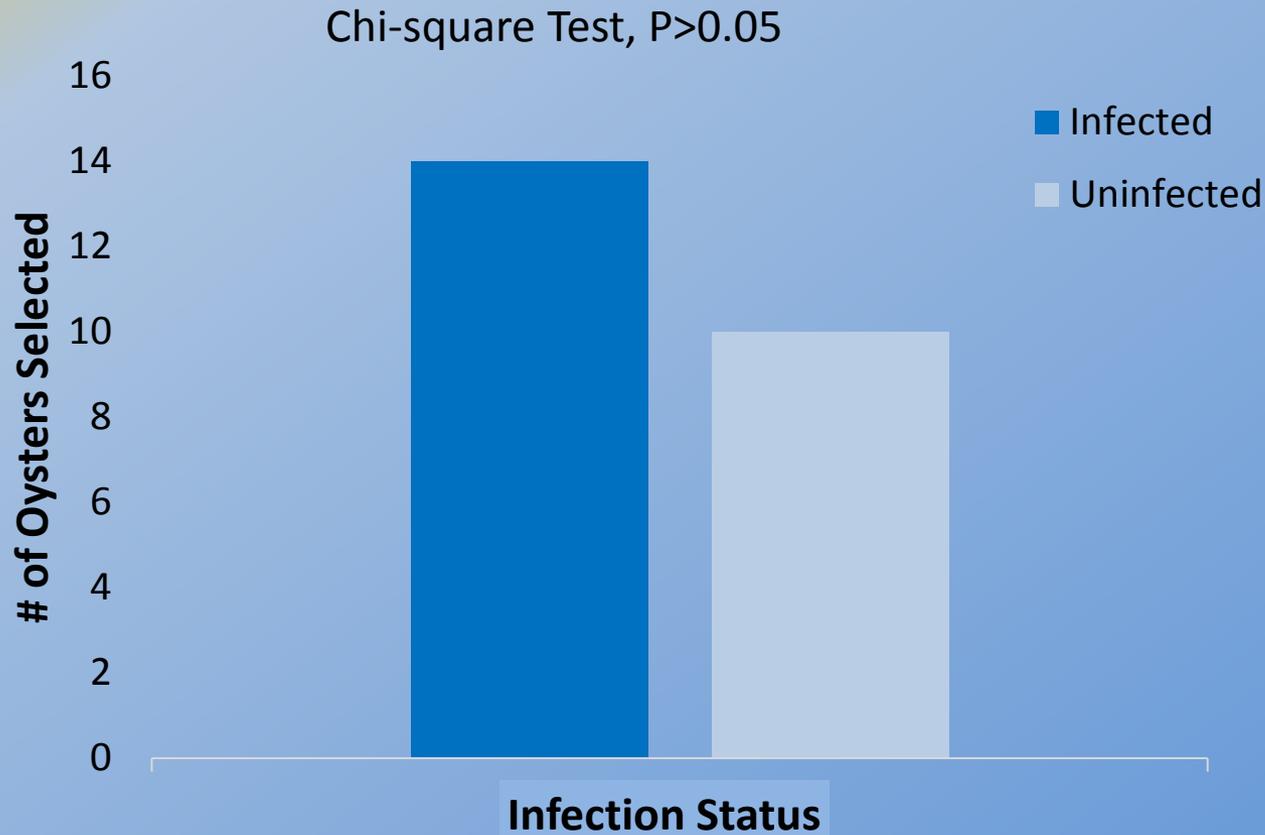
(no infection)

(heavy/lethal)

Do blue crabs choose prey based on *Perkinsus* infection status?



Do blue crabs choose prey based on *Perkinsus* infection status?

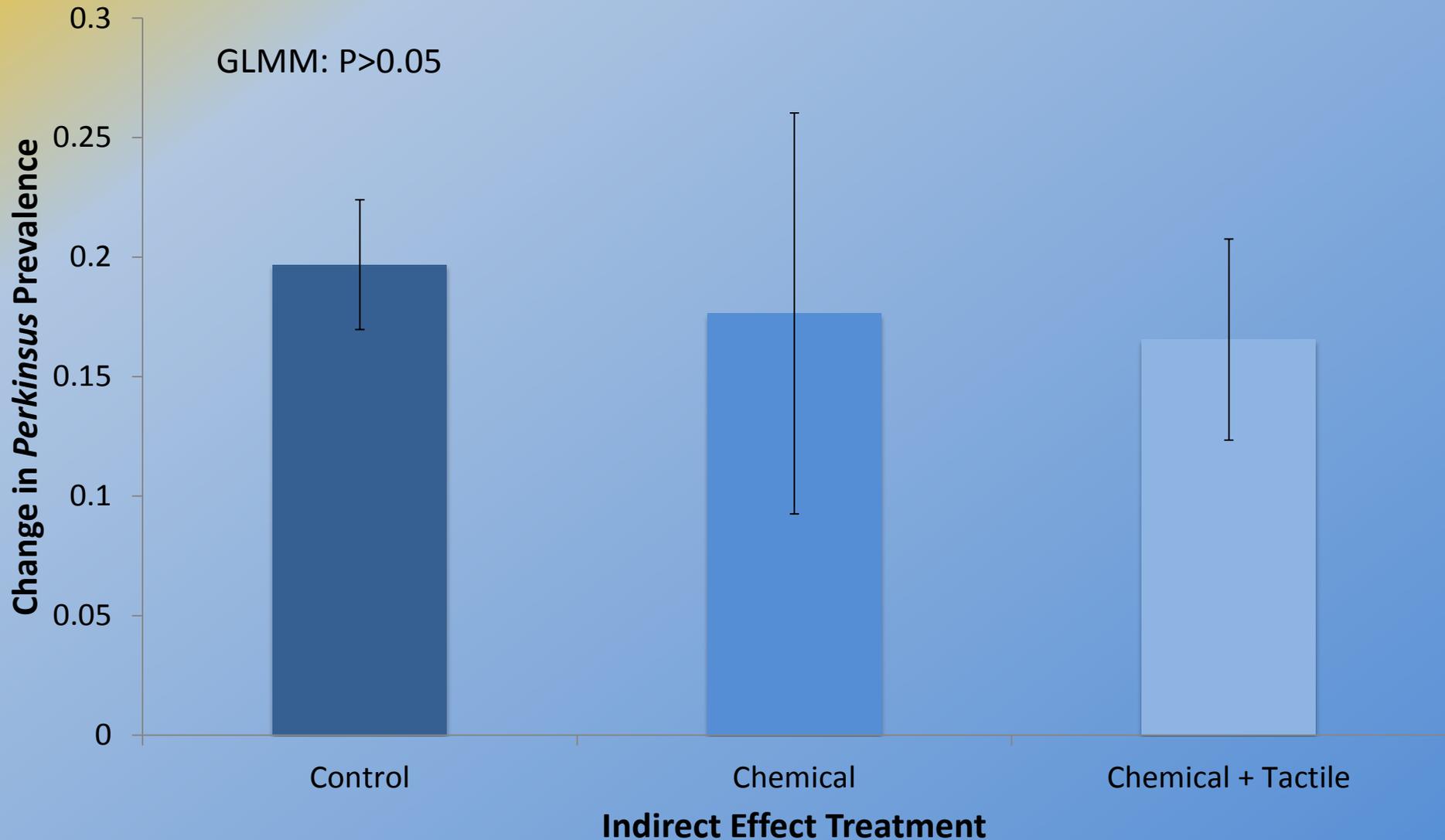


Methods: Lab Experiments

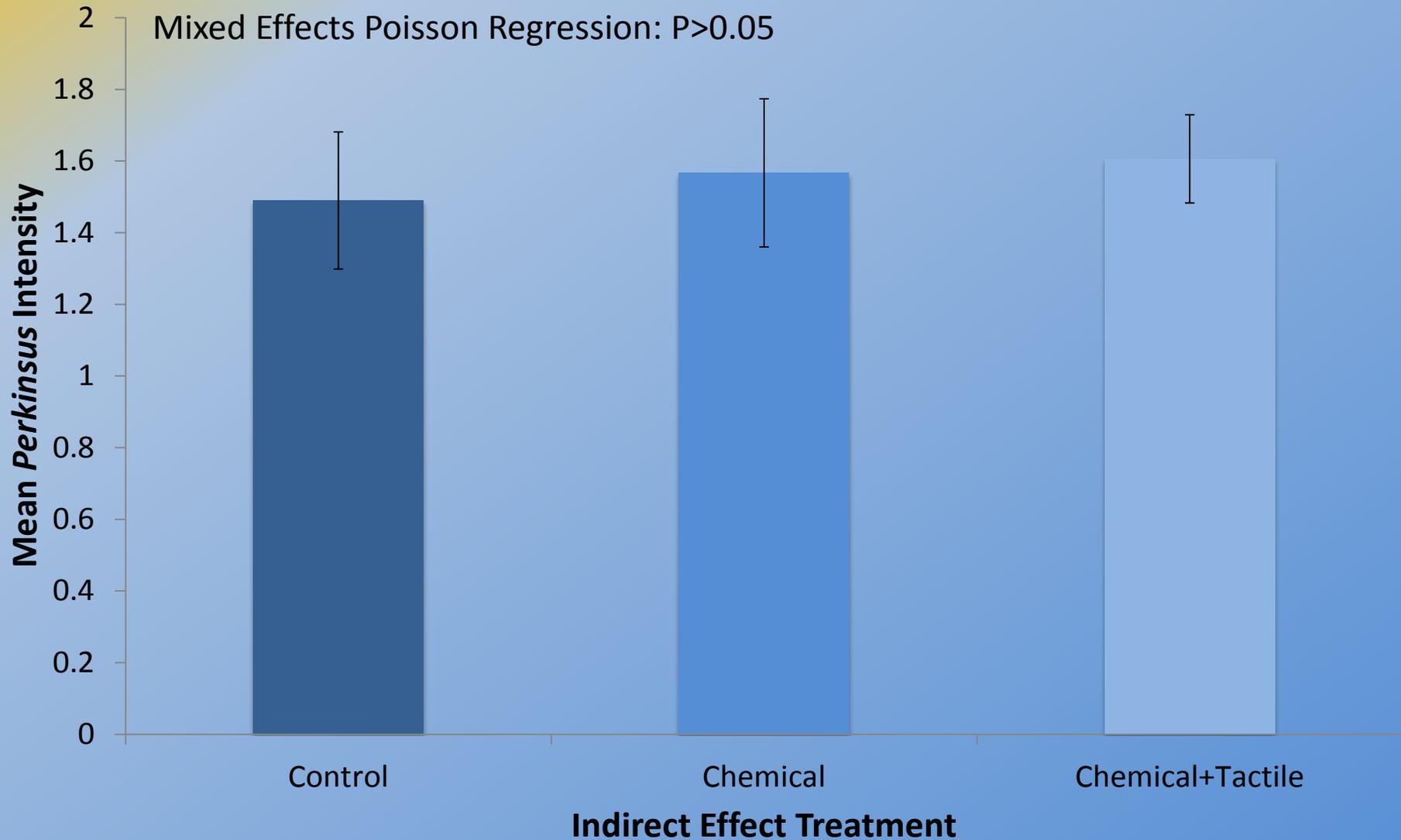
- Indirect effects of blue crabs
- 3 treatments
 - Oyster only control
 - Chemical: crab consuming non-focal oysters
 - Chemical + Tactile: crab consuming non-focal oysters + non-consumptive crab climbing on oysters



Do blue crabs affect *Perkinsus* infection transmission?



Do blue crabs affect *Perkinsus* infection intensity?



Conclusions

- Crab predators do not affect oyster-parasite interactions directly or indirectly



Implications

- Biotic environmental factors may not play as large of a role as abiotic factors in shaping oyster-parasite interactions
- Shifts in species ranges or trophic interactions may not affect oyster-parasite interactions

Big Picture

- Identifying which environmental factors influence oyster-parasite interactions
 - Water temperature
 - Salinity
 - Weather events
 - **Tidal elevation**
 - **Air temperature**
- Help inform future research, management, & policy



Beyond oysters...

- Better understanding of how environment can shape host-parasite interactions
 - Influence of abiotic vs. biotic factors
- Highlights importance of studying environmental effects on host-parasite interactions in ecosystem engineers and the ecosystems they create



- Special thanks to:
 - Martha Sanderson
 - Meghan Tait
 - Nancy Stokes
 - Ryan Carneige



Questions?



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