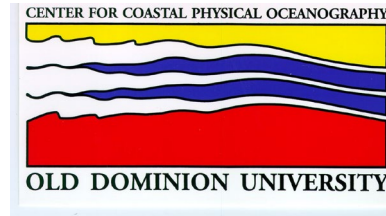


# Increased Dermo Disease in Chesapeake Bay Oysters Caused by Continued Warming and Nutrient Loading

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CHAMP Project  
Meeting  
30 October  
2019



# Presentation Outline

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- Oyster-Dermo model application to Chesapeake Bay
- Simulation results
- Rethinking simulation results
- Next steps

# Oyster Model

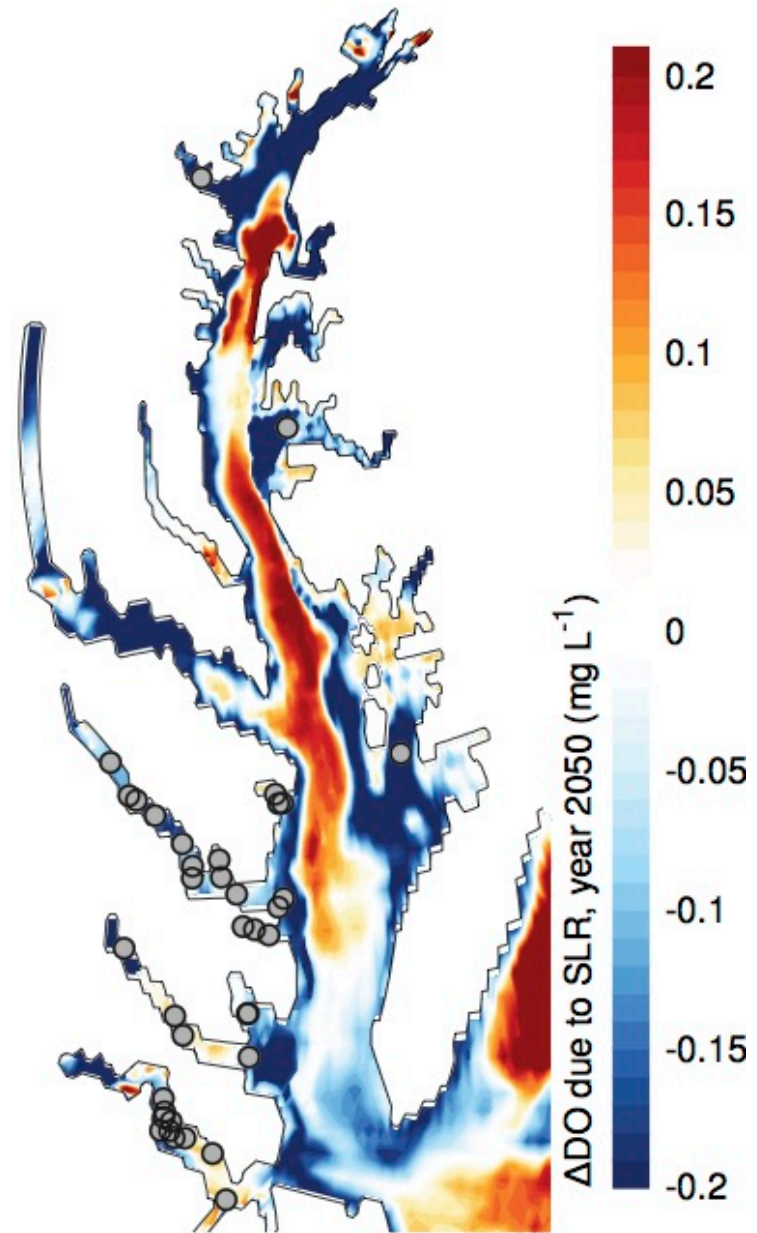
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- Simulate Dermo disease infection intensity and prevalence
- Inputs are temperature, salinity, food from Chesapeake Bay biogeochemical model
  - 1900 -1914
  - 1980 - 2015
- Results presented as Mackin Index; semi-quantitative scale of infection intensity
- Model setup

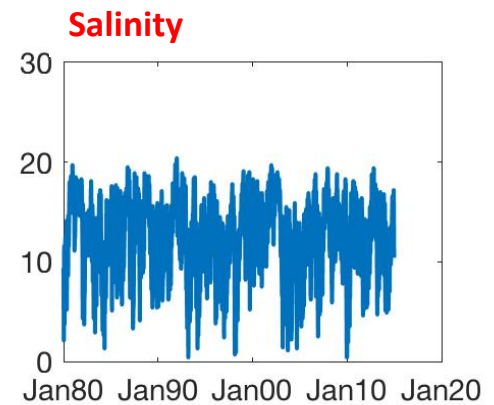
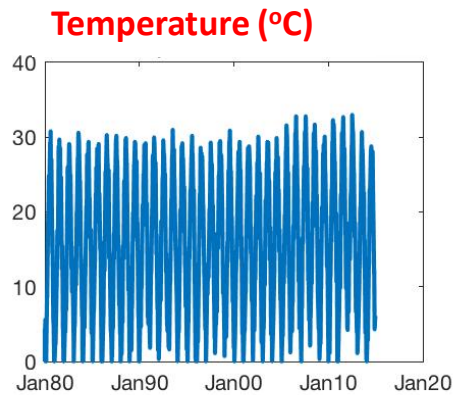
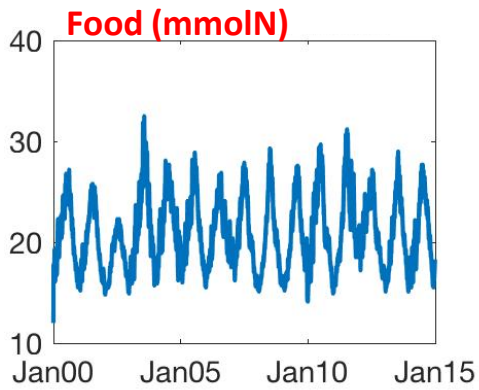
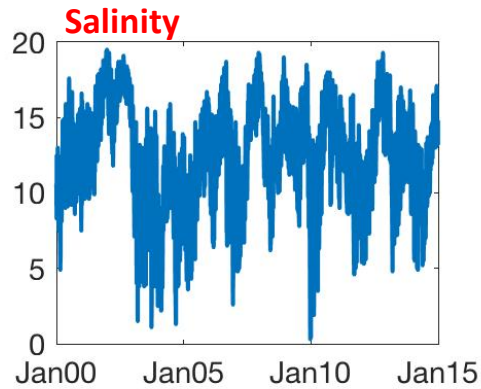
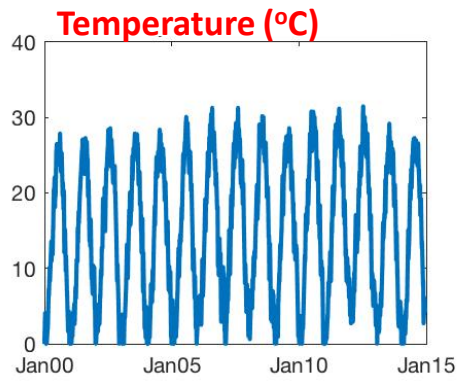


## Oyster-dermo model implementation sites

- Coincide with VIMS and Bay program long-term monitoring sites

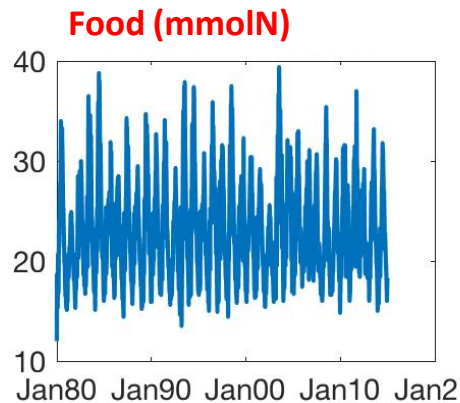


# York River Environmental Conditions

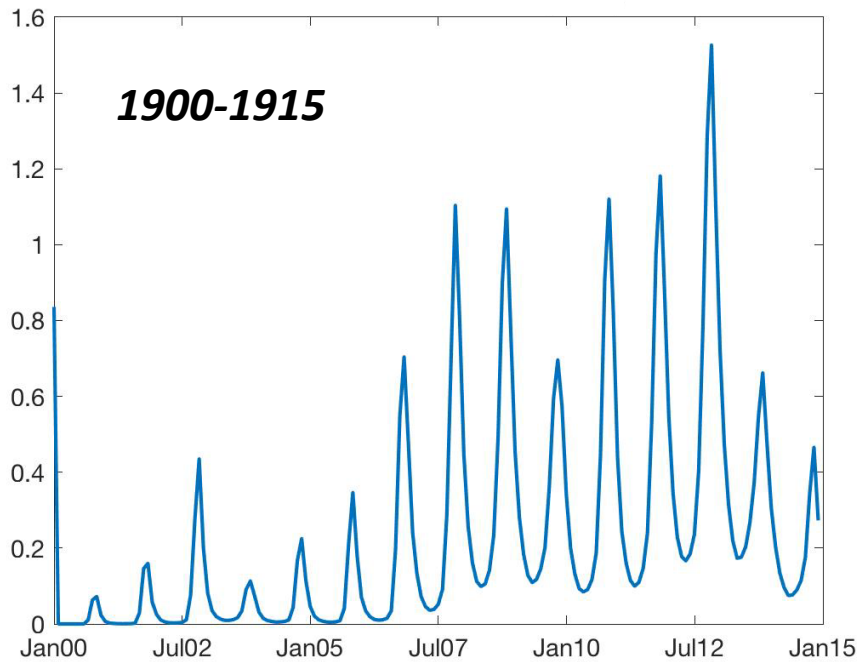


***1900s cooler***

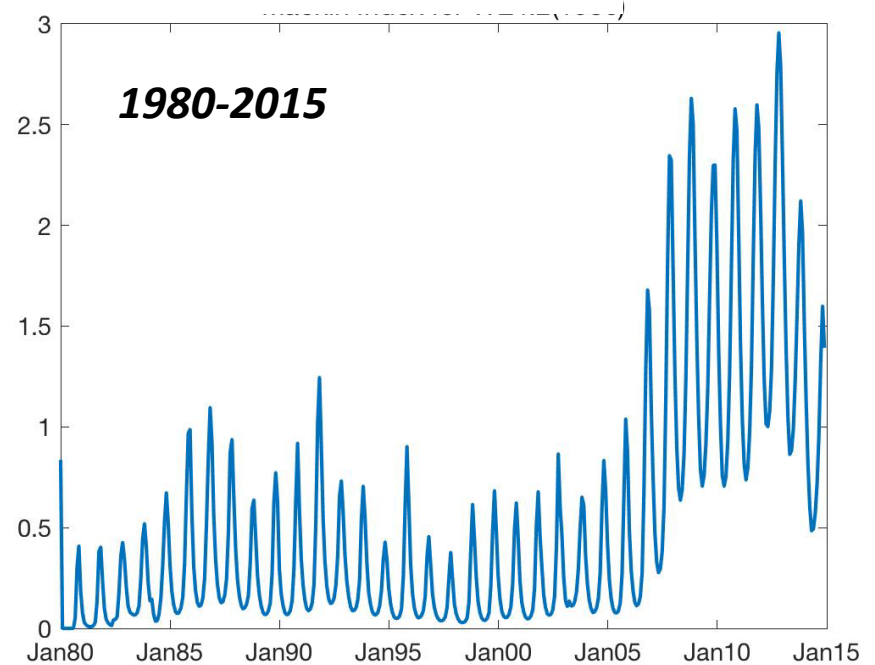
***1980s-2000s  
higher food***



# Mackin Index



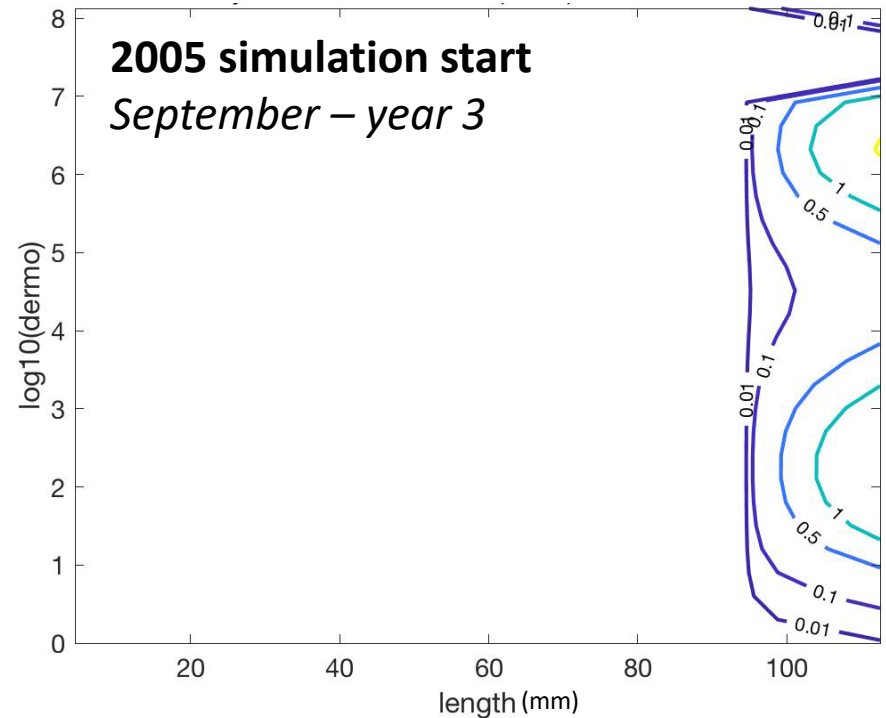
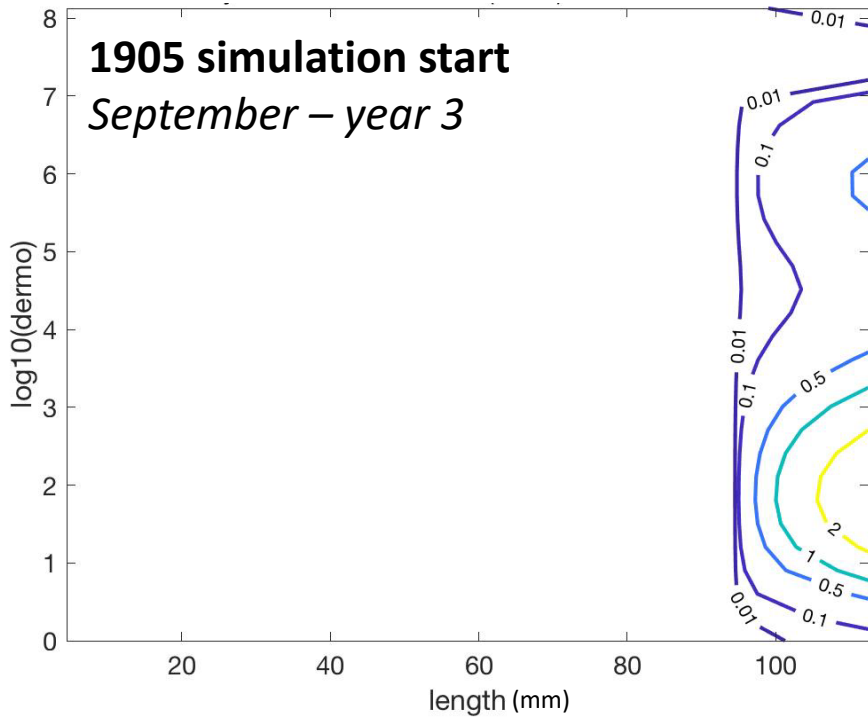
**1900-2015**

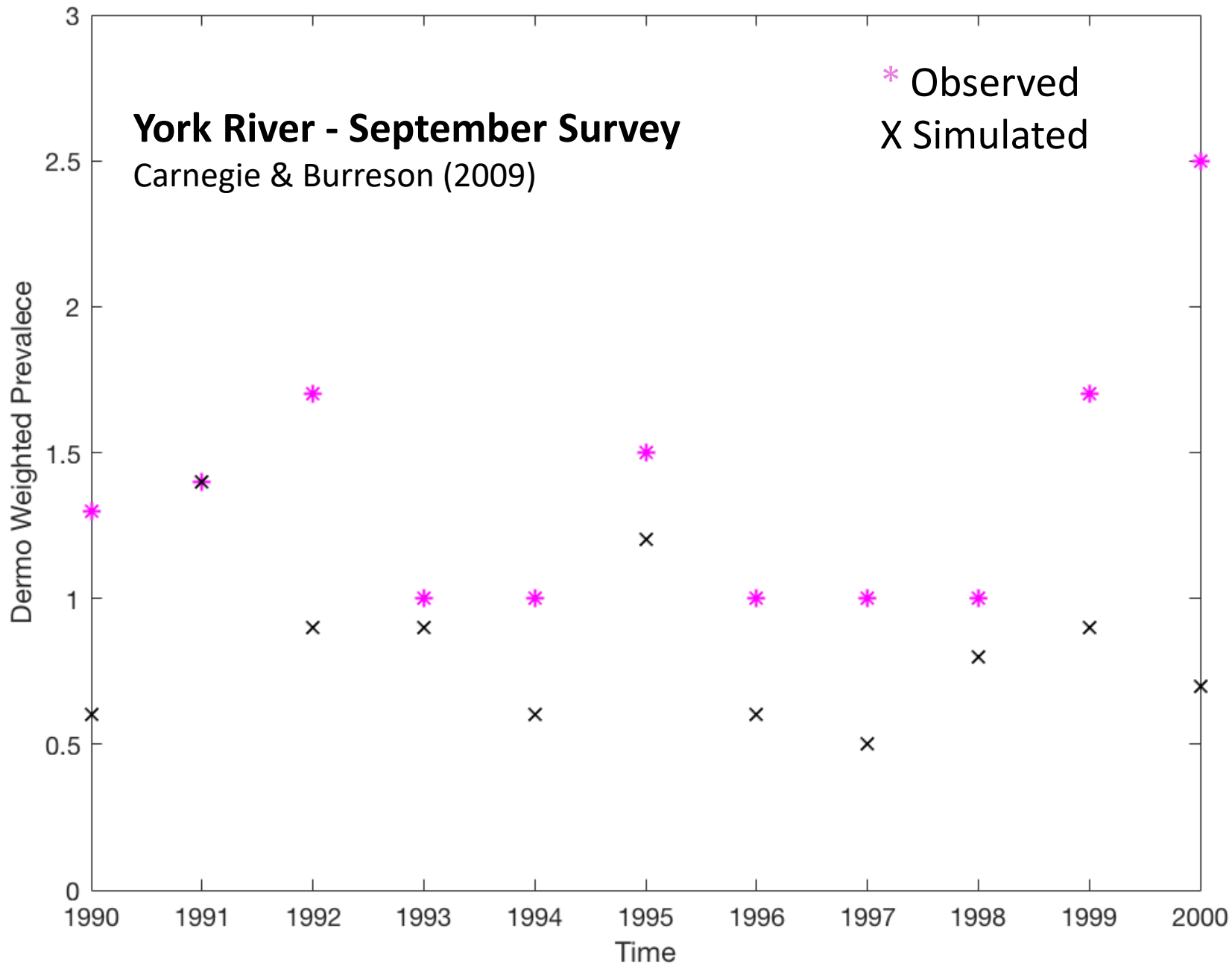


**1980-2015**

# Dermo Body Burden

More oysters at higher body burden in 2000s

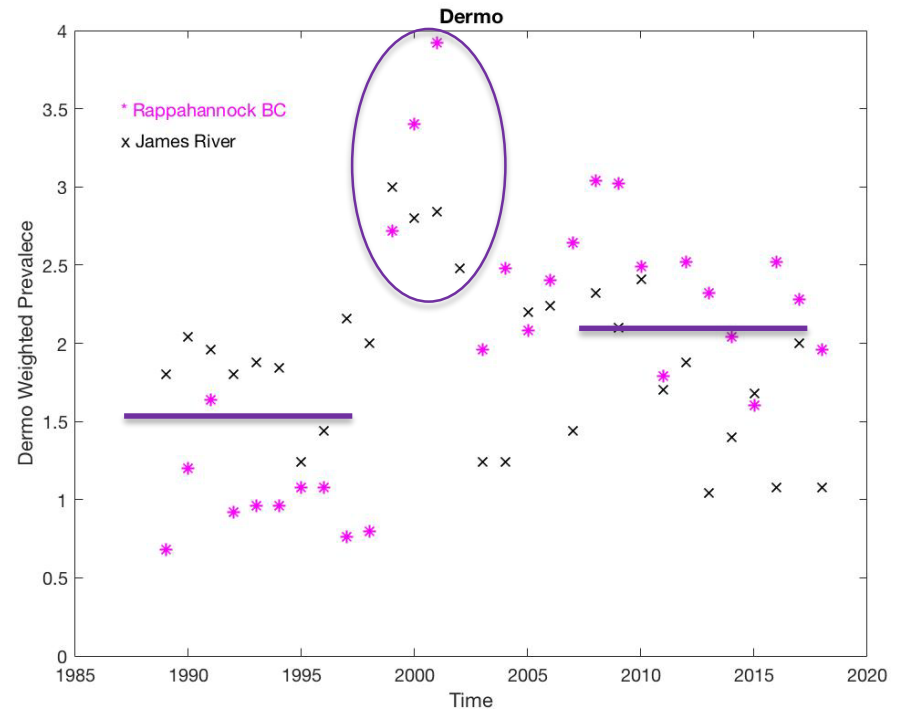
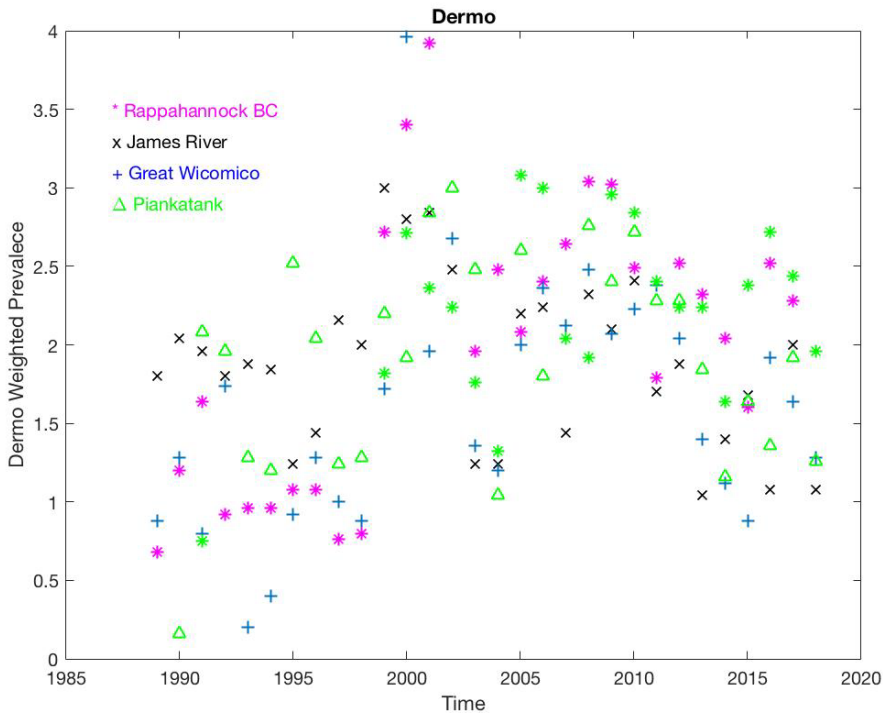


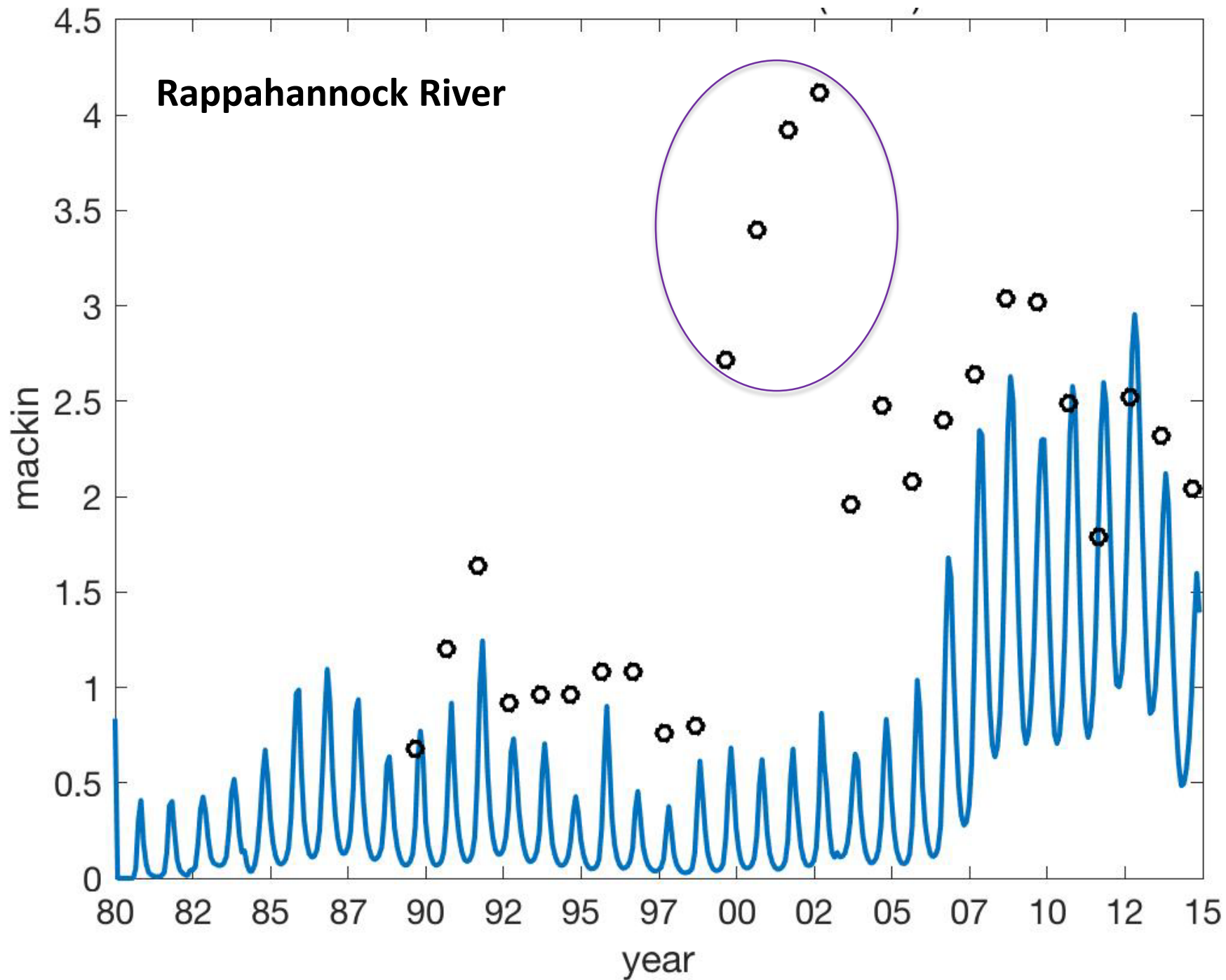




# Observed Dermo Weighted Prevalence

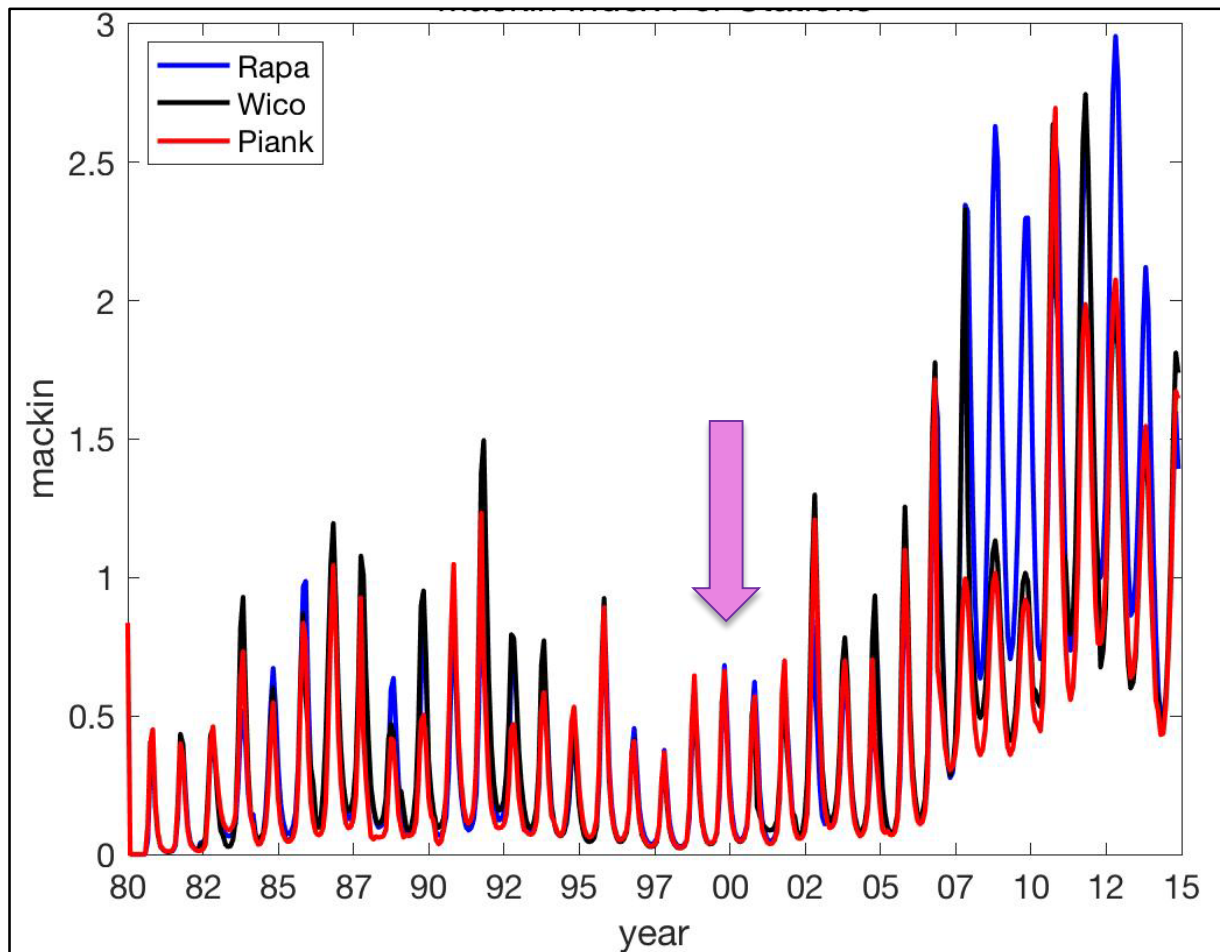
VIMS monitoring data – provided by Ryan Carnegie





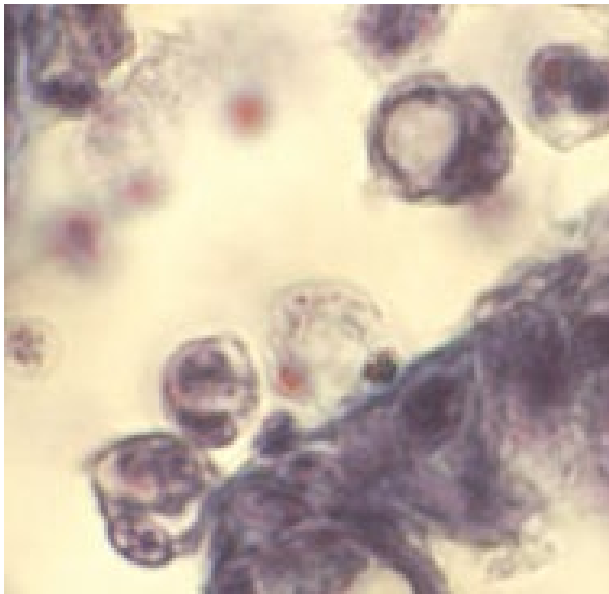
# Simulated Mackin Index

Rappahannock, Wicomico, Piankatank



# What is happening?

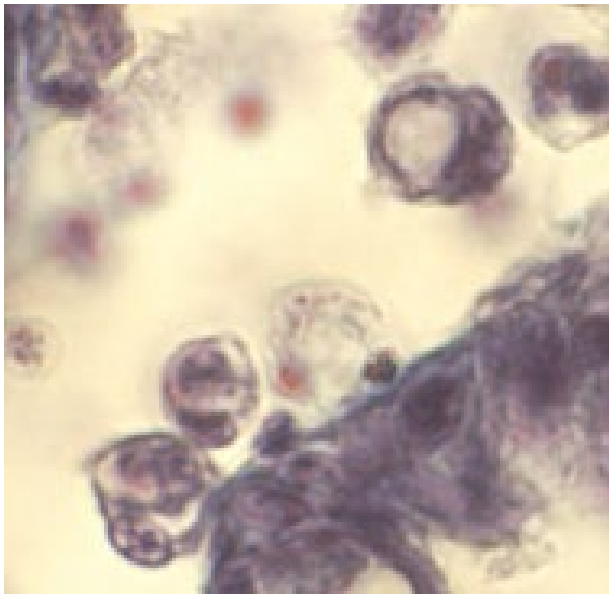
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- Environmental conditions insufficient to produce observed signal
- Missing process(es)
- MSX disease present – dual disease effect
- *“Unprecedented high prevalences and intensities of H. nelsoni were observed in the Great Wicomico, Coan, Yeocomico and Rappahannock Rivers.” (Calvo & Burreson, 2000)*

# What is happening?

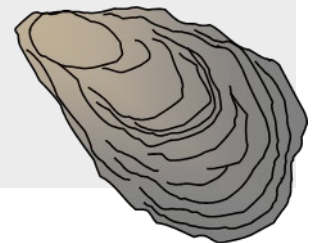
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- Change in dermo pathogen (*Perkinsus marinus*)
- Major phenotypic change producing increased virulence occurred in 1985/1986 epizootic
- Cell diameters smaller by 2011-2012
- Second change in 1999-2000?

# Summary

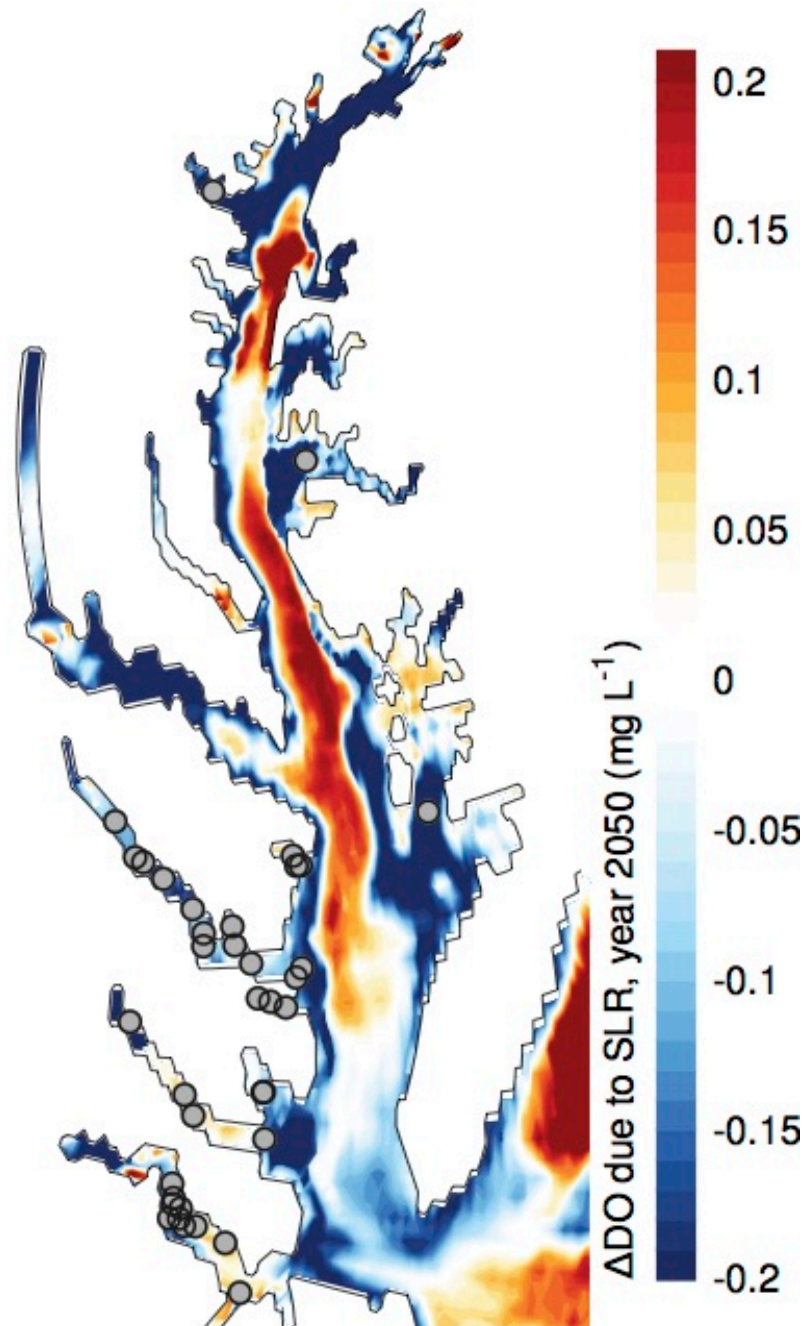
- Temperature higher in 1980s-2000s than early 1900s
- Nitrogen loading to Chesapeake Bay is higher in 1980s-2000s – enhances chlorophyll/POC concentrations
  - Higher temperatures released pathogen
  - Higher food allows oyster to exist with higher pathogen load
- Changed pathogen virulence?



## Oyster-dermo model implementation sites

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- Potential effects of decreased oxygen at some sites



# Next Steps

- Simulations with variable dermo virulence
- Revise model to allow recruitment
  - Broodstock-recruitment relationship from oyster survey
- Begin process of integrating oyster-dermo model with Chesapeake Bay model

