Responding to an Unanticipated Event:

How the Piney Point emergency discharge is reshaping future monitoring needs & collaborations in Tampa Bay

UF Water Institute Symposium: February 23rd, 2022

TBEP
TAMPA BAY ESTUARY PROGRAM
PARTNERSHIP FOR A HEALTHY BAY
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- TBEP Background & Nutrient Management Strategy
- 2021 Piney Point Emergency Discharge
- Chain of Events, Collaboration & Coordination
- Lessons Learned & Future Needs

Ed Sherwood
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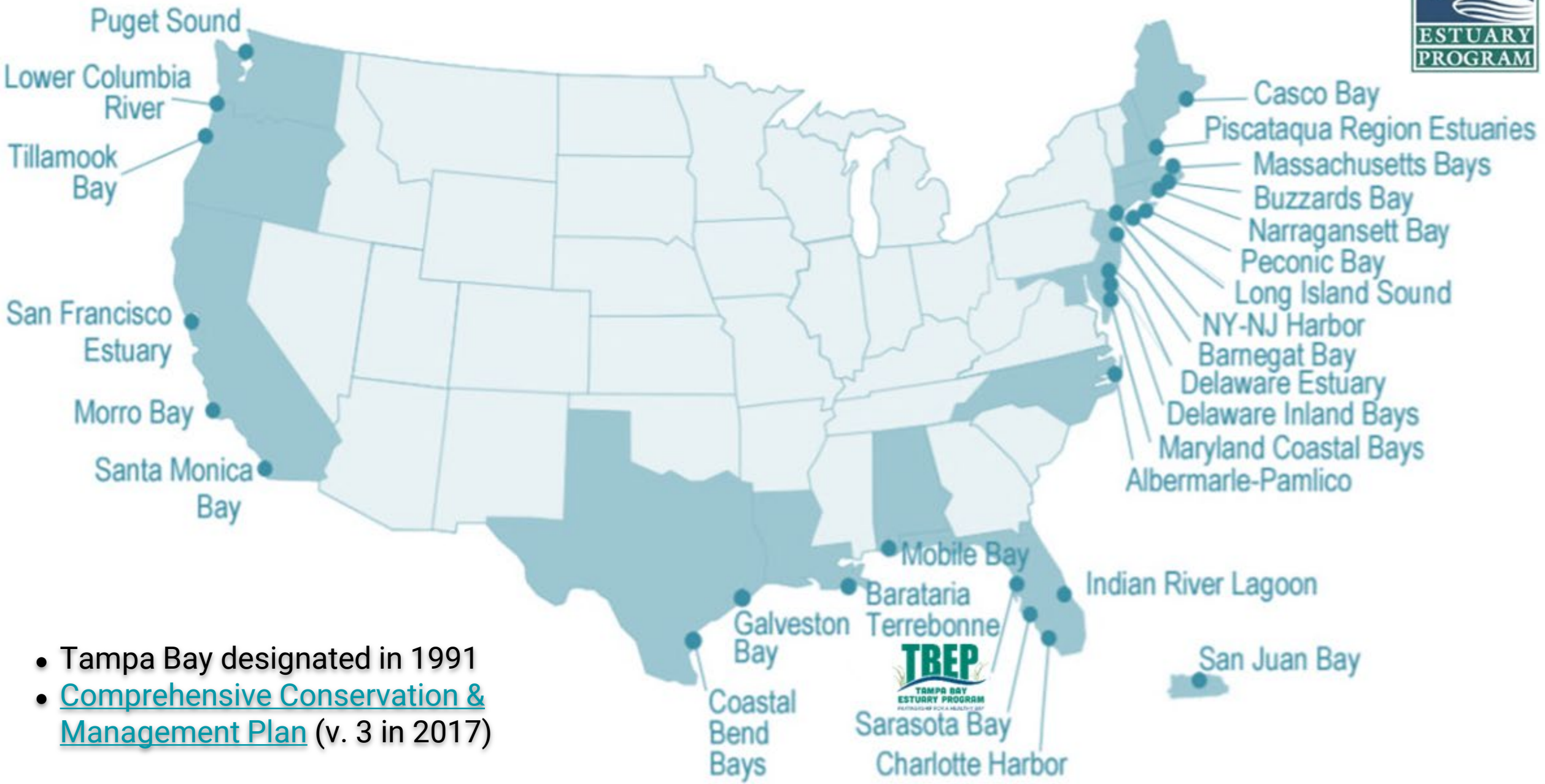
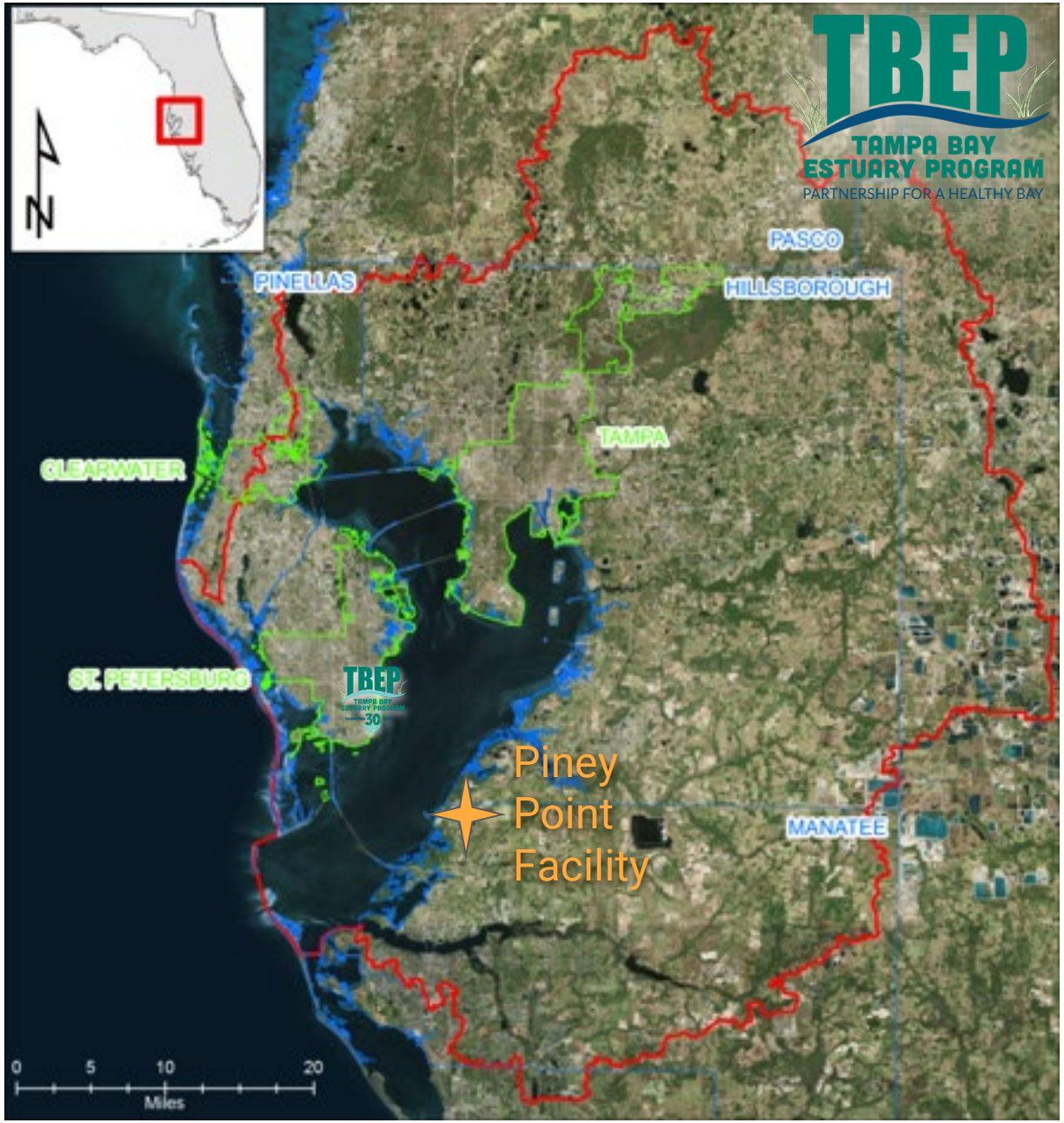
28 Estuaries of National Significance



- Tampa Bay designated in 1991
- [Comprehensive Conservation & Management Plan] (v. 3 in 2017)

Tampa Bay Estuary Program

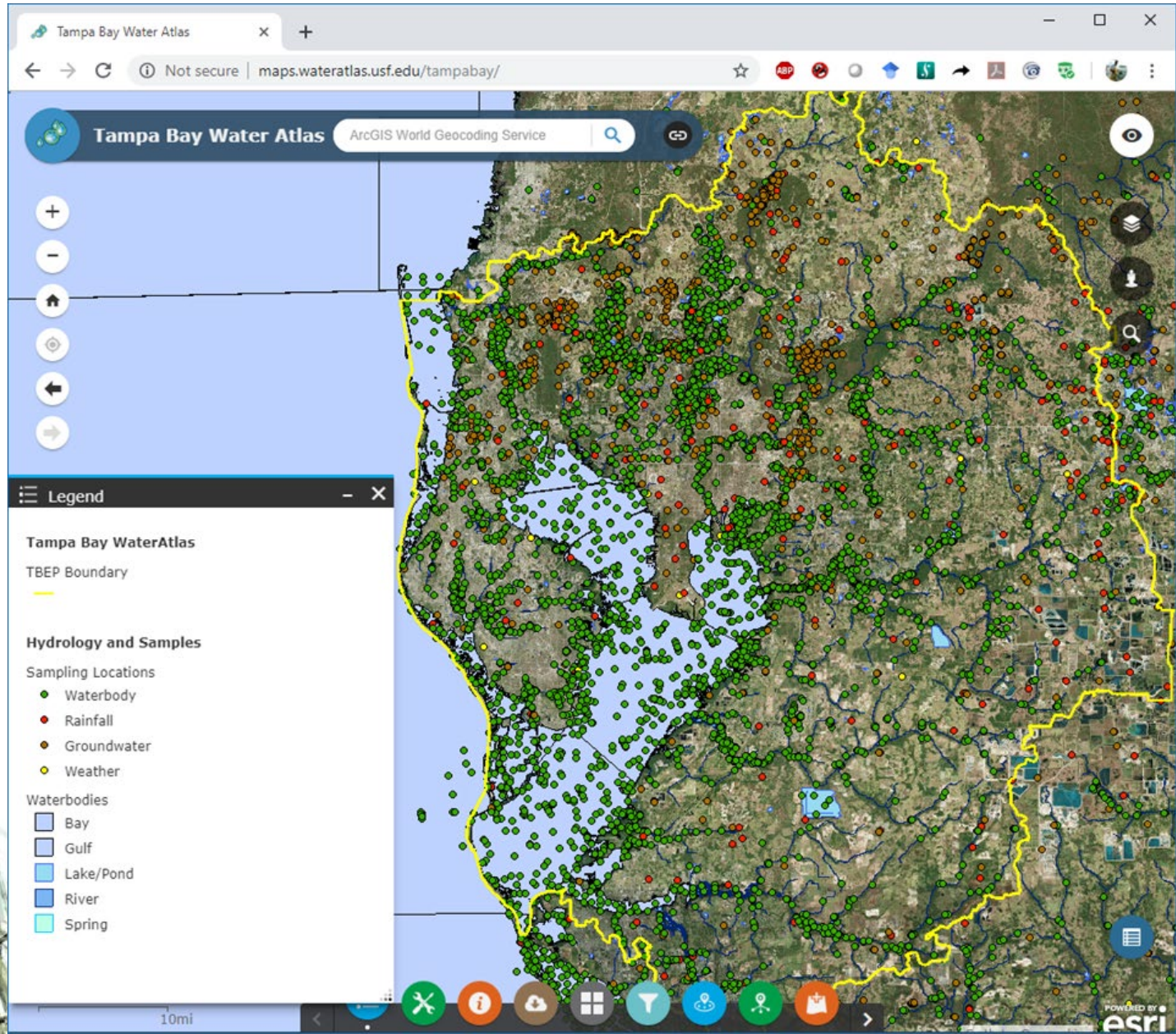
- Mission: Develop & foster partnerships to implement a science-based, management & restoration plan for the Tampa Bay estuary
- Comprehensive Conservation & Management Plan (v.3.0 in 2017; Interim Update in 2022)



Partner-Driven Monitoring Guides Management

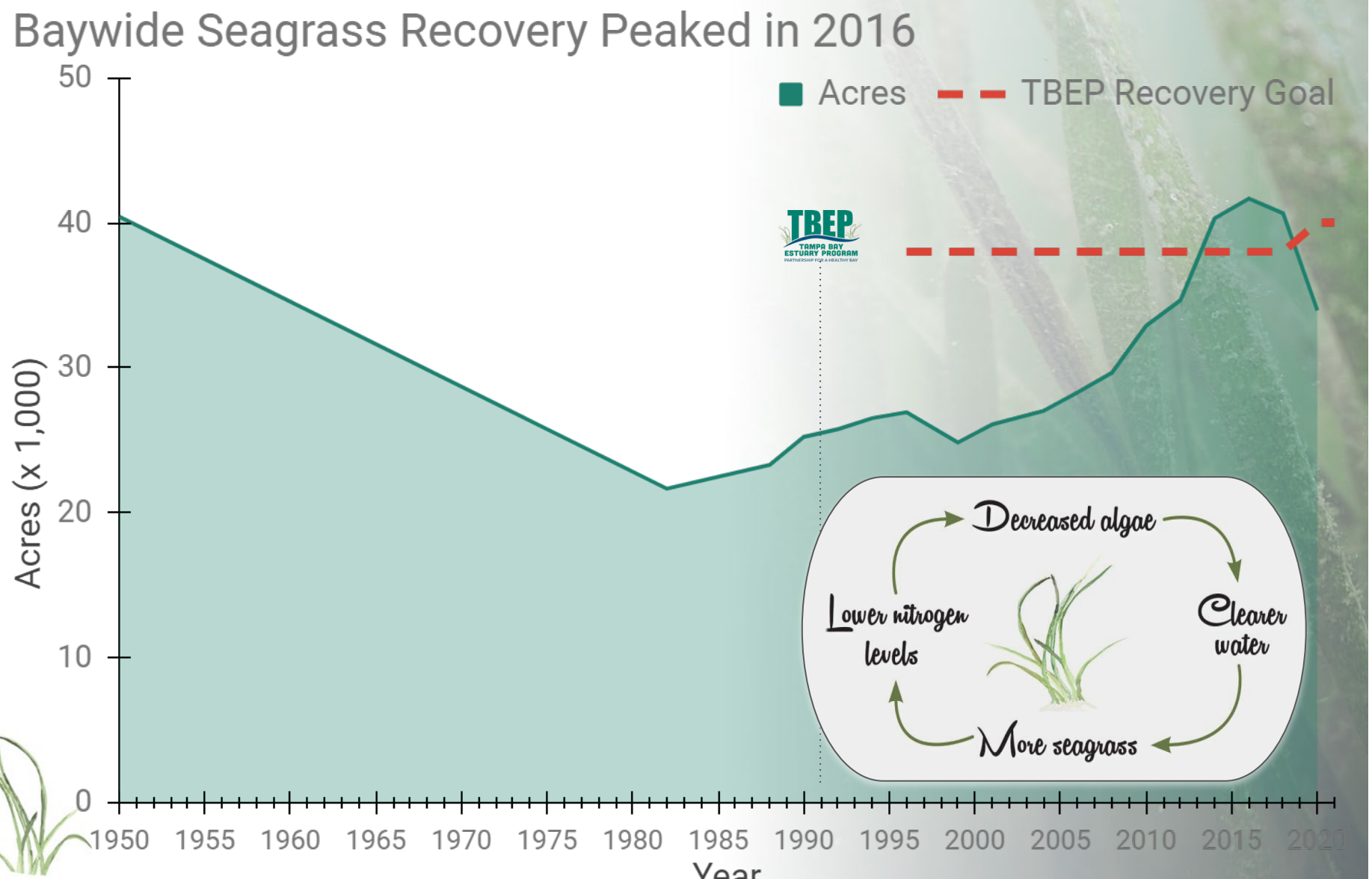
- 1970s to Mid-1990s
  - Long-term ambient water quality monitoring programs were critical to:
    - Establish early understanding of estuarine conditions
    - Develop initial recovery strategies

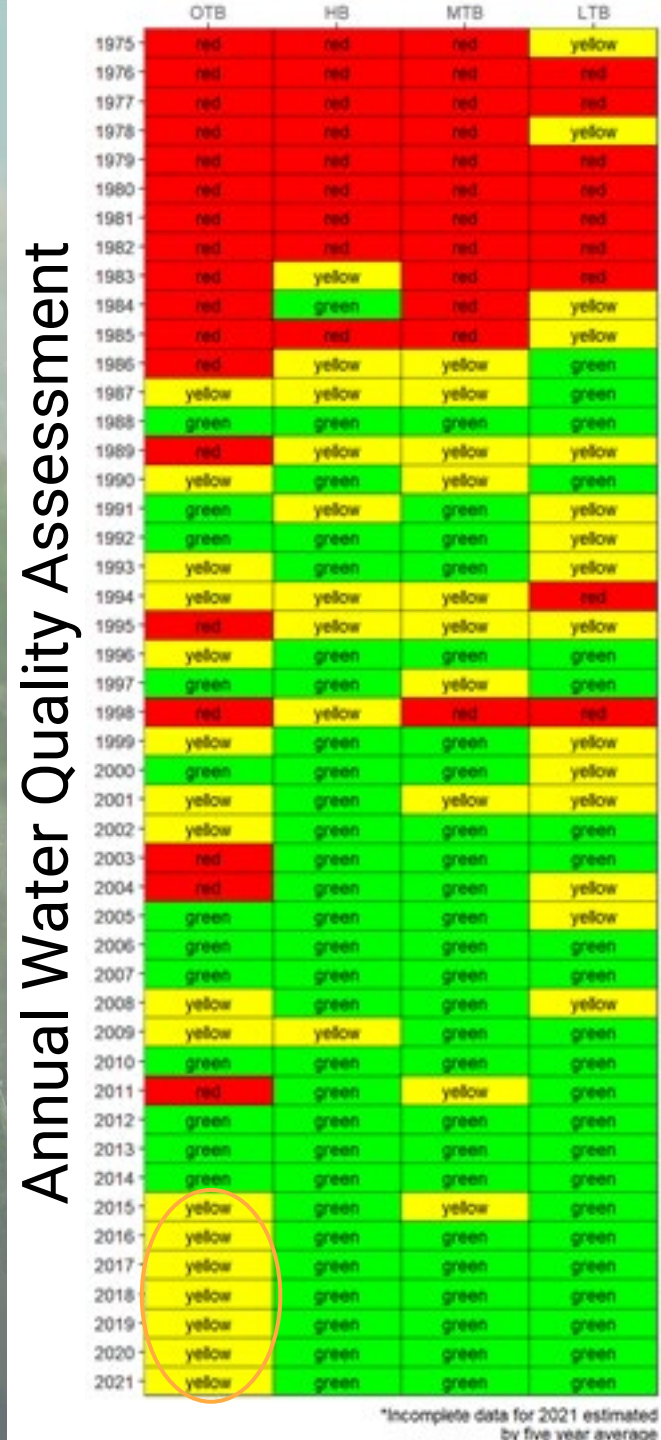
- Mid-1990s to Present
  - Expanding routine monitoring programs to fully understand the full scope of estuarine status and trends:
    - Benthic biota & sediment quality
    - Subtidal, emergent & upland habitats
    - Tidal tributary assessments
    - Coastal acidification trends



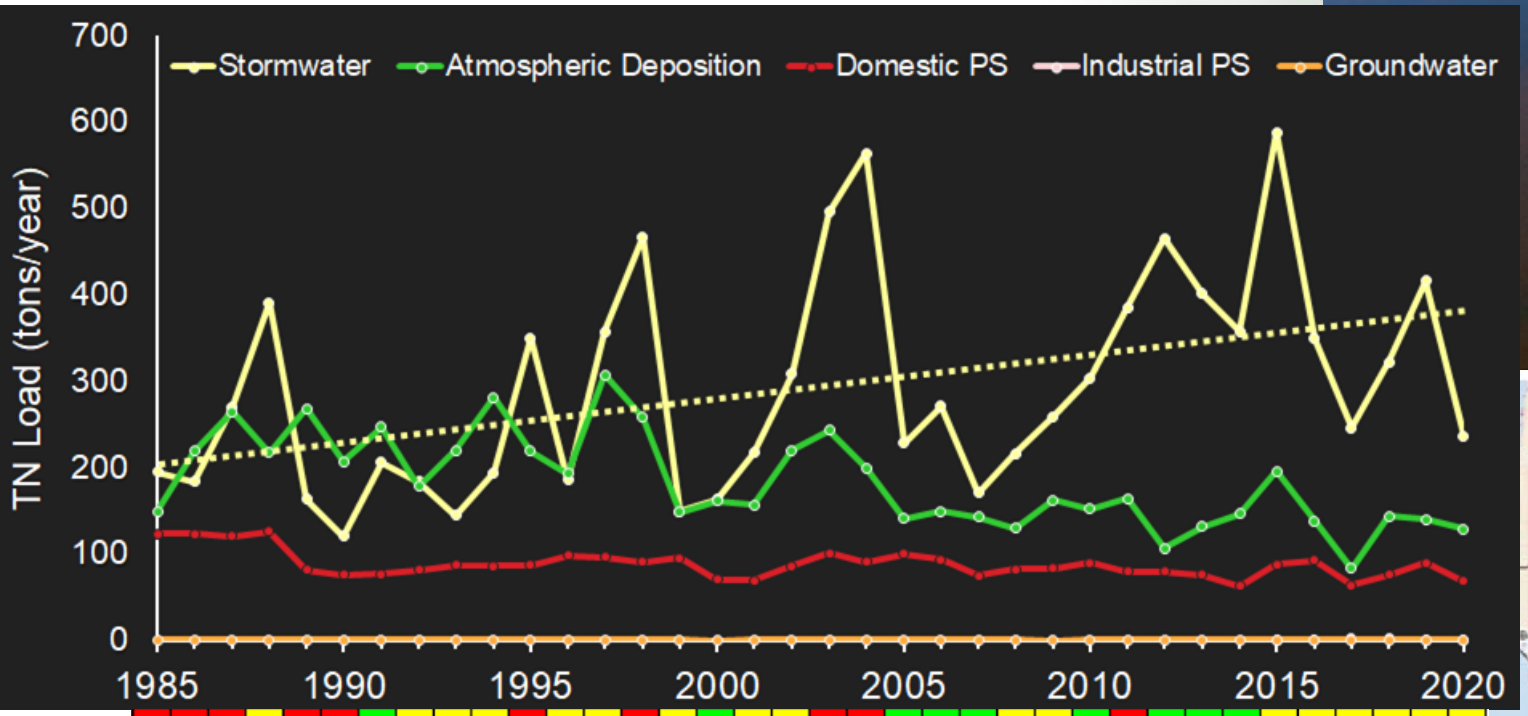
Primary Recovery Goal:

Restore & Sustain Seagrass at Historic Levels





Old Tampa Bay:
Recovery Focal Area (prior to Piney Point)



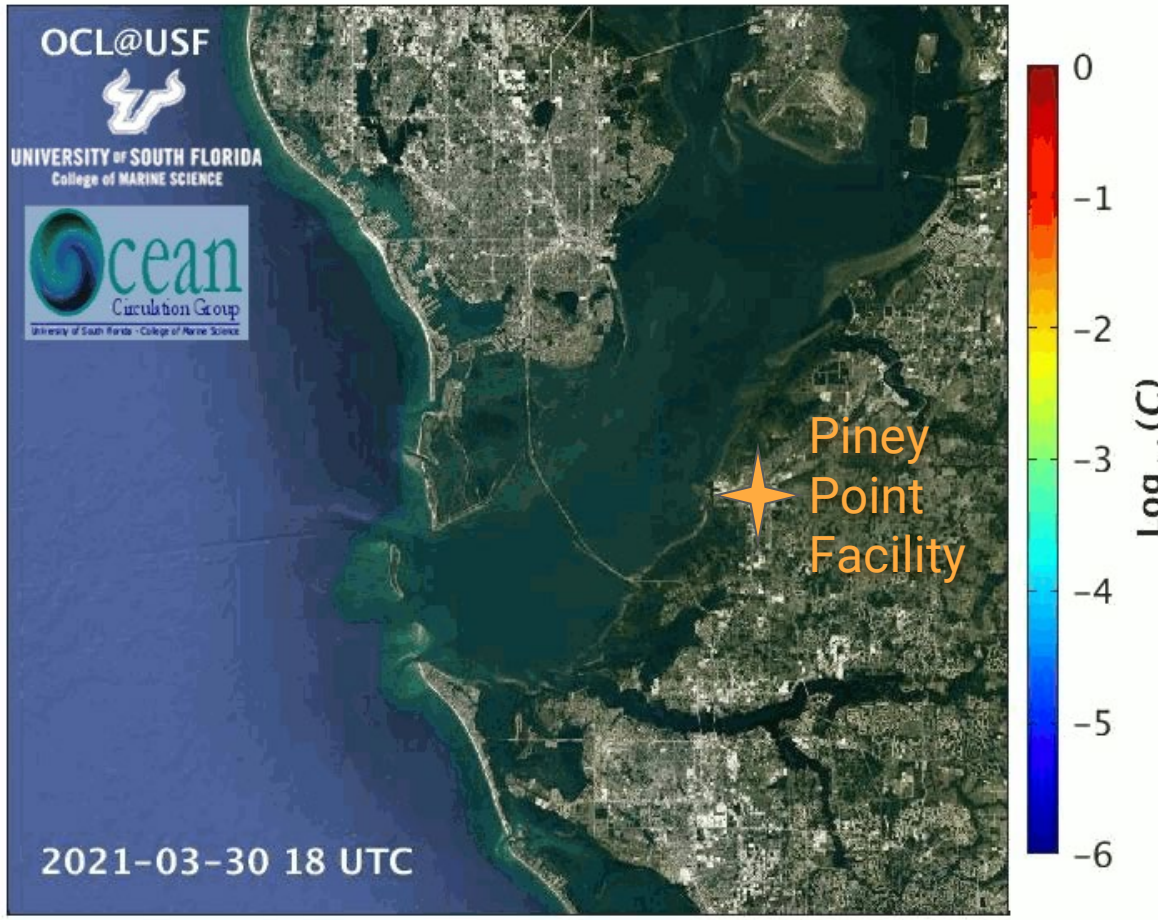
1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Red	Red	Red	Yellow	Red	Red	Green	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Red	Yellow	Green	Yellow	Yellow	Red	Red	Green	Green	Green	Yellow	Yellow	Green	Red	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

Tampa Bay

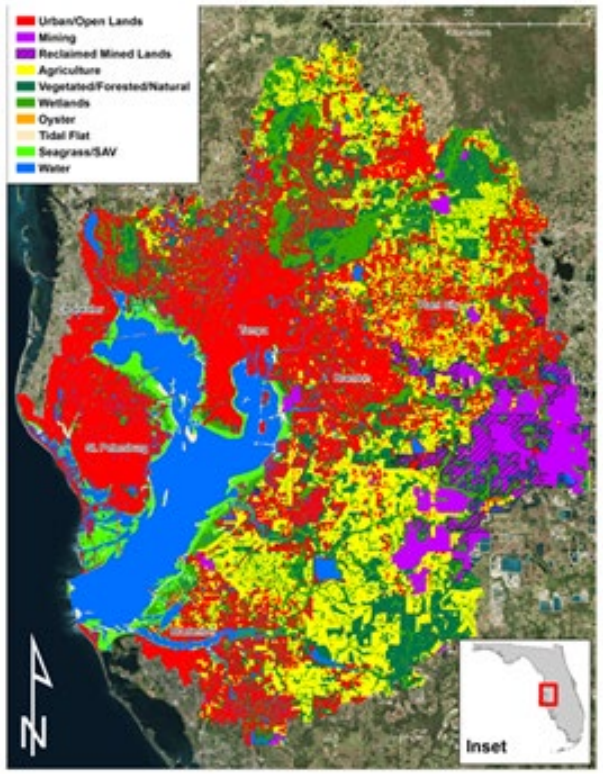
Segments	2018	2020	Δ Acres	% Change
Boca Ciega Bay	9,204	8,799	-405	-4%
Hillsborough Bay	1,464	837	-627	-43%
Lower Tampa Bay	7,953	7,888	-65	-1%
Manatee River	719	570	-149	-21%
Middle Tampa Bay	9,436	8,424	-1,012	-11%
Old Tampa Bay	10,741	6,701	-4,040	-38%
Terra Ceia Bay	1,134	1,079	-55	-5%
Tampa Bay Total	**40,651**	**34,298**	**-6,353**	**-16%**

Piney Point: Poses Interim & Longer-Term Concerns for Recovery

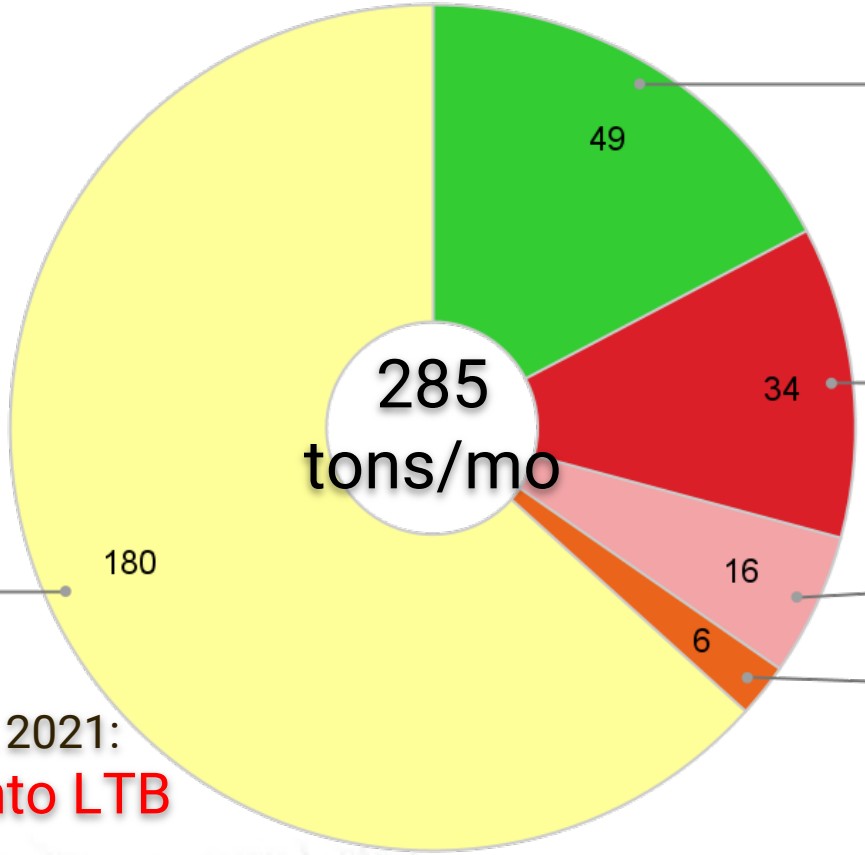
- Ammonium concentrations >200 mg/L; **205 Tons TN**
- Phytoplankton & macroalgal stimulation (harmful algal blooms) during growing season
- Cockroach Bay, Terra Ceia & Pinellas County Aquatic Preserves
    - Seagrass shading effects
    - Hypoxia and anoxia concerns (low oxygen)
    - Broader fish & wildlife impacts



Piney Point Represented a Significant N Load to LTB



Average Monthly TN Load (tons) by Major Source (2010 -2019)



Atmospheric Deposition
17.3%

Domestic Point Sources
11.9%

Industrial Point Sources
5.4%

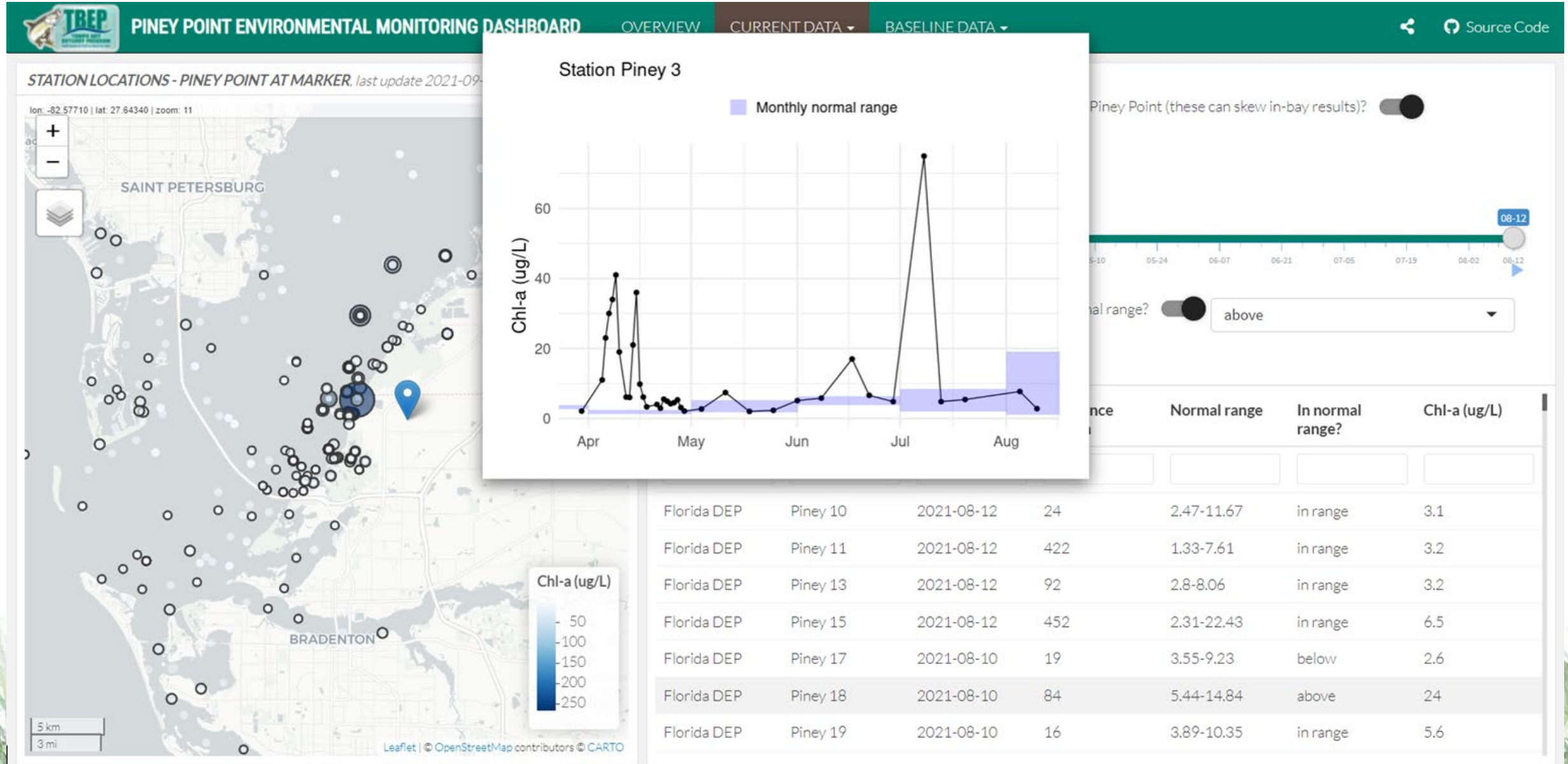
Groundwater Sources
2.1%

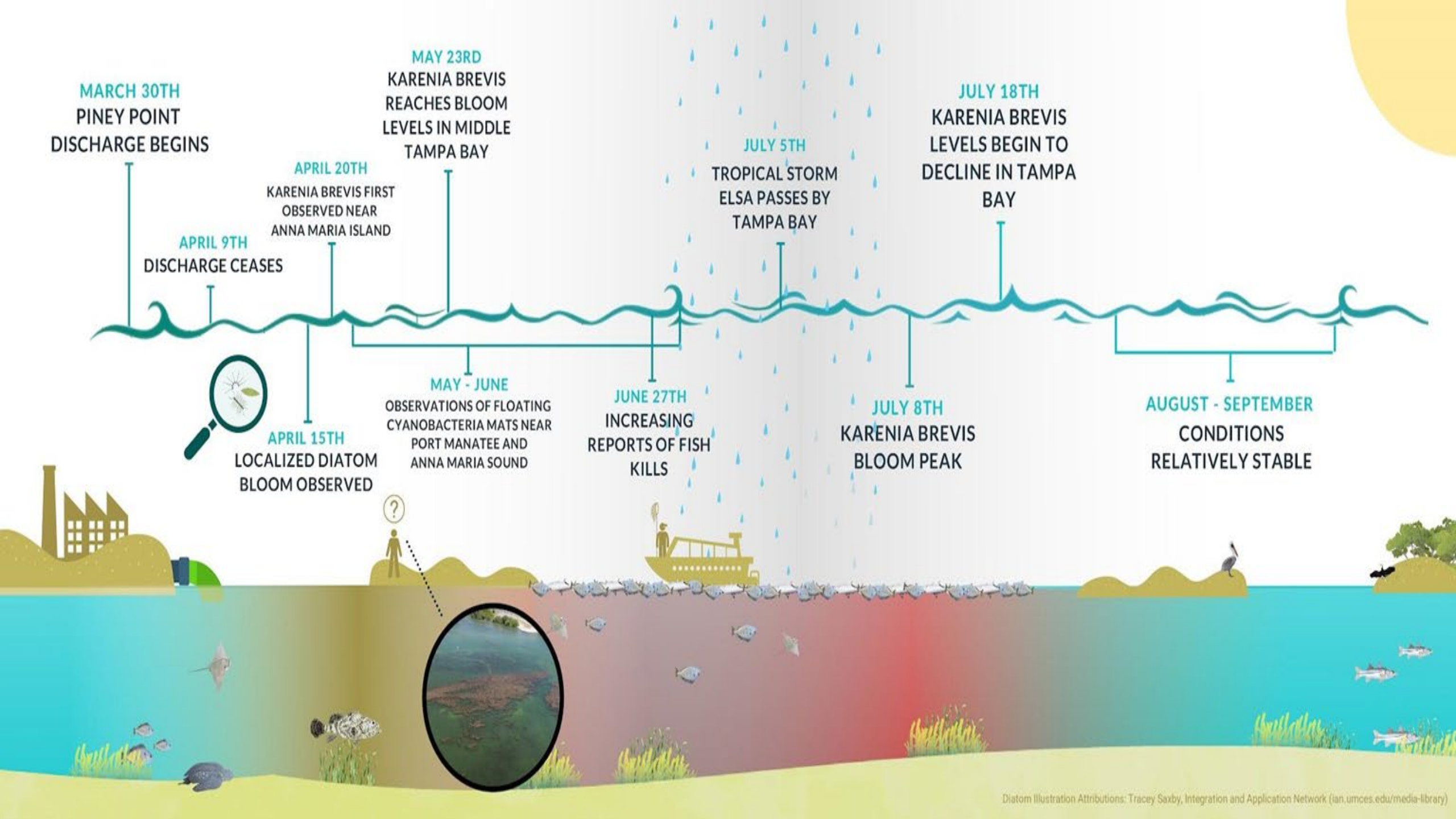
Stormwater
63.3%

Piney Point Emergency Discharge March 30 – April 9, 2021:
215 MGal Process-SW Mix ≈ 205 Tons TN load into LTB

Understanding & Comparing Recent Baselines …

Open Science Dashboard: shiny.tbep.org/piney-point




MARCH 30TH
PINEY POINT DISCHARGE BEGINS
APRIL 9TH
DISCHARGE CEASES
APRIL 20TH
KARENIA BREVIS FIRST OBSERVED NEAR ANNA MARIA ISLAND
APRIL 15TH
LOCALIZED DIATOM BLOOM OBSERVED
MAY 23RD
KARENIA BREVIS REACHES BLOOM LEVELS IN MIDDLE TAMPA BAY
MAY - JUNE
OBSERVATIONS OF FLOATING CYANOBACTERIA MATS NEAR PORT MANATEE AND ANNA MARIA SOUND
JUNE 27TH
INCREASING REPORTS OF FISH KILLS
JULY 5TH
TROPICAL STORM ELSA PASSES BY TAMPA BAY
JULY 8TH
KARENIA BREVIS BLOOM PEAK
JULY 18TH
KARENIA BREVIS LEVELS BEGIN TO DECLINE IN TAMPA BAY
AUGUST - SEPTEMBER
CONDITIONS RELATIVELY STABLE
?
Diatom Illustration Attributions: Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library)

Lessons Learned:

Monitoring Gaps Identified & Opportunities for Improvement

- Nutrient loading is the primary driver promoting instability, but other confounding factors can affect expression by HABs
- Unanticipated events can be a distraction (and $/time sink) from addressing more persistent issues
- Monthly/yearly ambient monitoring has served our long-term management purposes in the past, but Piney Point and more recent conditions highlighted weekly changes in the system
- Not all eutrophication indicators are easily (or consistently) monitored (e.g., macroalgae & seagrass)
- (Near) Real-time monitoring of nutrient levels and watershed inputs would have aided in response and assessment efforts
    - Now critical in longer-term management of dynamic estuaries facing continuing watershed and climate changes
- Consistent investments in natural and built infrastructure needed to address coastal eutrophication and longer-term ecosystem resilience in Florida's estuaries

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Thank you, any questions?

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#LOVE Tampa Bay

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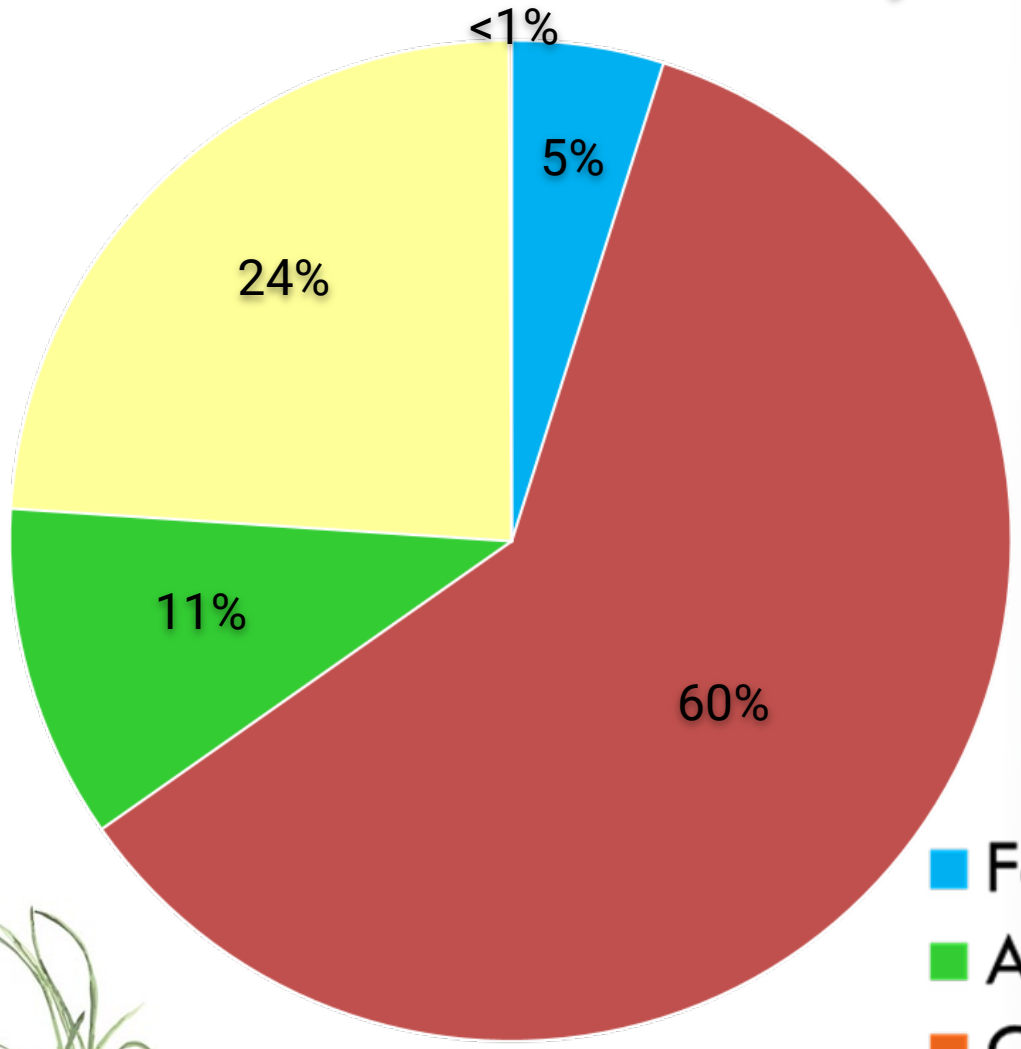
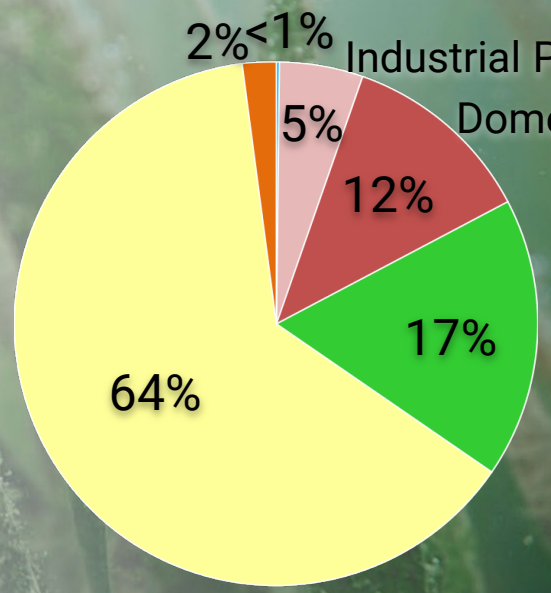
EXTRA SLIDES

Tampa Bay Coastal Nutrient Sources Have Been Reduced, Now Dominated by Stormwater/NPS Runoff

1970s: TN Load ~9900 tons/yr



2010-19: TN Load ~3400 tons/yr



- Fertilizer Losses
- Point Sources
- Atmospheric Deposition
- Nonpoint Sources
- GW & Springs

TAMPA BAY

NITROGEN MANAGEMENT CONSORTIUM

A PUBLIC - PRIVATE PARTNERSHIP

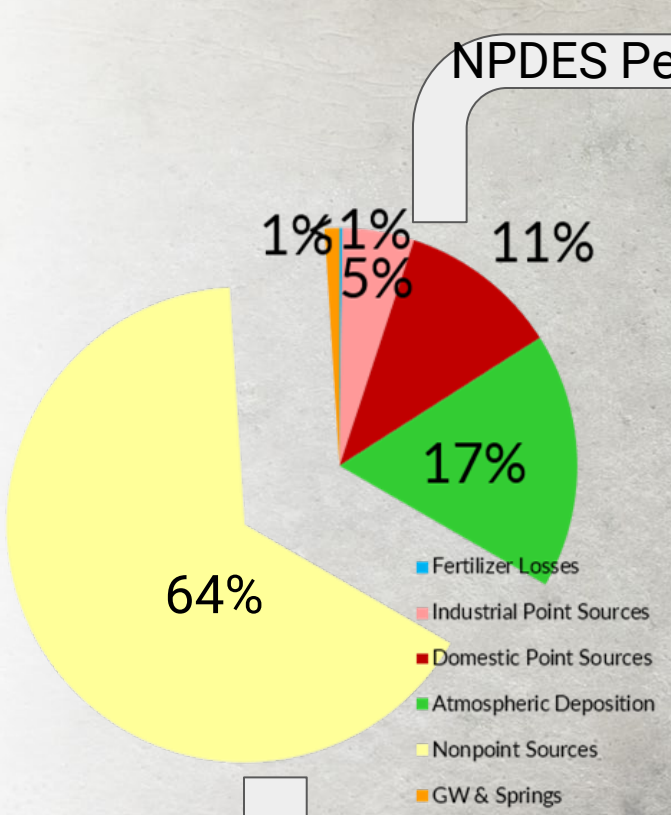
COASTAL & ESTUARINE RESEARCH FEDERATION

Nitrogen load responsibility fully allocated & capped in watershed

Final NMC Approved Document
September 11, 2009; Finalized addressing FDEP comments on January 22, 2010

Table IX-2: Proposed allowable, transferable nitrogen allocations for 2008-2012 for Hillsborough Bay. SW=Surface water discharge, RE=Reuse discharge.

Entity	Source	Proposed MS4 and Point Source Permit Limit (%)	TMDL Load (tons/year)
Hillsborough County	MS4	22.6%	235.6
	Point Source – Falkenburg SW		15.2
	Point Source – Falkenburg RE		2.8
	Point Source – South County SW		1.8
	Point Source – Valrico SW		5.6
	Point Source – Valrico RE		5.0
City of Lakeland	MS4	1.1%	10.9
	Point Source – Lakeland SW		20.0
	Point Source – Lakeland RE		0.2
City of Mulberry	MS4	0.2%	2.1
	Point Source – Mulberry SW		2.4
Pasco County	MS4	3.7%	38.4
	Point Source – Master Reuse System RE		5.8
City of Plant City	MS4	0.9%	9.2
	Point Source – Plant City SW		9.5
	Point Source – Plant City RE		1.0



Public Partners:

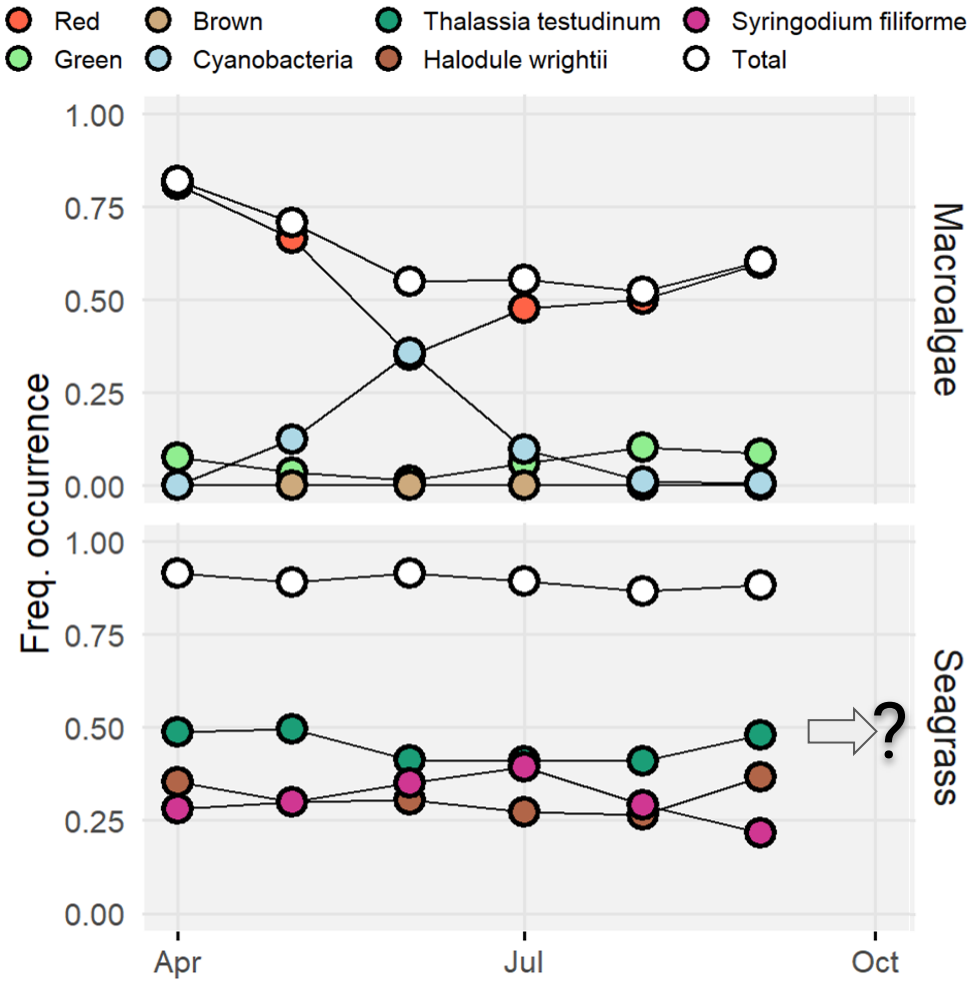
- Hillsborough County
- Manatee County
- Pinellas County
- Pasco County
- Polk County
- Sarasota County
- City of Tampa
- City of St. Petersburg
- City of Clearwater
- City of Palmetto
- City of Bradenton
- City of Largo
- City of Lakeland
- City of Oldsmar
- City of Gulfport
- City of Mulberry
- City of Plant City
- City of Safety Harbor
- SWFWMD
- US EPA
- FDEP
- FDACS
- FDOH
- FDOT
- MacDill AFB
- TBRPC
- Tampa Bay Water
- Tampa Port Authority
- EPC of Hillsborough County
- AEDC of Hills. County

Private Partners:

- Busch Entertainment
- Lowry Park Zoo
- Mosaic Co.
- CSX Transportation
- Florida Power & Light
- Tampa Electric Co.
- Kinder Morgan Bulk Term., Inc.
- Duke Energy
- Tropicana Products, Inc.
- Kerry I&F
- Trademark Nitrogen
- Yara N.A.
- Alafia Preserve, LLC
- Eagle Ridge, LLC
- LDC Donaldson Knoll Investments, LLC

Longer-Term Effects on Seagrass? Unknown, at this point

- Transect monitoring concluded
  - Preliminary results show resilience
- DISTRICT aerial seagrass coverage update anticipated this Winter 2021-22
- 2022 & Beyond:
  Re-focus efforts on baywide water quality improvements to support seagrass recovery



Sarasota Bay Estuary Program

Episodic events and coastal nutrient loads – How do we monitor for their impacts in Sarasota Bay?

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Substantial nutrient load increases in SW Florida

Tampa Bay (Pribble et al. 2001)

- 1995 to 1998 nitrogen loads were **2.7 times higher** than 1938

Sarasota Bay (Tomasko et al. 2005)

- 1990 nitrogen loads were **2.5 times higher** than 1890

Lemon Bay (Tomasko et al. 2001)

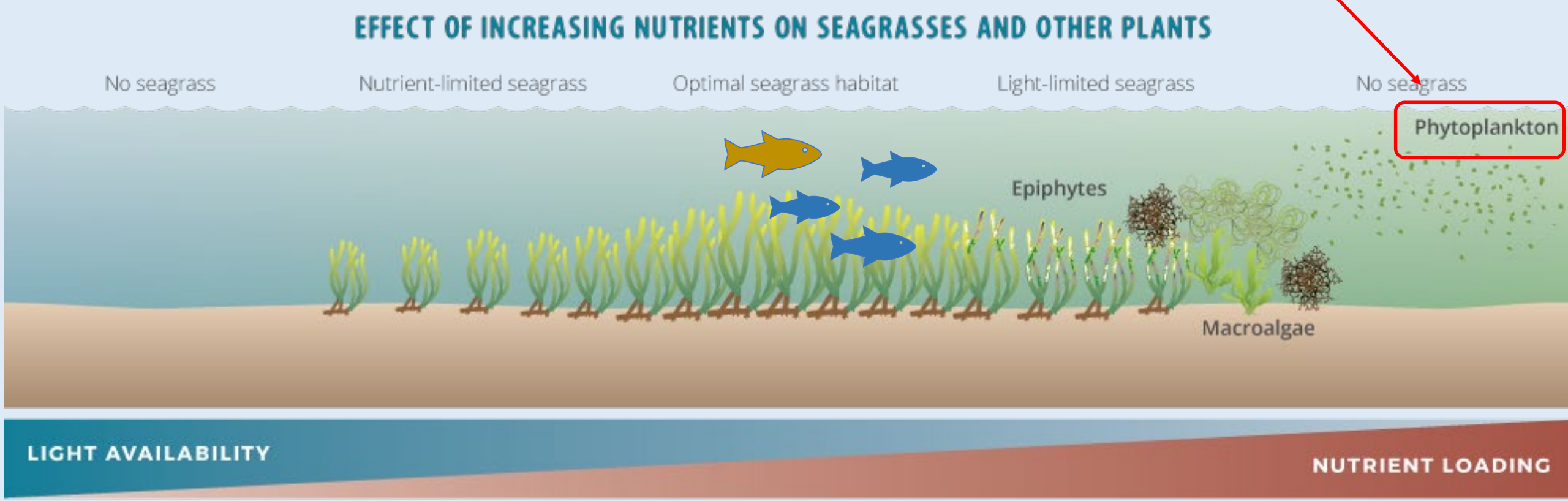
- 2000 nitrogen loads were **2.5 times higher** than in 1850

Charlotte Harbor (Turner et al. 2006)

- 2000 nitrogen loads were **3 times higher** than in 1800s

Sarasota Bay is sensitive to nitrogen loads

Only the water column has to be measured to determine “health”



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

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Sarasota Bay Report Card

Multiple indicators of levels of ecosystem health

- **Seagrass coverage**
- **Total Nitrogen**
- **Chlorophyll-a (phytoplankton)**
- **Macroalgae abundance**

Includes a "reference period" of 2006 to 2012

- **28% increase in seagrass coverage**
- **Lower levels of nitrogen**
- **No bay segment impaired for chlorophyll-a**
- **No bay segment with excessive macroalgae**

Report Card for Sarasota Bay

Year	Palma Sola	Upper Bay	Roberts	Little Sarasota	Blackburn
2006	3.67	3.50	3.50	3.75	3.75
2007	3.00	3.25	4.00	3.75	3.75
2008	3.67	3.00	3.00	3.25	3.25
2009	3.67	3.25	3.25	3.50	3.00
2010	3.67	3.75	3.00	2.75	2.75
2011	4.00	3.50	3.00	2.75	2.50
2012	3.00	3.25	3.25	3.00	3.25
2013	3.67	3.00	2.50	2.25	2.25
2014	4.00	3.50	2.50	2.50	2.25
2015	3.67	3.25	2.00	2.25	2.00
2016	3.67	2.75	1.75	2.00	2.25
2017	3.67	2.50	2.00	2.25	2.00
2018	4.00	2.50	2.00	1.50	1.75
2019	3.67	3.00	3.25	1.75	1.75
2020	3.67	3.00	3.00	2.25	2.25

Five bay segments, four management scenarios

Palma Sola Bay

- Continue to monitor, but likely no change needed

Upper Sarasota Bay

- Impact likely from 2018 red tide, but water quality has recovered

Roberts Bay

- Degraded conditions start in 2013, but evidence of recent recovery

Little Sarasota and Blackburn Bays

- Degraded conditions start around 2013, not *as much* evidence of recent recovery as in Roberts Bay

Bay-wide, seagrass coverage is lowest in over a decade

(22% decline since 2016)

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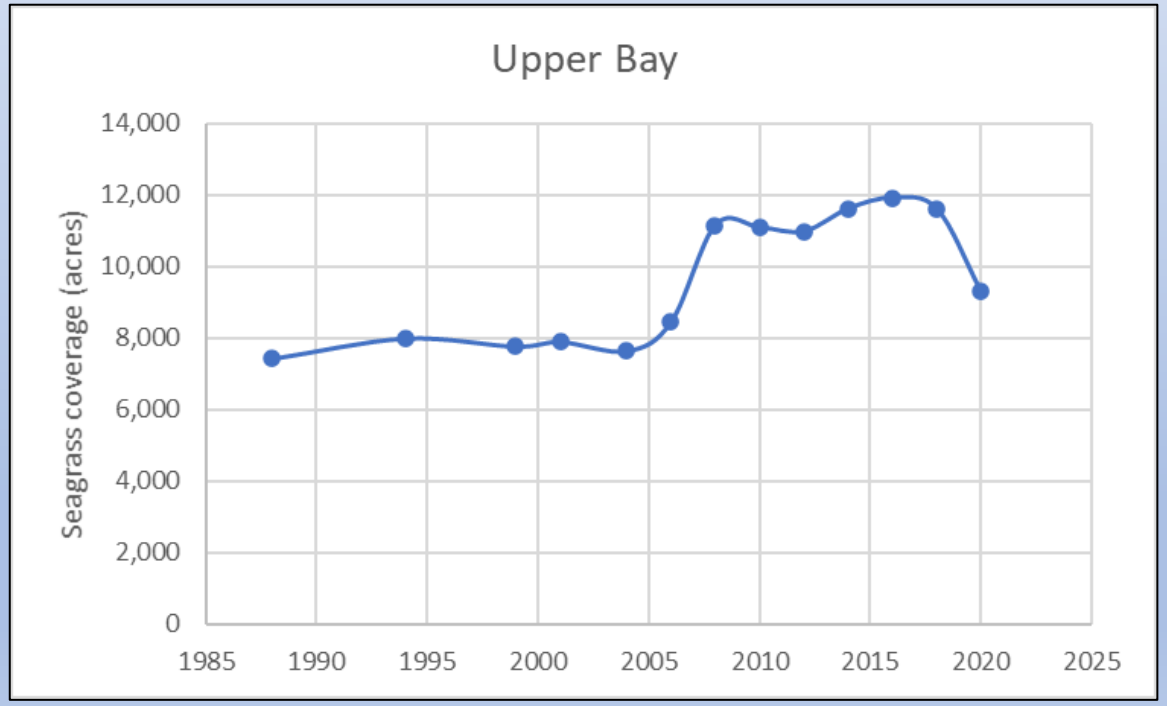
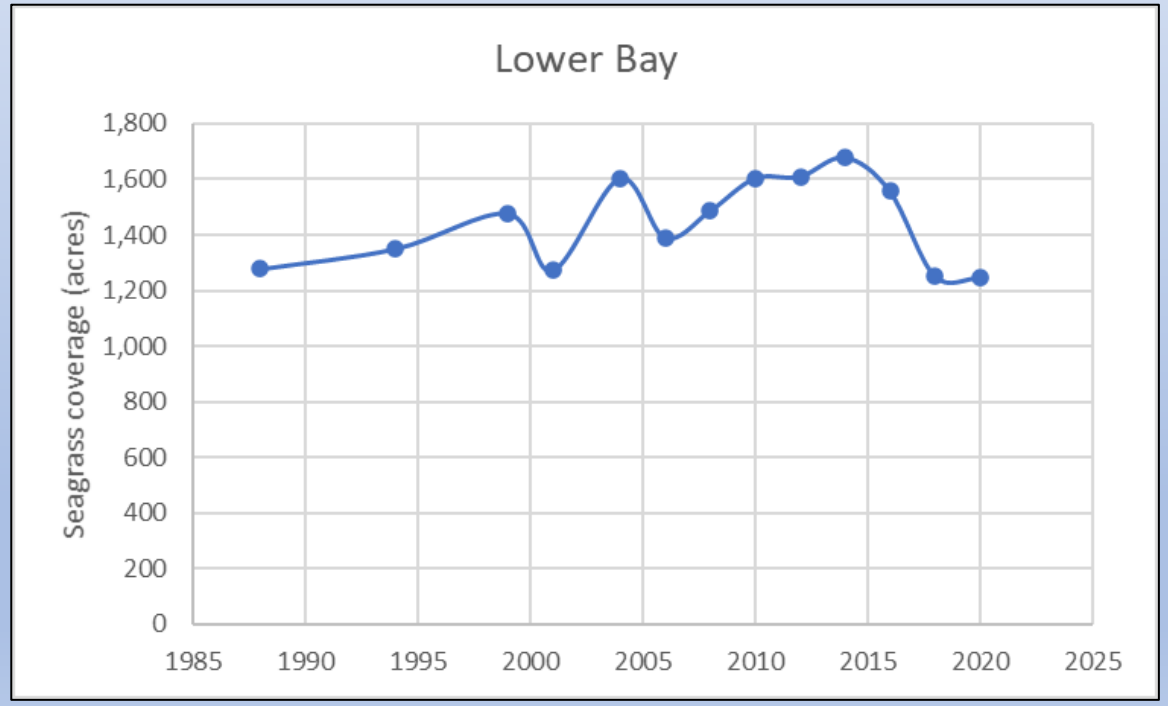
But seagrass patterns reflect different phenomena in different regions





In Upper Bay, biggest recent losses are in areas where water quality has historically been quite good

Potential management paradigm for seagrass loss in Upper Bay

Strong red tide during summer to fall of 2016

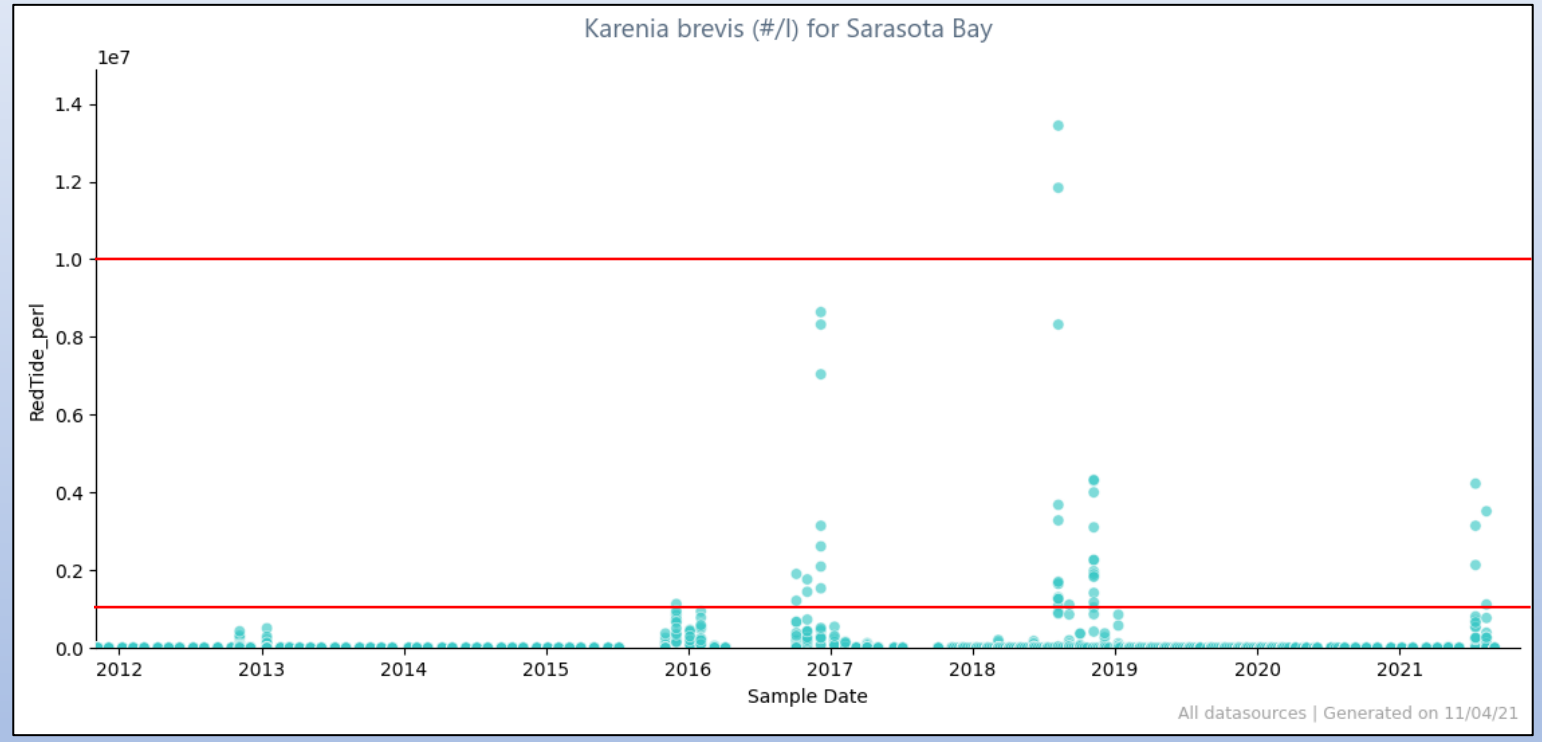
- Reduced water clarity with warm water

Hurricane Ima in 2017

Very strong red tide during summer to fall of 2018

- Reduced water clarity with warm water

In Upper Bay, *K. brevis* peaks in summer into fall of 2016 and 2018



Detailed *K. brevis* maps from New College - highest values in same area as seagrass loss

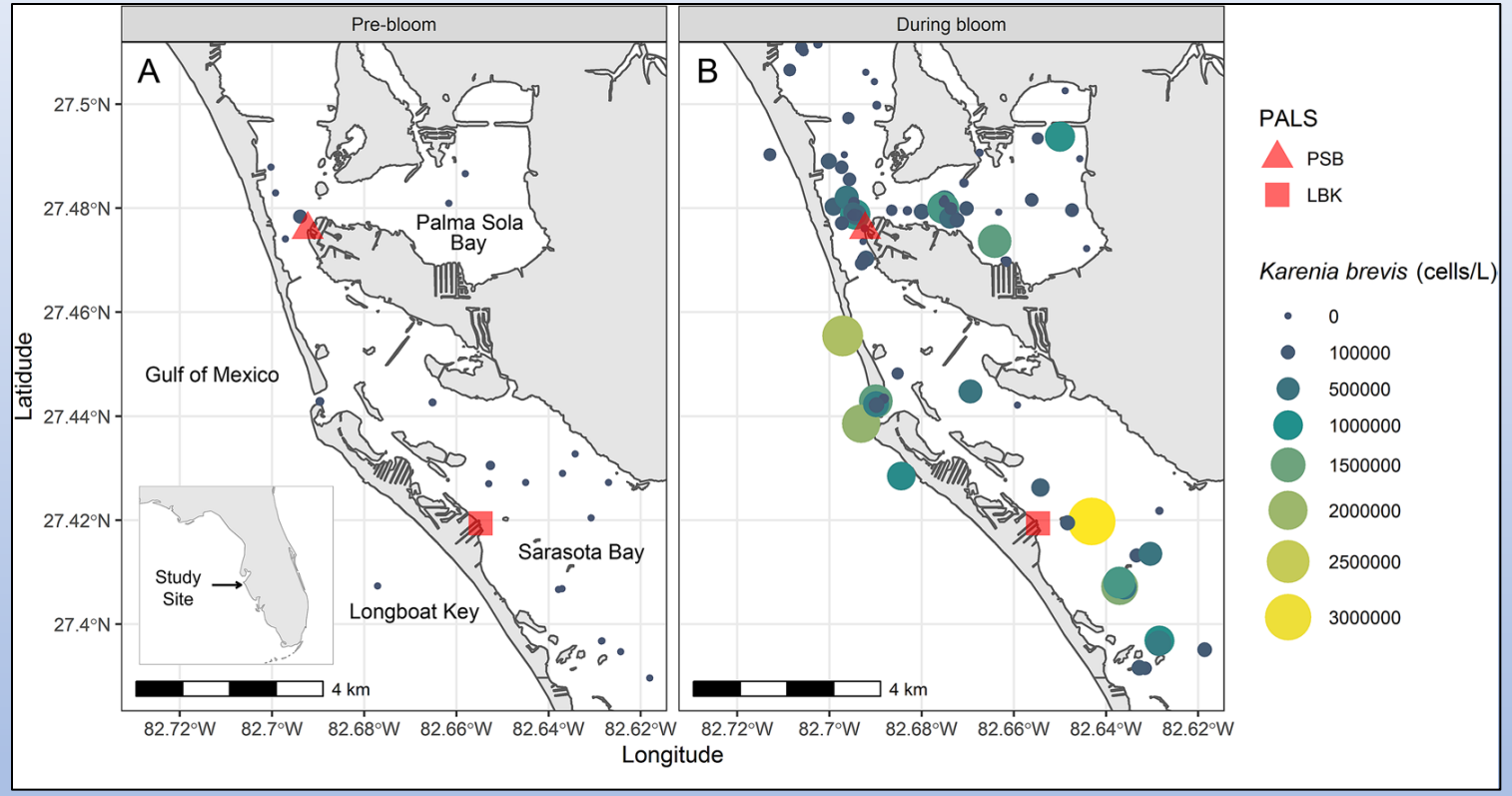


Figure from Rycyk et al. (2020)

Substantial impacts to fish populations

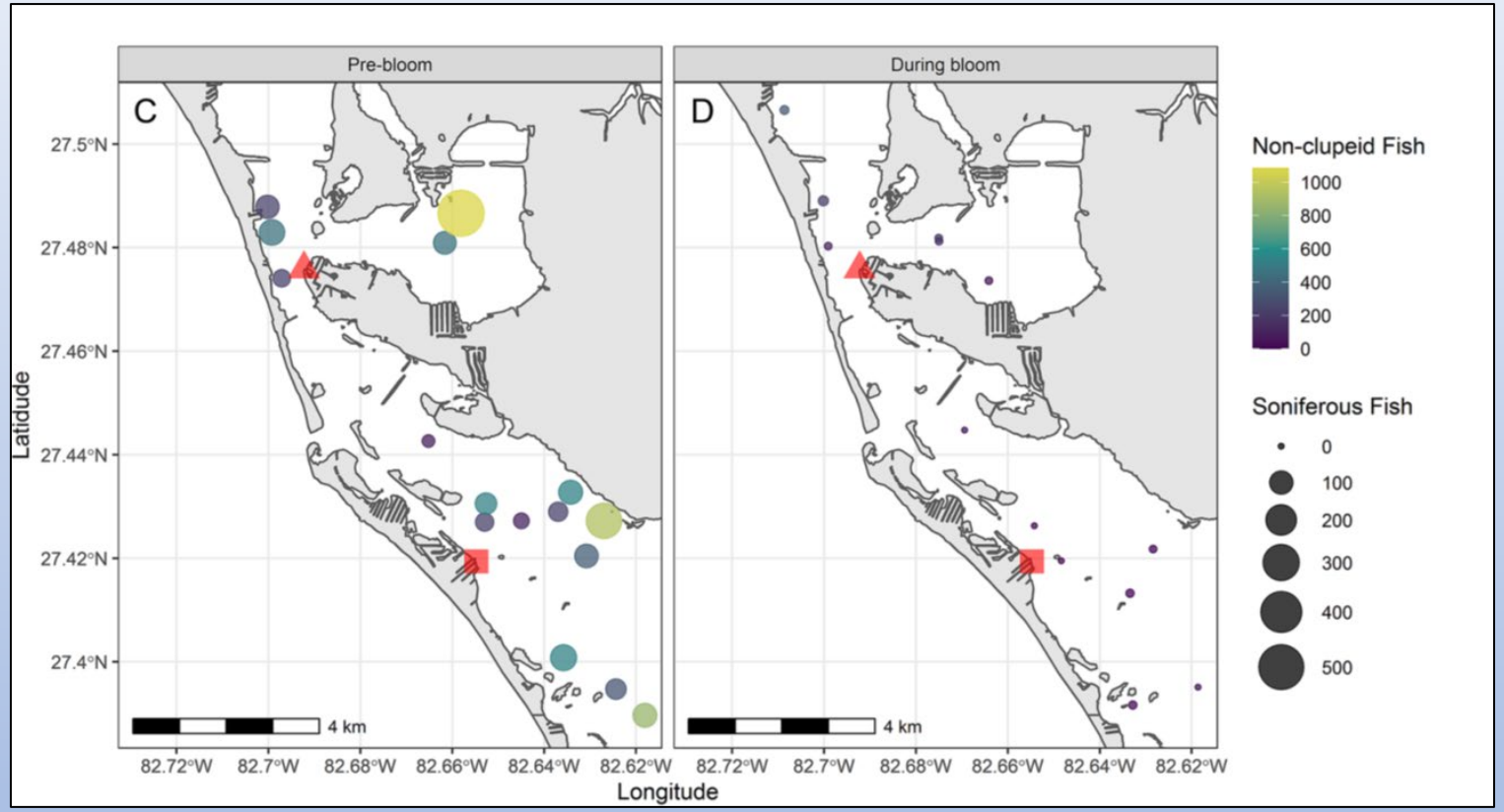
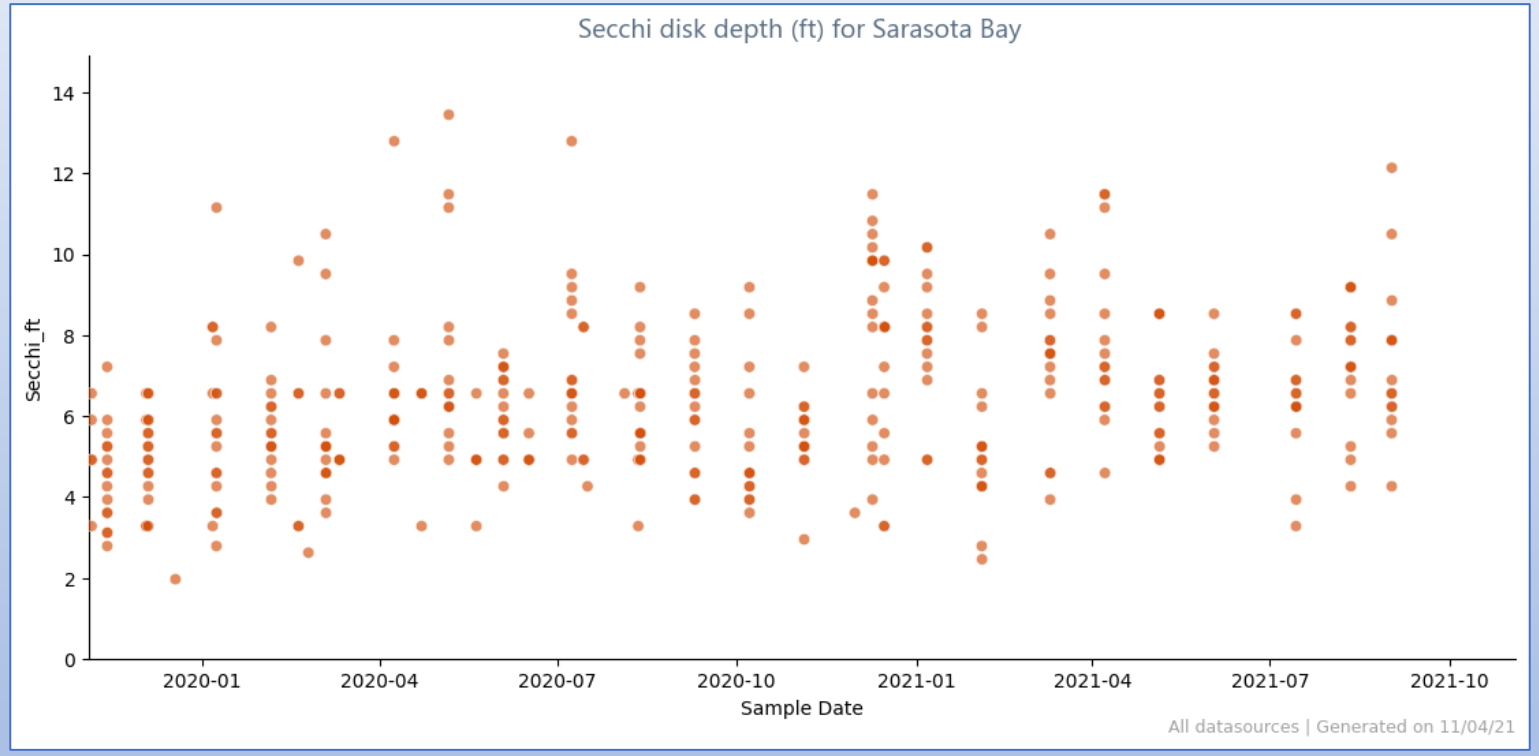


Figure from Rycyk et al. (2020)

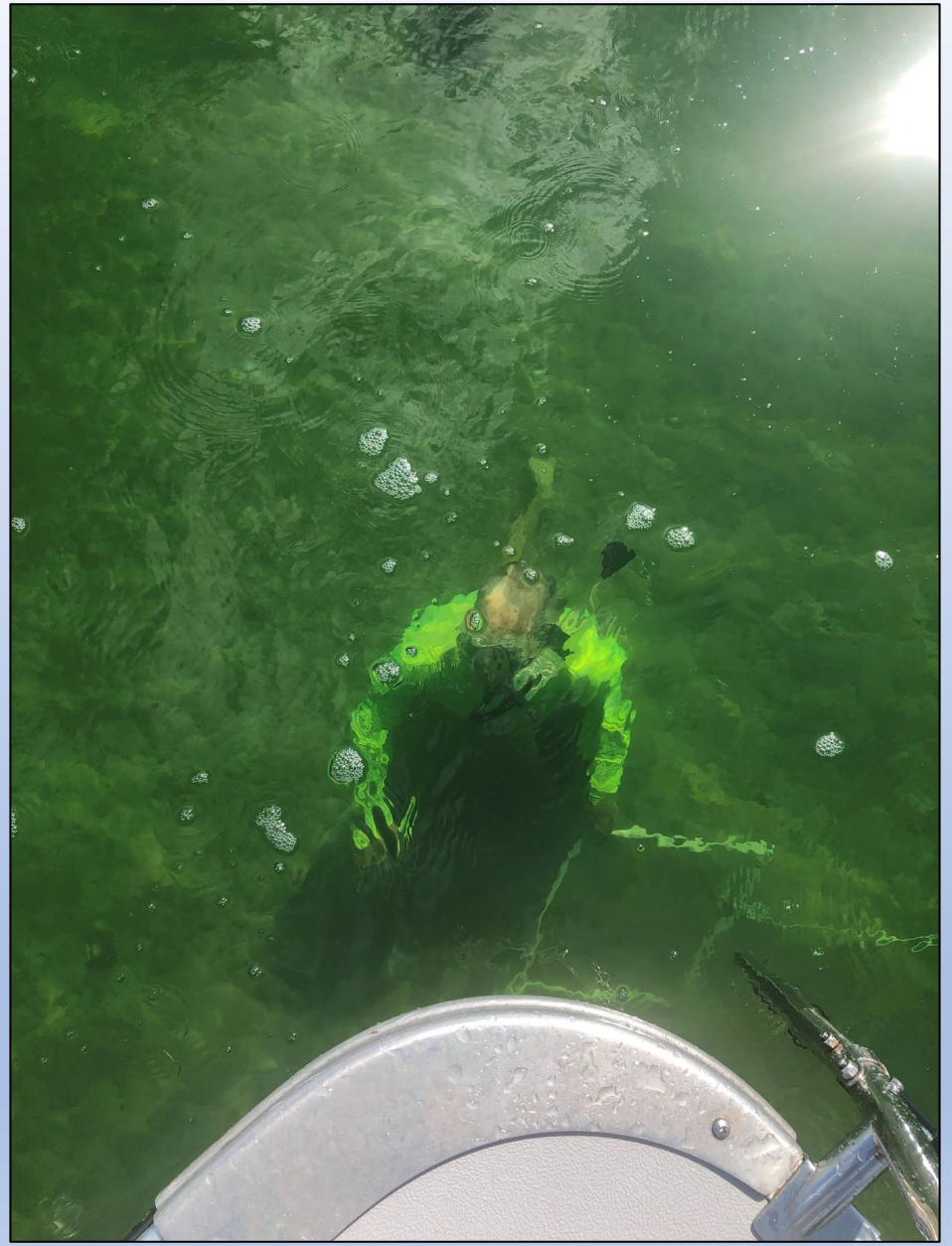
Audio recordings before, during and one-year after red tide event in Sarasota Bay (Tran 2020; All Quiet Under the Algal Bloom; Hakai Magazine)

- https://www.hakaimagazine.com/news/all-quiet-under-the-algal-bloom/#:~:text=That%20silence%20could%20mean,off%2C%20says%20Tyson%20Moore.

Since 2020, sufficient water clarity for seagrass recovery



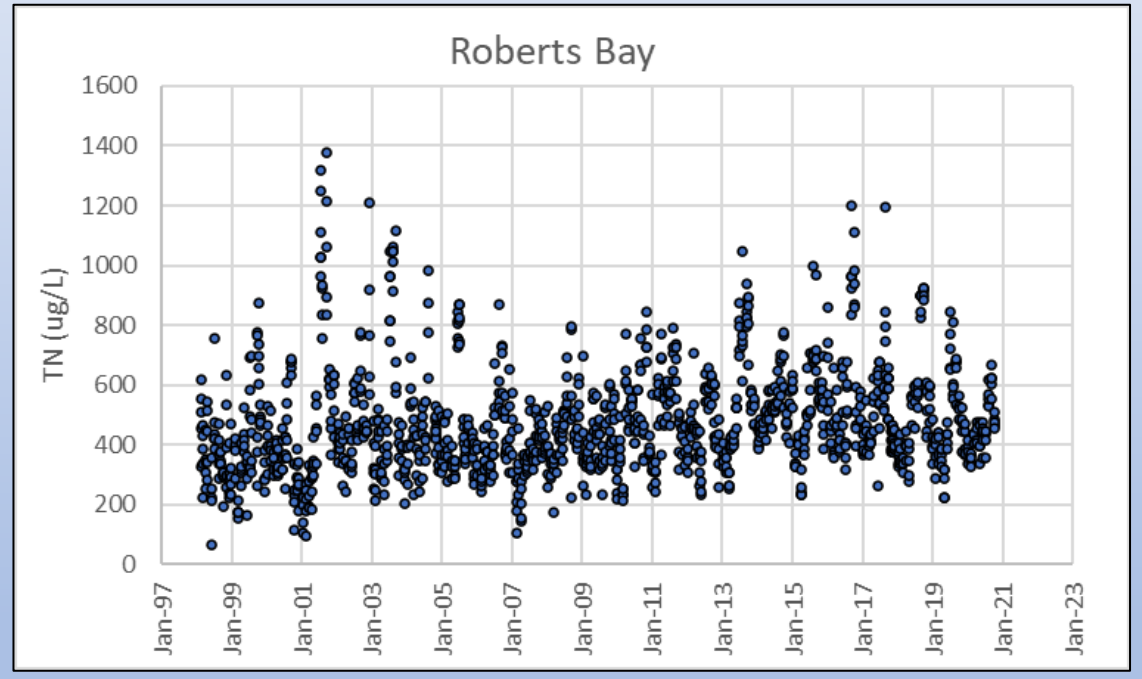
Should we consider efforts to “kick start” seagrass recovery in Upper Sarasota Bay?



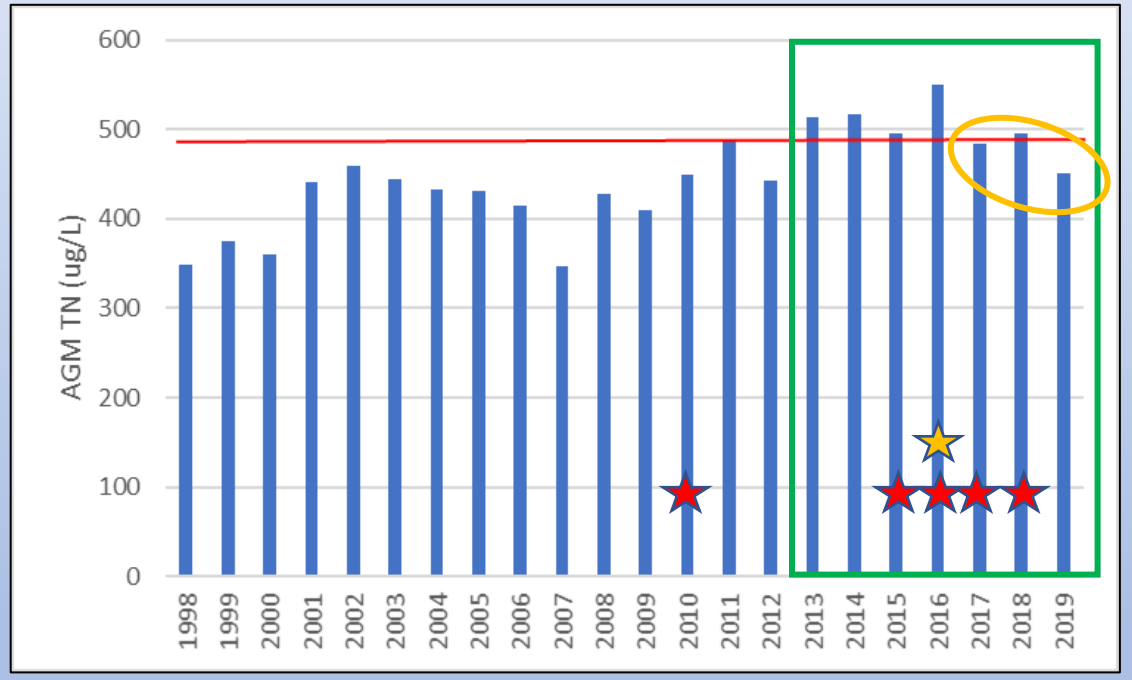
Lower Bay - Roberts Bay

TN exceedance
Chl-a exceedance

Raw Data



AGM values



Nitrogen concentrations were elevated starting in about 2013 & peaked in 2016 – evidence of decline since then.

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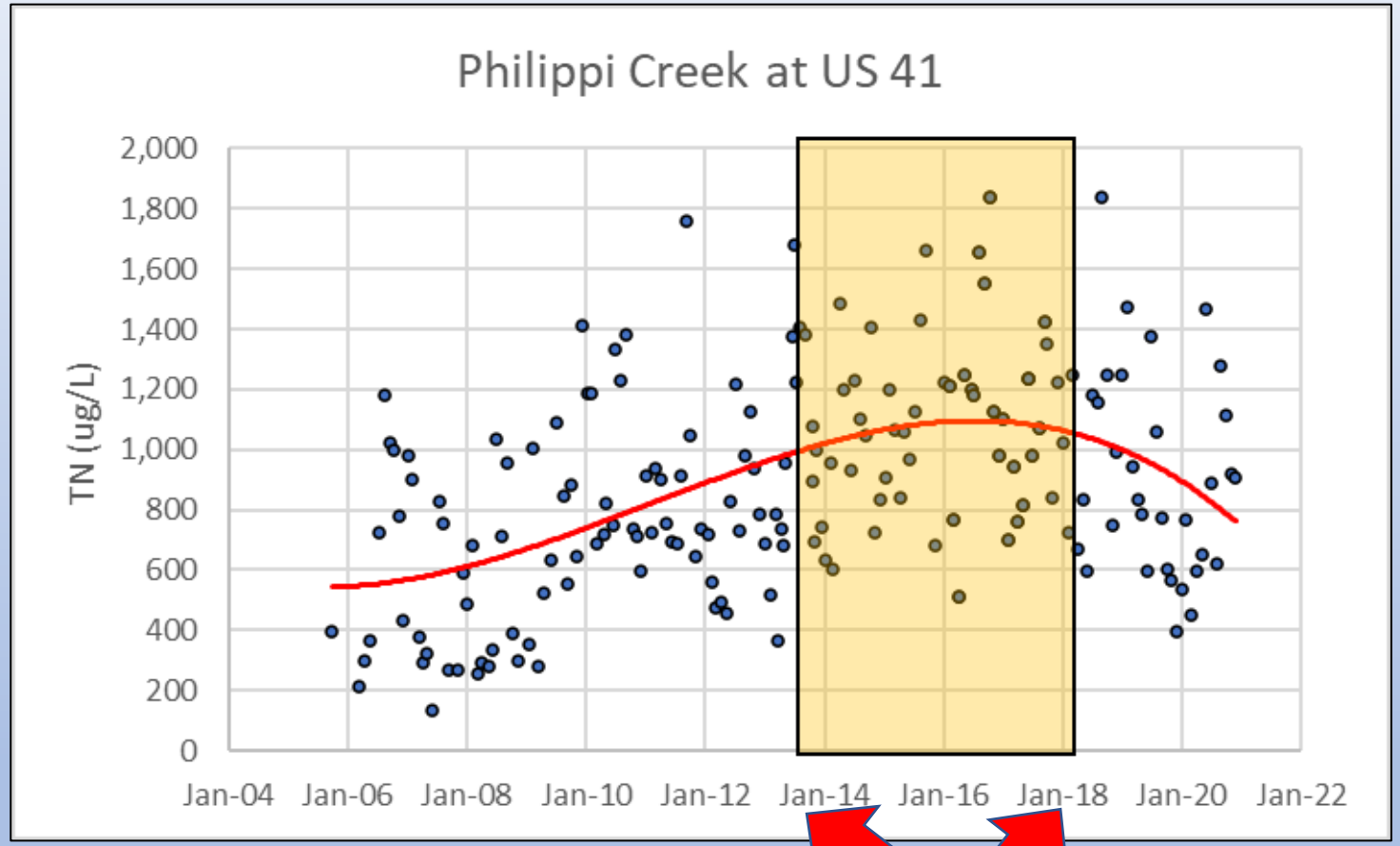
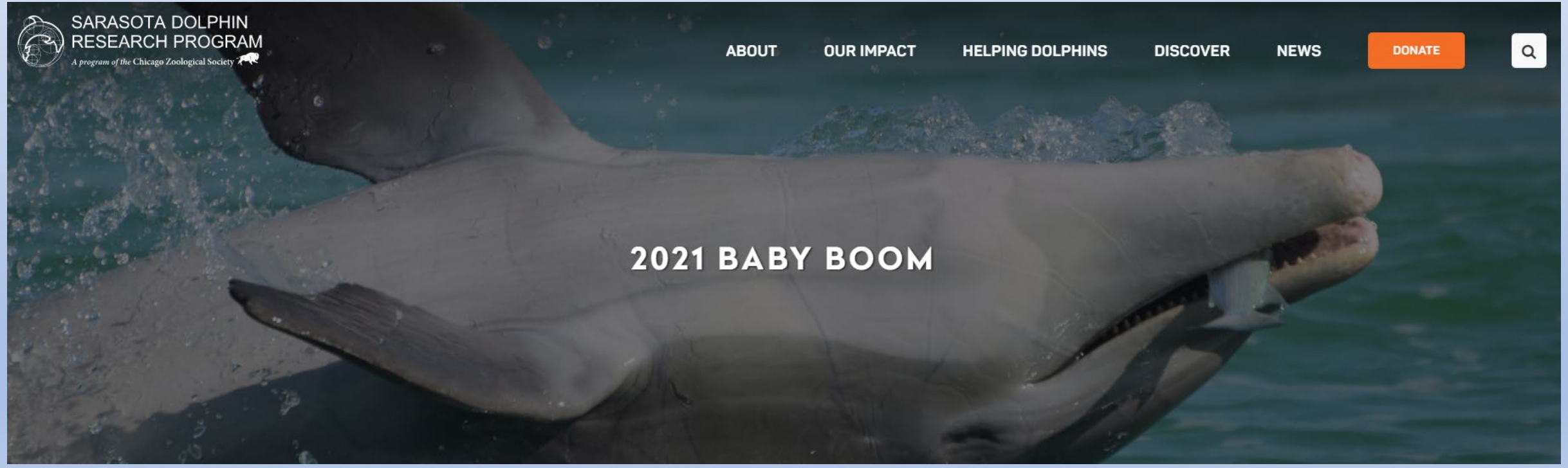
Nitrogen in Philippi Creek at US 41

- Nitrogen concentrations at US 41 increased around 2013 & peaked in 2016 – evidence of decline since then



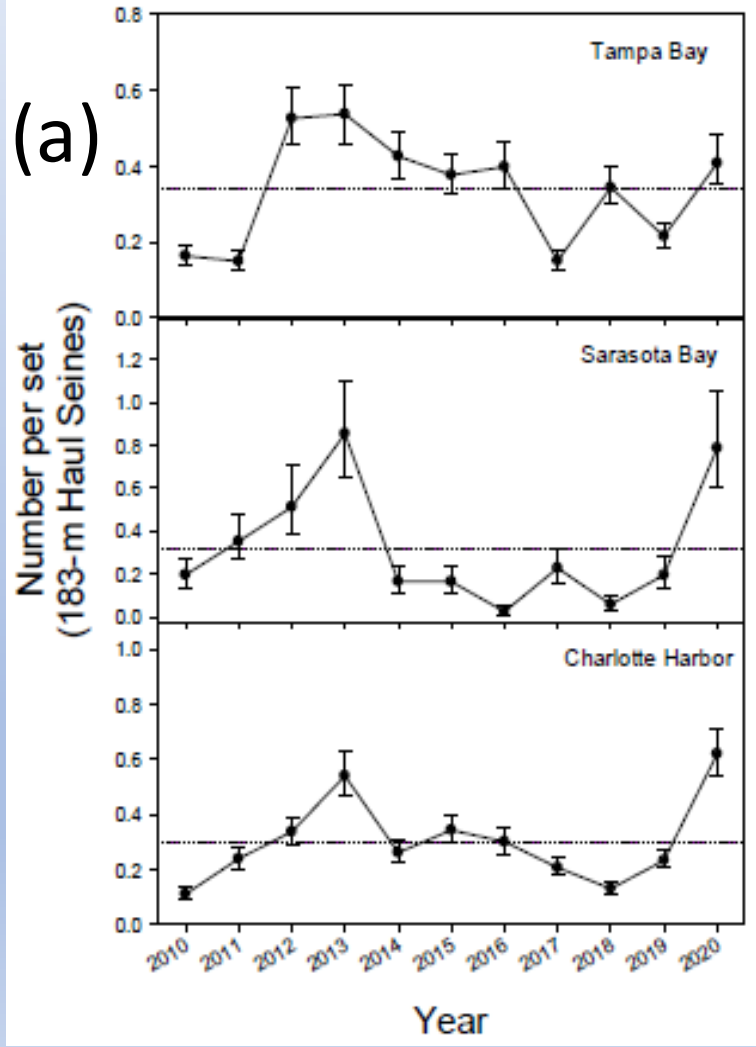
5-year period of non-AWT (16 to 18 mg TN/L) overflows
Excess of 750 million gallons

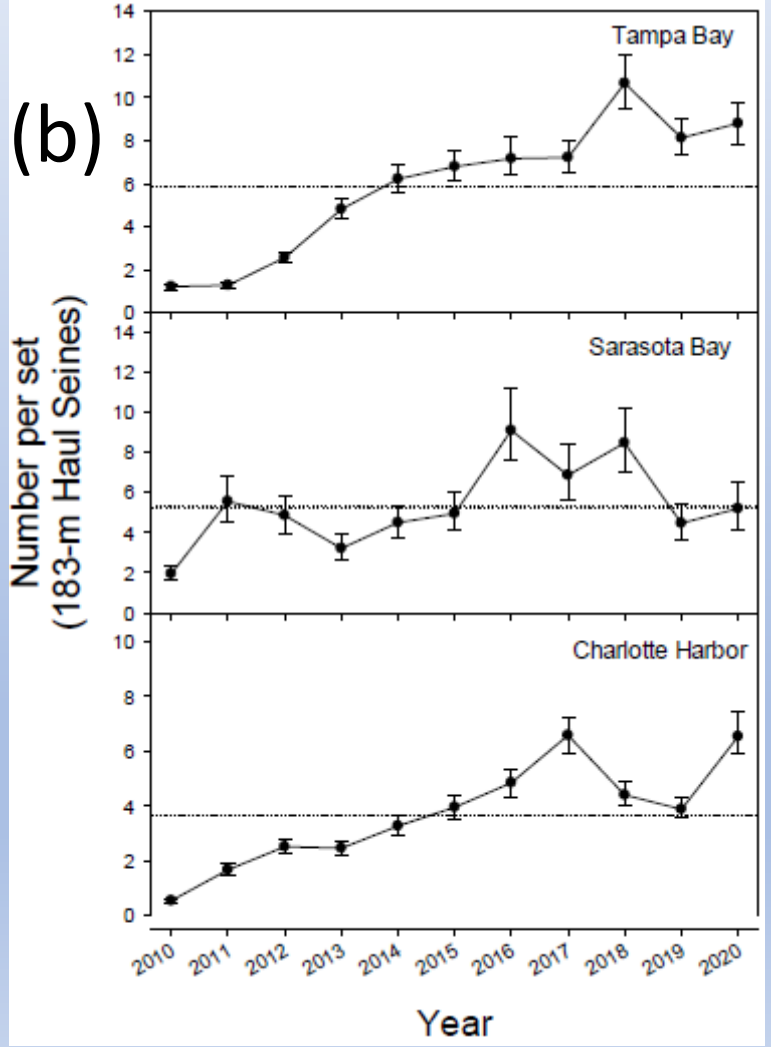
Don’t forget to monitor that what people care the most about…

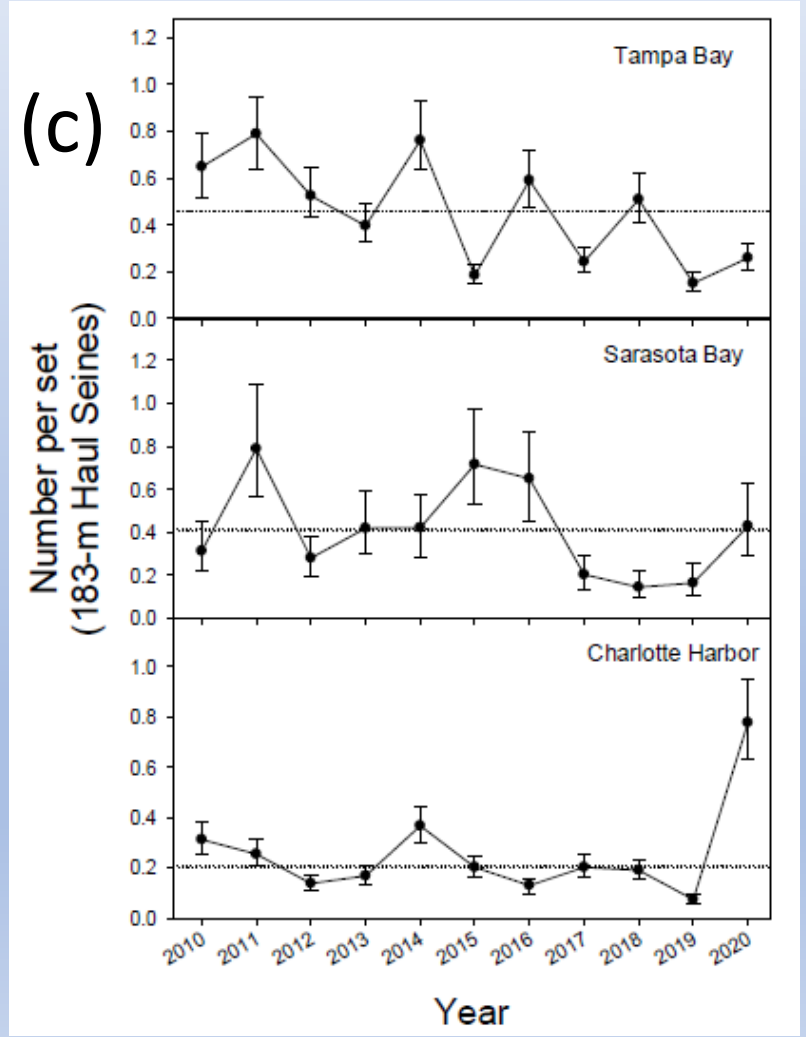


Relative abundance of **adult** (a)red drum, (b) snook and (c) spotted seatrout

Horizontal line is median value over the reporting period







Monitoring programs used in Sarasota Bay

Long-term monthly water quality monitoring	• Bare minimum
Seagrass and macroalgae transects	• Annual to twice yearly
Seagrass mapping	• Every two years
Priority tributary monitoring	• Monthly and co-located with staff gauges
Fish monitoring	• Data compared to adjacent systems
Marine mammal monitoring	• Dolphins & manatees

Questions?