Restoration of oyster reefs and their ecological services in the Big Bend of Florida

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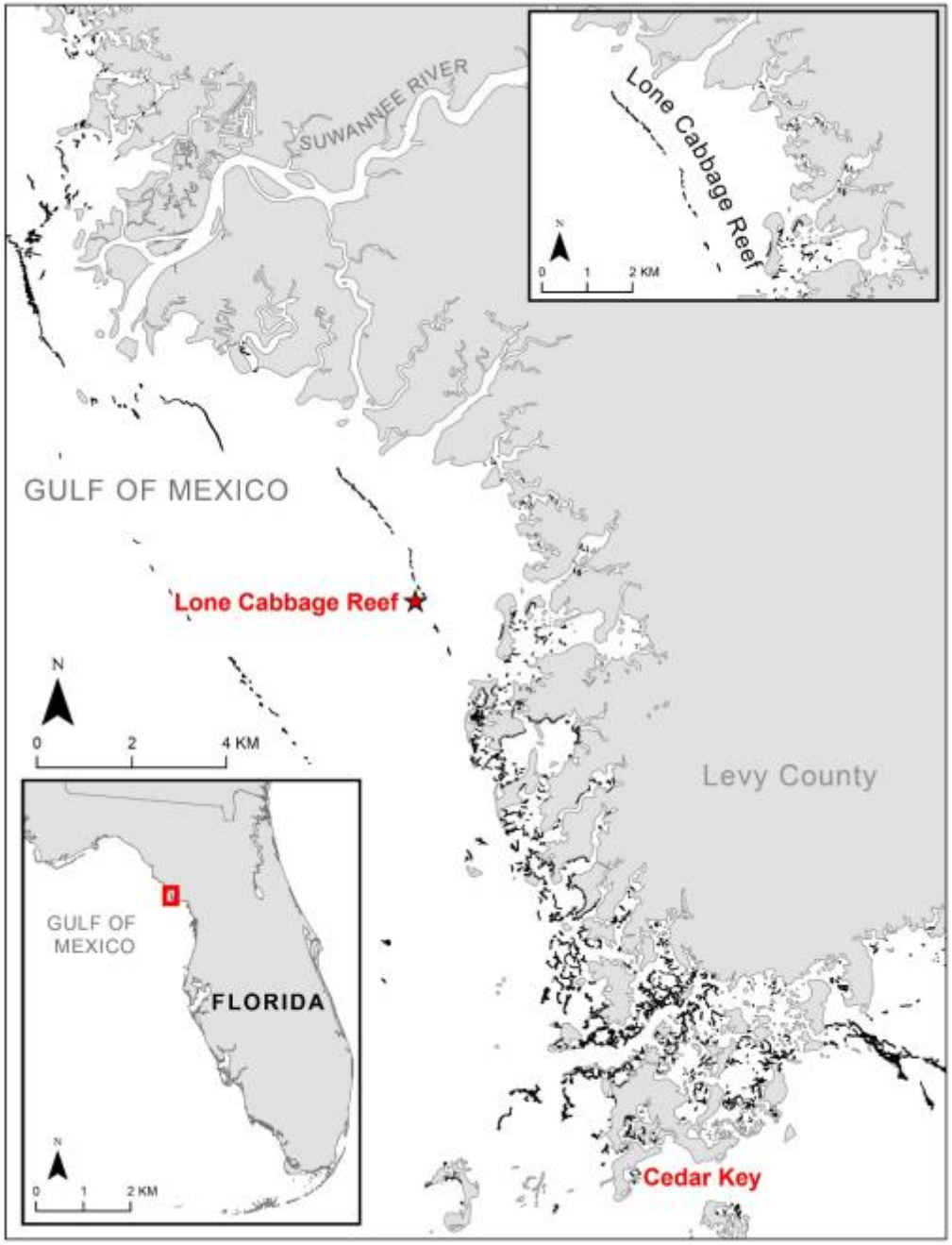
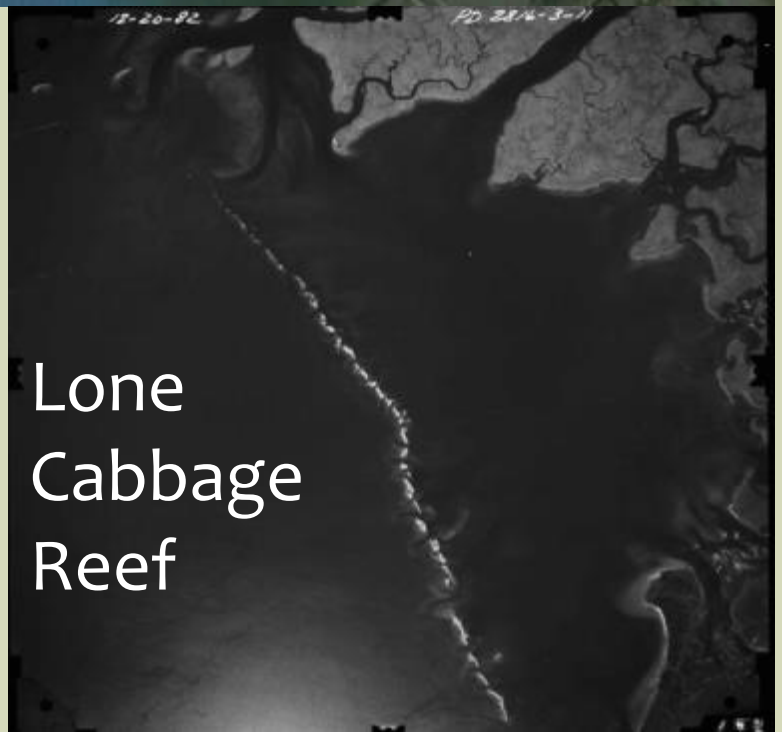
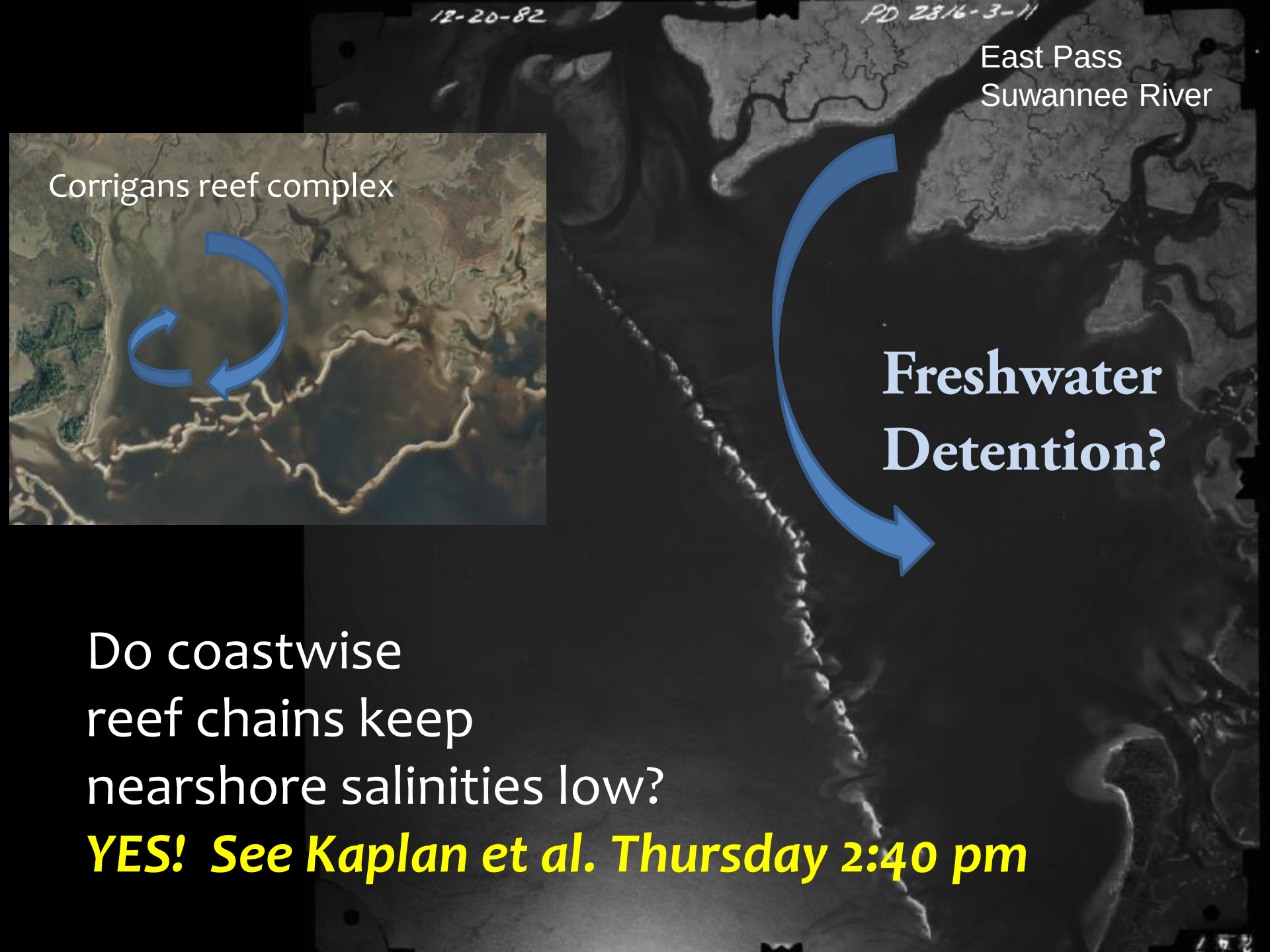

SUWANNEE RIVER
Lone Cabbage Reef
N
0 1 2 KM
GULF OF MEXICO
Lone Cabbage Reef
N
0 2 4 KM
Levy County
GULF OF MEXICO
FLORIDA
N
0 1 2 KM
Cedar Key

Big Bend oysters

reefs parallel to coast
mostly intertidal
low energy coast
low sediment supply
no barrier islands





Do coastwise reef chains keep nearshore salinities low?

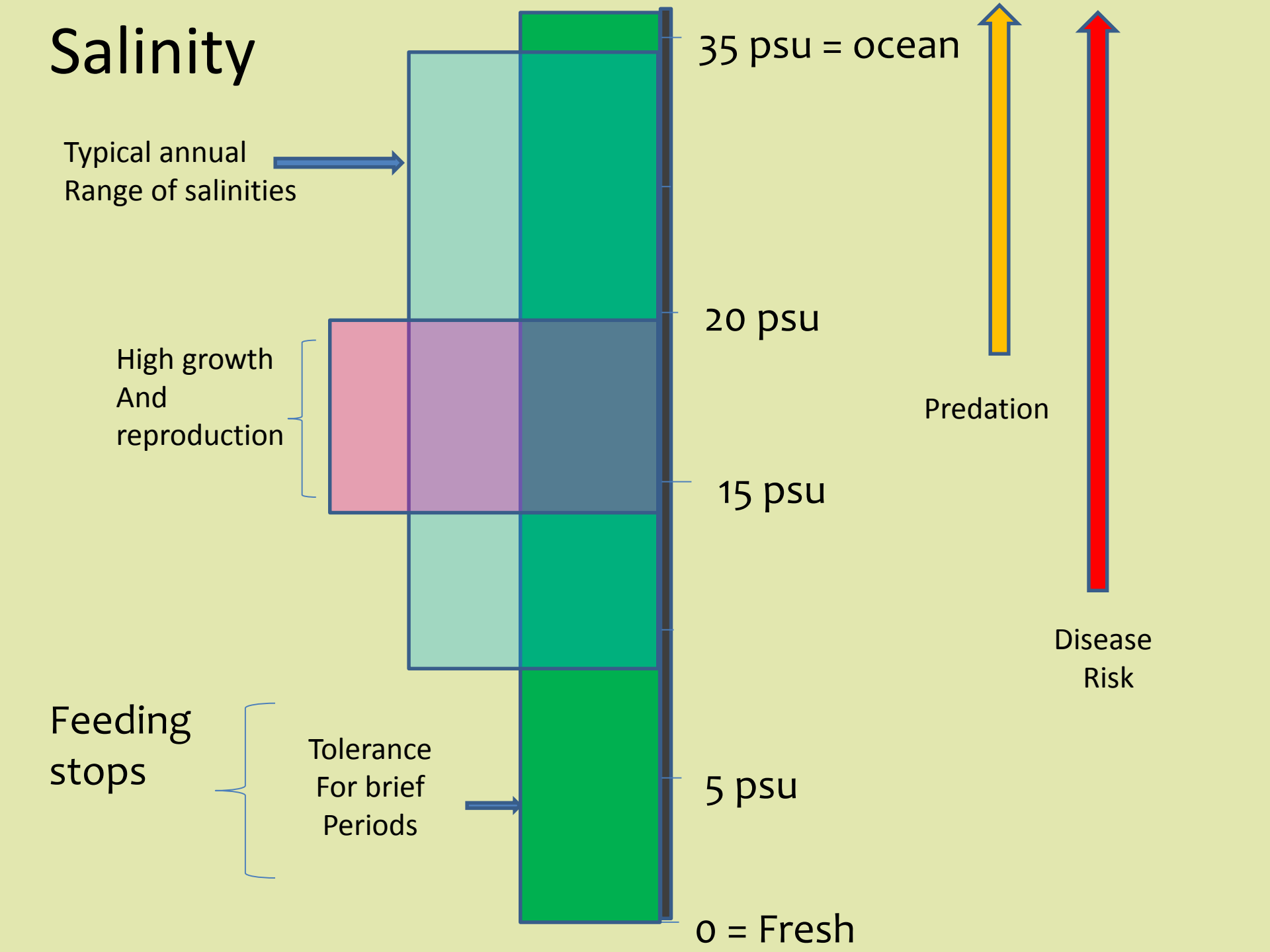
YES! See Kaplan et al. Thursday 2:40 pm


2010
Lone Cabbage Reef

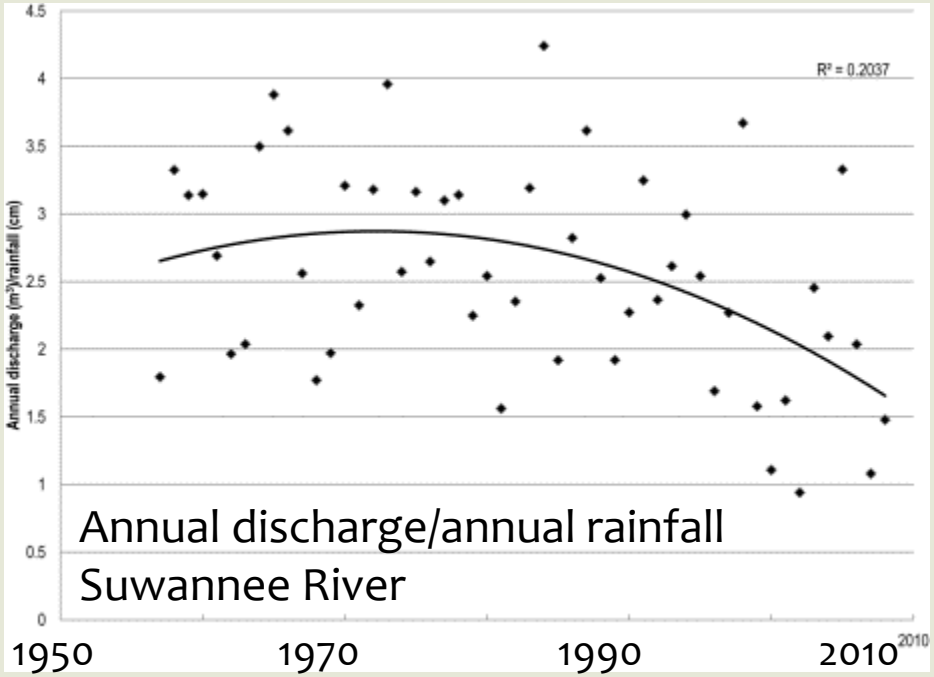
88% loss of offshore reefs
61% loss of nearshore reefs
50% loss of inshore reefs
In 30 years
3,000 year history

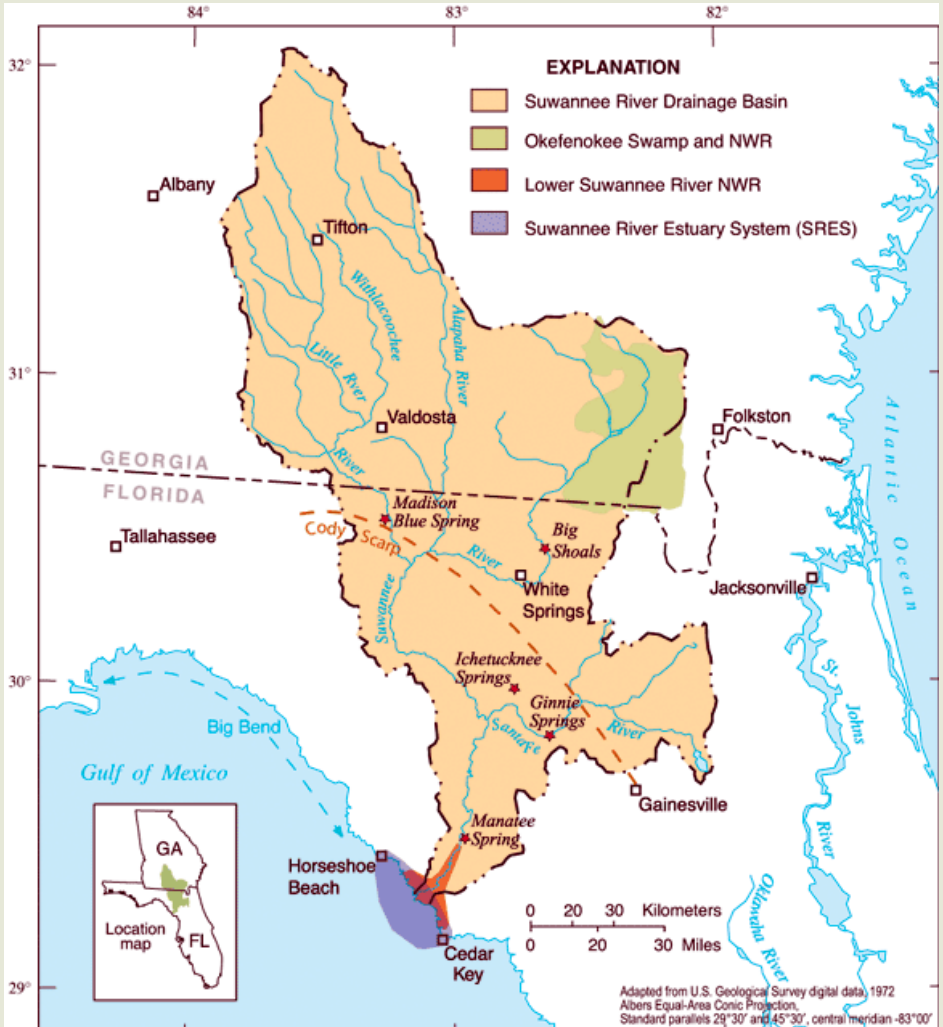

Degraded bars are still eroding
17 cm in 2 years
7 inches

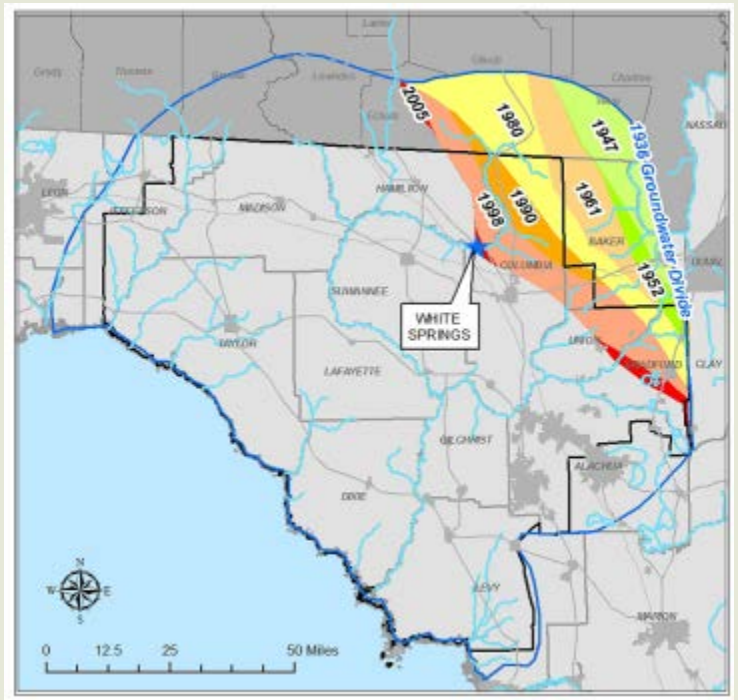
Salinity


35 psu = ocean
Typical annual
Range of salinities
20 psu
High growth
And
reproduction
15 psu
Predation
Disease
Risk
Feeding
stops
Tolerance
For brief
Periods
5 psu
0 = Fresh

Trend towards less discharge per drop of rainfall in Suwannee basin







Oyster reef feedback loops

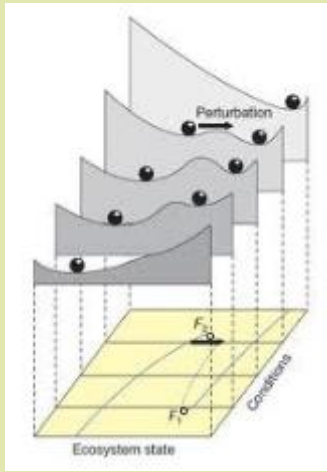
Upstream freshwater usage

Increased salinity

Episodic mass mortality

Loss of substrate

No recruitment

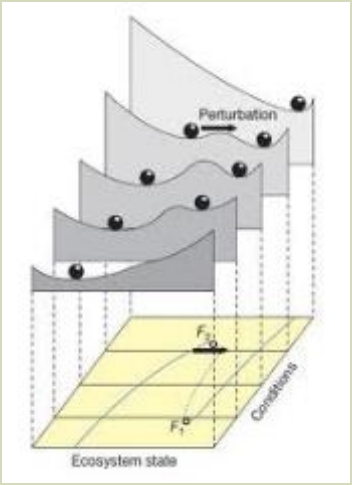


We have lots of larvae and spat from inshore

The spat cannot survive without places to hide

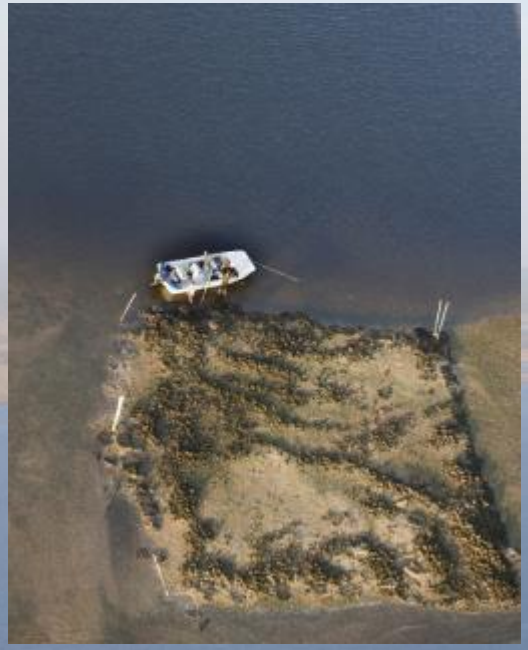
They cannot recolonize a degraded oyster bar without added structure.

Restoration hypothesis: Durable substrate allows repeated recolonization of reefs following episodic mass mortality events, leading to increased resilience



Intervene here

"Build it and they will come……
and go, and come, and go…."



Control

Restore

Control

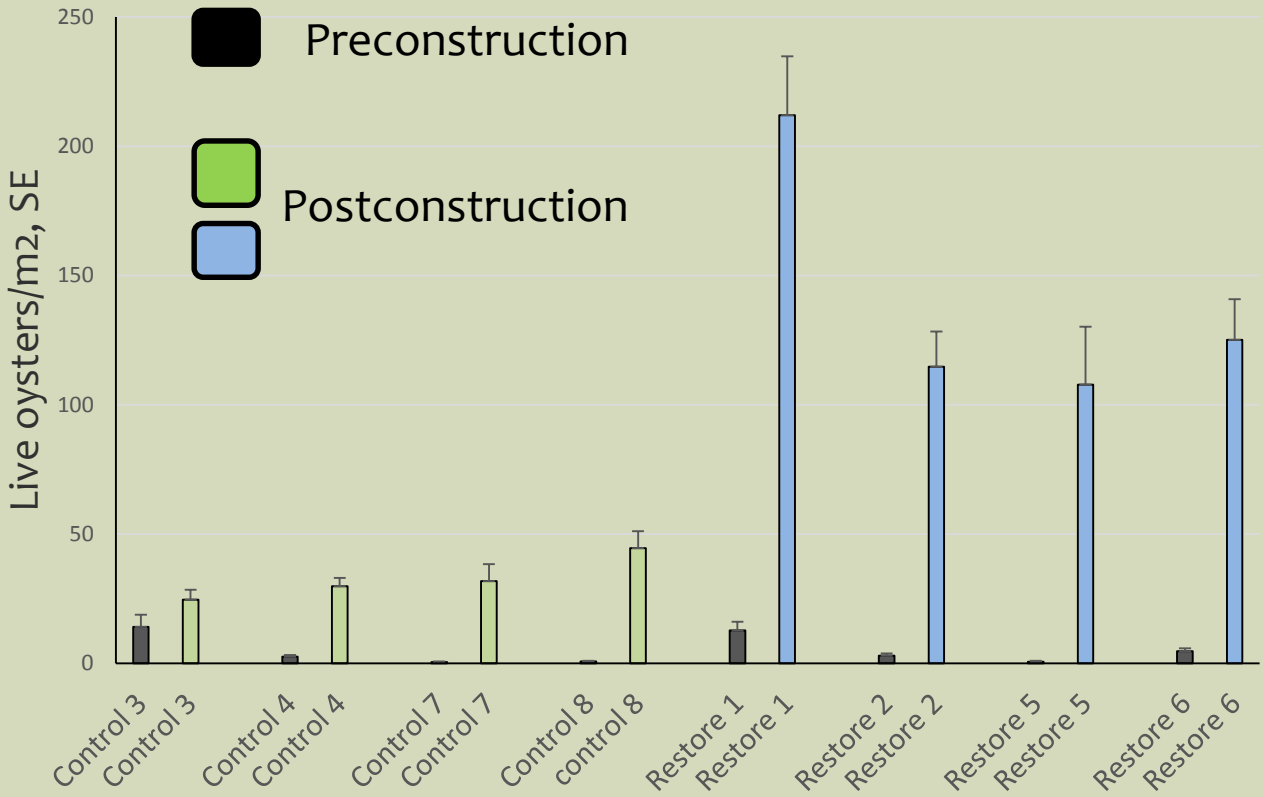
Restore

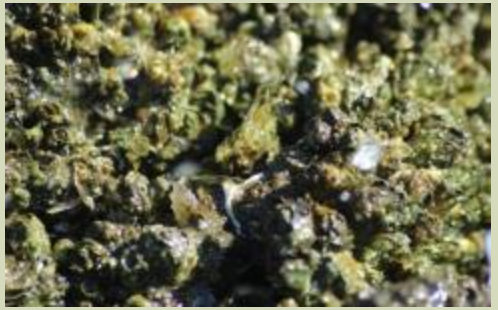
Limerock boulders installed
September 2013

Oyster Reef Building Blocks

Estimated 8,000 live oysters in a "damaged" clam bag and 0.15 yd^3 of cultch material

Oyster density

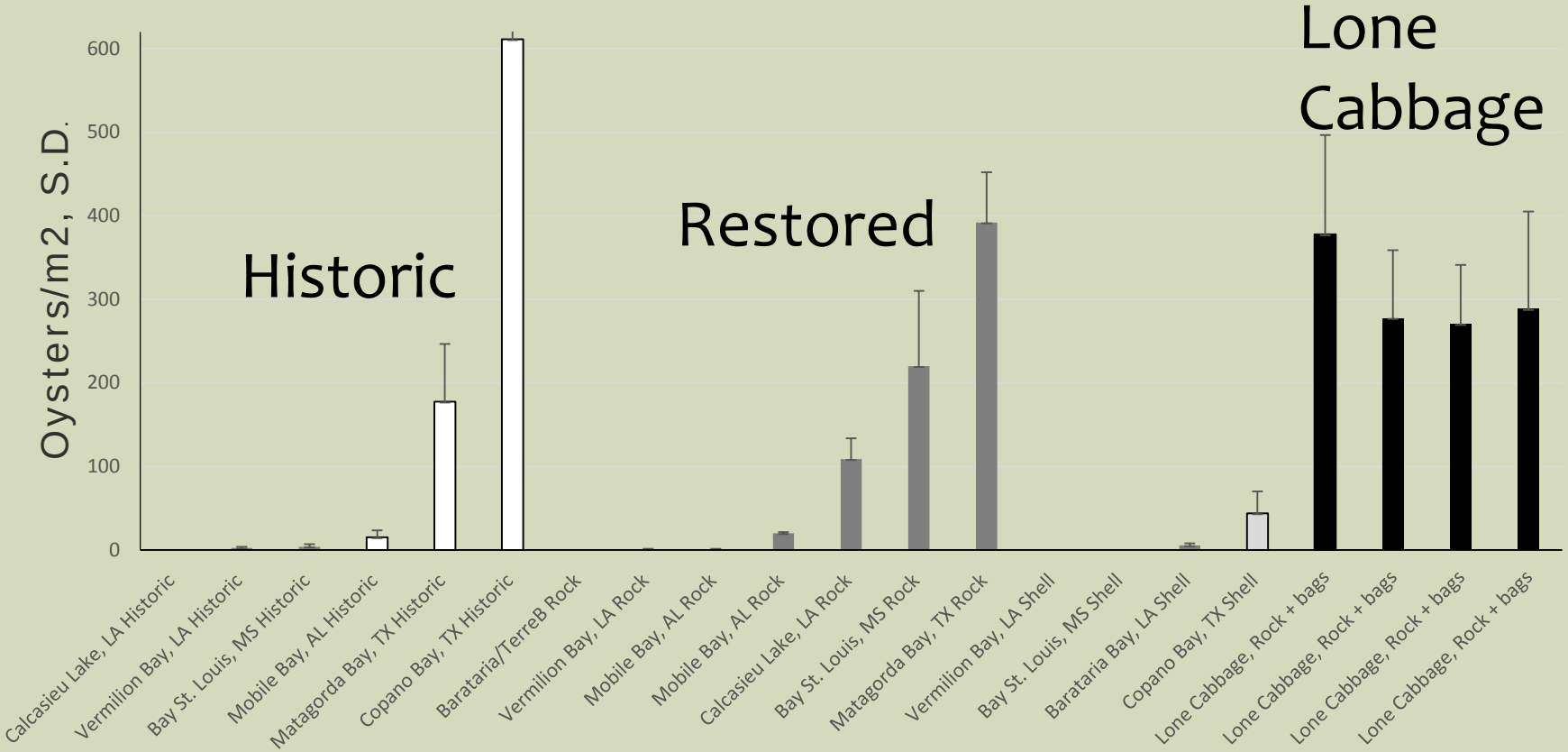




Oyster- cemented seam between rocks

Treatment	Before/after	Treatment effect
Control	64X increase	
Restoration	157X increase	9.2X increase over control

Restoration Success - oyster density



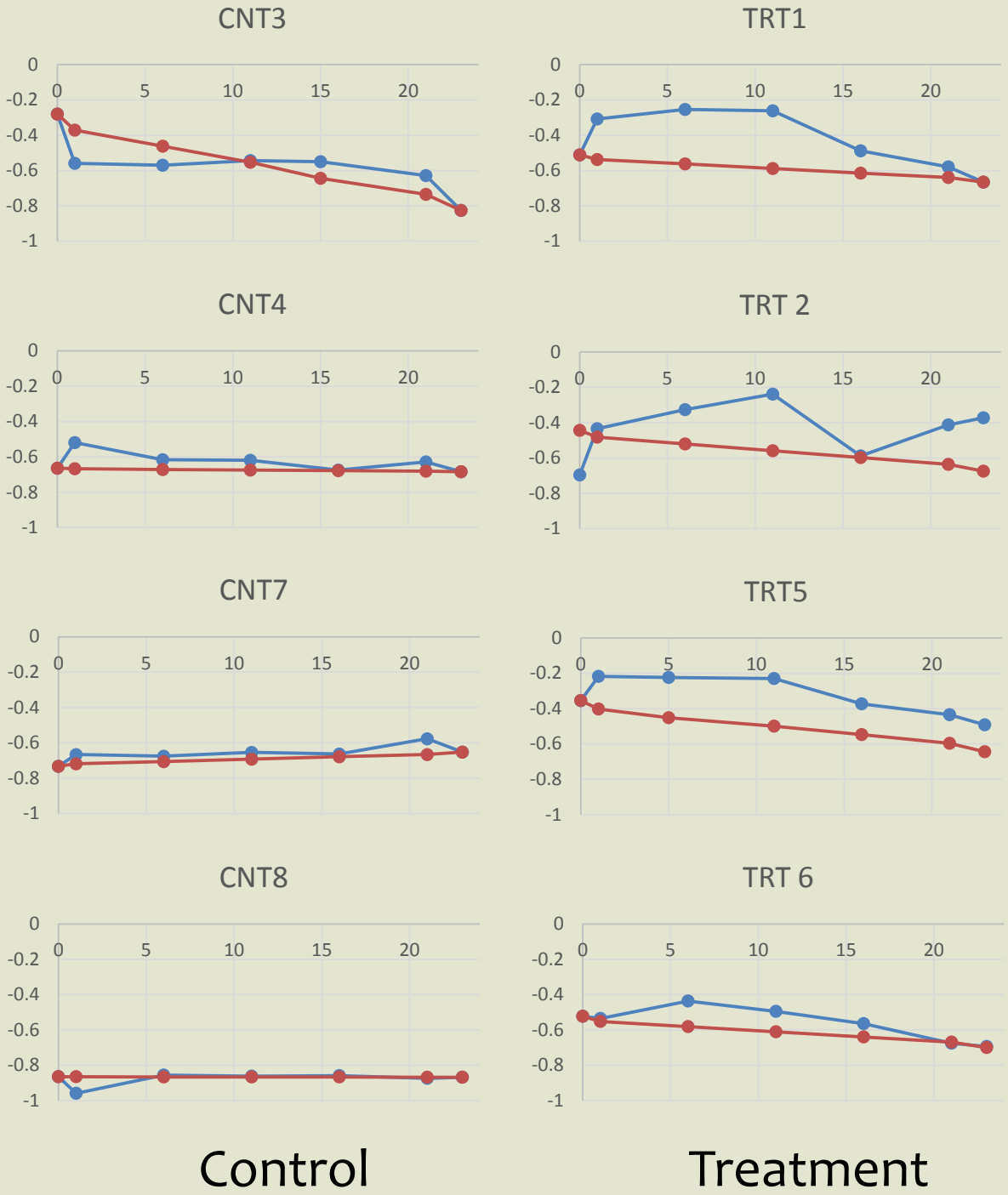
Data from LaPeyre et al. 2014
Ocean & Coastal Management 89:20-28

Bags: 25% of area, 52% of oysters

Elevations

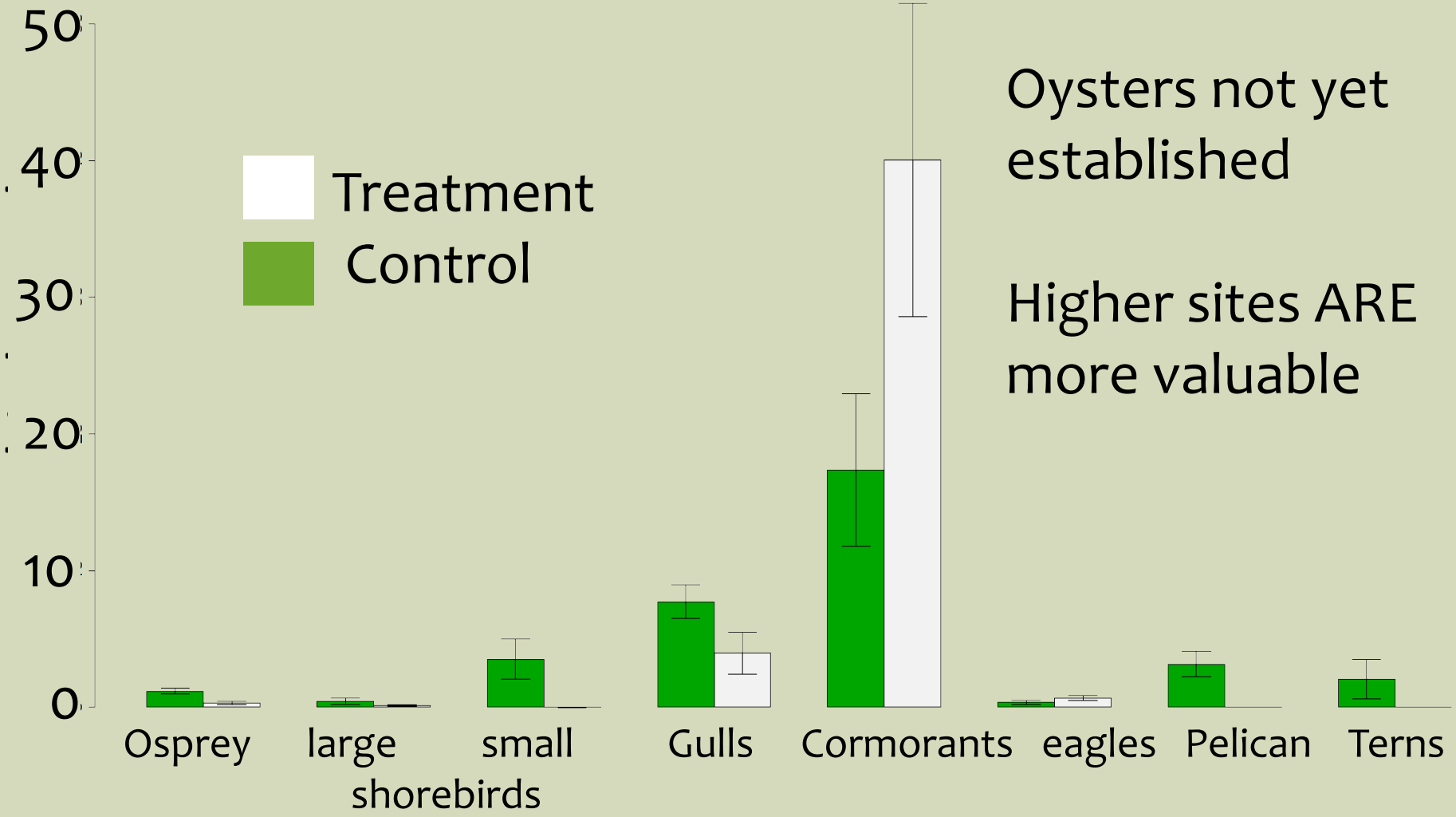
Before

After

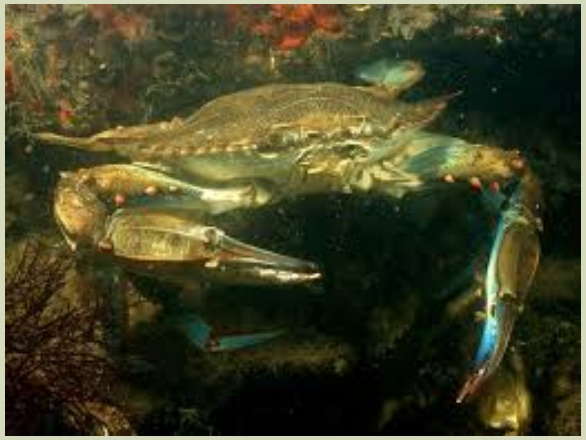





Birds/hour based on ***tide-standardized*** observations



Monitoring blue crabs



7.5X increase in blue crab Density

Poor detection probablilities!

Conclusions

- Restoration with local materials can be accomplished in 1.5 years.

- Freshwater detention appears to be a major, novel ecosystem service of linear chains of reefs – ***see Kaplan et al. Thursday 2:40 pm.***

- Building evidence that restoring reefs affects multiple trophic levels.

- Clear evidence of substrate limitation in the short term

- Long term resilience in response to droughts?

Long term goal –

Rebuild reef chains

↓

Retain fresh water

↓

Increase estuarine resilience to reduced freshwater discharge