Impacts of Diseases on oyster (*Crassostrea virginica*) populations and restoration efforts

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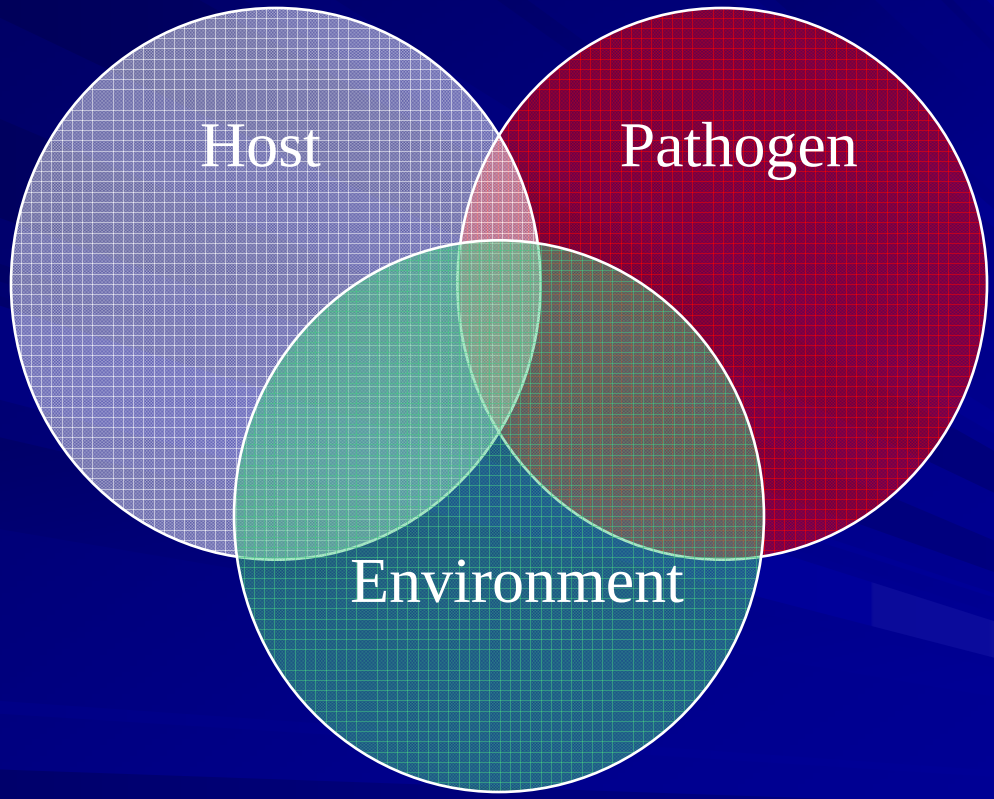
What is “Disease”?

- Any departure from normal structure or function of the animal (Sindermann, 1990)
  - Non-infectious diseases (genetic or environment)
  - Infectious diseases (pathogens or parasites)

Disease Triad



Infectious Oyster Diseases
Protozoan parasites

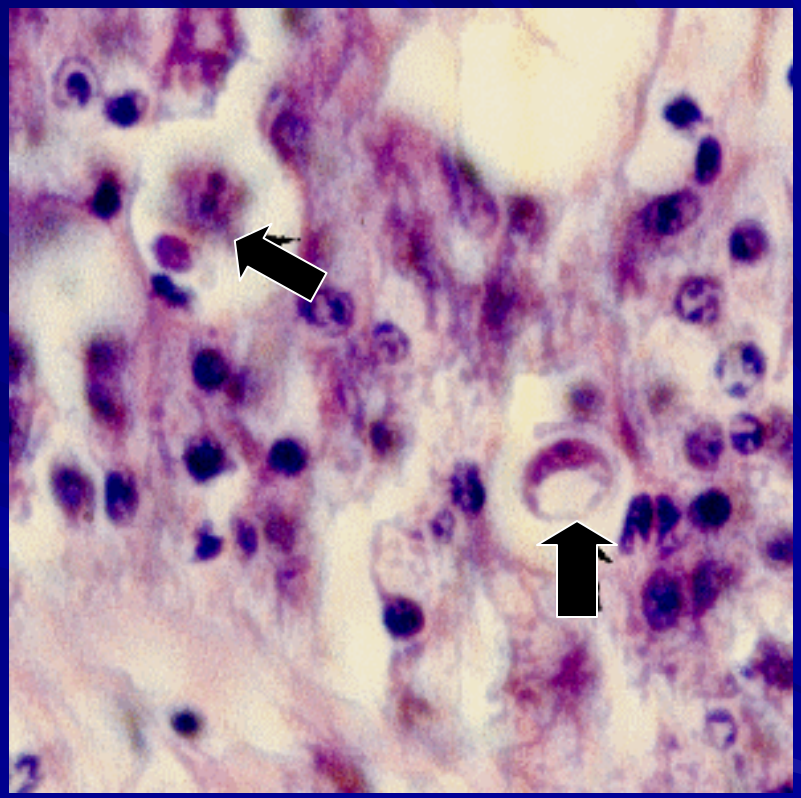
- MSX Disease
  - *Haplosporidium nelsoni*
- Dermo Disease
  - *Perkinsus marinus*
  - Other species of *Perkinsus?*

MSX Disease
(*Haplosporidium nelsoni*)

- Delaware Bay (1957) and Chesapeake Bay (1959)
  - 90-95% mortality in 3 yrs. (Haskin and Andrews, 1988)
- Not transmitted directly
  - Alternate host?
- Prefers >18 ^{o}C and >15 psu; cannot survive salinity <10 psu
- Distributed Nova Scotia to Florida?

Dermo Disease
(*Perkinsus marinus*)

- Gulf of Mexico (1940's) and Chesapeake Bay (1950's)
  - >70% mortality (Carnegie and Burreson, 2007)
- Direct transmission
  - highly infectious
- Prefers >20°C, and >15 psu, but tolerates lower salinity and temperature
- Maine to Texas

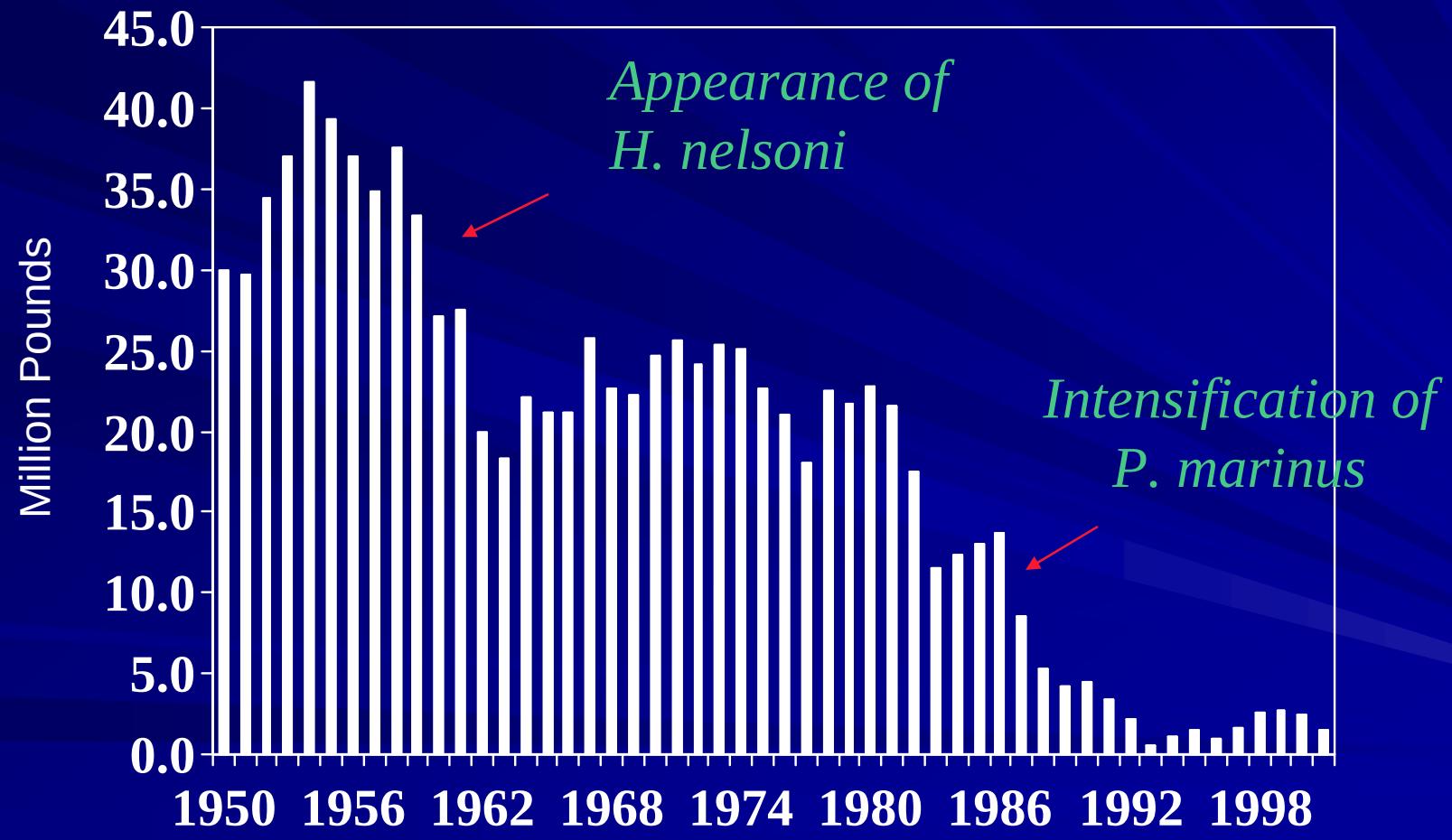


Effects of Disease on Individuals

- Lethal Effects
  - Mortalities 0-95% depending on location
- Sub-lethal Effects
  - Advanced MSX infections reduced condition index 31% and gonad mass 81% (Barber et al. 1988)
  - Oysters infected by MSX and Dermo did not complete gametogenesis (Barber 1996)
  - Advanced Dermo infections reduced condition index by 20-60% (Ford et al. 1999)

Disease Effects on Oyster Populations

Oyster landings in Chesapeake Bay (NMFS)



Impacts

Daily Press

sday
2, 1990

No. 275 • Hampton Roads' Morning Newspaper • Newport News-Hampton, Va. •

Bush points way toward peaceful s

Shellshocked

Charles Rowe tongs oysters from the waters of the James early Monday morning, the first day of the season. The catch was much worse than he expected.

Mollusks missing

Oysters scarce as season opens

By MARK DI VINCENZO
Staff Writer

Watermen guide their workboats on the James River as the sunlight works its way through the Monday morning shoals. The day wasn't too productive, and the overall poor catch early in the season is a sign of higher prices ahead, experts say.

Cong
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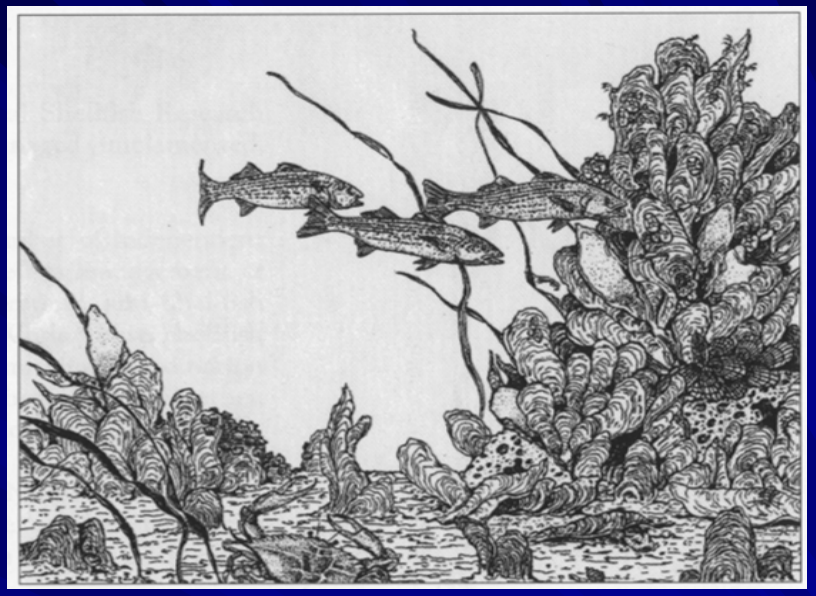
Republicans
aren't buying



- Economic
  - Loss of commercial harvest
- Ecological
  - Loss of filtration
  - Loss of habitat

Geographic Trends
Perkinsus marinus

- Late 1980s: spread and intensified in Chesapeake Bay (Burreson & Ragone Calvo 1996)
- 1985-87: mortalities in coastal Georgia (Lewis et al. 1992)
- 1990: reappeared in Delaware Bay (Ford 1996)
- 1991-92: new reports in NY, CT, MA (Cook et al. 1998)
- 1997: high (72%) prevalence in Maine (Ford et al. 1999)

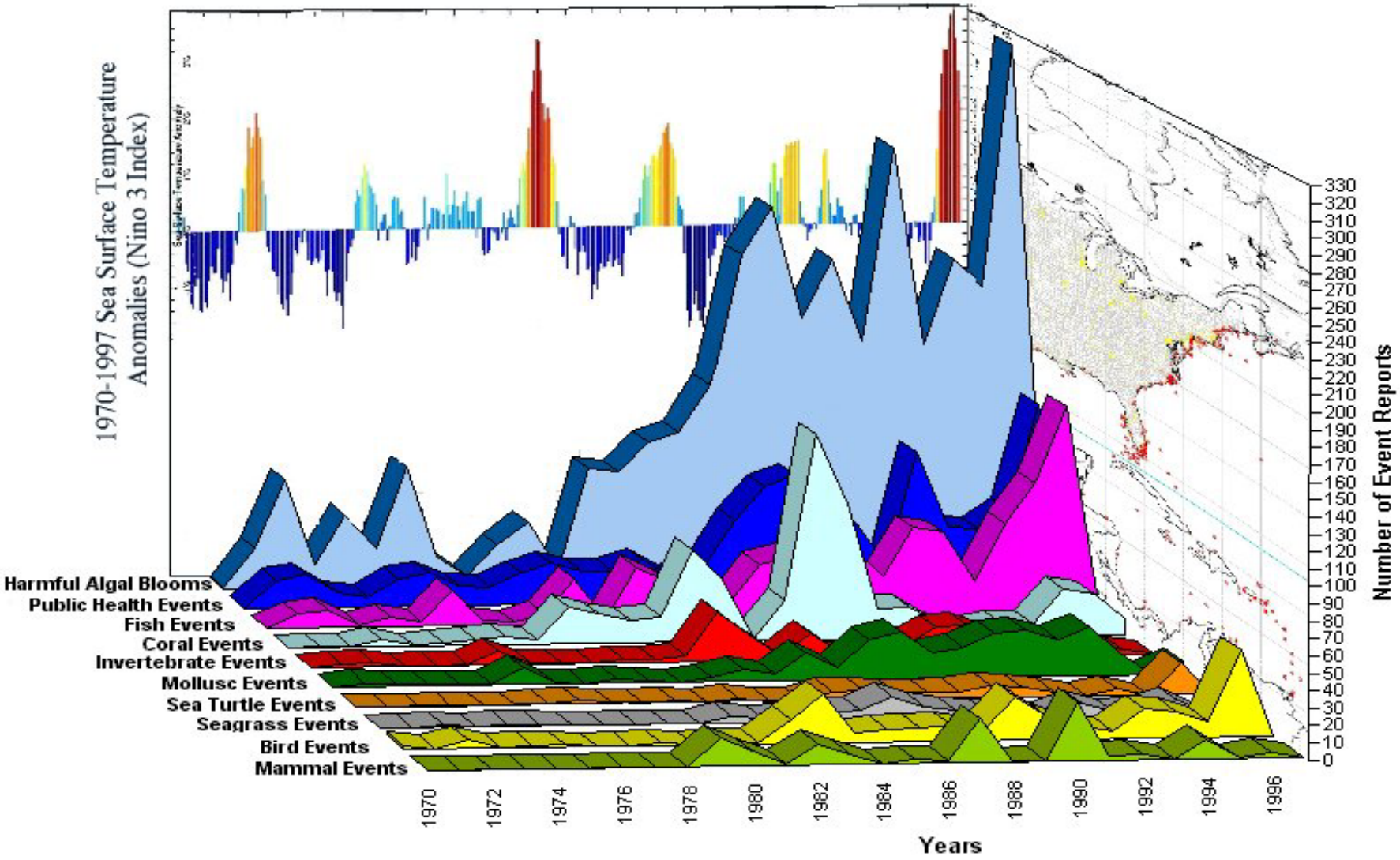
Geographic Trends
Haplosporidium nelsoni

- 1983-85: epizootic in NY
- 1984-85: 85% mortality in MA (Mattheissen et al. 1990)
- 1997-98: Up to 85% prevalence in CT (Sunila et al. 1999)
- 1995: 15-83% prevalence and mortality in Maine (Barber et al. 1997)
- 2002: 80% mortality in Nova Scotia, Canada (Stephenson 2003)

Geographic Trends

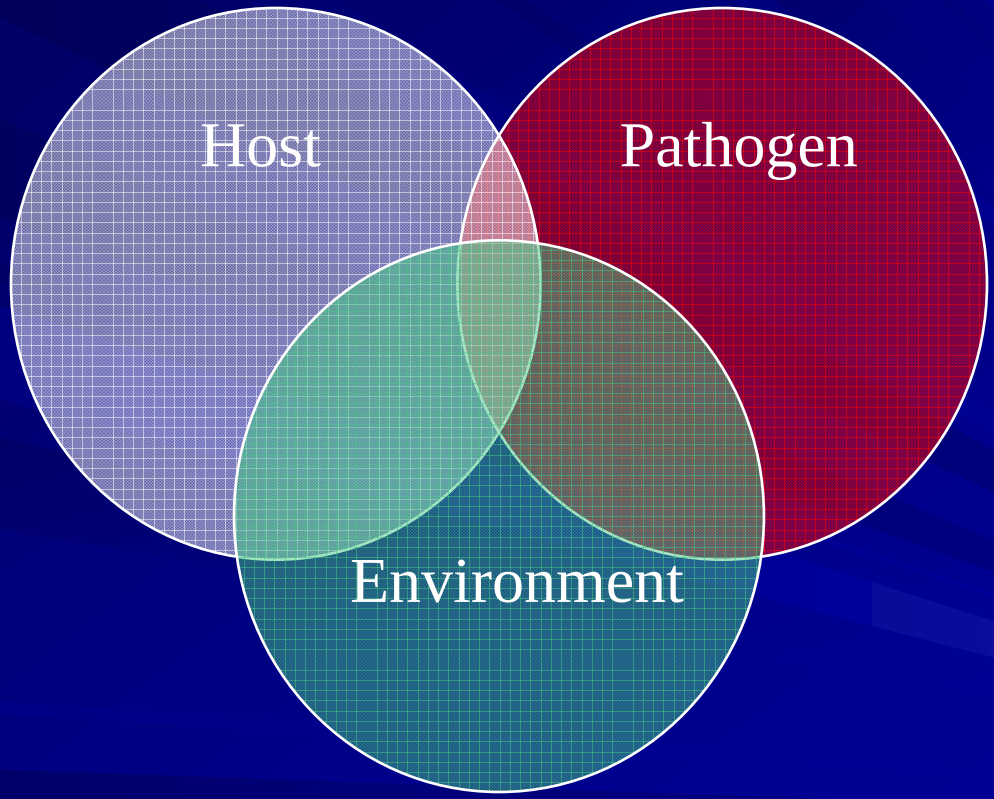
- Range expansion and new epizootics associated with warm, dry conditions
  - elevated water temperature
  - low rainfall = higher salinity
- MSX outbreak in Maine followed the second warmest and driest year in last century (Barber et al. 1997)

Disease Events and Global Climate Change



Harvard Medical: Health, Ecological and Economic Dimensions of Global Climate Change

Disease Triad



Conclusions

- Diseases are causing major declines in oyster populations
- Trend toward increasing geographic distribution and epizootiology
  - Global warming?
- Diseases are a major impediment to both commercial production and habitat restoration
  - Disease tolerance in natural populations not increasing
  - Selected lines not effective in Chesapeake Bay

How to Maximize Success of Oyster Habitat Restoration?

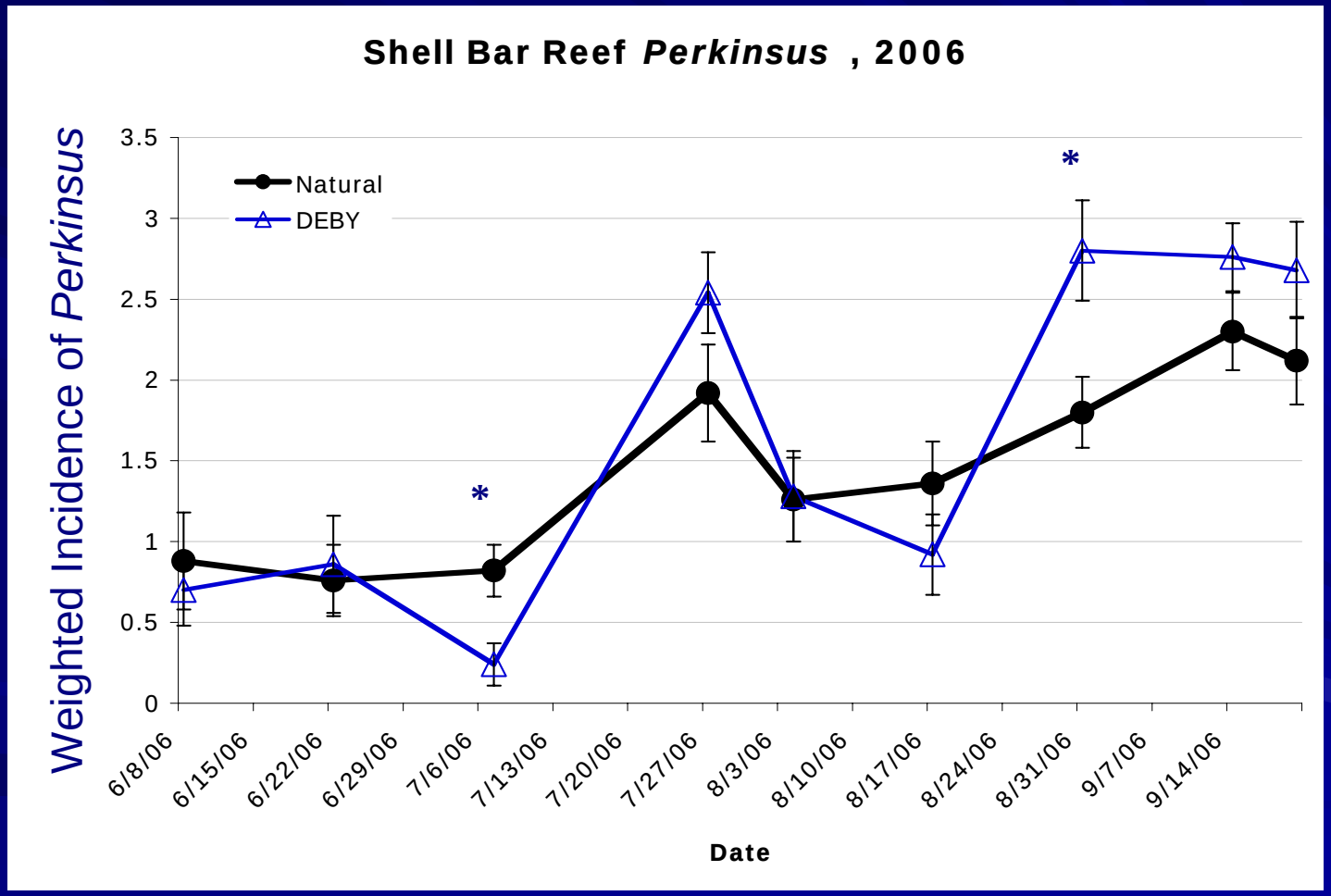
- Determine local disease status
  - Seasonal and long-term trends; recent impacts?
  - Identify and avoid potential “hotspots”
  - Identify other potential disease vectors?
- Follow-up disease monitoring
  - Does increasing oyster abundance result in higher disease mortality?
  - How many oysters survive to reproduce?
  - What is relationship between size and disease intensity?

Final Thoughts

- Just because disease does not appear to be a problem now, doesn’t mean it won’t be in the future
- Include disease monitoring in project plans

Dermo in selected vs. natural oysters

Great Wicomico River, 2006



* **Kruskal-Wallis test significant at $\alpha = 0.05$**