Classic paradigms in a novel environment: fate of restored oyster reefs governed by principles learned from rocky shores and saltmarsh wetlands

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Patterns of vertical zonation well-described in rocky and soft-sediment communities

http://www.netartsbaytoday.org/html/intertidal_zonation.html

http://www.nature.com/scitable/knowledge/library/ecology-of-wetland-ecosystems-water-substrate-and-17059765

- **Upper boundaries:** abiotic (desiccation) limits on rocky shores, biotic (competition) limits in saltmarshes

- **Lower boundaries:** biotic (competition, predation) limits on rocky shores, abiotic (salinity, O_2) limits in saltmarshes

Vertical distribution of oysters at Core Creek

Morehead City

Beaufort

Bogue Sound

Core Sound

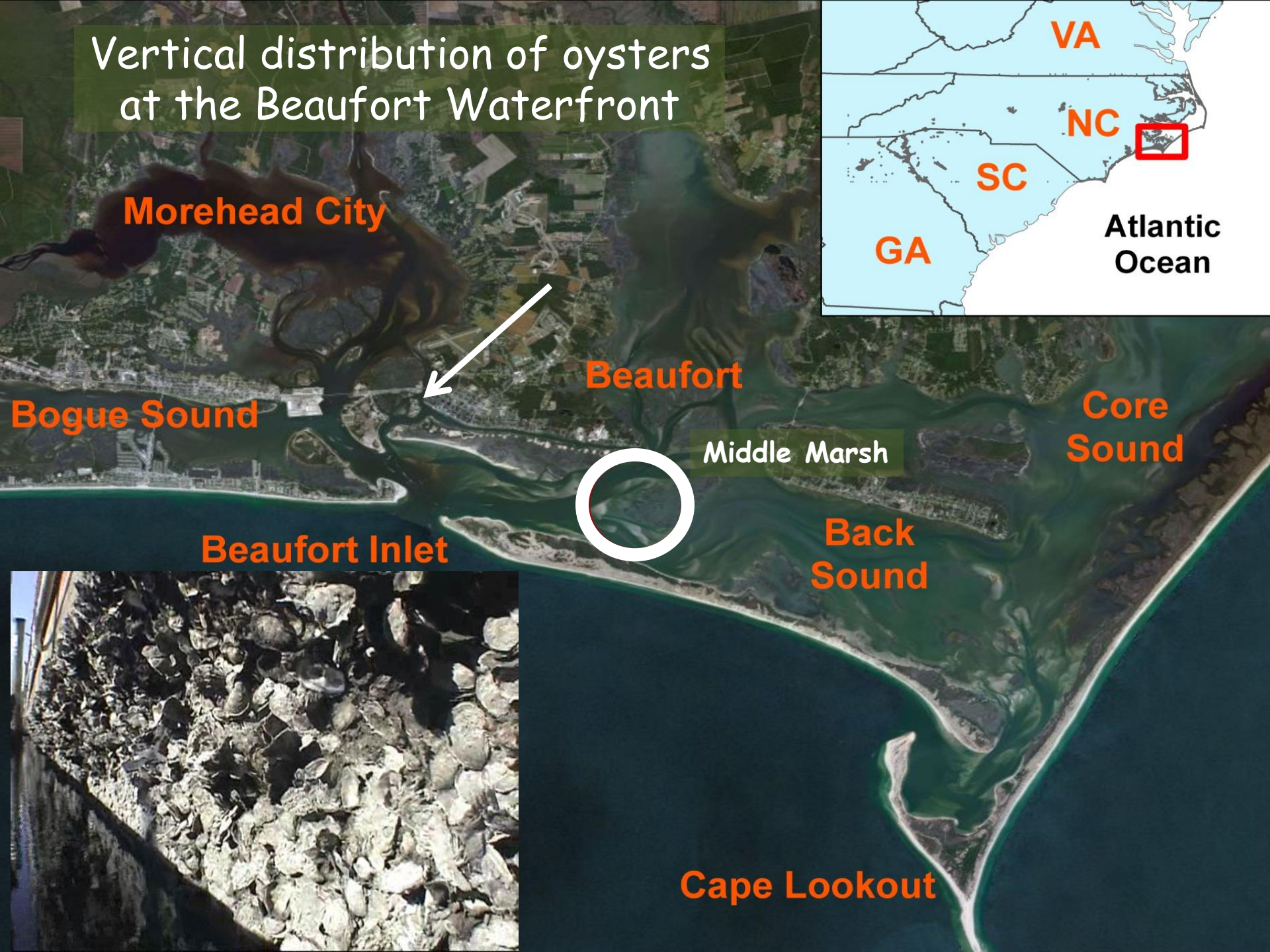
Middle Marsh

Beaufort Inlet

Back Sound

Cape Lookout

Vertical distribution of oysters at the Beaufort Waterfront



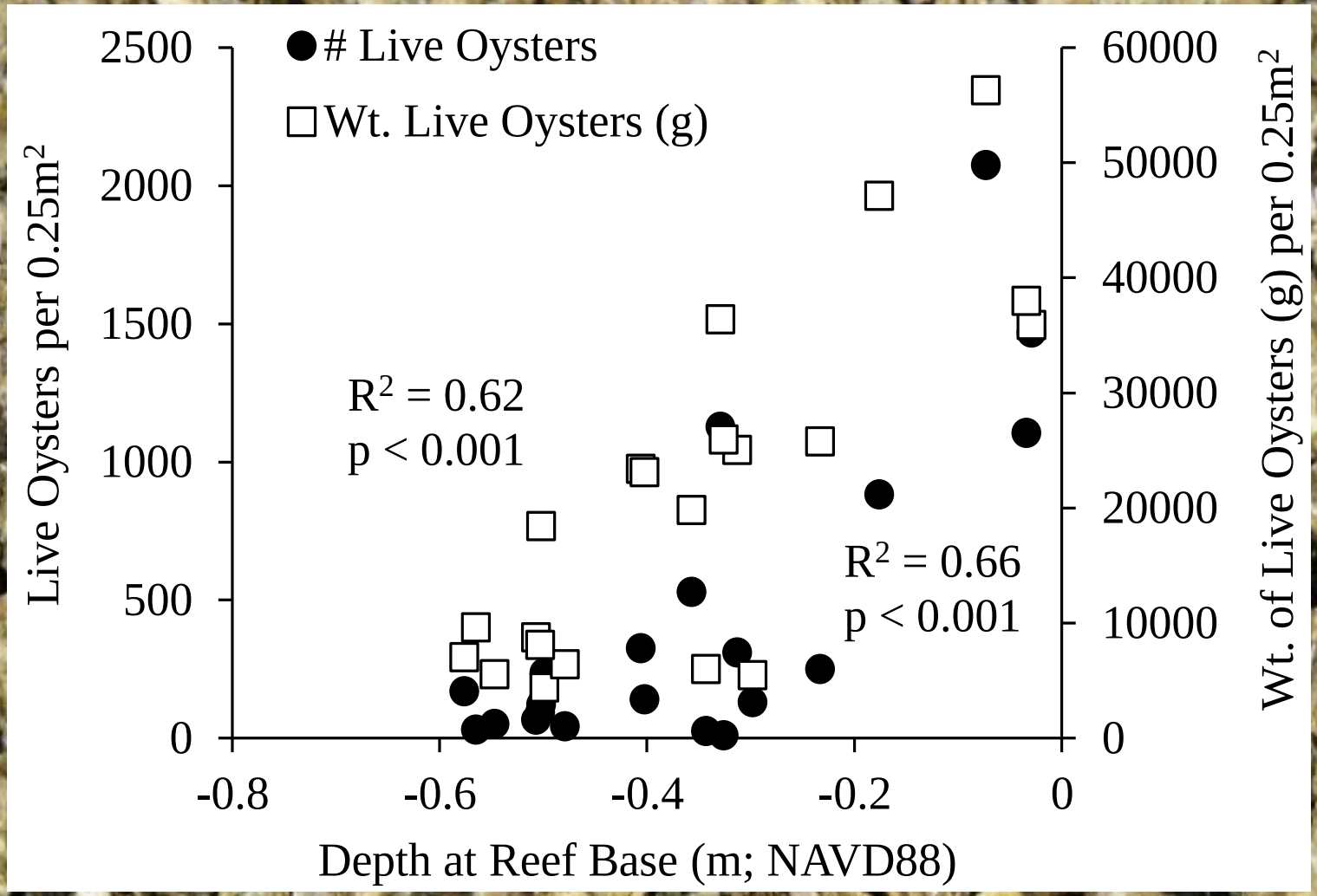
0 50 100 Meters

N

Some sandflat reefs look healthier and more robust than others. Why, when they were all created "the same"?

Grabowski et al. (2005)

Among and within reefs, strong relationship between density/biomass and "depth"

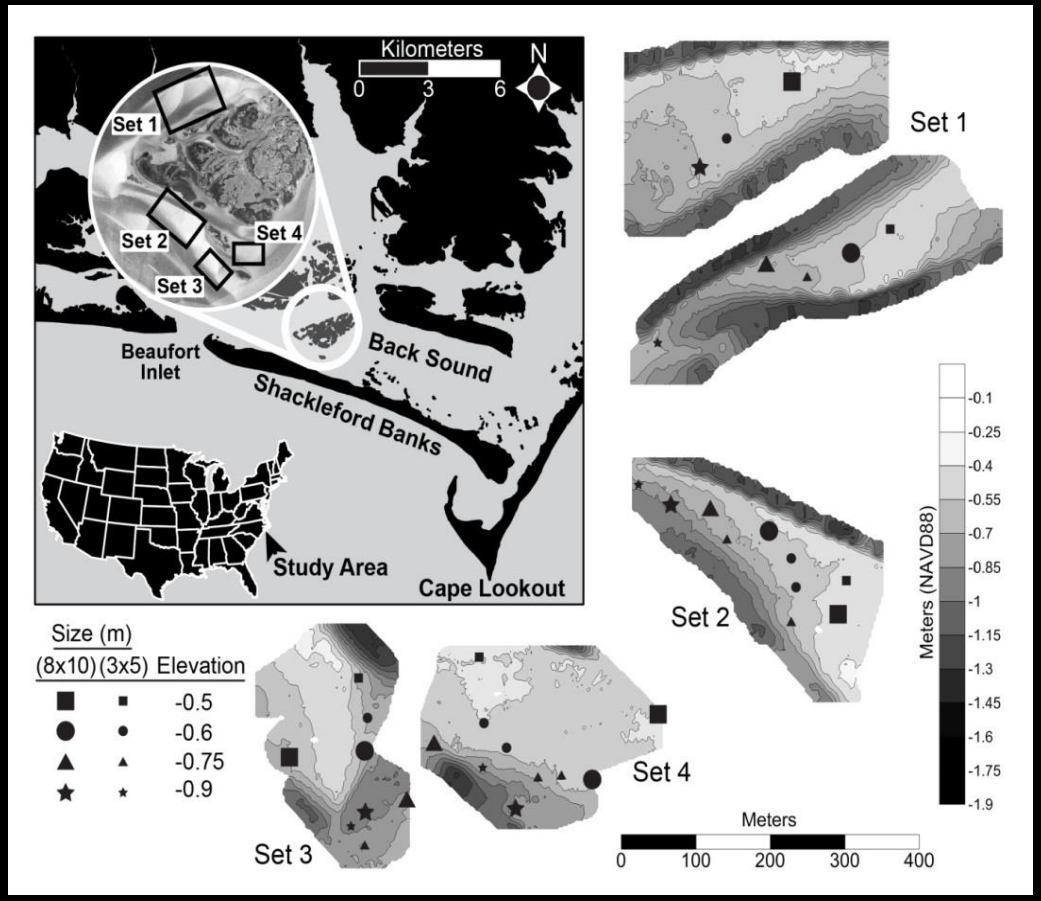


Testable questions

- How does depth (exposure) across the intertidal and shallow subtidal effect the evolution of restored experimental oyster reefs?

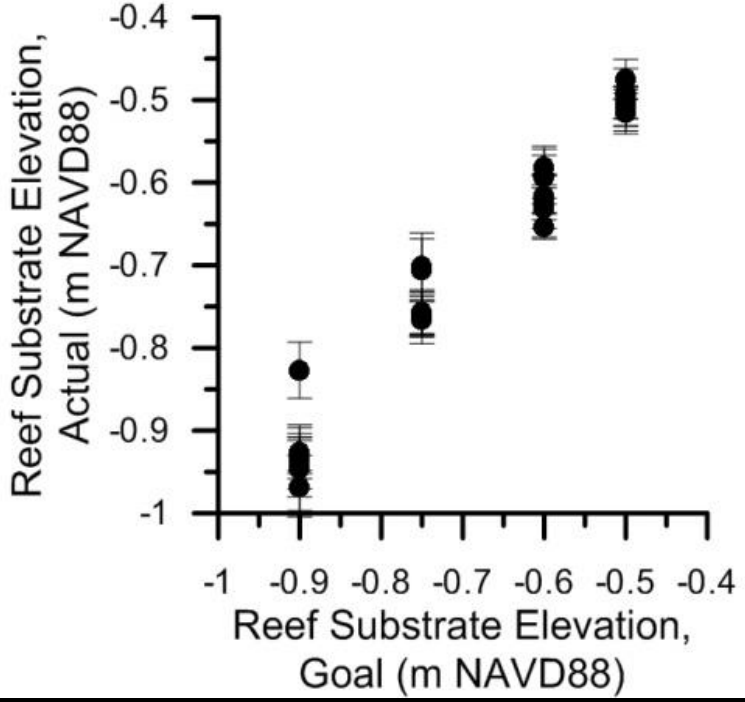
  - Mechanistically, how is depth (aerial exposure) controlling reef fate?

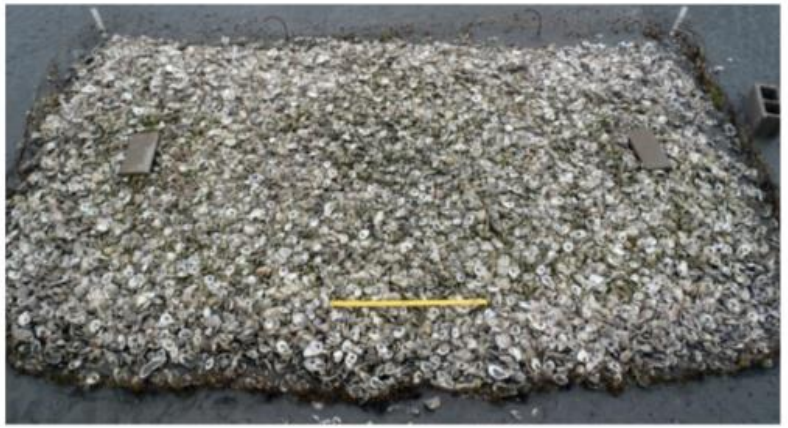
- Does initial reef size mitigate depth-related effects (perhaps due to changes in "edge" [A:P])?


Kilometers
0 3 6
N
Set 1
Set 2
Set 3
Set 4
Beaufort Inlet
Back Sound
Shackleford Banks
Study Area
Cape Lookout
Size (m)
(8x10) (3x5) Elevation
-0.5
-0.6
-0.75
-0.9
Set 1
Set 2
Set 3
Set 4
Meters (NAVD88)
-0.1
-0.25
-0.4
-0.55
-0.7
-0.85
-1
-1.15
-1.3
-1.45
-1.6
-1.75
-1.9
Meters
0 100 200 300 400

Experimental Reefs and Design

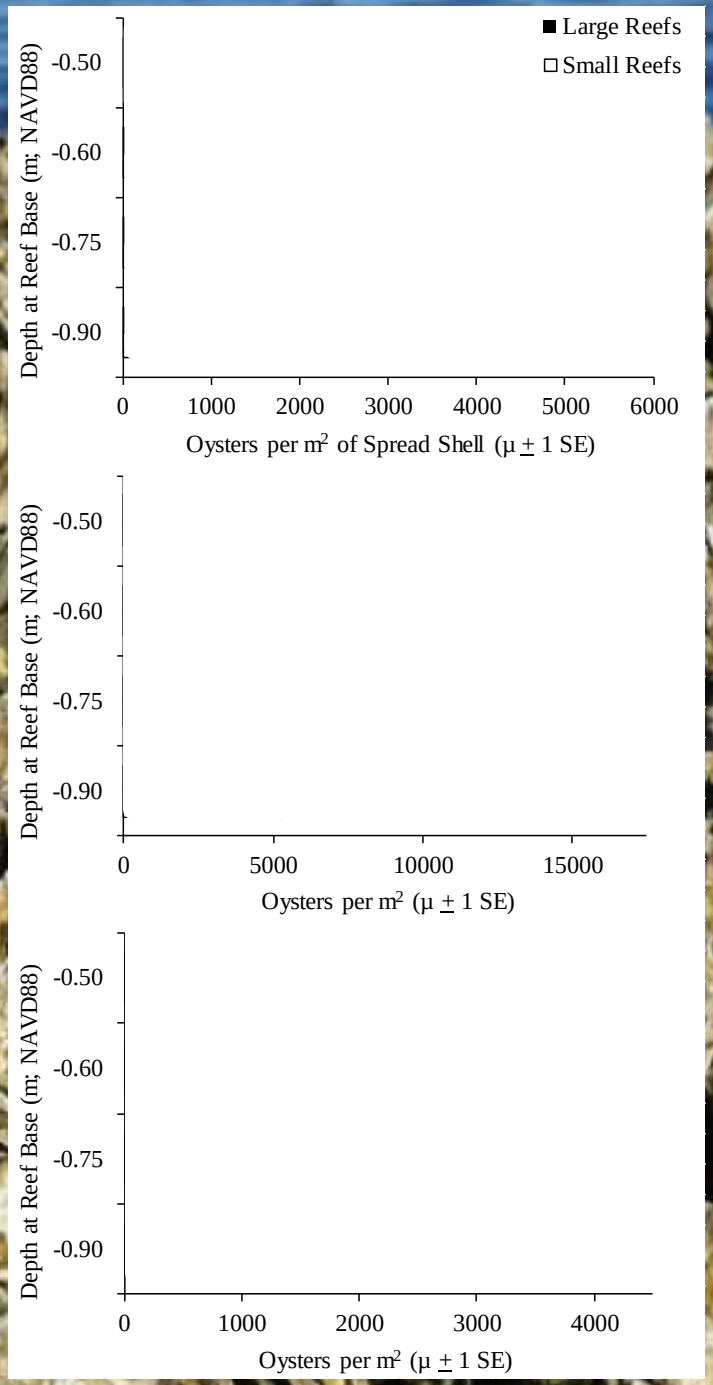
- Constructed in May, 2011
- 2 Sizes (60 bushels, 300 bushels cultch),
- 4 "depths"
- Sampled during:
  - -July, 2011 (2 mo)
  - -Sept, 2011 (4 mo)
  - -May, 2012 (12 mo)

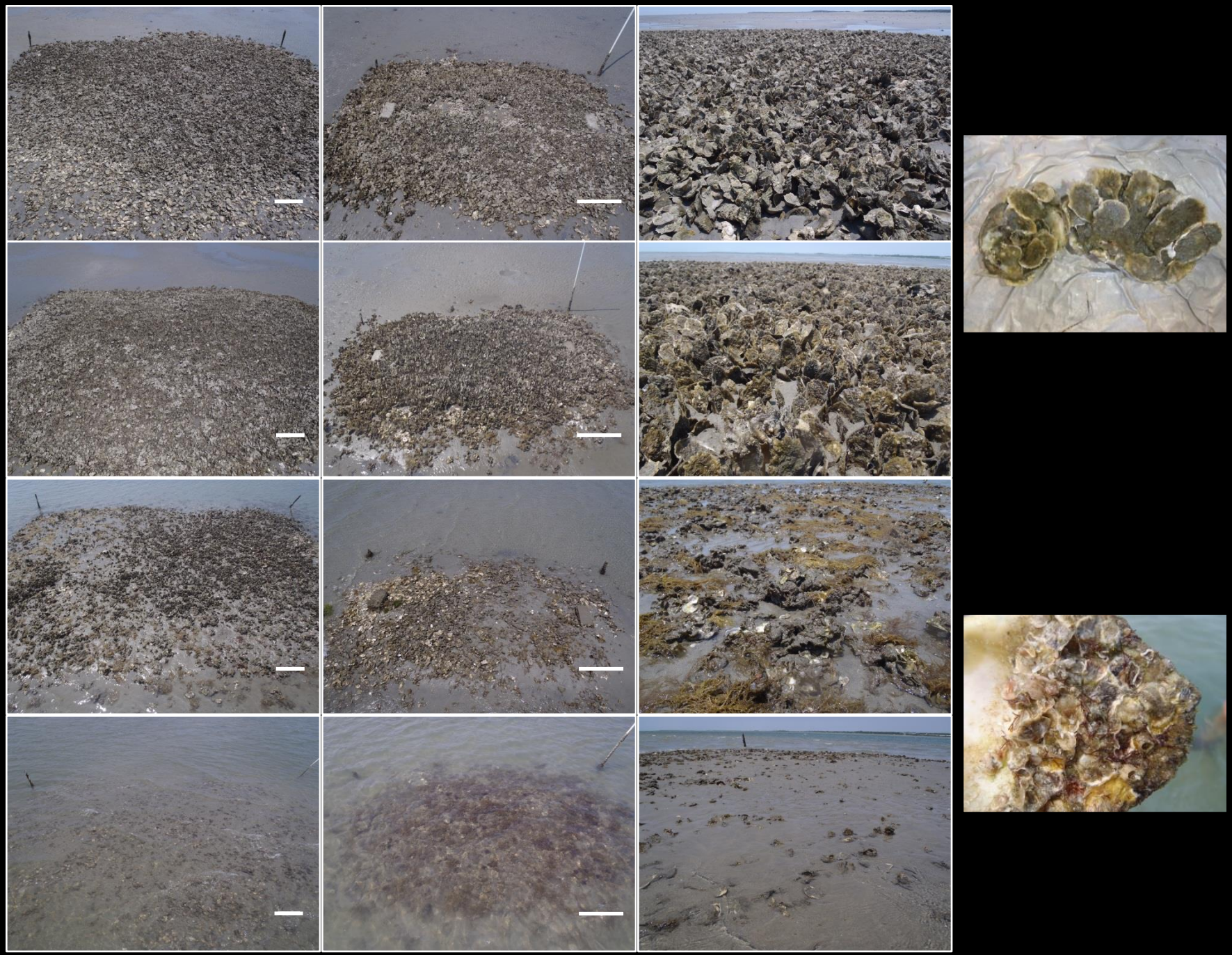




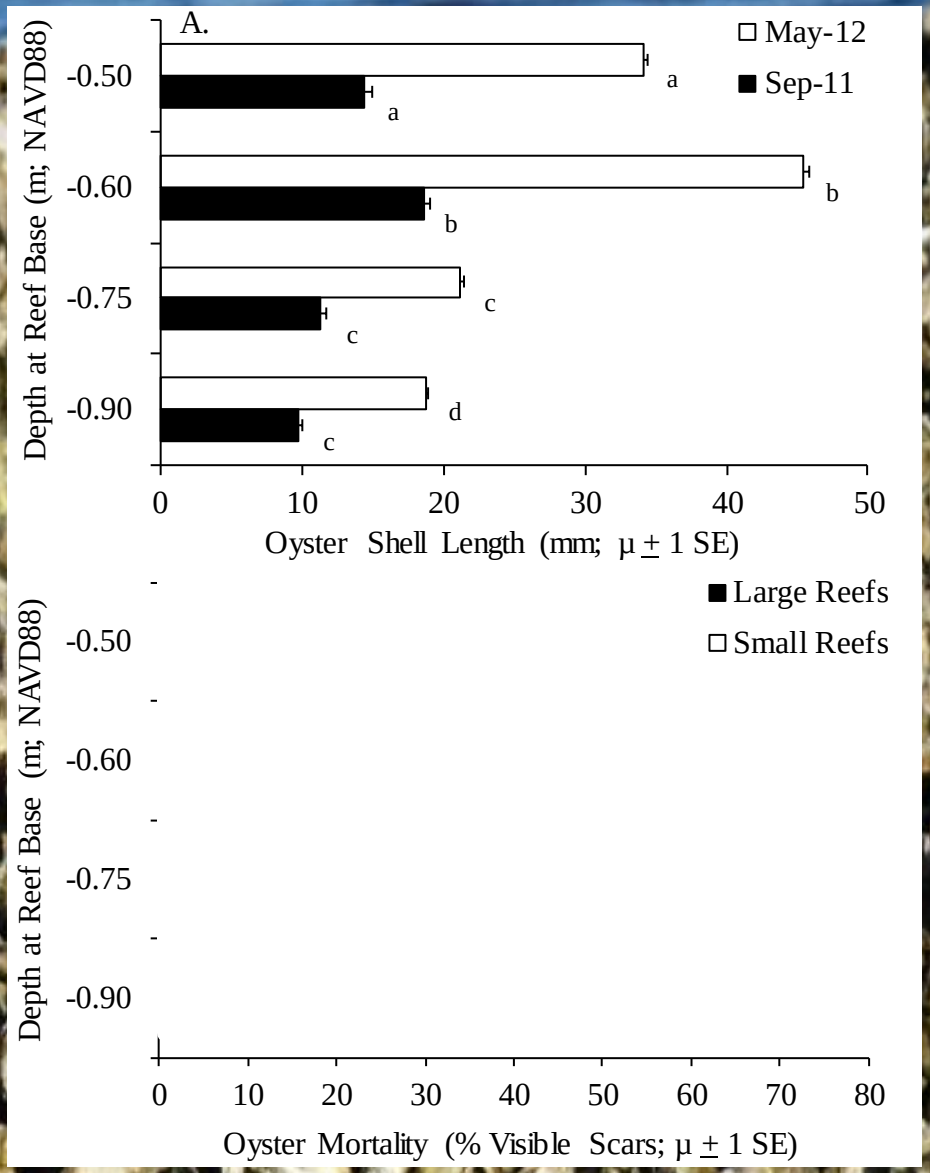
- -0.5 m (NAVD88)
- -0.6 m
- -0.75 m
- -0.9 m

Vertical patterns of settlement (spat) and oyster densities at 2, 4 and 12 months post construction.

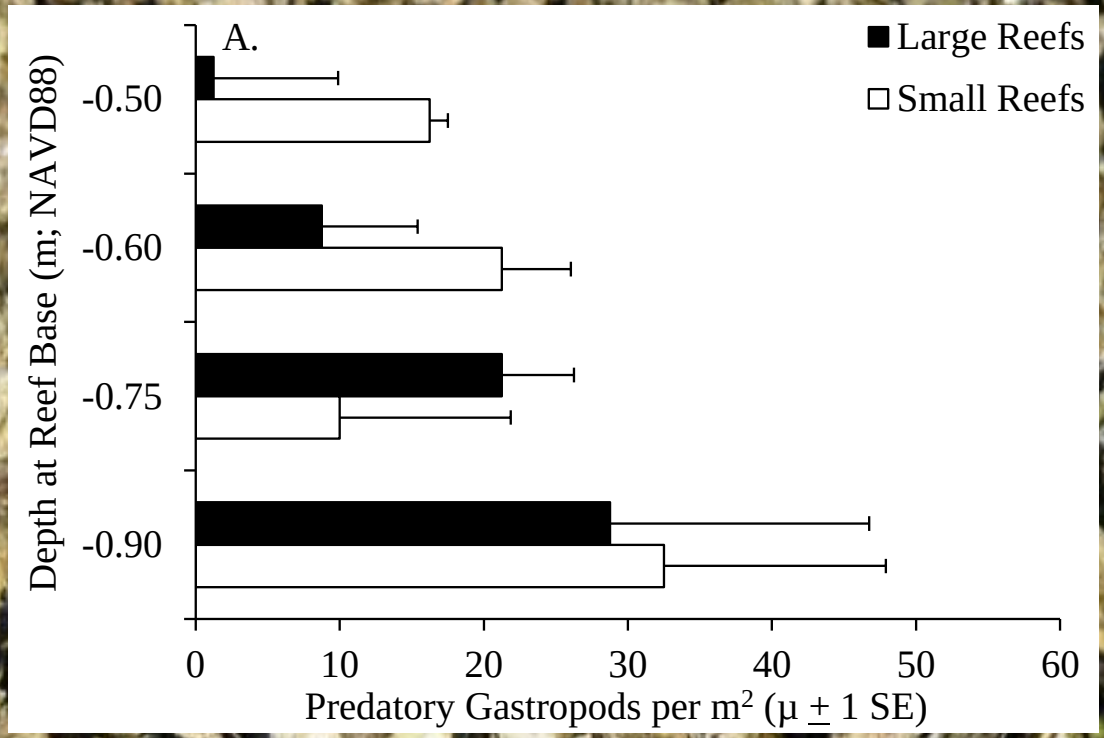



Large Reef (9*7 m)
Small Reef (5*3 m)
Ground-Level View
-0.50 m
-0.60 m
-0.75 m
-0.9 m

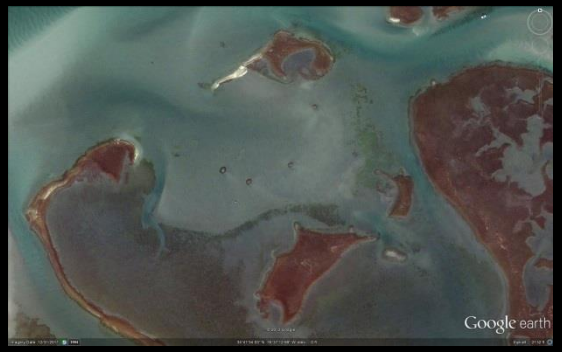
When and why did this "flip" occur?

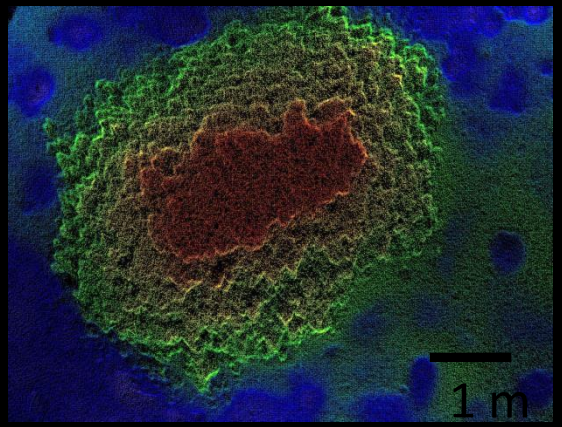


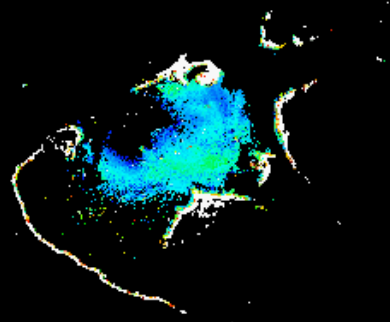
Vertical distribution of predators



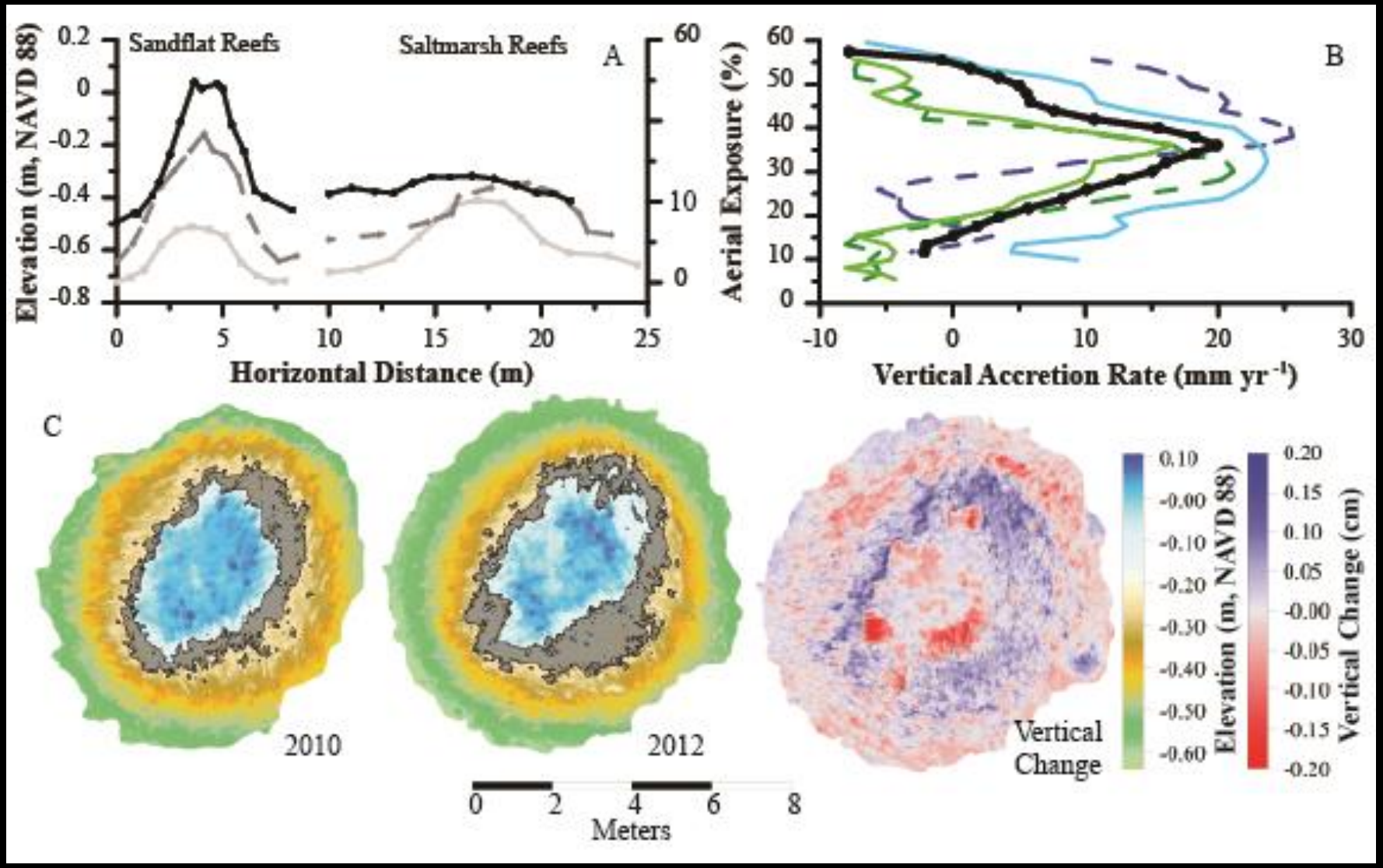
Whole-reef evolution (vertical accretion)



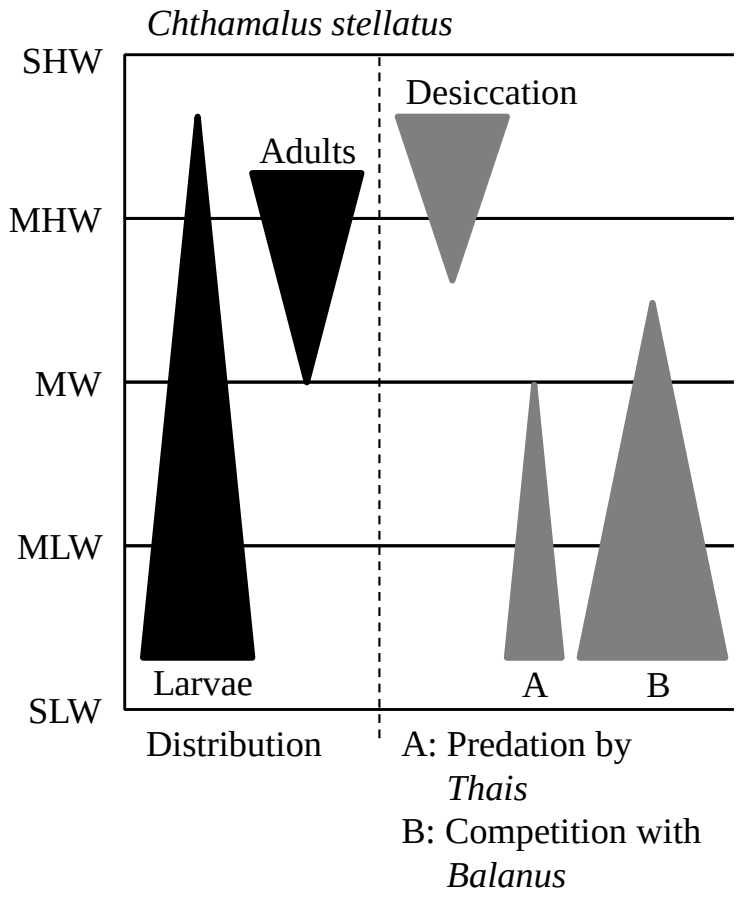




Vertical growth and horizontal expansion



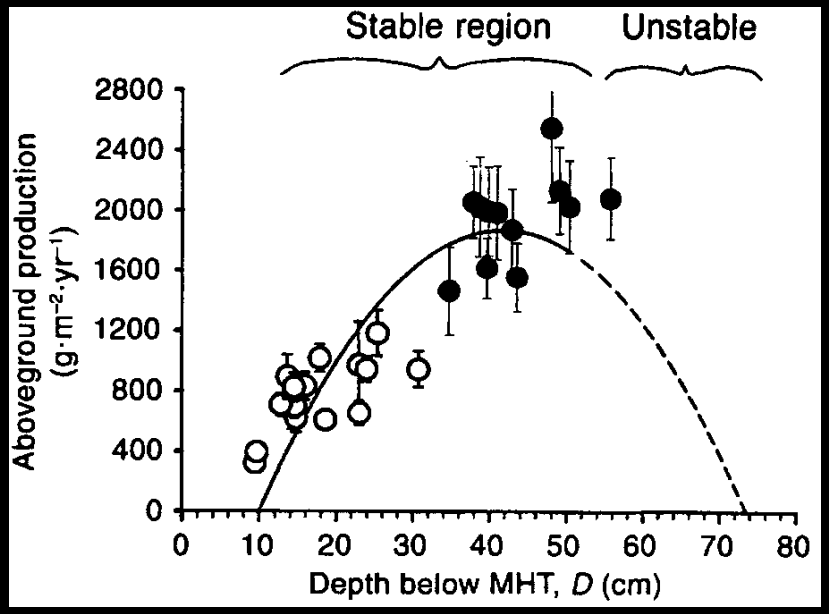
Fate of restored oyster reefs in NC governed by paradigms from the rocky intertidal



Connell 1961

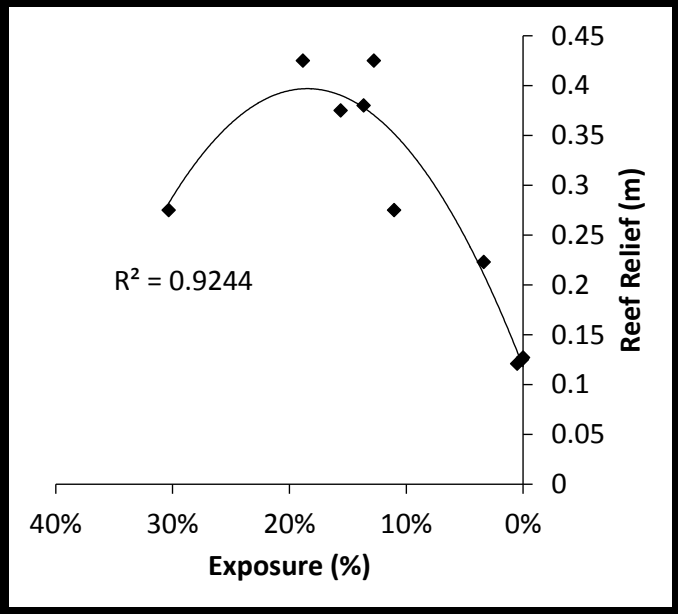
And like saltmarshes, there is a vertical "hotspot" for oyster reef productivity and accretion

Saltmarsh



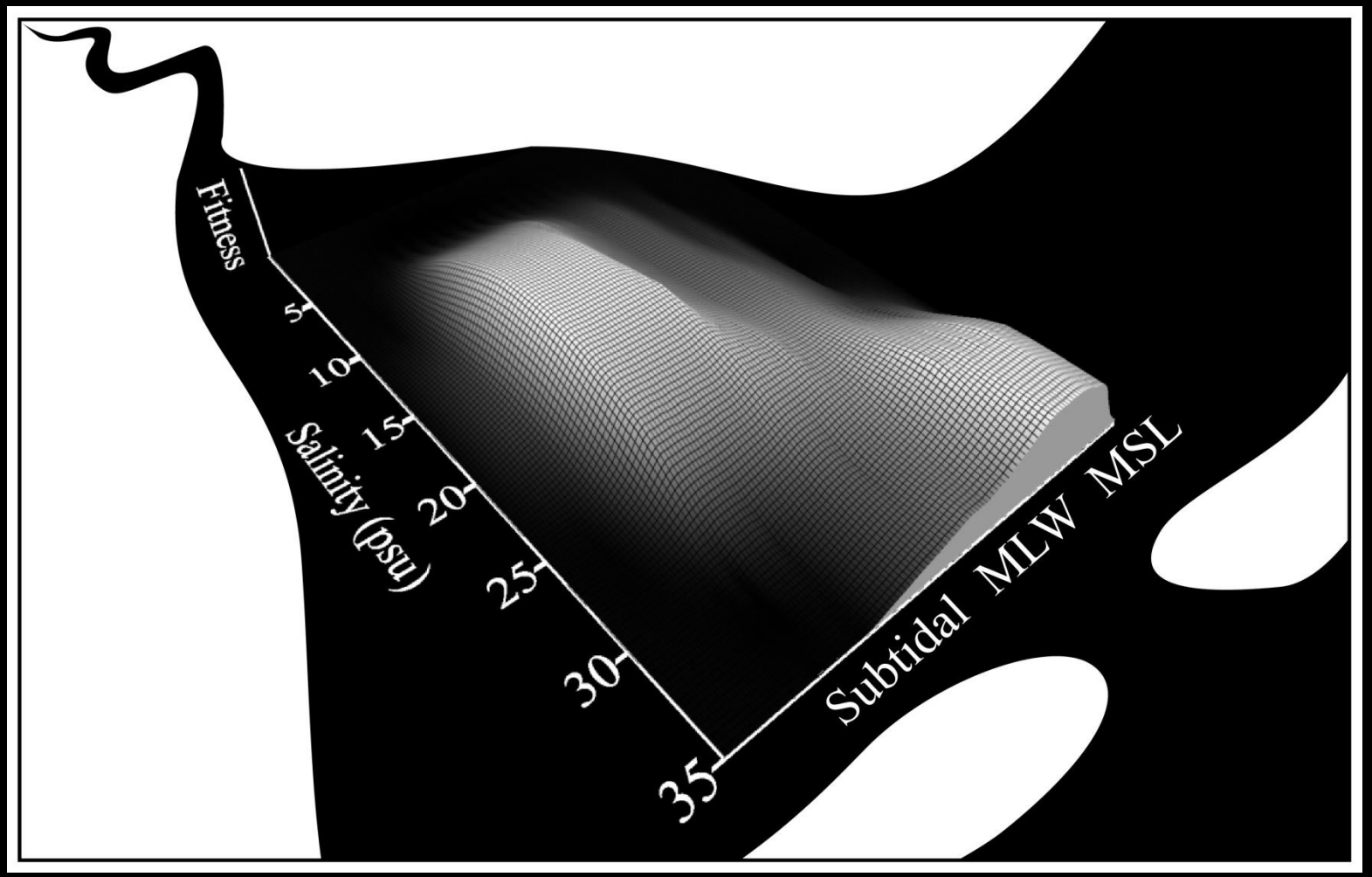
Morris et al. 2002

Oyster Reef



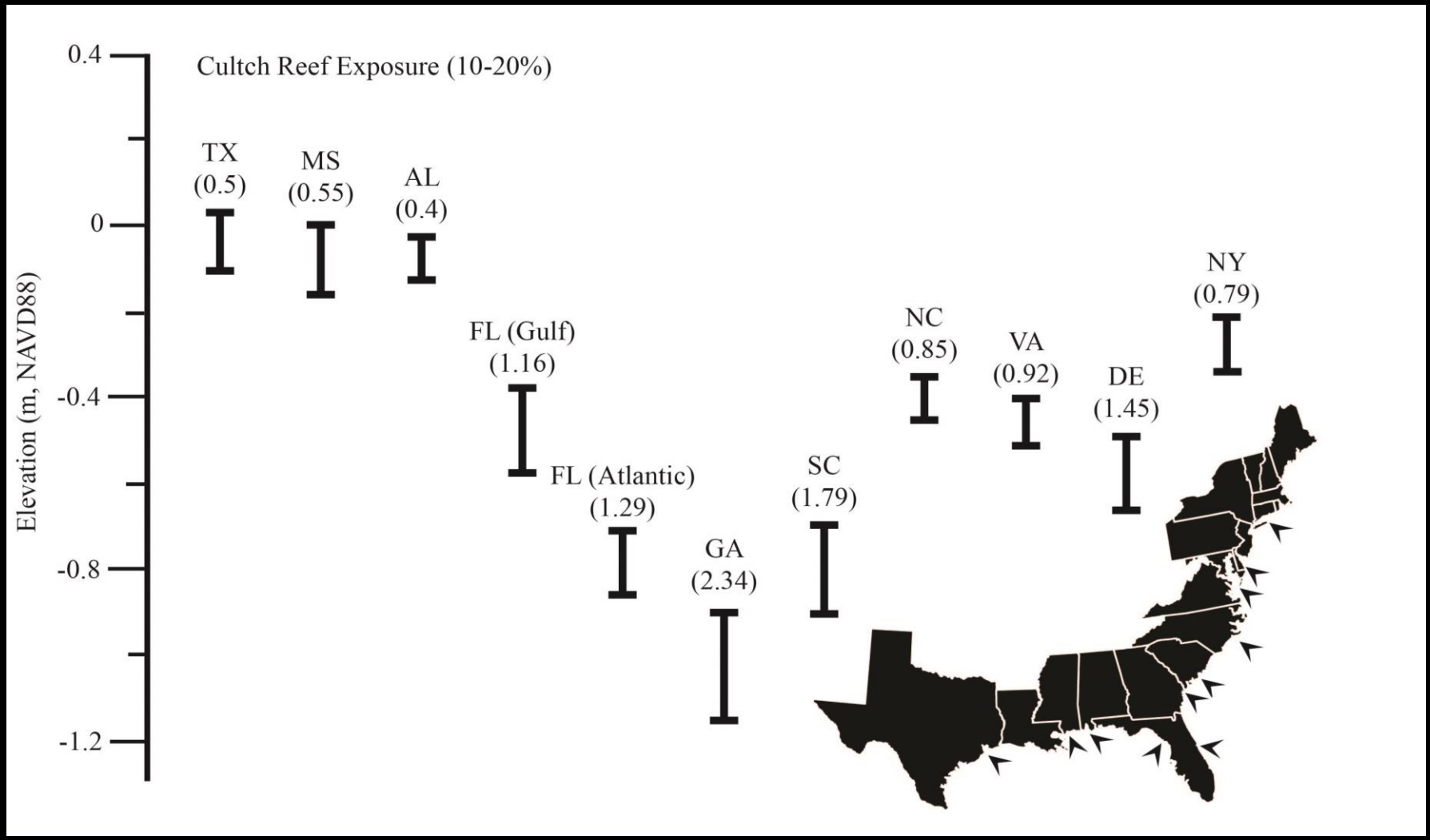
Ridge et al. *in prep*

Vertical and salinity gradients



Ridge et al. *in prep*

Regional model of intertidal oyster distribution



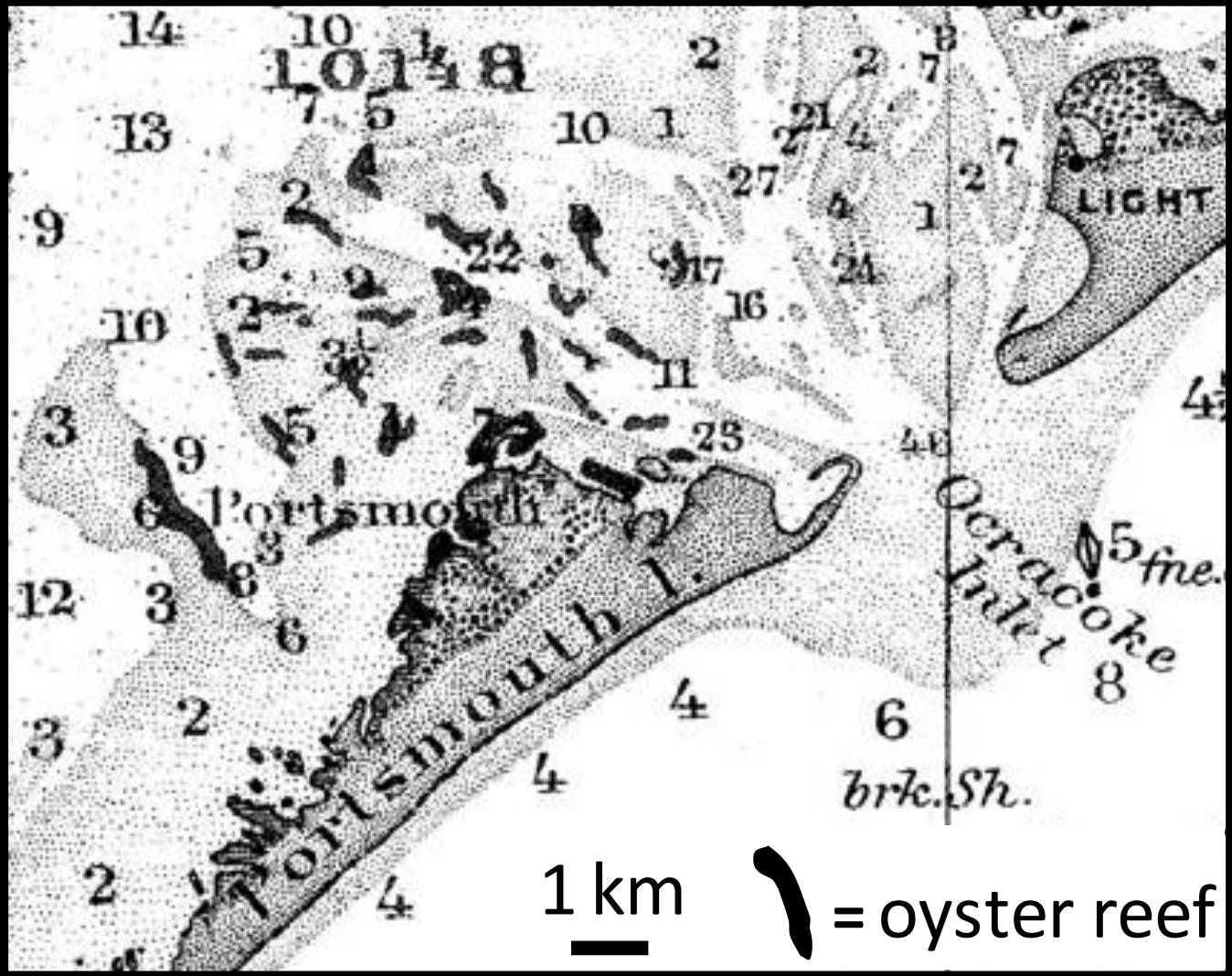
Ridge et al. *in prep*

A 'forgotten' oyster reef paradigm?

Intertidal oyster

Subtidal oyster

Winslow 1886



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Thank You.