

# *Sponge Restoration Efforts in Florida Bay*

**FLORIDA KEYS NATIONAL MARINE  
SANCTUARY**  
**Water Quality Protection Program Steering  
Committee**  
**March 7, 2024**

William Sharp



Florida Fish & Wildlife Conservation Commission  
Fish & Wildlife Research Institute  
South Florida Regional Laboratory







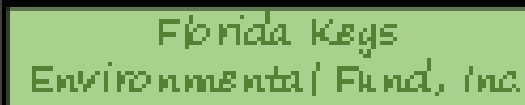
Elliot Hart of the Florida Fish and Wildlife Commission laying out sponge cuttings in the Sa nursery. © The Nature Conservancy (Jennifer Stein)

# Scaling-up Sponge Community Restoration in South Florida: its Efficacy and Ecosystem Implications

FLORIDA KEYS NATIONAL MARINE SANCTUARY  
Water Quality Protection Program Steering Committee

December 6, 2017

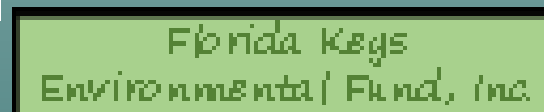
William C Sharp  
Fish & Wildlife Conservation Commission  
Fish & Wildlife Research Institute





# Scaling-up Sponge Community Restoration

- 1) *Test whether sponge nurseries are an efficient and sound method for large-scale sponge restoration Florida Bay*
- 2) *Test in a field experiment whether sponge restoration can restore natural sponge filtration*
- 3) *Test whether aggregation of restoration sites nearby one another improves sponge reproductive success and recruitment, as well as the effectiveness of restoration sites as essential fish habitat*
- 4) *Develop and incorporate community participation and a coordinated public outreach and education component*
- 5) *Undertake a large-scale sponge restoration effort*
- 6) *Estimate the cost to conduct large-scale sponge restoration*





# Widespread Mortality of Sponges





Cyanobacteria blooms (blue-green algae) have caused sponge die-offs in an area  $\sim 500\text{km}^2$  in south-central Florida Bay since the early 1990s









- Sponges have associations with many microorganisms that produce chemical transformations as water is pumped through their tissues
- Habitat for animals that live around sponges
- Habitat for many commensal animals
  - Shrimps, Worms, Brittle stars

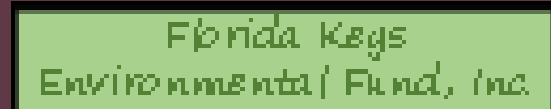
## Importance of Sponges





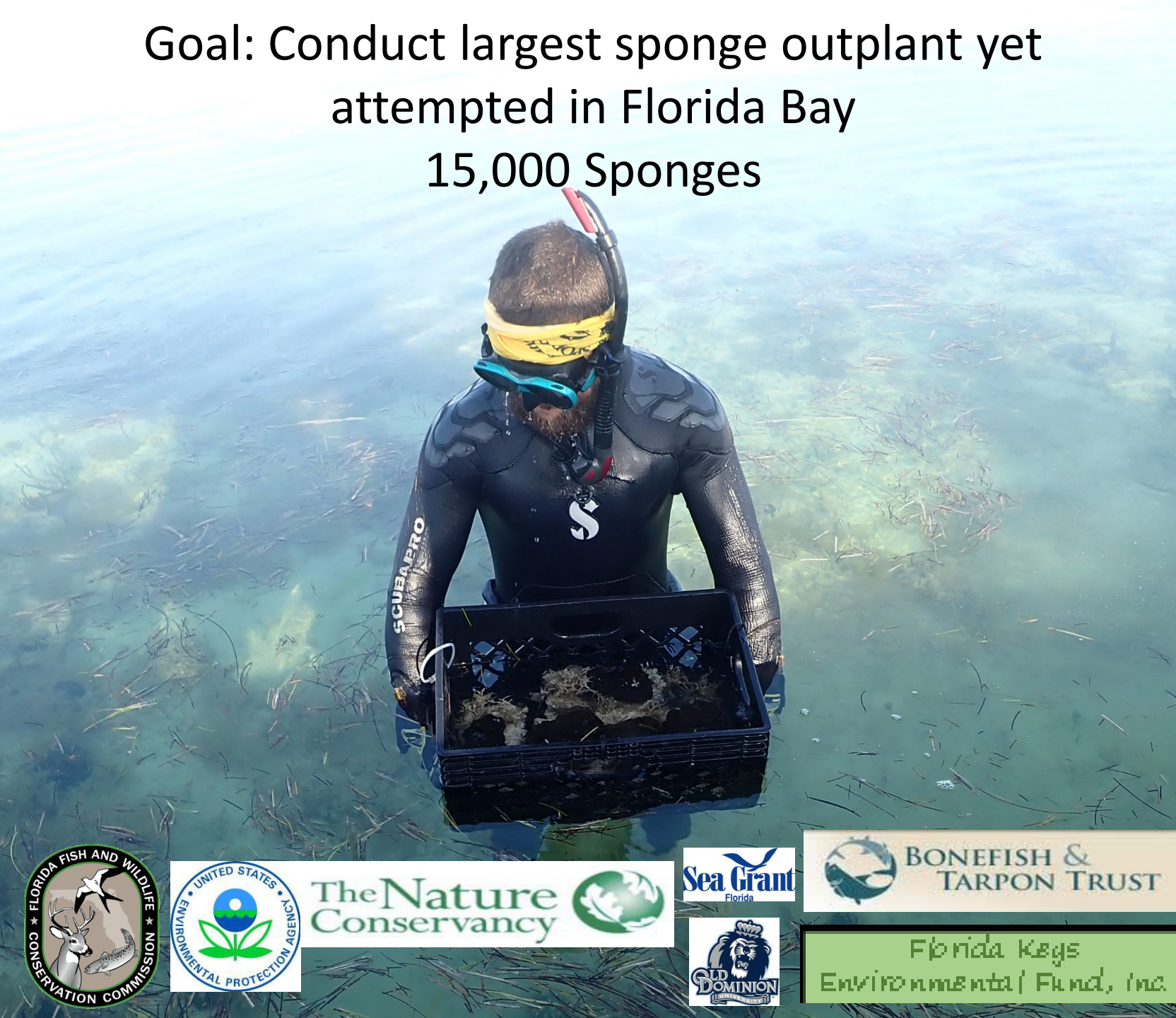


# Testing In-Water Sponge Nurseries to Support Large-Scale Restoration Efforts in Florida Bay 2016





# Goal: Conduct largest sponge outplant yet attempted in Florida Bay 15,000 Sponges



The Nature Conservancy

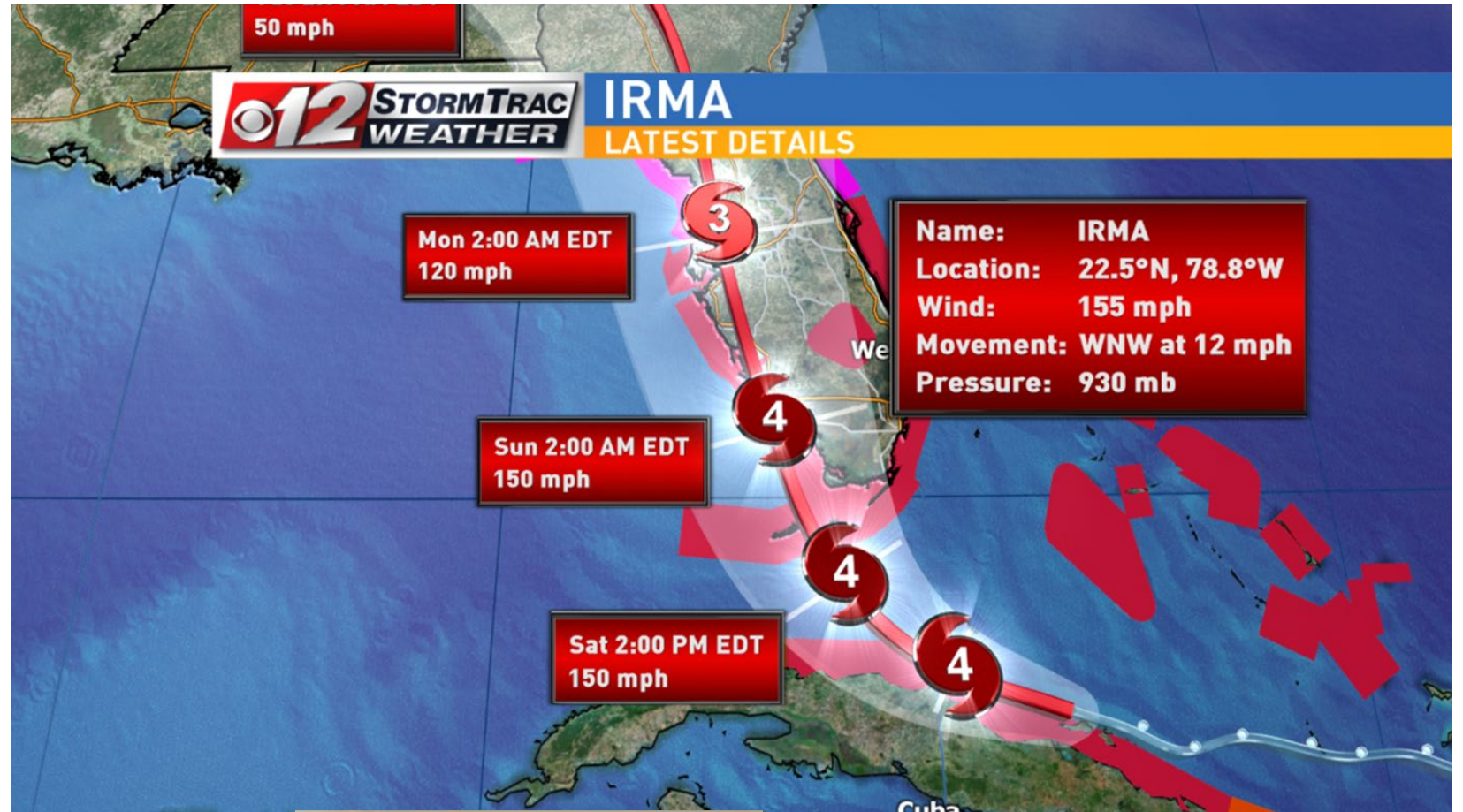


BONEFISH & TARPON TRUST

Florida Keys Environmental Fund, Inc.



# Hurricane Irma 2017



The Nature Conservancy



Sea Grant  
Florida

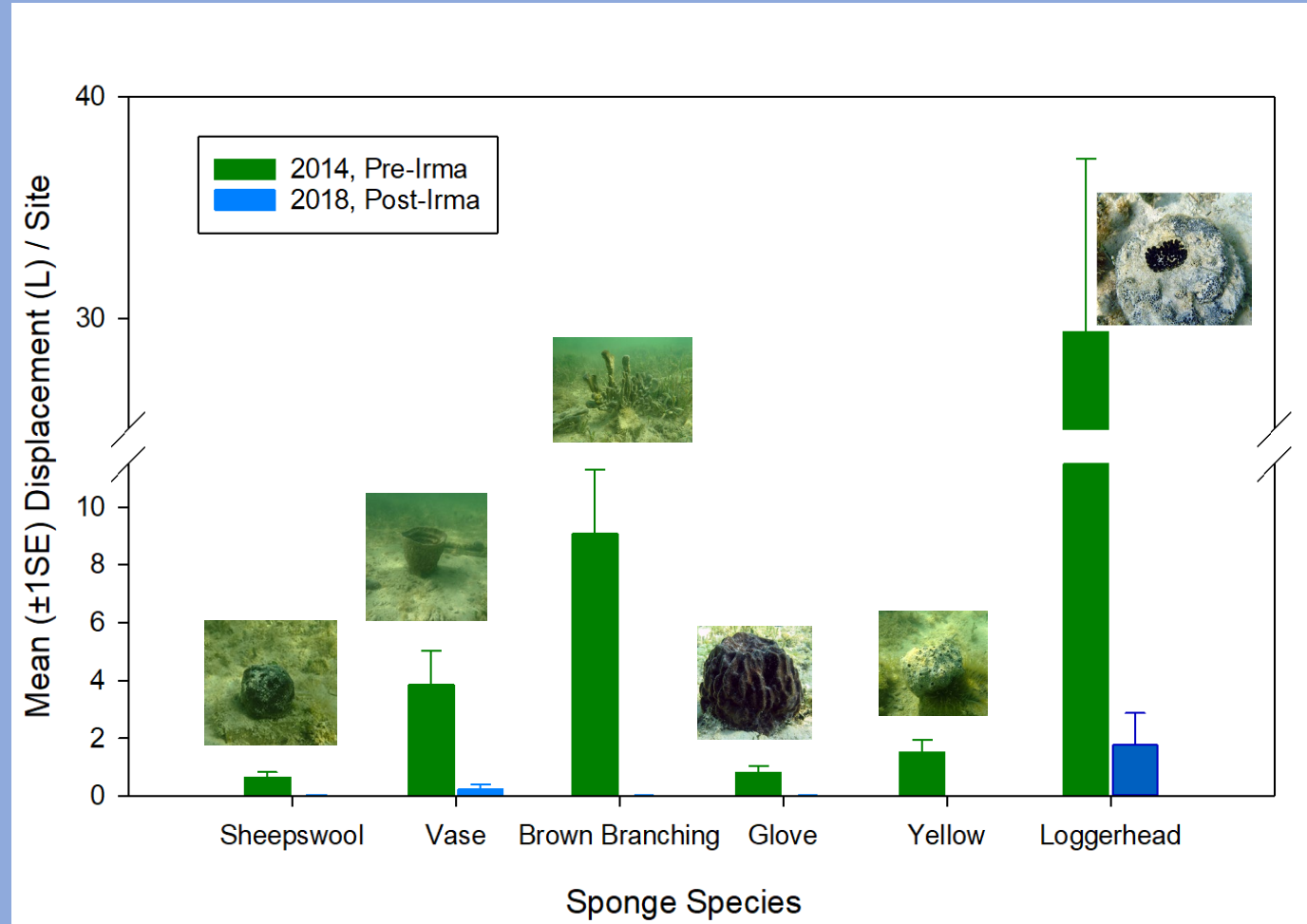
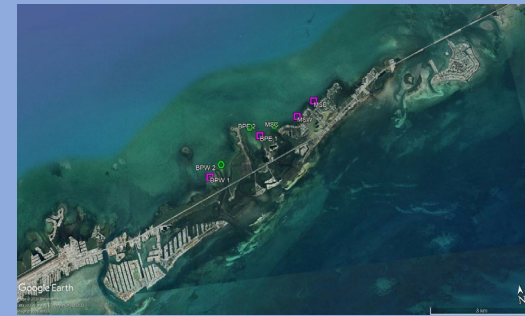


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Florida Keys  
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# Sponge Restoration Site Locations Burnt Point, Marathon Before/After Hurricane Irma



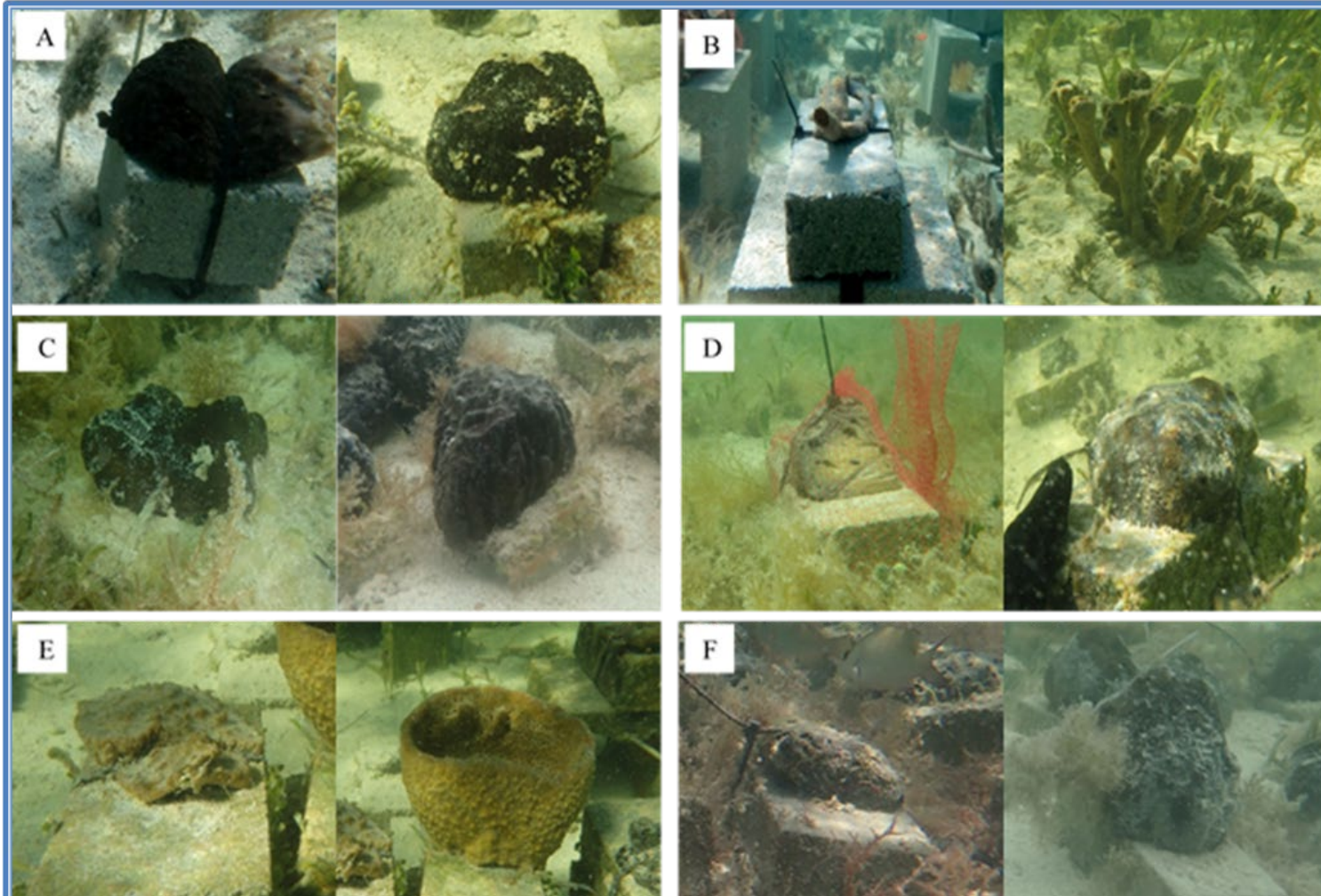




# Sandfly Key Sponge Nursery 2020







Examples of the six sponges propagated in the nurseries. In each photo pair, the sponge on the left is newly fragmented and the sponge on the right is approximately one-year post-propagation.

- A) Sheepswool sponge (*Hippospongia lachne*)
- B) Brown-branching sponge (*Ircinia felix*)
- C) Glove sponge (*Spongia graminea*)
- D) Loggerhead sponge (*Spheciospongia vesparium*)
- E) Vase sponge (*Ircinia campana*)
- F) Yellow sponge (*Spongia barbara*)



# Sponge Restoration Site Locations Burnt Point/Grassy Key Marathon FL

- Create four 0.25 Ha sponge restoration plots
  - Also monitored 3 control sites
- Monitor changes in community structure annually
  - Sponge community composition
  - Sponge biomass
  - Benthic Invertebrates
  - Finfishes





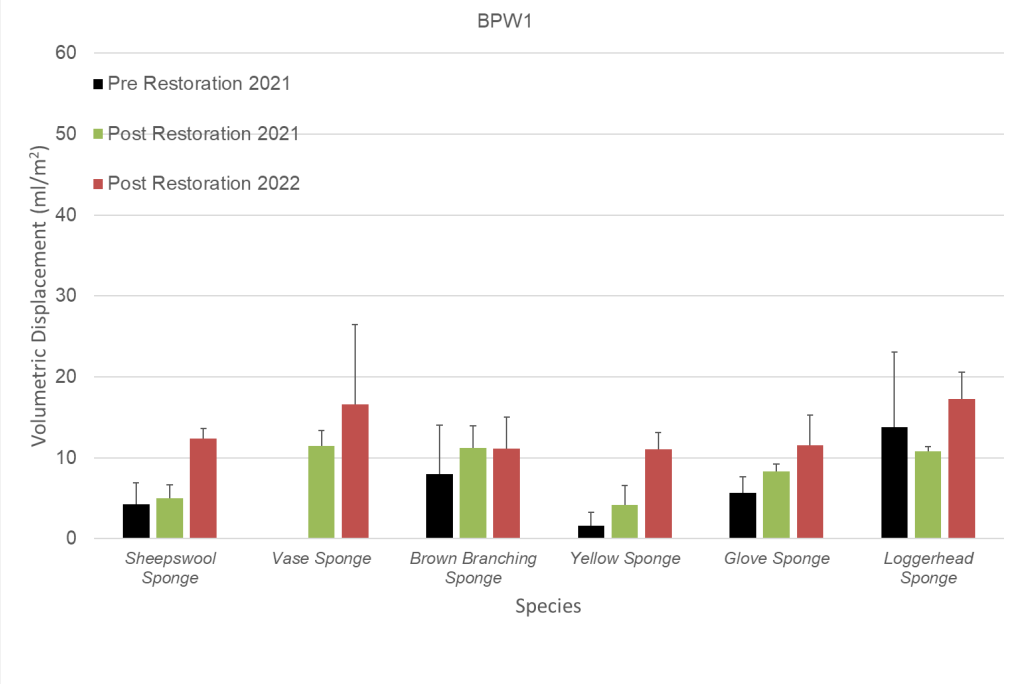
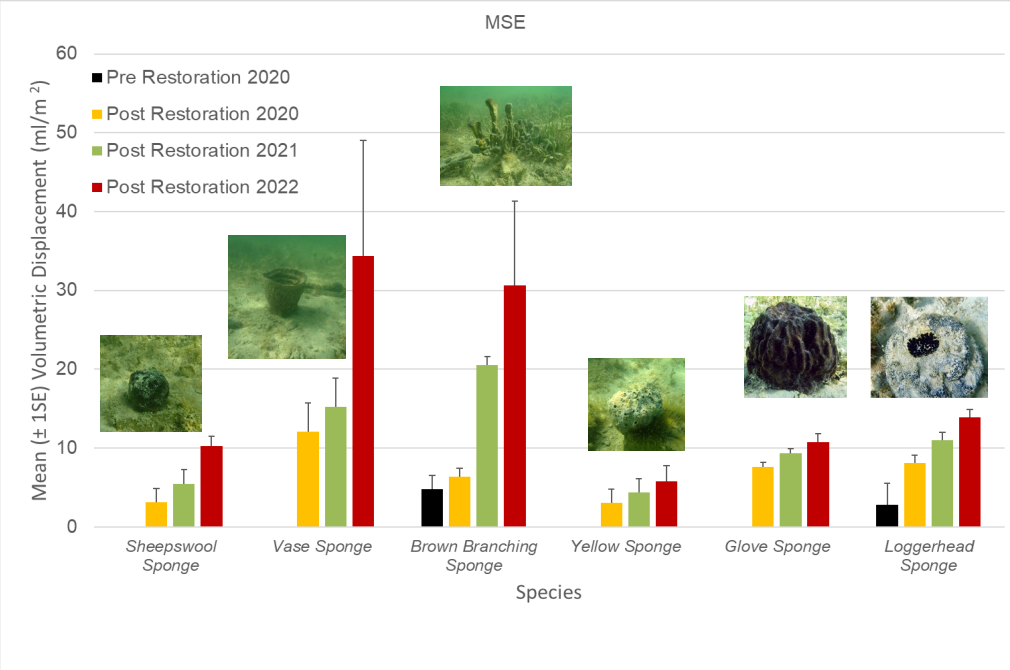
# Transplanting Sponges Nurseries to Restoration Sites

Winter 2020...Then Covid-19...Winter/Spring 2021



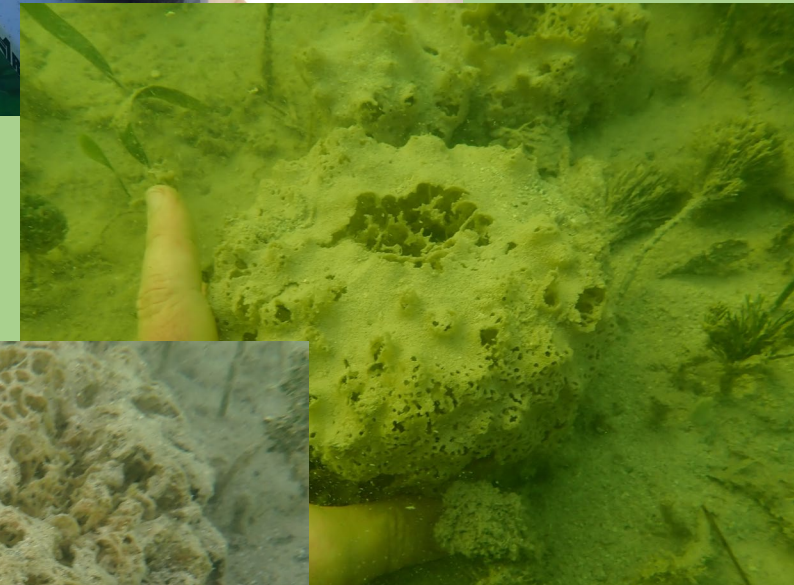


Restoration increased sponge biomass, with annual increases in biomass of all species.





# October 2022 Algal Bloom



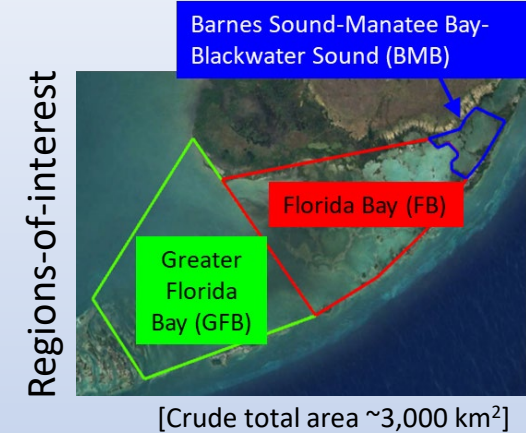


# Remote sensing of cyanobacteria (*Synechococcus* spp.) blooms in Florida Bay

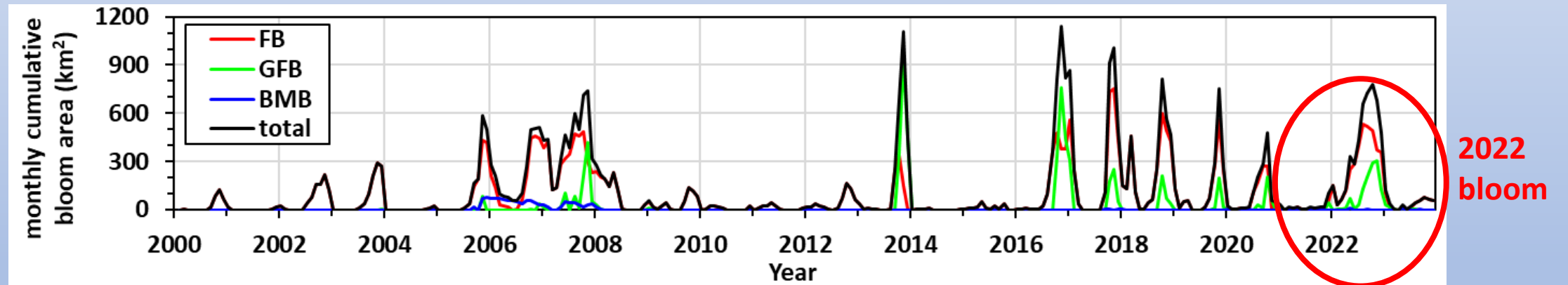
Jen Cannizzaro, Brian Barnes, Chuanmin Hu - University of South Florida

(<https://optics.marine.usf.edu/>)

The MODIS Cyanobacteria Index algorithm (Wynne et al., 2008; 2013) can be used to detect cyanobacteria (*Synechococcus* spp.) blooms in Florida Bay and adjacent waters, but additional criteria is required to prevent false positive classification of seagrass beds (Cannizzaro et al., 2019).



## Interannual variability (2000-2023):



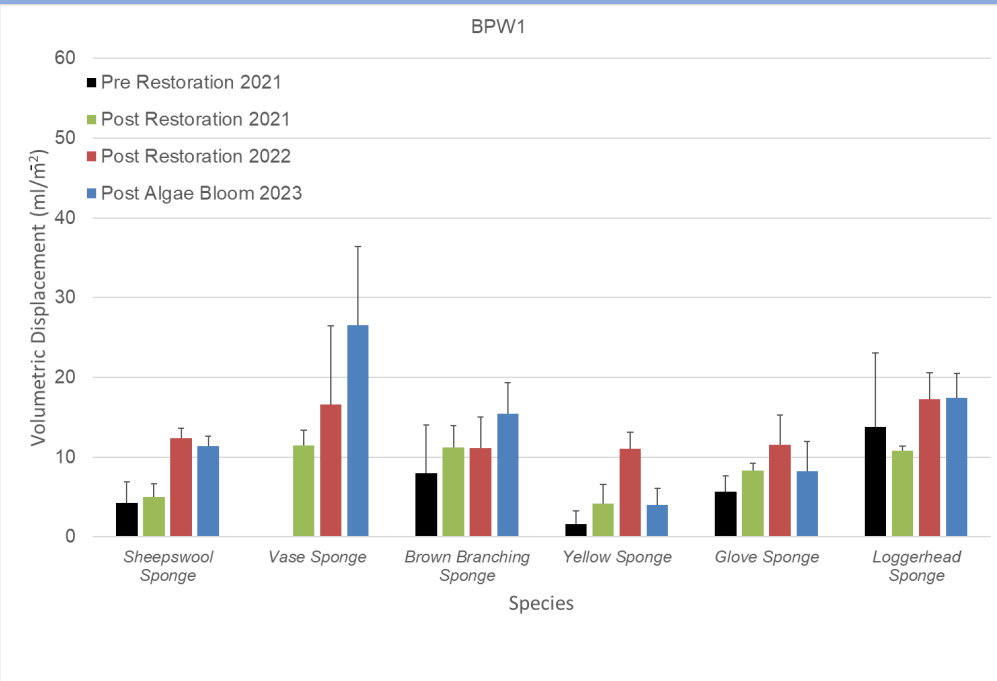
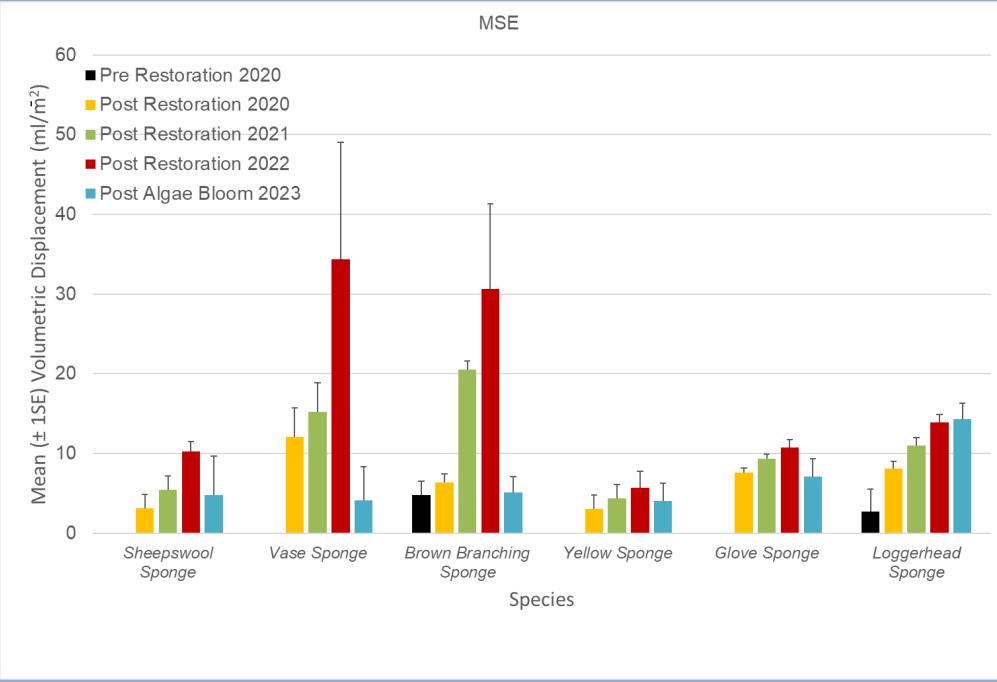
## Key takeaways:

- Florida Bay cyanobacterial blooms exhibit high interannual variability.
- Major blooms observed in 2002-2003, 2005-2008, 2013, 2016-2020, and **2022** are consistent with in-situ water quality monitoring data (NOAA, FIU-SERC/SFWMD, NPS).
- Major cyanobacterial blooms were not reported in 2021 and 2023.

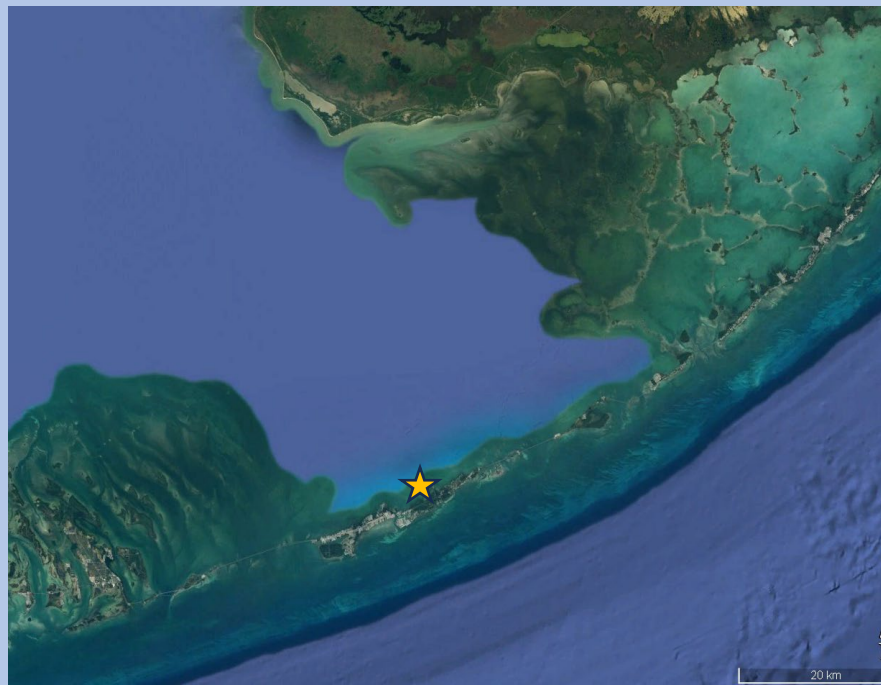
\*\*Bloom definition: Cyanobacterial Chl-a (Chl<sub>Cl</sub>; Cannizzaro et al., 2019) > 5 mg m<sup>-3</sup>



Restoration increased sponge biomass, with annual increases in biomass of all species.



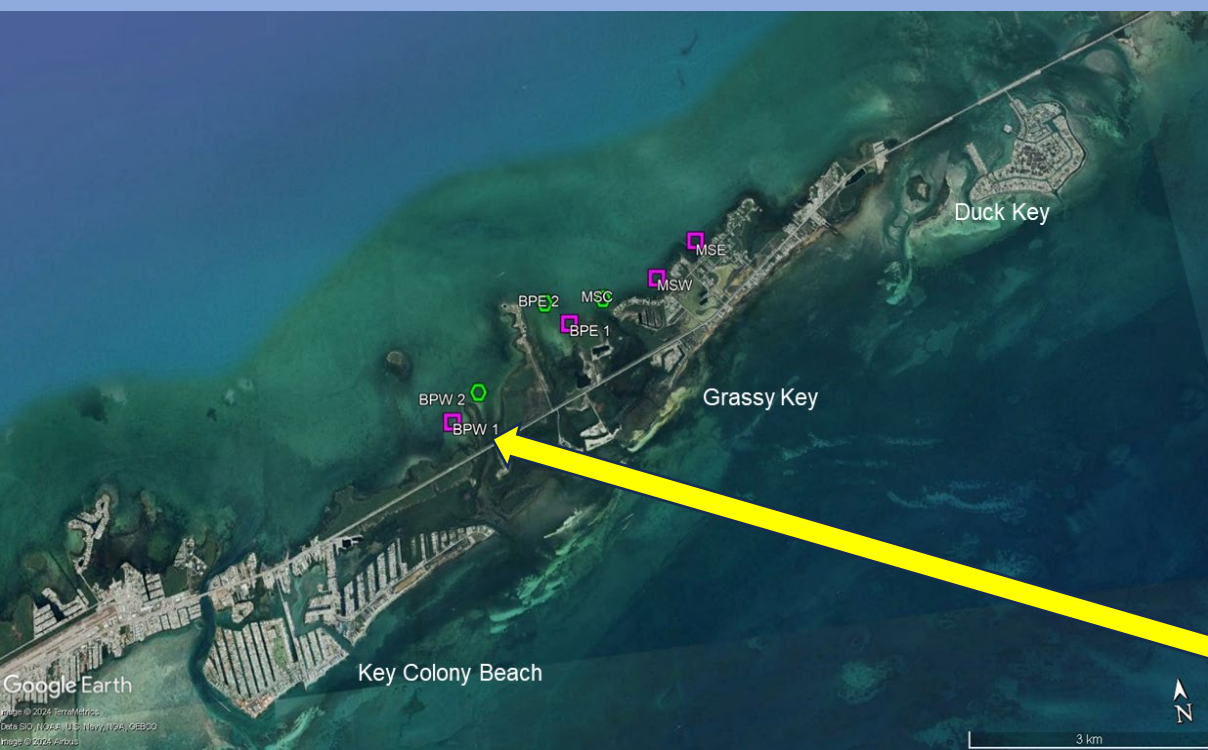




- BPW 1
- April 2023

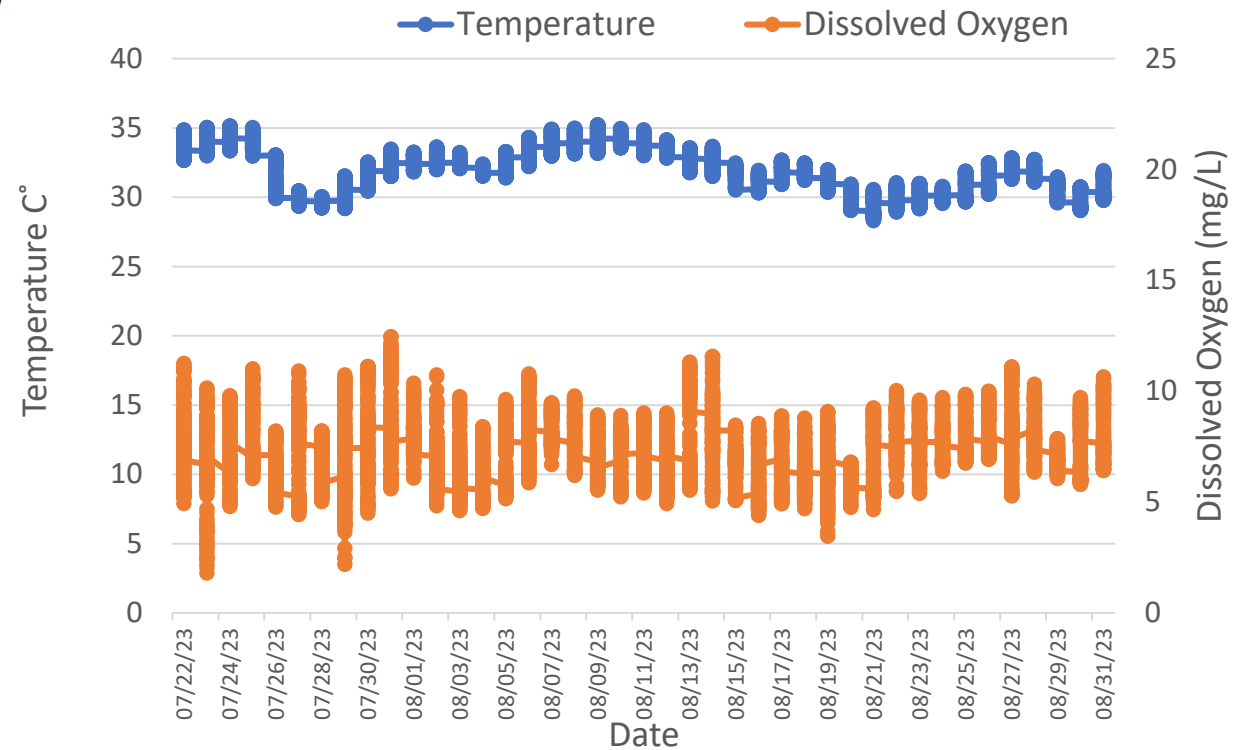






July –Aug 2023

Near-Shore Waters off  
Marathon reached 95°F







Glove Sponge

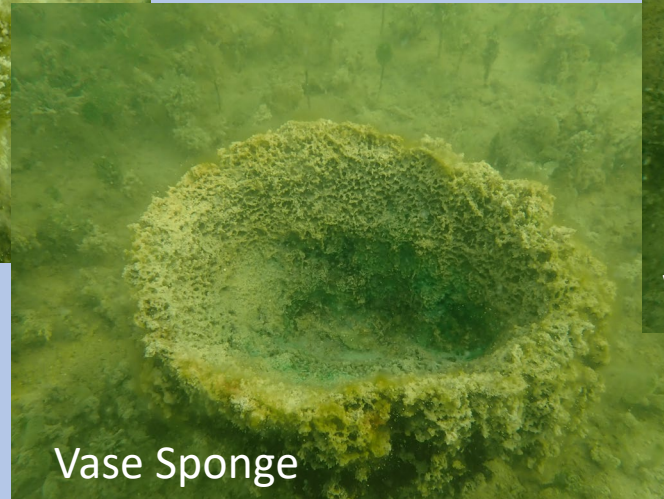
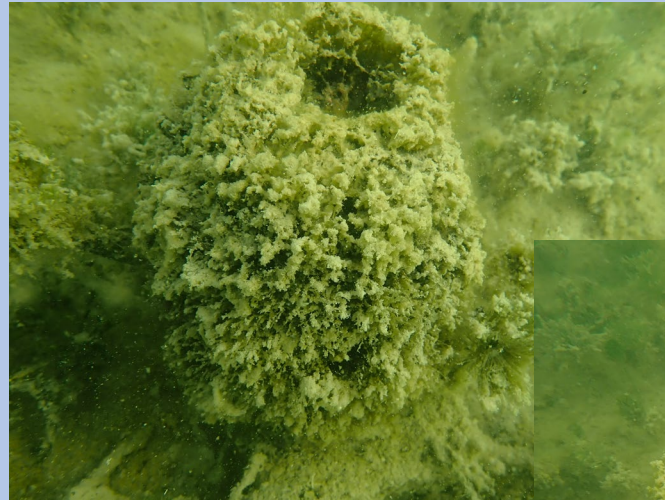


Yellow Sponge

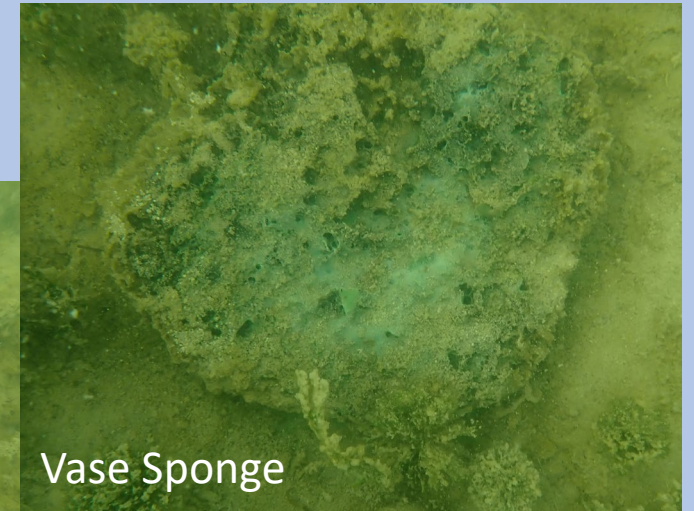


Loggerhead Sponge

- BPW 1
- July/August 2023

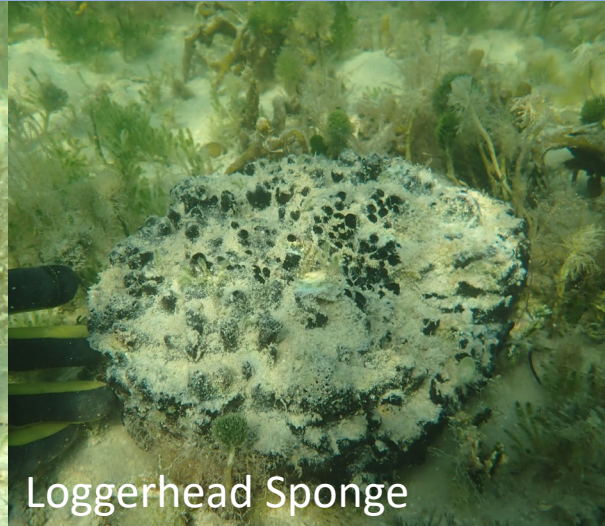


Vase Sponge



Vase Sponge

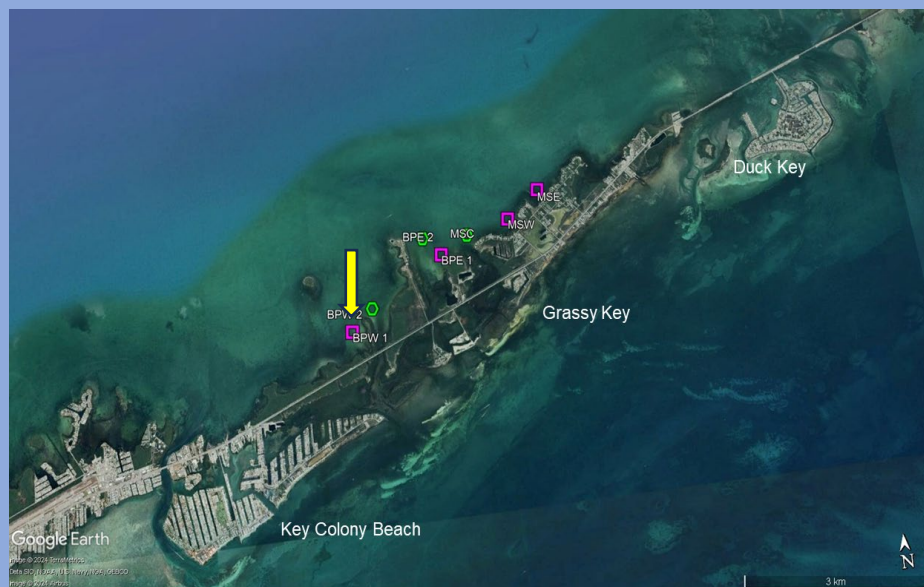
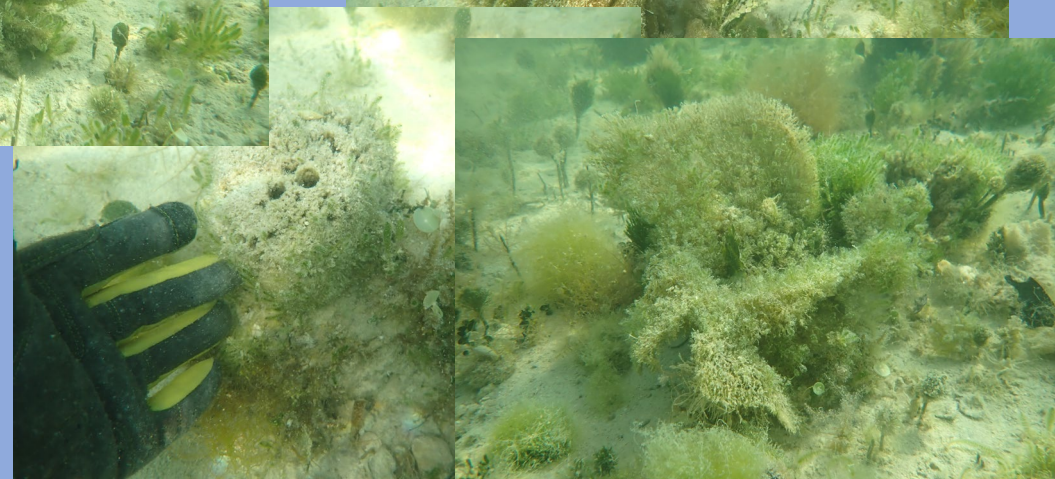




Loggerhead Sponge

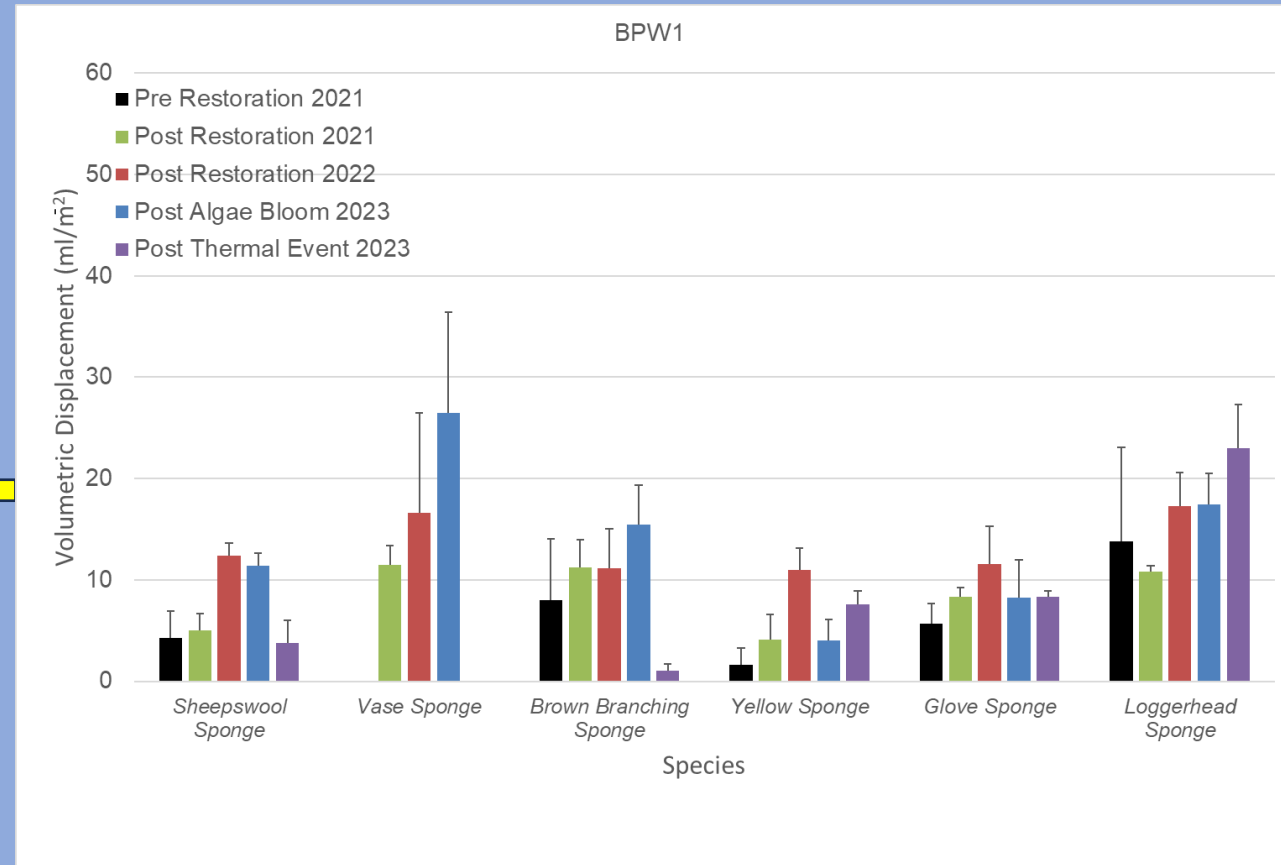
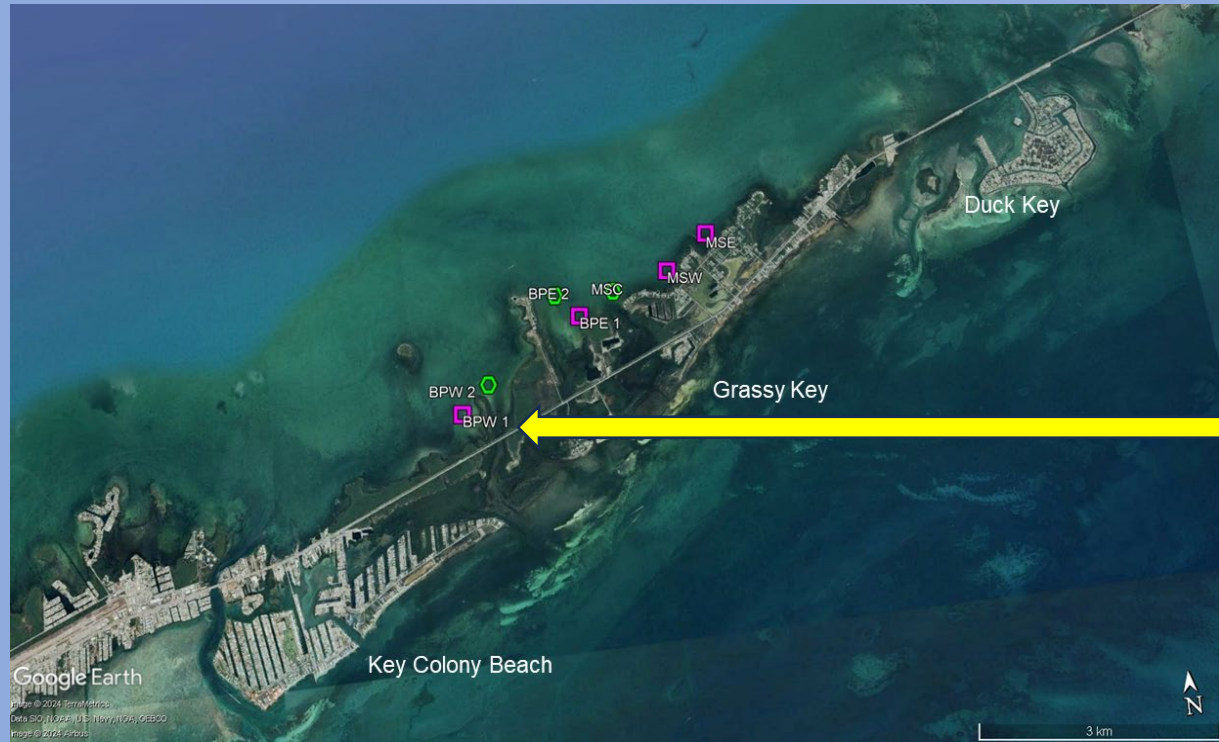


- BPW 1
- October 2023





# October 2023 Survey of BPW 1





# New EPA Funded Project

*“Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida”*





*Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida*

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Test different configurations of *in situ* sponge nursery designs to optimize sponge growth rates in support of large-scale sponge restoration efforts

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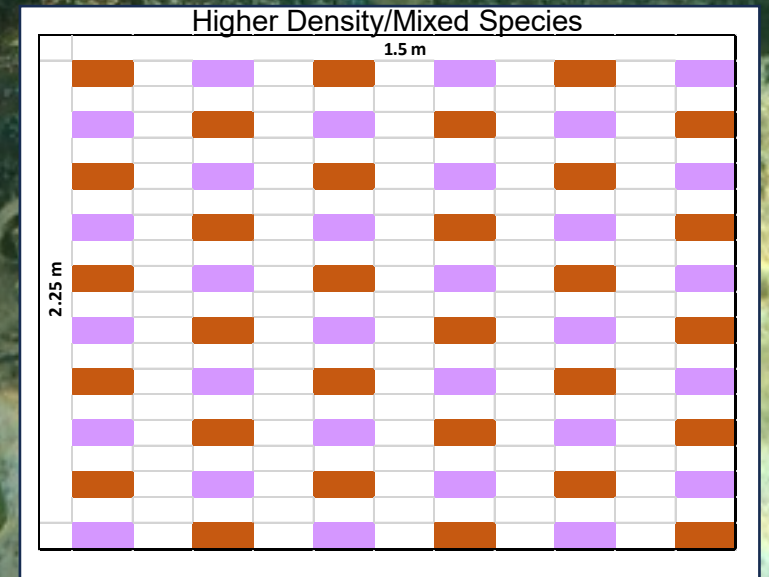
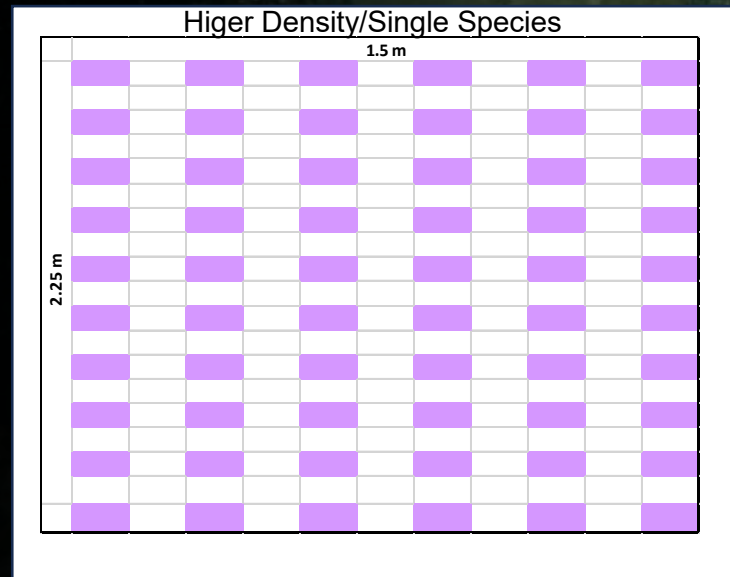




*Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida*

Test different configurations of in situ sponge nursery designs to optimize sponge growth rates in support of large-scale sponge restoration efforts

Plot: Higher density 17.2 indiv. m<sup>-2</sup>

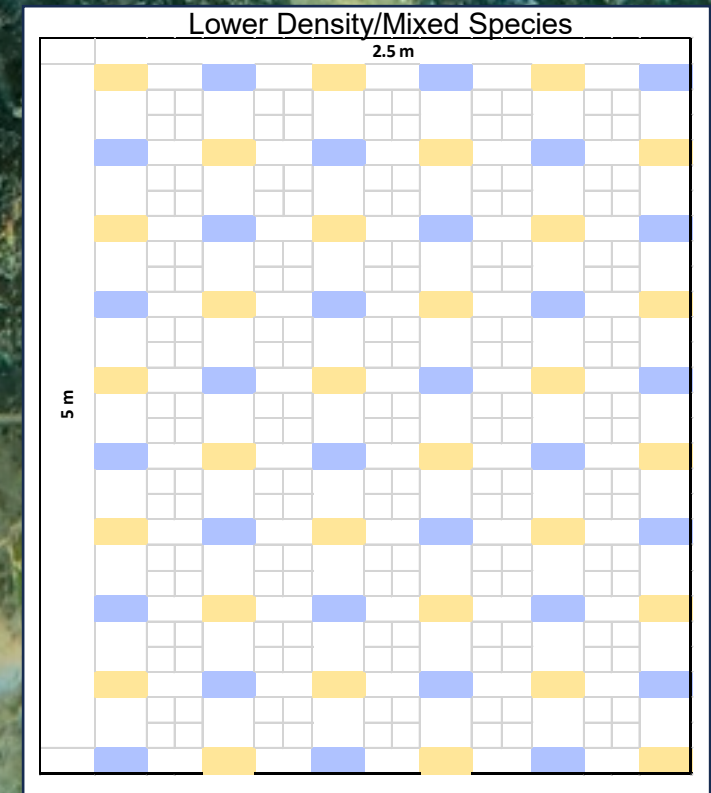
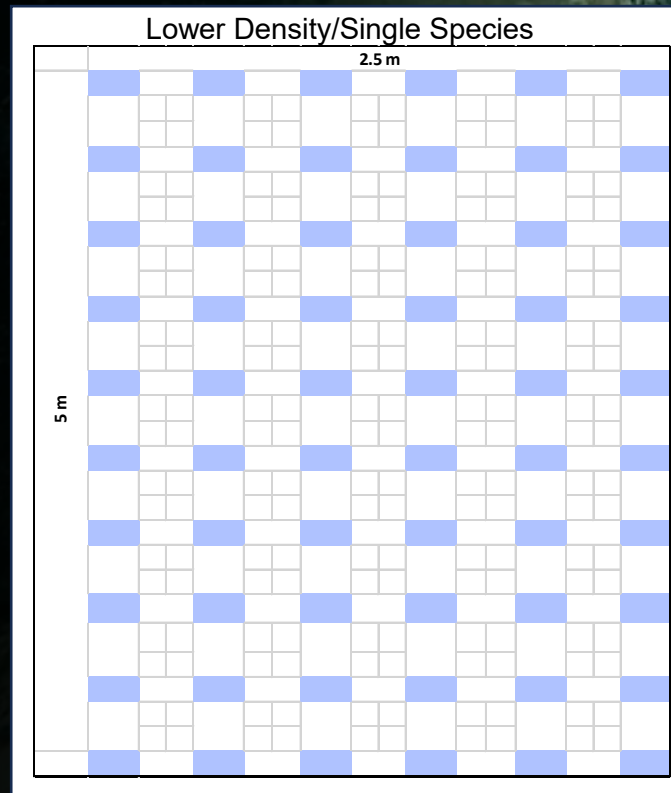




*Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida*

Test different configurations of in situ sponge nursery designs to optimize sponge growth rates in support of large-scale sponge restoration efforts

Plot: Lower density 4.8 indiv. m<sup>-2</sup>





*Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida*

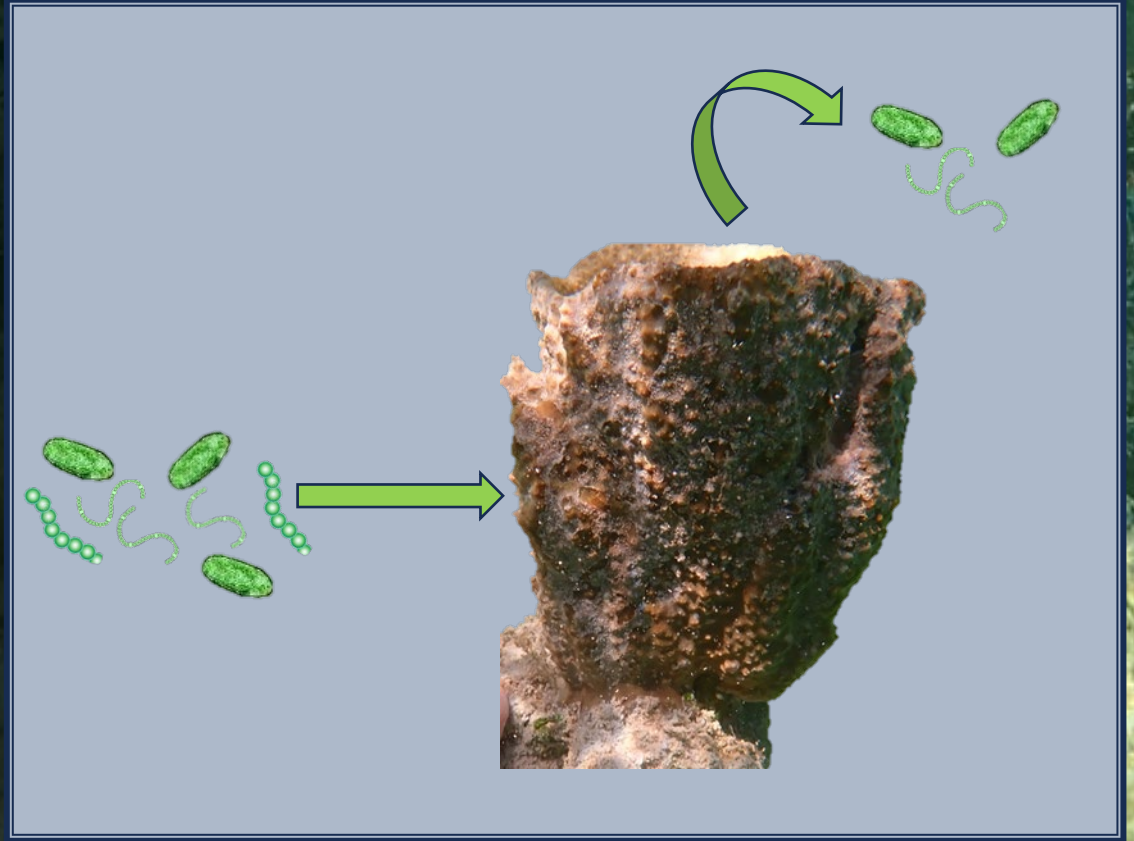
Test in situ the species-specific filtration effects of the planktonic communities by nursery propagated sponges transplanted onto nearshore habitats.





*Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida*

Test in situ the species-specific filtration effects of the planktonic communities by nursery propagated sponges transplanted onto nearshore habitats.





*Refining sponge nursery design and optimizing  
the effectiveness of sponge filtration on water  
quality for sponge community restoration  
efforts in the Florida*

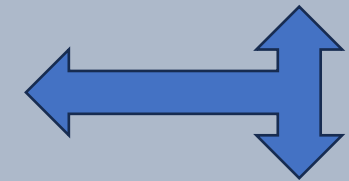
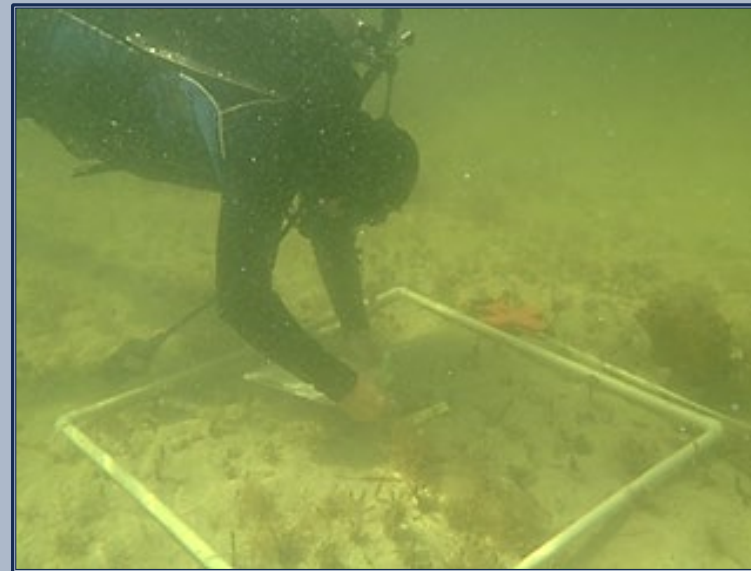
Test whether sponge  
nurseries act as local  
“spawning hubs” by improving  
sponge recruitment and  
adding habitat for fish and  
invertebrate species





*Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida*

Test whether sponge nurseries act as local “spawning hubs” by improving sponge recruitment





Refining sponge nursery design and optimizing the effectiveness of sponge filtration on water quality for sponge community restoration efforts in the Florida

Using controlled *ex situ* assays, test the relative tolerance of two species of nursery propagated sponges to cyanobacteria cells cultured from previous blooms in Florida Bay





# Thank You!

# Questions?



Work conducted under USFWS Permit &  
Florida Keys National Marine Sanctuary  
Permit # 2019-057 & 1018-0102