

# Red Tide and Some Research to Keep us Afloat

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**NCCOS** | NATIONAL CENTERS FOR  
COASTAL OCEAN SCIENCE

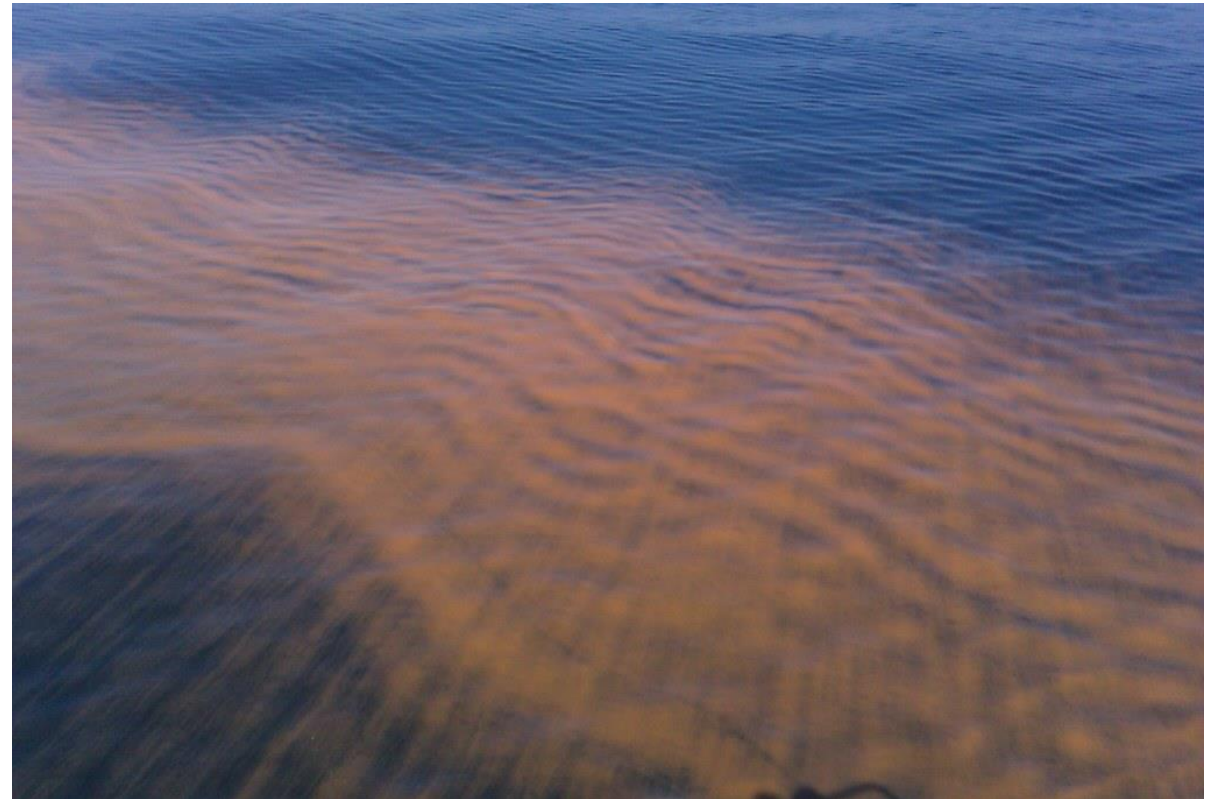
Photo taken Oct 03, 2018

## “Red water” is not all bad

*Noctiluca* (noticeable  
bioluminescence)

Kayaking tours

Also *Ceratium*, others.



*Noctiluca scintillans* Bloom,  
Offshore Walton County, February  
19, 2011, FWC Flickr

# *Karenia brevis* red tide, 2018

Casey Key, Florida, Before (June 2018) and During (August 2018)  
Red Tide

(video courtesy of Cody Johnson, @codesthedrones)



<https://coastalscience.noaa.gov/news/ncco>

s-research-and-support-in-response-to-red-tide/



# Why do we need some action on Karenia red tide?



Health » Florida's toxic algae problem and your health: 'Red tide' and 'green slime'

## Story highlights

Algae produce toxins that can cause a host of symptoms in humans at high concentrations

These toxins may be inhaled or ingested in contaminated water and seafood

"brought on by the red tide," she said.

**(CNN)** — When Marcy Cornell's toddler son "couldn't breathe" on the first day of their recent Florida vacation, she took him straight to the emergency room.

"Before they even asked me anything else ... they said, 'Did you go to the beach today?' " she recalled.

Doctors said her son had upper airway inflammation

Florida's toxic algae problem and your health: 'Red tide' and 'green slime'

By Michael Nedelman, CNN  
Updated 2:00 PM ET, Sat August 18, 2018

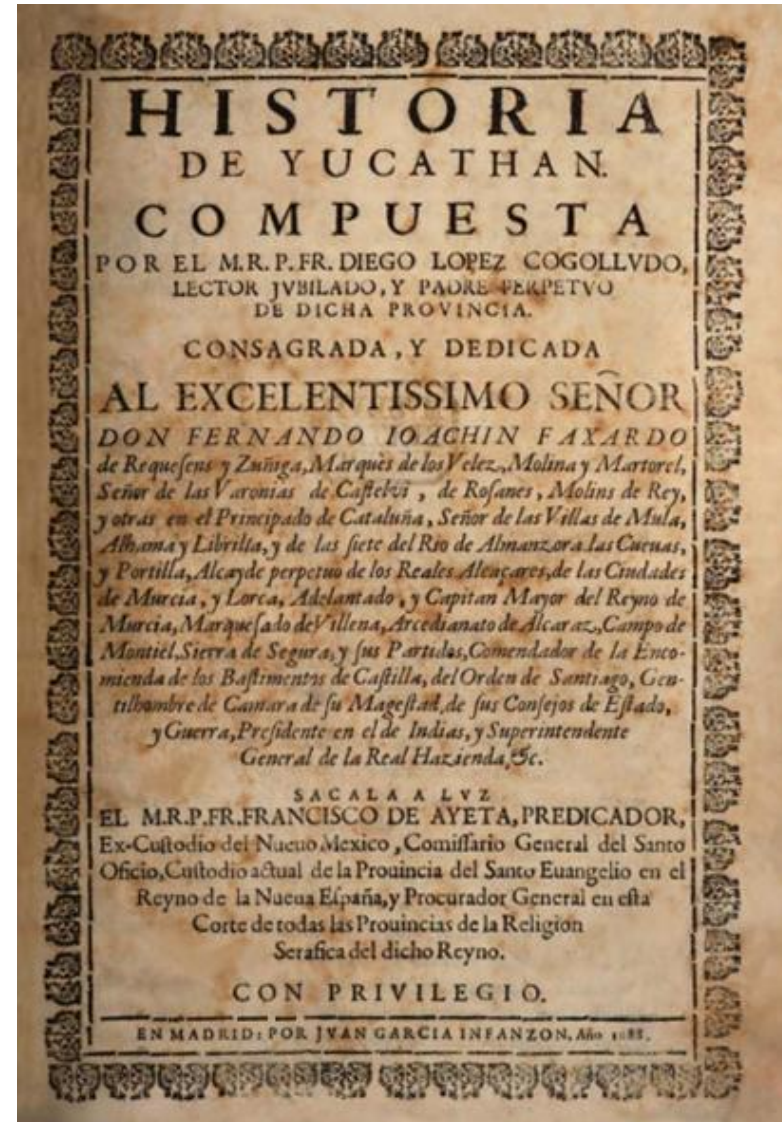




# Karenia brevis has been around for a while

Fray Diego Lopez de Cogolludo (1648)

A short time later, in the city of Merida, for several days, especially in the evenings when the wind blows from the sea, came a foul odor that at times could barely be tolerated, as it penetrated all parts. No one knew the cause of the odor until a ship from Spain encountered a mountain of dead fish near the coast. Dead fish were heaped on shore, and this is where the foul odor emanated.



## In Florida back to 1840s

Anita Feinstein, 1956.  
Correlations of Various  
Phenomena with Red  
Tide Outbreaks on the  
Florida West Coast.  
*Bull Mar Sci.*

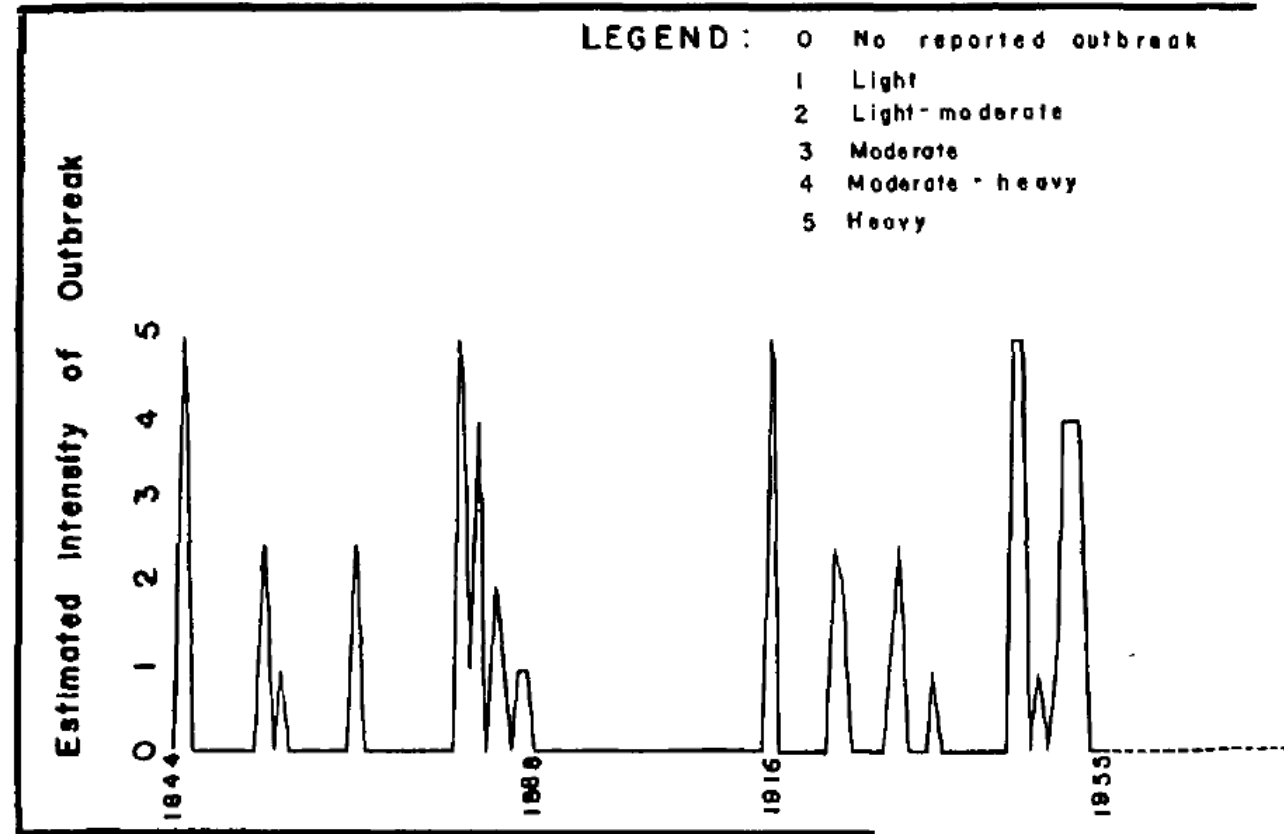


FIGURE 1. Estimated intensity of Red Tide outbreak 1844-1955.

"One of the oldest residents on the Florida coast, Mr. Benjamin Curry, of Manatee, told me, what others confirmed, that as far back as 1844 a widespread destruction of all sorts of saltwater animal life occurred, apparently due to causes precisely similar to those which produced the lately noticed desolation." **(Ingersoll, E., 1882, page 75)**

Anita Feinstein et al., 1955. "Red Tide Outbreaks off the Florida West Coast"

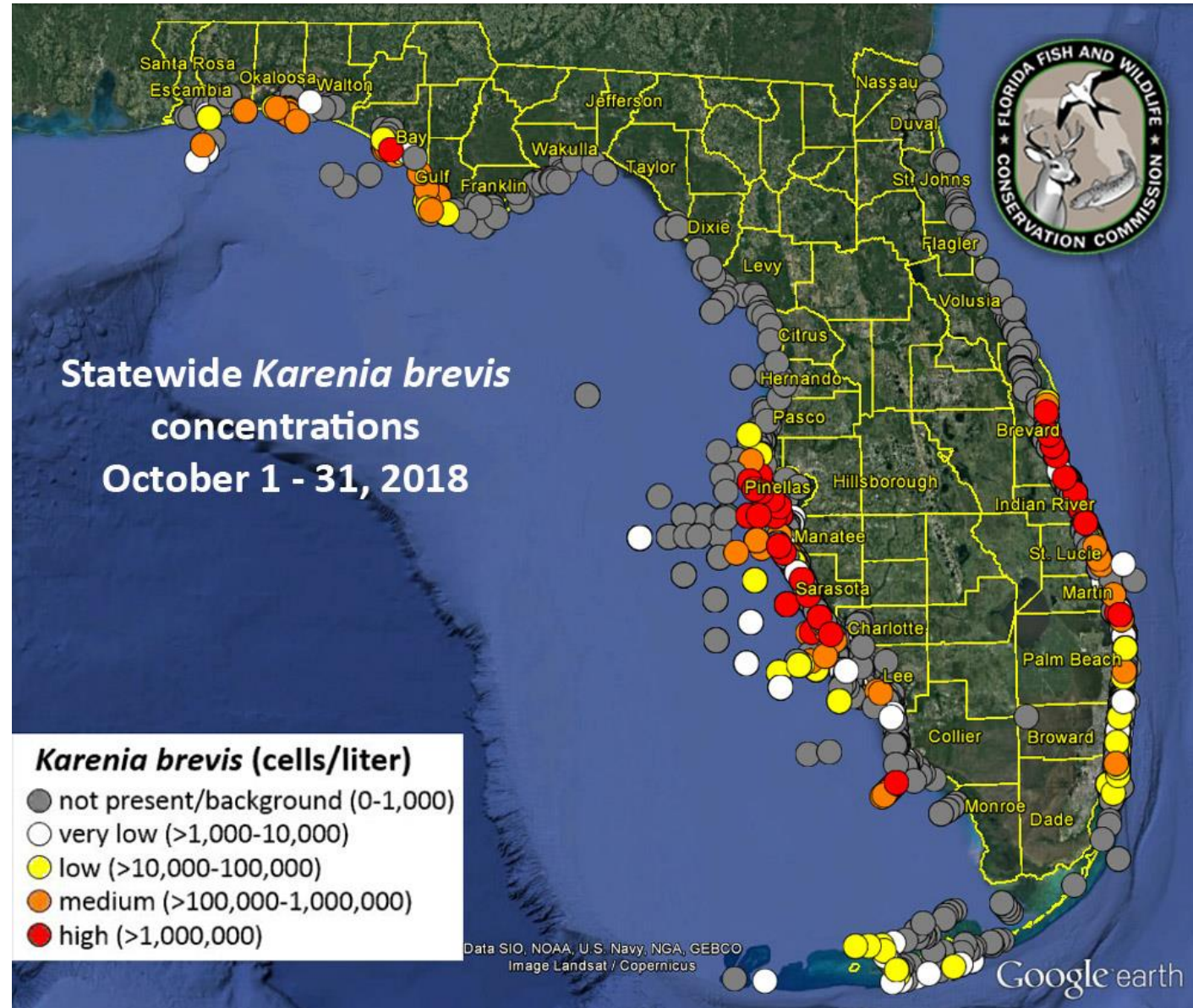
# Typical “red tide”

[myfwc.com/research/redtide/monitoring/historical-events/ne-coast-fl-2007/](http://myfwc.com/research/redtide/monitoring/historical-events/ne-coast-fl-2007/)

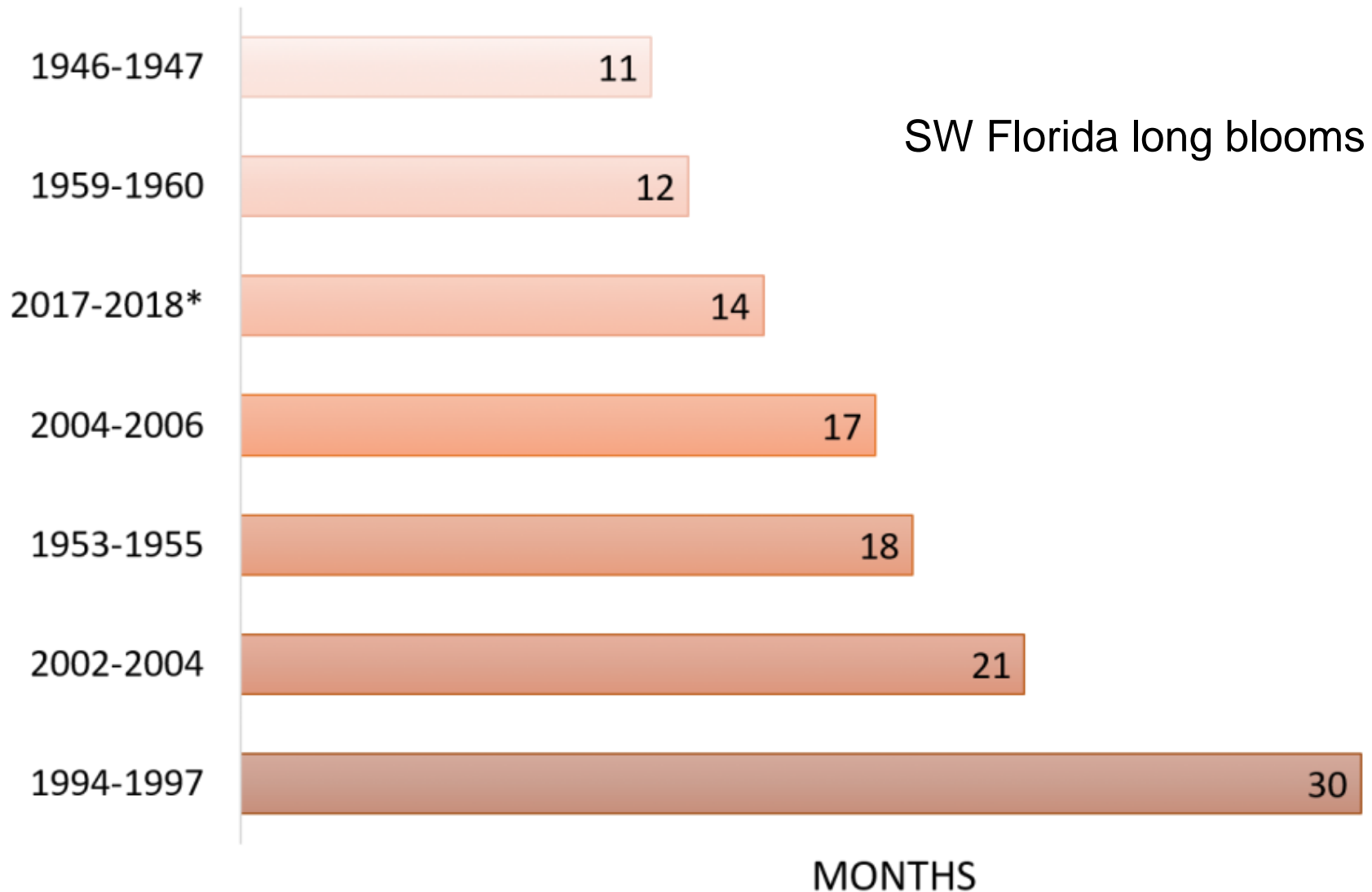




# 2018 Severe bloom year. SW, East Coast, & Panhandle



# Long-lived *Karenia* red tides occur occasionally



<https://www.flseagrant.org/news/2018/12/understanding-floridas-red-tide/>

# East coast



1946?

1972 (Martin Co.)

1977, 80, 83, 90, 97, 99, 2002

2007 JAX to Martin Co.

1987-88 North Carolina

2007 Delaware

## Some cells always in Gulf of Mexico

Karenia can use nearly any source of nitrogen (low concentrations)  
It swims between nutrients and light.  
Summer is optimal for growth (calm, warm)

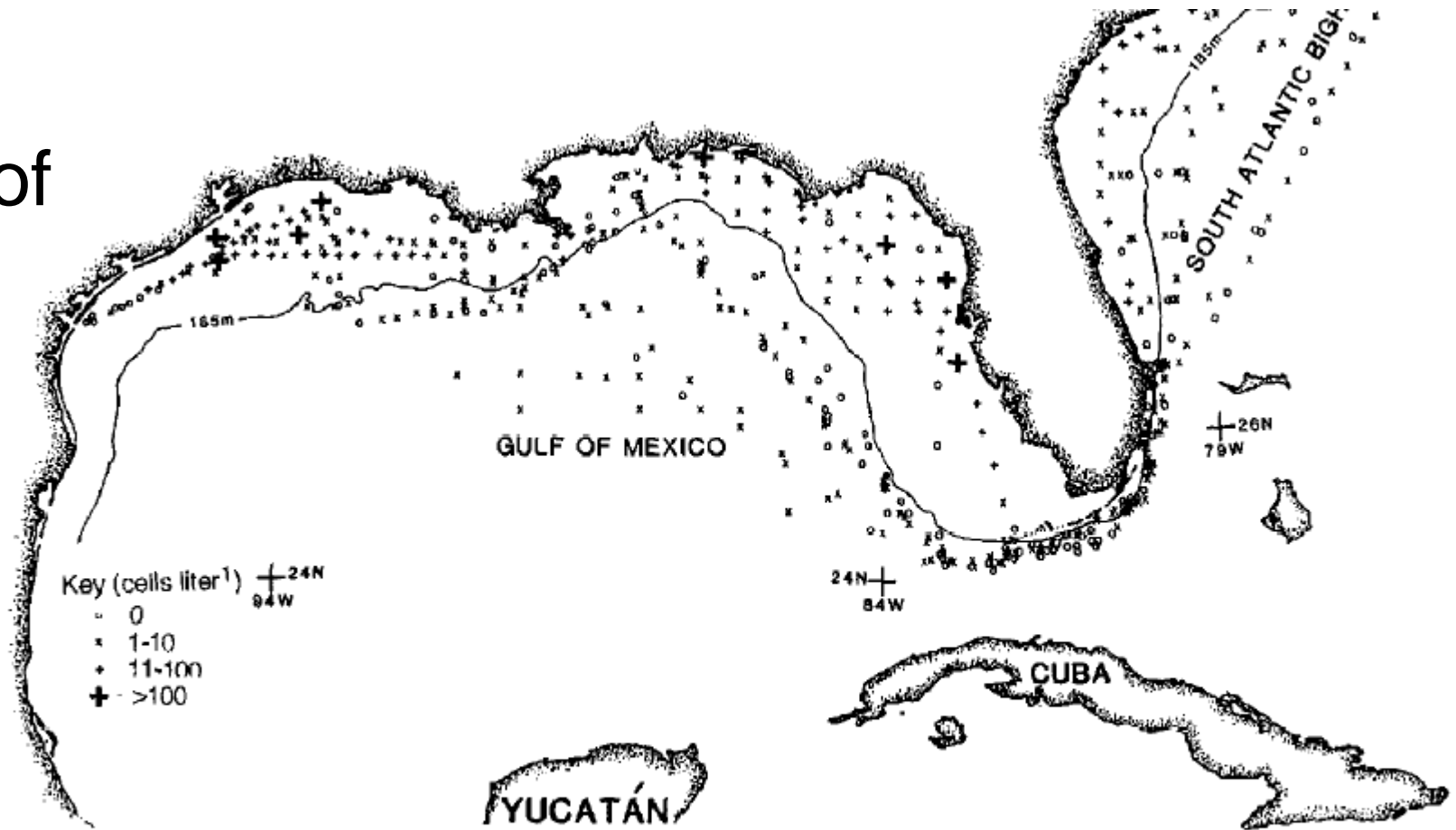
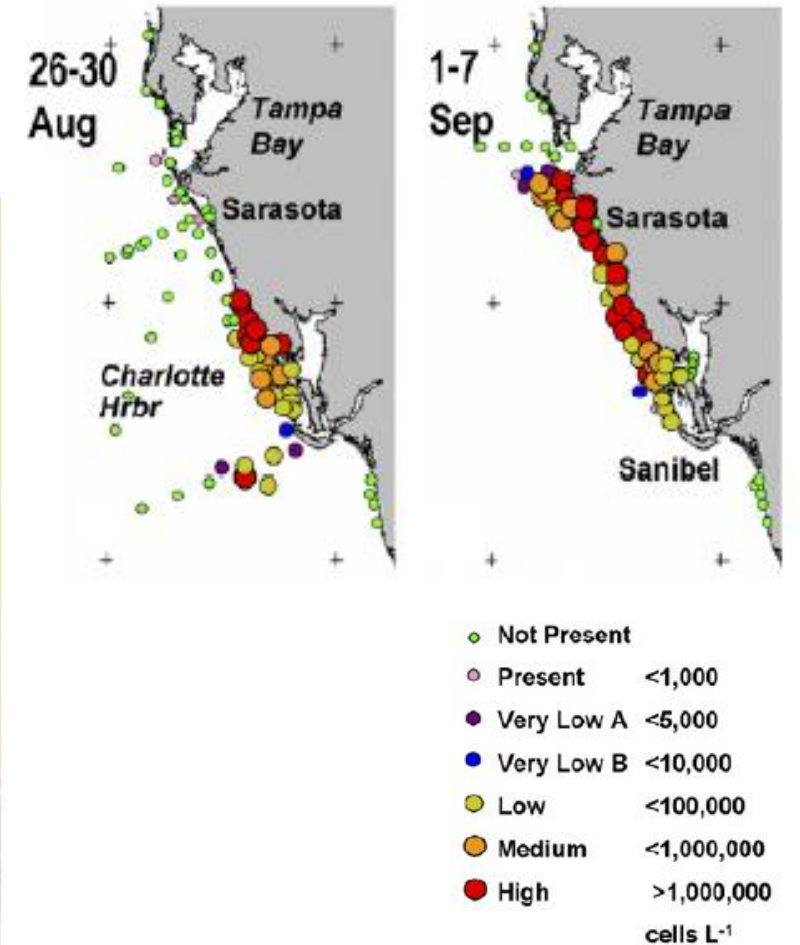
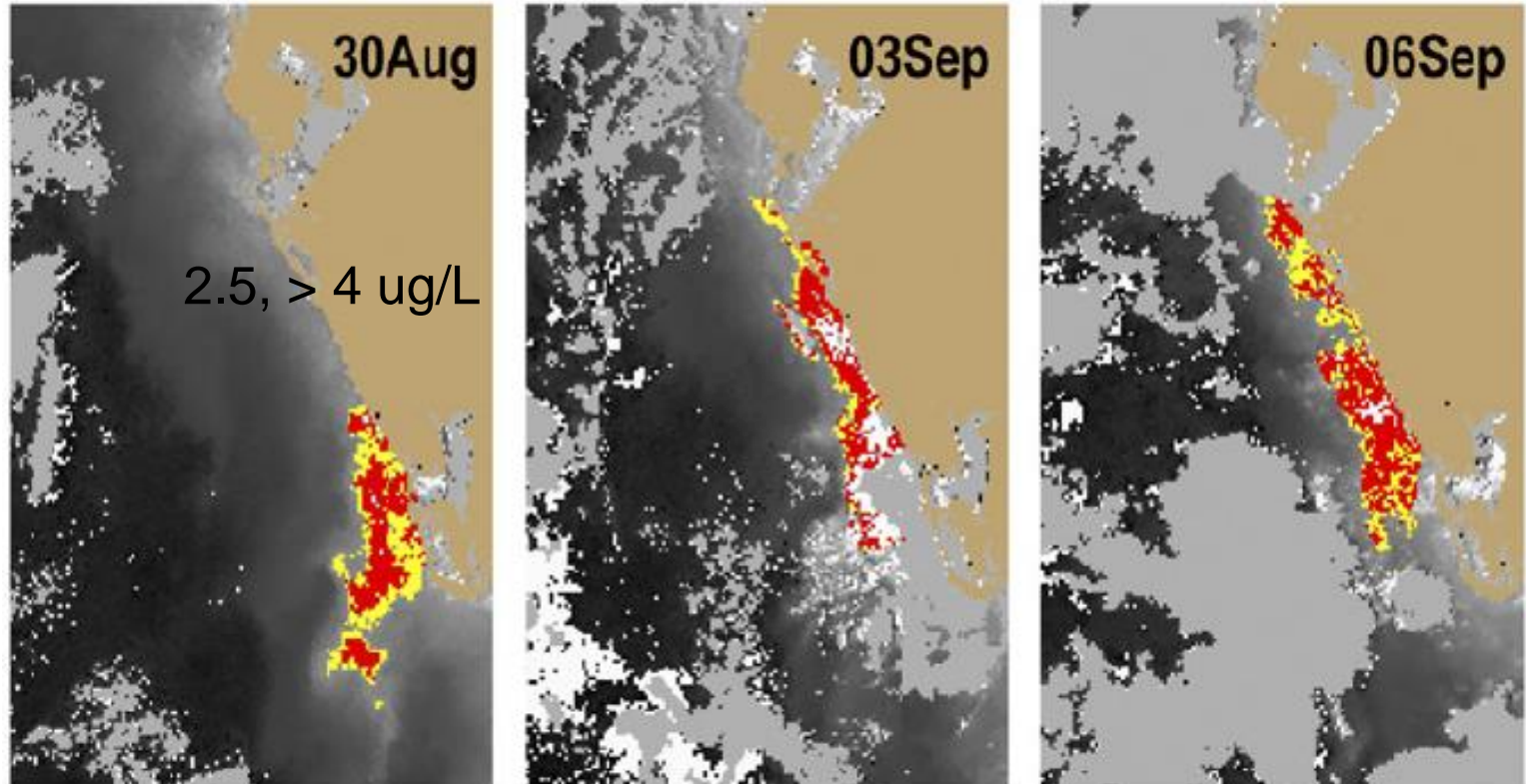


Fig. 2. *Gymnodinium breve* nonbloom, background concentrations in cells liter<sup>-1</sup>. Samples were taken during 1989–1991 by ships of opportunity (after Geesey and Tester 1993; Tester et al. 1993).

# Cells and wind currents move the blooms (upwelling starts most)

## Chl with bloom shown. 2001



1 from 19 to 25 August 2001, (b) 26–30 August 2001 and (c) 1–7 September 2001

**Respiratory irritation is the biggest problem  
(worse than dead fish)**

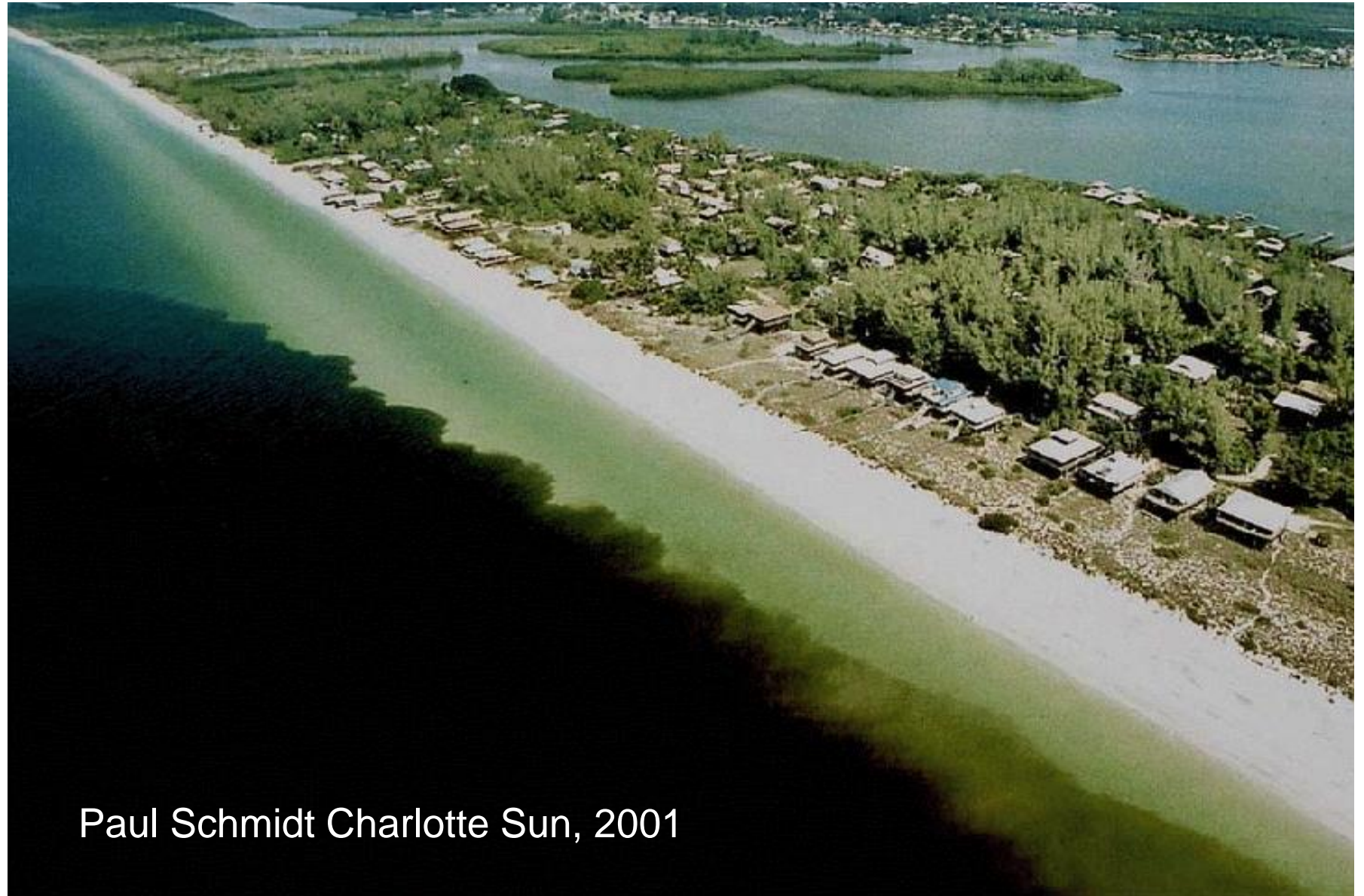
Research for mitigation:

**Need to know where the patches are at the beach**

Necessary for Respiratory forecasts

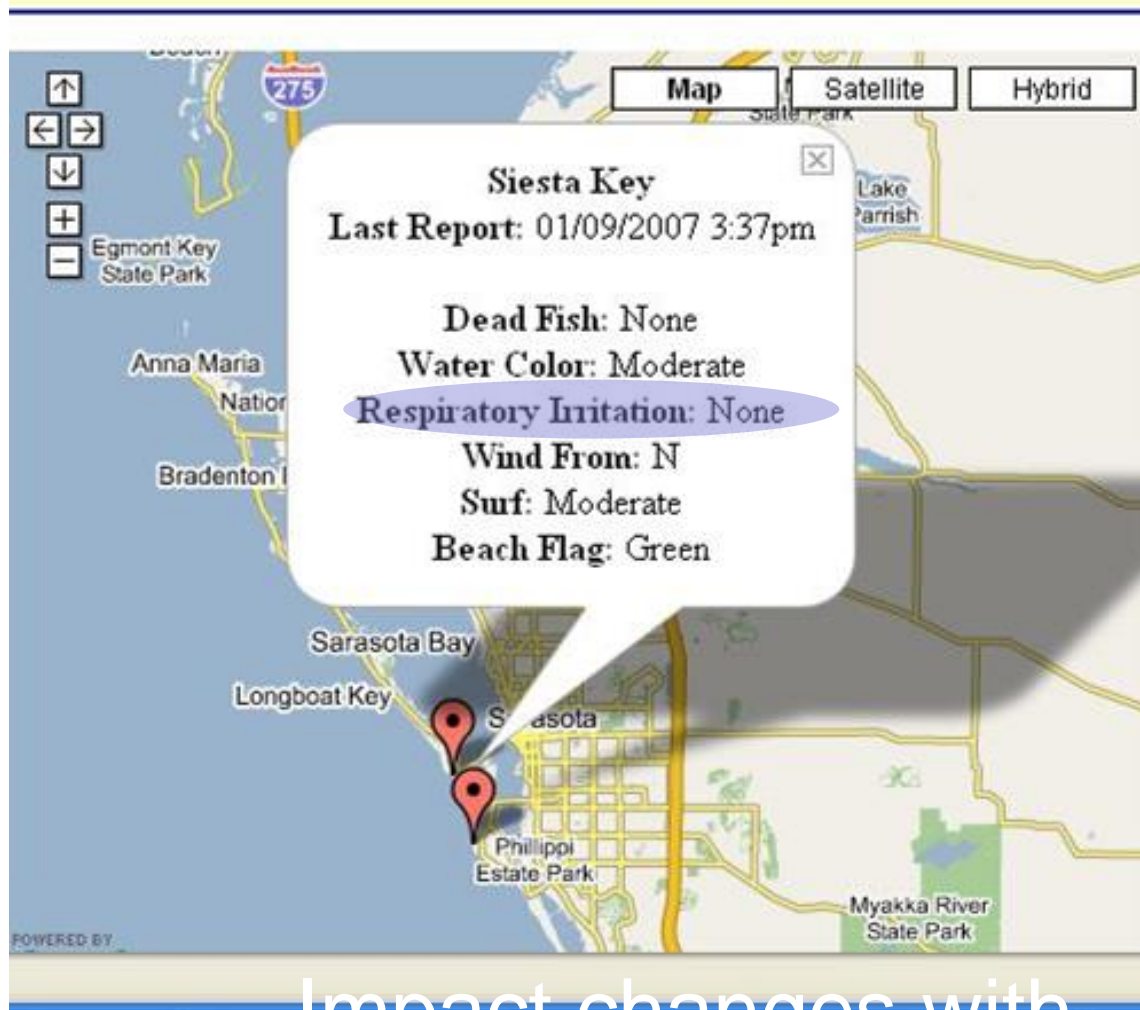
**We picture the bloom as covering the entire coast**

But frequently  
patchy

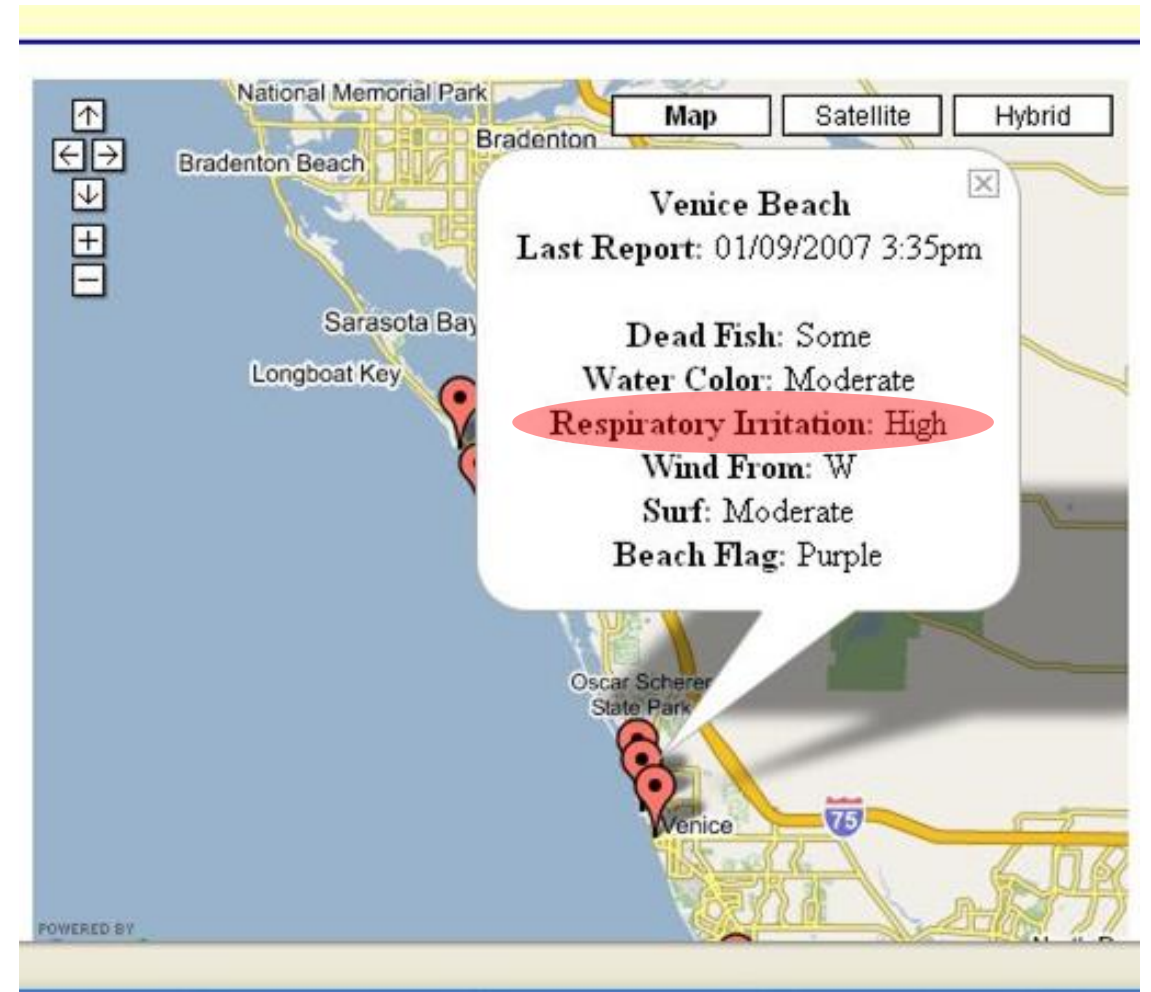


Paul Schmidt Charlotte Sun, 2001

# Impacts are patchy from beach to beach



~10 km apart





# Respiratory monitoring: Beach Conditions Reporting System

Uses FL's professional lifeguards at county beaches

10 am and 3 pm

Good when winds don't change and cells patches don't move,

and for those beaches

[Visitbeaches.org](http://Visitbeaches.org)

SO-COOL HAB Observatory | MOTE MARINE LABORATORY & AQUARIUM | Sarasota Operations Coastal Oceans Observation Lab BEACH CONDITIONS REPORTING SYSTEM

1-941-BEACHES (1-941-232-2437) | BEACHES | EMAIL ALERTS

Valdosta, Tallahassee, Jacksonville, St. Augustine, Lake City, Gainesville, Ocala, Daytona Beach, Orlando, Kissimmee, Melbourne, Tampa, Lakeland, St. Petersburg, Fort Lauderdale, Miami, West Palm Beach, Port St. Lucie, Fort Lauderdale, Miami

FLORIDA

MOTE MARINE LABORATORY

Google

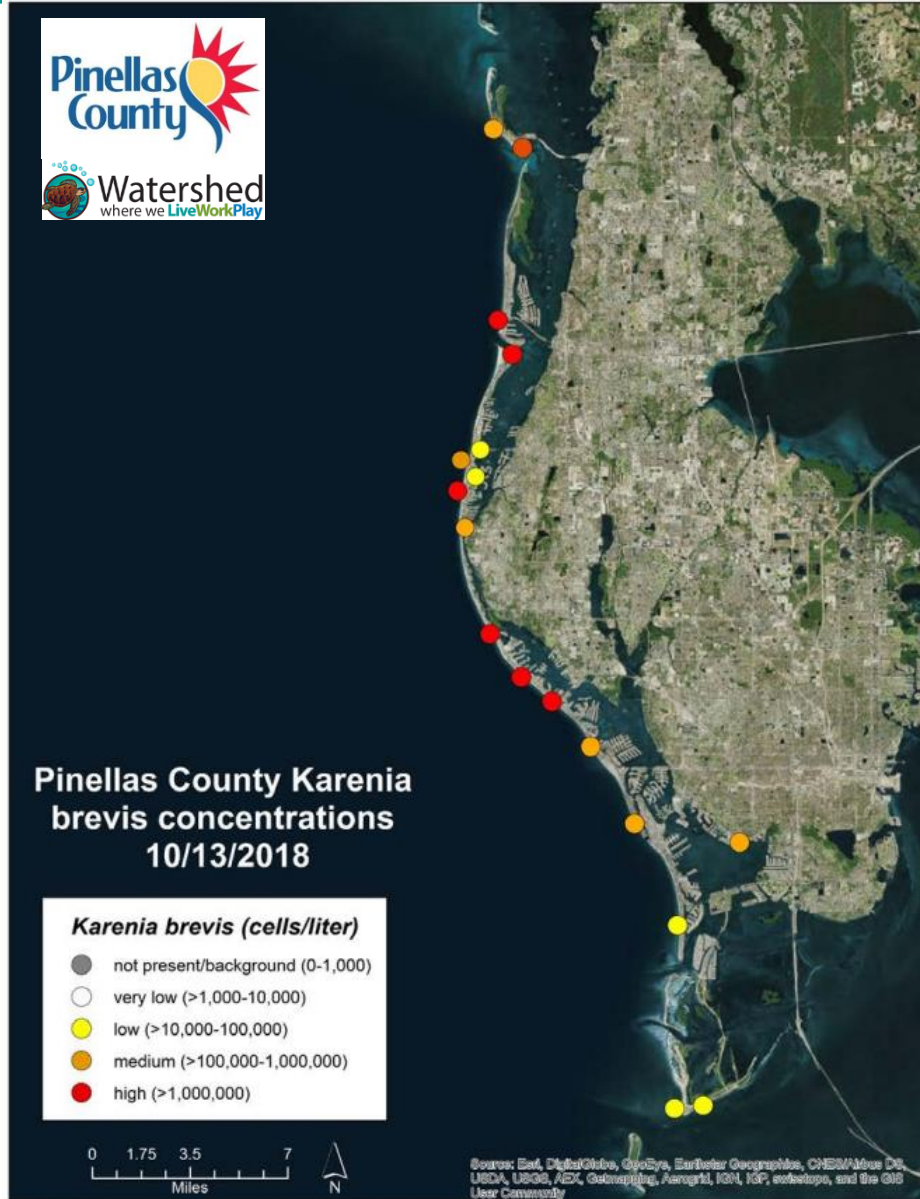
Map data ©2019 Google, INEGI 50 km

This service provides beach conditions reports from select beaches in the Southwest coast of Florida and the Florida Panhandle. The

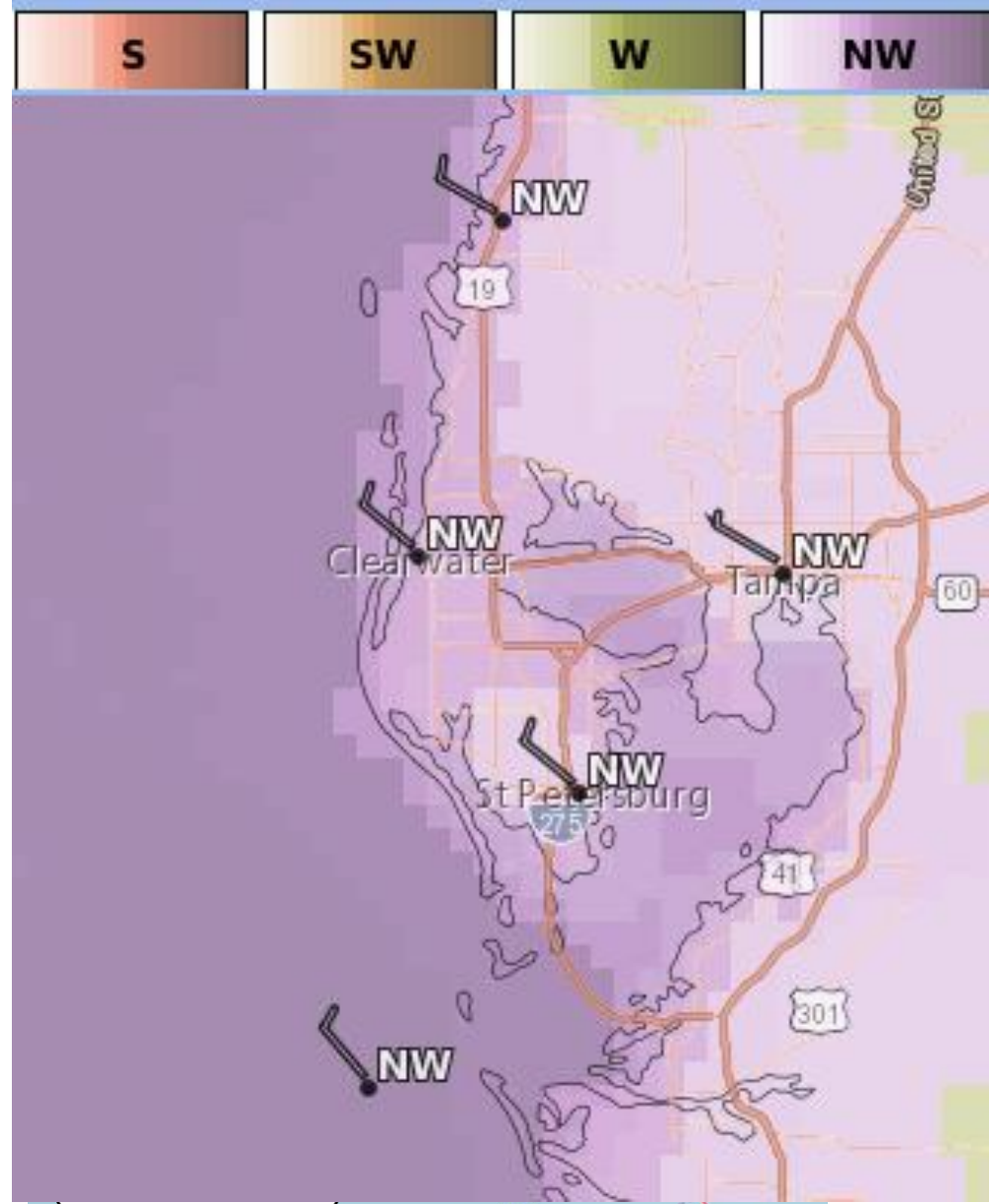
Most reports will be posted at 10 am and 3 pm local time. If reporting is late, please understand that the beach reporter

# Experimental respiratory forecast

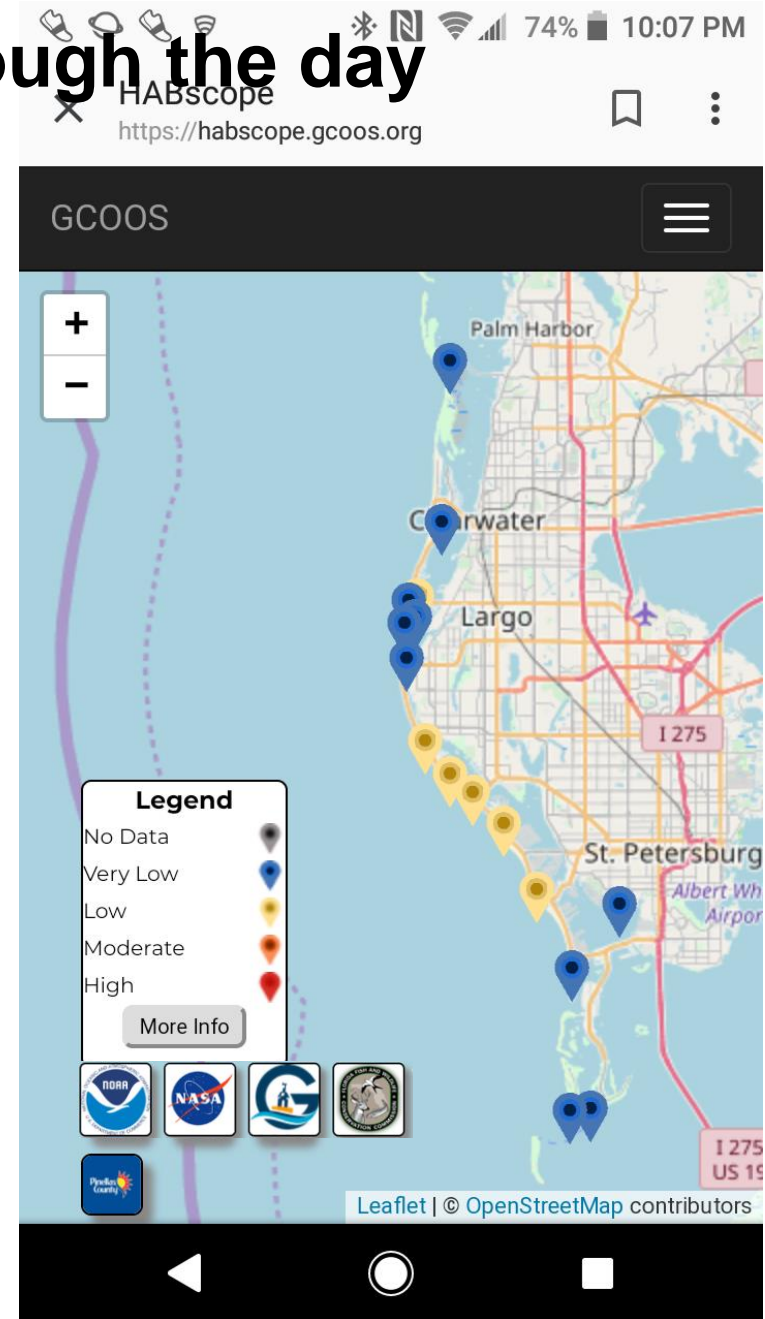
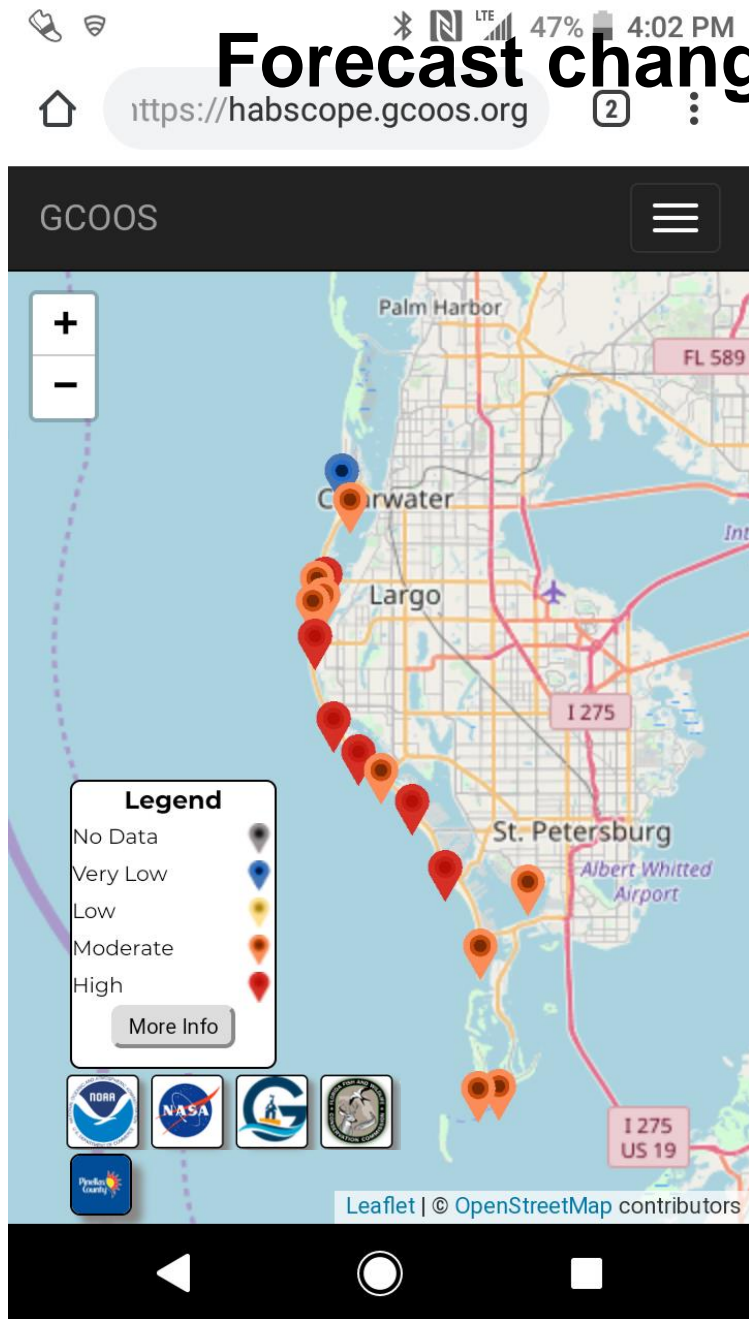
<https://habscope.gcoos.org/>



# Forecast winds and Respiratory model



# Forecast changes through the day



# HABscope



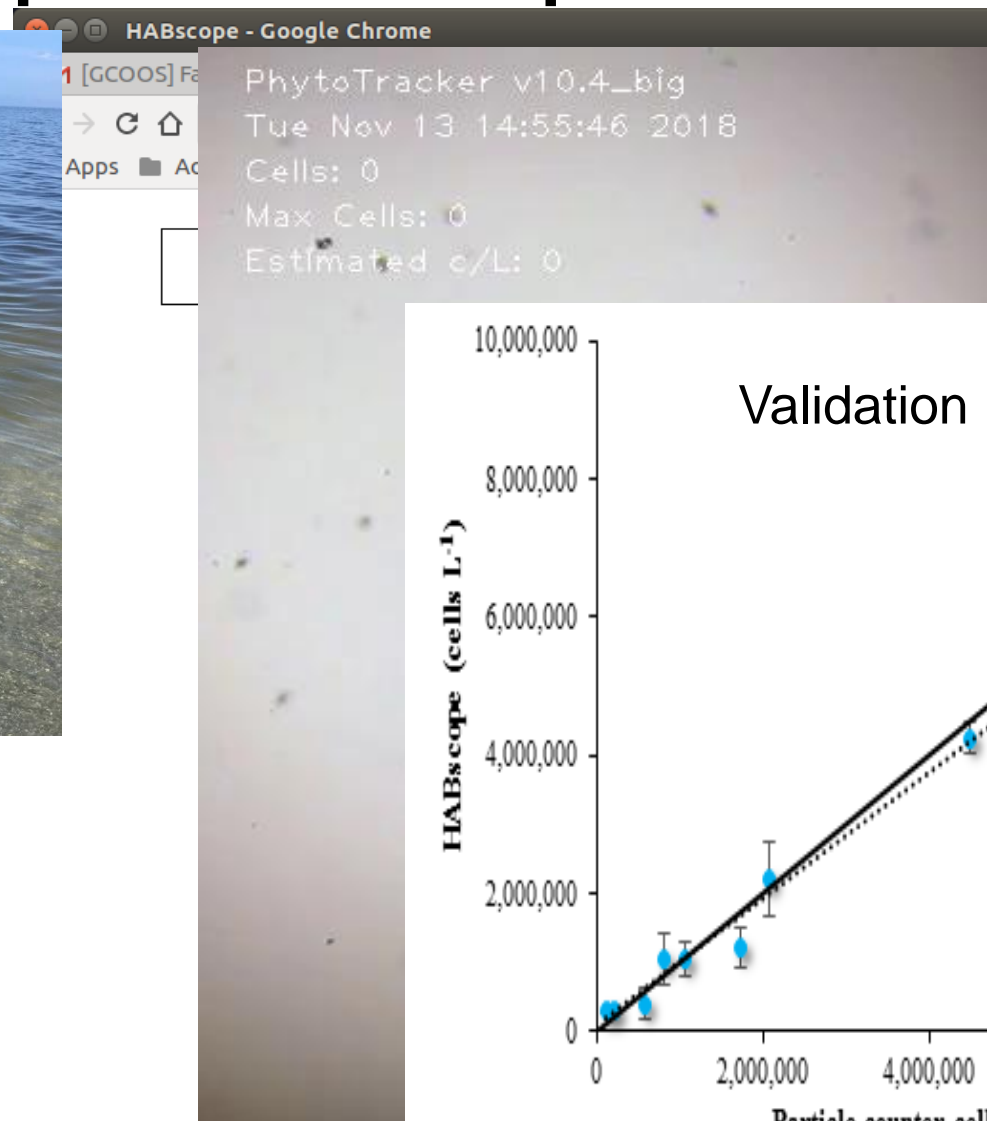
Supported by NASA Applied Sciences, Health and Air Quality Program

# HABscope, New technology, old deployment

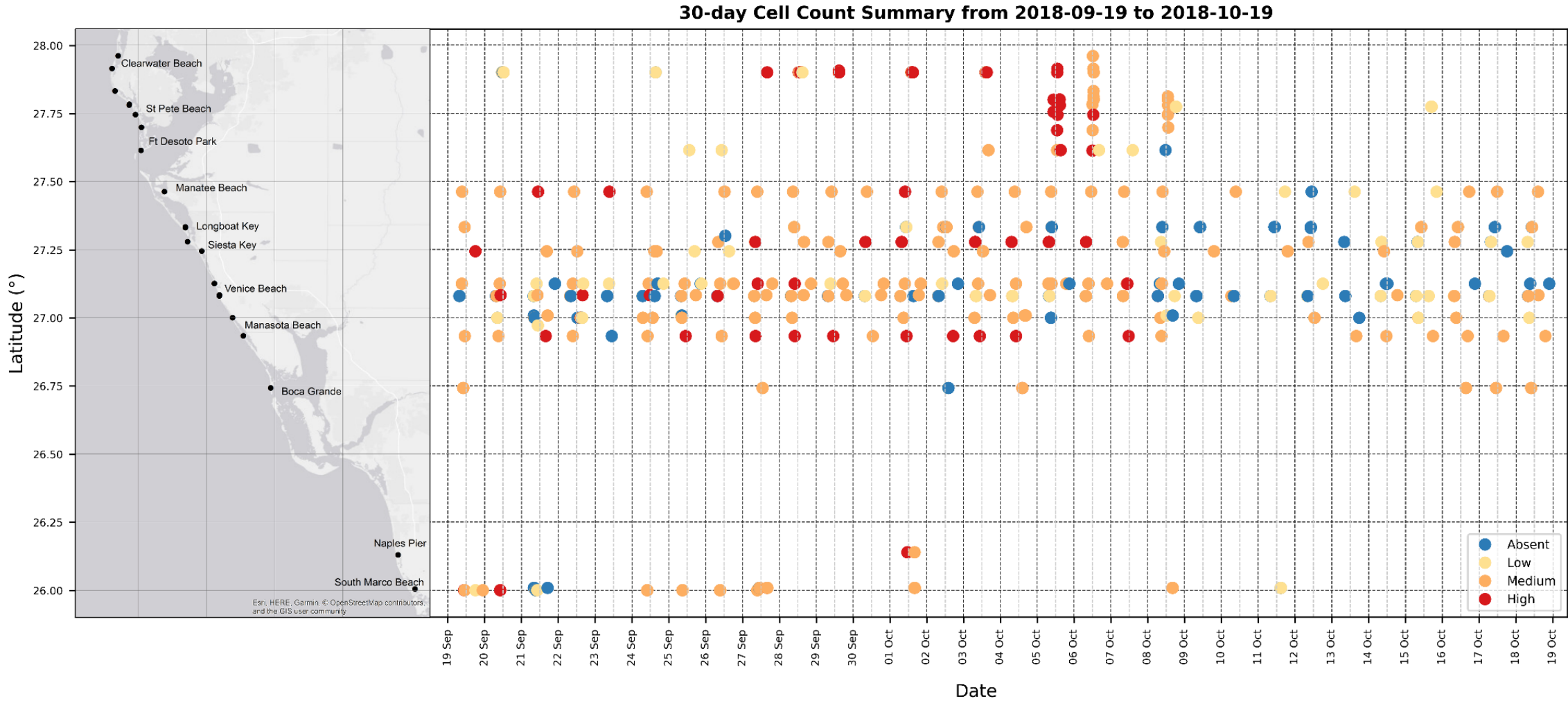
Standard (college) microscope  
New:  
iPad tablet  
3D printed eyepiece adapter  
Hot spot upload to data server  
standard feature recognition open  
source software (Tensorflow)



# Example video after process

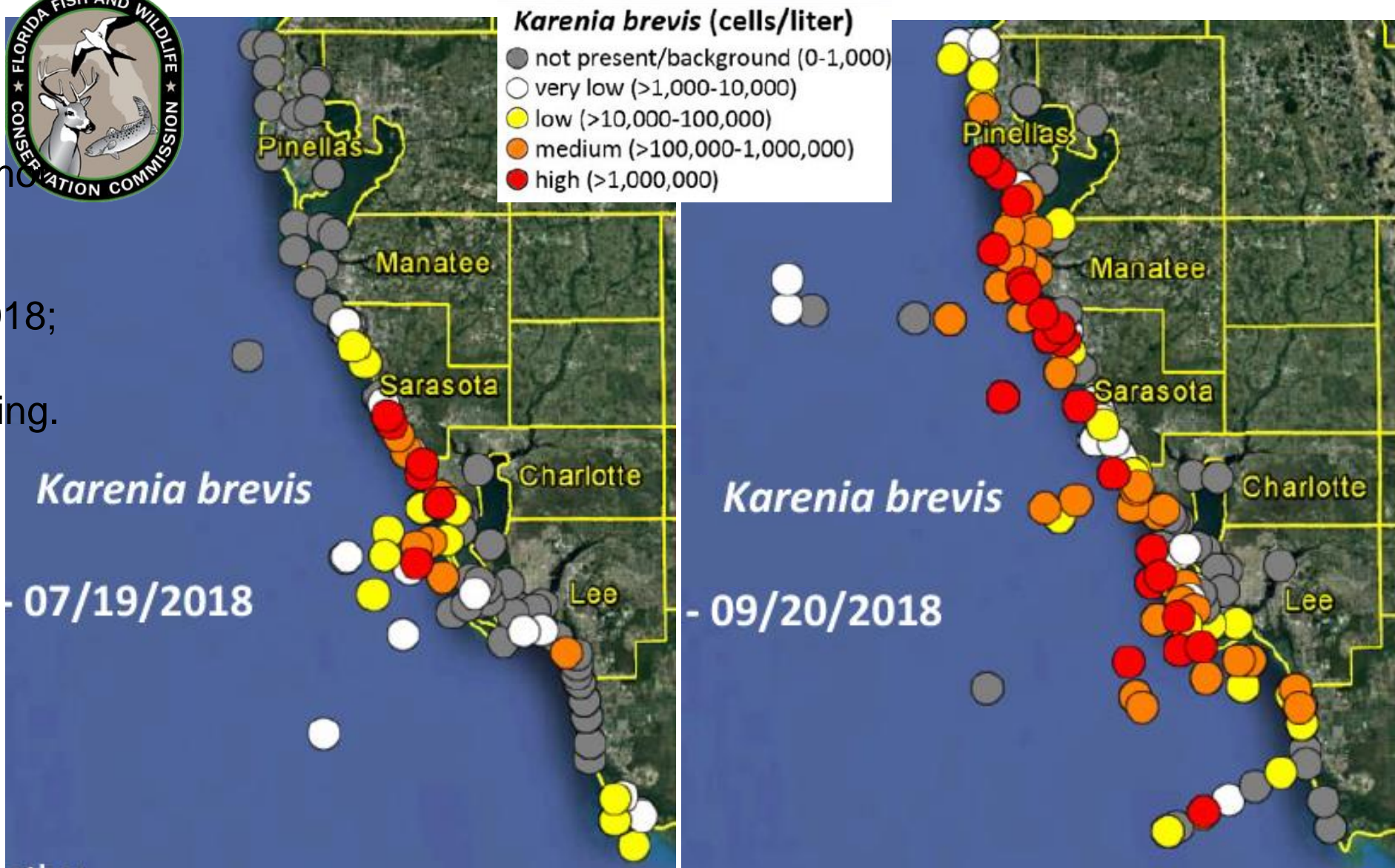


# Volunteer network testing phase HABscope data acquisition



# *Karenia* “red tide” bloom comparison July and Sep 2018

Standard monitoring is not enough. Thousands of samples in 2018; but this is still weekly sampling.

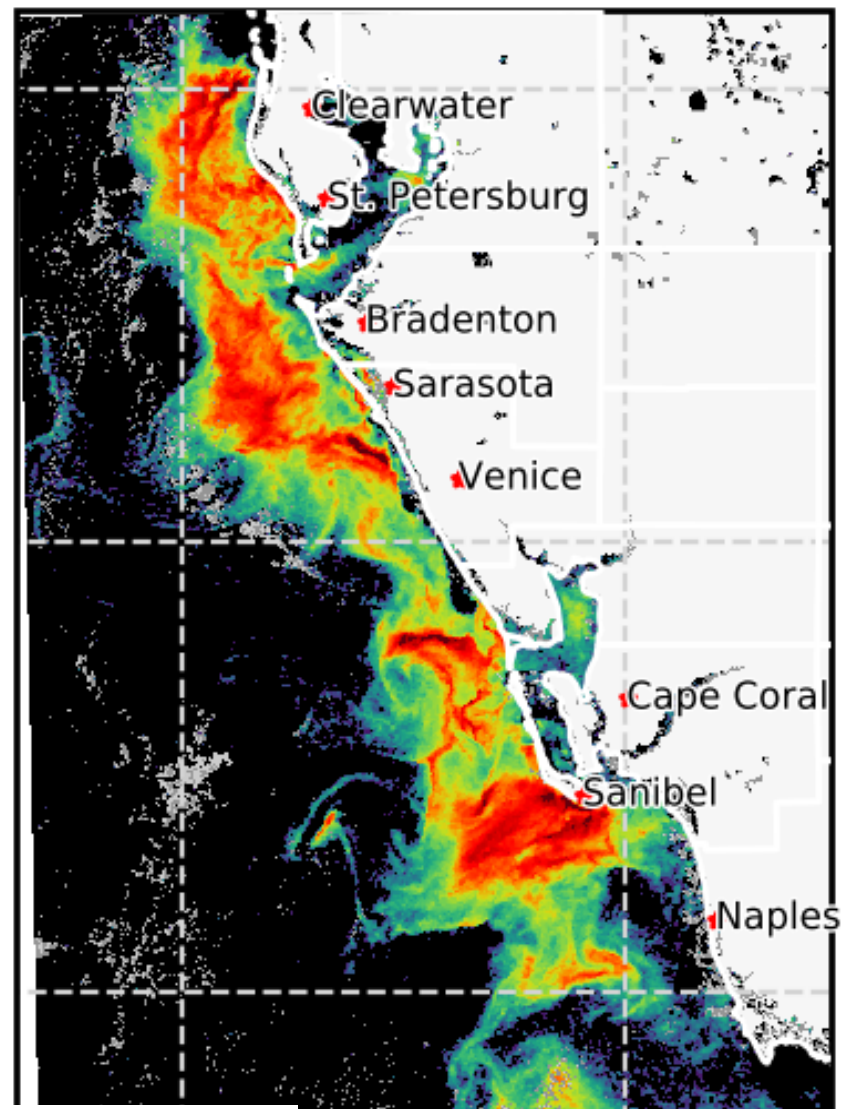
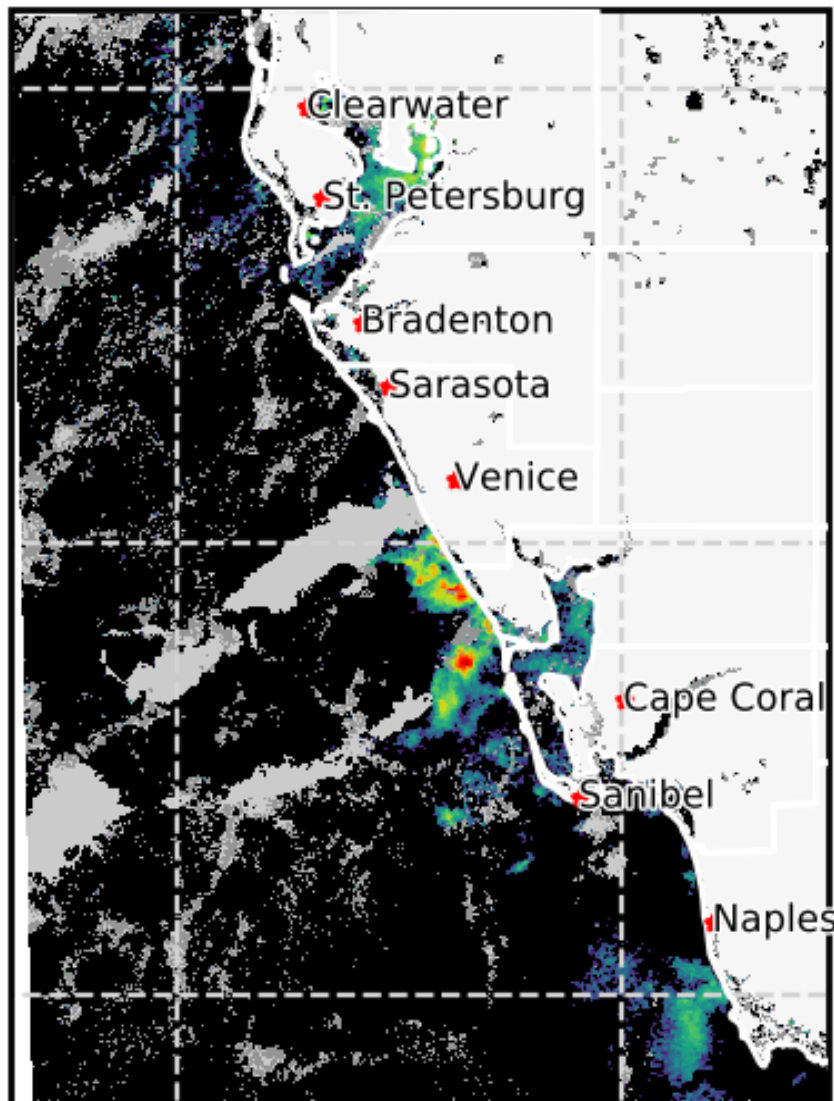




# *Karenia* “red tide” satellite bloom comparison July and Sep 2018

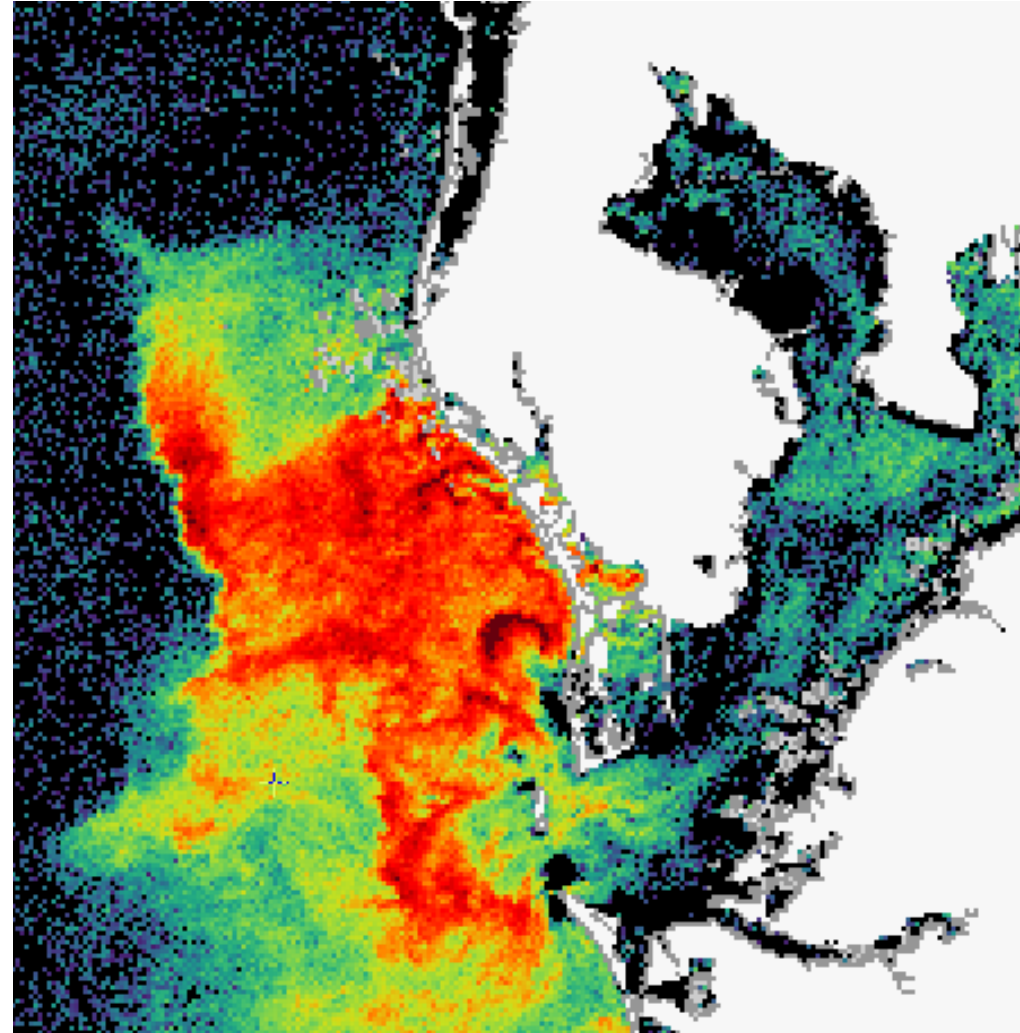
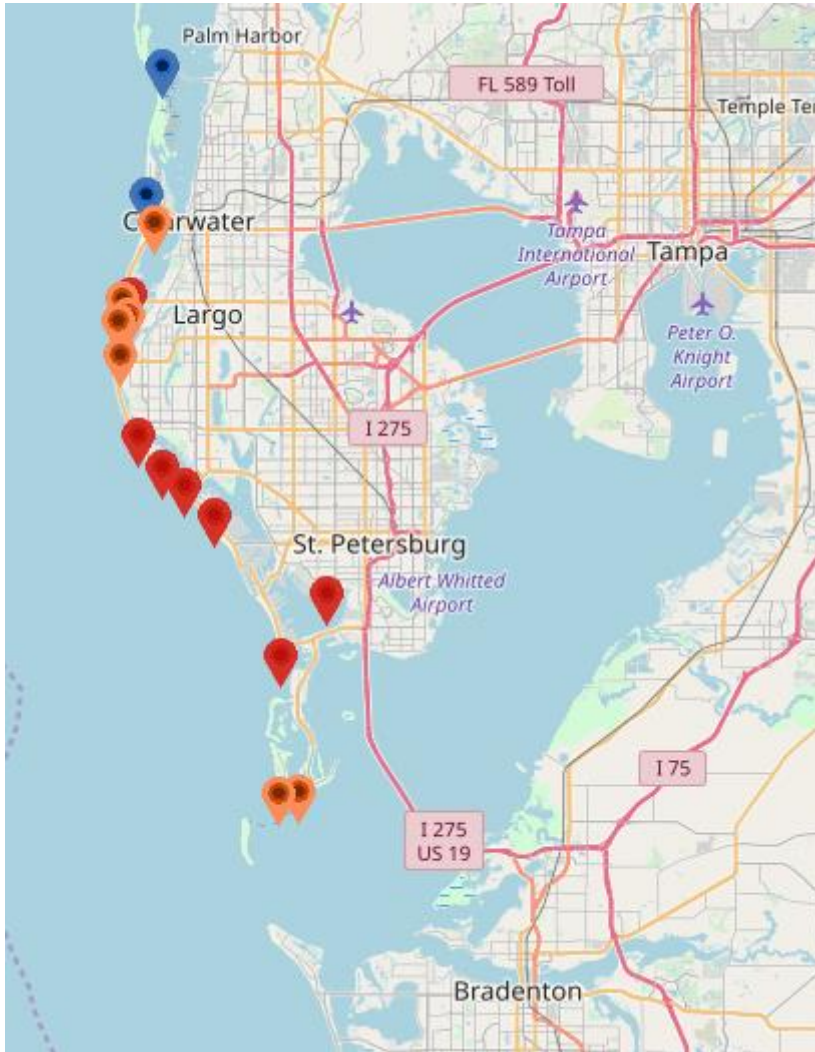
Image date: 2018-07-17

Image date: 2018-09-17



Products derived from Copernicus Sentinel-3 data

# Working on use of satellite to enhance field monitoring new (2016, 2018 launch, 300 m Sentinel-3 6x/week)



# Combine cell counts, HABscope, satellite



The screenshot shows the HABscope website interface. At the top, the URL is <https://habscope.gcoos.org>. Below the URL is a navigation menu with the GCOOS logo and a hamburger menu icon. The main content area features a map of Palm Harbor, FL, with a zoom control on the left. The map shows the coastline and surrounding areas.

Our goal is to forecast  
*“Every beach,  
every day”*



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