# BEING AN AMBASSADOR BEYOND THE CLASSROOM

***AN OVERVIEW OF CITIZEN SCIENCE PROGRAMS OFFERED BY FLORIDA SEA GRANT IN CHARLOTTE COUNTY & WHY THEY ARE NECESSARY***

EYES ON SEAGRASS

FLORIDA HORSESHOE CRAB WATCH

Linked with Limulus

CHARLOTTE HARBOR AMBASSADOR TRAINING
FEBRUARY 5TH, 2025

# FLORIDA SEA GRANT

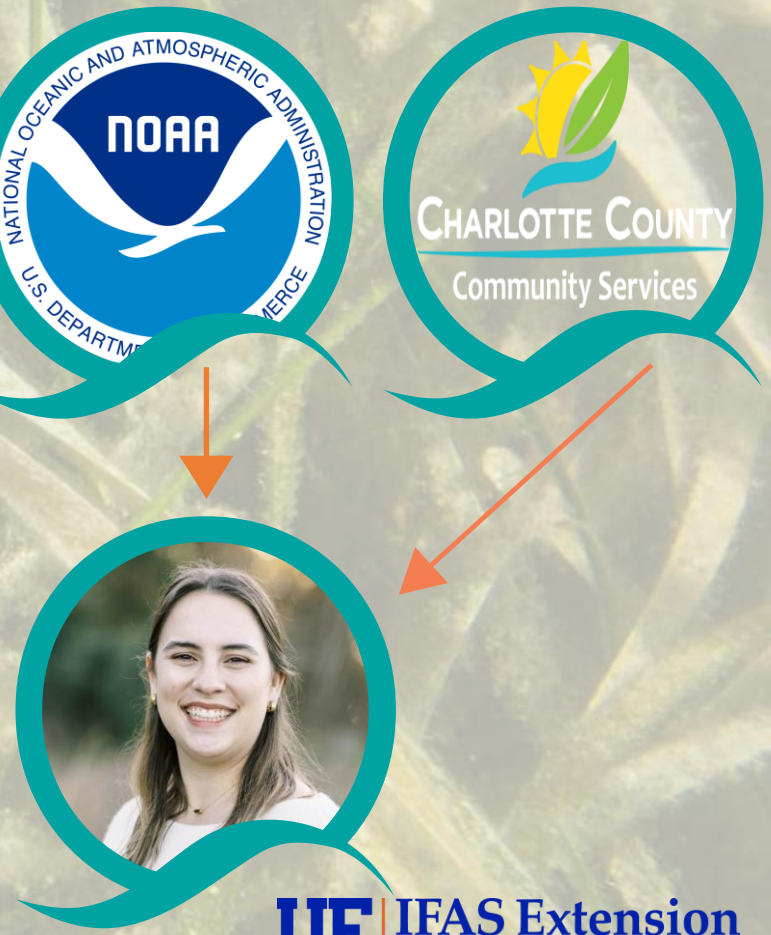
## SCIENCE SERVING FLORIDA'S COASTS

1862- Land Grant University system established

- University of Florida Institute of Food and Agricultural Sciences (IFAS)

1975- Sea Grant

- 35 Programs in Coastal States and the Great Lakes
  - Including Puerto Rico

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# SUBMERGED AQUATIC VEGETATION IN CHARLOTTE COUNTY

PLANTS

THAT LIVE UNDER-WATER

Katherine “Kate” Rose, M.S.
Florida Sea Grant Extension Agent
Charlotte County

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# Seagrass Ecosystem Services

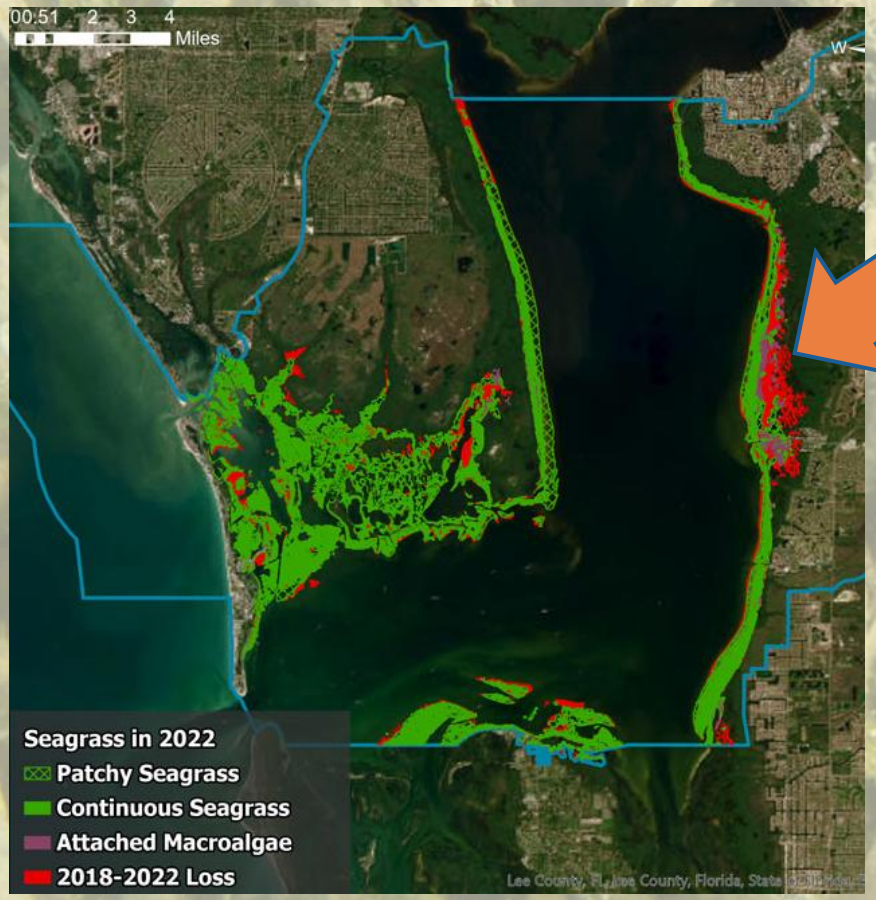
In the early 2000's, Florida's seagrasses contributed $180 billion annually to the state's economy with recreational & commercial fishing, nutrient cycling and aquaculture
*(UF/IFAS Department of Soil & Water Sciences)*

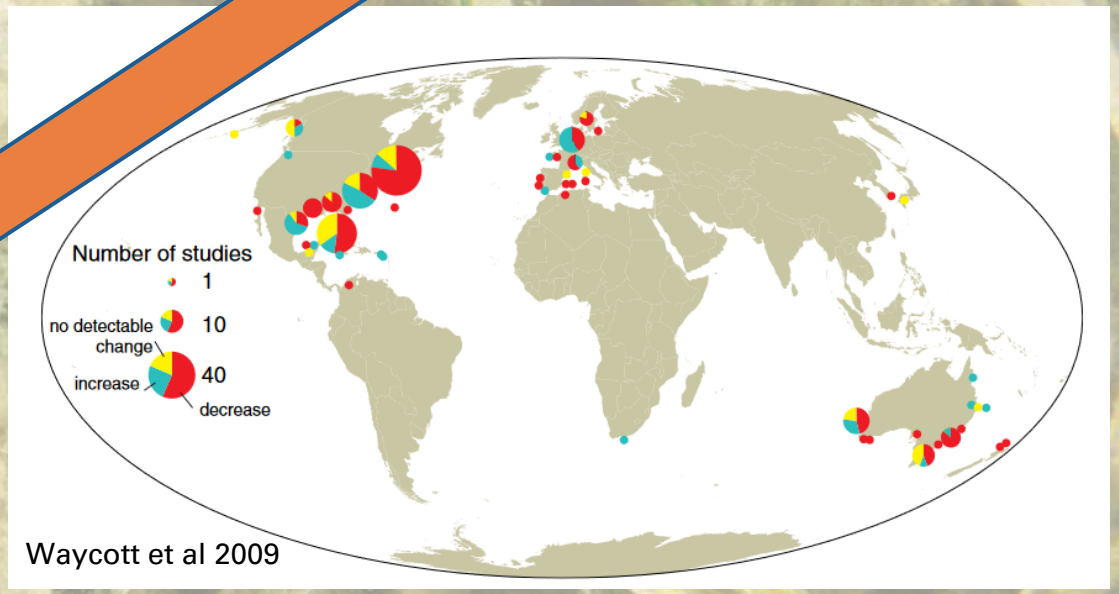
| Service | Description |
|---|---|
| Habitat | More than 70% of all commercial and recreational species in Florida rely on seagrass meadows at some point in their lives (FWC). |
| | According to the Smithsonian Marine Station at Fort Pierce (2002), one acre of seagrass can sustain upwards of 40,000 fish and 50 million invertebrates. |
| Food Supply | The organisms present in seagrass meadows AND the seagrasses themselves serve as a food source. |
| Improve water quality | One acre of restored successfully restored seagrass provides a median of about $3,500 in nitrogen removal (Smyth et al 2024). |
| | Coral reefs near seagrass see less coral & fish diseases than those that exist in isolation (Lamb et al 2017). |
| Carbon sink | Seagrasses hold 336 metric tons of carbon per square kilometer. The average terrestrial forest holds 121 (Forquean et al 2012). |
| Shoreline stabilization | One acre of restored successfully seagrass provides a median of $33,893 per year in shoreline stabilization (Smyth et al 2024). |

# Seagrass coverage is declining globally at a rate of 7% per year…

## Thousands of acres of seagrass gone in Charlotte Harbor

By BETSY CALVERT Staff Writer Jun 11, 2021 Updated Jul 17, 2022 0




Waycott et al 2009

## …because of algae*

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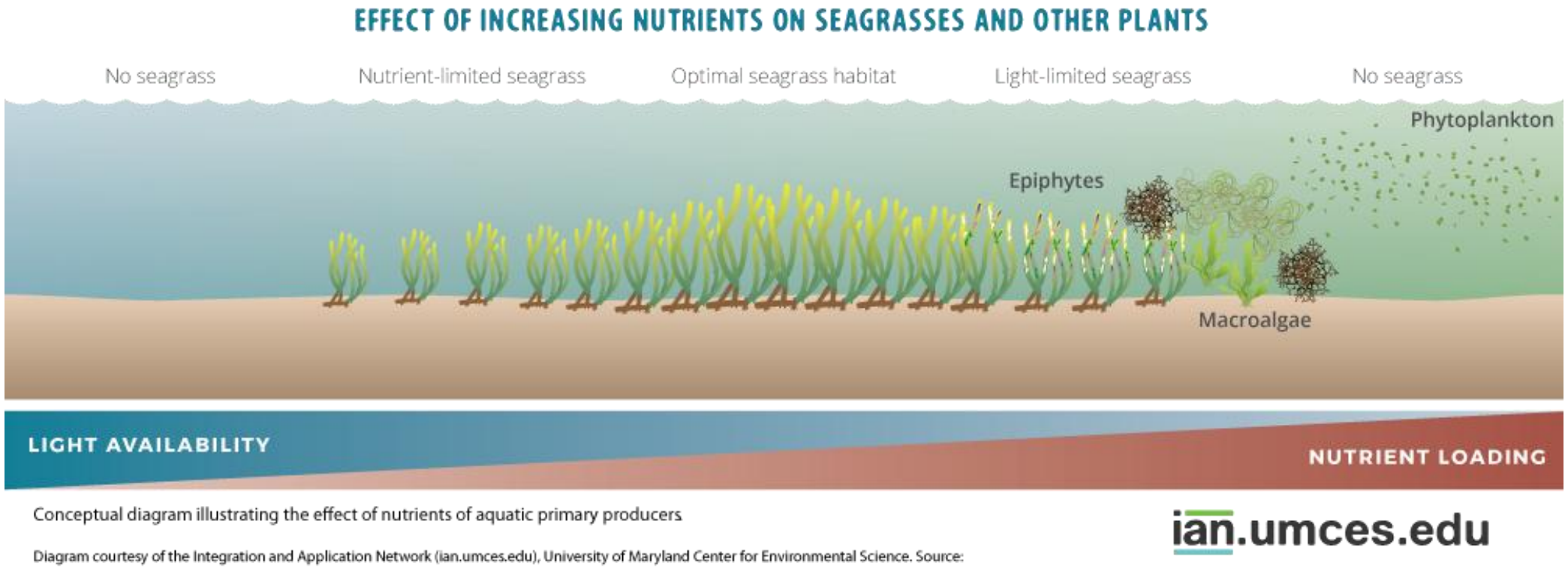
# Macroalgae & Seagrass Interactions




Conceptual diagram illustrating the effect of nutrients of aquatic primary producers

Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: ian.umces.edu

Increasing Turbidity

Boat propeller scars

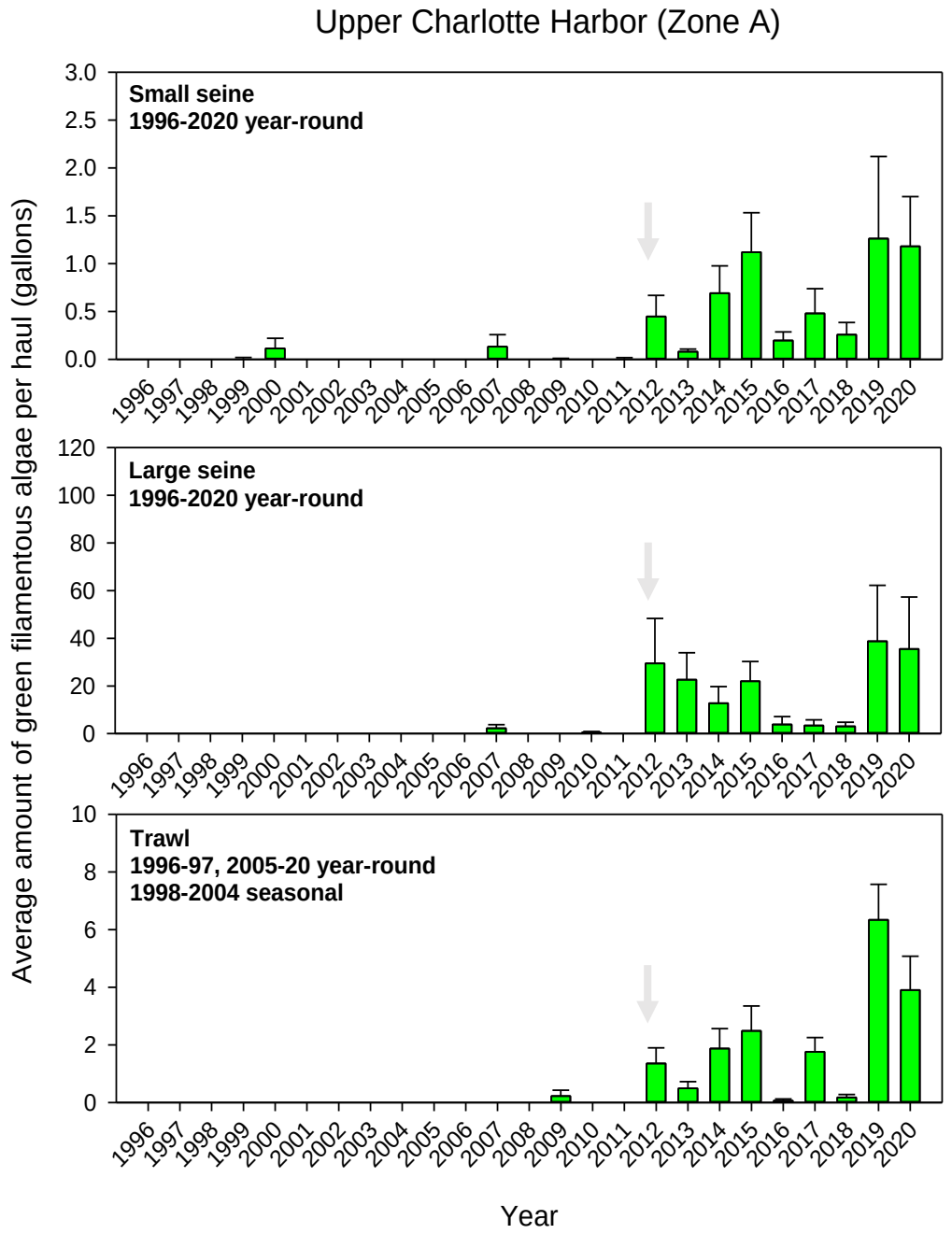
Increasing temperatures

Changing Sediment Conditions

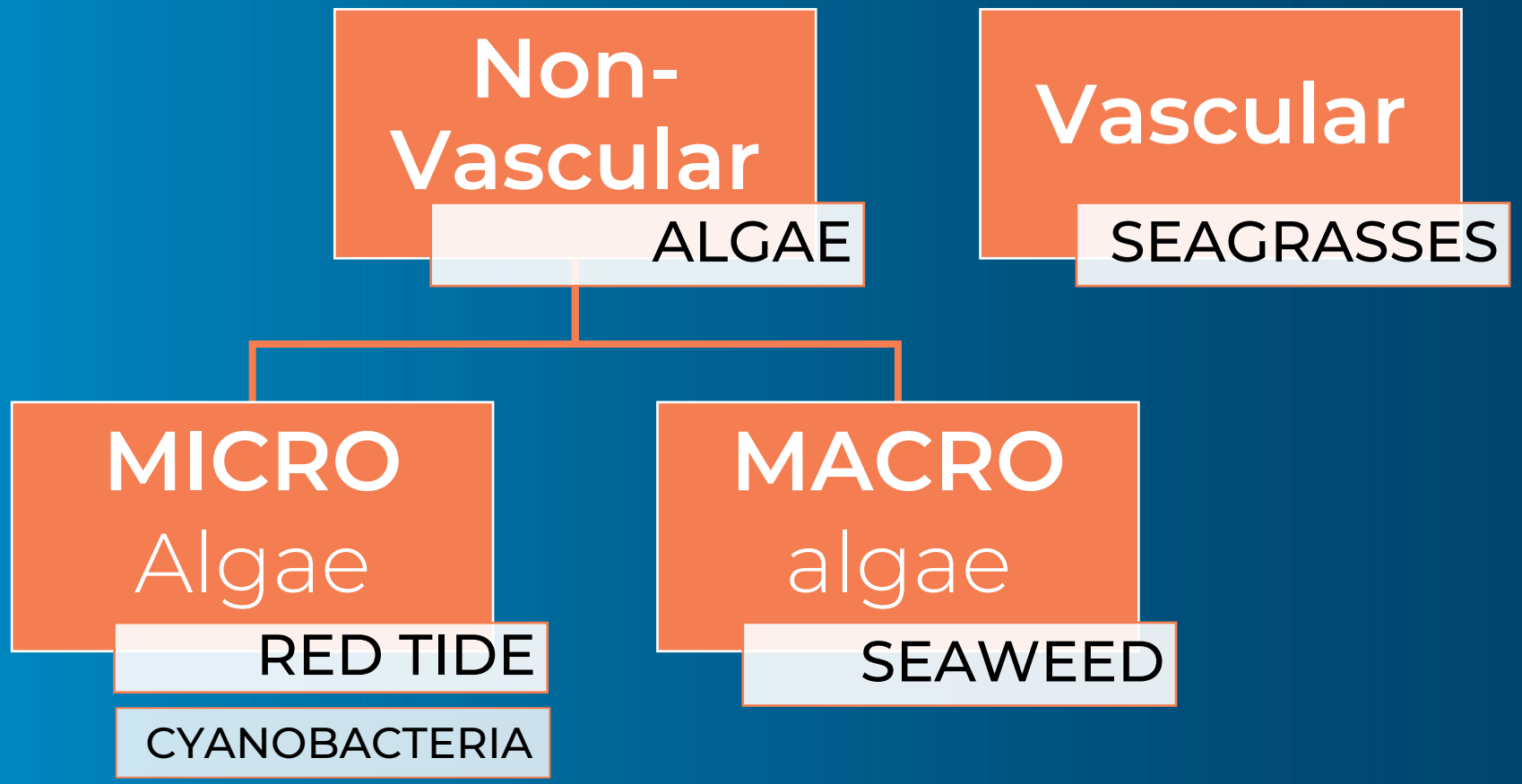
Salinity Variation


***Anastasiou, C. (2022). The Hangover Effect: Seagrass Loss and Macroalgal Growth in Charlotte Harbor Following the 2017-2018 Red Tide Event***

*FWC - FIM*



# SUBMERGED AQUATIC VEGETATION

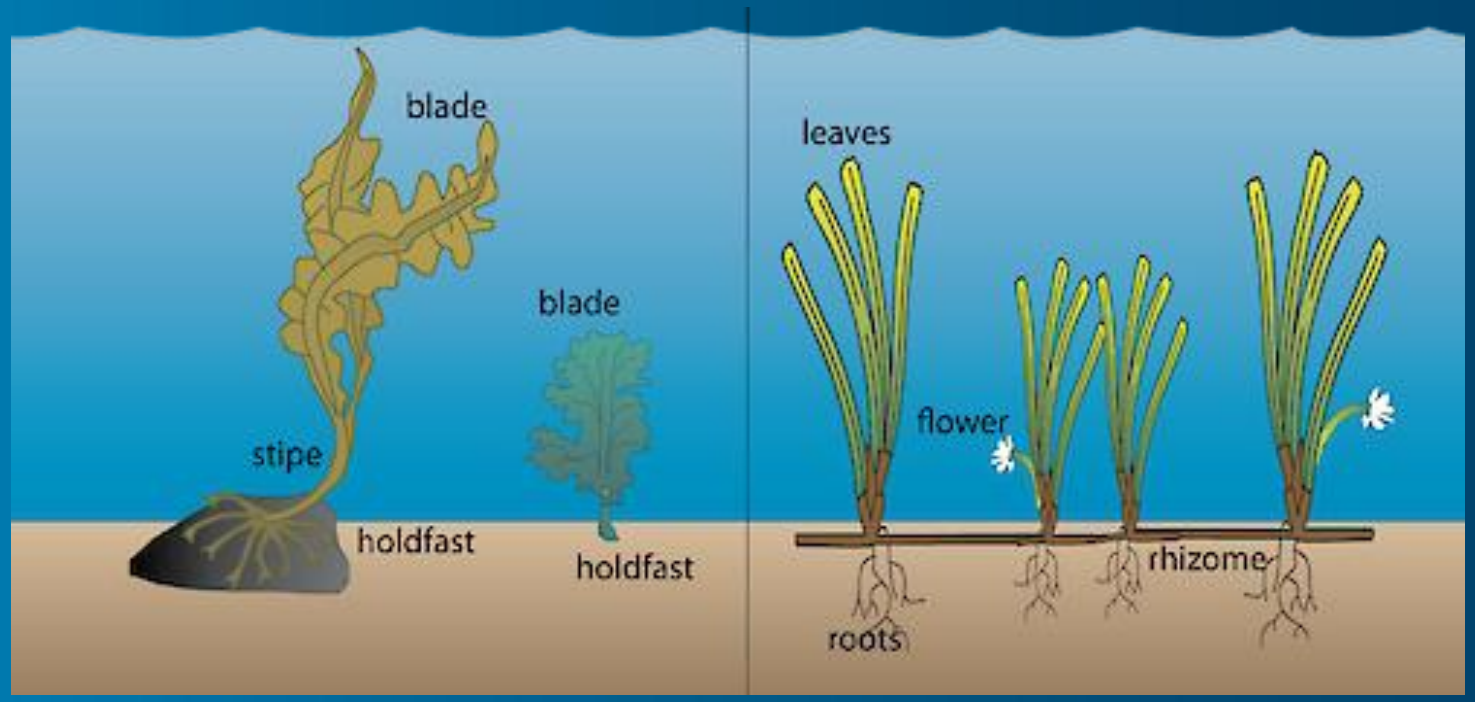


# Non-Vascular

ALGAE

# Vascular

SEAGRASSES




Conceptual diagram illustrating that benthic algae have a holdfast and transport nutrients by diffusion whereas true seagrasses are flowering vascular plants with an internal transport system and roots that penetrate the sediment to transport nutrients.
Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Kruczynski, W.L., and P.J. Fletcher (eds.). 2012. Tropical Connections: South Florida's marine environment. IAN Press, University of Maryland Center for Environmental Science, Cambridge, Maryland. 492 pp.



Sea Grant Florida

# FACTORS THAT INFLUENCE ALGAL BLOOMS

NITROGEN fuels blooms in marine environments

- Nutrients
  - **Non-point source**
  - Point Source
- Water Clarity
- Circulation Patterns
- Climate and Weather

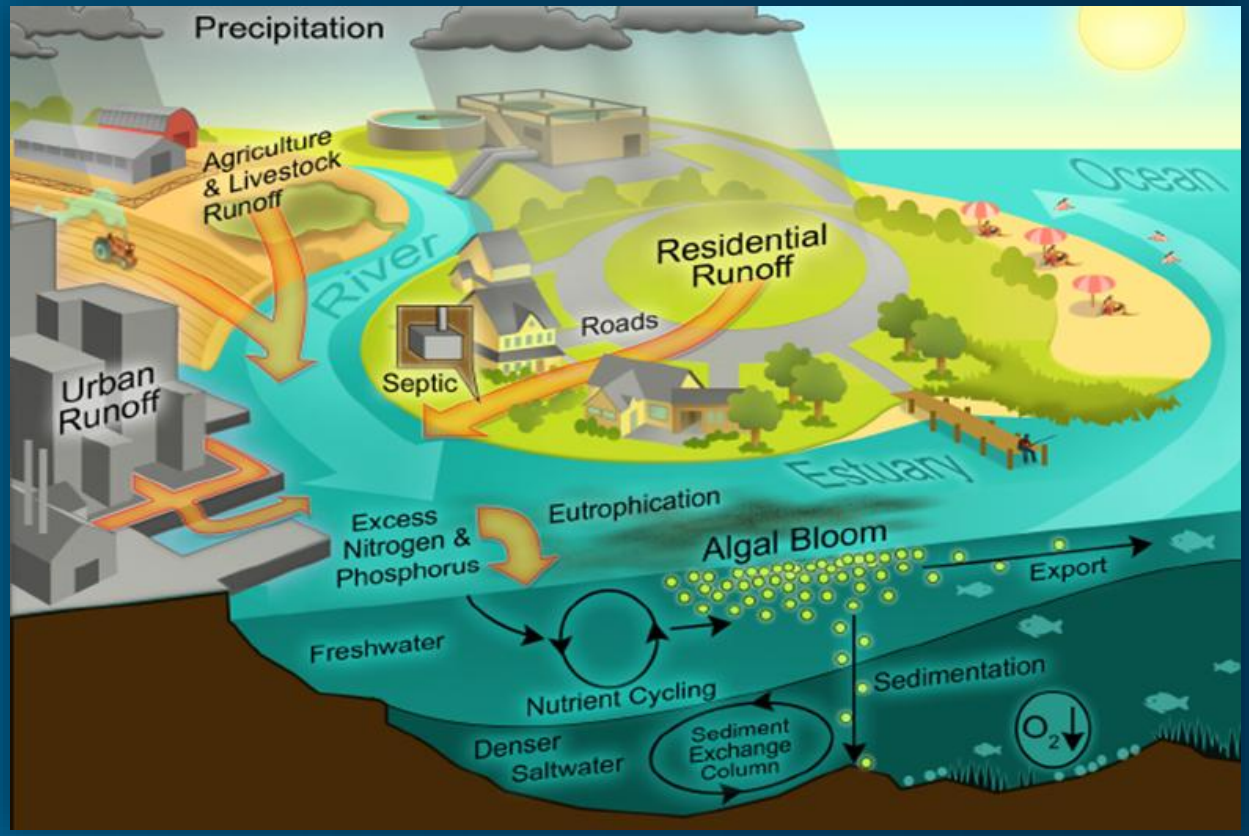
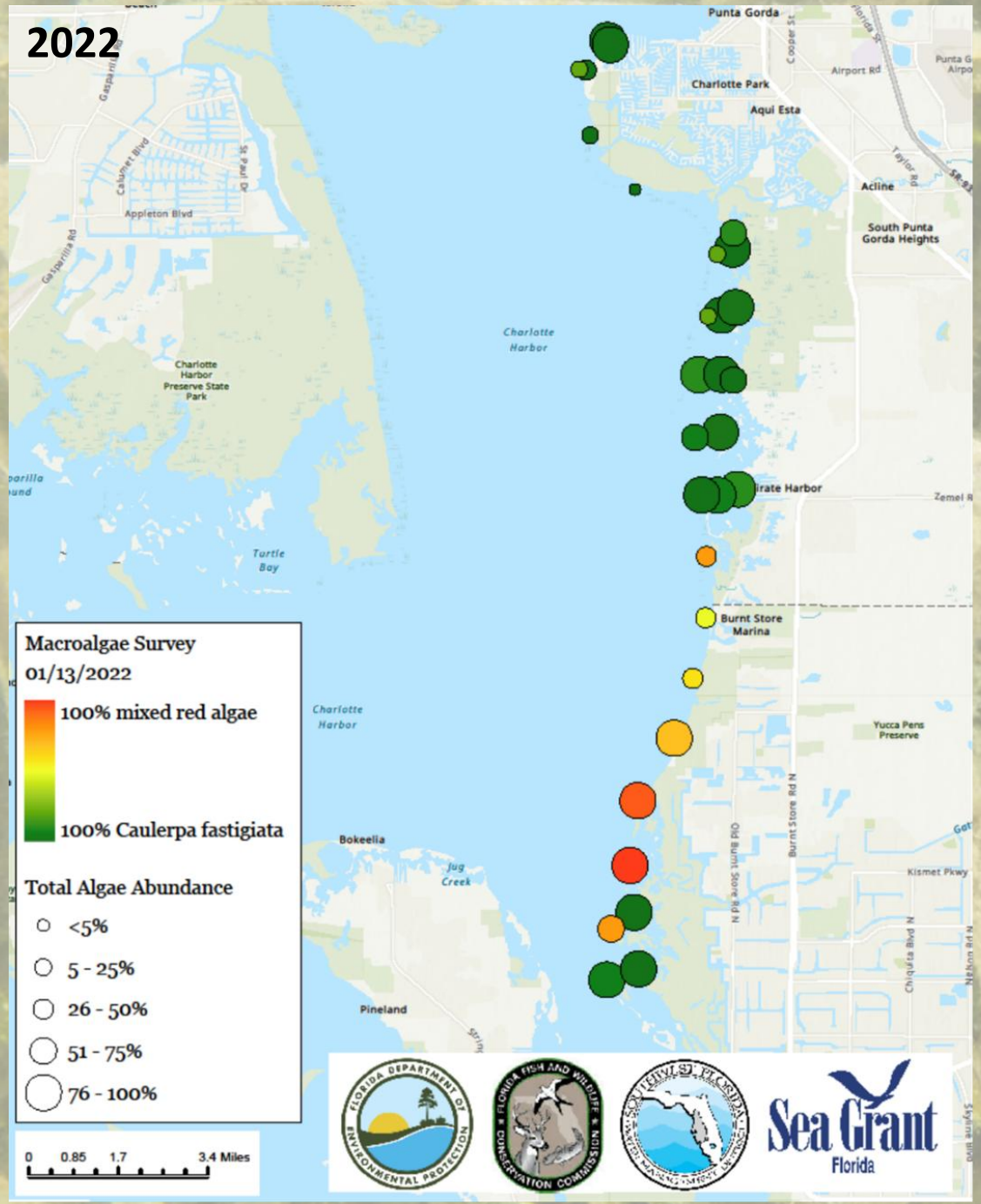





Image: http://lepo.it.da.ut.ee/~olli/eutr/paerl

**2022**




Macroalgae Survey

01/04/2024

100% mixed red algae

100% filamentous green algae

Total Algae Abundance

<5%

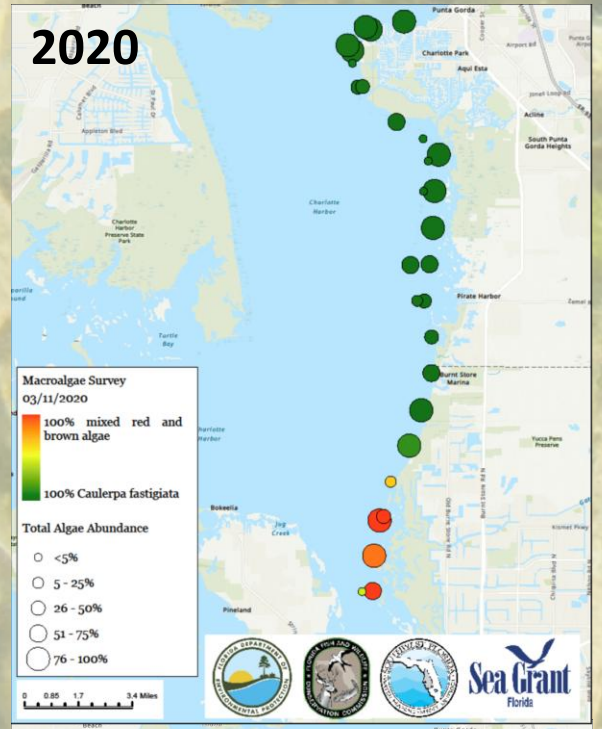
5 - 25%

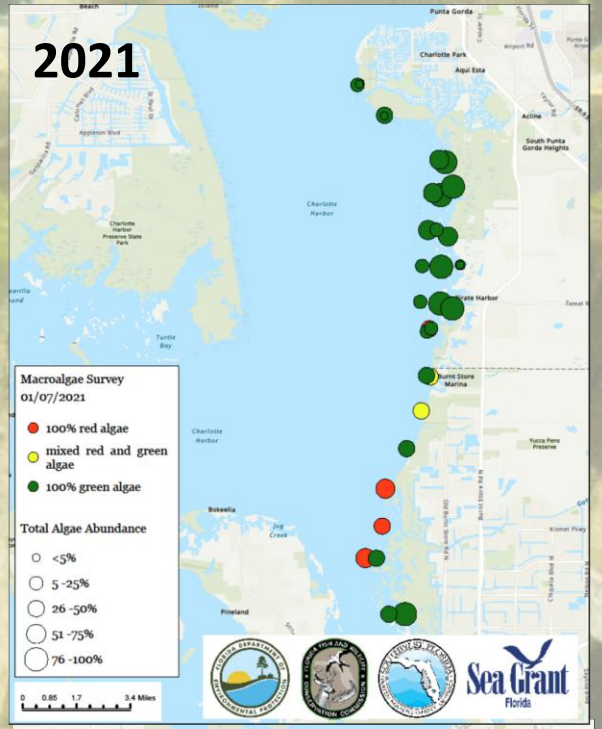
26 - 50%

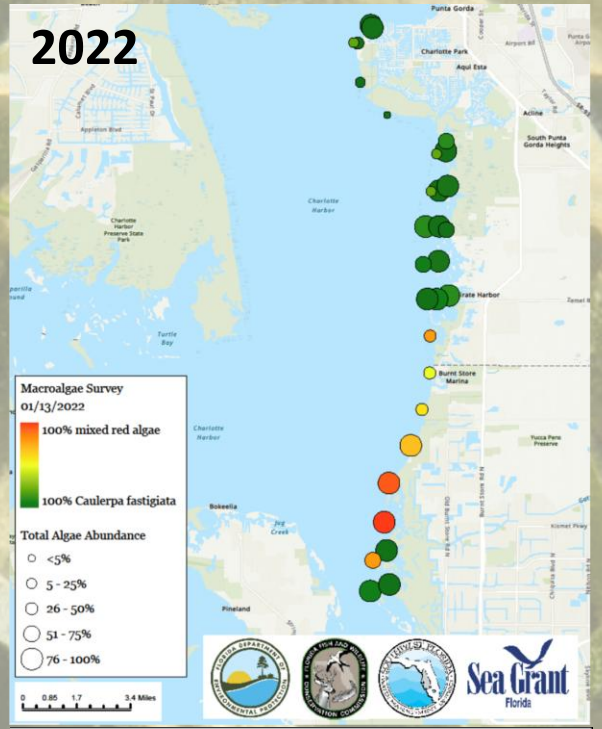
51 - 75%

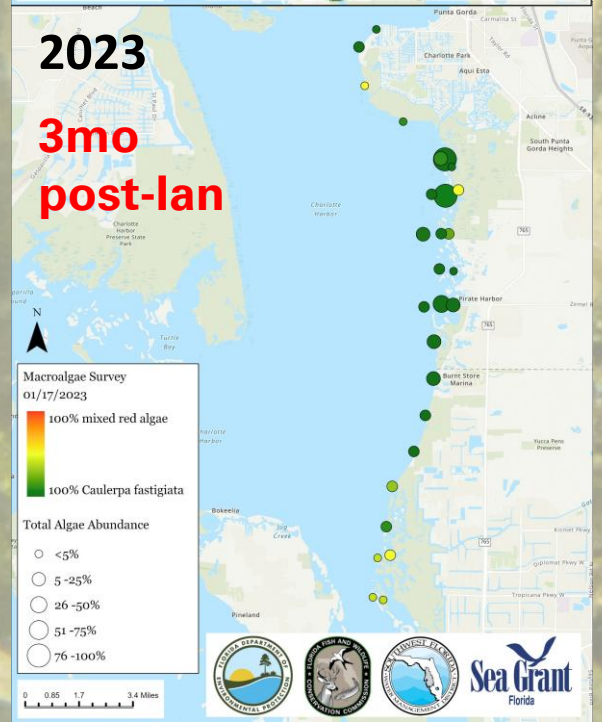
76 - 100%

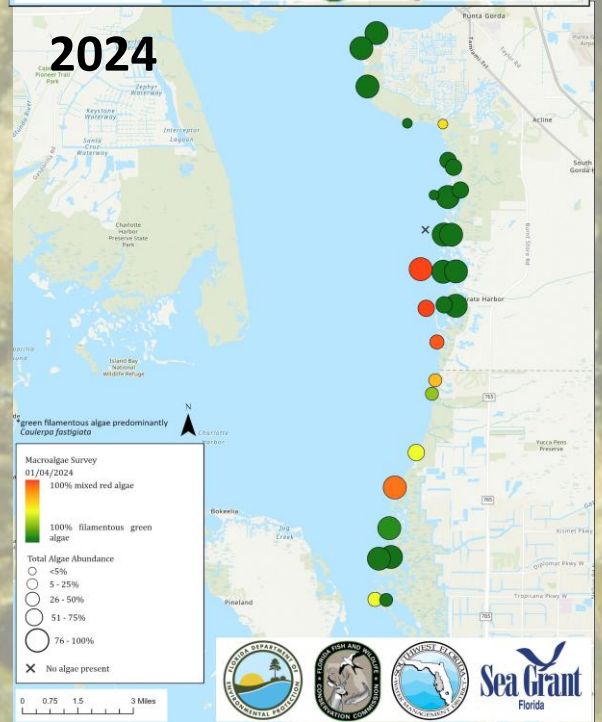
No algae present

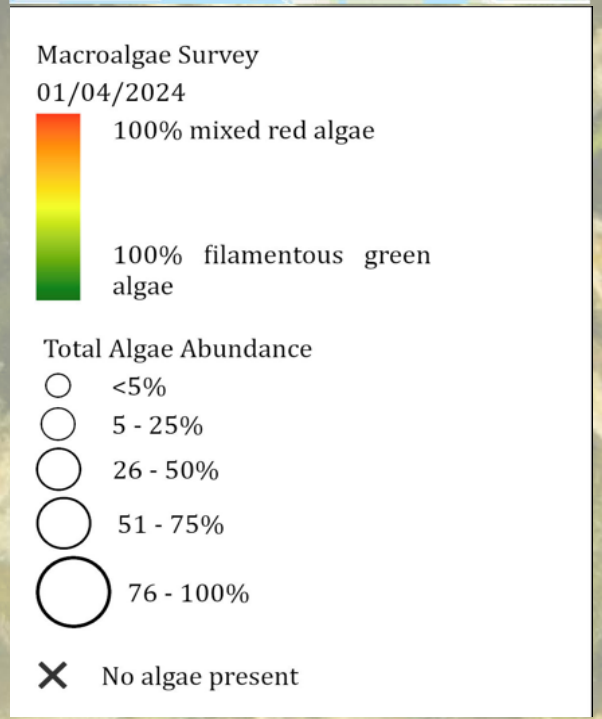
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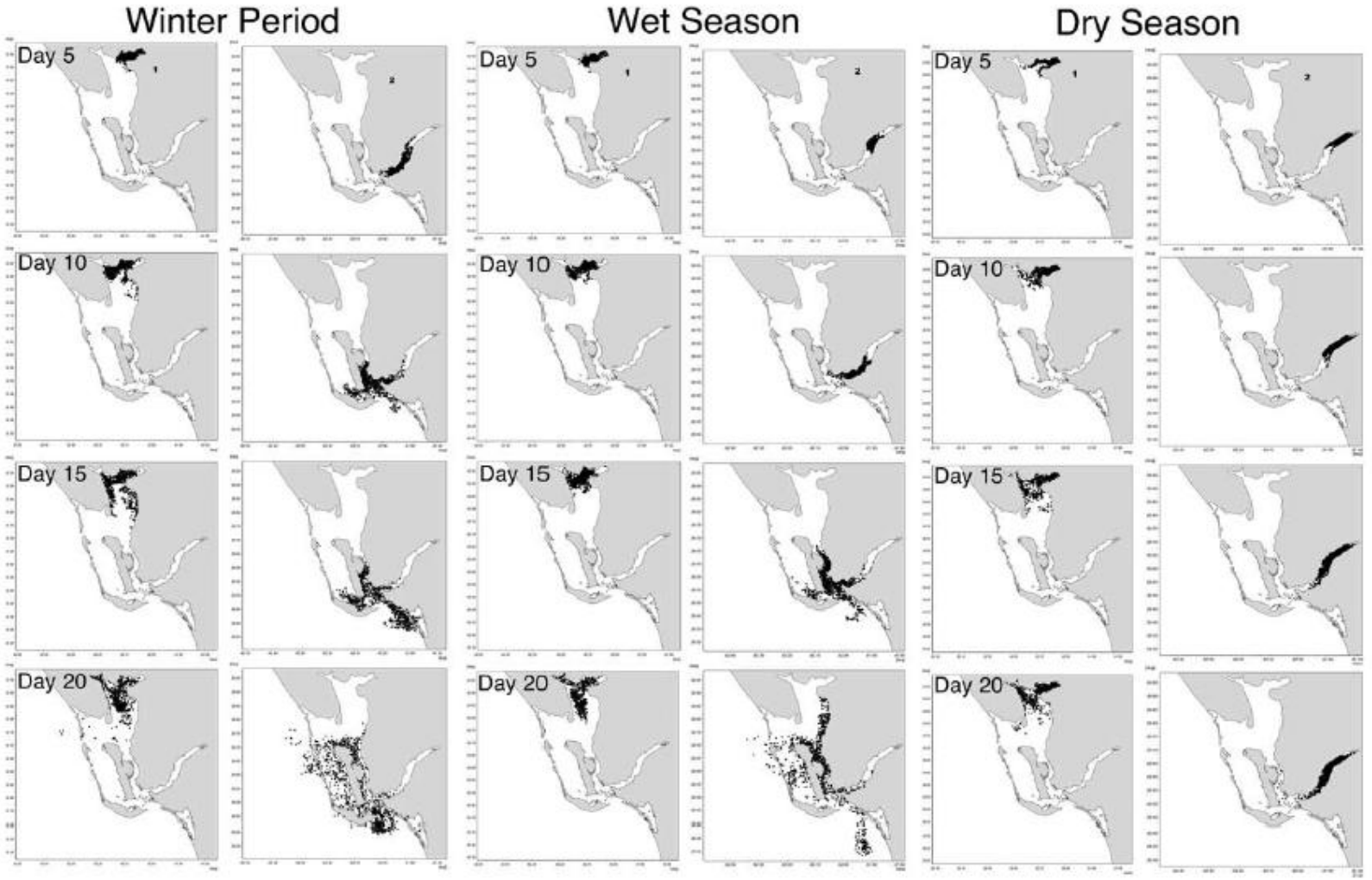



Figure 9. Spatiotemporal distribution of neutrally buoyant particles released into the estuarine system from Peace River and Caloosahatchee River for the three seasons representing three contrasting hydrologic conditions. Panels on the left represent Peace River simulations; panels on the right represent Caloosahatchee River simulations.

**Bass Dye, Felix Jose, and Mohammad Nabi Allahdadi "Circulation Dynamics and Seasonal Variability for the Charlotte Harbor Estuary, Southwest Florida Coast," *Journal of Coastal Research* 36(2), 276-288, (2 December 2019).**

# WHAT CAN YOU DO?

Reflect: Are you doing everything you can to reduce your nutrient contribution?

- Do you utilize Florida Friendly Landscaping principles in your yard?
- Are you properly maintaining your septic/sewer system?

Get Involved!

- Participate in Eyes on Seagrass

# Eyes on Seagrass

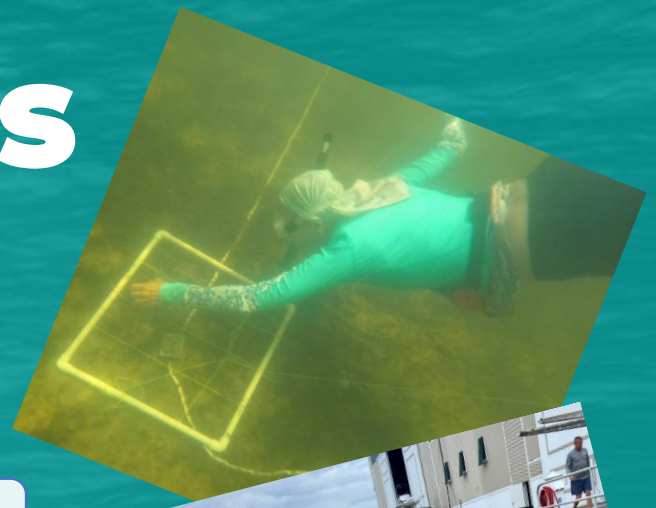
## *Citizen Science*

EYES ON SEAGRASS

Eyes on Seagrass

Eyes on Seagrass

FDEP/CHAP



45 sites for 5 years in Charlotte County

- Close to in 150 sites in 9 counties statewide

Volunteer time and resources < $78,000 annually

- Skilled volunteer value = $31.61/hr (Florida Independent Sector)

EYES ON SEAGRASS

# Eyes on Seagrass

***Citizen Science***

Creating Environmental Stewards

- 91% of 2023 volunteers made at least one change to improve conditions for Seagrass

Scientific Impact

- Data presented at local, national & international meetings
- Working with Seagrass Biologists to create database


# CONSERVATION VS RESTORATION

Restoration is not effective

- Less than 30% of all seagrass restoration efforts succeed

Seagrass is resilient

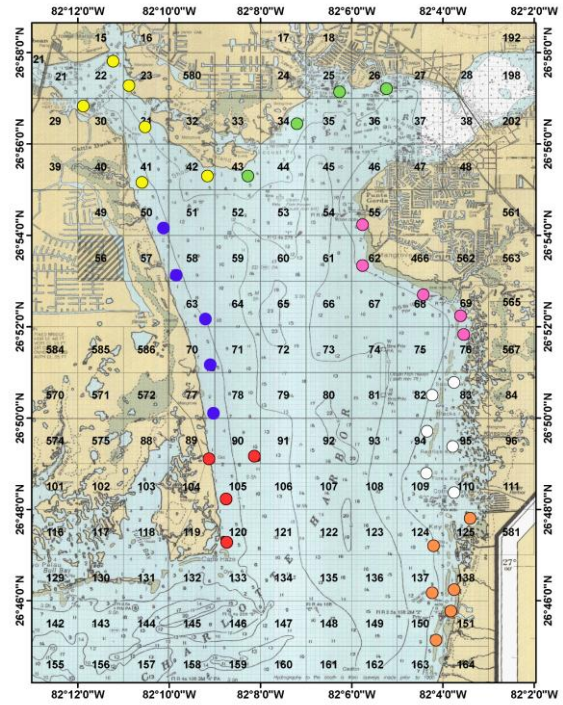
- If we improve conditions, seagrass will likely return

Failed restoration may increase nutrient levels

# Charlotte Harbor Sea Grass Cover

*(Preliminary Results)*

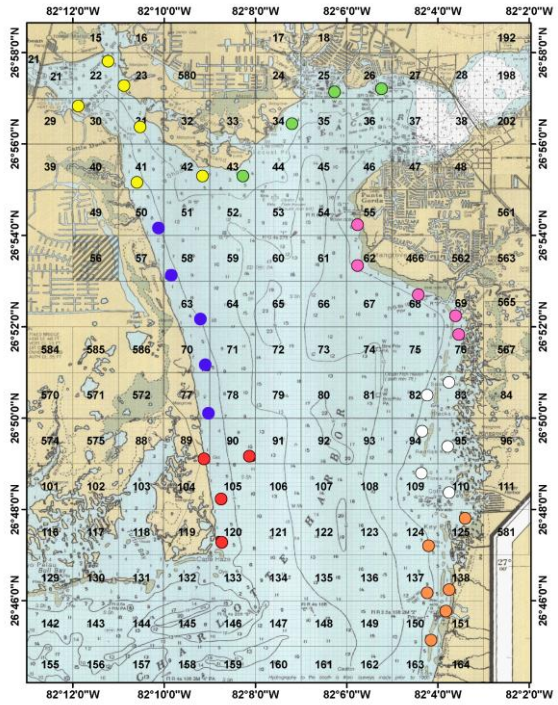
EYES ON SEAGRASS



# Charlotte Harbor Algae Cover

*(Preliminary Results)*

EYES ON SEAGRASS



# Eyes on Seagrass Procedure

EYES ON SEAGRASS

- ✓ Depth
- ✓ Sediment
- ✓ Algae Thickness
- ✓ Seagrass thickness
- ✓ Seagrass species
- ✓ Blade height
- ✓ Epibiota

0 m

- ✓ Depth
- ✓ Sediment
- ✓ Algae Thickness
- ✓ Seagrass thickness
- ✓ Seagrass species
- ✓ Blade height
- ✓ Epibiota

10 m

+ Collect Algae

20 m

- ✓ Depth
- ✓ Sediment
- ✓ Algae Thickness
- ✓ Seagrass thickness
- ✓ Seagrass species
- ✓ Blade height
- ✓ Epibiota

30 m

- ✓ Depth
- ✓ Sediment
- ✓ Algae Thickness
- ✓ Seagrass thickness
- ✓ Seagrass species
- ✓ Blade height
- ✓ Epibiota

40 m

- ✓ Depth
- ✓ Sediment
- ✓ Algae Thickness
- ✓ Seagrass thickness
- ✓ Seagrass species
- ✓ Blade height
- ✓ Epibiota

50 m

# BREAK


## Kate Rose
## Florida Sea Grant
## *Charlotte County*

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EYES ON SEAGRASS

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**Spring Sampling**
***APRIL 14TH-APRIL 30TH***

**Summer Sampling**
***JULY 14TH-JULY 31ST***

FLORIDA HORSESHOE CRAB WATCH

Linked with Limulus

# Charlotte Harbor Ambassador Training

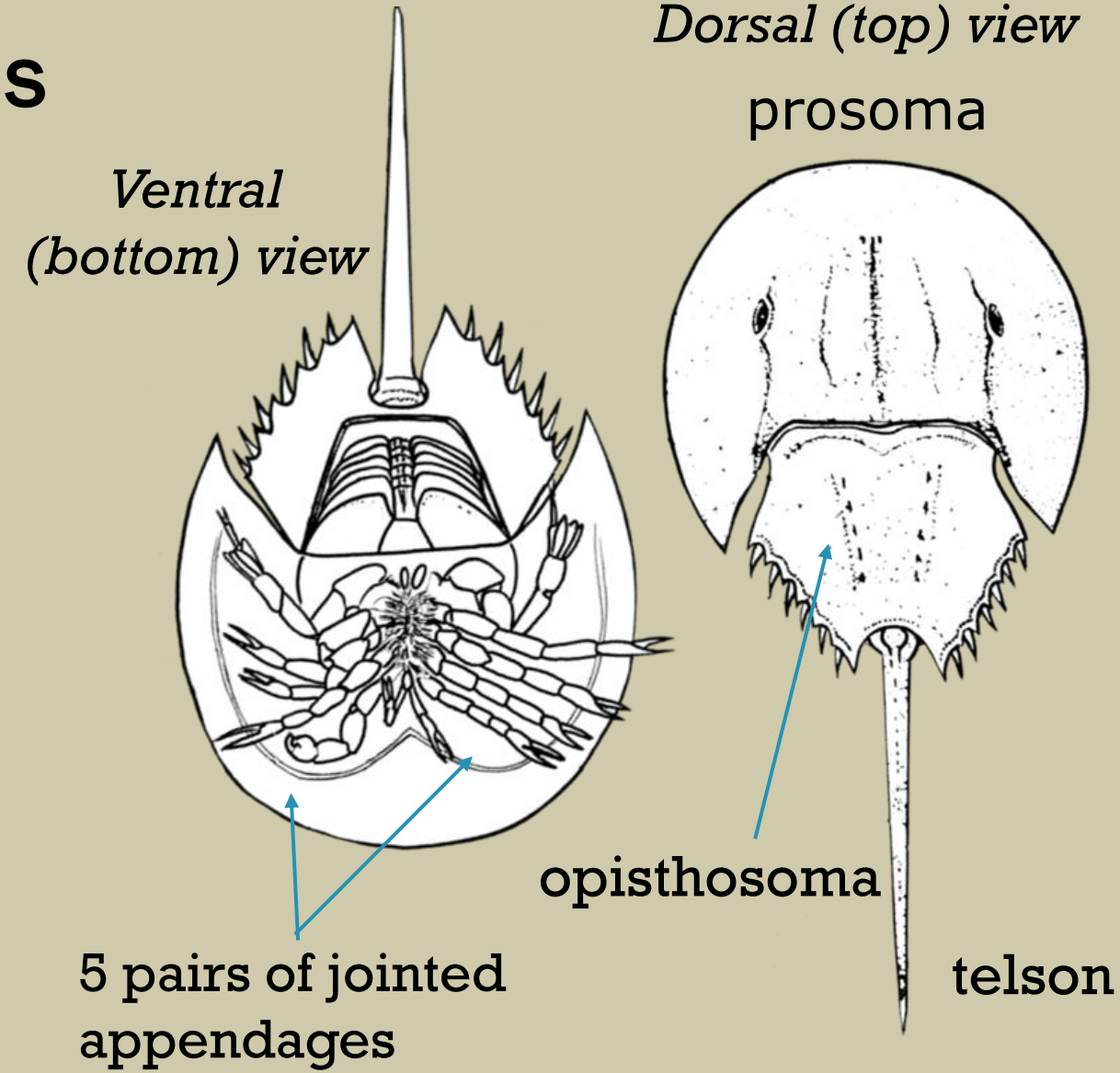
*February 5th, 2025*

# Horseshoe crabs are Arthropods

- Exoskeleton made of chitin
- Jointed appendages
- ***But they are not crustaceans or "crabs"***
  - *More closely related to spiders, ticks & scorprions*

**Aren't they really ancient?**

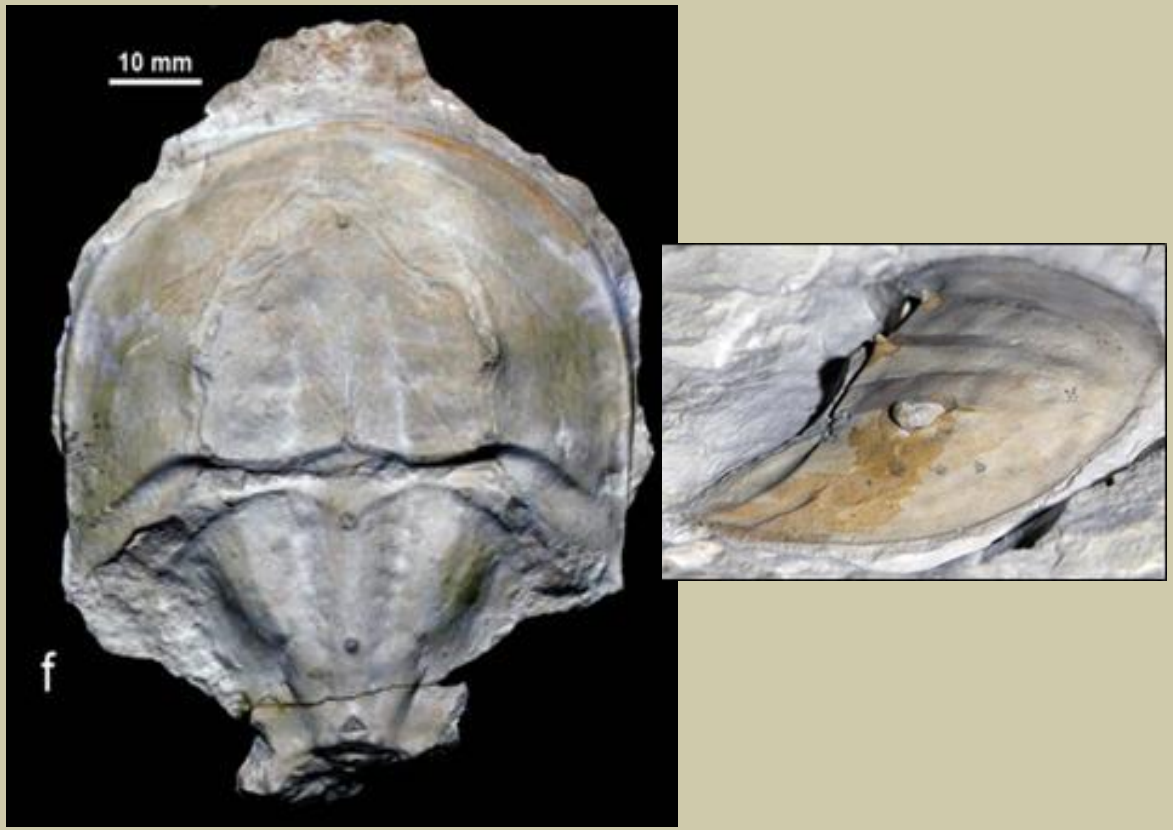
- Lineage arose in the Paleozoic, way before dinosaurs
- Horseshoe crabs have survived many mass extinctions!



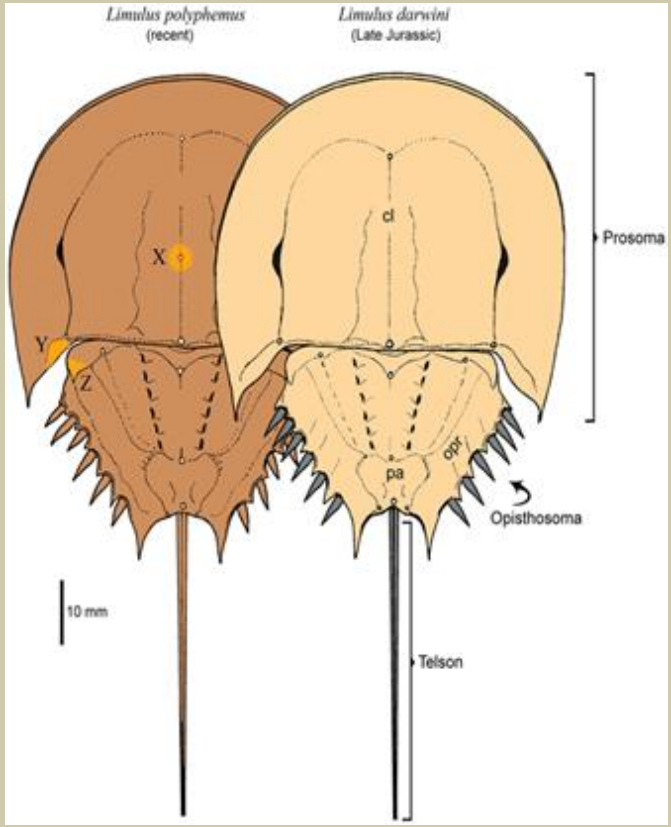
# HSCs are “Living fossils”

## Very little external change in 200 million years

Oldest fossils
Paleozoic 445 myr



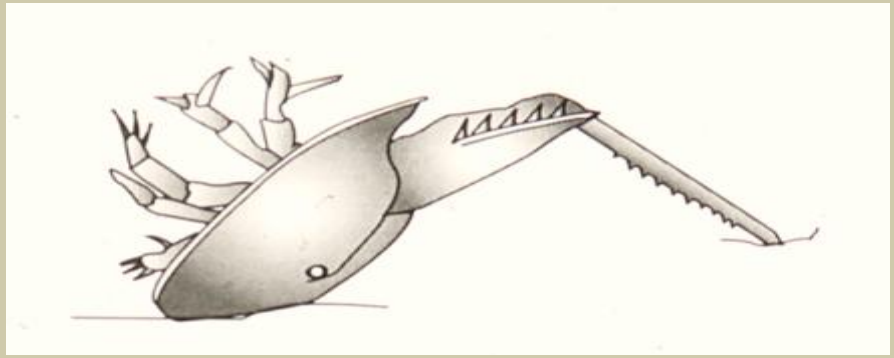

*Limulus darwini*, Jurassic 150 myr




Comparison of
*L. polyphemus* and *L. darwini*

# Are they dangerous? No!

Crabs use their tails to right themselves when overturned






**Never handle a crab by its tail!**

# Horseshoe Crab Management: Multiple Stakeholders




- Federal Fisheries Management Plan regulates the horseshoe crabs in Atlantic states
- Established maximum number for bait harvest (state limit)
- Since 2001, bait harvest stabilized, around 1 million/yr harvested
- Biomedical harvest has increased (But not in Florida)
- In Florida, the aquarium trade is a significant additional use

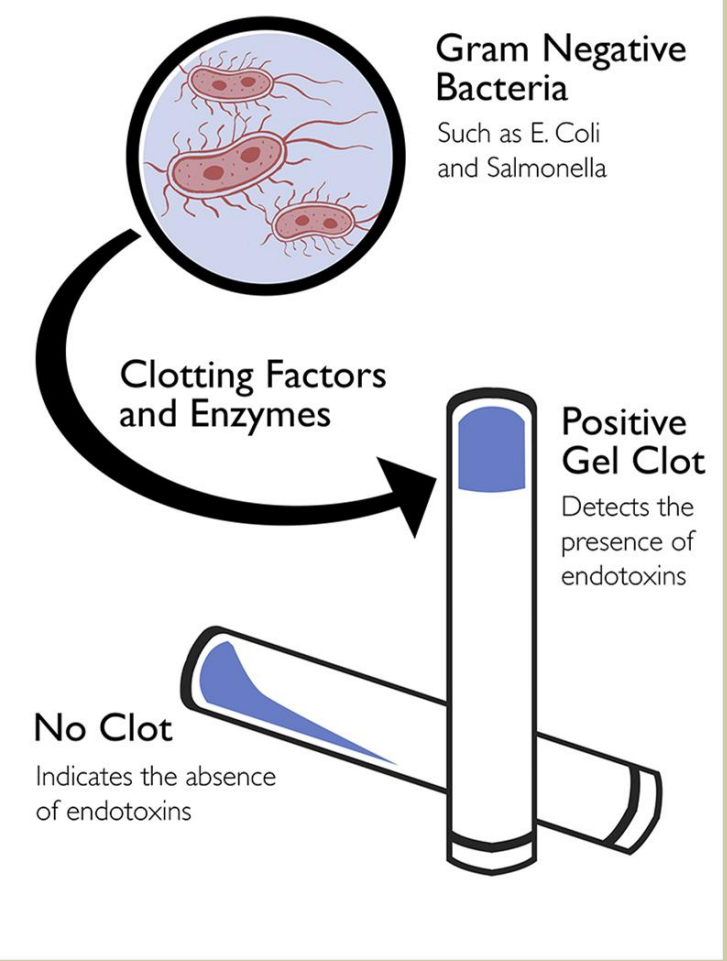
# Economic Importance: Blood


- Horseshoe crabs are wild-collected
- Transported to the lab
- Scraped clean

- Heart punctured
- ⅓-½ of blood removed
- Returned alive

- Blood cells (amebocytes) removed, broken open (lysed)
- Bottled: *Limulus* amebocyte lysate or “LAL”

# What is the LAL Test for?





- Indicates presence of bacteria that cause infections and disease
- LAL Test is extremely sensitive
- LAL is the standard for testing *all* injectables (since 1987)
- Used in pharmaceuticals, implantable devices, also in space and computers
- 5 US companies: MA, NJ, MD, VA, SC
- Billion dollar industry $$$

**Everyone benefits from *Limulus!***

# A feeding bonanza for shorebirds!

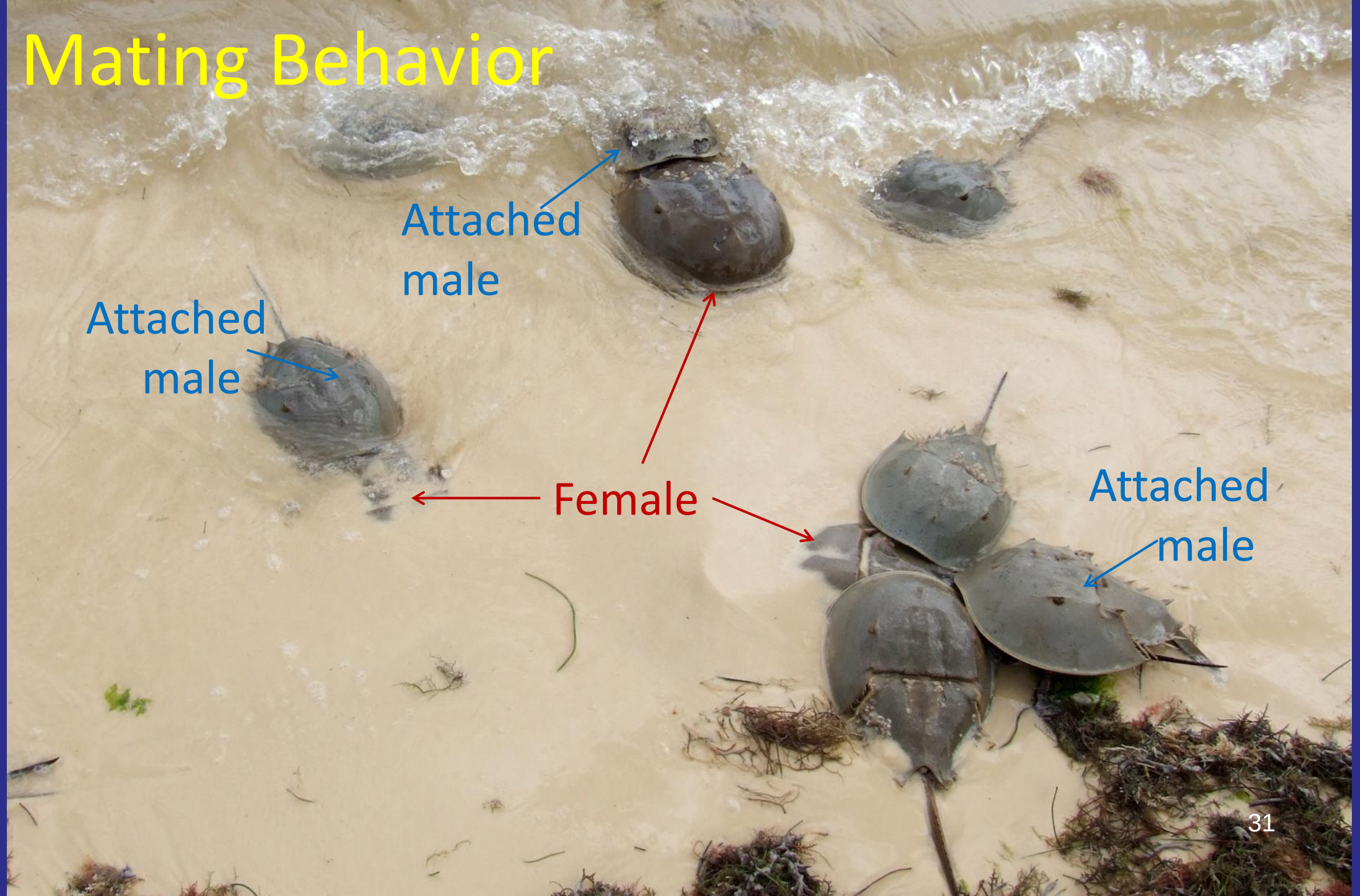

The threatened Red Knot depends on HSC eggs during their 10,000 mile migration to breeding grounds in the high arctic. They double their weight in 2 weeks in DE Bay feeding on horseshoe crab eggs.

# Spawning: Synchronized, high intertidal

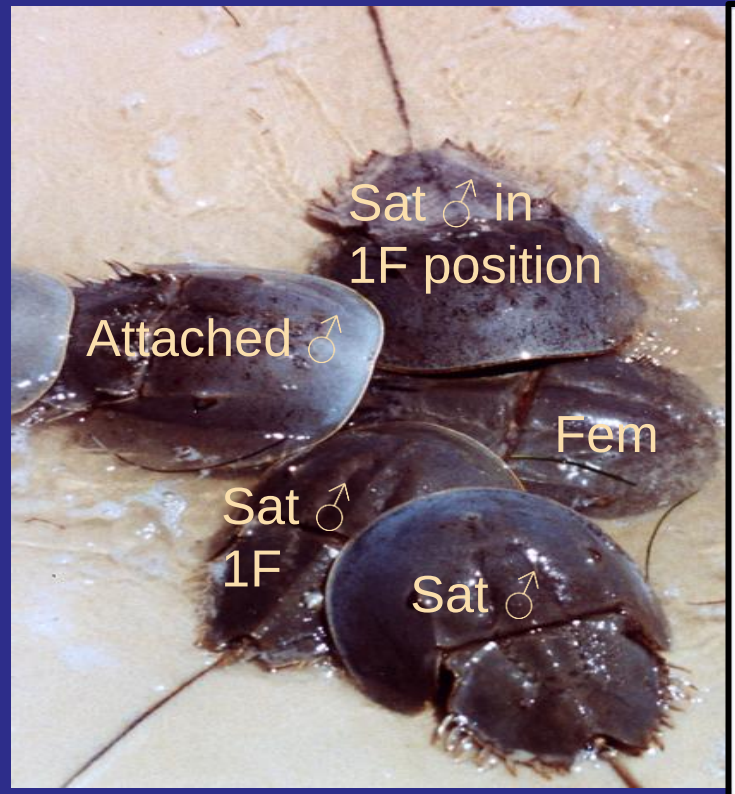


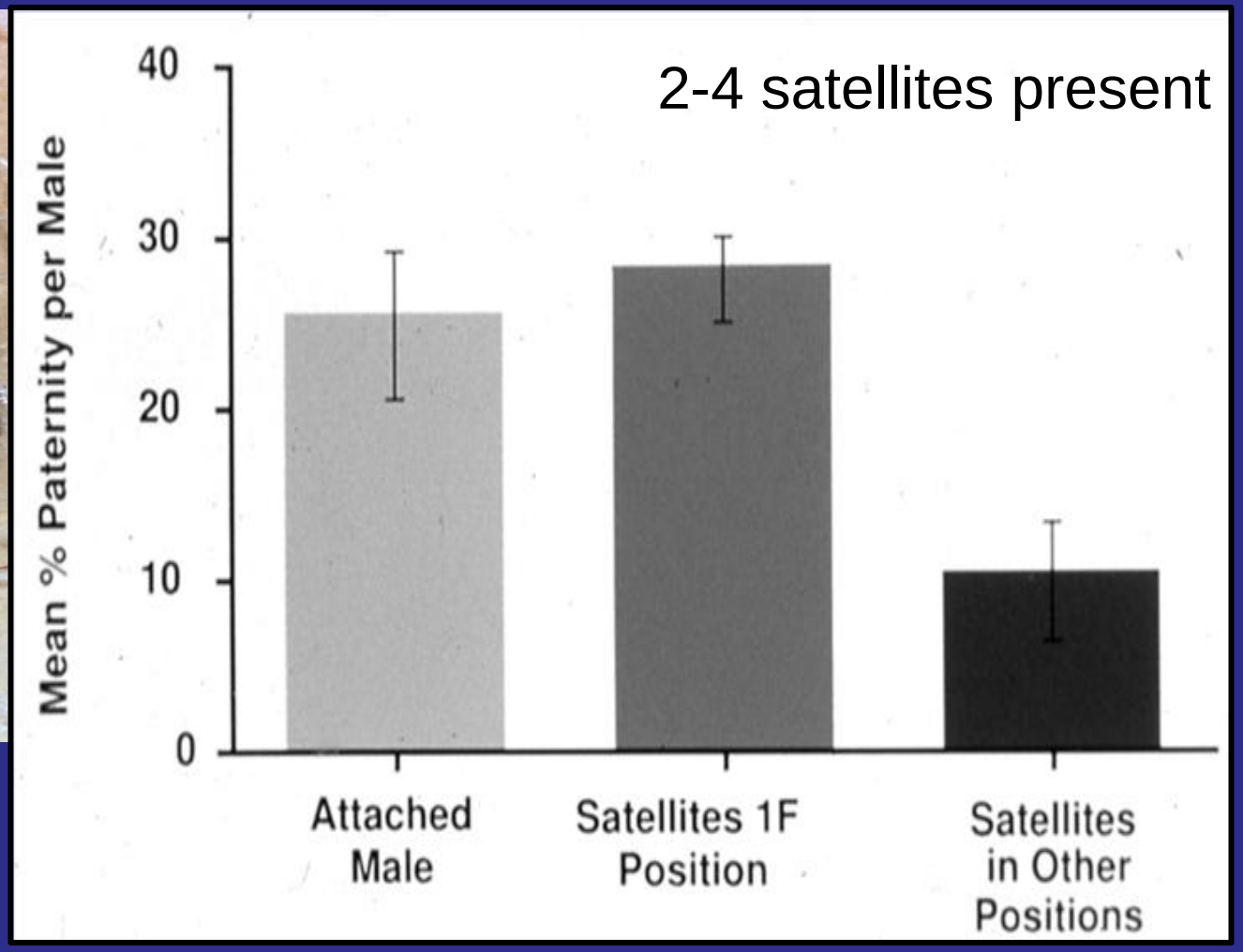
- Mate and nest on high tides associated with the new and full moons, the highest tides of the month.
- Spawn at the top of the high tide line

# Mating Behavior



# Satellite males fertilize eggs




Brockmann et al. 1994, 2000

# Threats


Development


Shoreline Armoring - Seawalls and Rip rap


Aquarium trade


Beach driving


Sea-level rise


Shoreline erosion

# Population Status

| Region | Population Trend | |
|---|---|---|
| **New England** | ↓ | Evidence of significant declines |
| **New York** | ↓ | Evidence of significant declines |
| **Delaware Bay** | ↑ | Evidence of significant increase in juveniles & adult males |
| **Southeast** | ↔ | No evidence of declines; increases possible |
| **Florida** | ? | Hint of declines on east coast; west coast not known |

FLORIDA HORSESHOE CRAB WATCH
Linked with Limulus

UF UNIVERSITY of FLORIDA
UF IFAS UNIVERSITY of FLORIDA NATURE COAST
Sea Grant Florida
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

# Enter: Citizen Scientists!!


In 2015, FWC, in conjunction with UF Biology and UF/IFAS Florida Sea Grant, created Florida Horseshoe Crab Watch to monitor HSC populations.

FLORIDA HORSESHOE CRAB WATCH
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# What Questions can Citizen Science Data Answer?

SHORT-TERM DATA

- Beach fidelity/movement
- Sex ratio (# males vs. females)
- Size differences in males and females
- Average age - using shell condition to hint at population status

# What Questions can Citizen Science Data Answer?

LONG-TERM DATA:

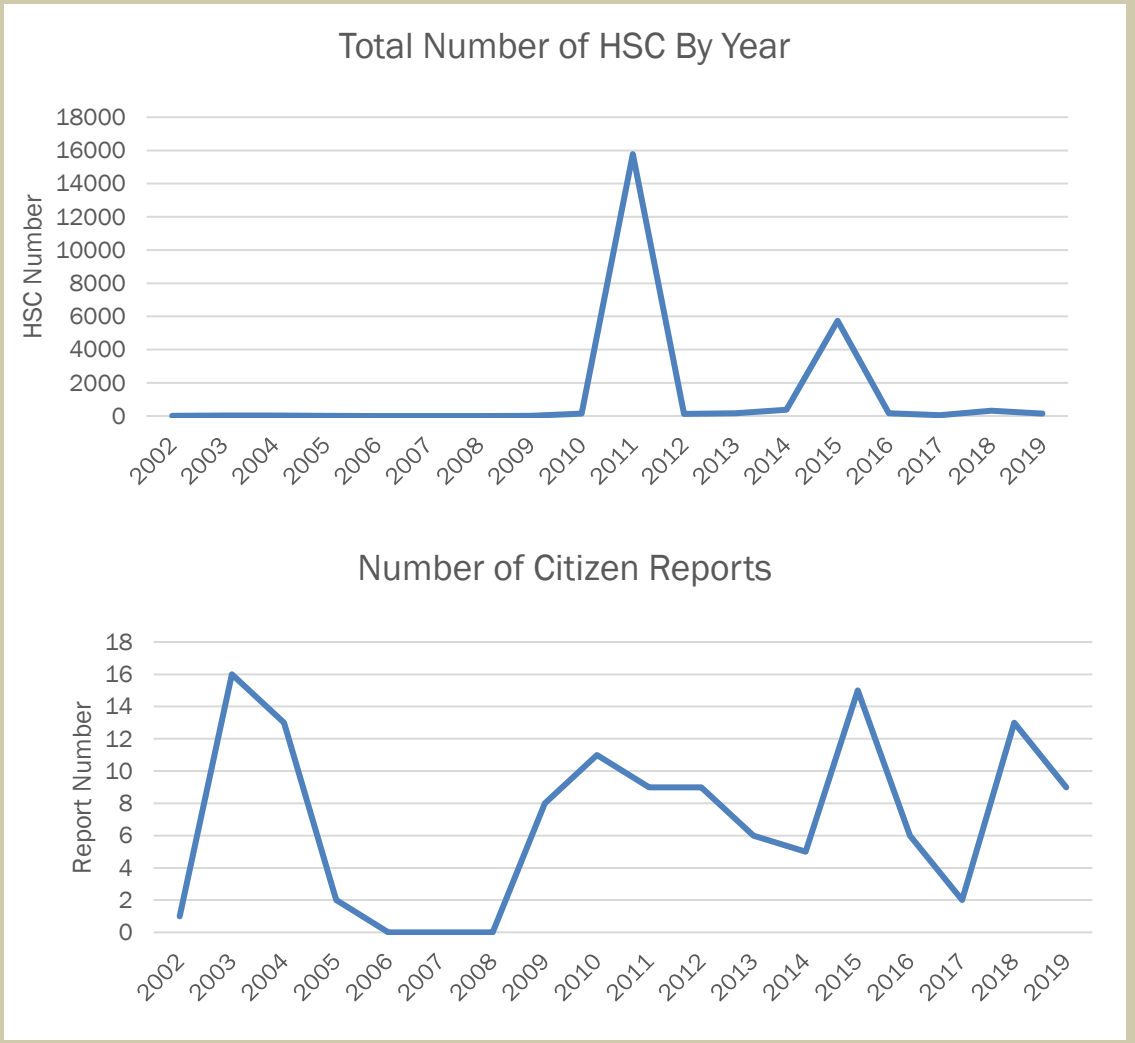
- What are the spawning population trends?
- Are horseshoe crab numbers increasing, decreasing or stable within Florida populations?
- Does the mating status of female and male horseshoe crabs change over time?
- What are the environmental conditions that stimulate breeding?

# What do we know about Charlotte County?

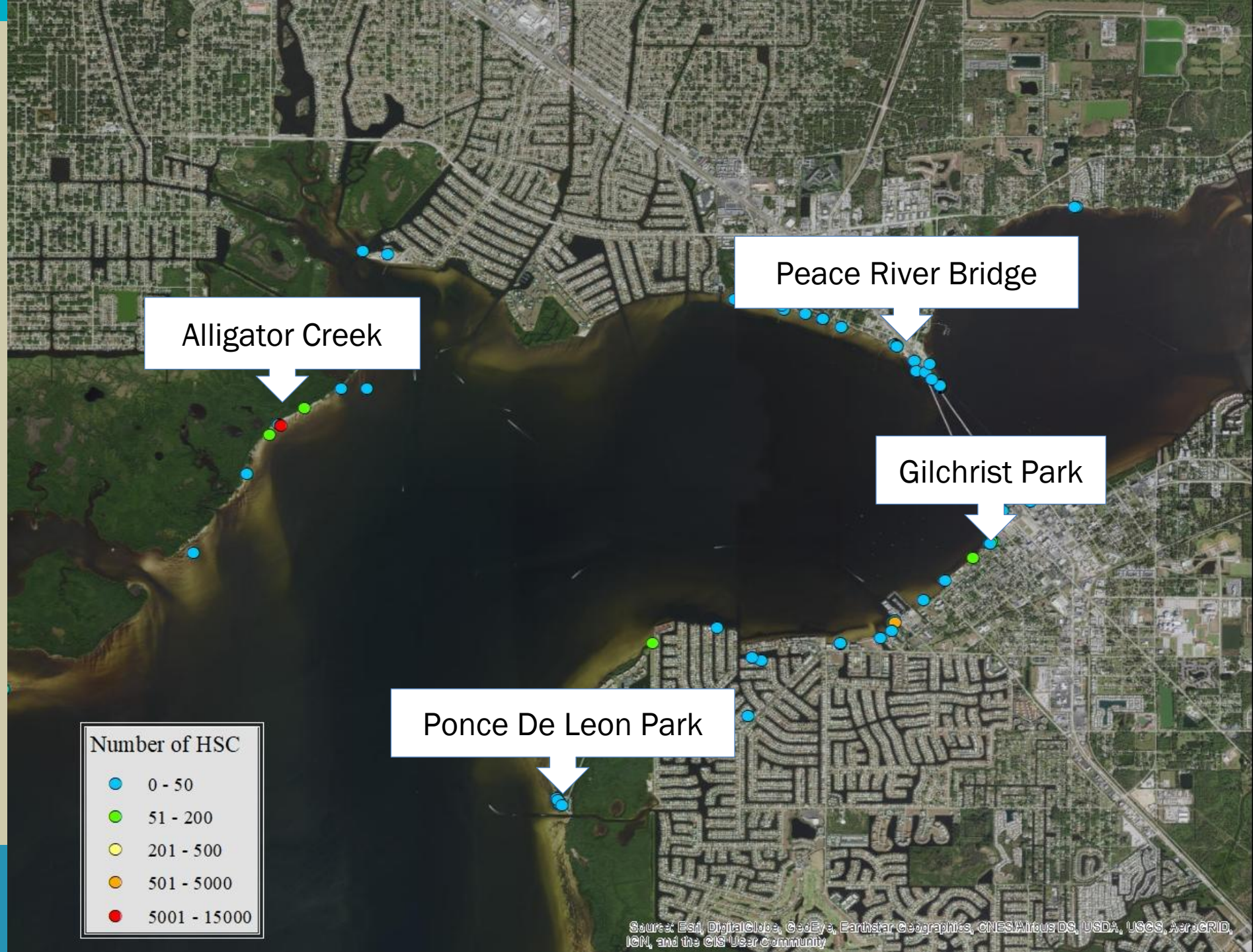
- Phone, email, survey monkey, and FWC Reporter App
- 126 reports in Charlotte county since 2002
- Brevard county has had 582, Sarasota has had 69

| Most Common Terms | Count |
|---|---|
| Punta Gorda | 11 |
| Ponce De Leon Park | 4 |
| Gilchrist Park | 4 |
| Charlotte Harbor Bayshore | 3 |
| Peace River Bridge | 3 |
| Alligator Creek | 2 |
| Waterfront Hotel | 2 |
| Cattle Dock Point | 2 |

# What do we know about Charlotte County?



# Charlotte Harbor Sightings




FLORIDA HORSESHOE CRAB WATCH

Linked with Limulus

# Where have the horseshoe crabs gone?

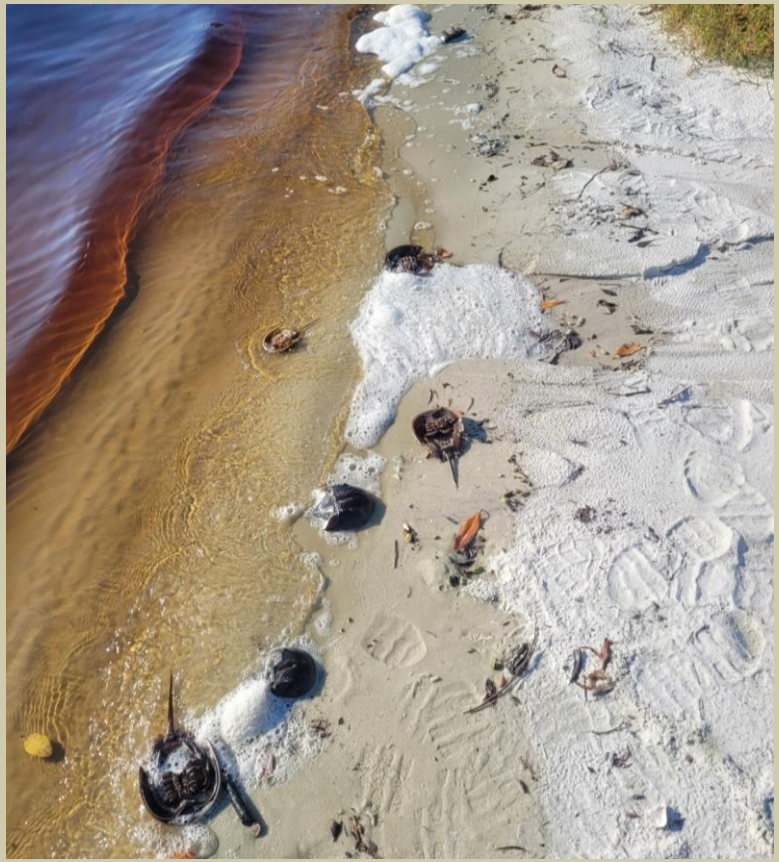
Volunteers needed for a population survey

*September 12, 2024*

FLORIDA WEEKLY
CHARLOTTE COUNTY EDITION

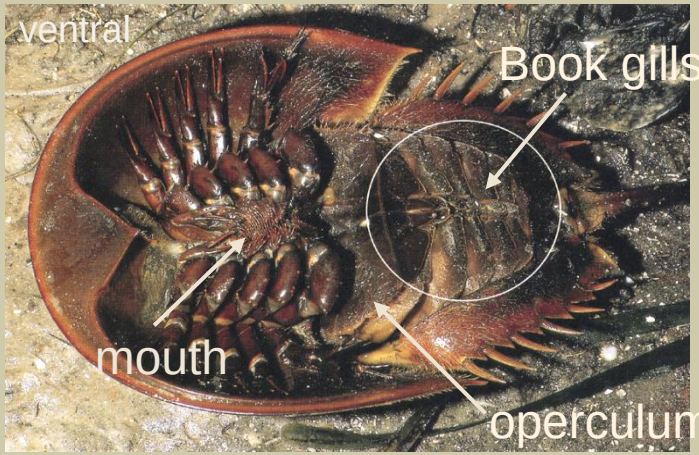
**Dead horseshoe crabs at Bayshore Live Oak Park, Port Charlotte**

*Dave Schutz*



## Possible Die Off Drivers

- Low oxygen conditions
  - Unlikely but water waters, summer algae blooms, rain, lined up with a mating event may be the perfect storm
- Red Tide
- Large tidal variation



# A few key findings from other sites

- Male horseshoe crabs are resighted more often than females
- Horseshoe crabs are usually resighted 8-10% of the time
- Horseshoe crabs usually stay in the same area, but some have been found 50 miles from their original tag site.
- Citizen scientists are vital for collecting resighting data, but the public also have an important role

## Attention Beachgoers:

Help us collect data on nesting horseshoe crabs by reporting tagged animals


If you see a tagged crab (like the ones in the photo on the left):
1) Snap a picture of the tag or record the tag # (number is on the bottom of the tag, shown in the photo on the right).
2) Note the date, location, and general condition of the crab (alive or dead)
3) Report data using the online form at (www.fws.gov/crabtag/) or by calling 1-888-546-8587 (1-888-LIMULUS).

**IMPORTANT:**
-DO NOT remove the tag. When recording the tag #, try to limit disturbance to the crab (try not to pick it up and if you must pick it up, NEVER pick it up by the tail).

Data goes into a national database maintained by the US Fish and Wildlife Service and contributes to knowledge about horseshoe crab movements and population numbers.

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FLORIDA HORSESHOE CRAB WATCH
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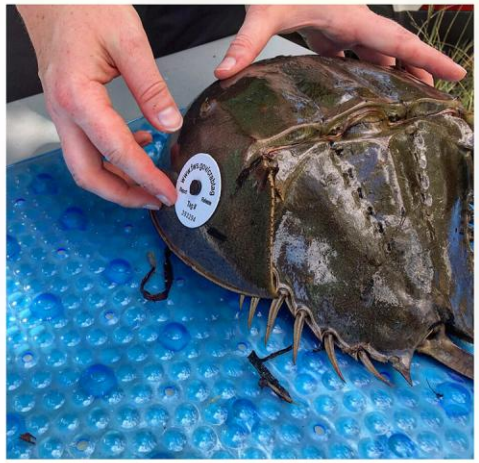
# Other data uses

- Stock assessments
- Genetic studies
- Behavioral, nesting, and biological indicators or thresholds
- Habitat requirements and actions pertaining to habitat restoration initiatives


# Florida Horseshoe Crab Watch



- Beach nesting surveys at **Ponce de Leon Park** at full moons in Spring & Fall
  - In person training in summer
- Collect information on sex, size, age
  - Tag for mark recapture study

FLORIDA HORSESHOE CRAB WATCH
Linked with Limulus

UF UNIVERSITY of FLORIDA
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NATURE COAST
Sea Grant Florida
FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

# STATIONS

EYES ON SEAGRASS

FLORIDA HORSESHOE CRAB WATCH

Linked with Limulus

1. **REEL**
   - UNSPOOL & RESPOOL PARACORD TRANSECT
2. **SEAGRASS ID**
   - IDENTIFY THE THREE MOST COMMON SPECIES
3. **PERCENT COVER**
   - ESTIMATE PERCENT COVER OF SEAGRASSES
4. **SEXING/AGING**
   - DETERMINE THE SEX & AGE OF EACH HORSESHOE CRAB
5. **TAGGING**
   - APPLY A TAG TO THE CARDBOARD HORSESHOE CRABS
6. **SURVEY**
   - COMPLETE EVALUATION