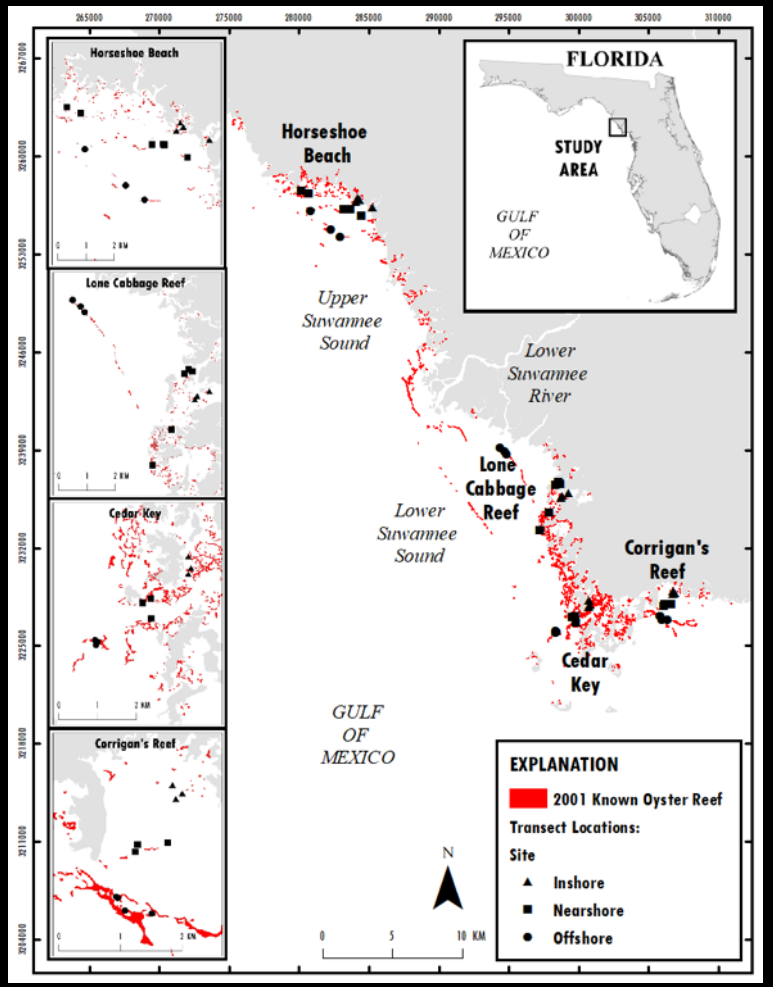
Lone Cabbage Reef (LCR) Restoration

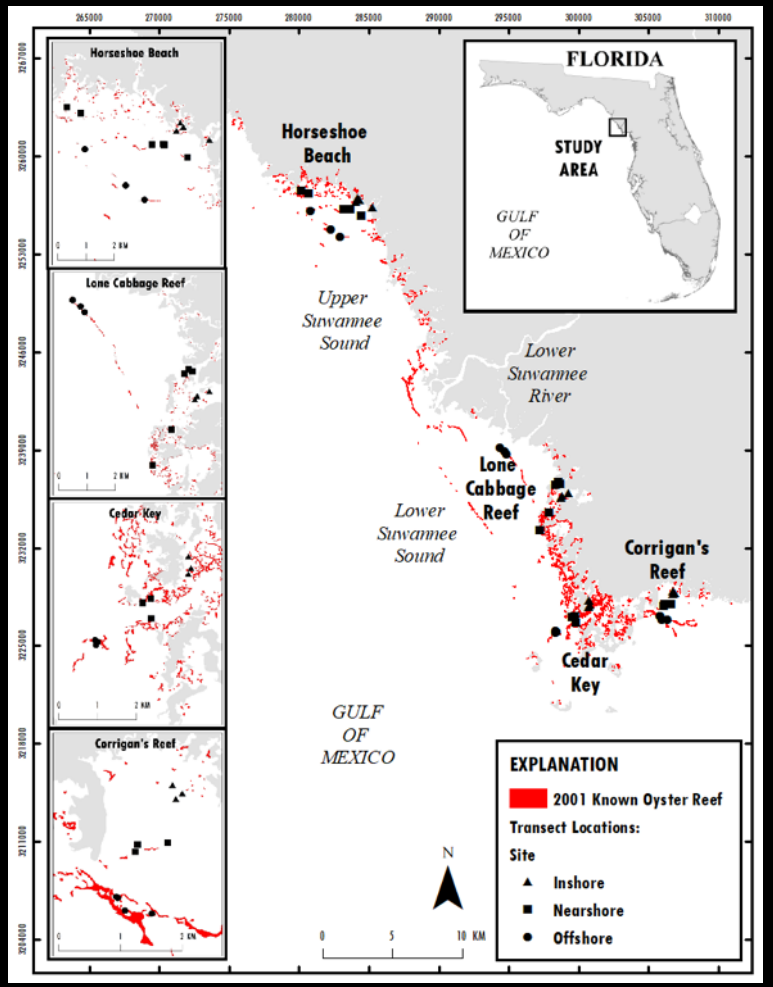
LCR Restoration: Motivation

- Seavey et al. 2011: large losses in intertidal oyster reefs 1982-2011
  - Aerial surveys and on-the-ground assessment
  - Horseshoe Beach to Corrigan's Reef



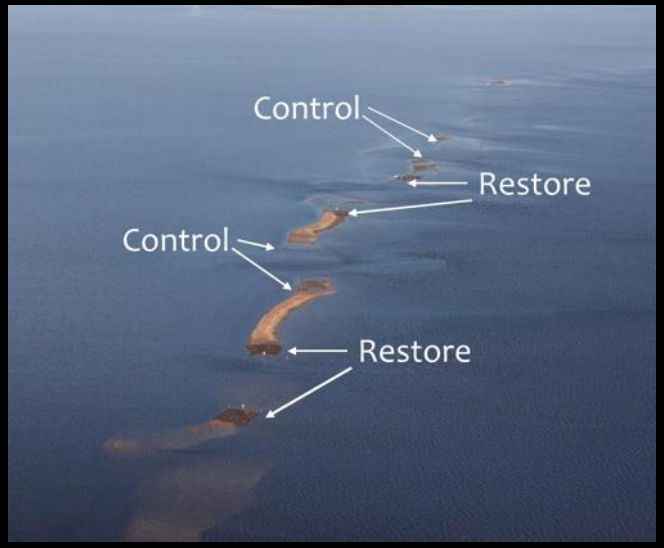
LCR Restoration: Motivation

- 66% loss of intertidal oyster reef 1982-2011
- Largest losses “offshore” oyster reef



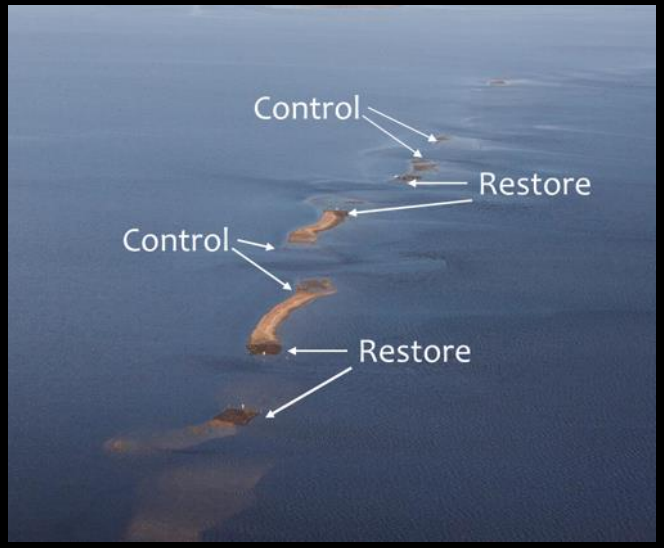
LCR Restoration: Motivation

- *Seavey et al. results led to…*
- Pilot restoration project 2013 (Frederick et al. 2016)



Pilot LCR Restoration: What are we learning?

- Ho: Does addition of rock as durable substrate allow oyster colonization and persistence?



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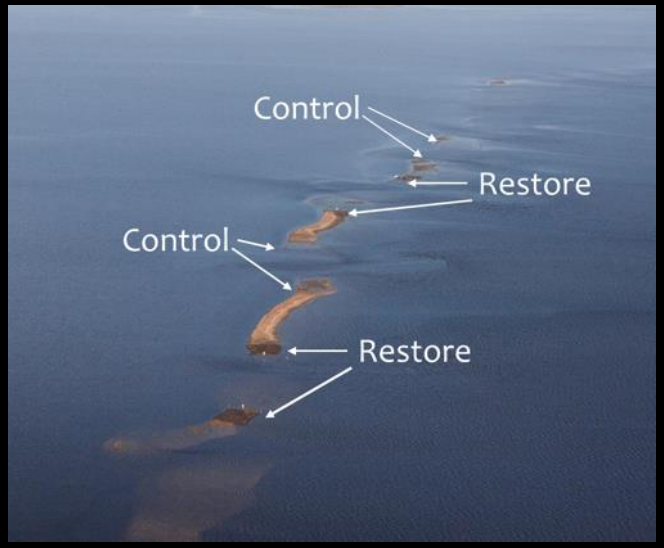
  - 4 rock restoration sites
  - 4 control sites
  - Each about 21 m x 21 m



Pilot LCR Restoration: What are we learning?

- Ho: Does addition of rock as durable substrate allow oyster colonization and persistence?
  - 4 rock restoration sites
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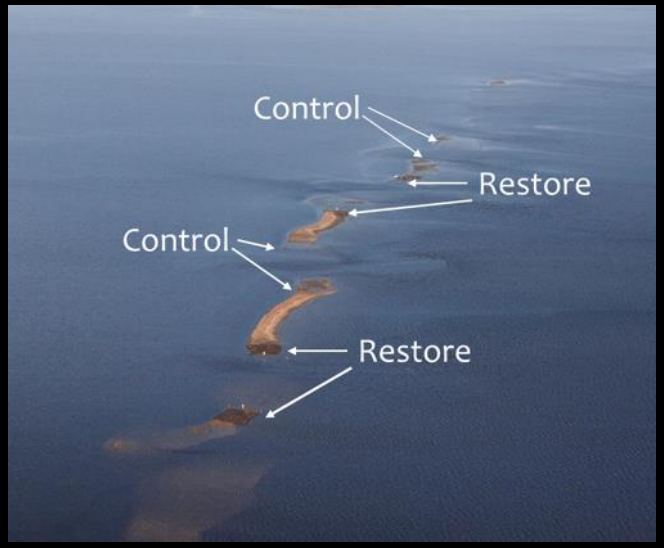
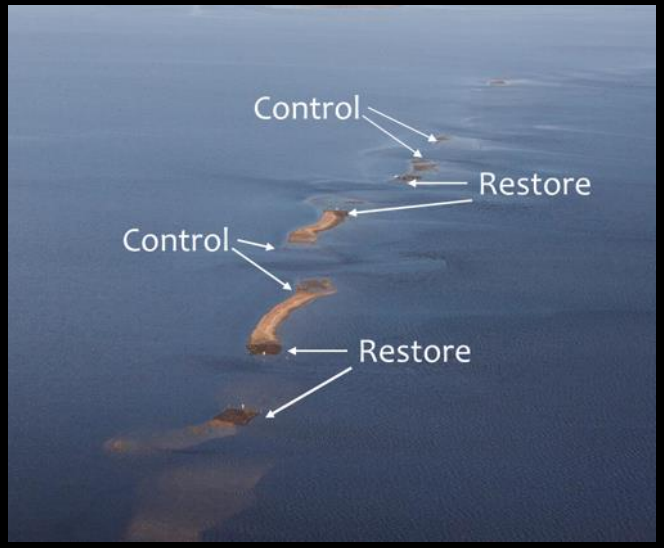
  - Each about 21 m x 21 m
  - **9x increase in oysters on restored vs. control sites**



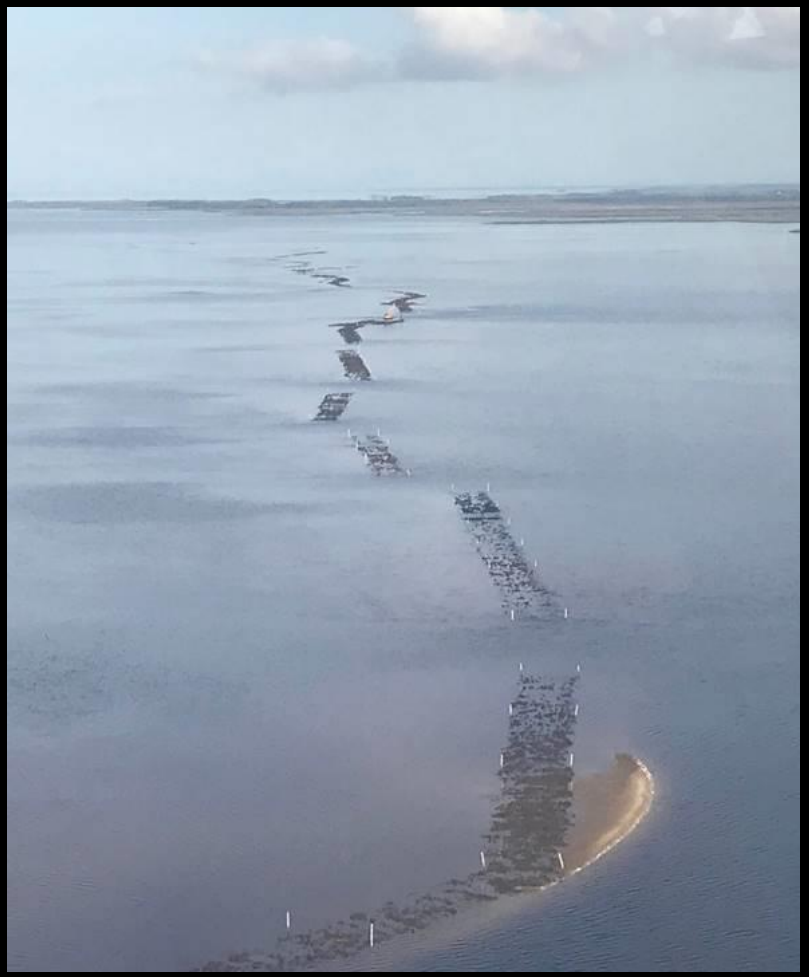
Pilot LCR Restoration: What are we learning?

- *Frederick et al. pilot project results led to…*
- Large-scale restoration of LCR 2017-2024



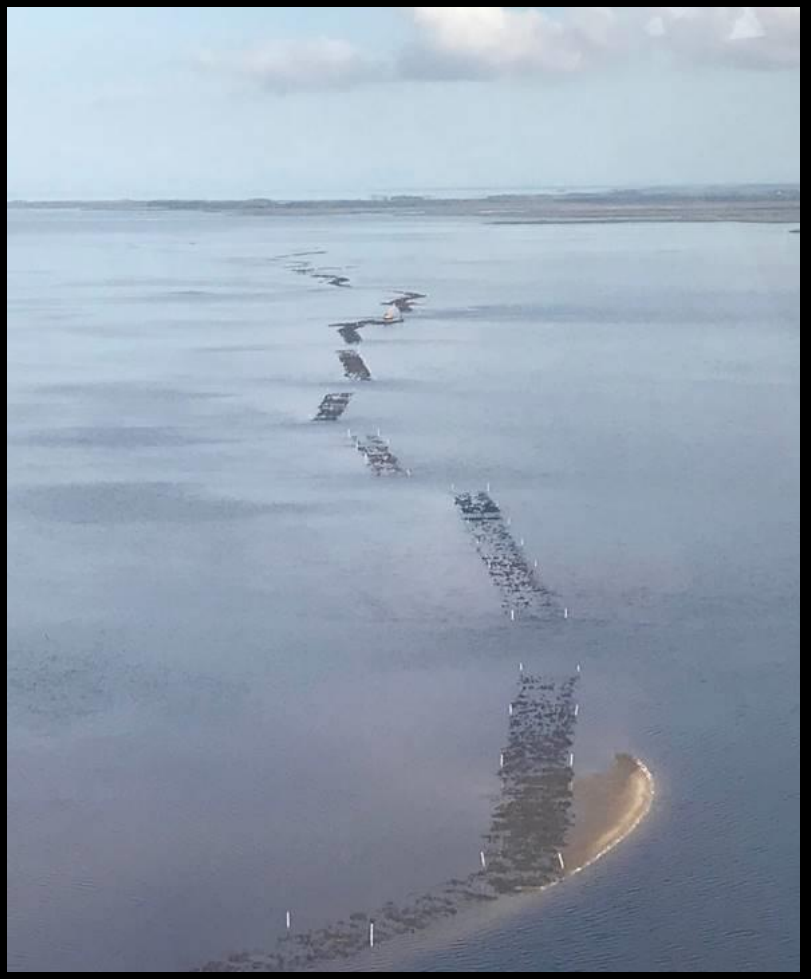
LCR Restoration: What are we learning?

- 22 reef elements along relic reef footprint identified from maps created in the 1800's



LCR Restoration: What are we learning?

- 22 reef elements along relic reef footprint identified from maps created in the 1800's
- ~17,000 yds^3 locally sourced limestone 8-18" in size (13,00m^3; 20-45 cm)
  - Same limestone as found along this coast "Ocala formation"



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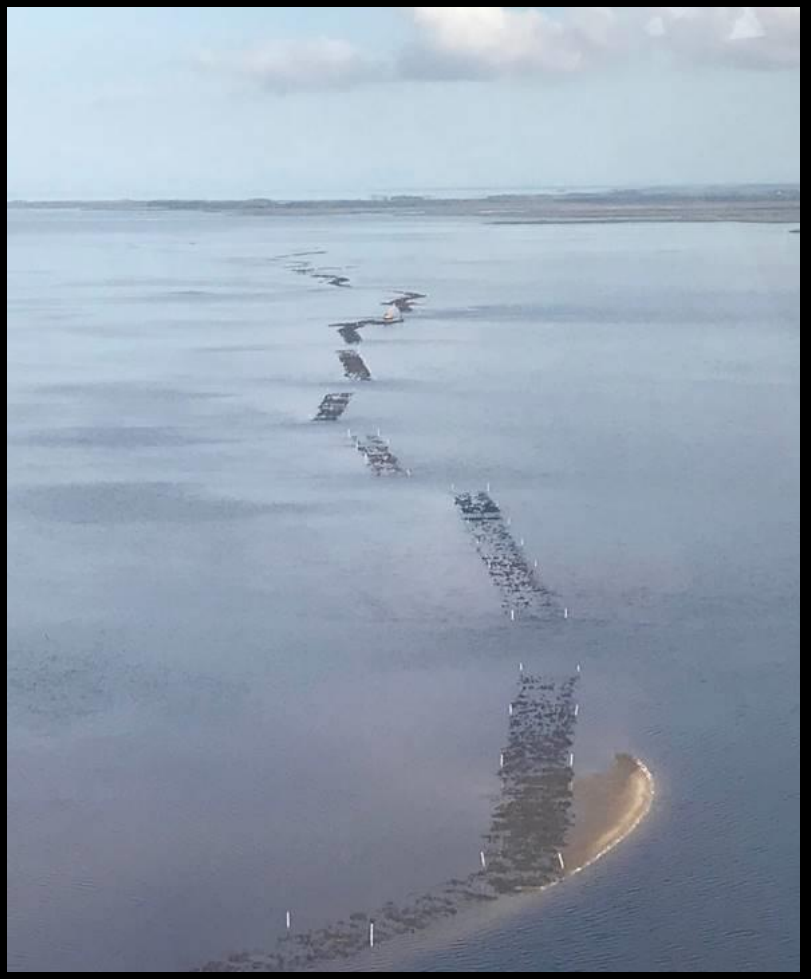
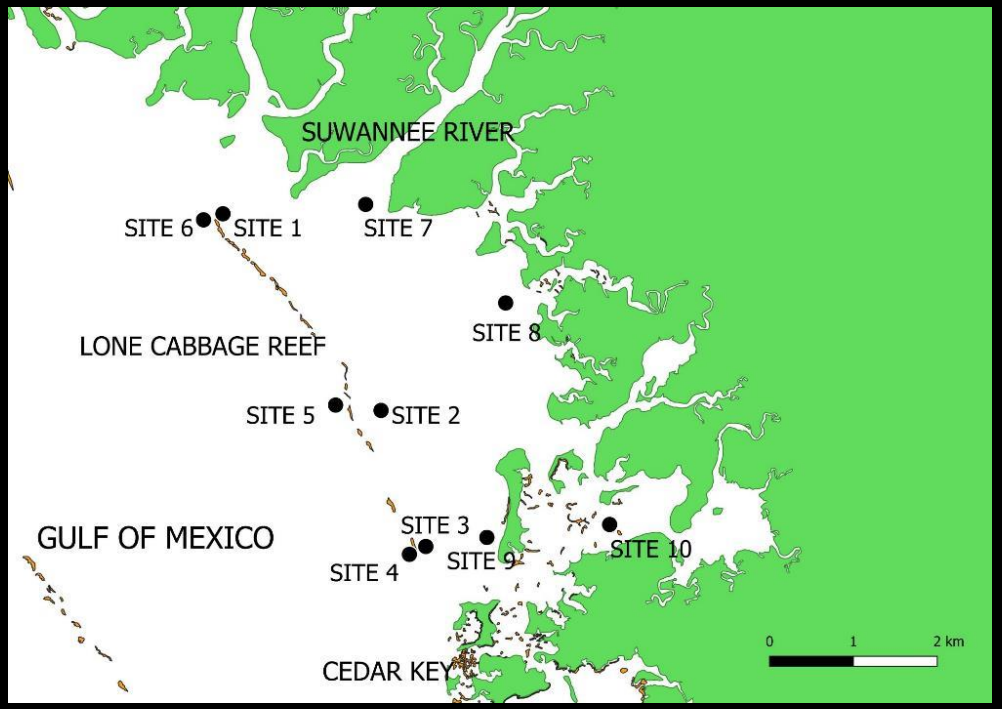
- Construction completed summer 2018



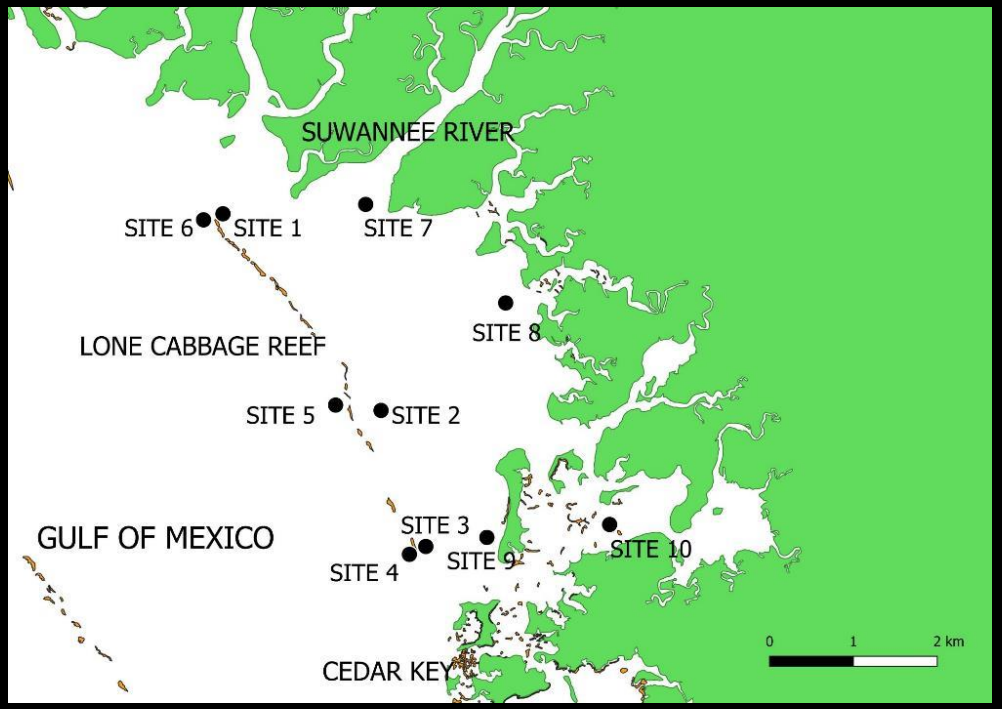
LCR Restoration: What are we learning?

- Line transect to monitor restored and wild intertidal oyster bars
- Autonomous WQ monitoring stations at 10 sites
- Rigorous data management and reporting standards

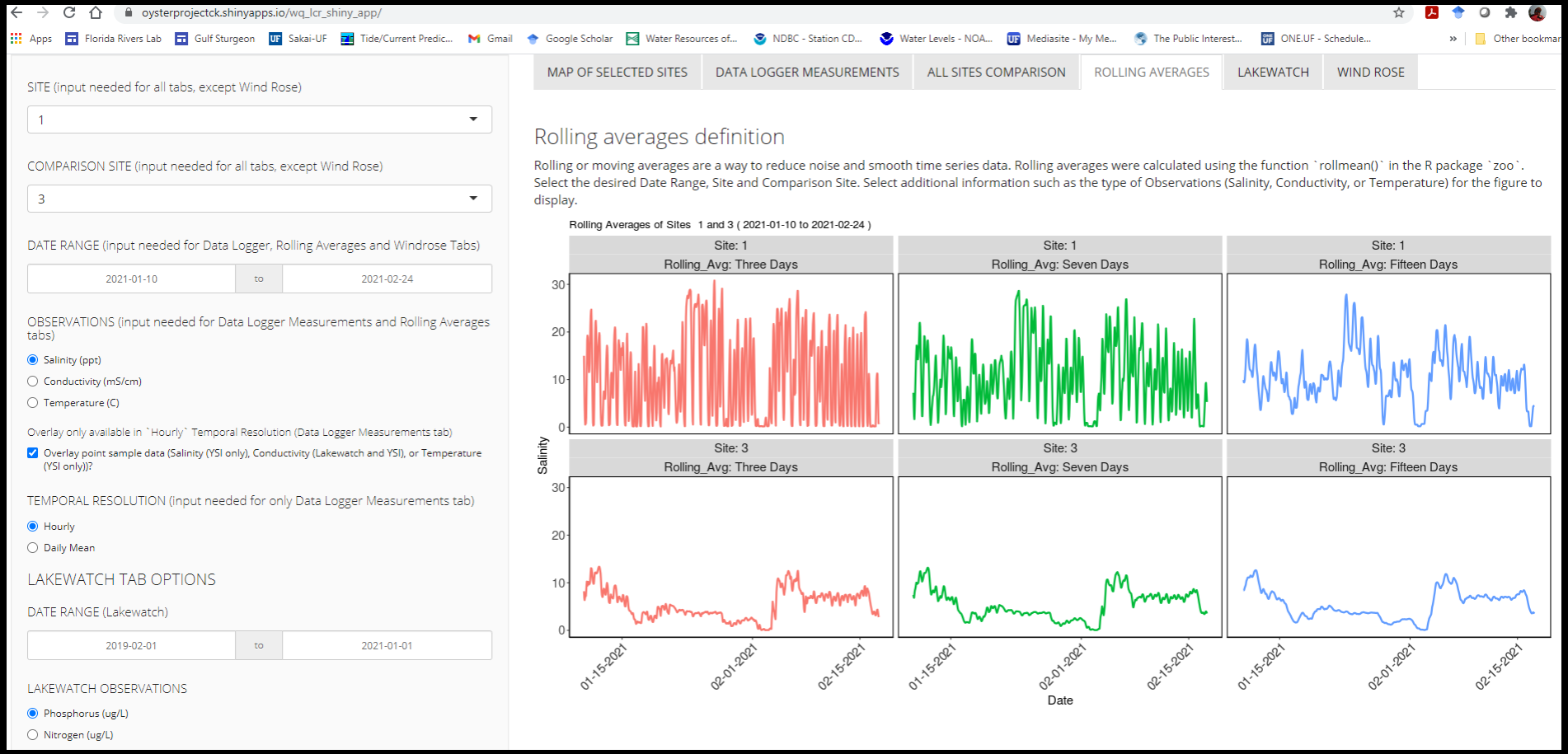


LCR Restoration: What are we learning?

- Line transect to monitor restored and wild intertidal oyster bars
- Autonomous WQ monitoring stations at 10 sites
- Rigorous data management and reporting standards
  - Database to manage WQ files
  - WQ sensor library
  - Data entry system
  - Standard reports routinely generated using R-markdown
  - Shiny App for water quality



Shiny App for Public WQ Visualization



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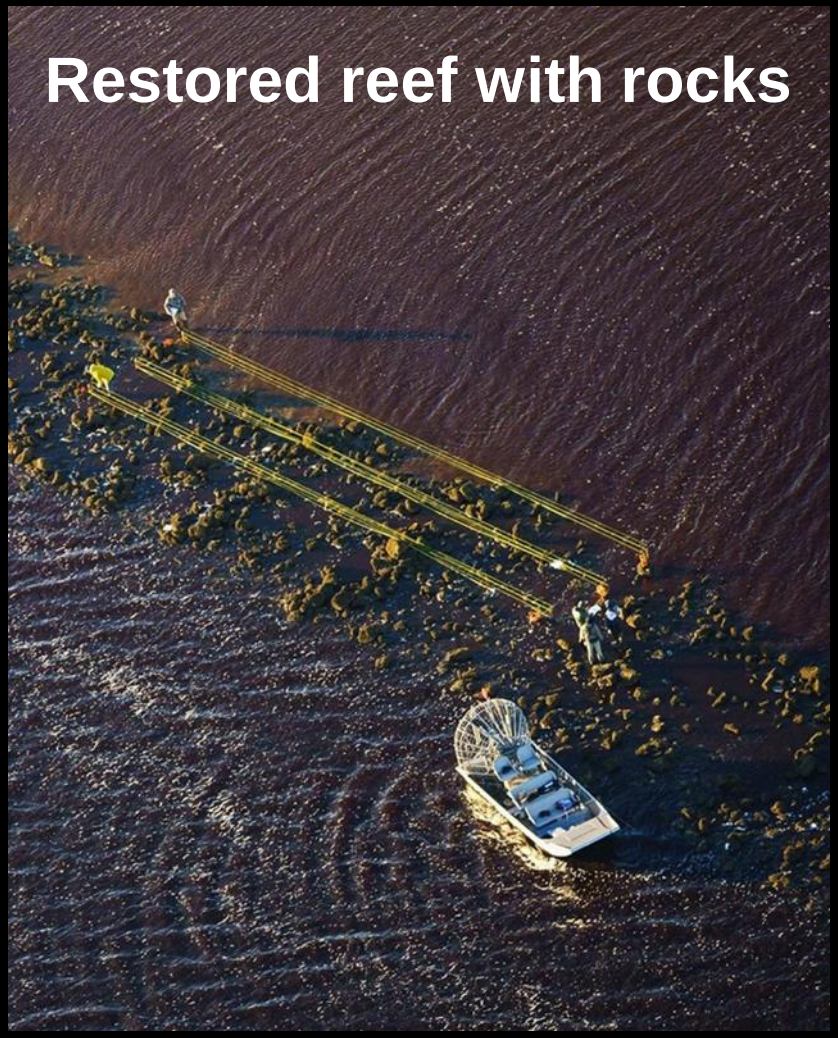

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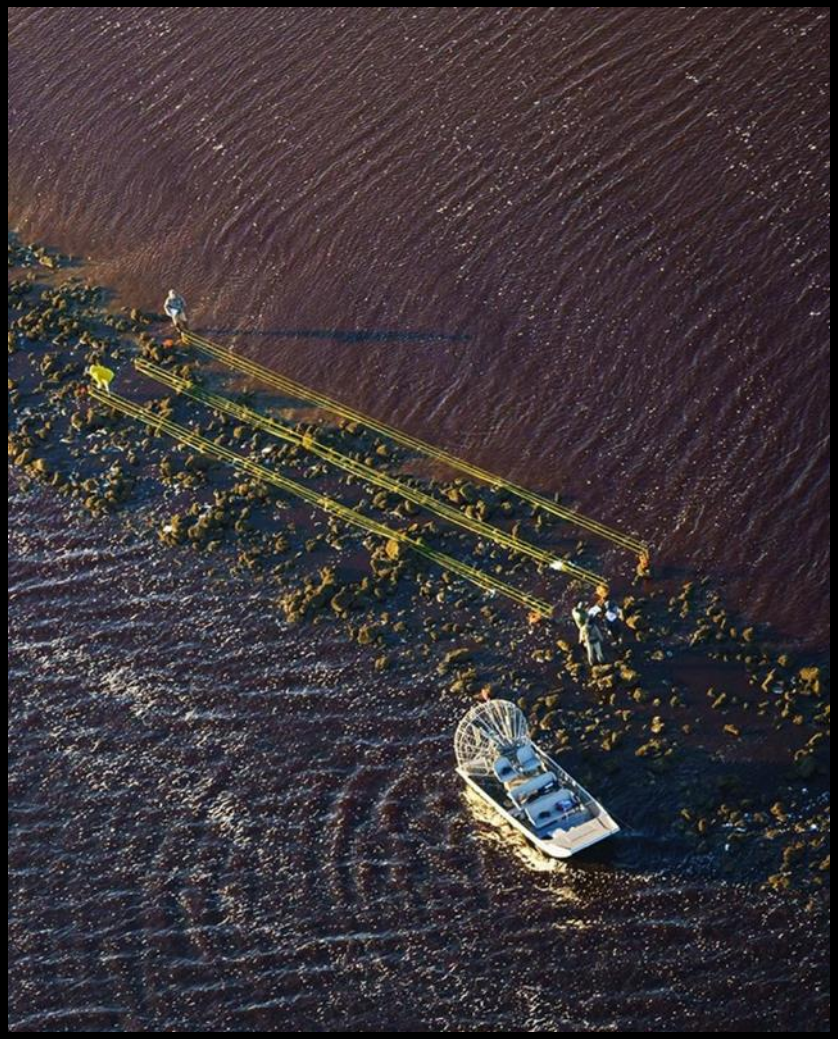
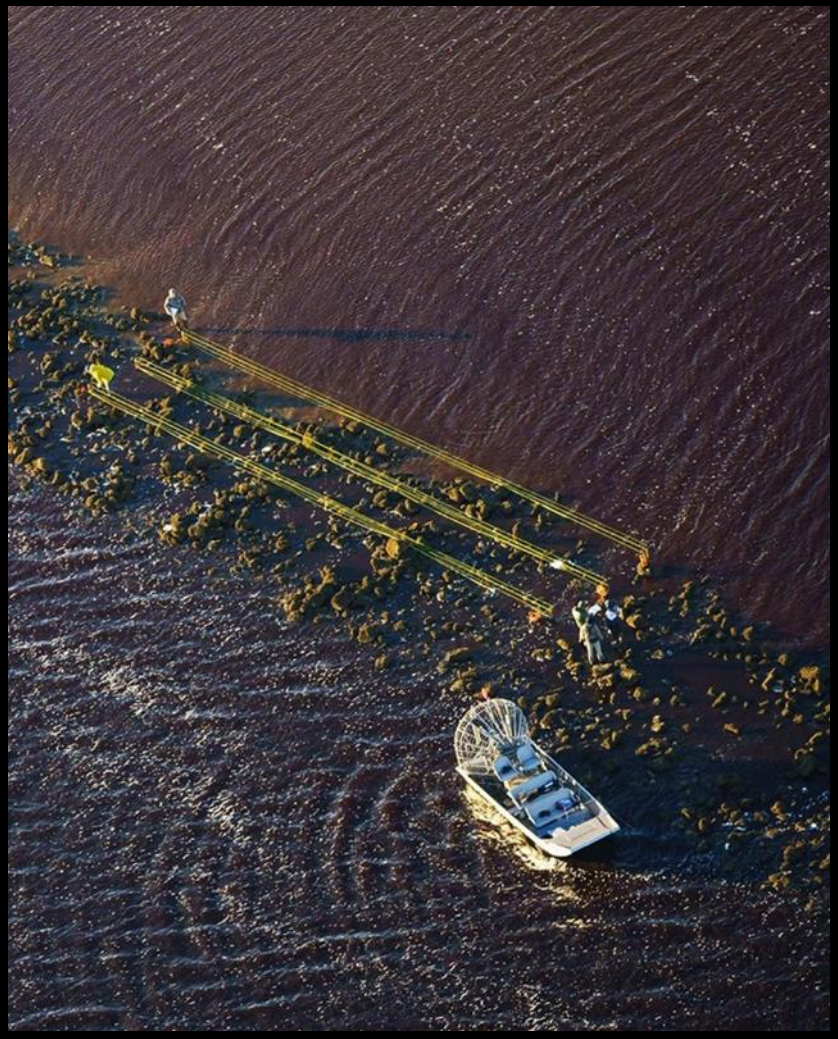


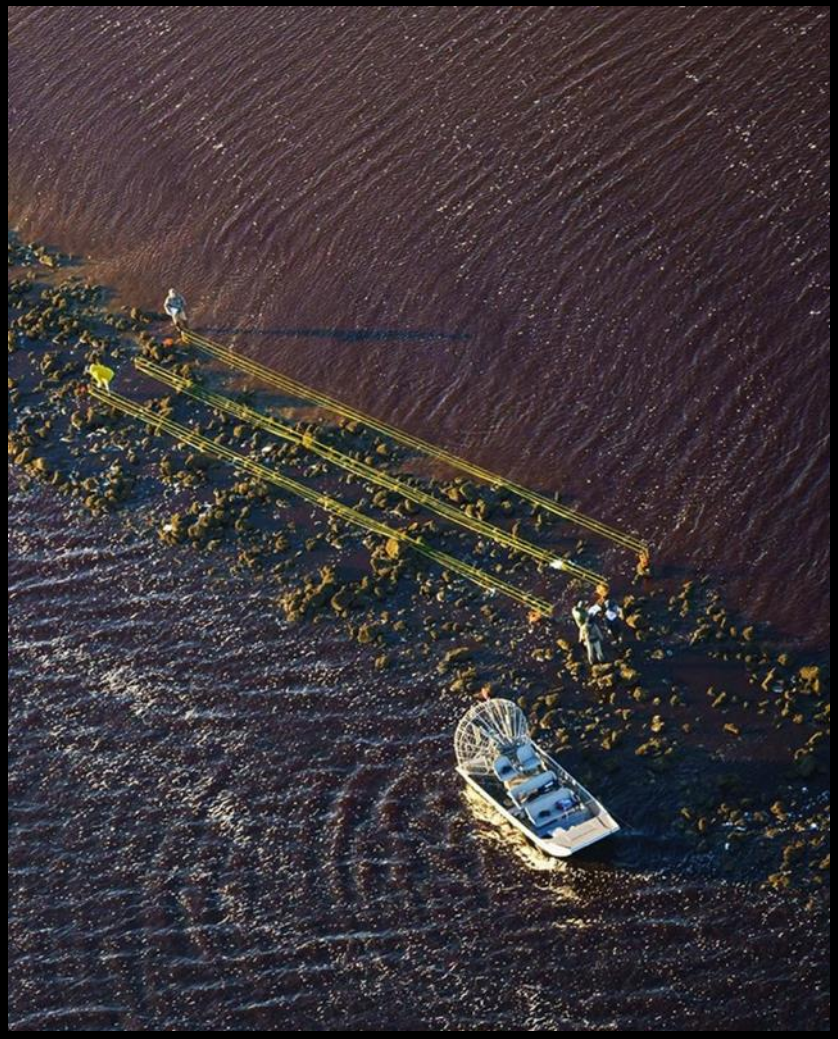
- Monitoring program through simulation and analyses
  - Inform monitoring based on oyster counts in previous years

LCR Restoration: What are we learning?



- Monitoring program through simulation and analyses
- Pre-season power analyses to determine sampling effort

LCR Restoration: What are we learning?



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- In-season assessments to update effort allocation and track progress

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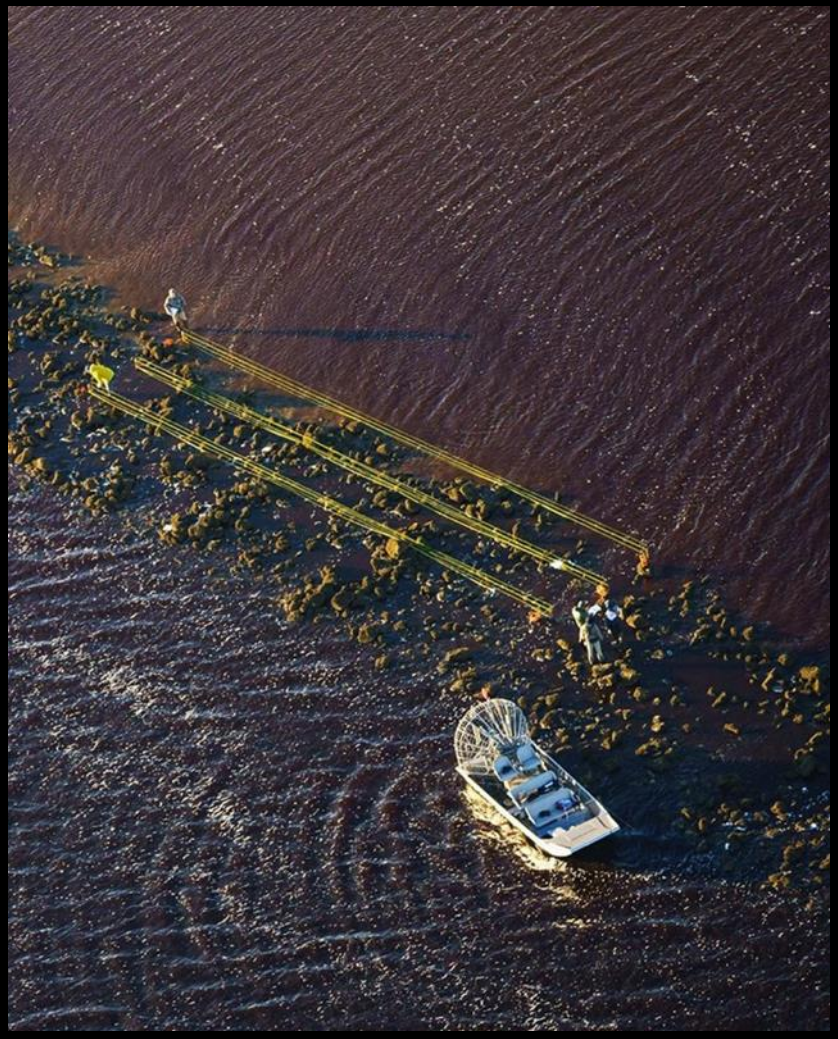
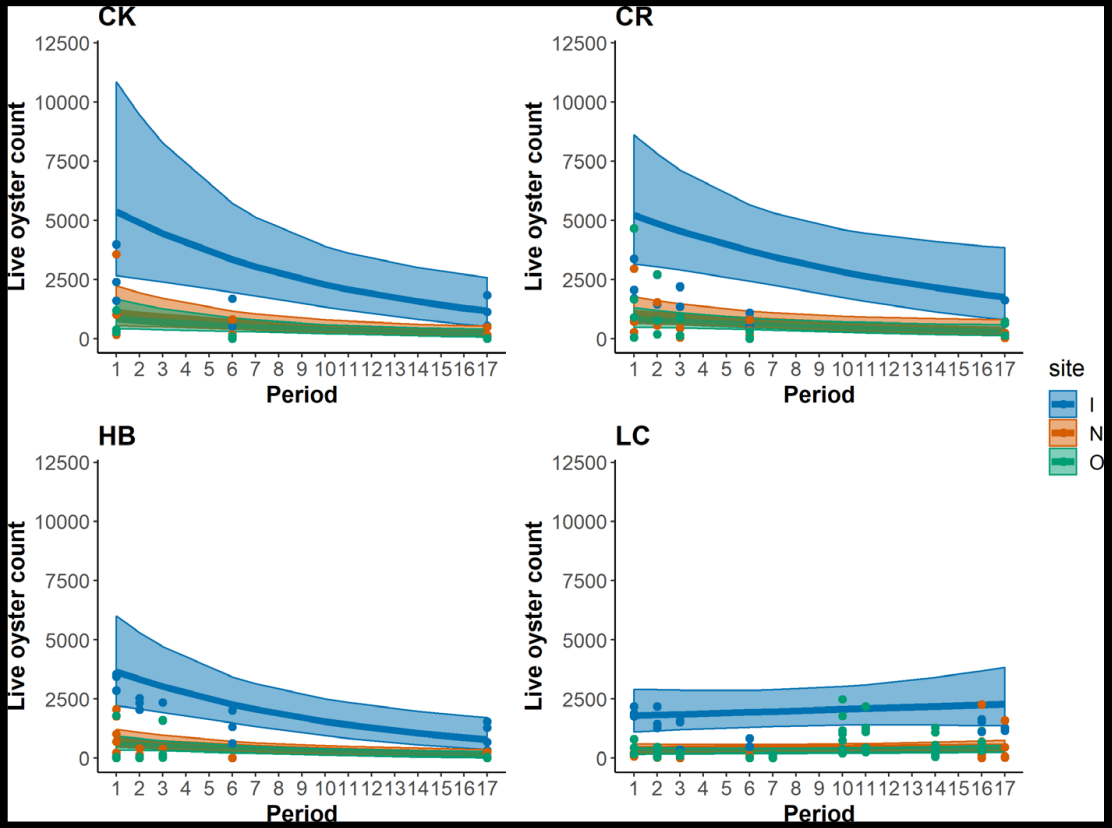


- Monitoring program through simulation and analyses
- Pre-season power analyses to determine sampling effort
- In-season assessments to update effort allocation and track progress
- End-of-season analyses to update learning

Large Scale: What are we learning?

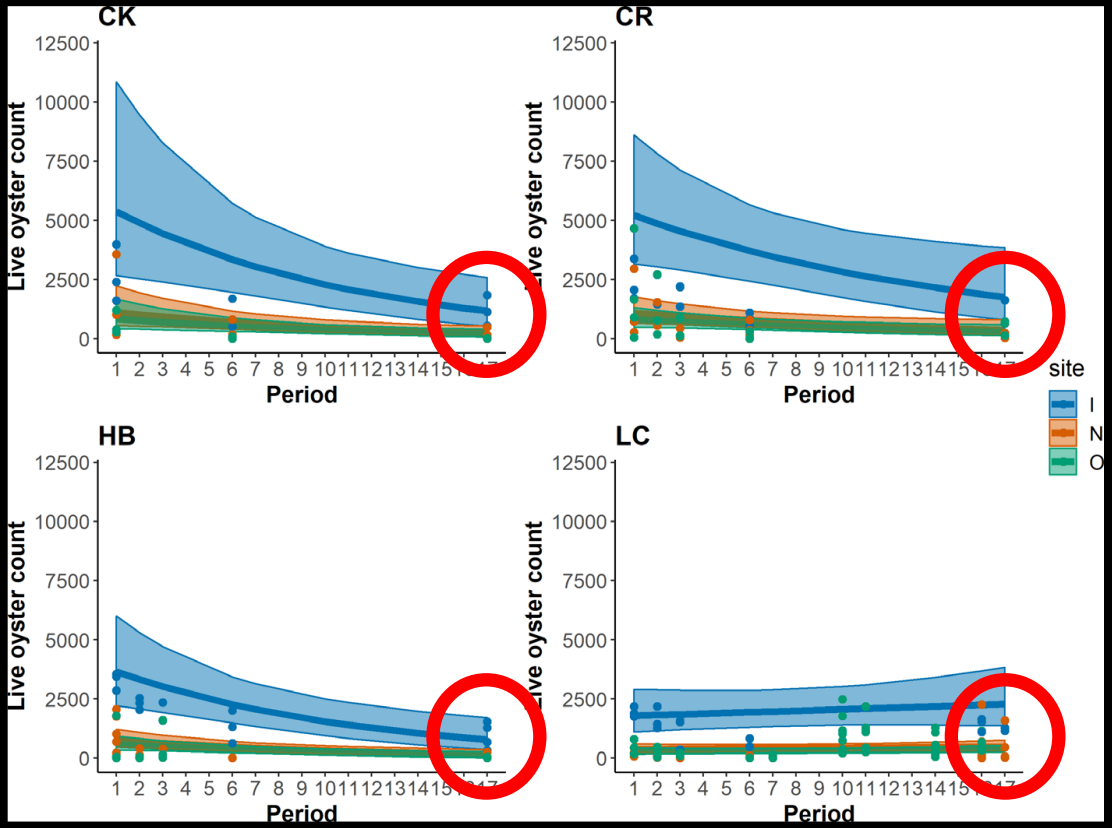
- Big Bend intertidal oyster resources – declining rapidly
- 237% decline in counts since 2010
- Intertidal reefs are becoming more similar…



(Moore et al. 2020)

Large Scale: What are we learning?

- Big Bend intertidal oyster resources – declining rapidly
- 237% decline in counts since 2010
- Intertidal reefs are becoming more similar…
  - But more similar at **LOWER NUMBER OF OYSTERS**



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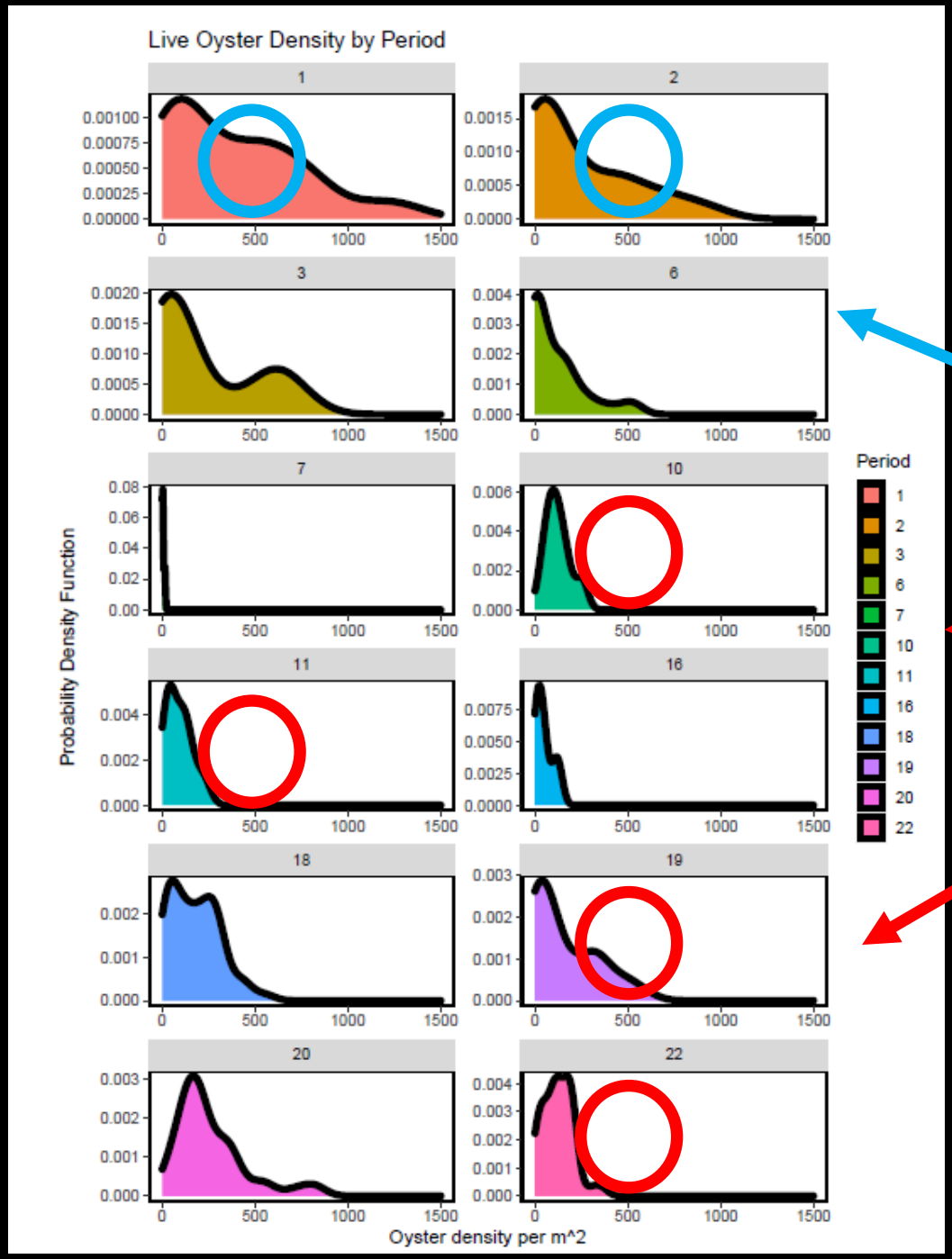
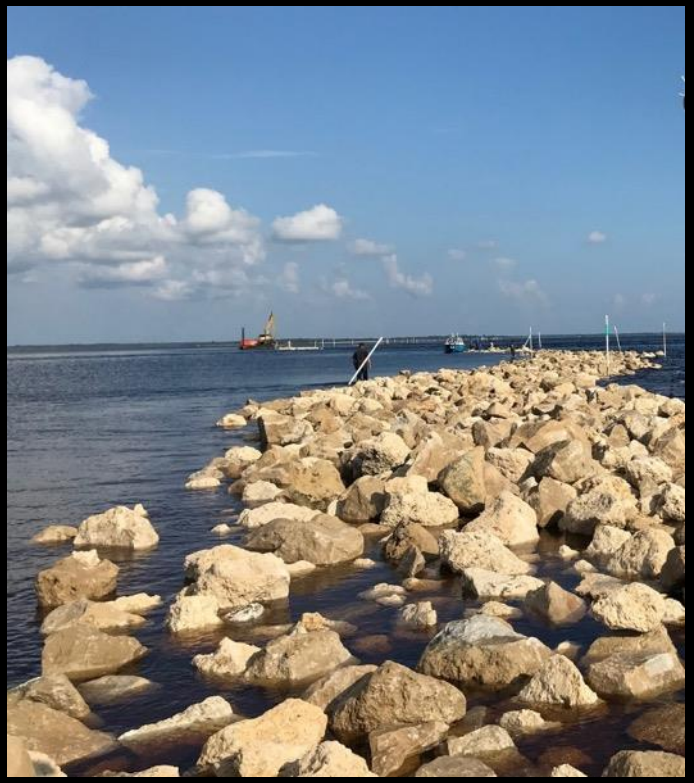


Since 2010, distinct loss of highest density intertidal oyster bars

Can restoration help?



July 2018

July 2018

December 2018

July 2018

December 2018

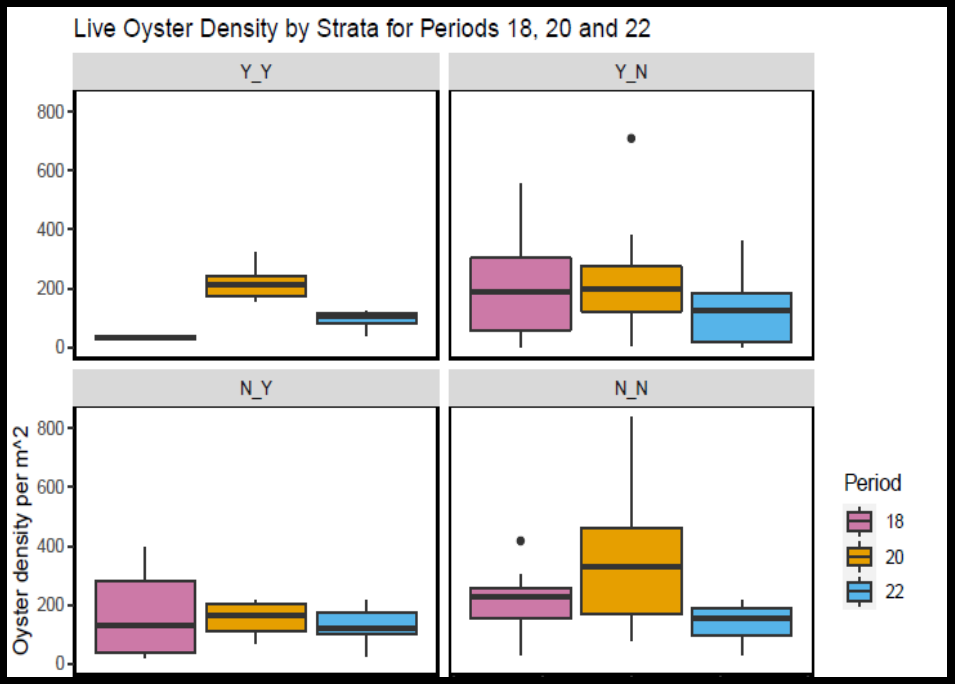
July 2019

Can restoration help?

- Local effect of oysters growing on rocks? **YES!**
- But do these oysters persist?

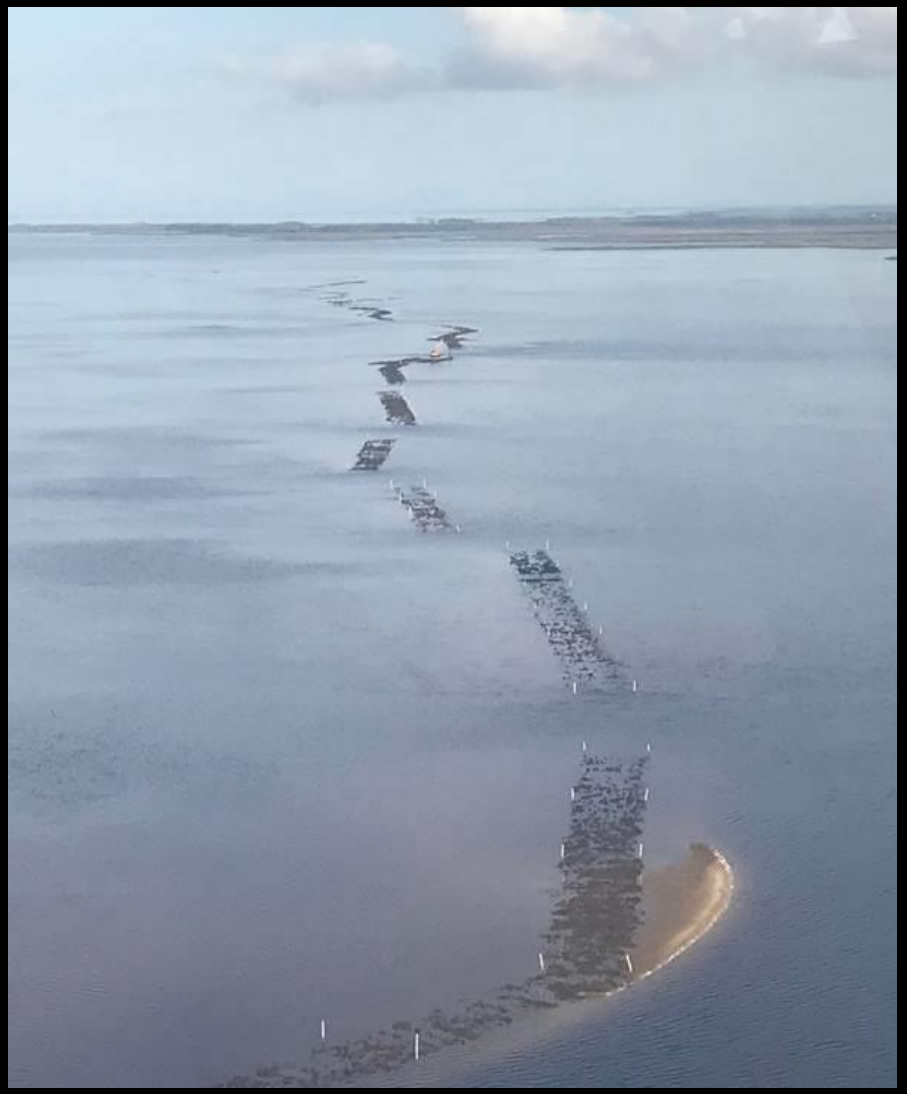
Can restoration help?

- Oysters persist on restored reefs (so far)
- Similar density of oysters of rock reefs compared to wild reefs



Can restoration help?

- Benefits beyond the ribbon of rock?

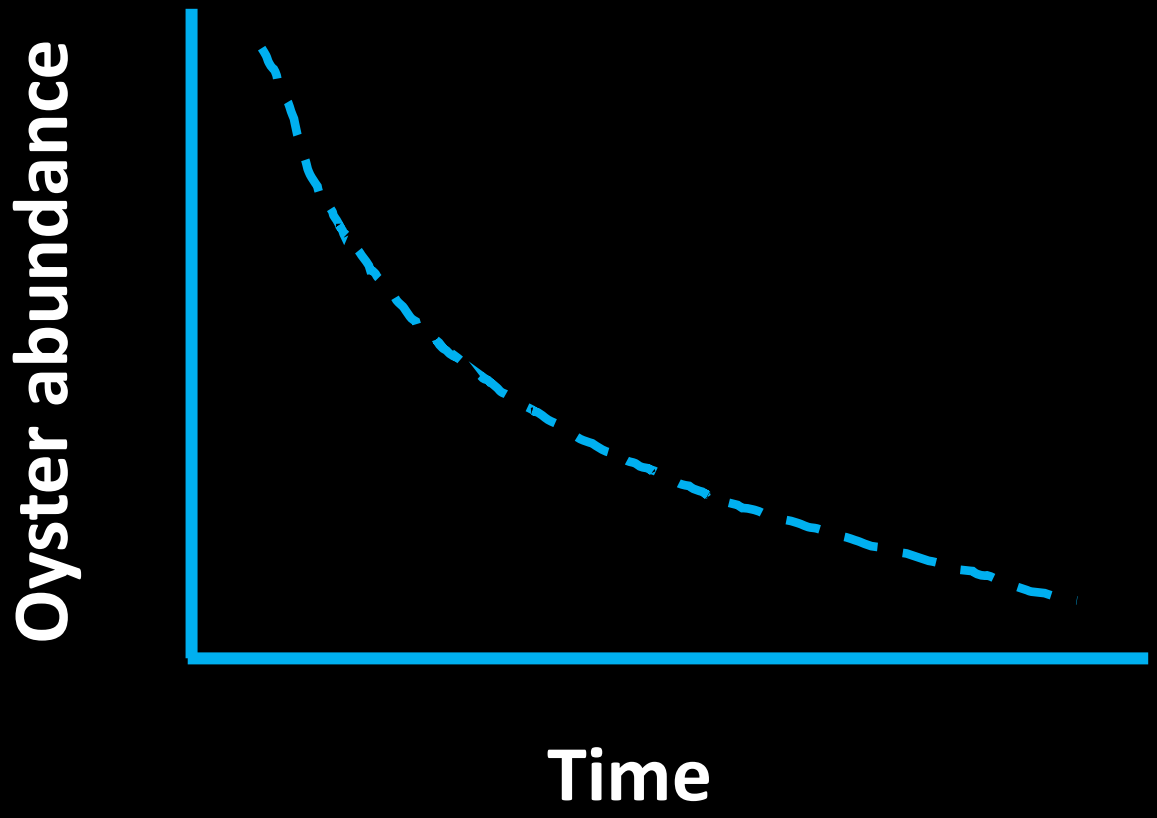


Can restoration help?

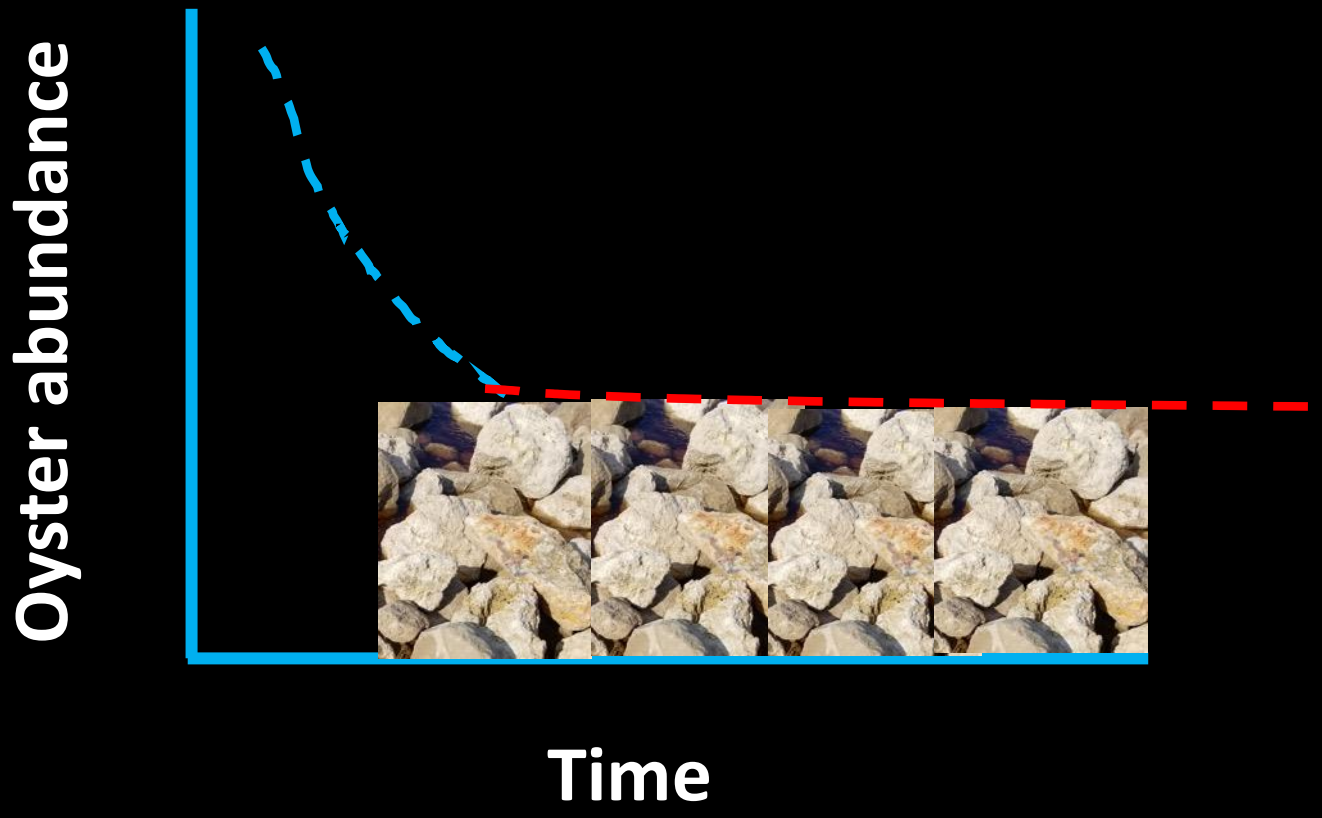
- Benefits beyond the ribbon of rock?

- Not yet known…
  - My dissertation focuses on responses of oyster populations and water quality

Going forward...

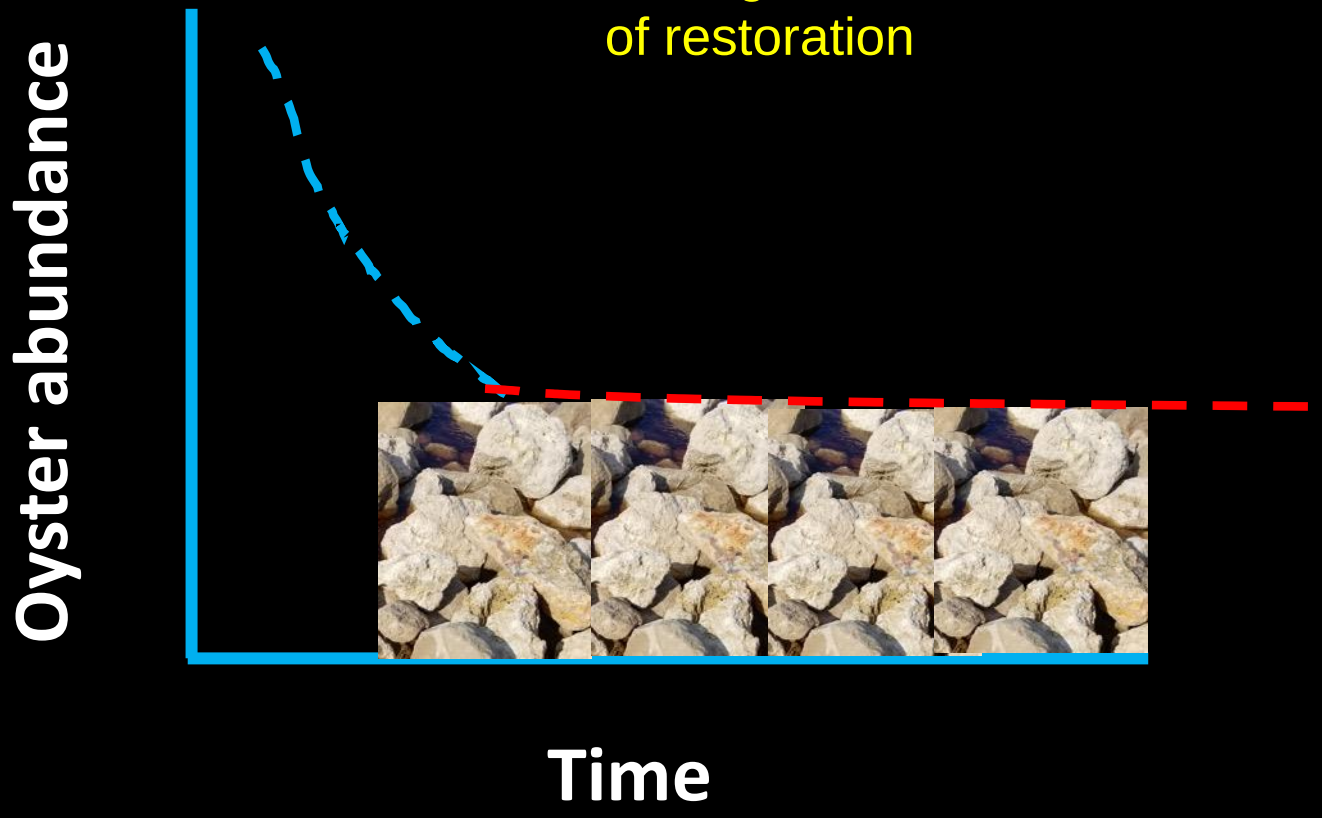


Seavey et al. 2011; Moore et al. 2020



Seavey et al. 2011; Moore et al. 2020

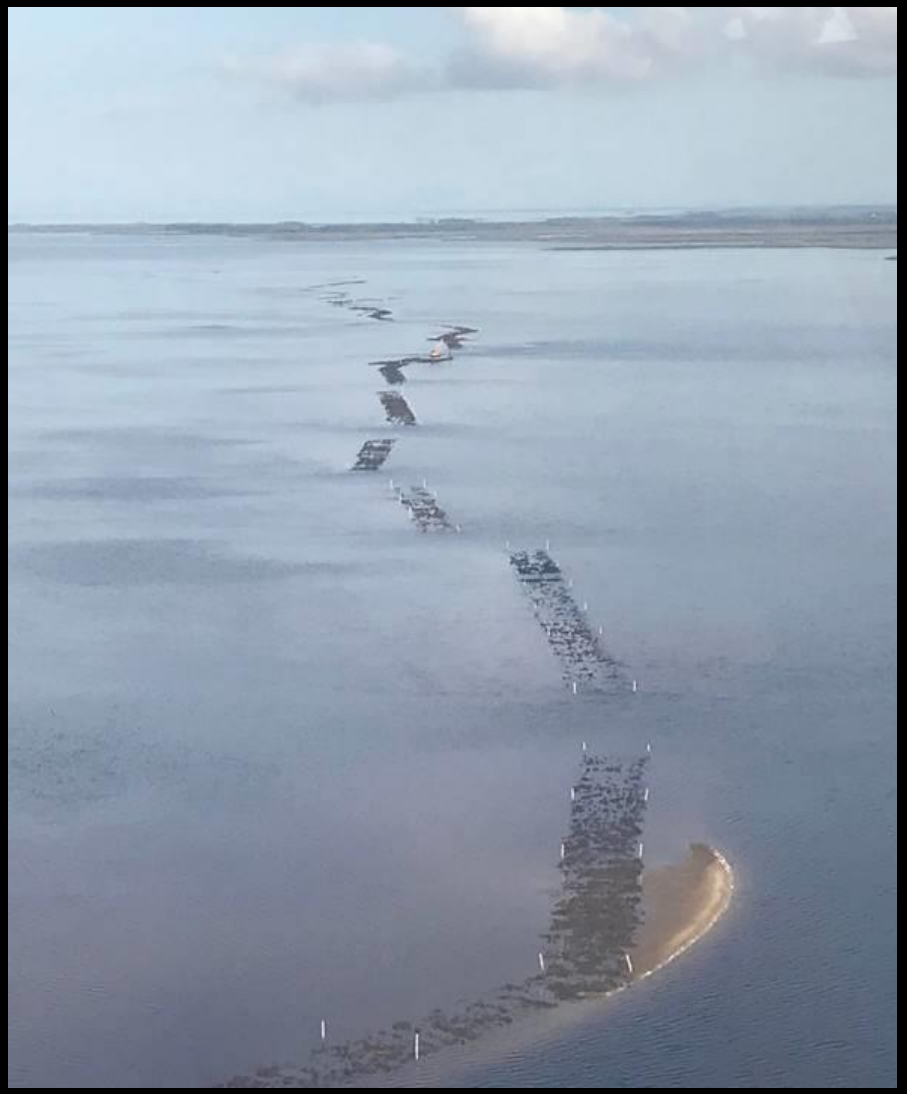
- But if spat sources persist, the hope is that the “floor” of the restored reefs are higher than it would be in absence of restoration



Seavey et al. 2011; Moore et al. 2020

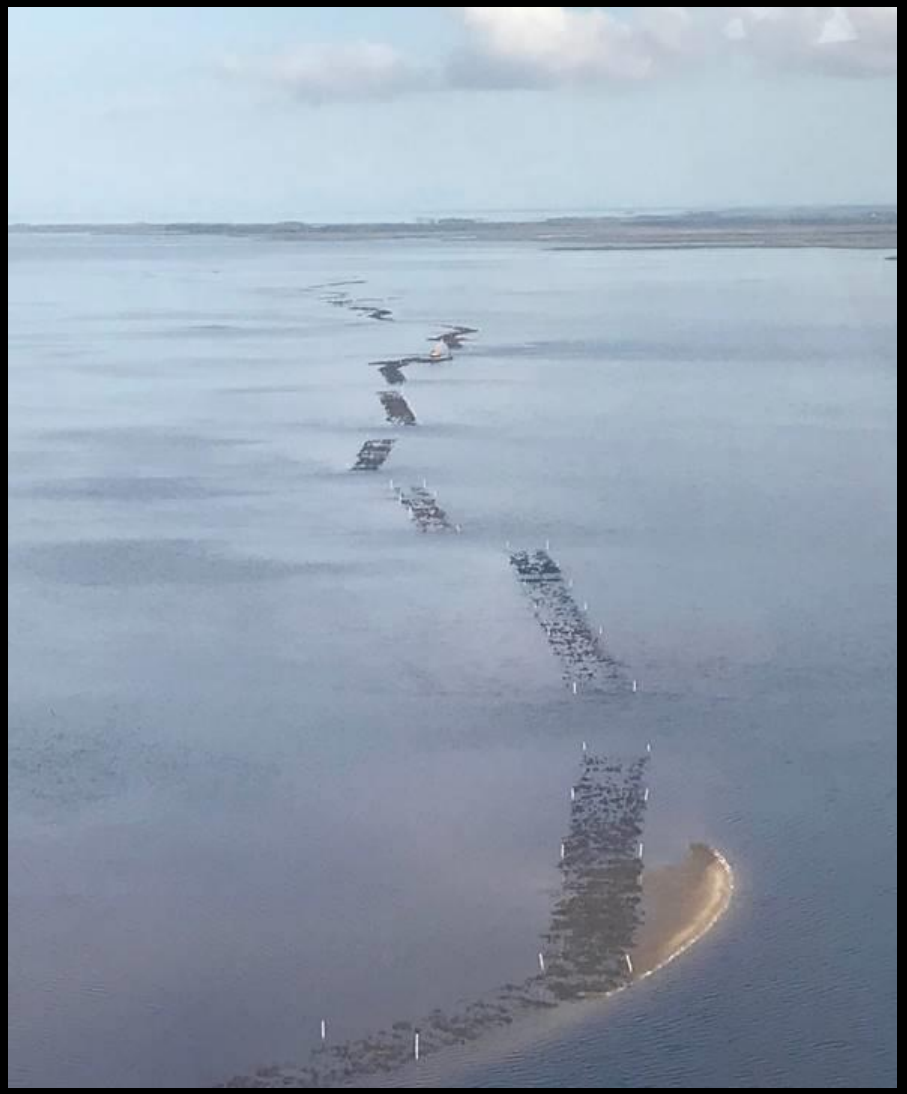
Going forward...

- A ribbon of rock
  - LCR restoration is “large” for a restoration
  - But “small” compared to changes that are ongoing in the region
    - Sea-level rise
    - River discharge patterns



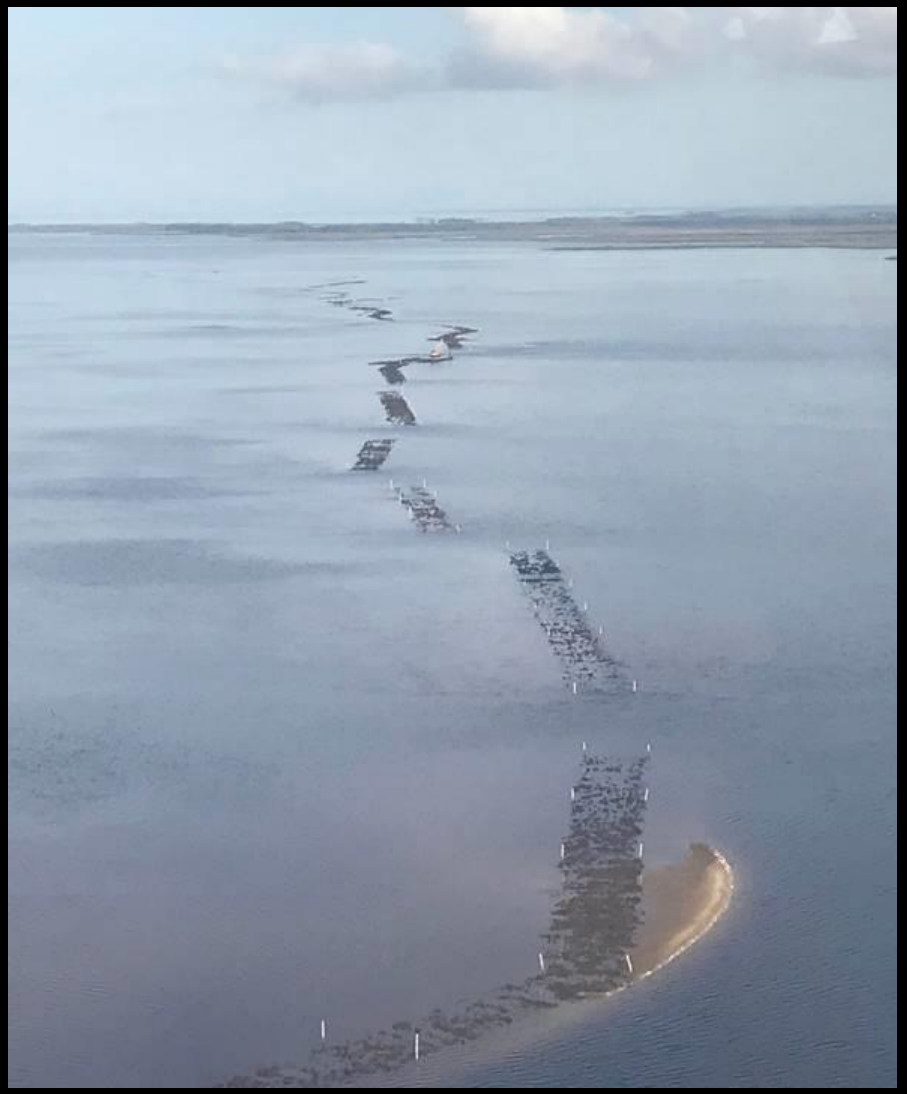
Going forward...

- Treat restoration projects as experiments, not solutions



Going forward...

- Treat restoration projects as experiments, not solutions
- Focus efforts on promoting resilience in existing wild reefs



End

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- Bill Pine billpine@ufl.edu

- Thank you for this opportunity
- Funding for restoration provided by National Fish and Wildlife Foundation
- Project co-PIs Leslie Sturmer, Peter Frederick, and Mike Allen
- Massive team effort Peter, Mel, Steve, Brad, Jennifer, Jamie, Joe, and many others