An overview of Florida's Marine Harmful Algal Blooms

Katherine Hubbard, Ph.D.

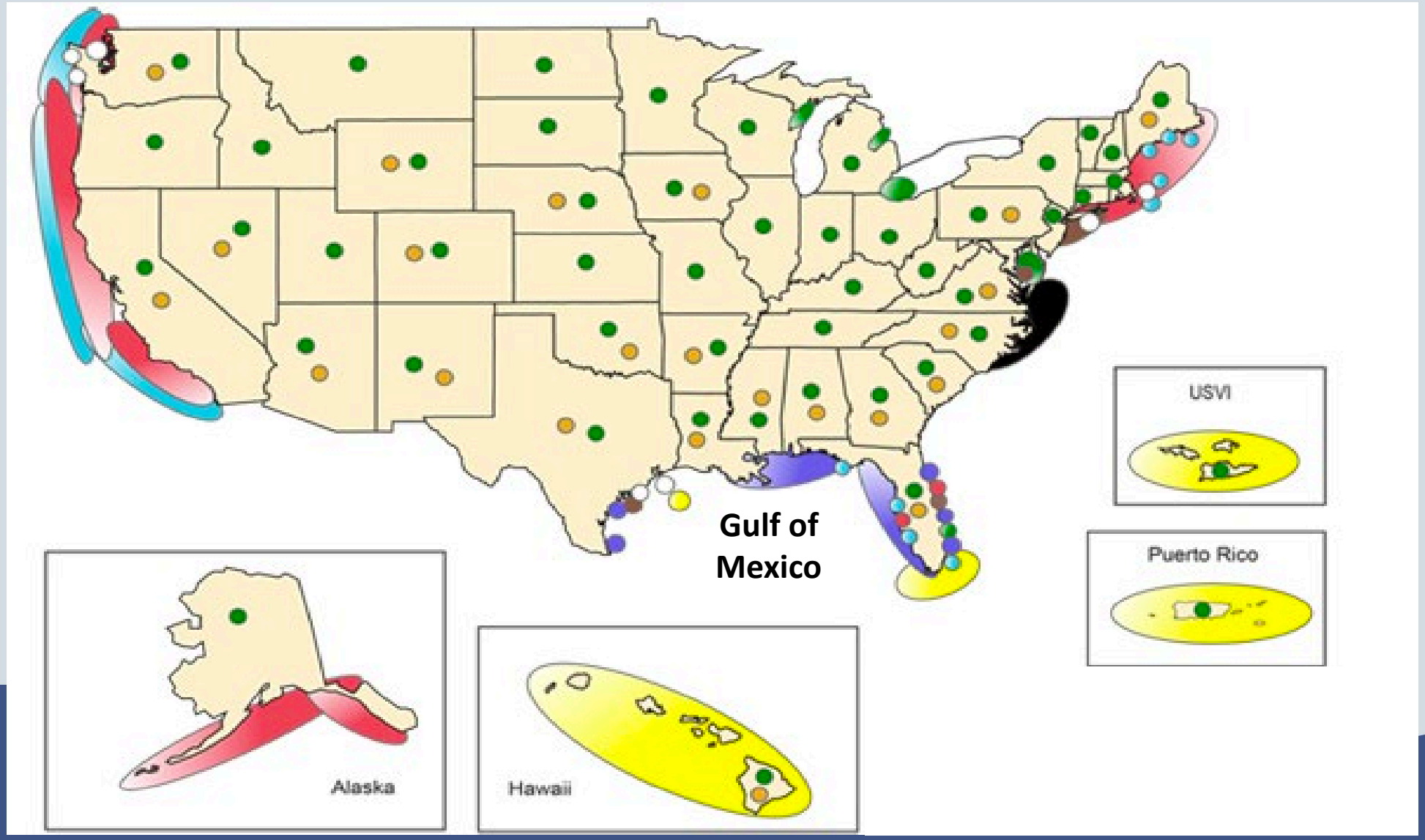
Florida Fish and Wildlife Conservation Commission
Fish and Wildlife Research Institute

Distribution of HAB-related Poisoning Syndromes in the United States

https://www.whoi.edu/redtide/regions/us-distribution

SP = Shellfish Poisoning
FP = Fish Poisoning

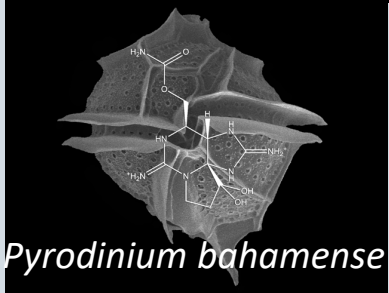
- Neurotoxic SP
- Paralytic SP
- Amnesic SP
- Diarrhetic SP
- CyanoHABs
- Ciguatera FP
- Brown tide
- Golden alga
- *Karlodinium*

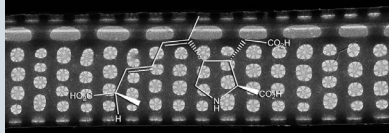


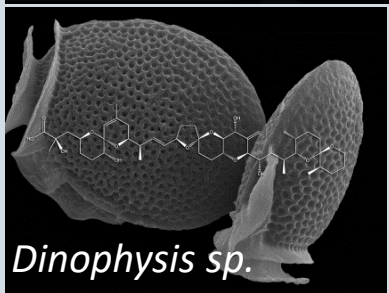
Toxin-producing HABs present human health risks.

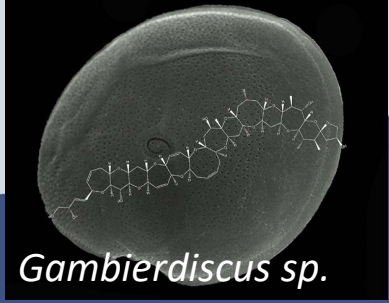
Organism(s)	Toxins	Syndrome
Karenia brevis	Brevetoxins	Neurotoxic Shellfish Poisoning
Pyrodinium bahamense	Saxitoxins	Paralytic Shellfish Poisoning Saxitoxin Puffer Fish Poisoning
Pseudo-nitzschia spp.	Domoic Acid	Amnesic Shellfish Poisoning
Dinophysis spp. *Prorocentrum* spp.	Okadaic Acid, Dinophysistoxins	Diarrhetic Shellfish Poisoning
Gambierdiscus spp.	Gambiertoxins, Maitotoxins	Ciguatera Fish Poisoning


Karenia brevis


Pyrodinium bahamense

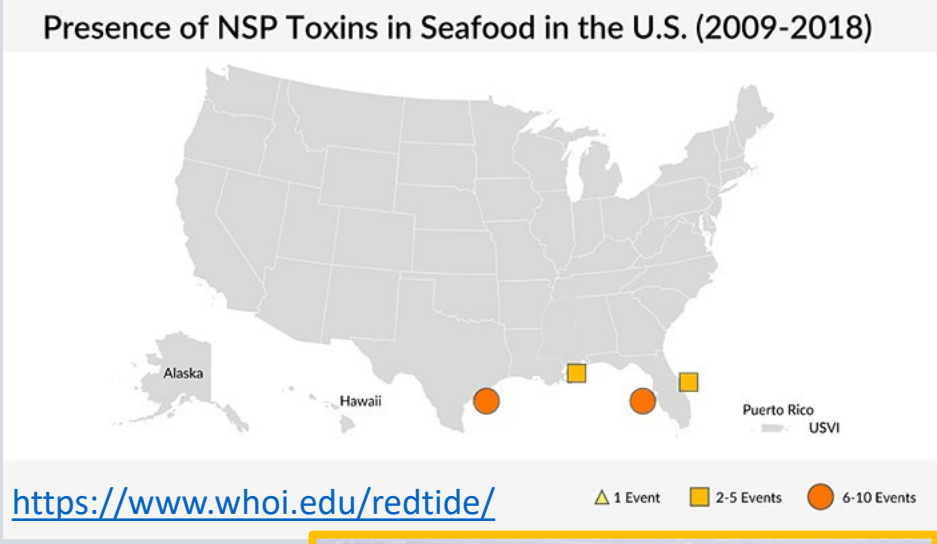

Pseudo-nitzschia sp.


Dinophysis sp.

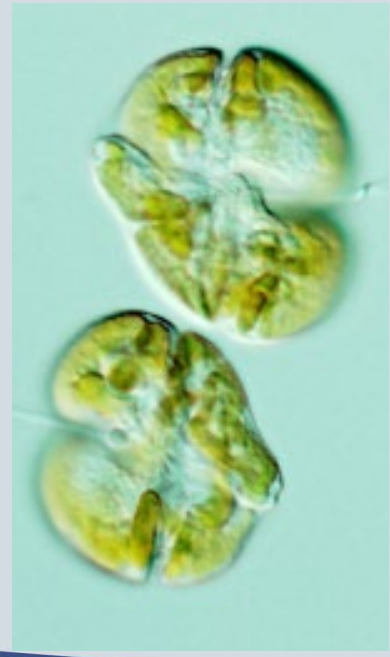

Gambierdiscus sp.

Karenia brevis

- Dinoflagellate with long history of blooms in GOM
- Duration, location, and spatial extent of the bloom varies from year to year
- Produces brevetoxins, which can cause Neurotoxic Shellfish Poisoning if consumed and cause respiratory irritation when toxins are aerosolized
- Wildlife mortality during blooms (fish, marine mammals, birds, sea turtles)
- Blooms form 10-40 miles offshore at depth
- Occurs across wide range of environmental conditions



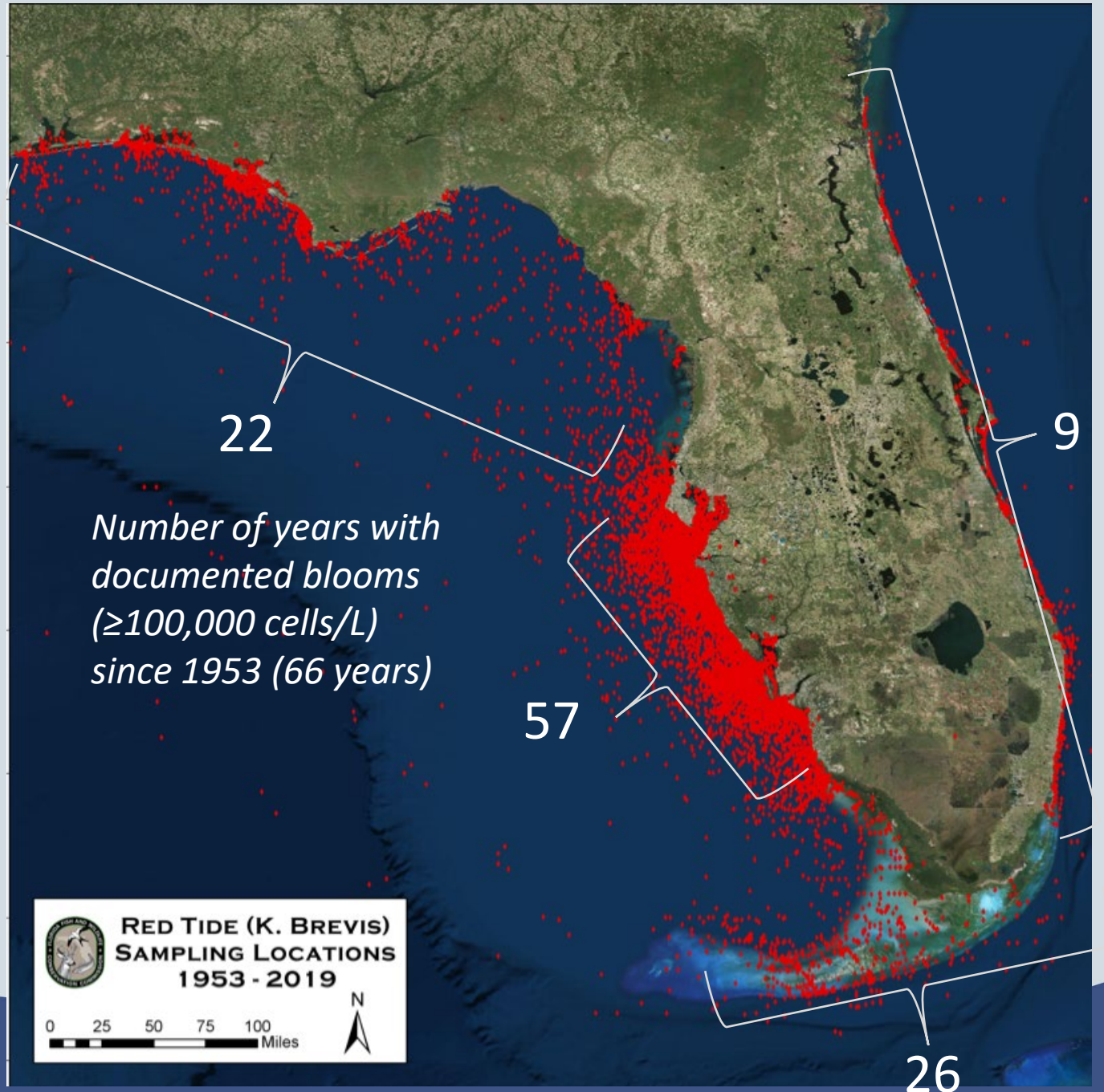
https://www.whoi.edu/redtide/



Integrating monitoring and research critical

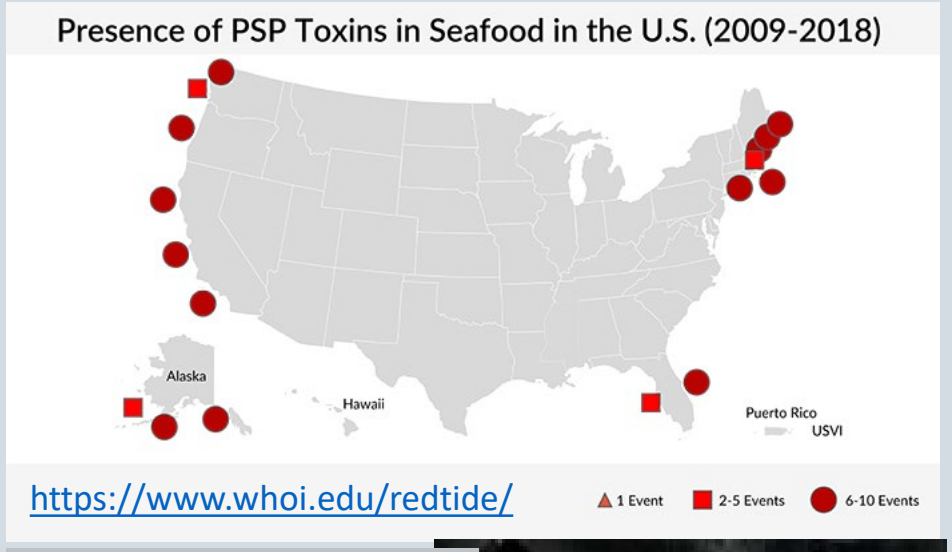
- Bivalve testing methods expanded
- New detection technology for cells and toxins
- Lab/field efforts examine key aspects of bloom initiation, growth, and termination
- Model development for prediction

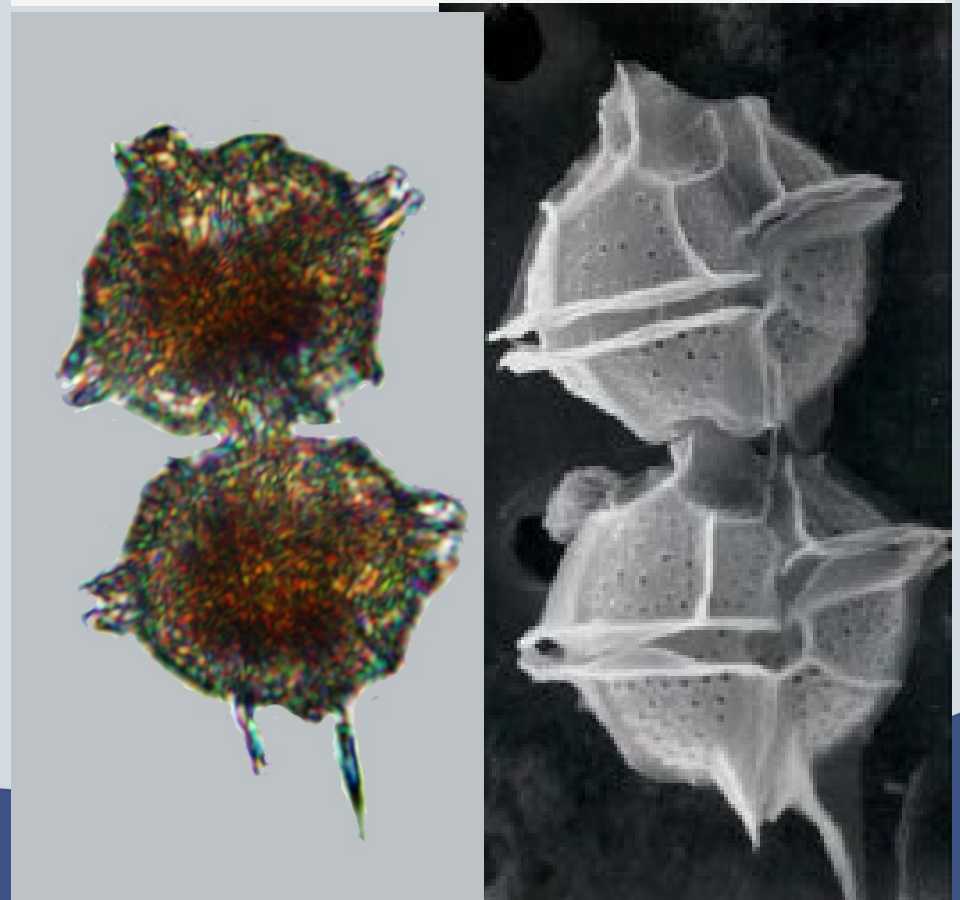
Monitoring and prediction networks continue to improve



Pyrodinium bahamense

- One of several dinoflagellates that produces PSP toxins (saxitoxins)
- Atlantic strain (*P. bahamense* var. *bahamense*) was not known to be toxic until 2002
- 2002-2004: 28 cases saxitoxin poisoning associated with consumption of puffer fish originating in the IRL
- First confirmation of saxitoxin in marine waters in Florida
- Permanent ban on harvest of puffer fish from the IRL
- Saxitoxin can also cause Paralytic Shellfish Poisoning





Pyrodinium bahamense

- Blooms occur annually in the Indian River Lagoon and Tampa Bay
- First PSP closure in Pine Island Sound in 2016
- Bioluminescent
- Forms cysts

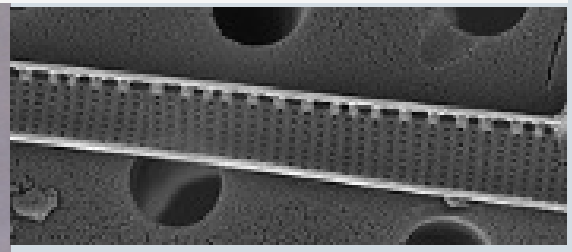

photo credit: Dorian Photography


photo credit: FWC

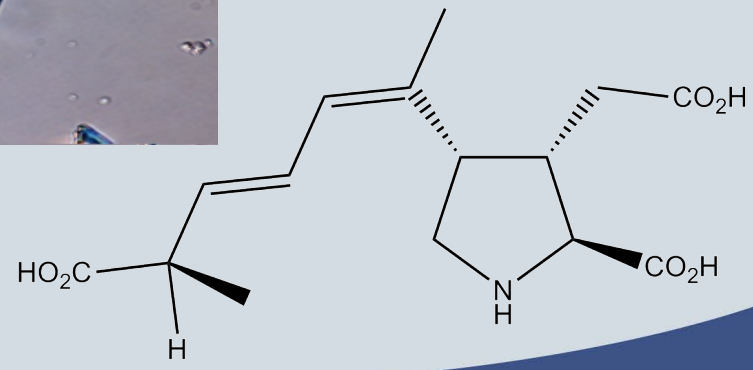
Pseudo-nitzschia spp.

- Cosmopolitan chain-forming marine diatom with 52 species
- At least 26 species of *Pseudo-nitzschia* produce the neurotoxin domoic acid (DA)
- DA is the only marine algal toxin produced by diatoms
- DA can cause Amnesic Shellfish Poisoning in humans and Domoic Acid Poisoning in marine birds and mammals

https://www.whoi.edu/redtide/

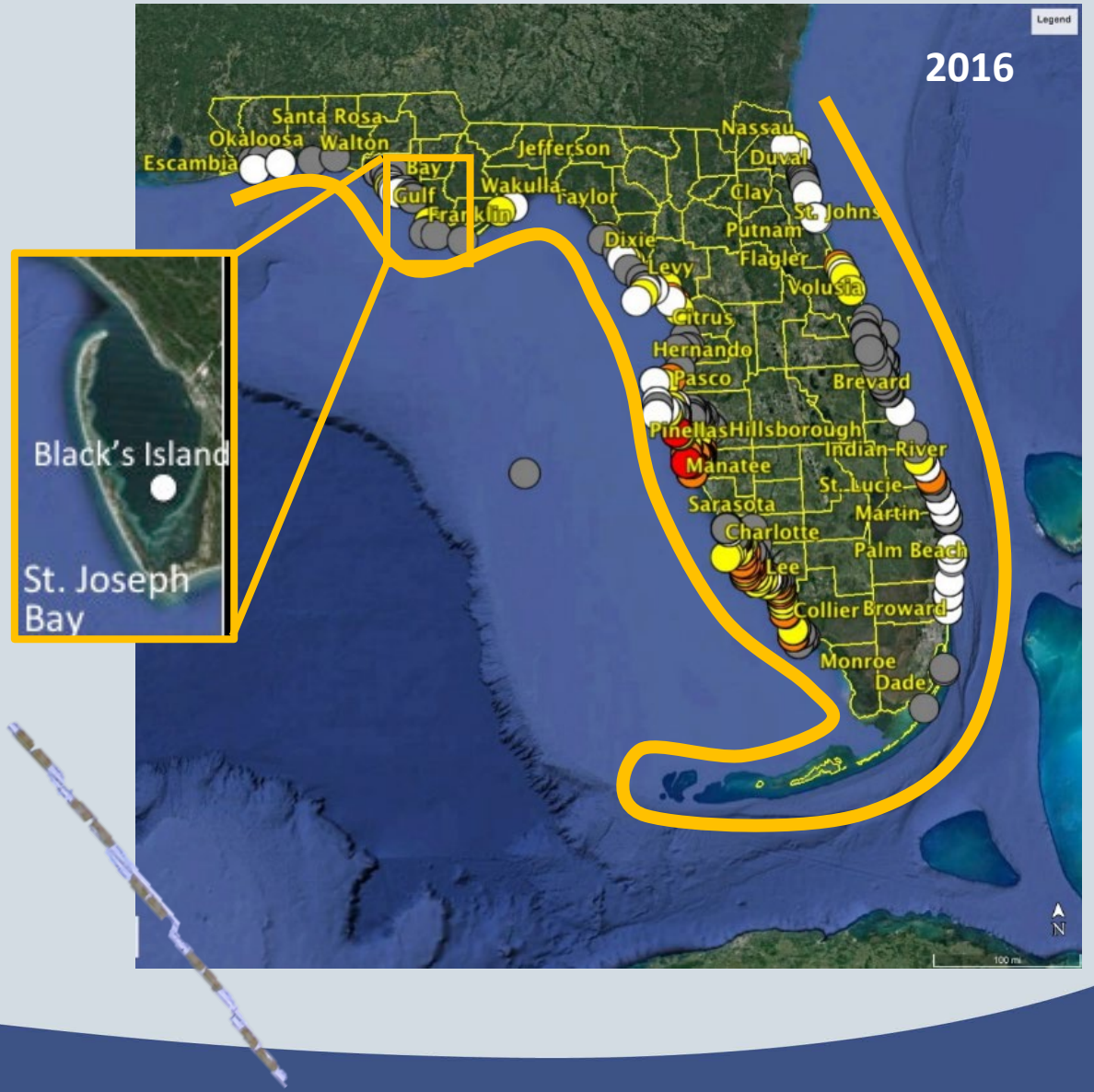


Domoic Acid

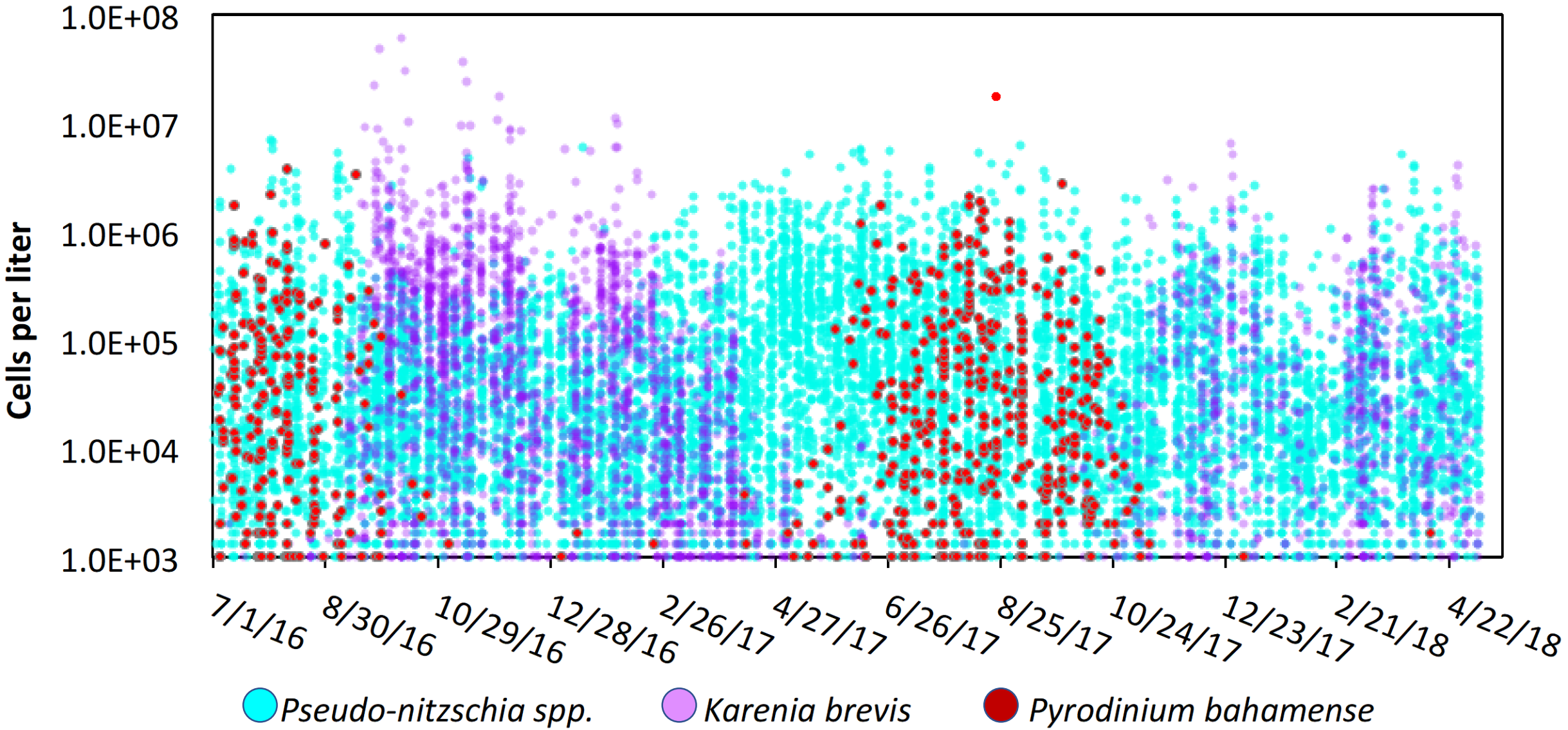


Pseudo-nitzschia spp.

- Nearly year-round presence
- Approximately 50% of samples contain DA
- 3 harvest closures in Saint Joseph Bay since 2013
- At least 14 species occur in GOM
- Species often co-occur and can't be identified by light microscopy



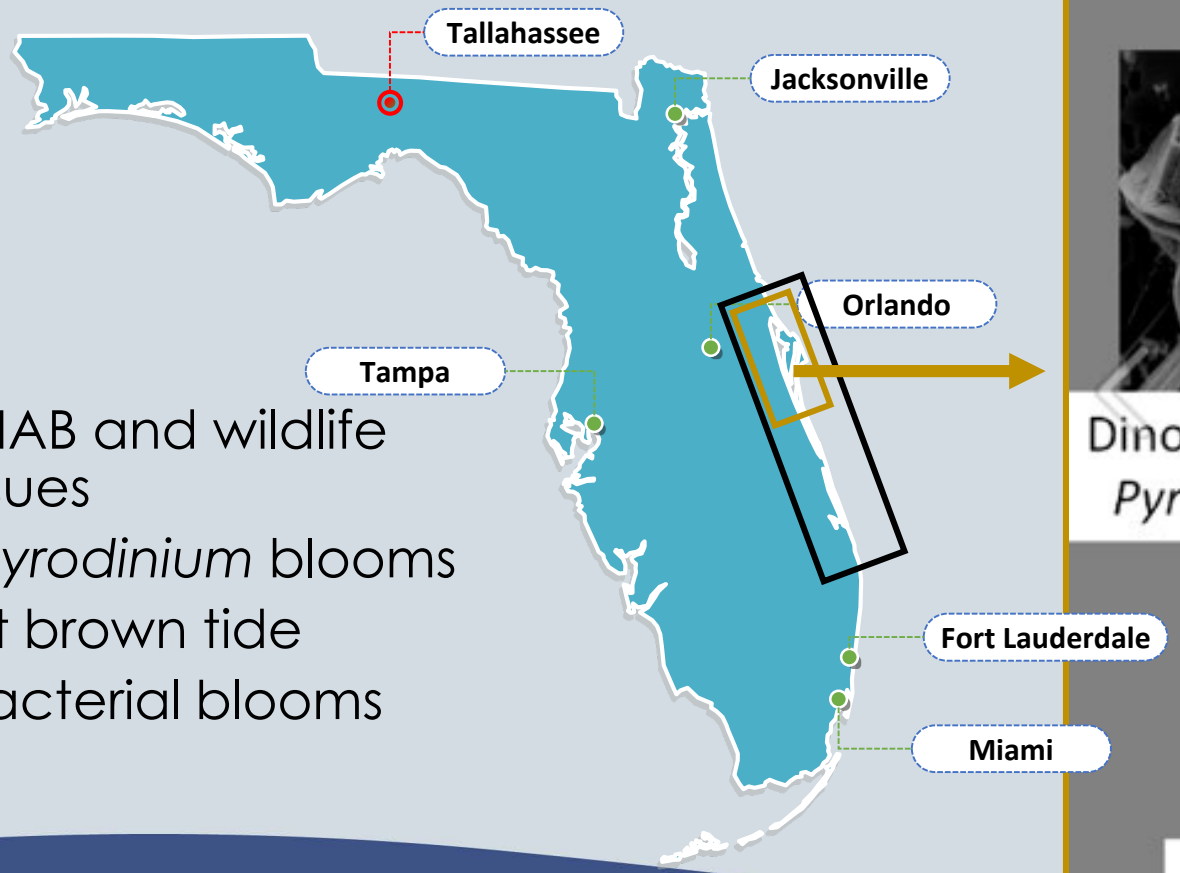
Seasonality and overlap of Florida's three primary HABs



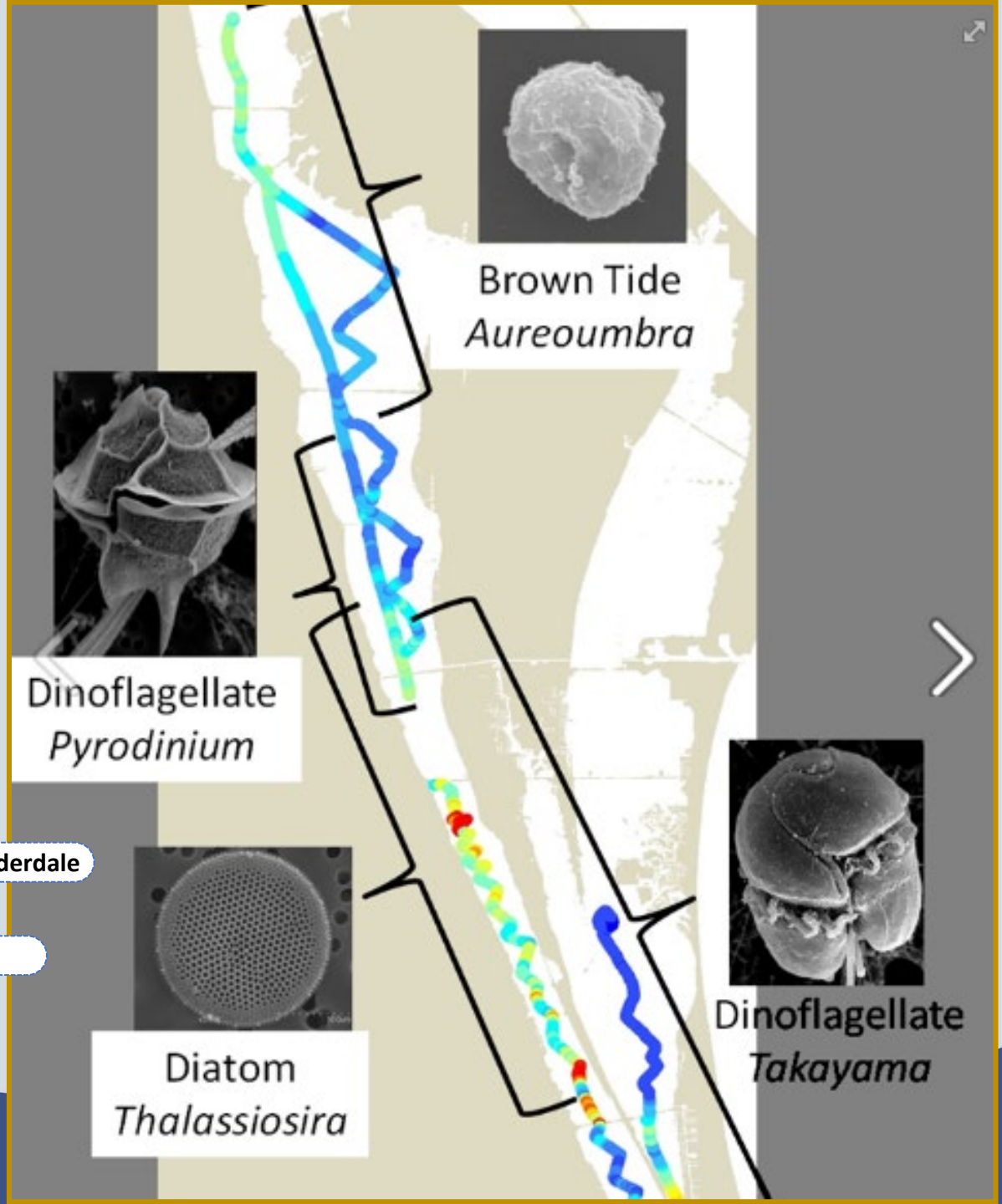
Ciguatera Fish Poisoning

- Most common seafood poisoning (affects 50,000-100,000 people each year)
- Ciguatoxin precursors produced by *Gambierdiscus* spp. (epibenthic dinoflagellate); transformed and concentrated in tropical reef fish through food web
- Neurological symptoms can persist for several months; chronic symptoms can persist for years
- Can be fatal
- Distinct forms and varying potencies in ciguatoxins from the Pacific, Caribbean, and Indian oceans
- Expanding global issue; no monitoring

Indian River Lagoon

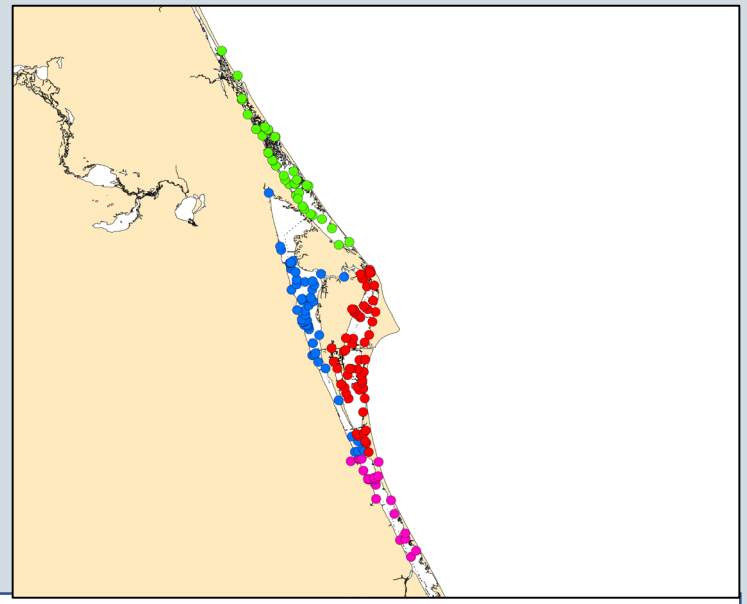


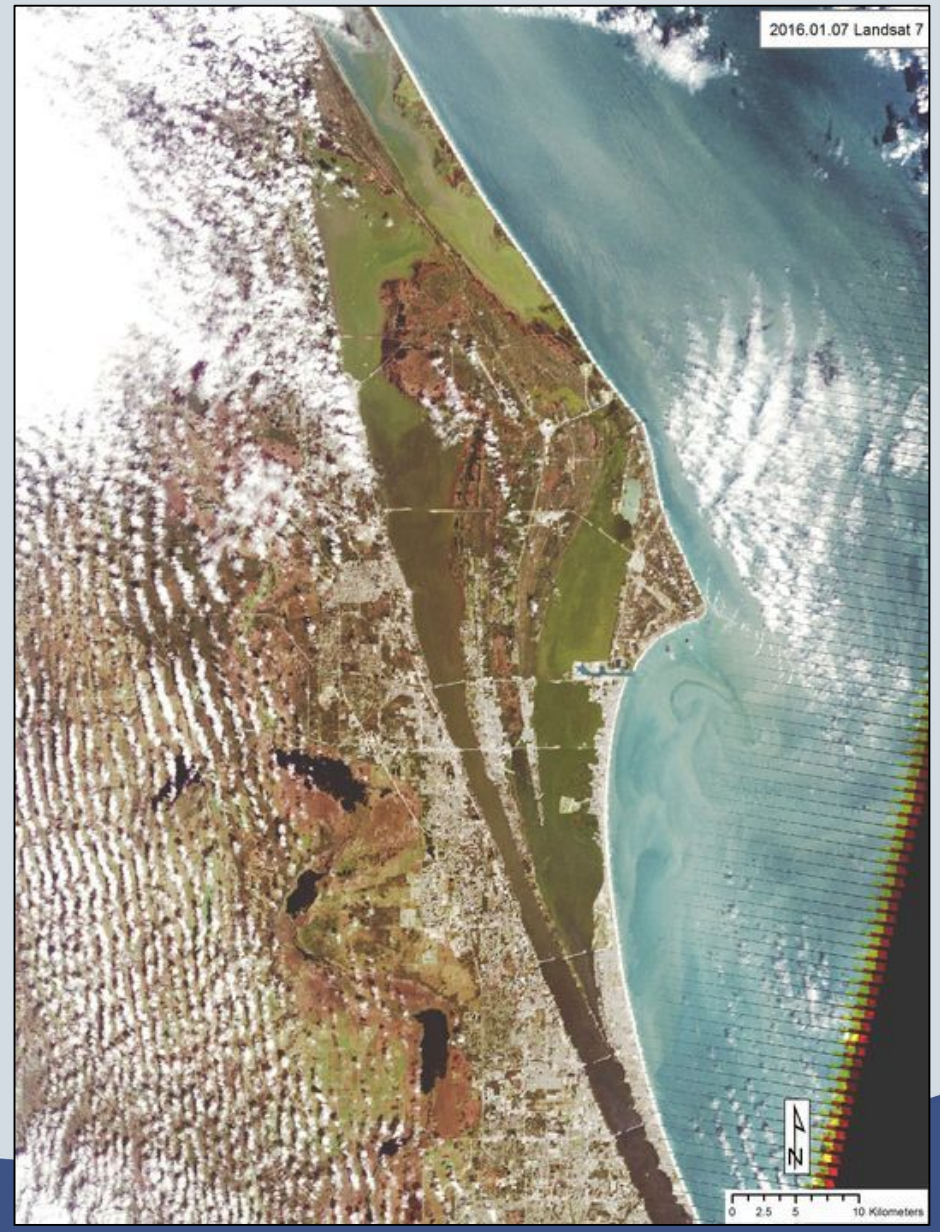
- Diverse HAB and wildlife health issues
- Annual *Pyrodinium* blooms
- Persistent brown tide
- Cyanobacterial blooms

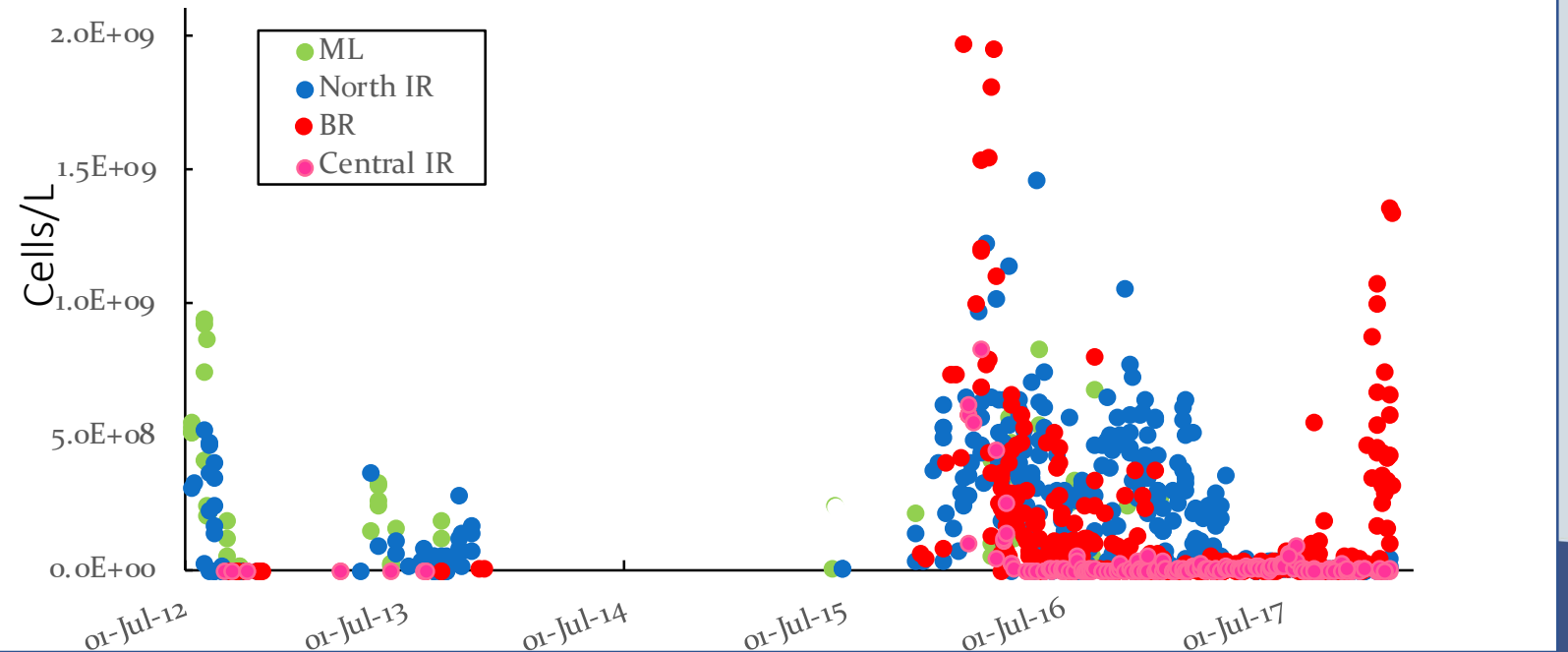


Brown tide

- Loss of seagrasses
- Bivalve mortality
- Fish kills (low DO)

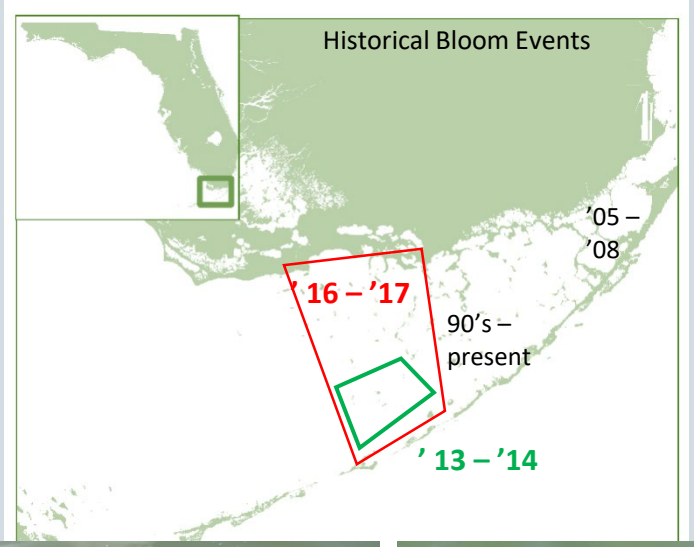


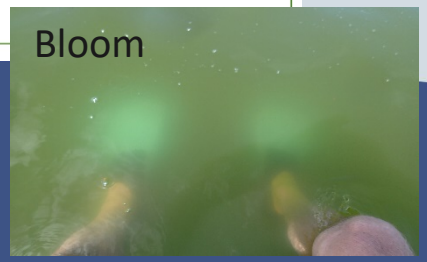




Marine Cyanobacteria

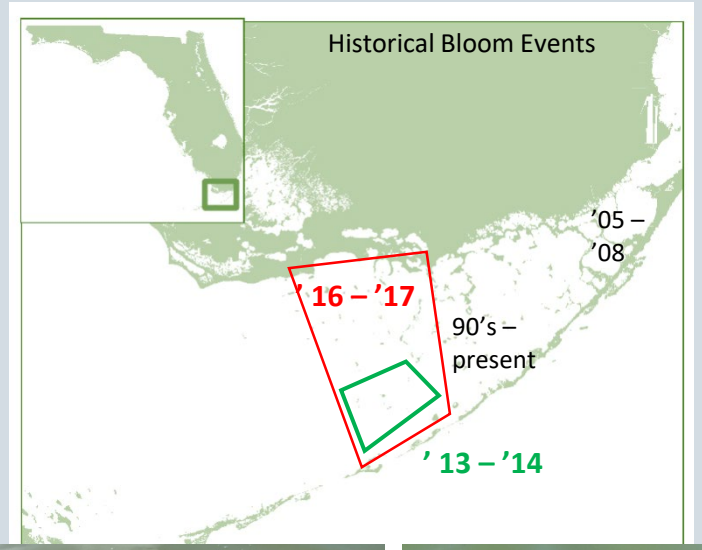
- *Synechococcus*

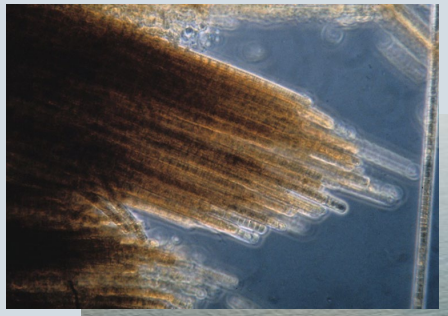


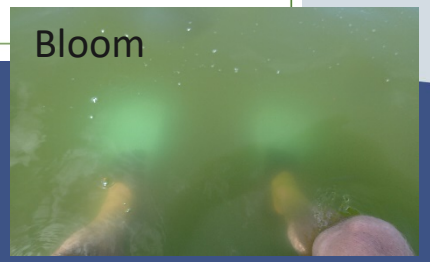


Marine Cyanobacteria

- *Synechococcus*
- *Trichodesmium*

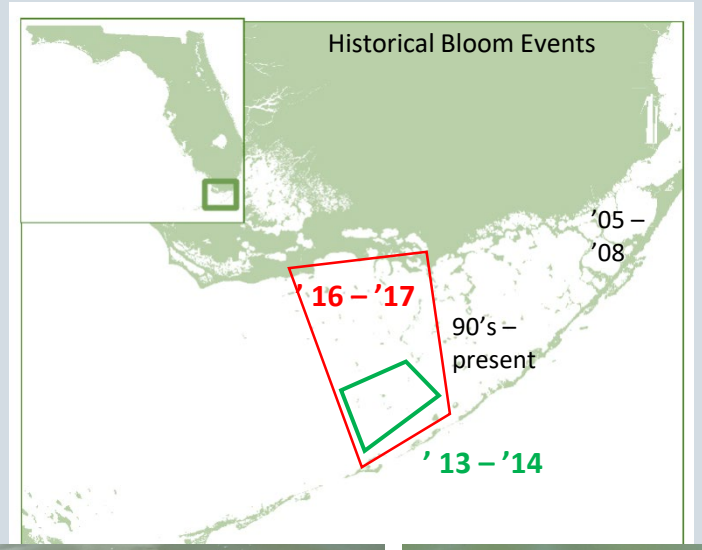


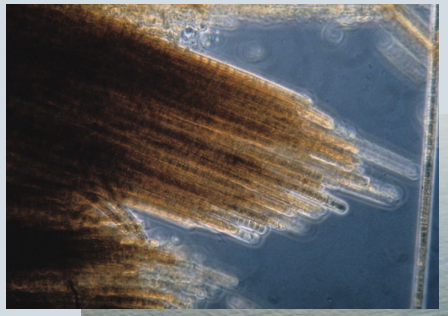


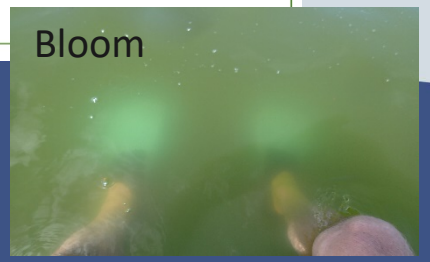


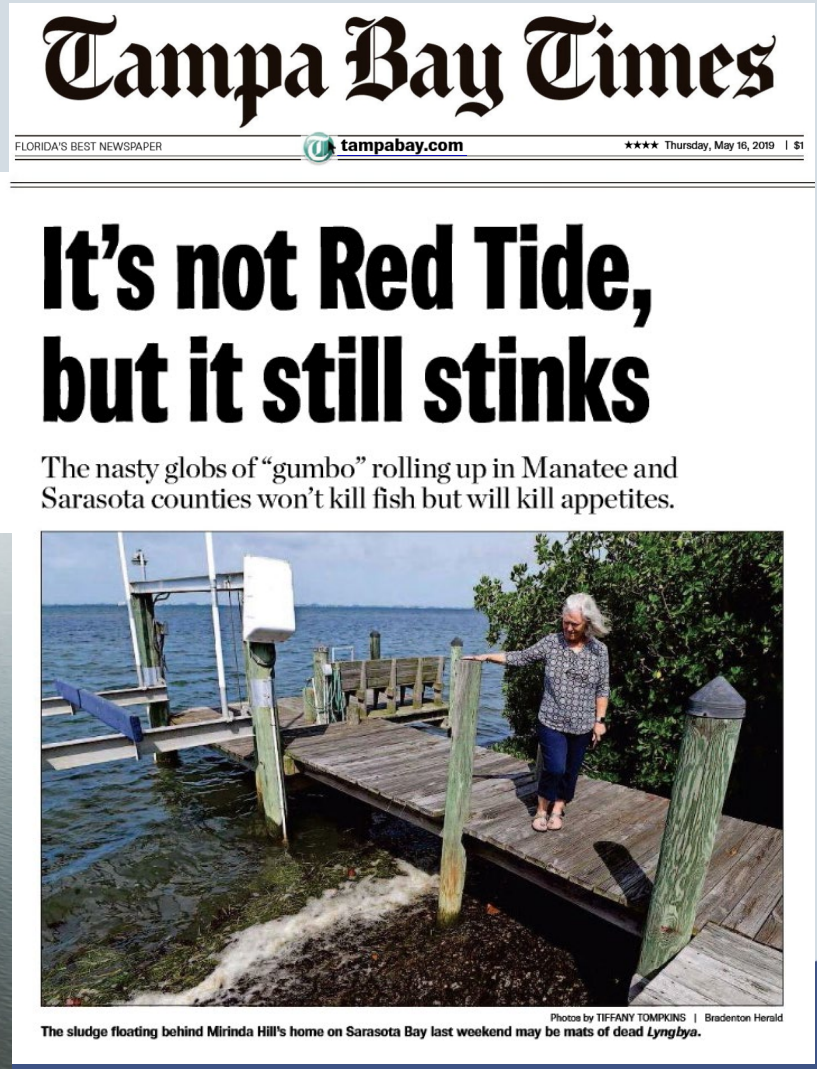
Marine Cyanobacteria

- *Synechococcus*
- *Trichodesmium*
- *Lyngbya* and *Lyngbya*-like spp.









Tampa Bay Times

FLORIDA'S BEST NEWSPAPER tampabay.com ★★★★ Thursday, May 16, 2019 | $1

It's not Red Tide, but it still stinks

The nasty globs of "gumbo" rolling up in Manatee and Sarasota counties won't kill fish but will kill appetites.

Photos by TIFFANY TOMPKINS | Bradenton Herald

The sludge floating behind Mirinda Hill's home on Sarasota Bay last weekend may be mats of dead *Lyngbya*.

Macroalgae

- Sargassum

Macroalgae

- Sargassum
- Red drift algae

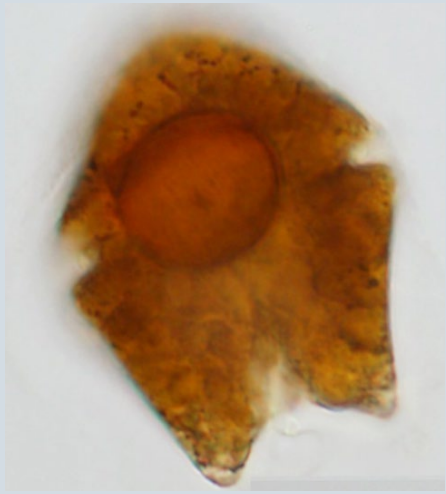

photo credit: Brian Cousin, HBOI


photo credit: sanibelseaschool.org

And others…

Chattonella marina

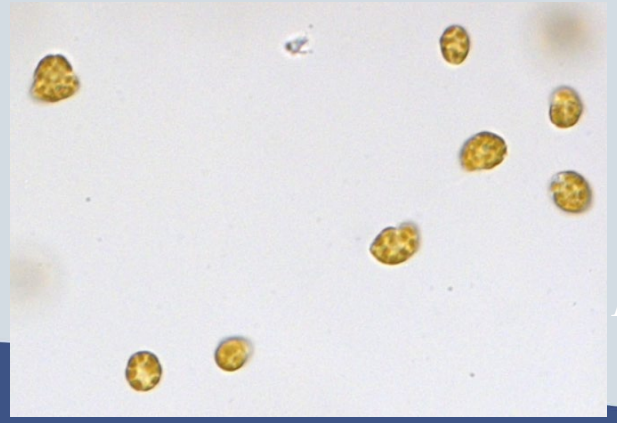
Protoperidinium crassipes



Akashiwo sanguinea

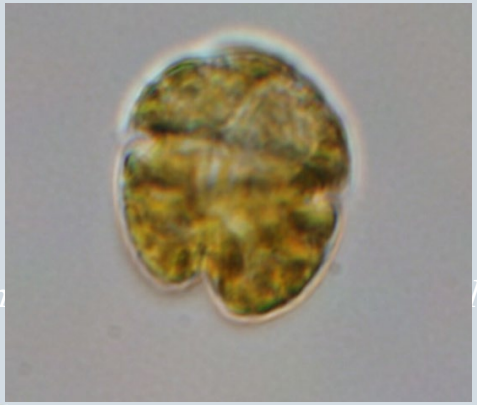
Prymnesium parvum

Fibrocapsa japonica

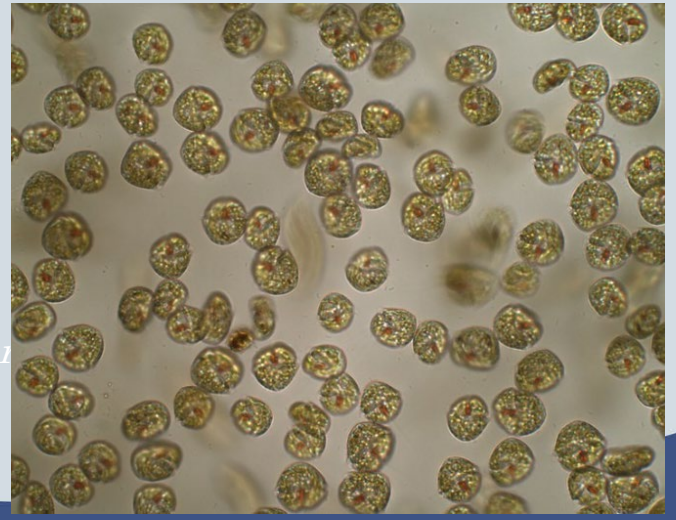


Heterosigma akashiwo

commons.wikimedia.org/wiki/File:CCMP452.jpg



Takayama tasmanica



Kryptoperidinium foliaceum