



**FIU**

**Plymouth State**  
UNIVERSITY



# 2020 Annual Report

WATER QUALITY MONITORING PROJECT FOR  
THE WATER QUALITY PROTECTION PROGRAM:  
FLORIDA KEYS NATIONAL MARINE SANCTUARY

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7/23/2021

US EPA Agreement #X7-00049716-0

@NASA

# Water Quality Monitoring Project Florida Keys National Marine Sanctuary

- *Introduction*
- *WQ & Ocean Circulation in the FKNMS*
- *WQ trends*
- *Impacted waters within the Halo*
- *The road ahead....*

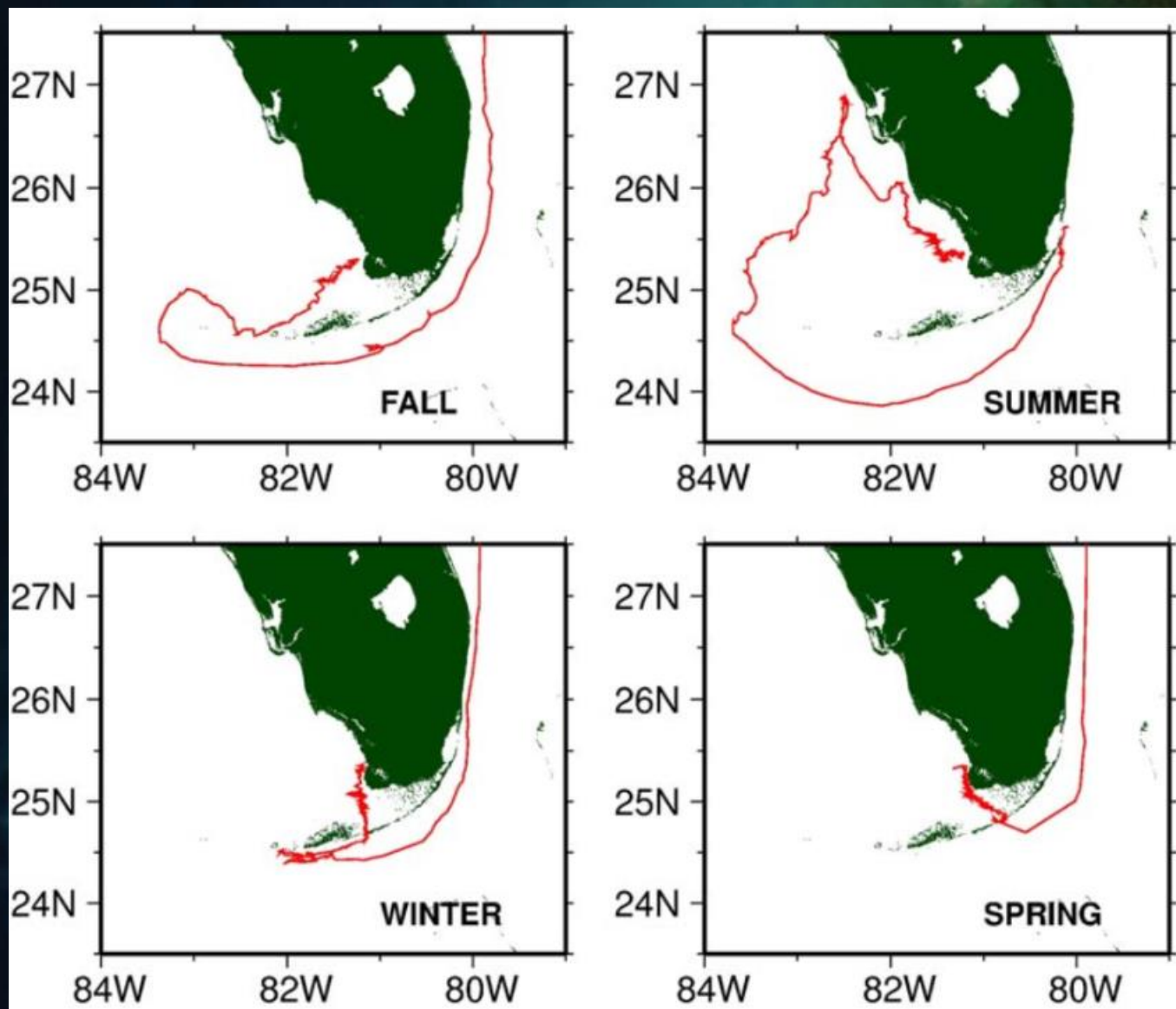
A satellite image of the Florida Keys National Marine Sanctuary coastline. The land is shown in dark brown and green, with the ocean in shades of blue and green. A large, semi-transparent green area covers the water, representing water quality monitoring data. The text is overlaid on the left side of the image.

Water Quality Monitoring Project  
Florida Keys National Marine Sanctuary

*“Long-term water quality monitoring program, designed to provide information about the status and trends of water quality in the Sanctuary, as well as information about the effectiveness of remedial actions to reduce pollution...”*

# General Ocean Circulation in the Florida Keys

After: Johns et al. 2006



# General Ocean Circulation in the Florida Keys

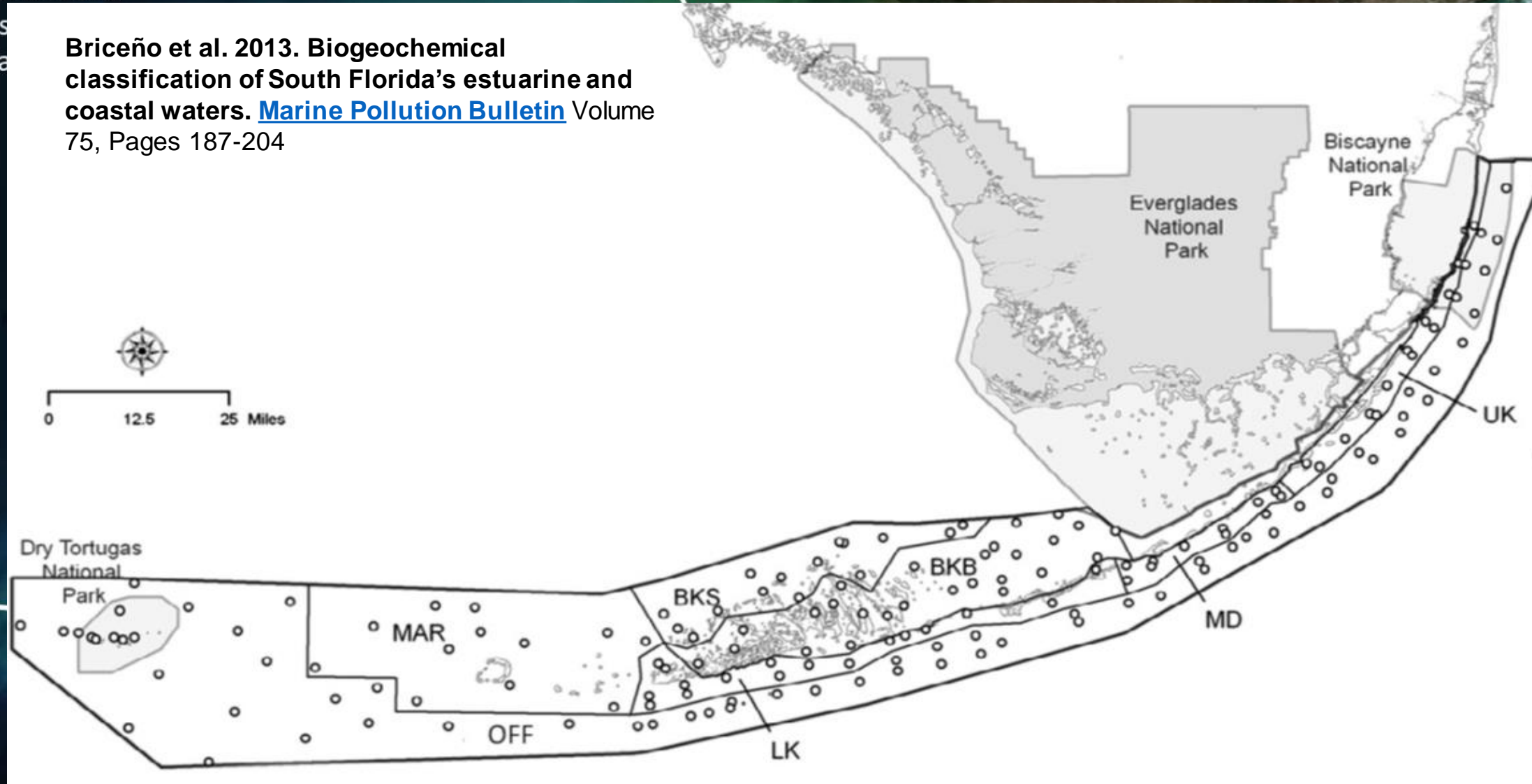
After: Klein & Orlando 1994

Lee et al. 1992

Johns

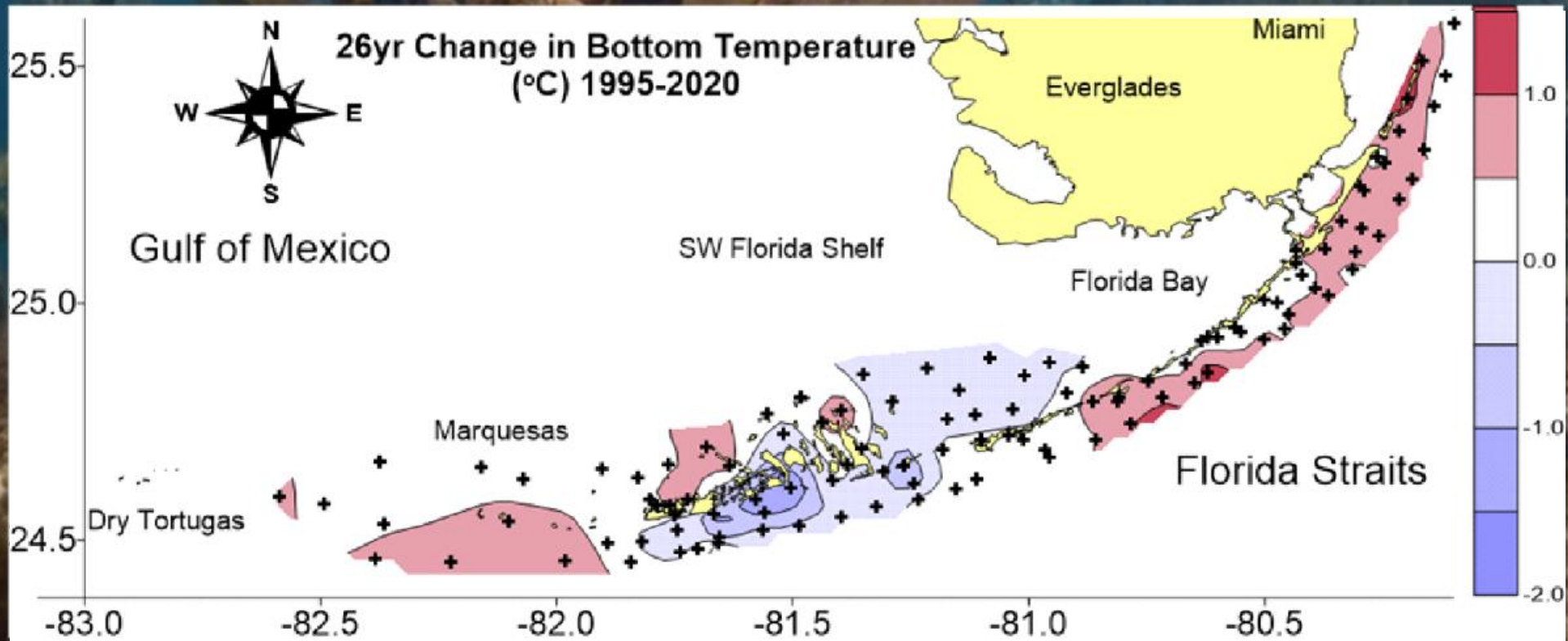
Koura

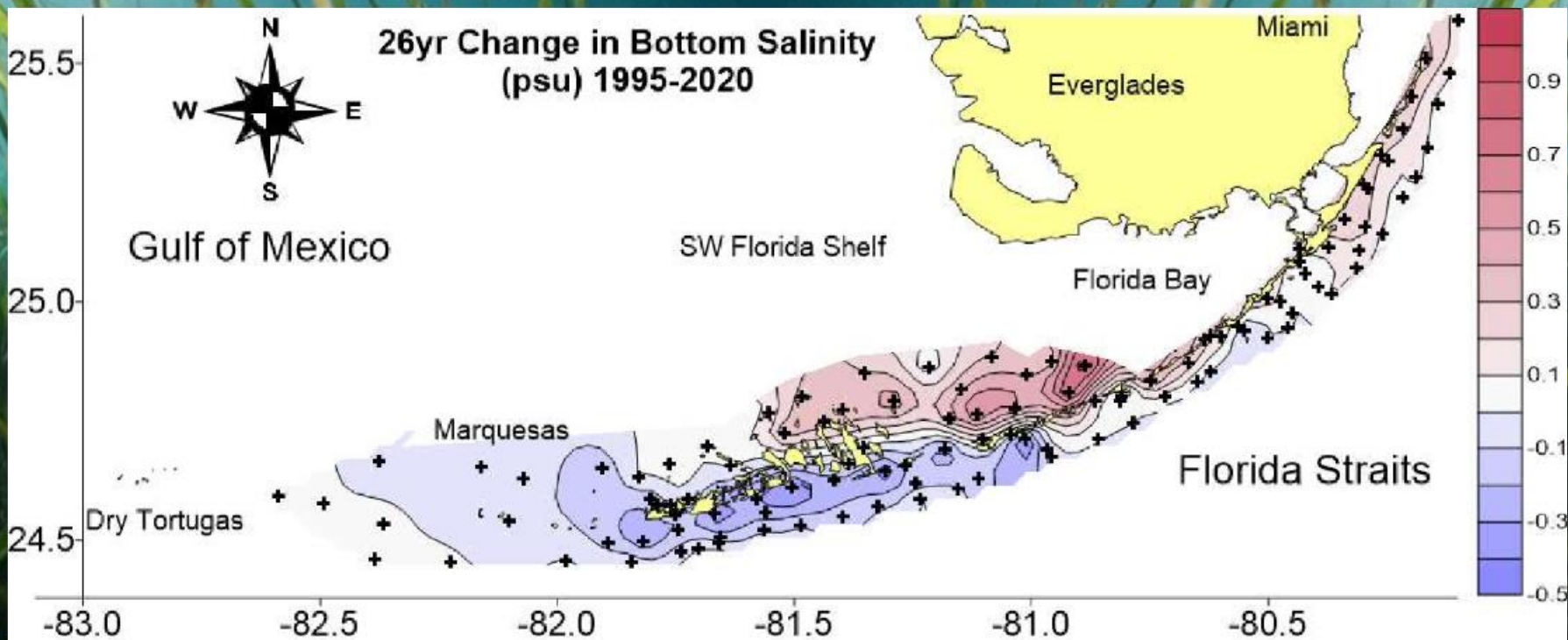
Briceño et al. 2013. Biogeochemical classification of South Florida's estuarine and coastal waters. [Marine Pollution Bulletin](#) Volume 75, Pages 187-204



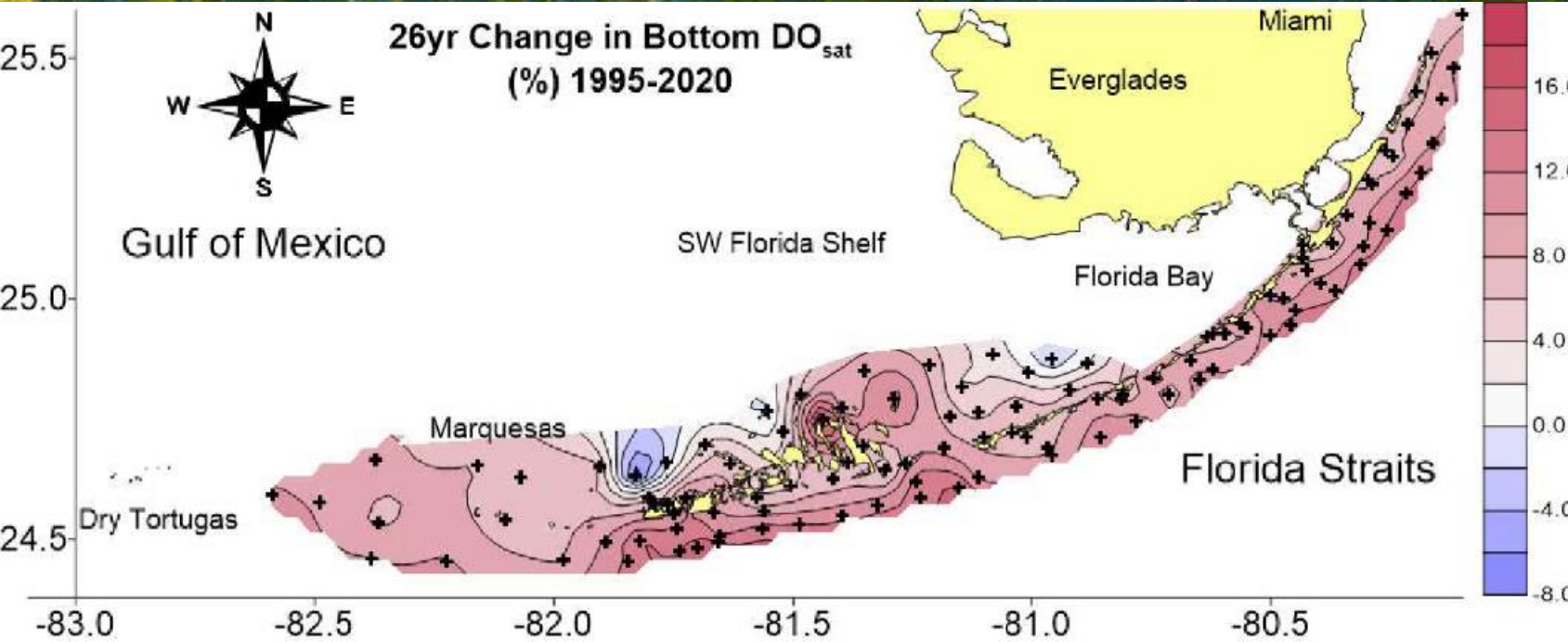
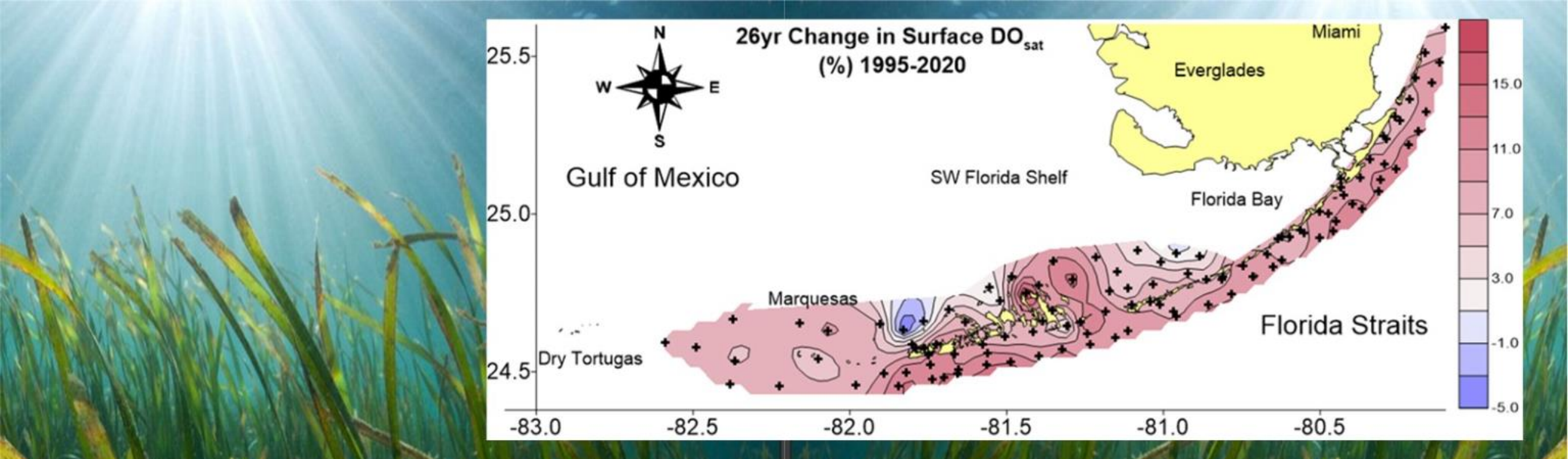
# 26 years of Water Quality Change

Significant temperature increase  $>0.5\text{ }^{\circ}\text{C}$  threatens iconic coral reefs





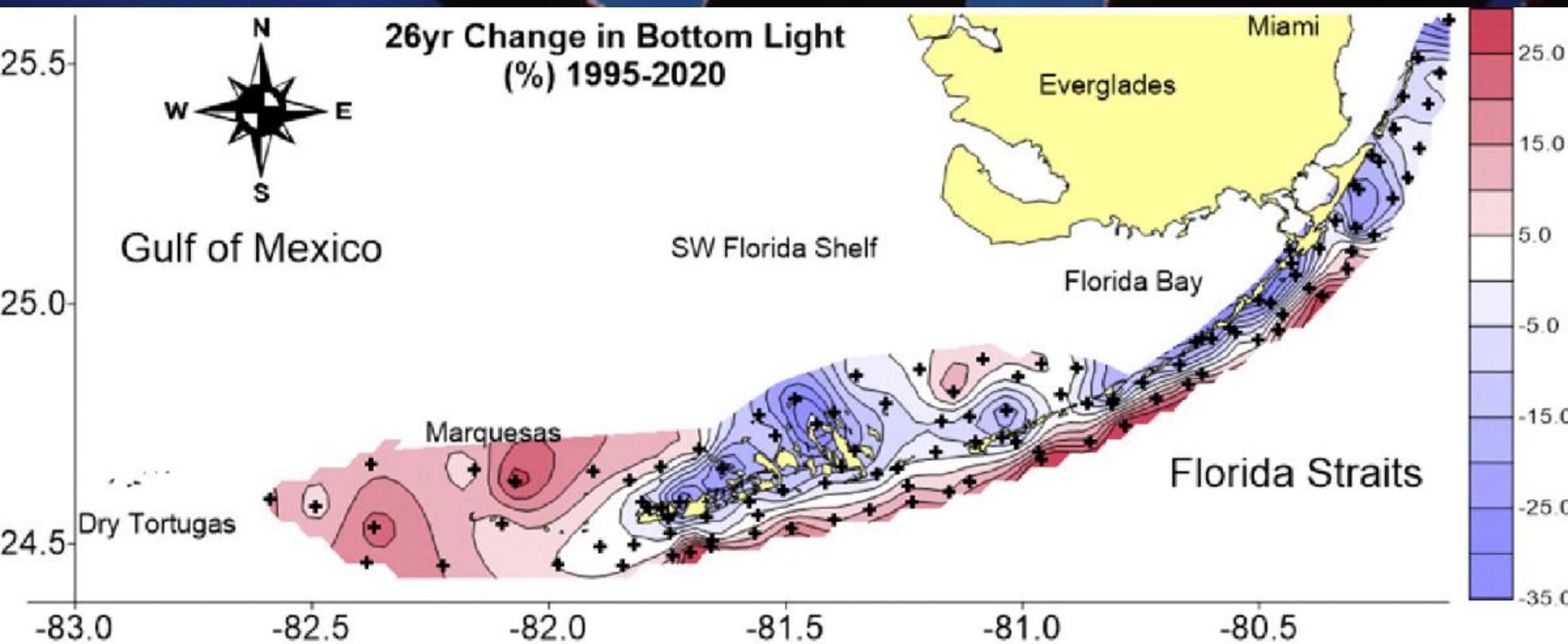
Small (< 1psu) increase in Sluice, Middle and Upper Keys



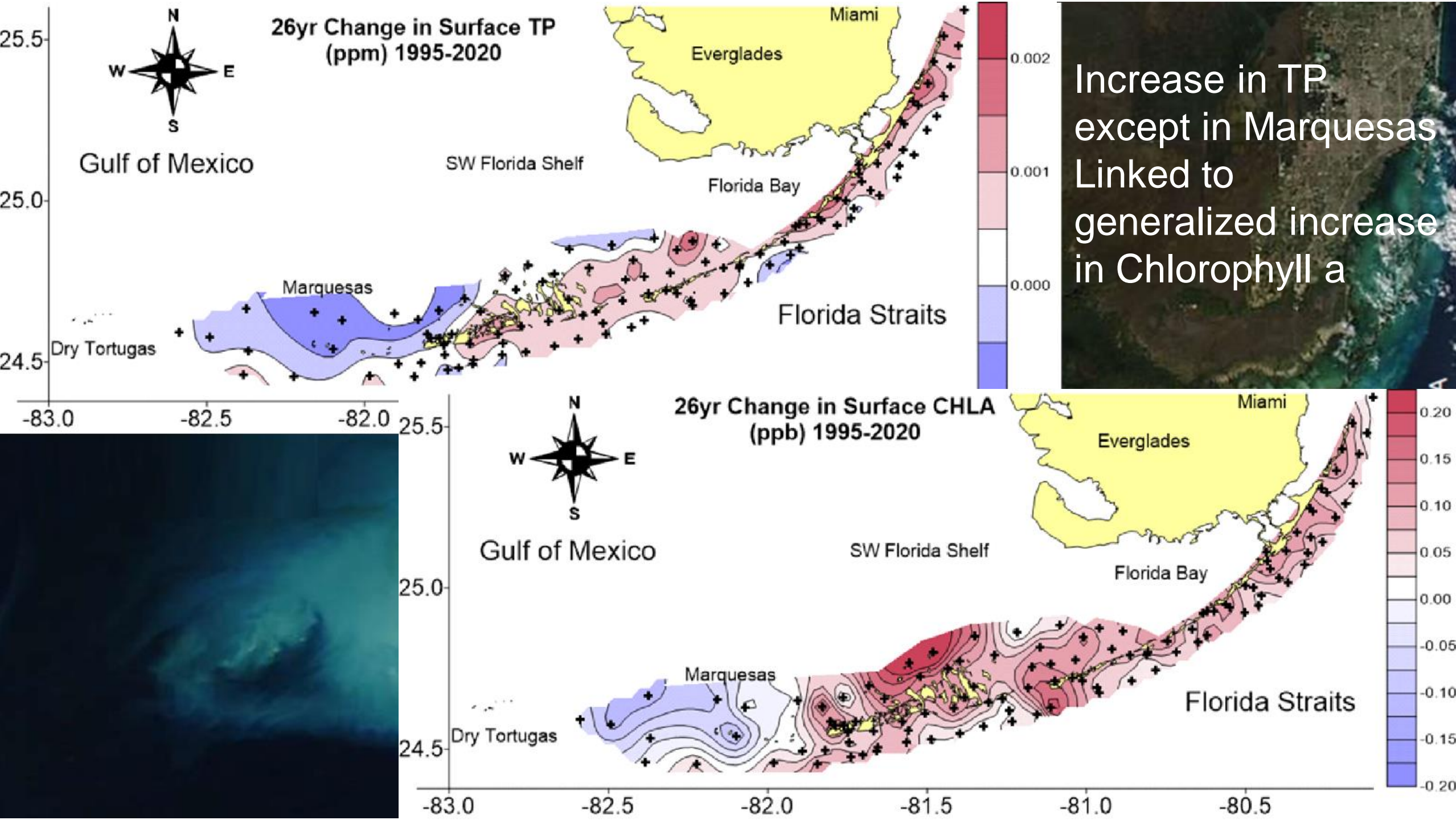
Dissolved oxygen has increased significantly Sanctuary wide



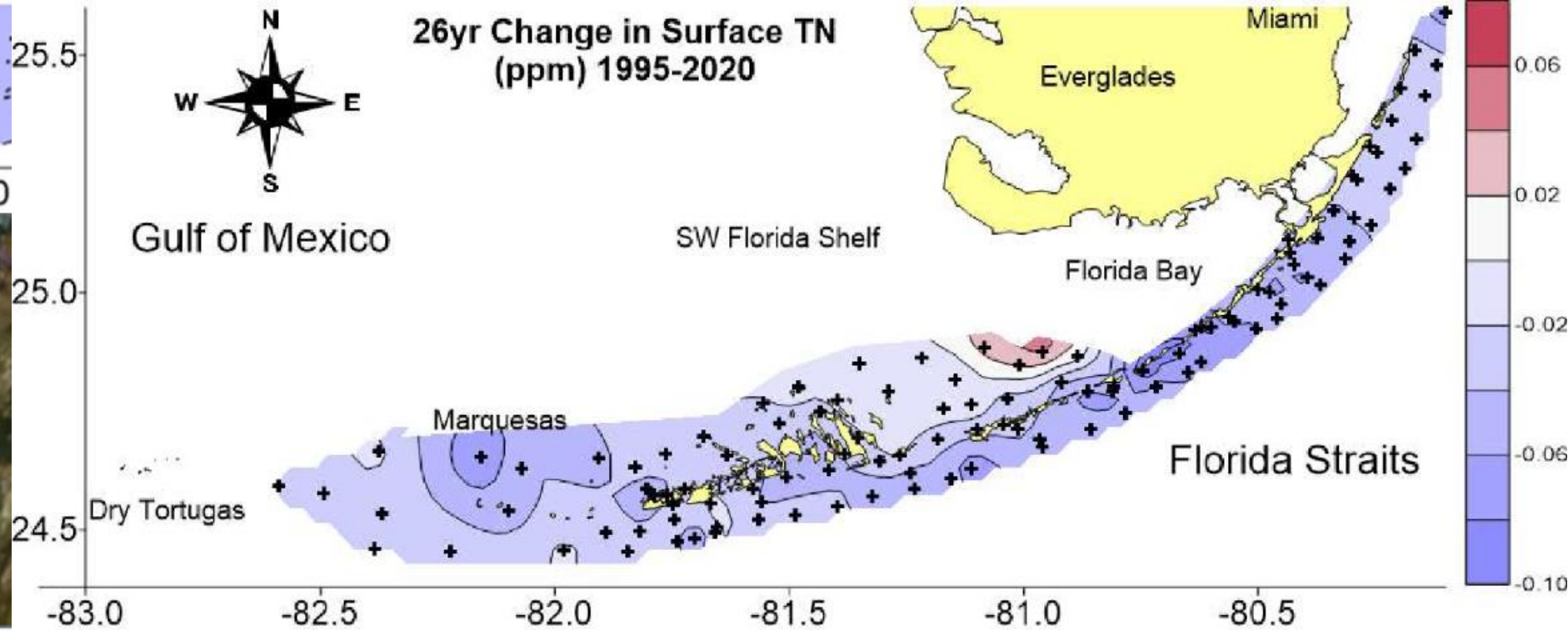
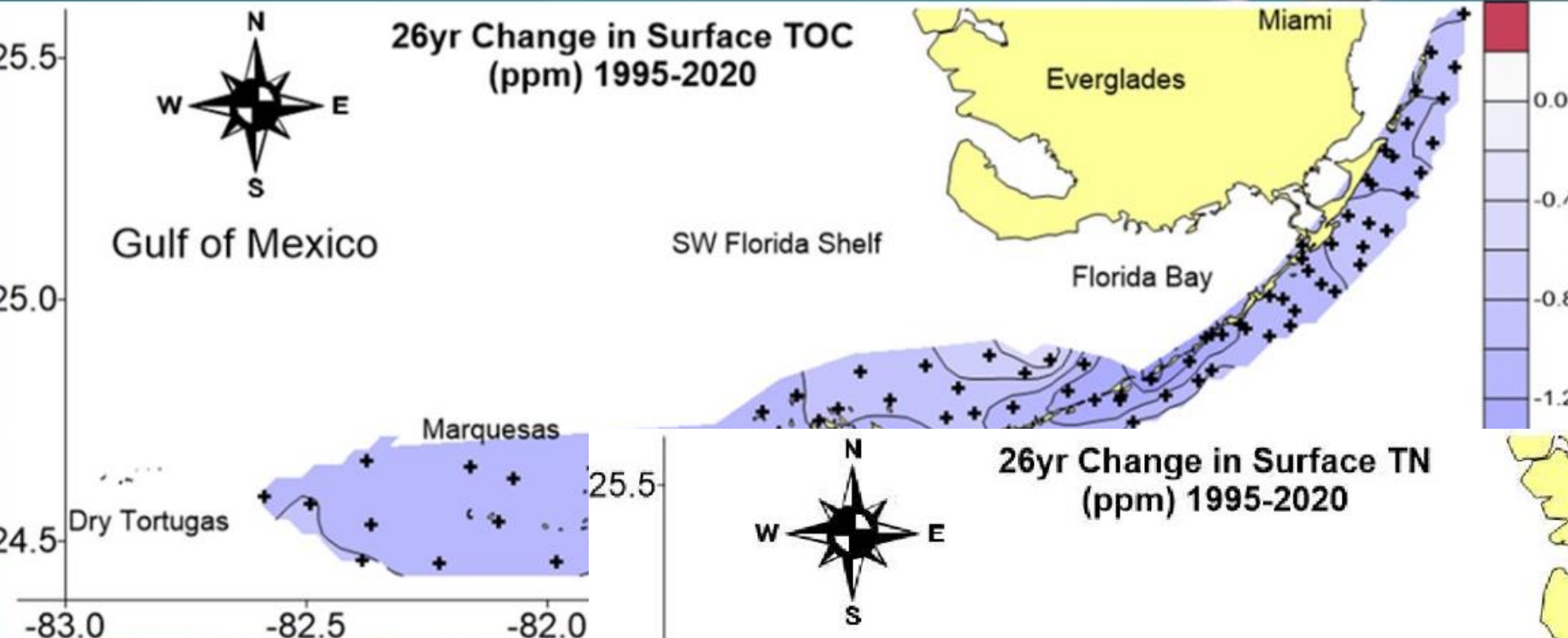
# Decline in water clarity in areas influenced by Keys



Decrease in light reaching benthic communities except in Marquesas and reef-track



Continuous region-wide decline of Total Organic Carbon since the early 1990s



## Key Largo

Calusa Park Marina

501

500

Lake Largo Canal

# Halo Stations

## Islamorada

a

Blackwood Dr

503

502

Indian Creek

## Marathon

Hidden Harbor

505

504

Ocean 100<sup>th</sup> St

## Big Pine

507

Big Pine Bay

506

Little Torch

Image Landsat / C

## Key West

Int. Airport

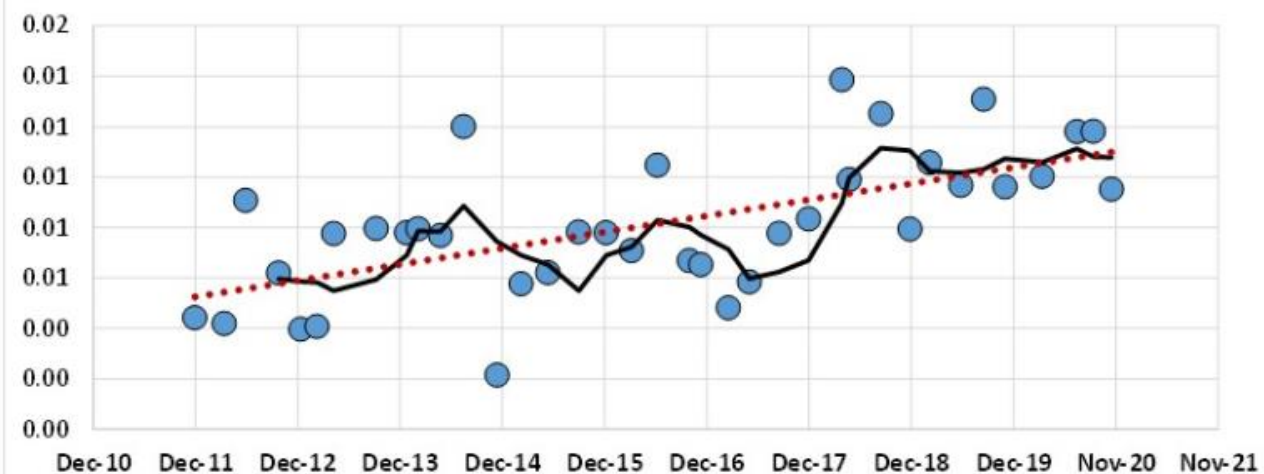
508

509

Marriot Beach

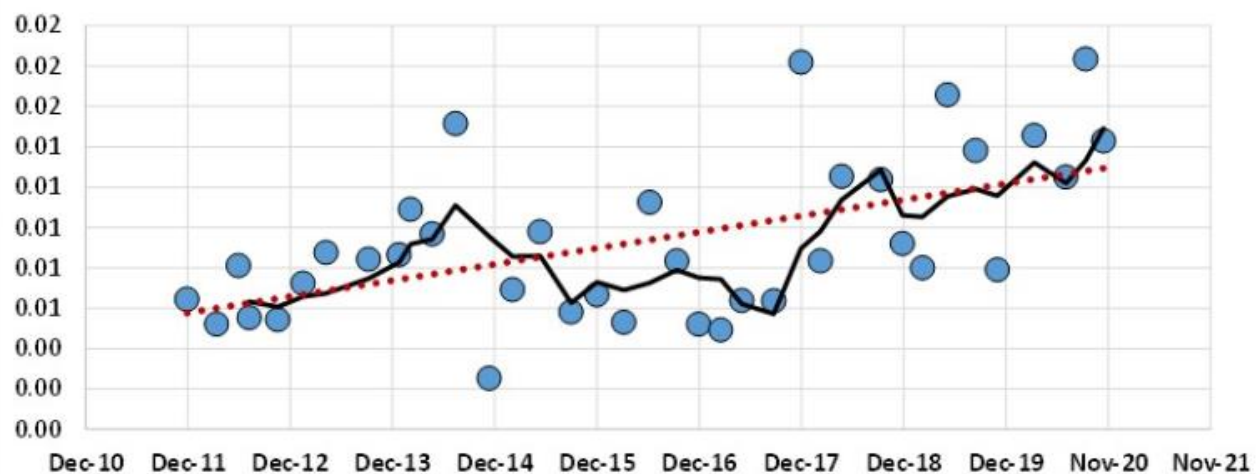
TP-S

#500



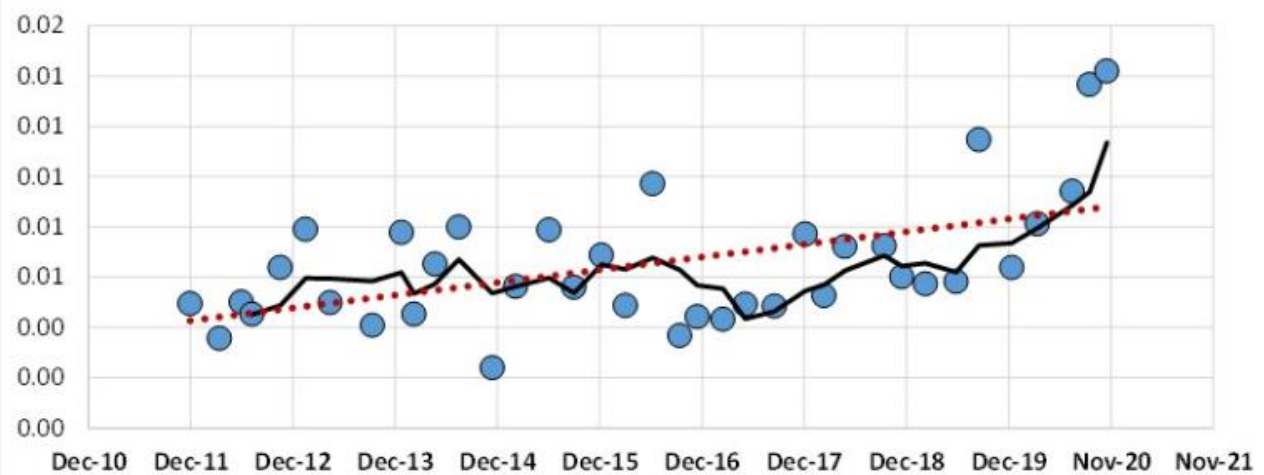
TP-S

#501



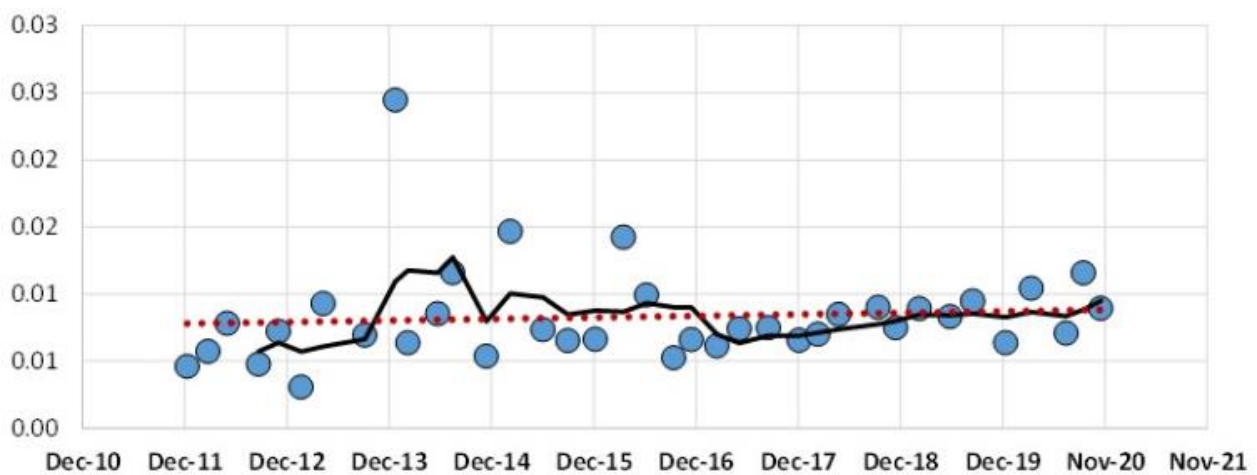
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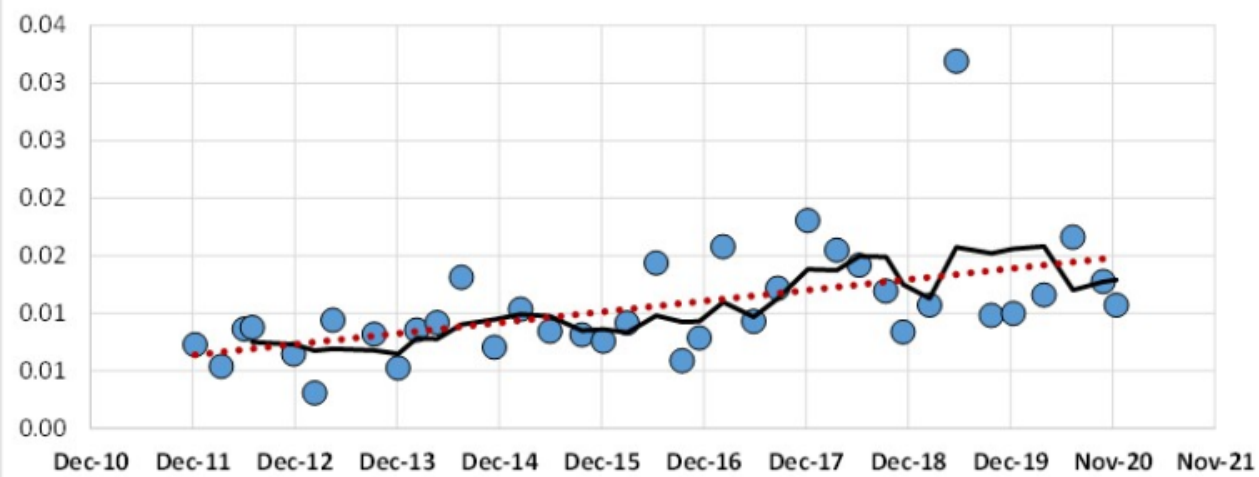
TP-S

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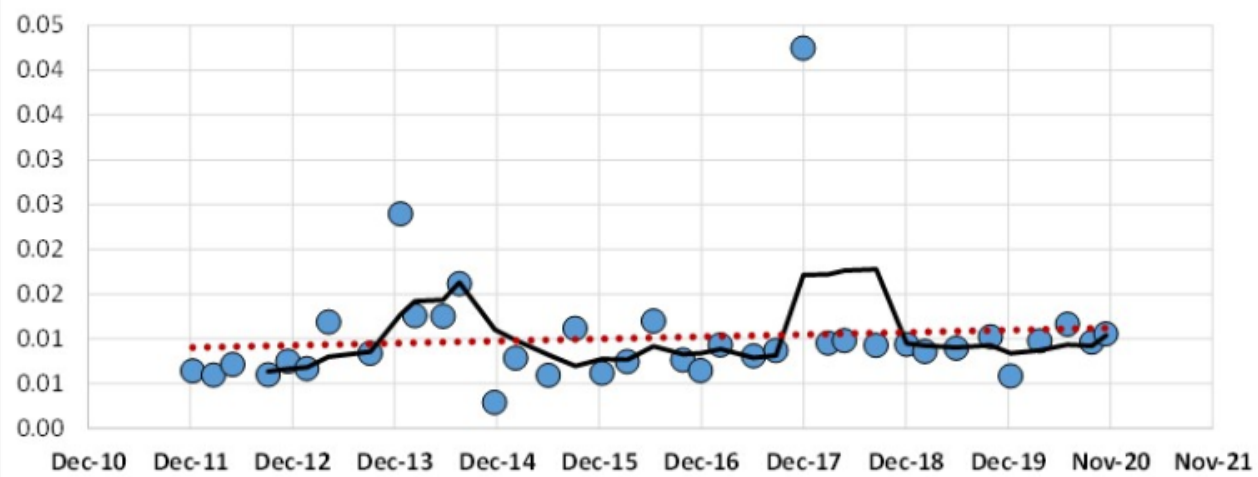
TP-S

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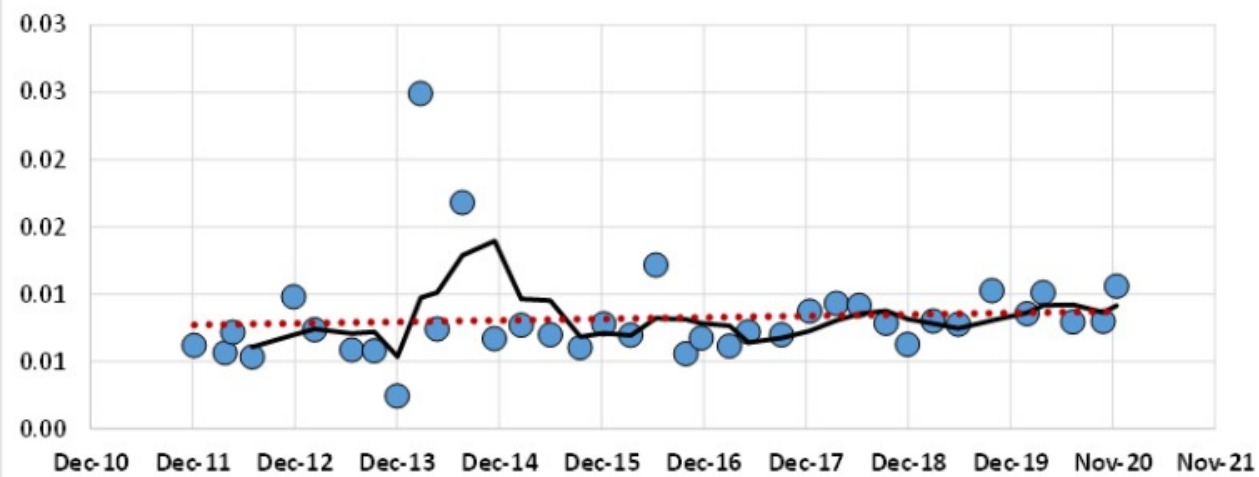
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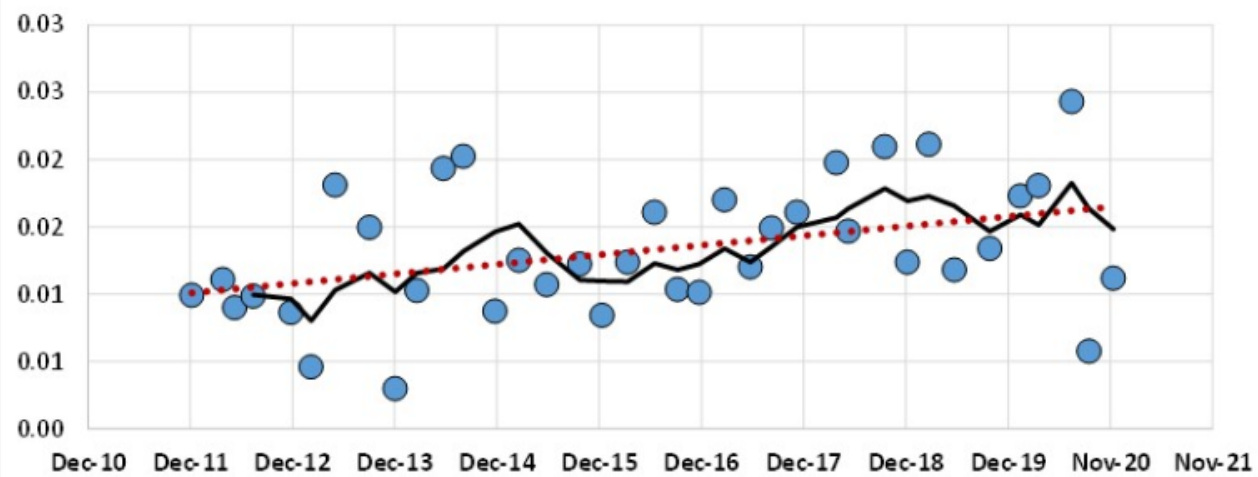
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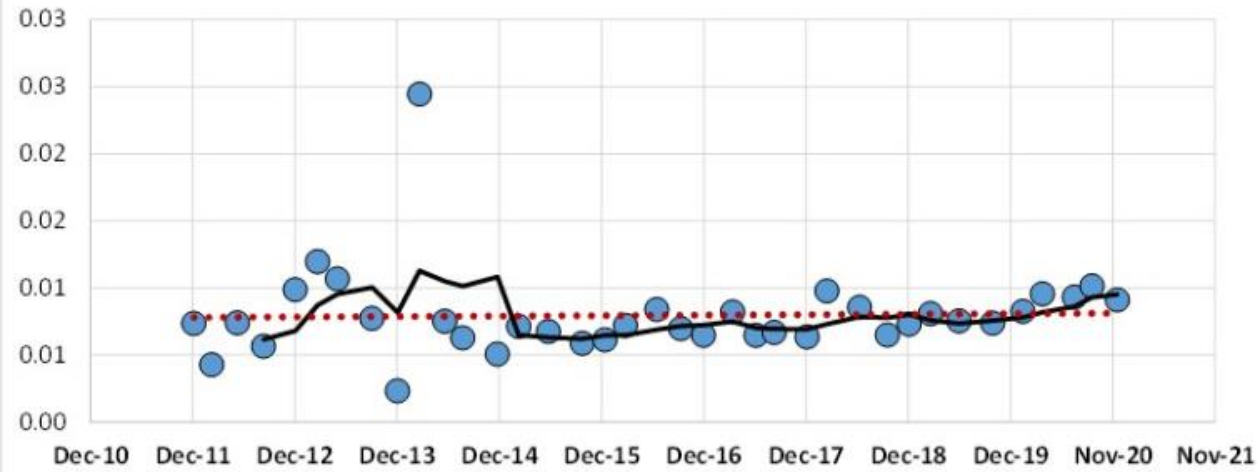
TP-S

#507



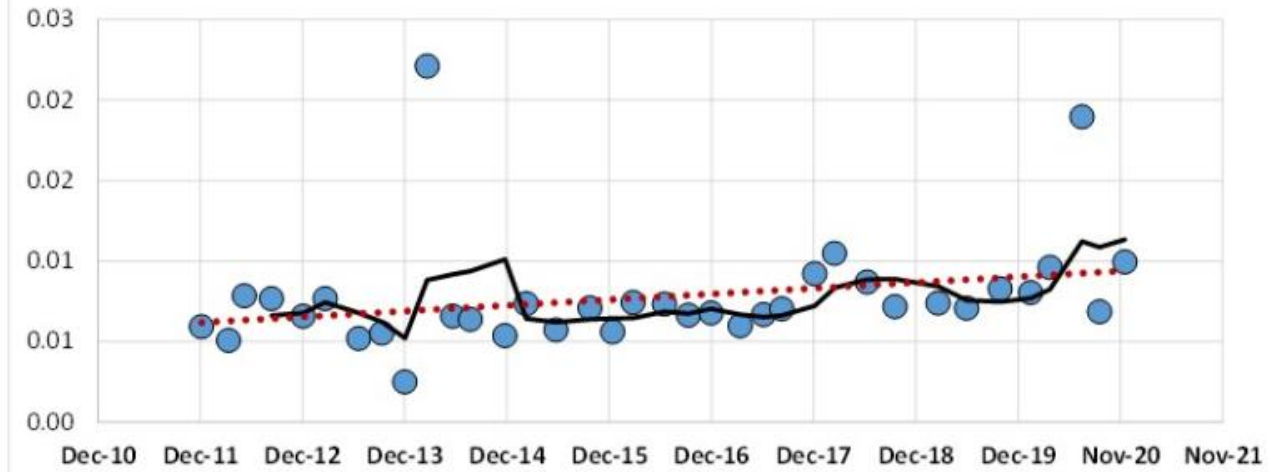
TP-S

#508



TP-S

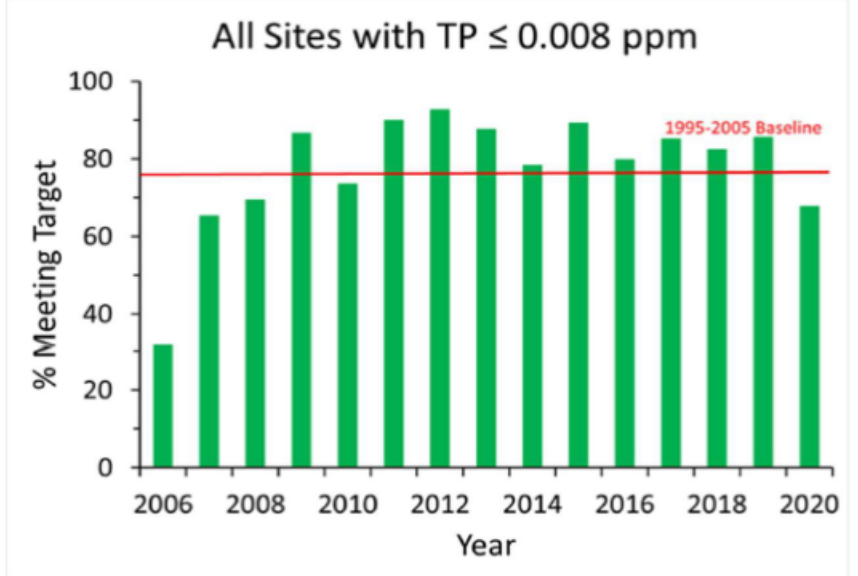
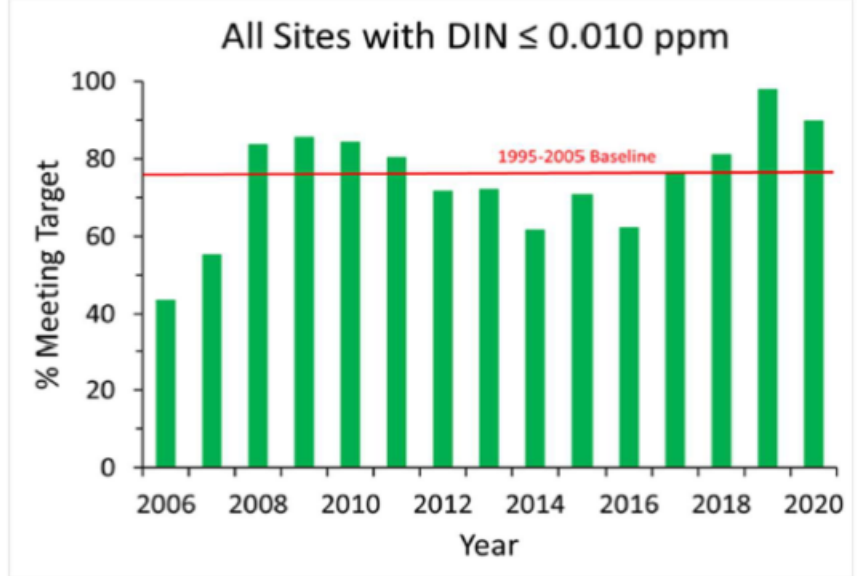
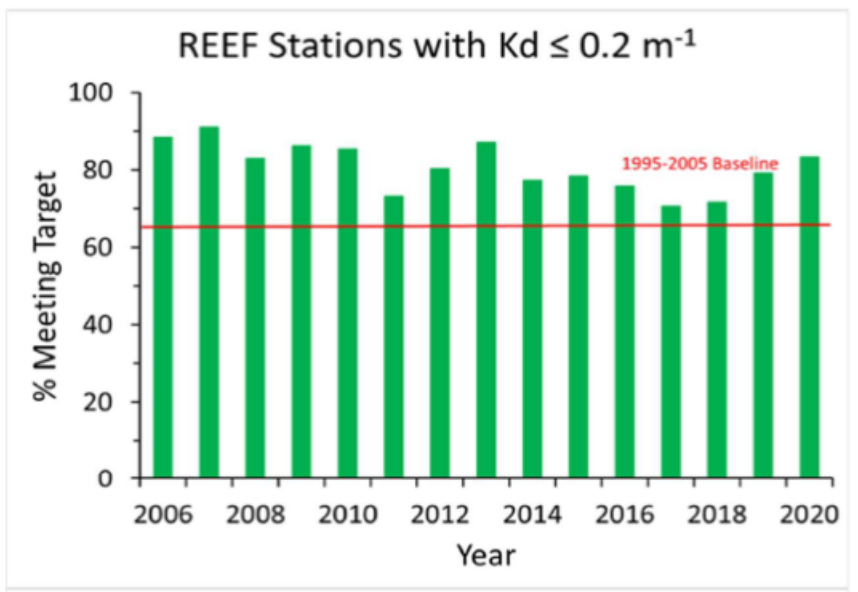
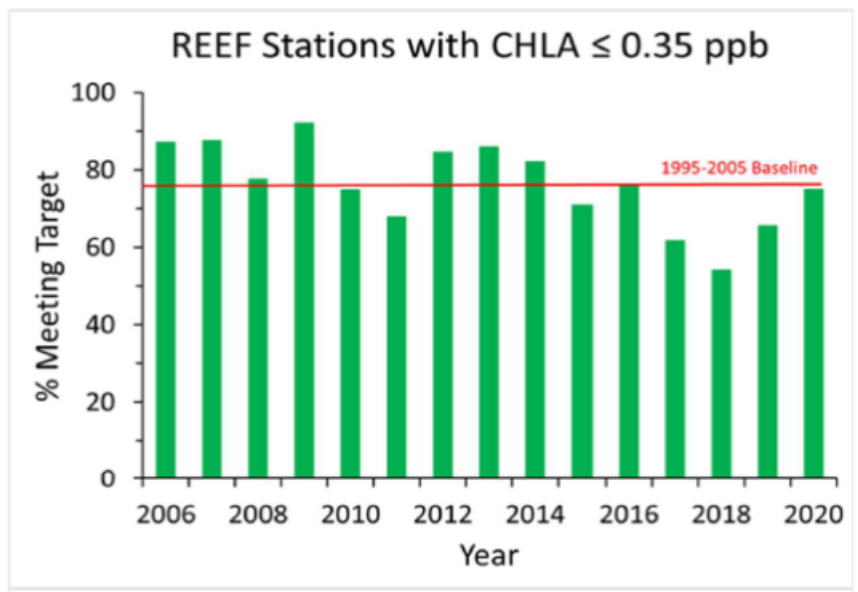
#509



## Sen Slope

STATION	SITE	CHLA-S	TN-S	TON-S	TP-S	TURB-S
500	Lake Largo Canal	0.0313	0.0129	0.0111	0.0007	0.1291
501	Calusa Park Marina	0.0301	0.0443	0.0483	0.0008	0.0653
502	Indian Key	0.0223	0.0033	0.0034	0.0004	0.1092
503	Blackwood Dr	0.0207	0.0162	0.0151	0.0003	0.0804
504	Marathon - Ocean 100th St	0.0396	0.0114	0.0120	0.0007	-0.0492
505	Hidden Harbor Beach	0.0074	0.0073	0.0070	0.0003	0.1019
506	LittleTorch	0.0219	0.0103	0.0120	0.0003	0.0315
507	Big Pine Bay	0.0676	0.0180	0.0180	0.0008	0.0491
508	Marriott Beach side	0.0158	0.0101	0.0114	0.0002	0.0573
509	Key West Ocean- Intl airport	0.0256	0.0105	0.0112	0.0003	0.0937

# Water Quality Monitoring Project Florida Keys National Marine Sanctuary





# Three critical questions for the Monitoring Program

- 1- Are we measuring/sampling where we should be measuring/sampling?
- 2- Are we measuring/analyzing what we should be measuring/analyzing?
- 3- Are we measuring at the frequency we should be measuring?

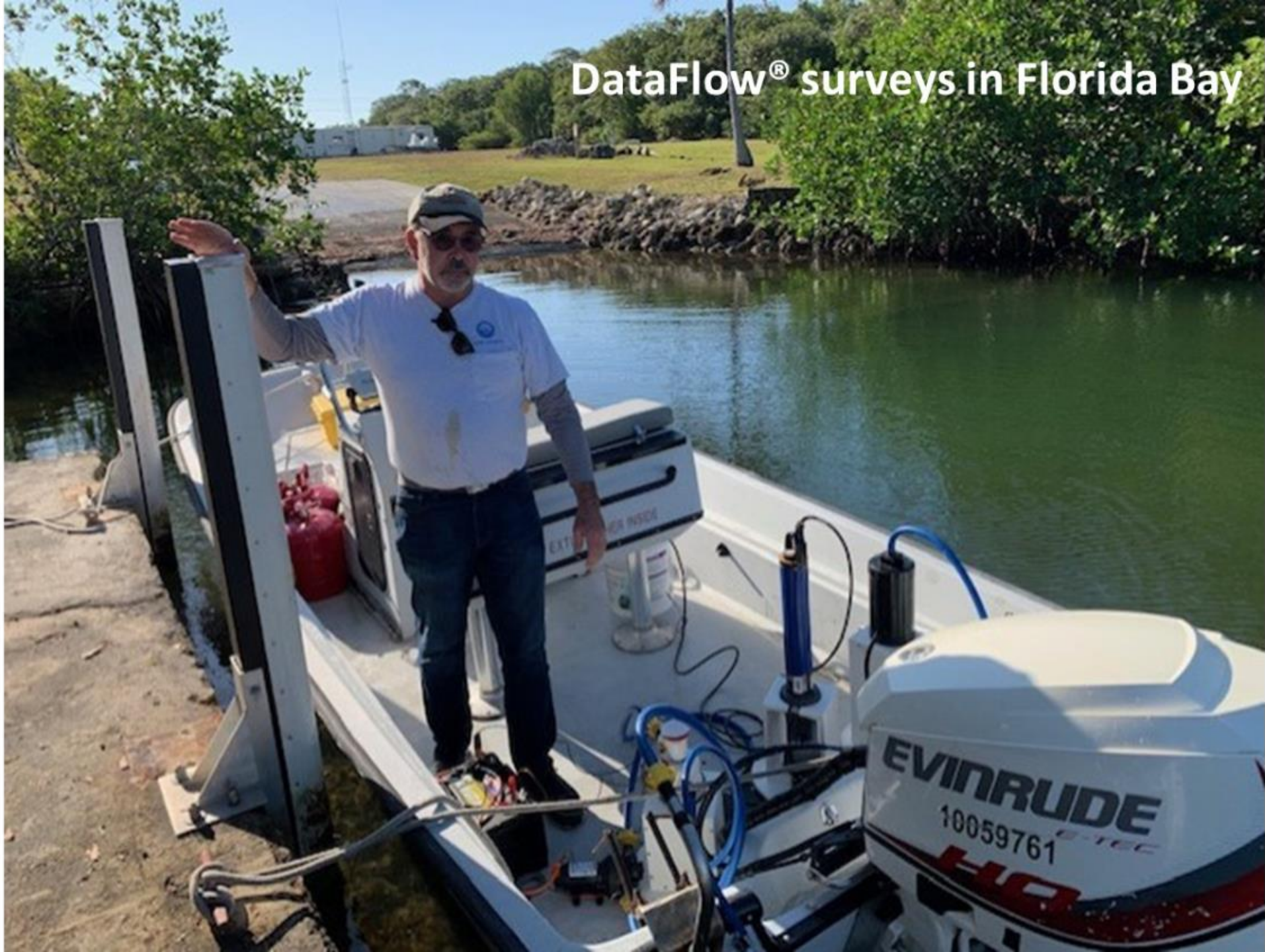
# Three critical questions for the Monitoring Program

1- Are we measuring/sampling where we should be measuring/sampling?

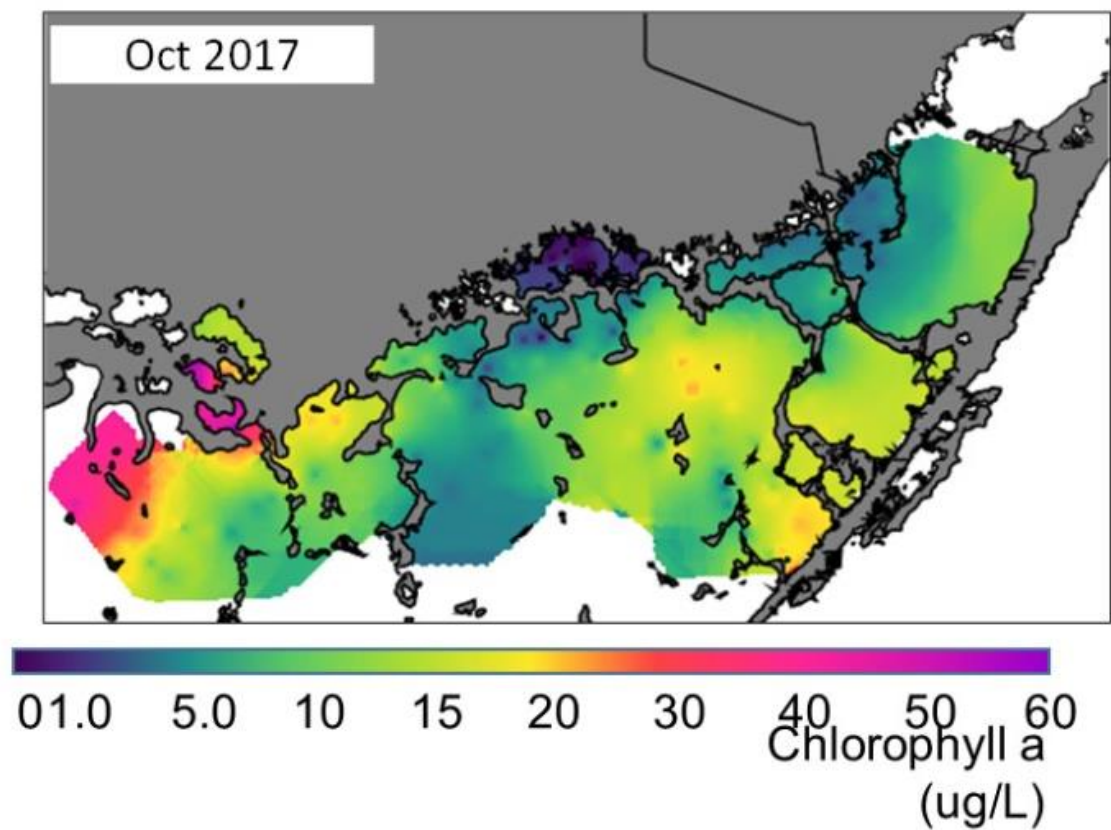
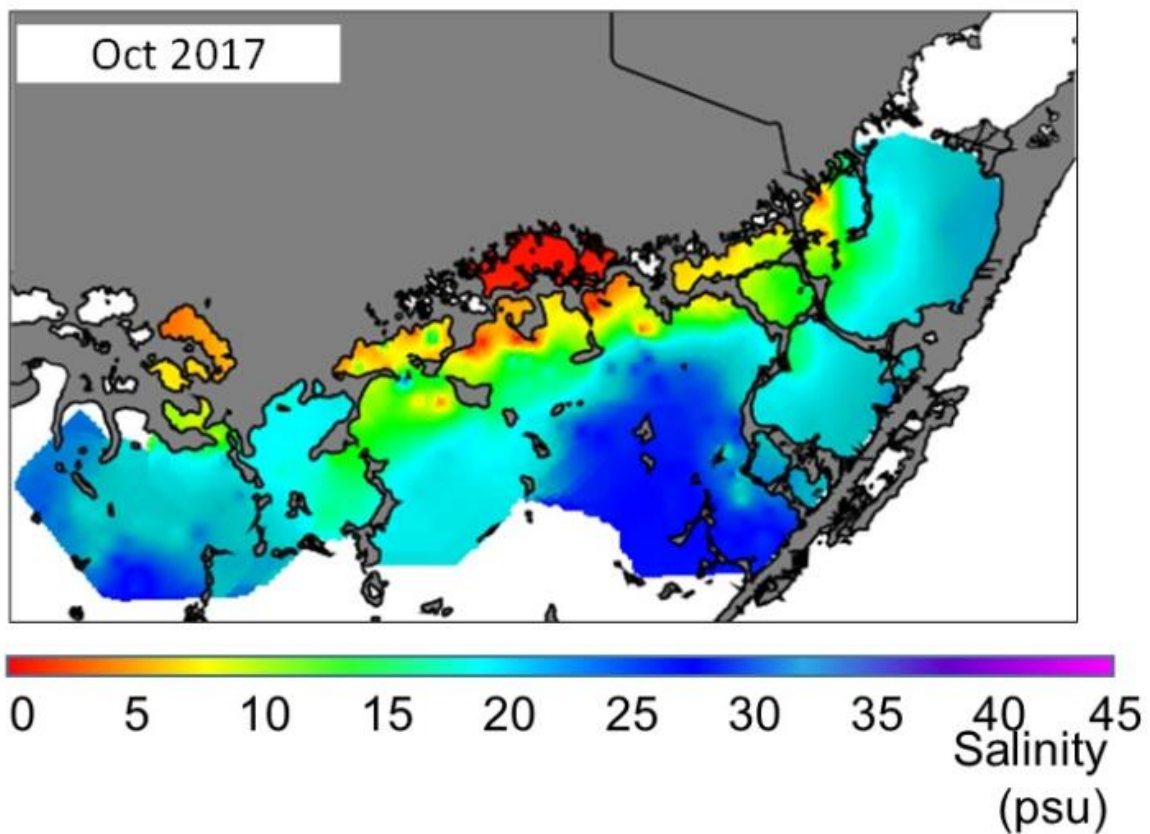
Yes, we are, for the initial goal of the project, but new questions, linked to the sources of pollutants would require a re-assessment and the inclusion of more stations, especially within the Halo, or around critical areas, like the Port of Key West

## DataFlow® surveys in Florida Bay

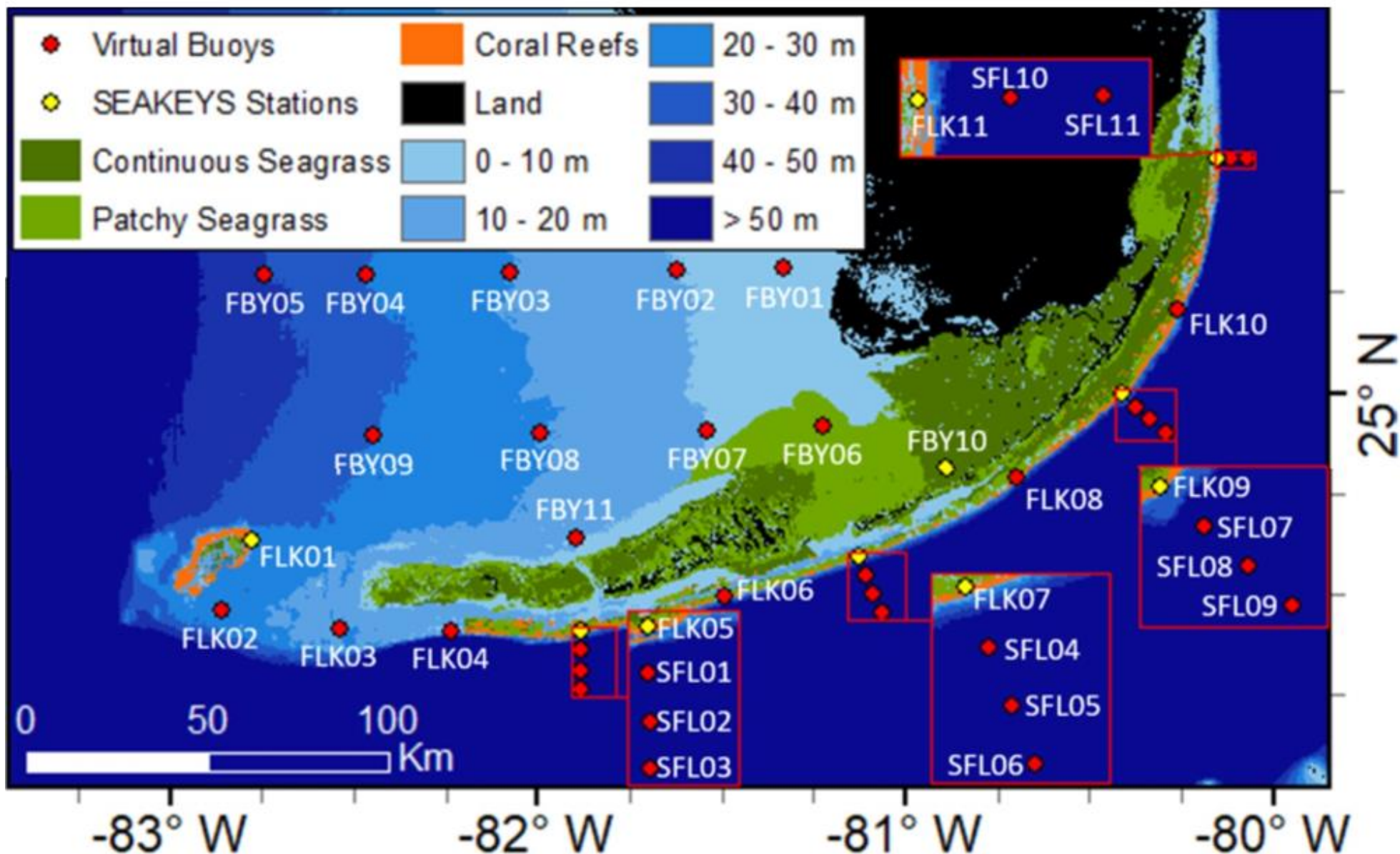
DataFlow has the capacity of gathering surface water physical-chemical data at relatively high speed (35 knots), covering large areas in a short time.



## DataFlow<sup>®</sup> surveys in Florida Bay



# Virtual Buoys

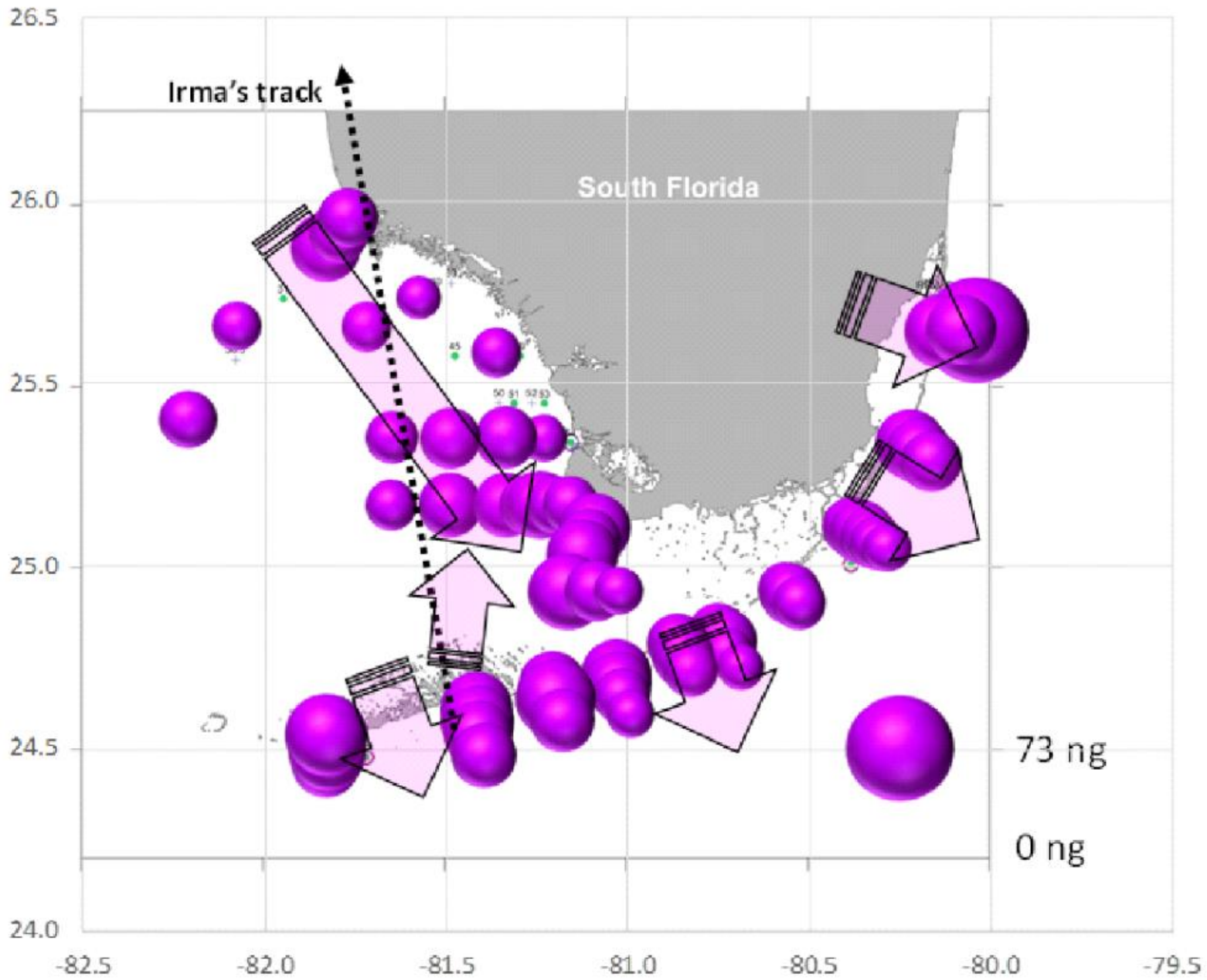


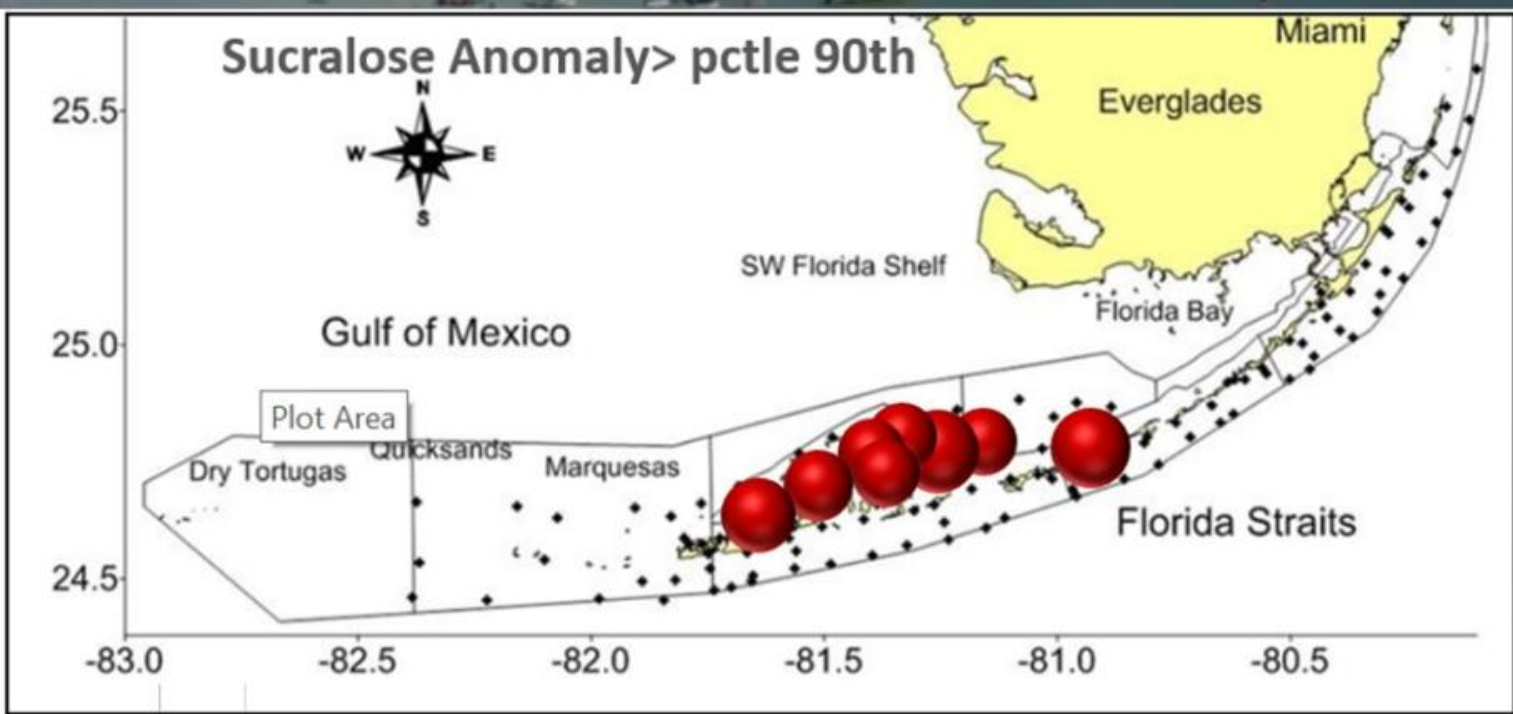
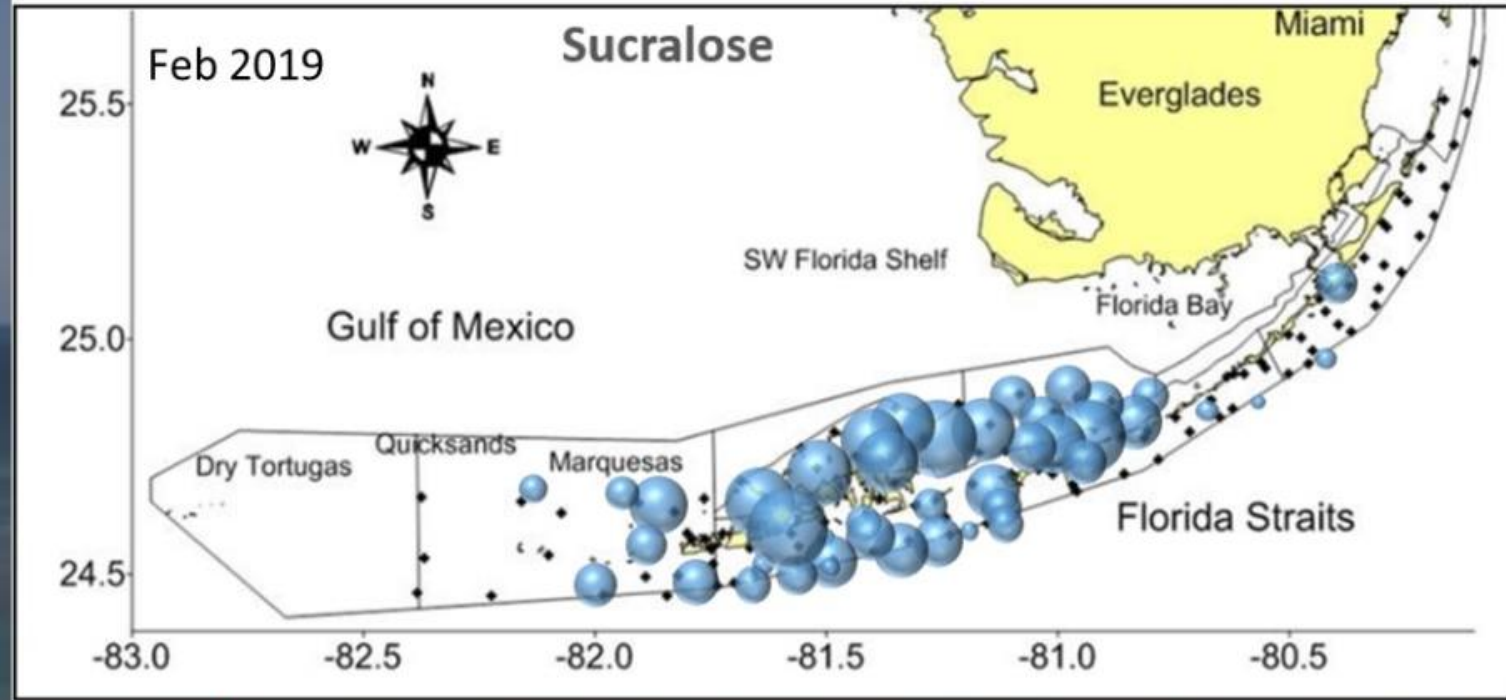
**DATA**  
 Temperature  
 chlorophyll-a,  
 turbidity (NTU),  
 diffuse light  
 attenuation,  
 secchi disk depth,  
 colored dissolved  
 organic matter  
 and bottom  
 available light.

2- Are we measuring/analyzing what we should be measuring/analyzing?

We cover all “traditional” monitoring species, but new compounds, especially emergent pollutants of concern, like sucralose, microbial communities, etc. should be included in some localities


# Sucralose







# Three critical questions for the Monitoring Program

A satellite image of Earth showing the ocean and landmasses. The ocean is a deep blue, and the land is a mix of brown, green, and tan. The image is taken from a high angle, showing the curvature of the planet. The text is overlaid on the left side of the image.

3- Are we measuring at the frequency we should be measuring??

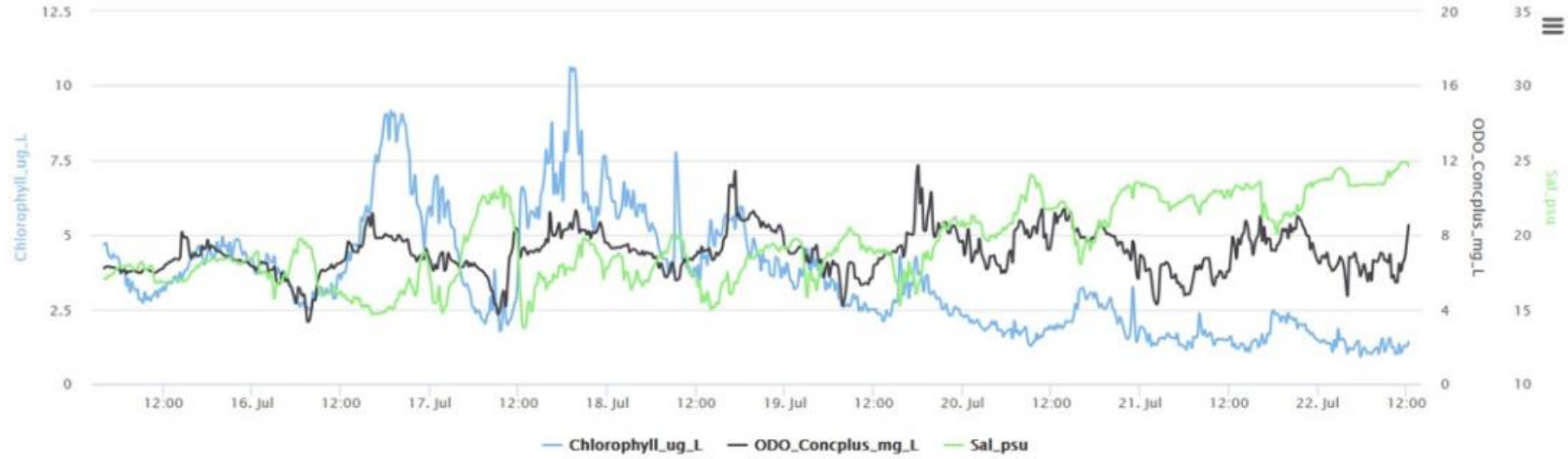
Definitively no. Quarterly sampling cannot go beyond seasonally-driven variability, and many processes/transformations occur at shorter frequency. We may suggest the deployment of instrumented buoys, able to collect/transmit data near real-time.

# FIU\_CREST2

Chart View

Table View

Site Information



A satellite image showing a coastal region. The land is visible in the upper right, with a large, irregularly shaped area of greenish water extending from the coast into the dark blue ocean. This greenish area is likely a plume of sediment or phytoplankton. The bottom of the image shows a white, textured area, possibly a cloud cover or a different type of water feature. The text "Questions?...." is overlaid in white on the greenish water.

Questions?....

## Water Quality Monitoring Laboratory

### The team..



Henry Briceño



Joseph N Boyer



Jeff Absten



Haley Kilgour



Sandro Stumpf



Eyleen Moncada

Key Largo Field Headquarters

Miami Laboratory