Do Scavengers Influence Dermo Disease (*Perkinsus marinus)* Transmission Among Delaware Bay Oysters?

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Introduction

Perkinsus marinus is a protozoan endoparasite of the Eastern oyster (*Crassostrea virginica*), and is responsible for Dermo disease, which is prevalent in oyster populations from Maine to Florida and into the Gulf of Mexico (Ford 1996). Transmission of the parasite is typically direct; *Perkinsus* is released by decay of tissue from infected oyster hosts into the water column to be filtered by new hosts, a process known as passive shedding (Ray 1954, see Figure 1, pathway A). In 1962, Hoese demonstrated that scavengers could facilitate transmission after feeding upon Dermo-infected oysters, but few studies have investigated the importance of such trophic interactions. As Hoese (1962) demonstrated, there may be other processes at work, such as the actions of scavengers (Figure 1, pathway B). The object of this research is to separate the effects of scavengers and determine if they have a significant effect on *P. marinus* transmission.

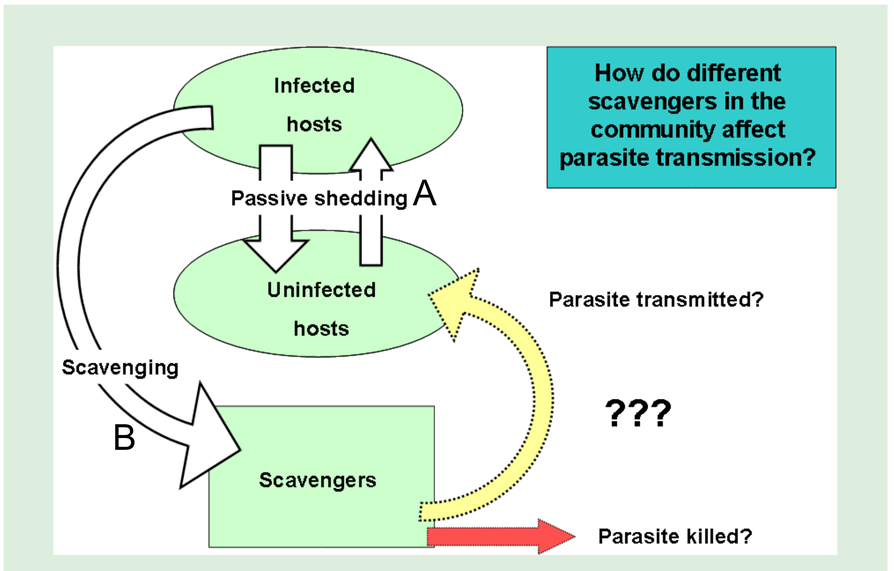


Figure 1: Simplified box model demonstrating possible fates of *Perkinsus* when consumed by a scavenger, and how it might affect overall transmission.

The Players

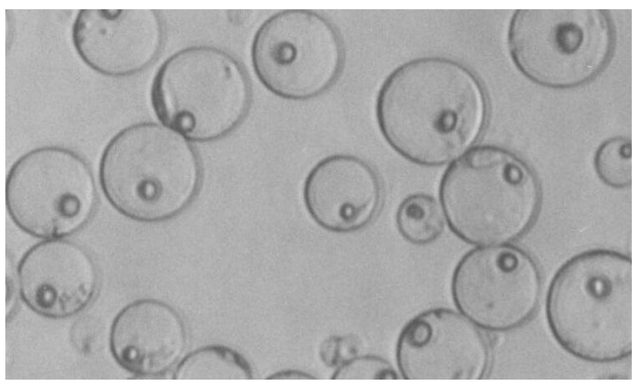
This project focuses on the actions of common reef species that are known to scavenge dead or moribund oysters. Based on observations of captive animals, the crustaceans and fish tend to tear oyster tissue apart during rapid consumption, while the snails cover the tissue and graze slowly, but steadily. These differences in feeding behavior between scavenger types may alter the number of parasites either released into the water through tearing, or removed from the system through digestion.

Blue crab (*Callinectes sapidus*)

Mud snail (*Ilyanassa obsoleta*)

Black-fingered mud crab *(Panopeus herbstii)*

Mummichog (*Fundulus heteroclitus*)



Perkinsus marinus cells (meronts) in culture.

Hypotheses

1) Null: The presence of scavengers has no effect on the rate of parasite transmission.

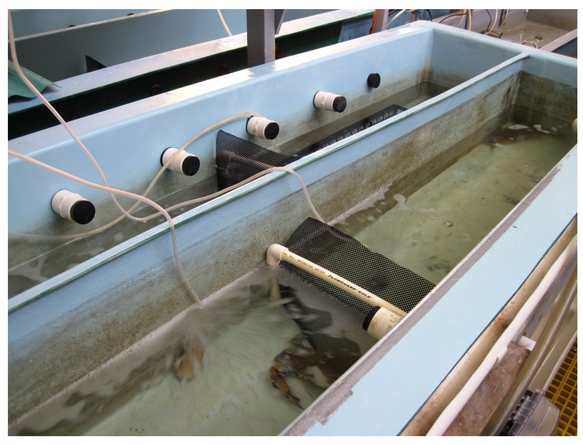
2) Alternate: The presence of a scavenger alters the rate of parasite transmission. Composition of the scavenger community will determine their overall effect on transmission.

Methods and Design

- Eight treatments (Figure 2) run simultaneously at 20 psu and 25°C
  - 2 months duration
- Quantification of parasite burdens:
  - Subsamples of fed tissue (Bushek et al. 1994)
  - Pre-challenge hemolymph sampling of SPFs (Gauthier and Fisher 1990)
  - Sacrificial body burdens (Bushek et al. 1994) at termination

Infected oyster meals (Treatment)	Uninfected oyster meals (Control)
2 Blue crabs	2 Blue crabs
10-15 mud crabs 100 mud snails	10-15 mud crabs 100 mud snails
20 mummichogs	20 mummichogs
No scavengers (positive control)	No Scavengers (negative control)

Figure 2: The physical setup of experimental treatments. Each of the eight treatments also contained a tray of 30 SPF (specific pathogen free) oysters that were assayed for accumulated parasite burden at termination.



Results

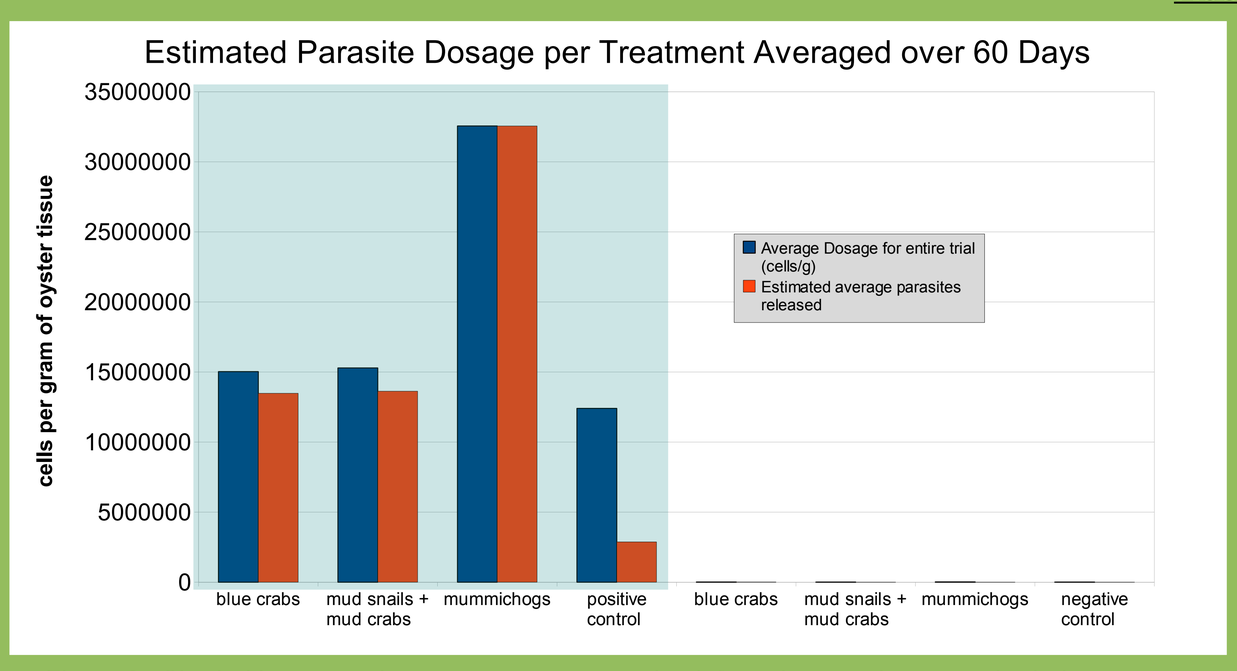


Figure 3: Shaded box comprises treatments exposed to infected oyster tissue; unshaded treatments were given uninfected oyster tissue. Blue bars (total average parasite dosage), are calculated from body burdens of fed tissue subsamples taken before every feeding. Red bars (estimated transmission potential) are based on the percentage of fed tissue remaining in tanks after approximately 24 hours.

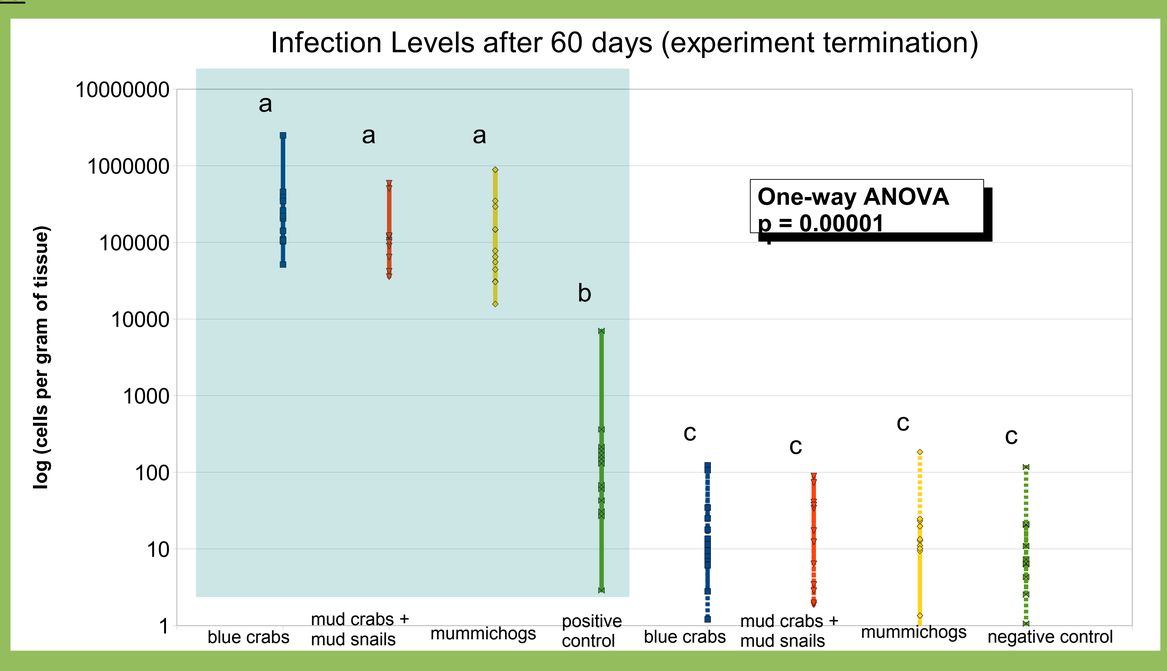


Figure 4: Shaded box comprises the treatments exposed to infected oyster tissue; unshaded treatments were given uninfected oyster tissue. All values of parasite burden are determined from body burden counts of the SPF oysters sacrificed upon termination of the experiment. Letters above data indicate statistical differences.

Discussion

- First replicate indicates that:
  - SPF oysters exposed to scavengers consuming infected oyster tissue accumulate a significantly higher parasite burden than oysters exposed to decomposing infected tissue alone (Figure 4).
  - Scavenger activity, probably the tearing of tissues while feeding, increased the number of parasites released into the water relative to passive shedding through tissue decay (Figure 3).
- A second trial is currently being analyzed to confirm these results.
- Practical applications include:
  - Predicting parasite spread through estuaries with different community structures
  - Determining how restoring oyster reef communities may affect Dermo disease dynamics
  - Identifying the positive or negative impact of scavengers on parasite transmission in oyster aquaculture.

References

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Acknowledgments

Elizabeth Diamond is supported on a Rutgers Graduate School Excellence Fellowship through the Institute of Marine and Coastal Sciences, with additional research funding from Dupont's Clear Into the Future grant. We thank the students and staff of the Haskin Shellfish Research Laboratory for their continued and loyal support, in particular the participants of the Ecology of Marine Parasites seminar.