

The role of sponges in modulating nitrogen cycling in the Florida Keys

Ashley Smyth & Shelly Krueger



The Florida Keys



Photo credit: Julie Myer

Sponges come in all shapes and size

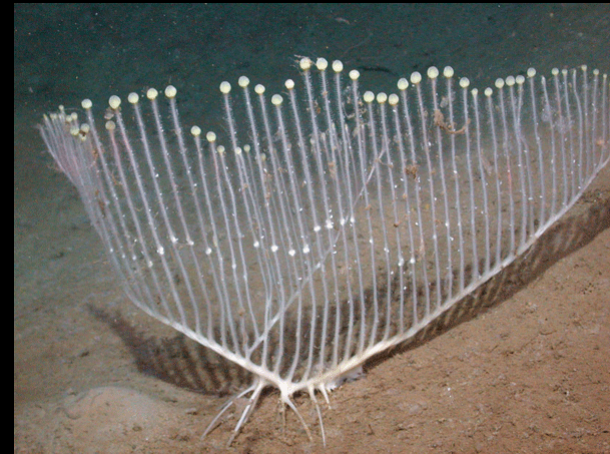


Photo Credits: Harbor Branch Oceanographic Institute, Florida Sea Grant, Florida Fish and Wildlife Conservation Commission, Mark Butler (ODU), J.R. Pawlik (UNCW), and Monterey Bay Aquarium Research Institute

Sponges are found all around the world

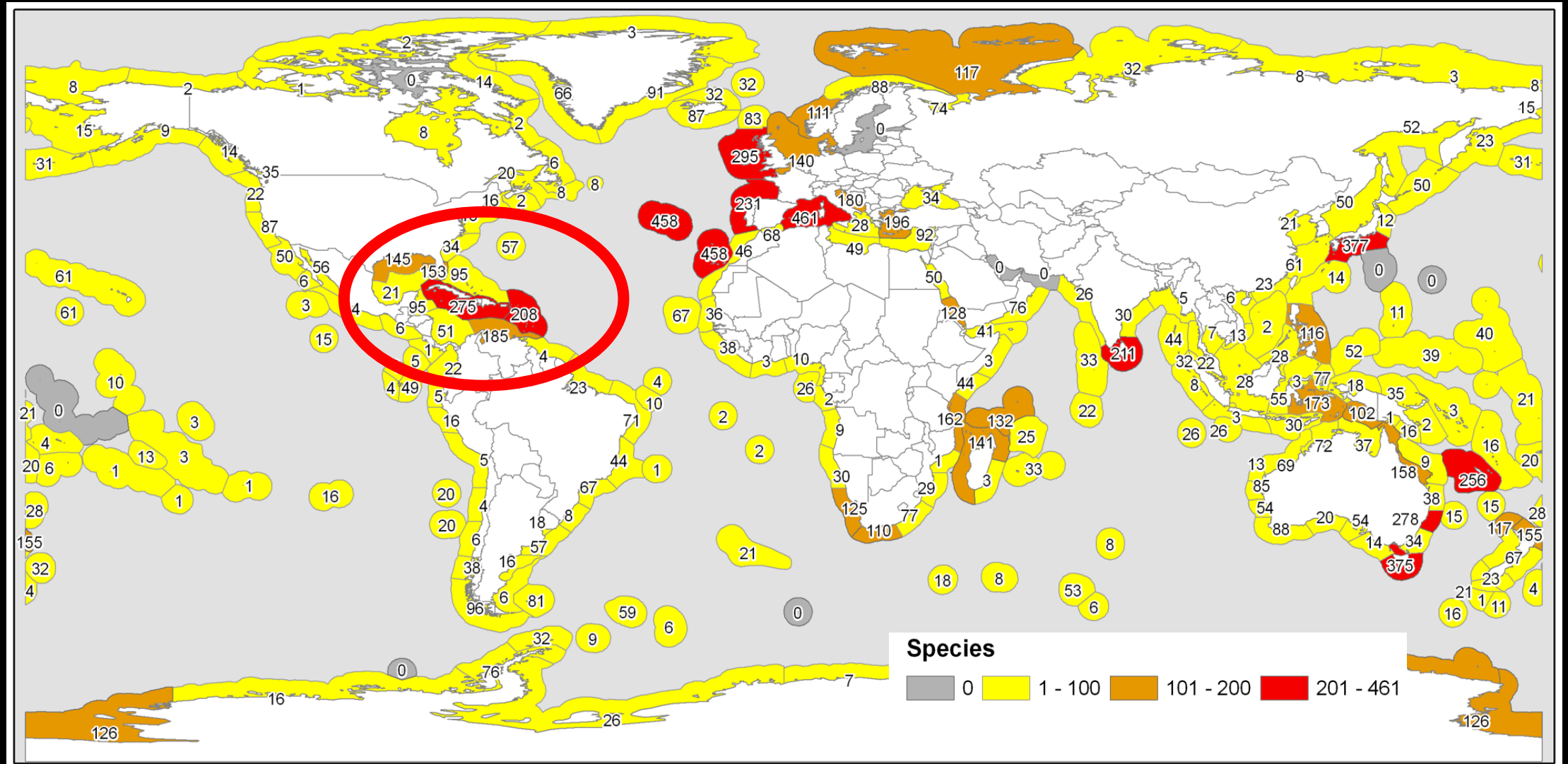




Photo from the Scott DeWolfe Collection

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



Sponges are important to the Florida economy

From 2013-2018, average commercial landings were \$597,332 per year with nearly 300,000 pieces harvested during an average of 335 trip tickets (FWC, 2019).

Sponge Ecosystem Services

Provide Habitat

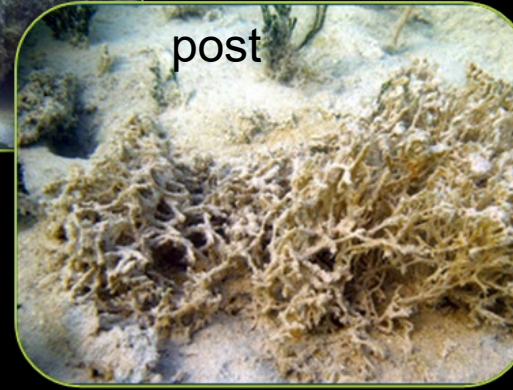


Loggerhead Sponge with Spiny Lobster



Loggerhead sponges washed ashore after Hurricane Irma.

Source: Martha Meroni



Loggerhead sponge pre and post algal bloom

Source: Mark Butler



Sponges for sale in Key West

Source: Shelly Kruger

Water quality and stochastic events have led to the need for sponge restoration

Sponges: The oysters of South Florida?

Oysters

- Efficient filters
- Nitrogen removal
- Local economy
- Global decline
- Large restoration efforts
- Oyster gardening at the local level

Sponges

- Efficient filters
- Local economy
- Global decline
- Large restoration efforts



Sponges: The oysters of South Florida?

Research Questions

- Can sponge gardening support offshore nurseries?
- Do sponges impact the nitrogen cycle?



Sponge species



Glove Sponge



Loggerhead Sponge



Sheepswool Sponge



Why sponge gardening?

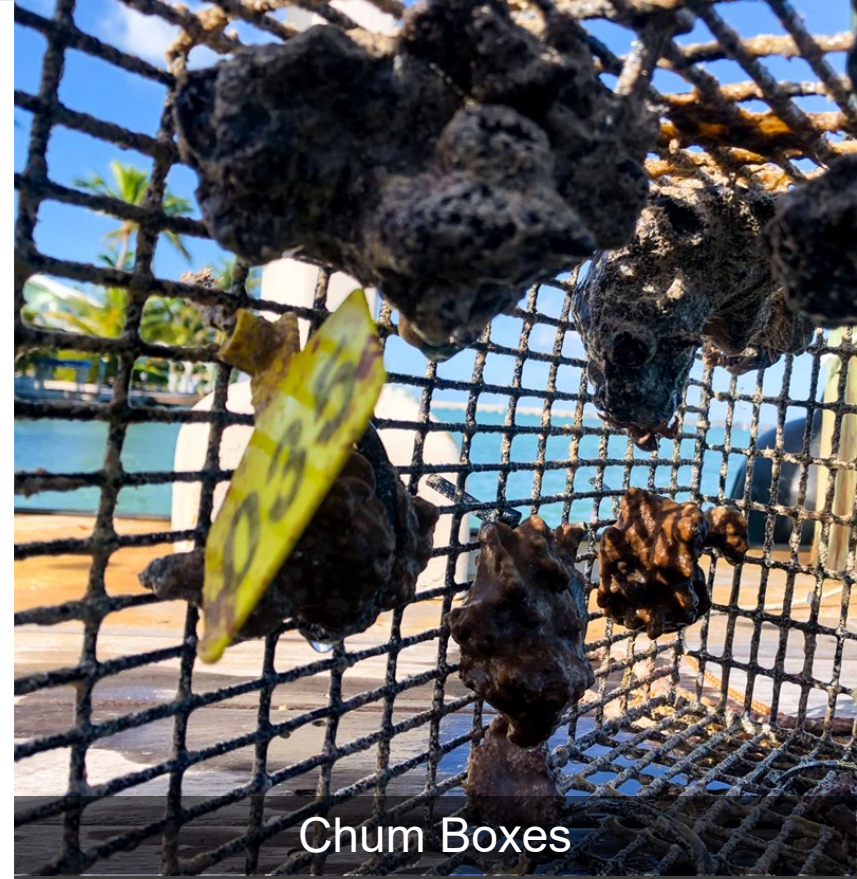
- Citizen science
- Residential canals
- Alternative nurseries
- Oyster gardening



Manilla Rope



Aquaculture Mesh



Chum Boxes

Which substrate is best for sponge gardening?

Chum Boxes had the highest habitat value



- Tiger goby
- Brittle Stars
- Crabs
- Octopus
- Barracuda
- Mangrove tunicates
- Mangrove oysters
- Amphipods/copepods
- Pipefish
- Snails

How do sponge species process nitrogen?



Glove Sponge



Loggerhead Sponge



Sheepswool Sponge

- We expected:
 - Nitrogen fixation to occur in excess of denitrification (Wilksen 1983)
 - NO_3^- production due to nitrification (Valentine & Butler 2019)



Shelly taking water measurements



Bella looking at the sponges in the incubation chamber

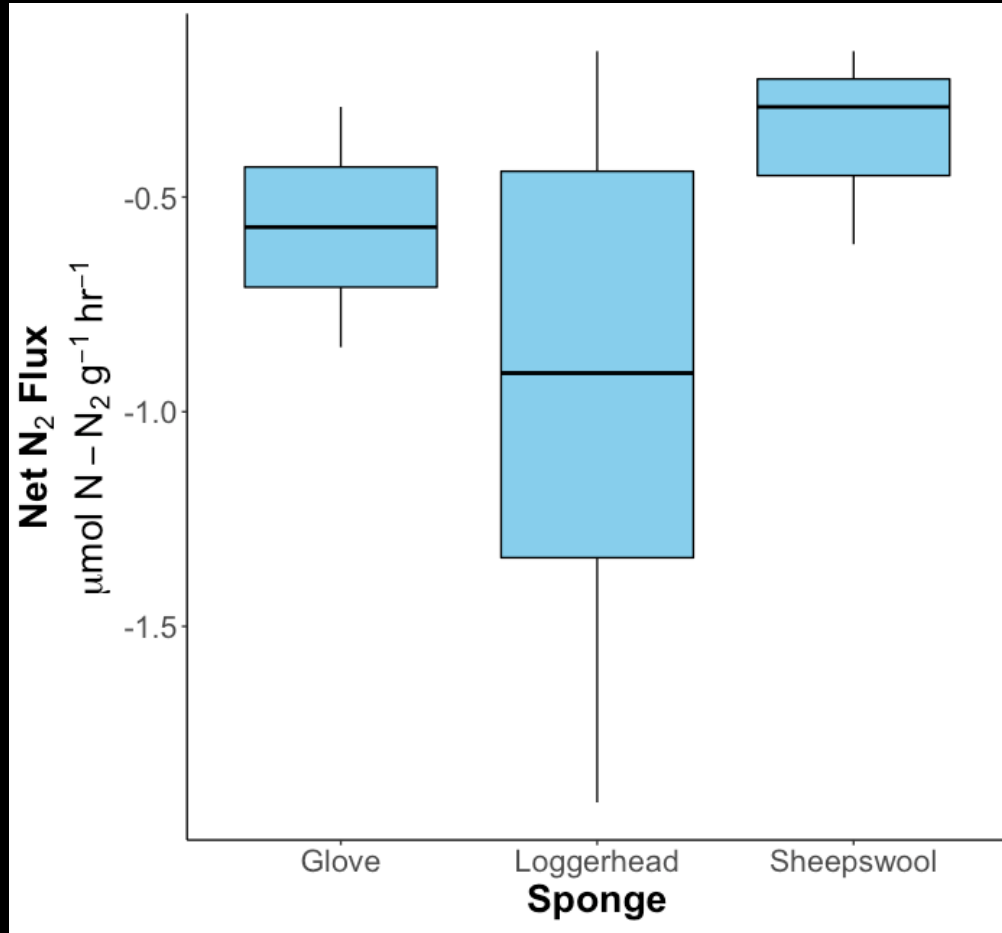


Sponges

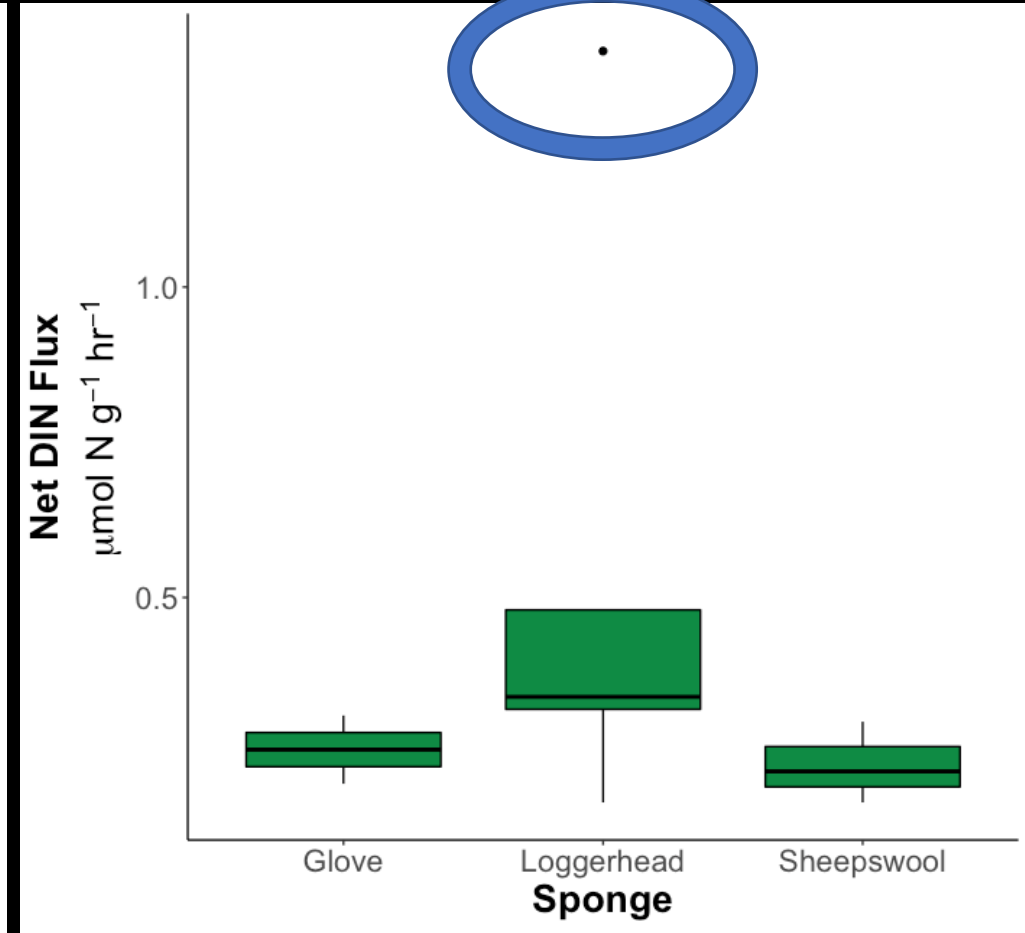
Measuring nitrogen fluxes with sponges

Sponges are a source of nitrogen

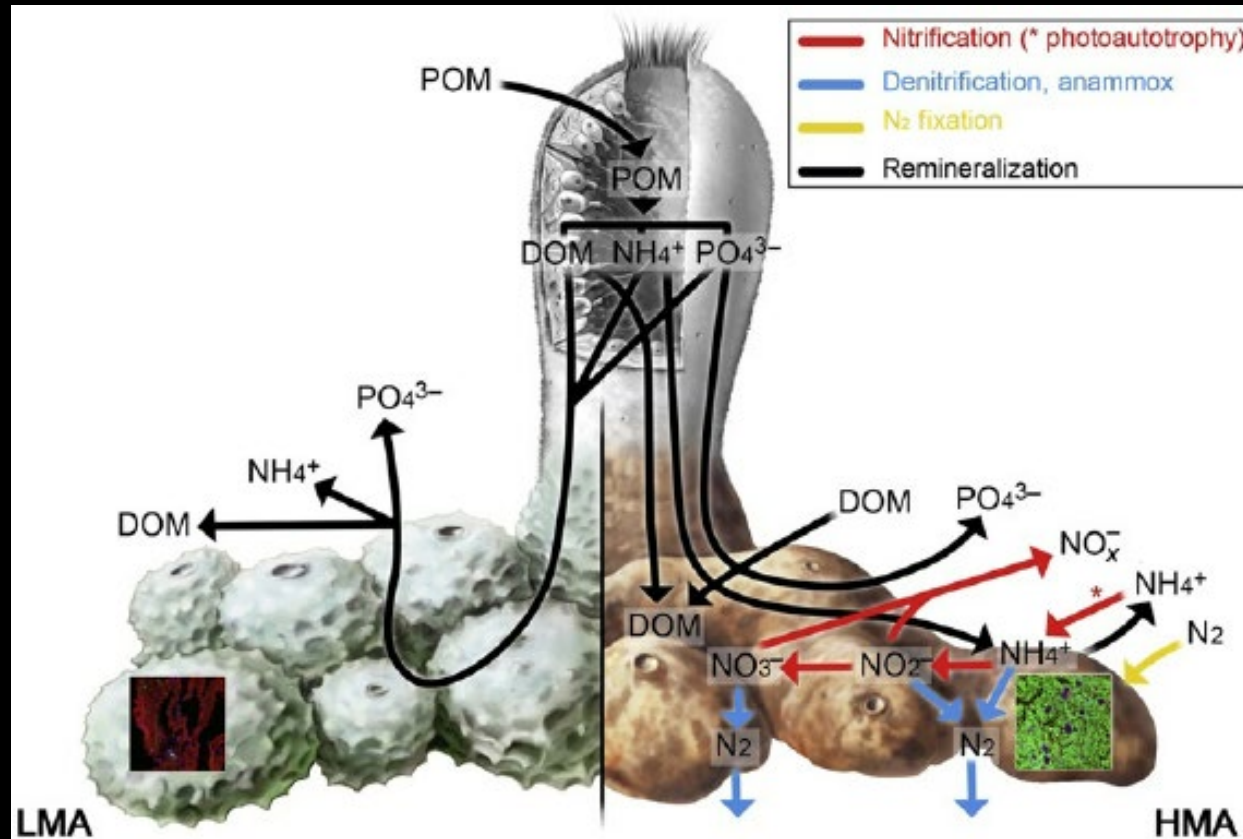
Net N₂ Flux



Net NO_x + NH₄⁺ Flux

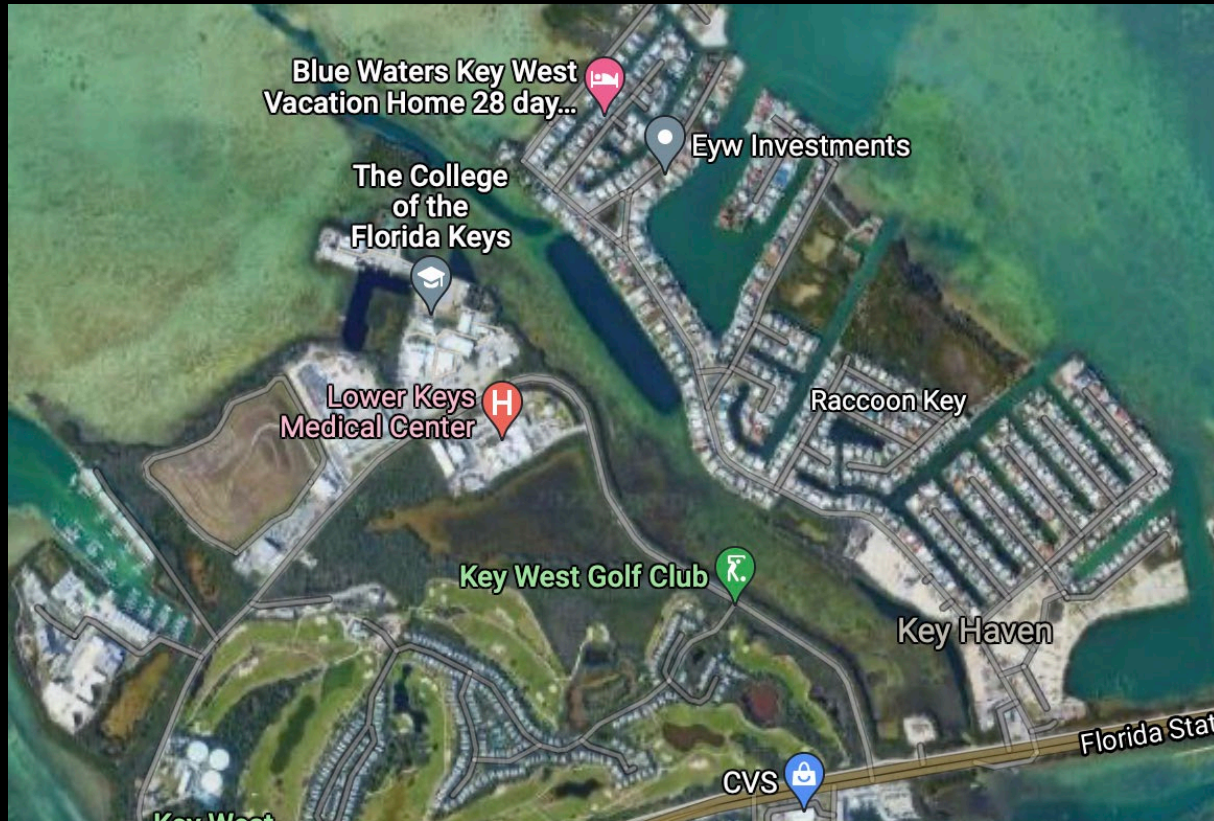


Sponges: Missing Link in Recycling on Reef Ecosystems



- Review of sponge studies: Denitrification rare
- nifH associated with sponges
- Transfer material and energy from water column to benthic community

Sponges contribute to water quality




- 96 canals in Monroe County have poor water quality
- Sponge gardening has potential in canals with sponges
- Water filtration services

An underwater photograph showing a vibrant and diverse sponge reef. The scene is filled with various types of sponges in shades of yellow, orange, and white, some with intricate, porous structures. The background is slightly blurred, showing more of the reef and some green seagrass. The lighting is natural, highlighting the textures and colors of the marine life.

Sponges are
important to water
quality in shallow
tropical waters

Ashley Smyth
ashley.smyth@ufl.edu

 @ashleyrsmlyth

Ecosystem Functions and Services

Sponges contribute to water quality

Sponge Common Name	Scientific Name	Filtration Rate (ml water/hr/ml sponge biomass)	Filtration Rate (gallons/hr)
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