New Perspectives on Oyster Disease Ecology in Chesapeake Bay, and Relevance to Oyster Restoration

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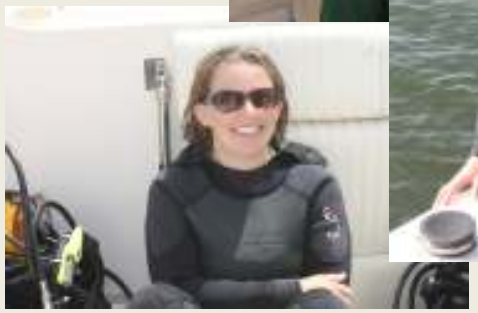
Current Project: Influence of Oyster Reef Elevation on the Health of *Crassostrea virginica*

- *PI*: Ryan Carnegie, VIMS
- *Partner*: Ken Paynter, University of Maryland





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Influence of Oyster Reef Elevation on the Health of *Crassostrea virginica*

- *Rationale*: Reef elevation (and architecture generally) influences interactions with physical factors (currents, waves), which partly determine rates of growth (accretion versus burial)
  - Reefs may be designed (and sited) to resist burial
  - It has been argued that oysters on taller reefs are also healthier, suggesting that reefs may be "engineered" such that oysters are more likely to resist disease
  - Scientific support for this, however, is absent

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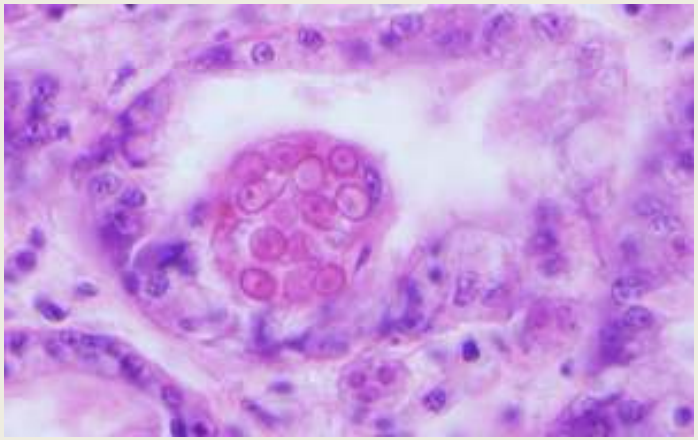
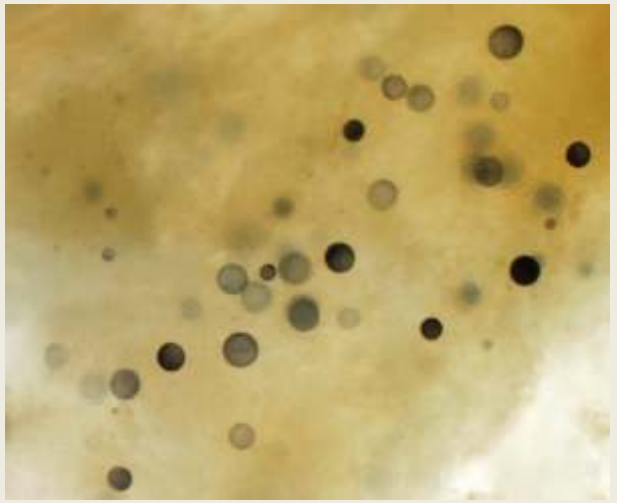
Influence of Oyster Reef Elevation on the Health of *Crassostrea virginica*

- *Objective*: To determine the influence of oyster reef elevation on both MSX and dermo diseases at two locations in disease-intense Virginia waters



Haplosporidium nelsoni (MSX)



Perkinsus marinus (dermo)

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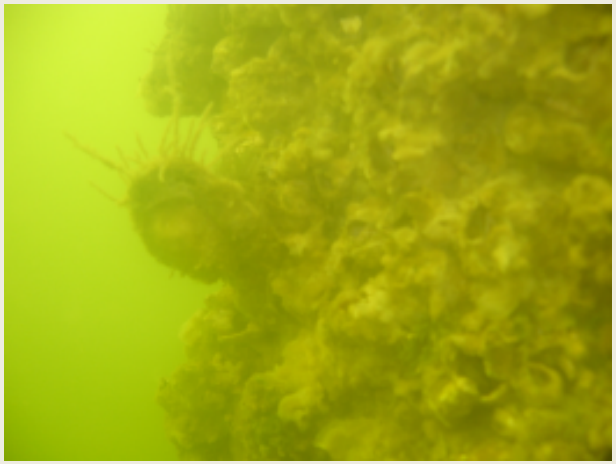
Influence of Oyster Reef Elevation on the Health of *Crassostrea virginica*

- *Approach*: Dive sampling and disease analyses of oysters from crest and base (elevation difference: 5’) of reefs in the Piankatank and Great Wicomico Rivers
  - September 2011, peak dermo
  - May 2012, peak MSX



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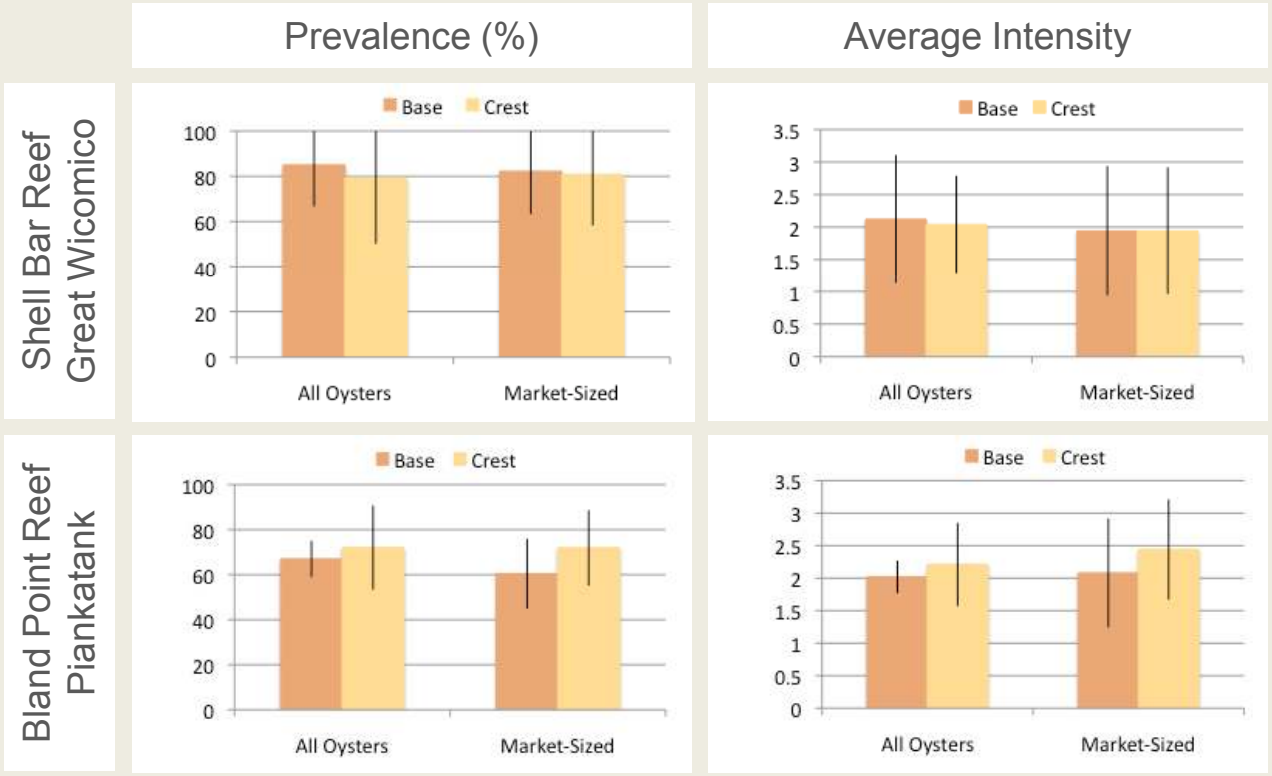
Influence of Oyster Reef Elevation on the Health of *Crassostrea virginica*

- *Results*: No difference in dermo disease between elevations



N = 4 samples (each ≤ 25 oysters) from each elevation, from each reef, on each date
Error bars: 95% Confidence Intervals

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Influence of Oyster Reef Elevation on the Health of *Crassostrea virginica*

- *Potential relevance/impacts*:
  - Suggests that resistance to disease does not vary with elevation (assuming, reasonably, that disease pressure was similar)
  - Cannot "engineer" around oyster disease
    - Questions remain concerning elevation and disease *tolerance*, and reproductive fitness (and MSX results are pending)
  - Should focus on building reefs to meet objectives related to sediment deposition, growth, and recruitment—not disease

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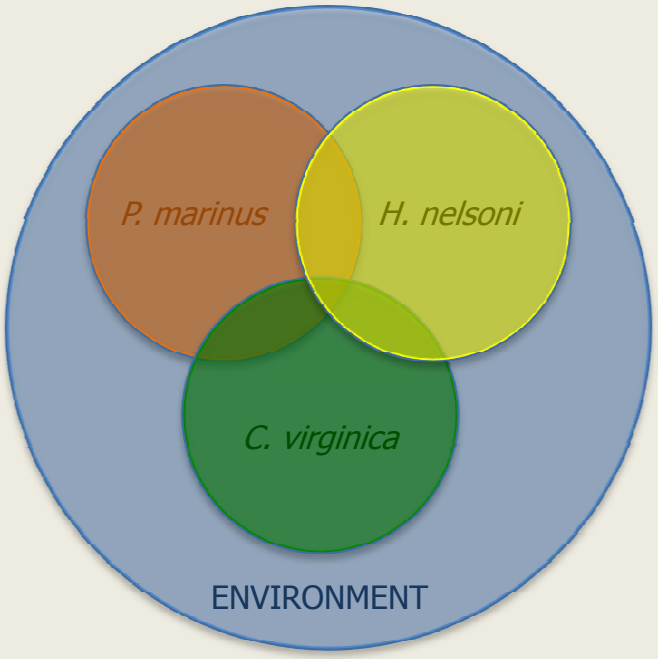
However: We Should Recognize the Potential for Human Activities to Influence Disease

- First, must view oyster-dermo-MSX system as dynamic, not static
  - Host resistance, pathogen virulence under selection
  - Interactions among species under influence of changing environment



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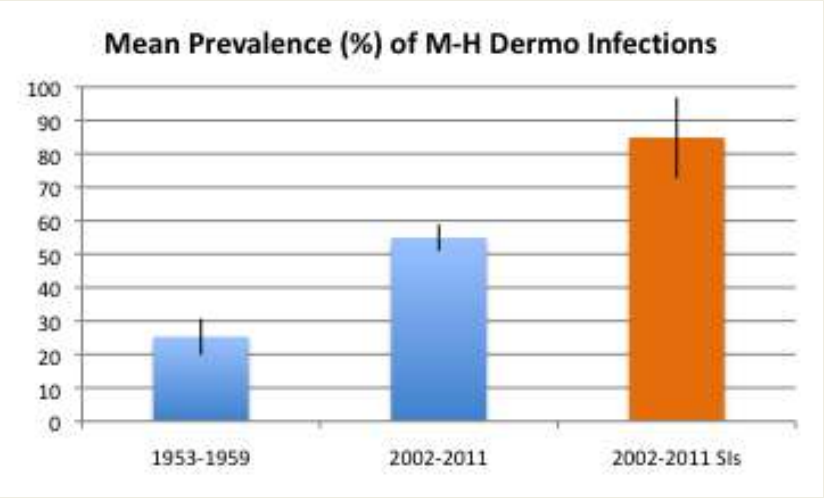
Human Activities May Influence Disease

- Second, recognize the existence of resistant oysters in the populations
  - Long-exposed oysters are (relatively) resistant to MSX (Carnegie and Burreson 2011), but to dermo too (see below)
  - More tolerant, perhaps, as well



Wild reefs (10 most dermo-intense in VA)

Naïve sentinels in York River

Error bars: 95% Confidence Intervals

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Management Strategies Theoretically May Promote Resistance

- Expansion of resistance depends on resistant individuals being able to pass on underlying genes
- Strategies can be designed to promote an increase in the frequency of resistant genotypes, and would make sense
  - Sanctuaries and rotational harvest schemes (theoretically) would provide resistant individuals the opportunity to realize advantages in longevity, and thus fecundity
  - Focus efforts not only in low salinities but in high-disease areas where selection is most intense

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A New Idea?

- No—see the Chesapeake Research Consortium "Consensus of a Meeting of Scientific Experts" June 1999 recommendations
- But one that is increasingly and strongly supported by the latest research on oyster diseases in Chesapeake Bay

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