

# Sponge Restoration

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# Outline

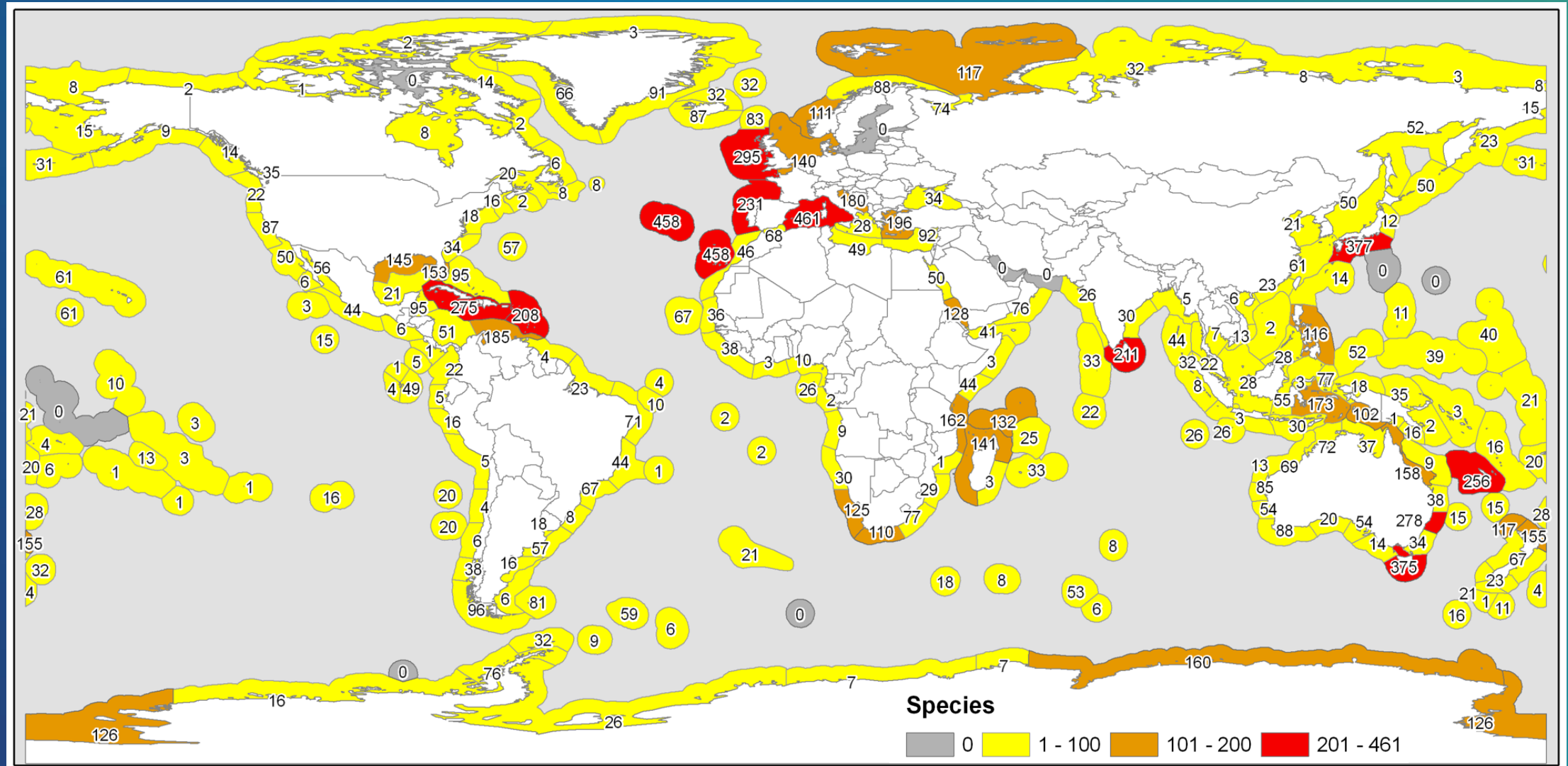
- Intro to sponges
- Economy
- Threats
- Sponge restoration



Loggerhead sponge in the Florida Keys

*Source: Dr. Mark Butler, Old Dominion  
University (ODU)*

# Sponge Distribution



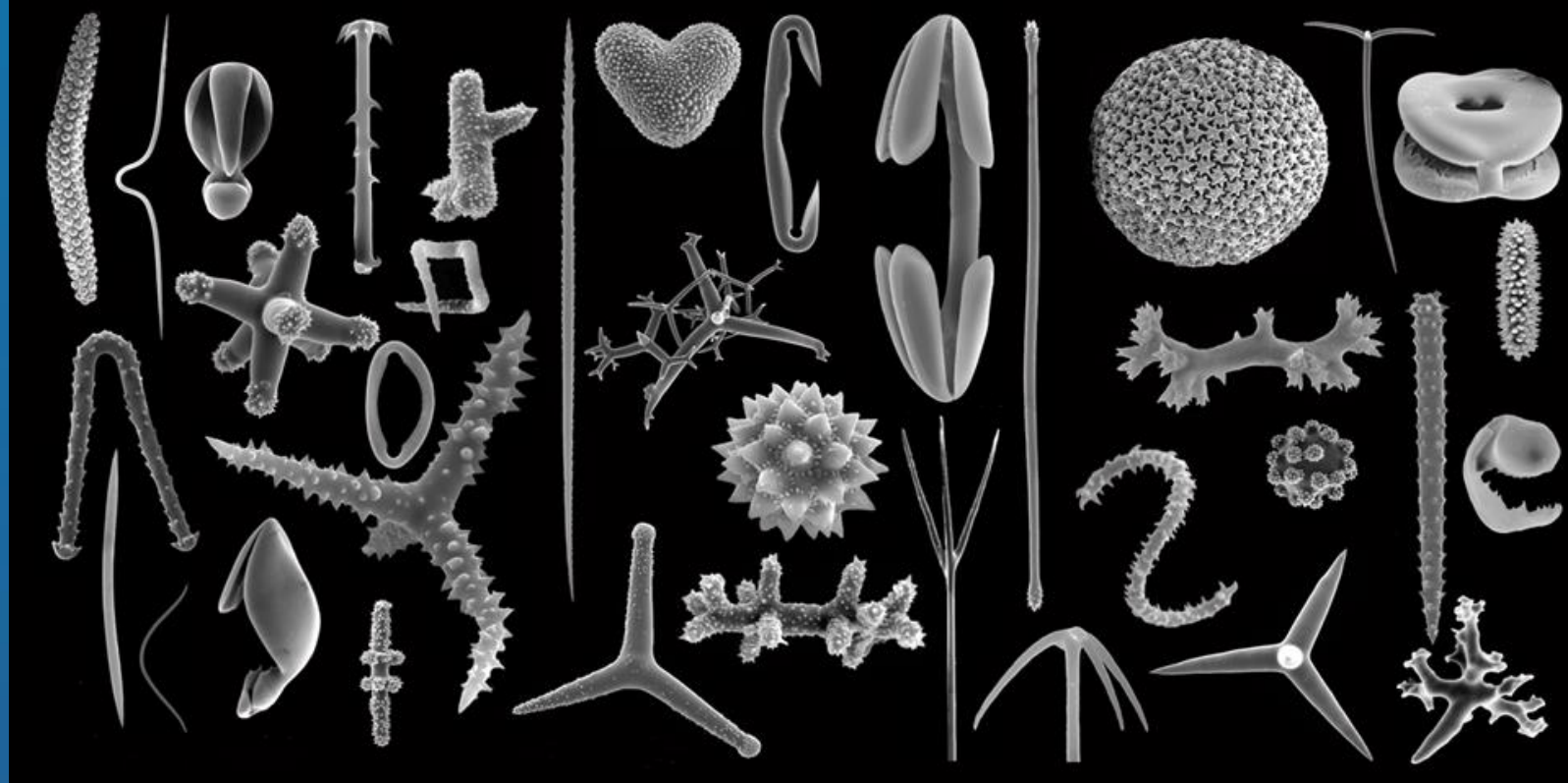
The global distribution and diversity of sponges (Phylum Porifera).

Source: Van Soest et al. 2012. PLoS ONE



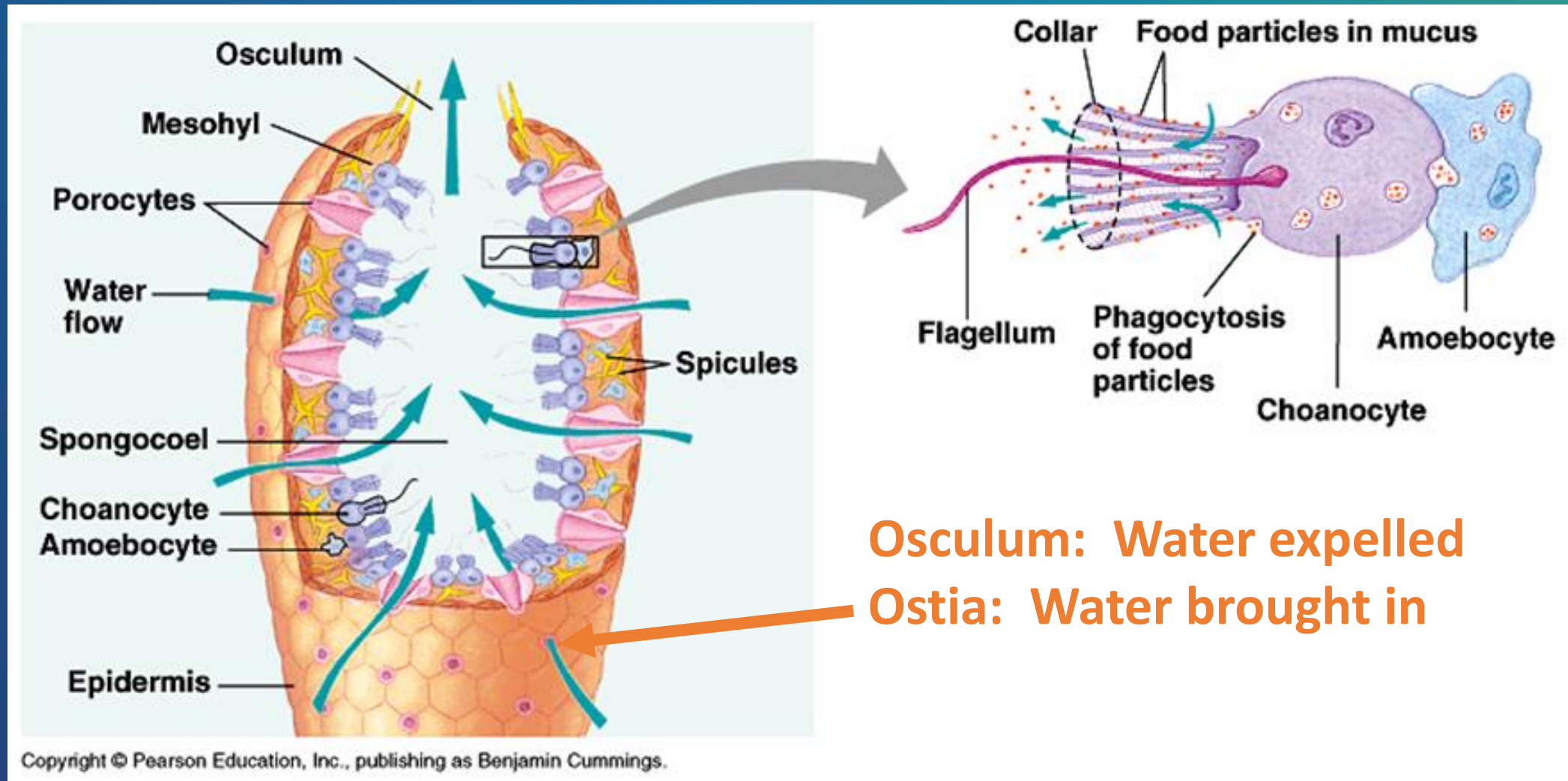
# Sponge Taxonomy

- Phylum Porifera
  - Class Calcarea
  - Class Hexactinellida
  - Class Demospongiae
  - Class Homoscleromorpha
- Spicules – Ca or Si
- 8,553 described species
- ~24 bath sponge spp.
- Spongin



Sample of spicule formations from sponges.  
*Sources: Taylor et al. 2007; Van Soest et al. 2012*

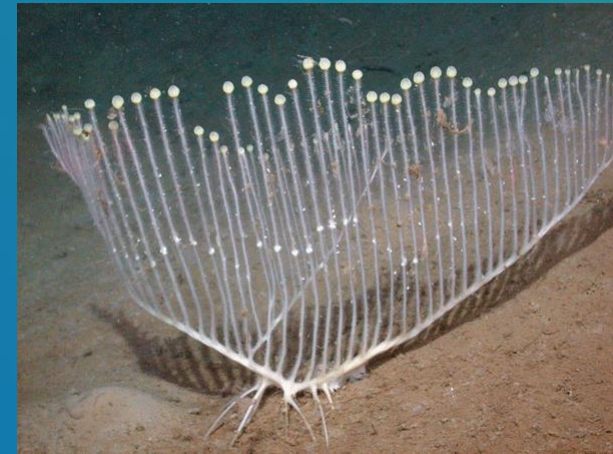
# Sponge Organization



General body organization of a sponge.  
Source: Pearson Education Inc., Benjamin Cummings



# Sponge Morphology



Sources: Harbor Branch Oceanographic Institute, Florida Sea Grant, Florida Fish and Wildlife Conservation Commission, Mark Butler (ODU), J.R. Pawlik (UNCW), and Monterey Bay Aquarium Research Institute

# Sponge Predators

- Hawksbill turtle
- Starfish
- Butterfly fish
- Angelfish
- Trunkfish
- Cowfish
- Nudibranchs



Bahama star *Oreaster reticulatus* in Florida Keys

Source: Shelly Krueger, UF/IFAS



# Miracles from the Sea

“More novel bioactive compounds are obtained from members of this phylum each year than any other marine taxon” ~Shaala et al., 2015

1969: Cytarabine = first marine derived drug from a sponge for leukemia

Breast cancer, prostate cancer, antimalarial drugs, herpes medications



*Tectitethya crypta.*

Source: The Sponge Guide



# Ecological Importance



Snapping shrimp, *Synalpheus* species  
Source: Arthur Anker, Wikimedia Commons



Juvenile spiny lobster hiding under loggerhead sponge  
Source: Dr. Mark Butler, Old Dominion University

# Water Quality: Sponge Filtration Rates

Sponge Common Name	Scientific Name	Filtration Rate (ml of water per hour per ml of sponge biomass)	Filtration Rate (gallons per hour)
Sheepswool	<i>Hippospongia lachne</i>	34.37	594
Loggerhead	<i>Spheciospongia vesparium</i>	17.6	304
Brown branching	<i>Ircinia species</i>	25.1	432
Vase/basket	<i>Ircinia campana</i>	28.83	498
Grass	<i>Spongia graminea</i>	18.26	316
	Average	24.8	429





# Commercial Sponge Fishery

## TODAY IN KEYS HISTORY



Photo from the Scott DeWolfe Collection

Sponges on Greene Street dry in the sun on this day in 1900. If the weather and water condition were satisfactory a sponger could make a good living.



The history and culture of the sponge fishery in Florida is of interest to many.

Sources: Scott DeWolfe Collection and [dglobe.com](http://dglobe.com)



# Threats

- Algal/cyanobacteria blooms
- Diseases
- Dredging
- Freshwater runoff
- Poor water quality
- Hurricanes



Loggerhead sponges washed ashore after Hurricane Irma.

*Source: Martha Meroni*



# Synechococcus blooms in Florida Bay

- Cyanobacteria
- *Synechococcus* blooms
- “Pea soup”
- Florida Bay



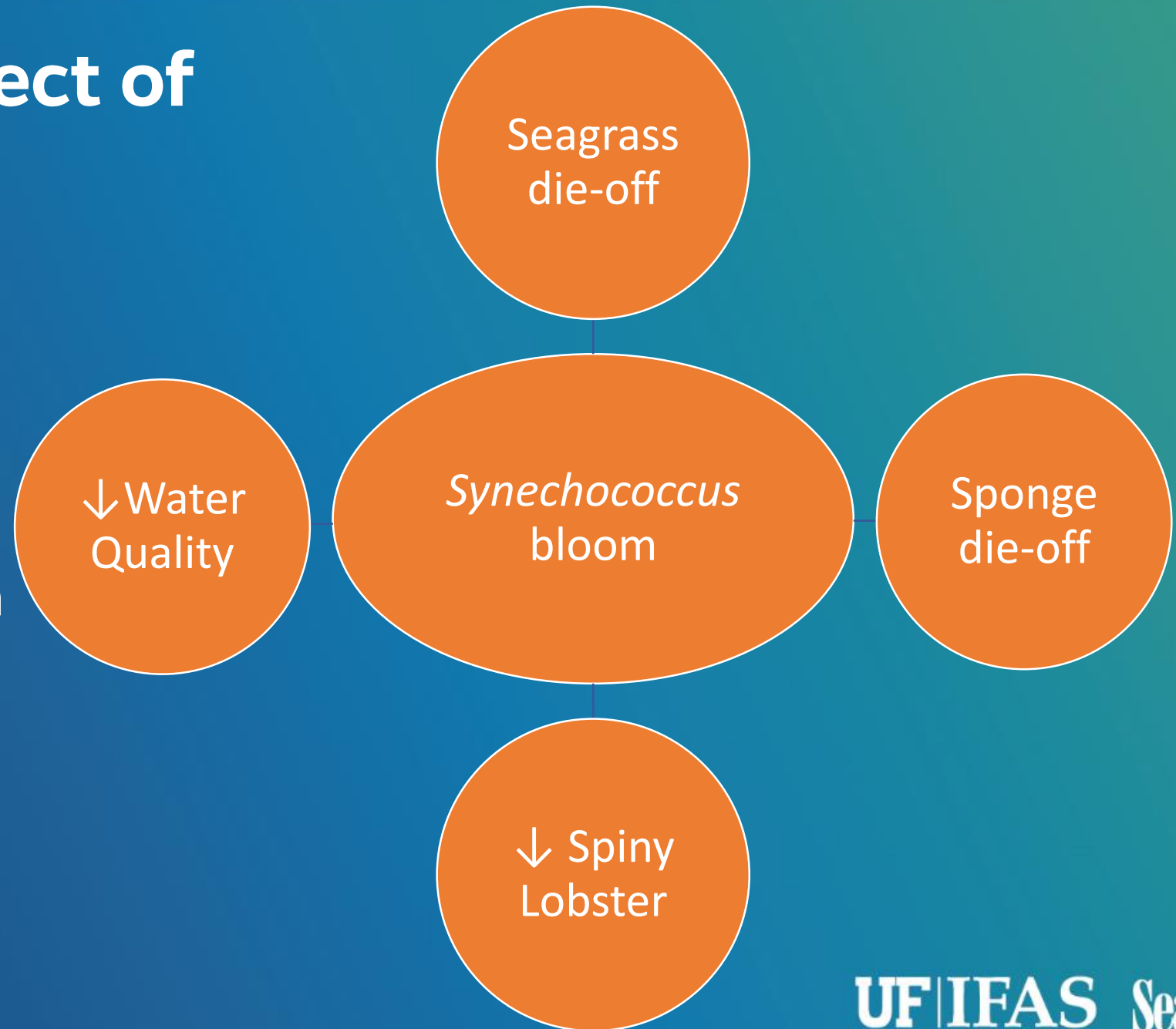
A boater measures water clarity during a bloom.

Source: *Phlips et al., 1995; Phlips et al., 1999; Chanton et al., 2003, Eye on Miami*

# Cascading Effect of Blooms

Changes in:

- Rainfall
- Salinity
- Nutrients
- Dissolved oxygen
- Hydrology
- Temperature

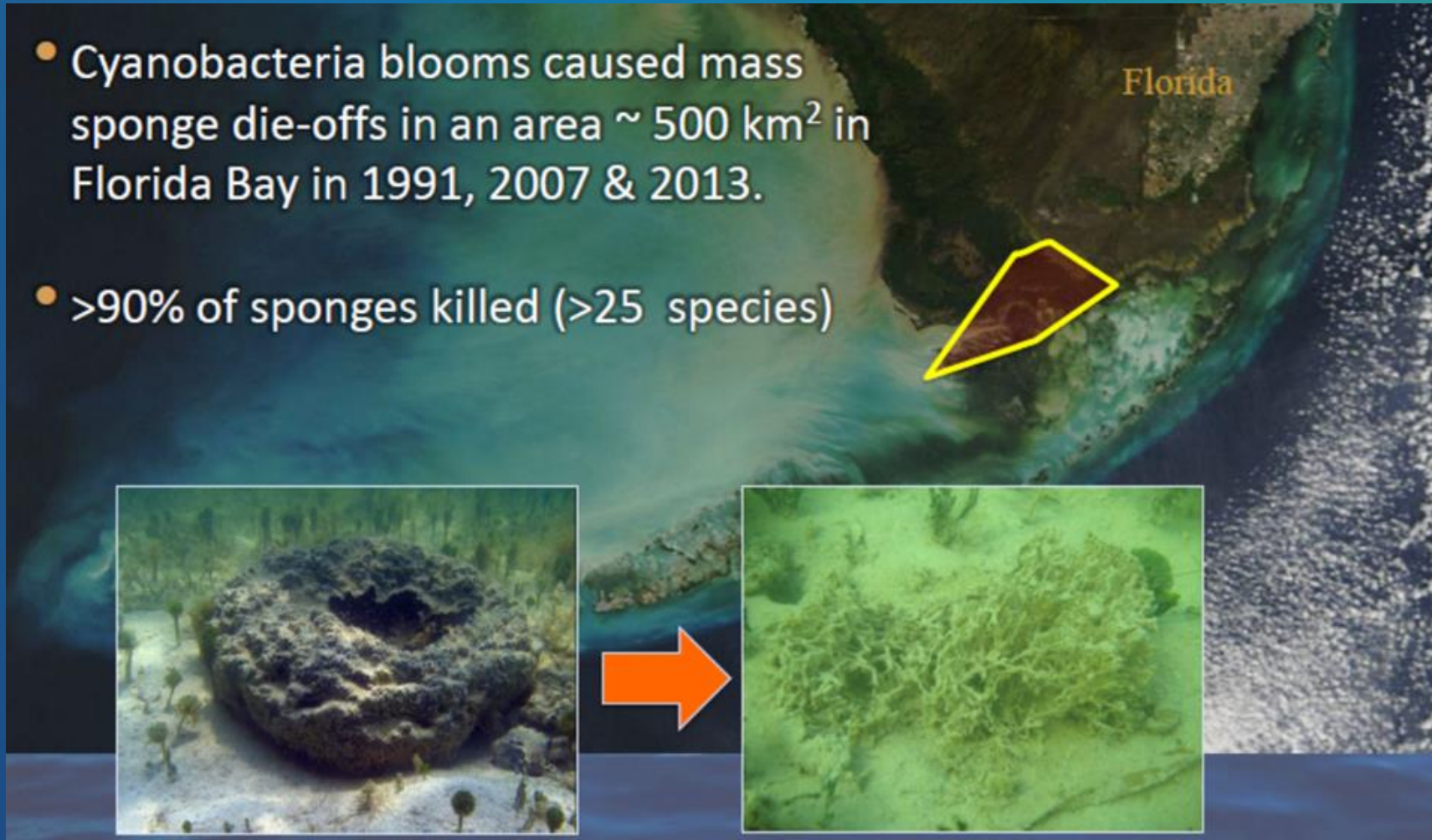


Sources: Butler et al., 1995; NOAA Fisheries, 2013; Butler and Dolan, 2017



# Consequences of Algal Blooms

- Cyanobacteria blooms caused mass sponge die-offs in an area  $\sim 500 \text{ km}^2$  in Florida Bay in 1991, 2007 & 2013.
- >90% of sponges killed (>25 species)



Source: Dr. Mark Butler, Old Dominion University



# Loggerhead sponge pre- and post-algal bloom



*Source: Dr. Mark Butler, Old Dominion University*



# Basket sponge pre- and post-algal bloom



*Source: Dr. Mark Butler, Old Dominion University*



# Sponge Restoration



FWC researcher Elliott Hart placing sponges into  
sponge nursery, Marathon, Florida

*Source: Jennifer Stein*



# Sponge Species

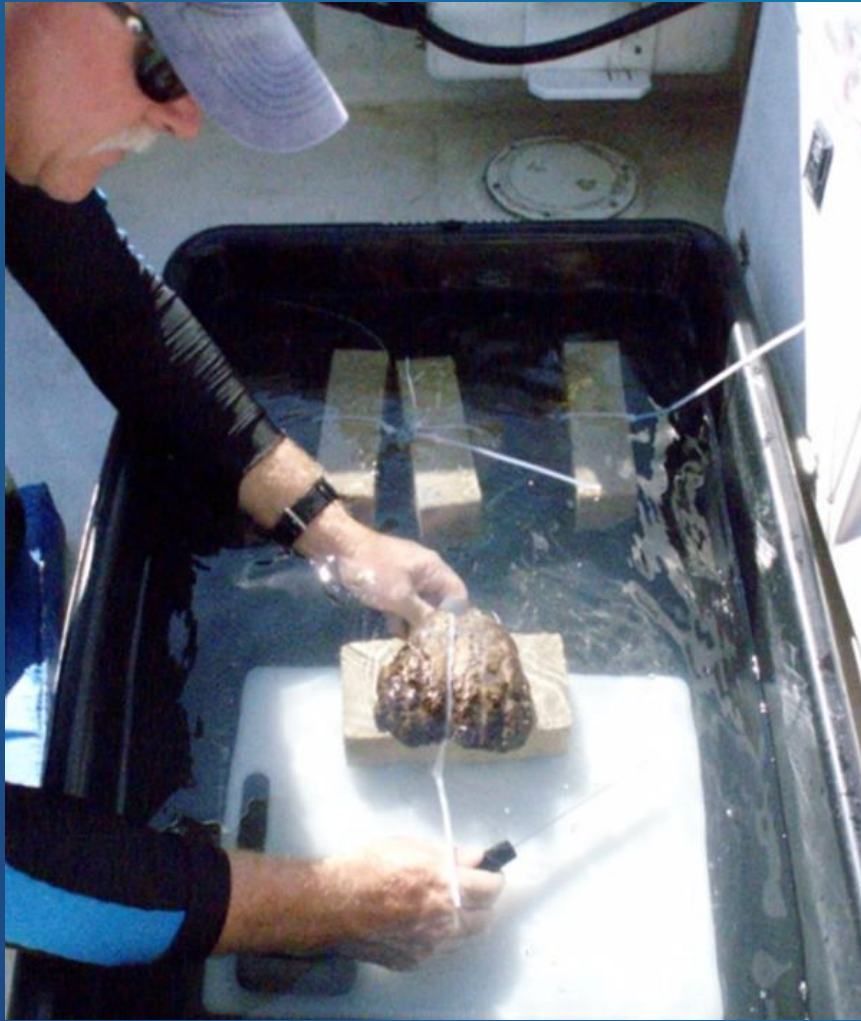
Clockwise: glove sponge, brown branching sponge, vase sponge, alf sponge, fire sponge, and blackball sponge

Sources: Dr. Mark Butler, Old Dominion University; Shelly Krueger, UF/IFAS Florida Sea Grant; Smithsonian Tropical Research Institute; and Coralpedia





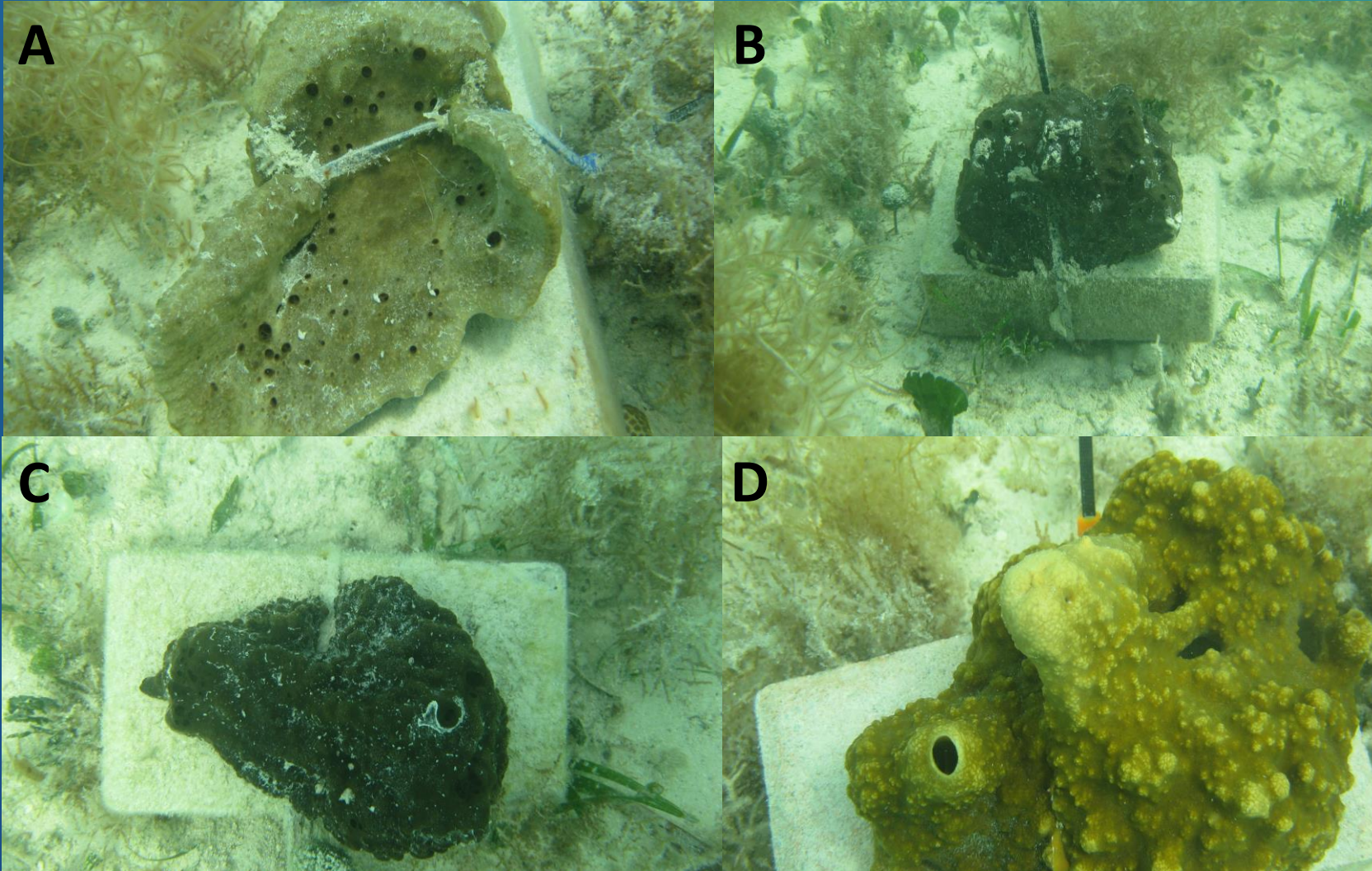
# Sponge Propagules (cuttings)



Dr. Mark Butler attaching sponge to brick (left) and sponge cuttings awaiting attachment to bricks (right) Sources: Dr. Mark Butler, Old Dominion University and Shelly Krueger, UF/IFAS



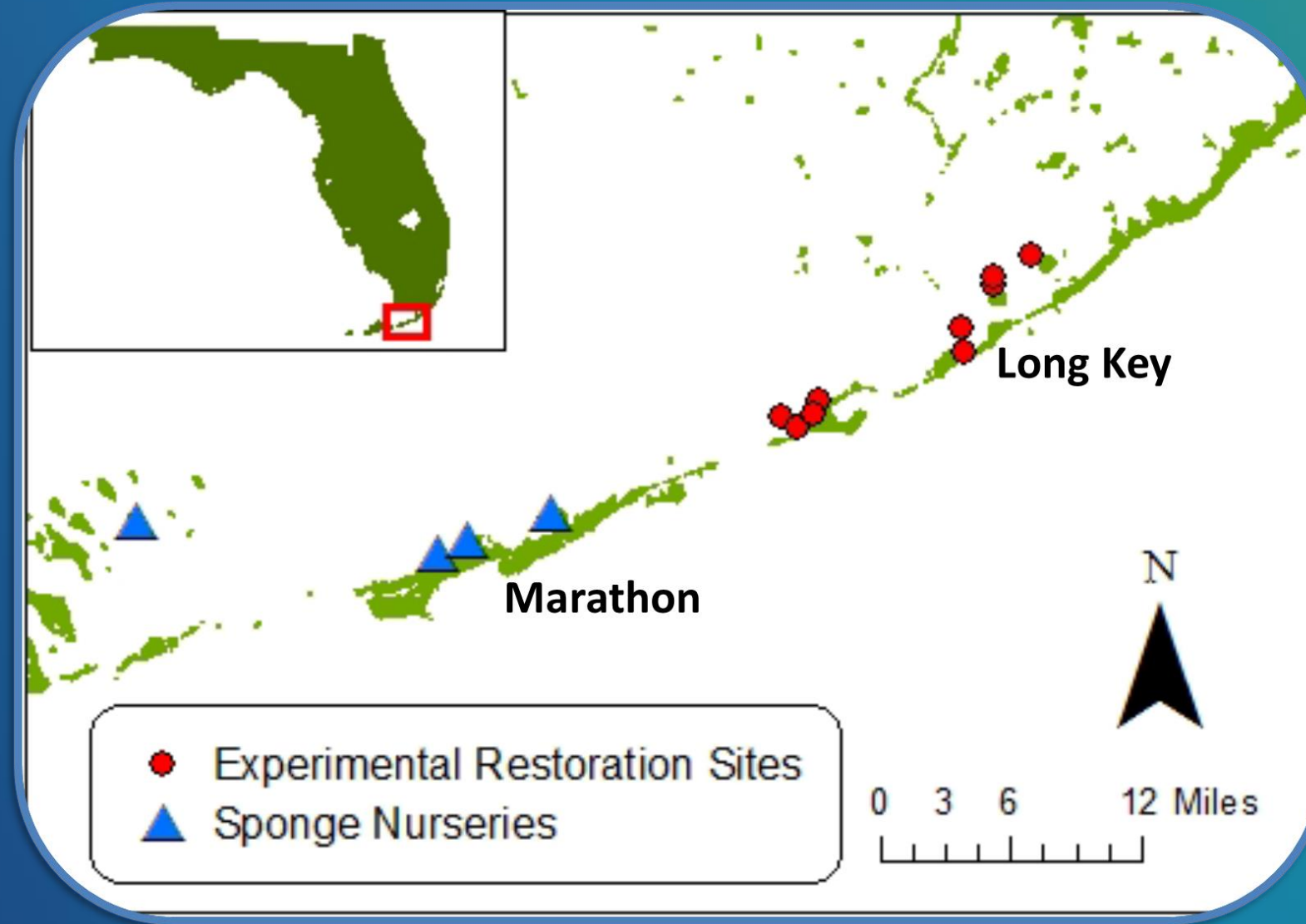
# *Sponge Propagules (cuttings)*



Propagules of four sponge species on bricks in nursery, Florida Keys.

*Source: Shelly Krueger, UF/IFAS*

# FWC Sponge Nurseries and Restoration Sites



Map of FWC sponge nurseries and restoration sites in the Middle Florida Keys.

Source: Elliot Hart, Florida Fish and Wildlife Conservation Commission (FWC)



# Basket Sponge Restoration



Basket sponge *Ircinia campana* propagules (left) and 4 years later

Source: Dr. Mark Butler, Old Dominion University



# Sponges: The oysters of South Florida?

## Oysters

- Efficient filters
- Large restoration efforts
- Nitrogen removal
- Oyster gardening

## Sponges

- Efficient filters
- Restoration efforts
- Nitrogen removal?
- Sponge gardening?





# UF/IFAS Florida Master Naturalist Program

- **Marine Habitat Restoration \$175**

UF/IFAS Florida Master Naturalist Program – a new Marine Habitat Restoration Course



*Developed by:*

*Shelly Krueger, Savanna Barry, Scott Jackson, Shelly Johnson, Josh Patterson, Laura Reynolds, Martin Main*

*Supported by:*

*University of Florida/IFAS and Florida Sea Grant*



## Seagrass Restoration

- Savanna Barry, Laura Reynolds

## Coral Reef Restoration

- Josh Patterson

## Sponge Restoration

- Shelly Krueger

- **Artificial Reefs**

- Scott Jackson



Questions?

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Source: Internet Movie Database (IMDB)