

# The Hangover Effect:

## Coupling seagrass loss, macroalgal growth, & water quality in Charlotte Harbor, Florida

**Chris J Anastasiou, Ph.D.**

Chief Scientist & Seagrass Mapping Program Lead  
Surface Water Improvement and Management (SWIM) Program  
Southwest Florida Water Management District

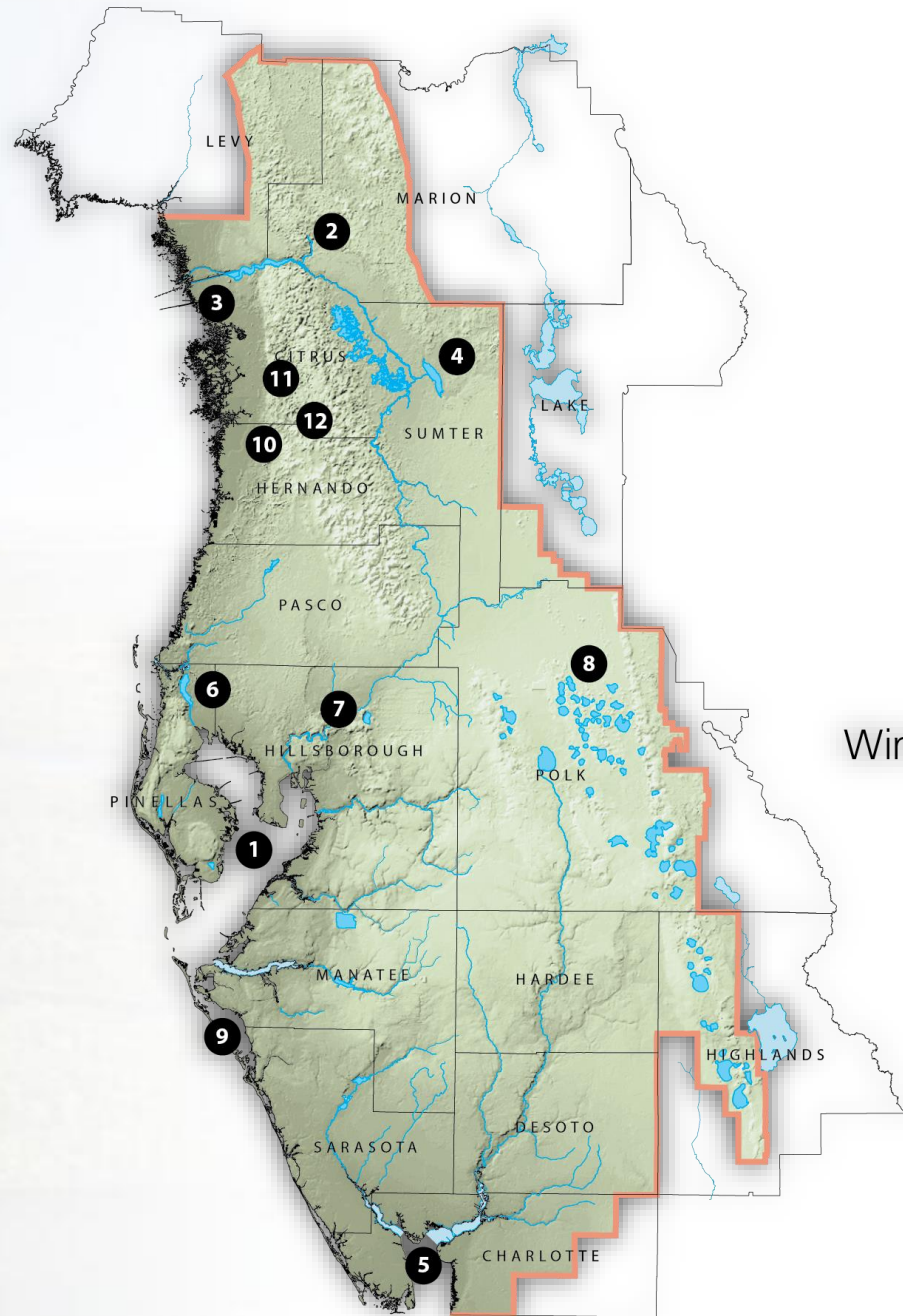
**Mark Walton**, SWIM SWFWMD

**Tara Schiro**, SWIM SWFWMD



2023 Charlotte Harbor Watershed Summit  
June 21-22, 2023

# SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT



- Tampa Bay **1**
- Rainbow River **2**
- Crystal River/Kings Bay **3**
- Lake Panasoffkee **4**
- Charlotte Harbor **5**
- Lake Tarpon **6**
- Lake Thonotosassa **7**
- Winter Haven Chain of Lakes **8**
- Sarasota Bay **9**
- Weeki Wachee River **10**
- Chassahowitzka River **11**
- Homosassa River **12**

# Charlotte Harbor Estuary



- 2<sup>nd</sup> largest open water estuary in Florida (~ 700 km<sup>2</sup>)
- Large watershed to open water ratio (12:1)
- “Hold the Line” nutrient management strategy (SWIM 2020)
  - From 2000 to 2017 no evidence of:
    - Degrading water clarity
    - Increasing chlorophyll-a
    - Increasing TP
    - Increasing TN

**Charlotte Harbor a relatively healthy estuary. . . BUT**

# Charlotte Harbor Estuary



- 2<sup>nd</sup> largest open water estuary in Florida (~ 700 km<sup>2</sup>)
- Large watershed to open water ratio (12:1)
- “Hold the Line” nutrient management strategy (SWIM 2020)
  - From 2000 to 2017 no evidence of:
    - Degrading water clarity
    - Increasing chlorophyll-a
    - Increasing TP
    - Increasing TN

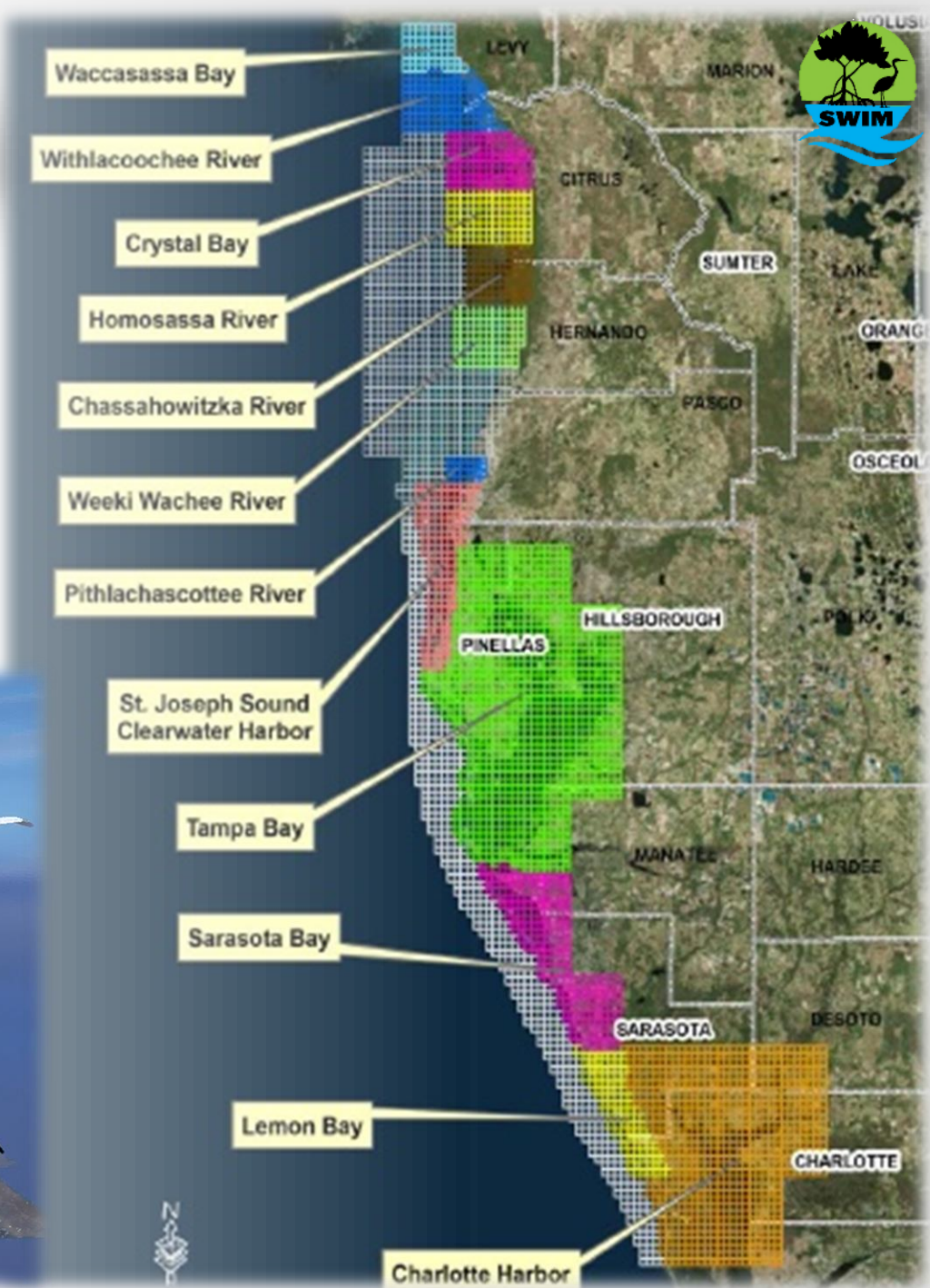
**Charlotte Harbor relatively healthy estuary... BUT NOT Pristine**

2000 Nitrogen loads 3X greater than in the 1800s (Turner, et al. 2006)

# SWFWMD Seagrass Mapping Program



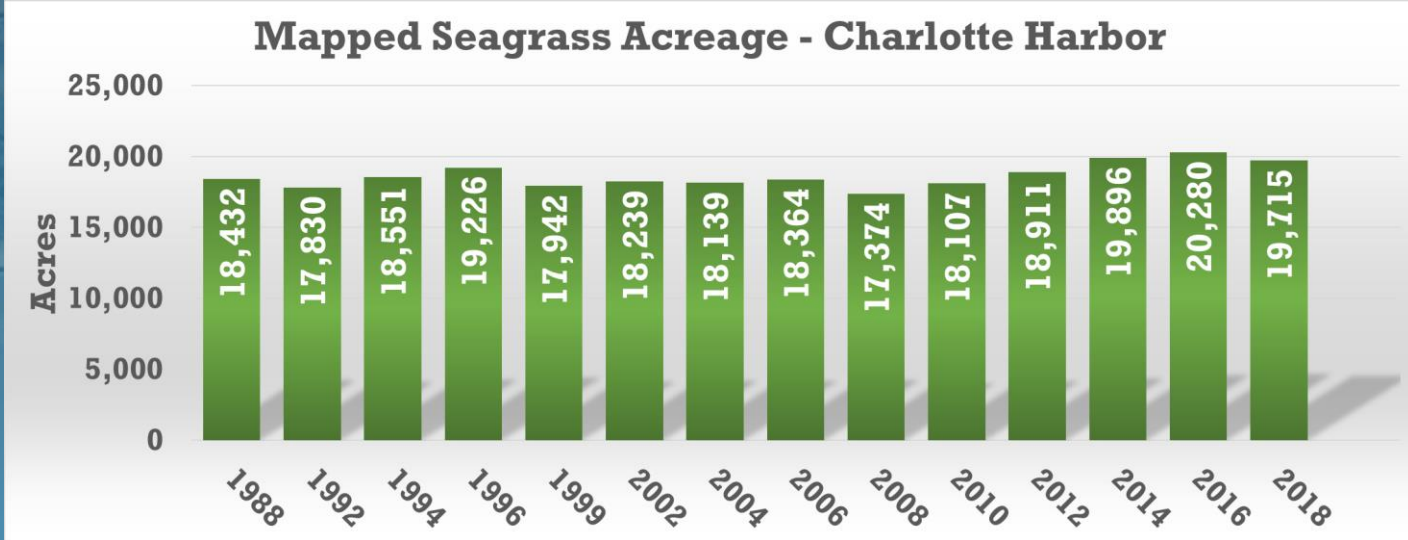
- **1988 – Present**
- **Photointerpretation of aerial imagery**
- **Field Verification (>1,200 points)**
- **Flight coverage area = 9,876 km<sup>2</sup>**



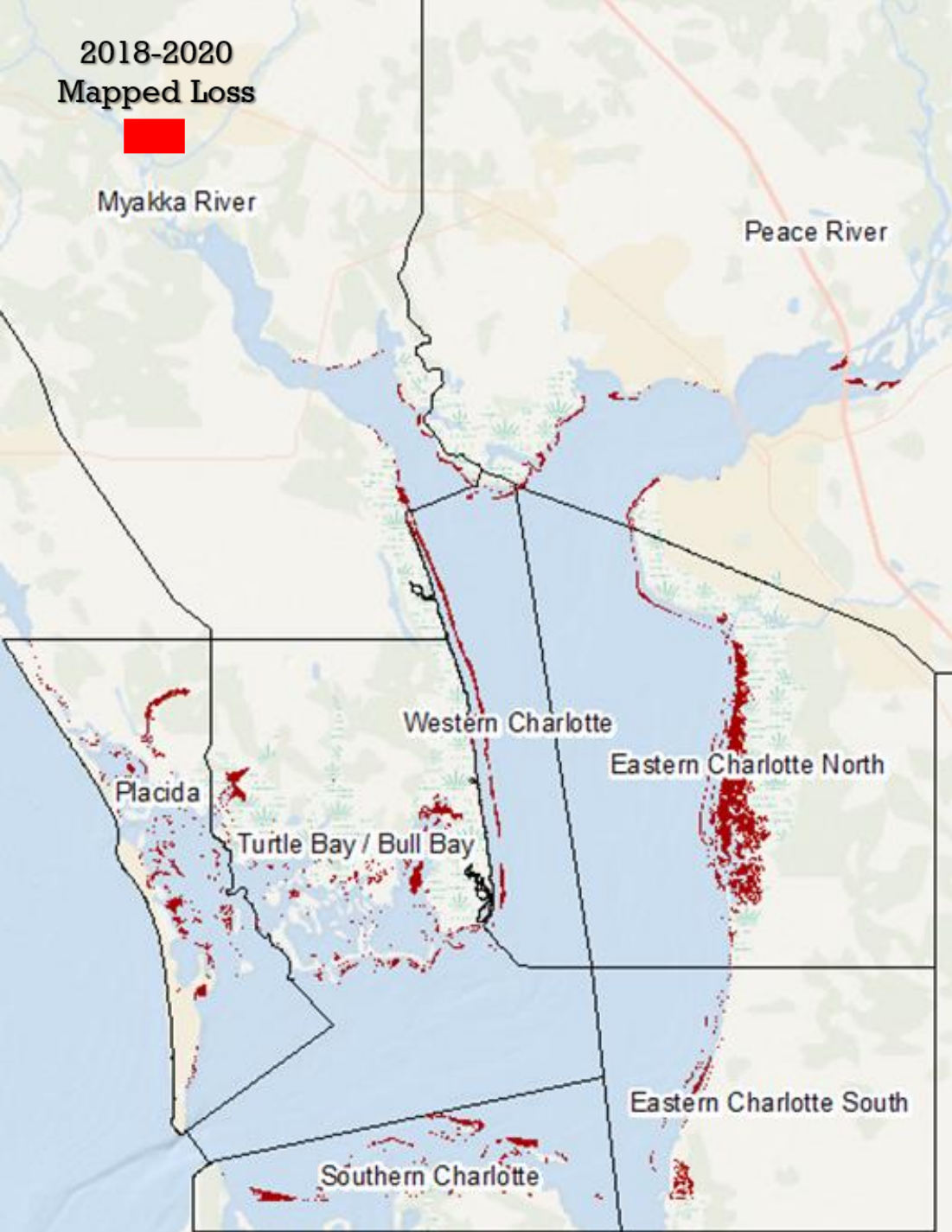


# Charlotte Harbor

Segments	2018
Eastern Charlotte Harbor N	3,530
Eastern Charlotte Harbor S	1,444
Myakka River	351
Peace River	602
Placida	4,630
Southern Charlotte	2,511
Turtle Bay / Bull Bay	4,811
Western Charlotte	1,835
<b>Charlotte Harbor Total</b>	<b>19,715</b>



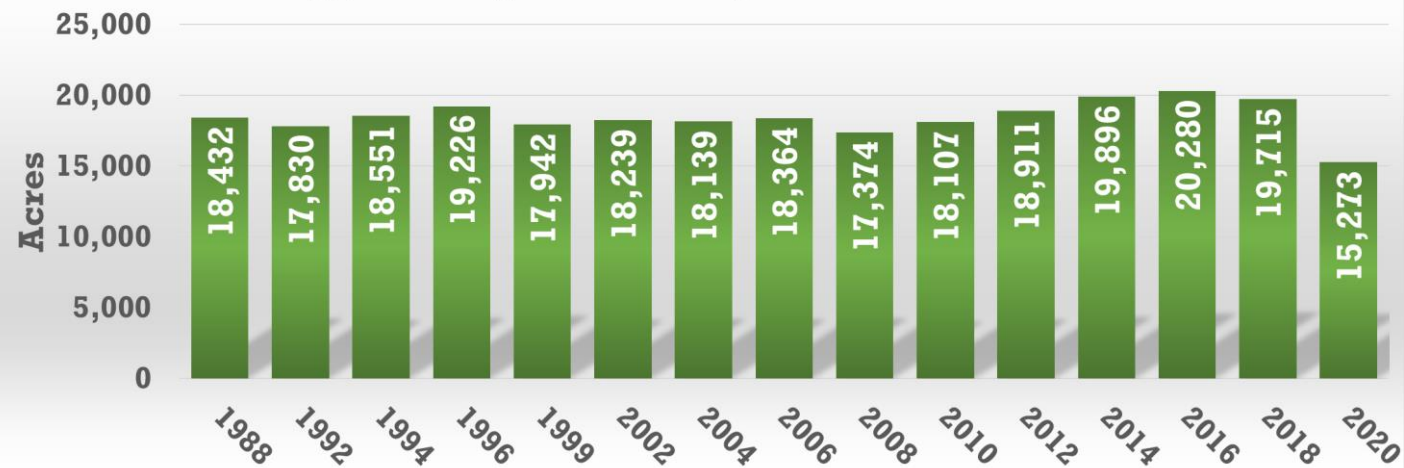
2018-2020  
Mapped Loss



# Charlotte Harbor

Segments	2018	2020	Δ Acres	% Change
Eastern Charlotte Harbor N	3,530	1,770	-1,760	-50%
Eastern Charlotte Harbor S	1,444	1,258	-186	-13%
Myakka River	351	189	-163	-46%
Peace River	602	349	-253	-42%
Placida	4,630	4,029	-602	-13%
Southern Charlotte	2,511	2,079	-432	-17%
Turtle Bay / Bull Bay	4,811	4,178	-634	-13%
Western Charlotte	1,835	1,421	-414	-23%
<b>Charlotte Harbor Total</b>	<b>19,715</b>	<b>15,273</b>	<b>-4,442</b>	<b>-23%</b>

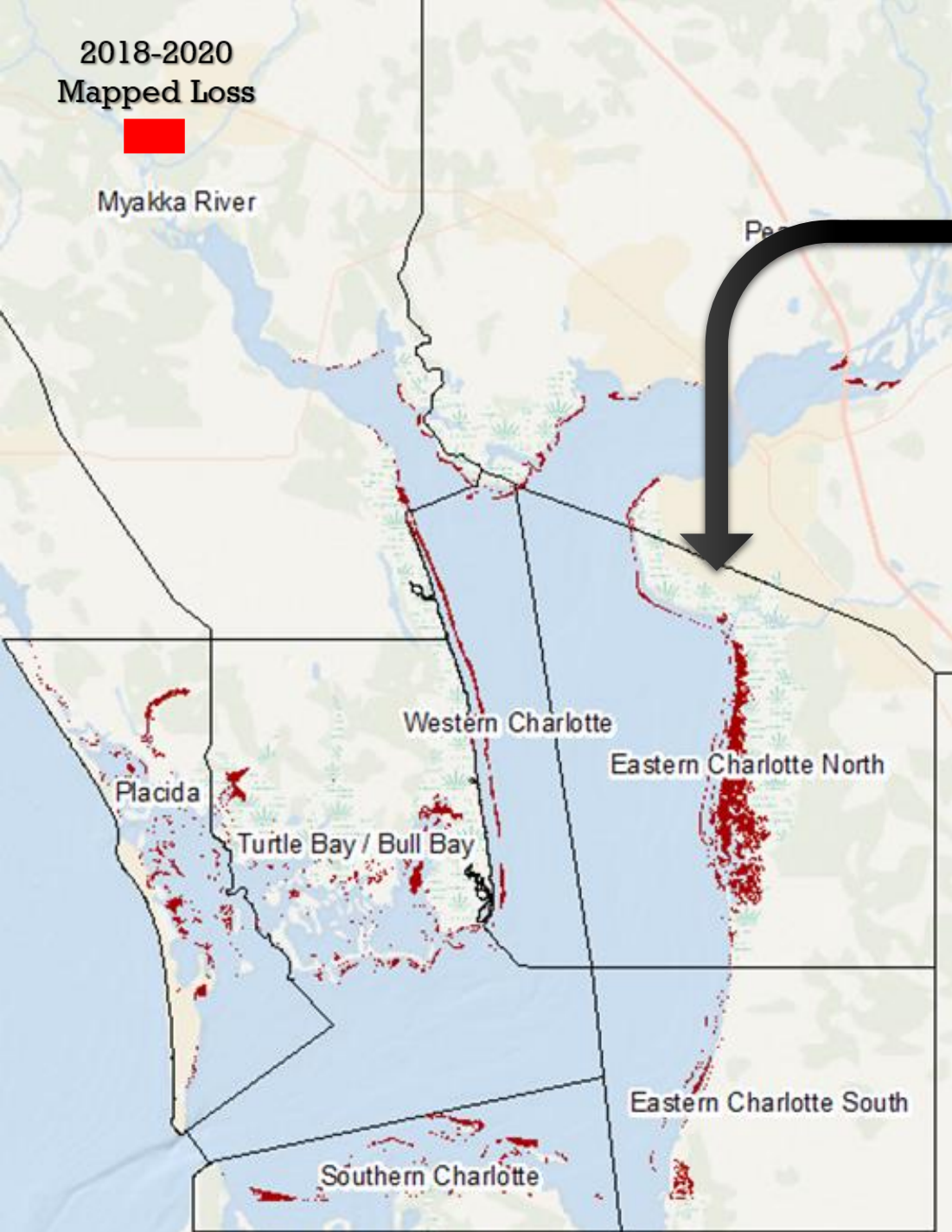
Mapped Seagrass Acreage - Charlotte Harbor



2018-2020  
Mapped Loss



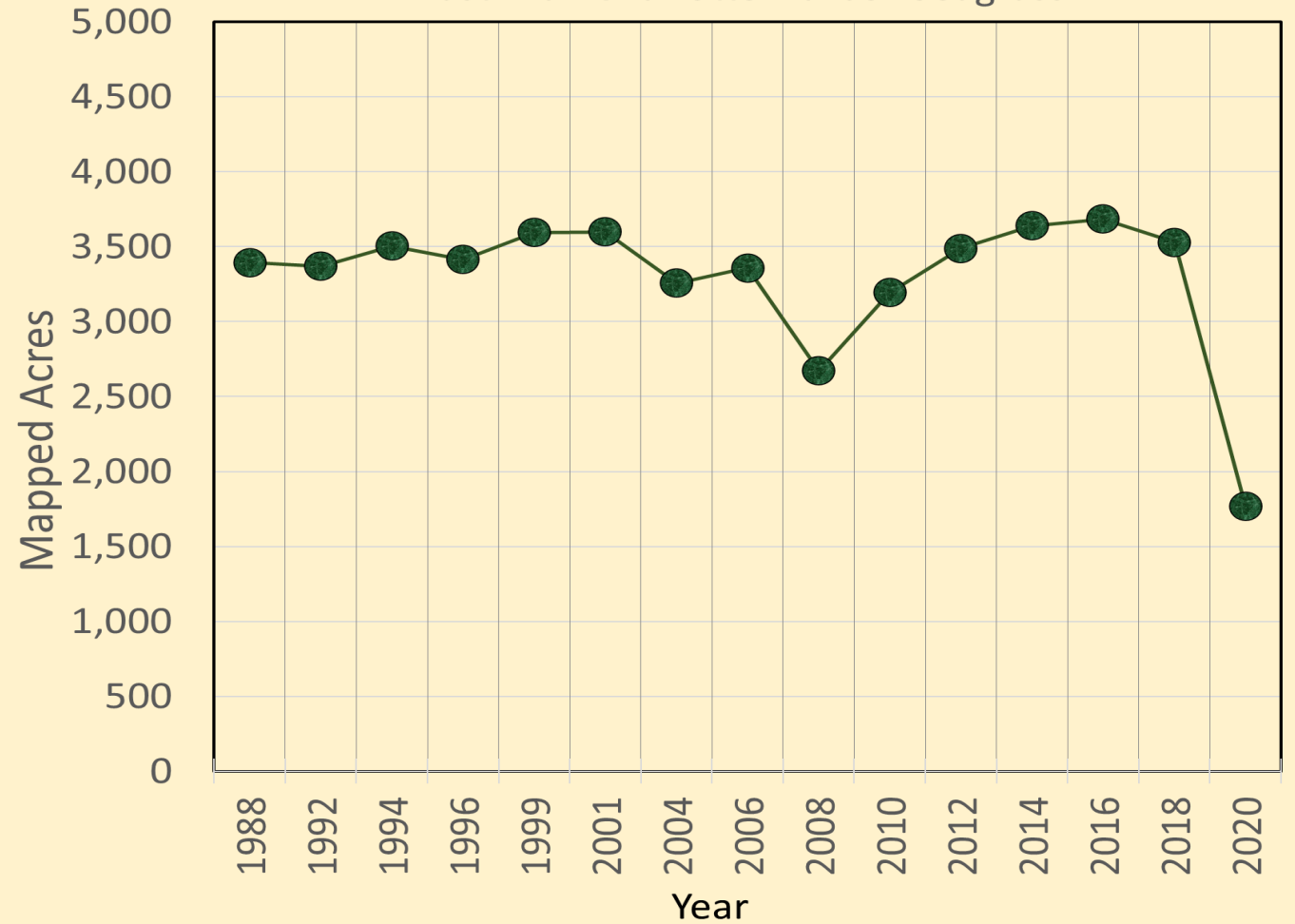
Myakka River



# Charlotte Harbor

Segments	2018	2020	Δ Acres	% Change
Eastern Charlotte Harbor N	3,530	1,770	-1,760	-50%

East Wall Charlotte Harbor Seagrass





# *Caulerpa fastigiata* Montagne, 1837



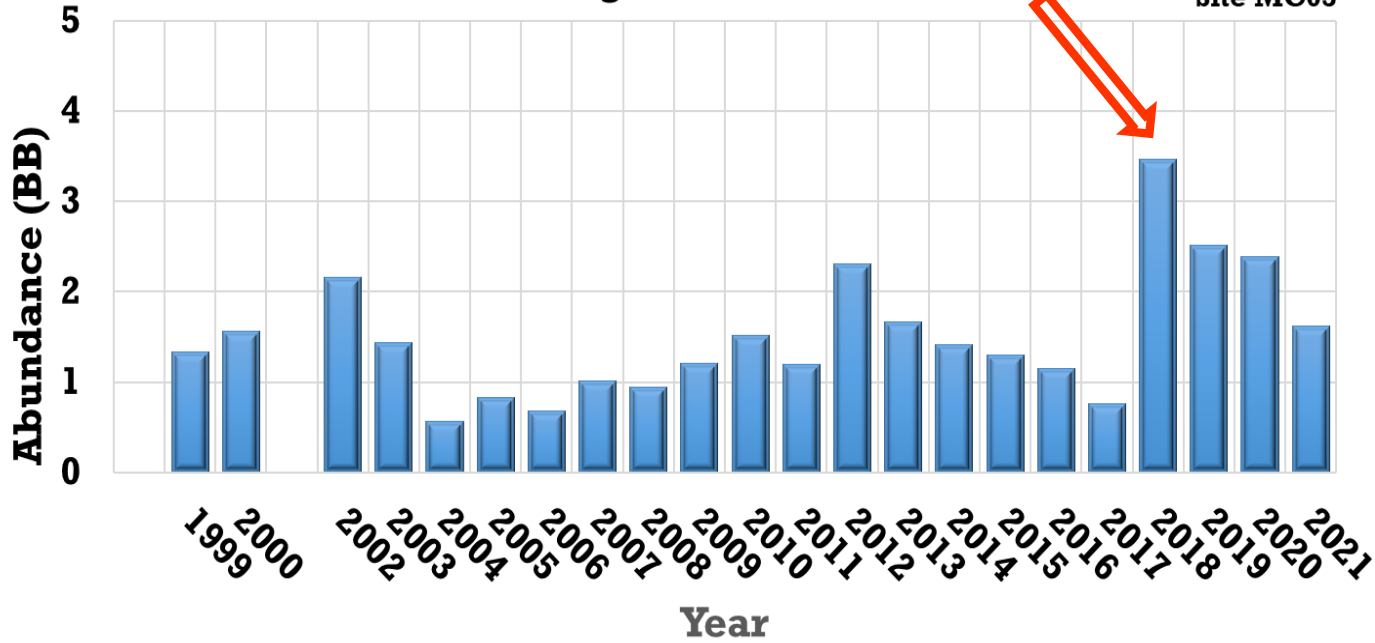
Punta Gorda  
August 17, 2020



FWC (August 17, 2020)

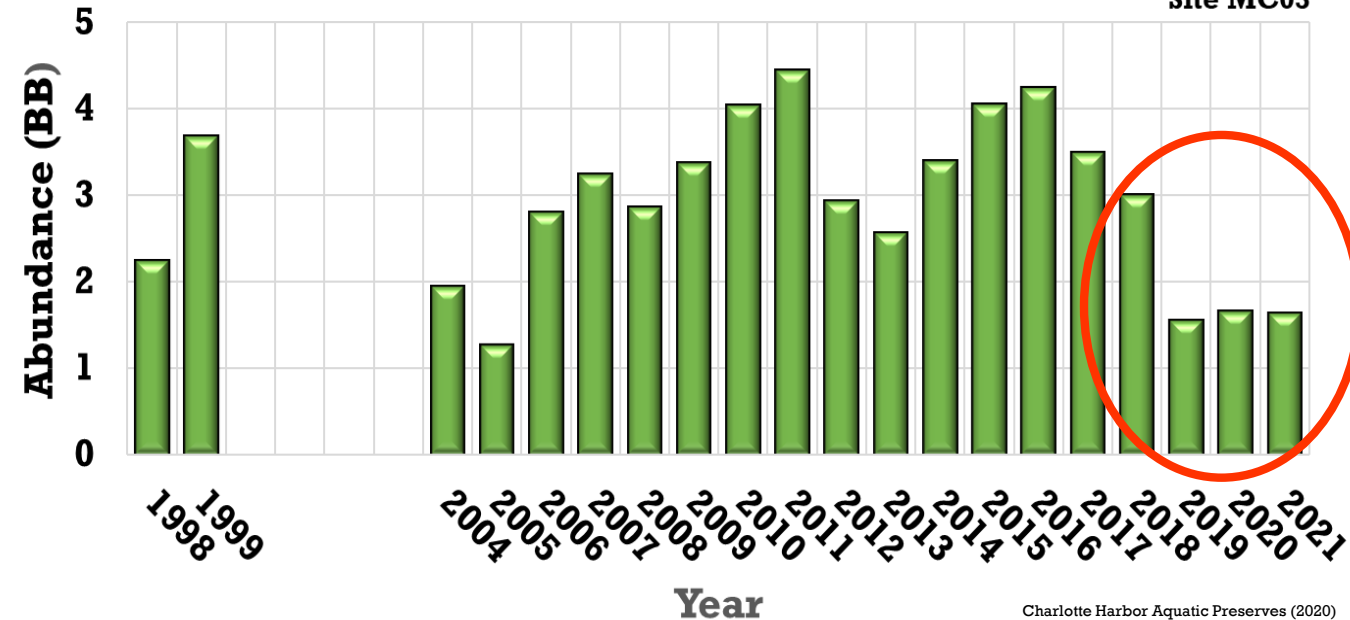
# Drift Algae Abundance

Site MC03

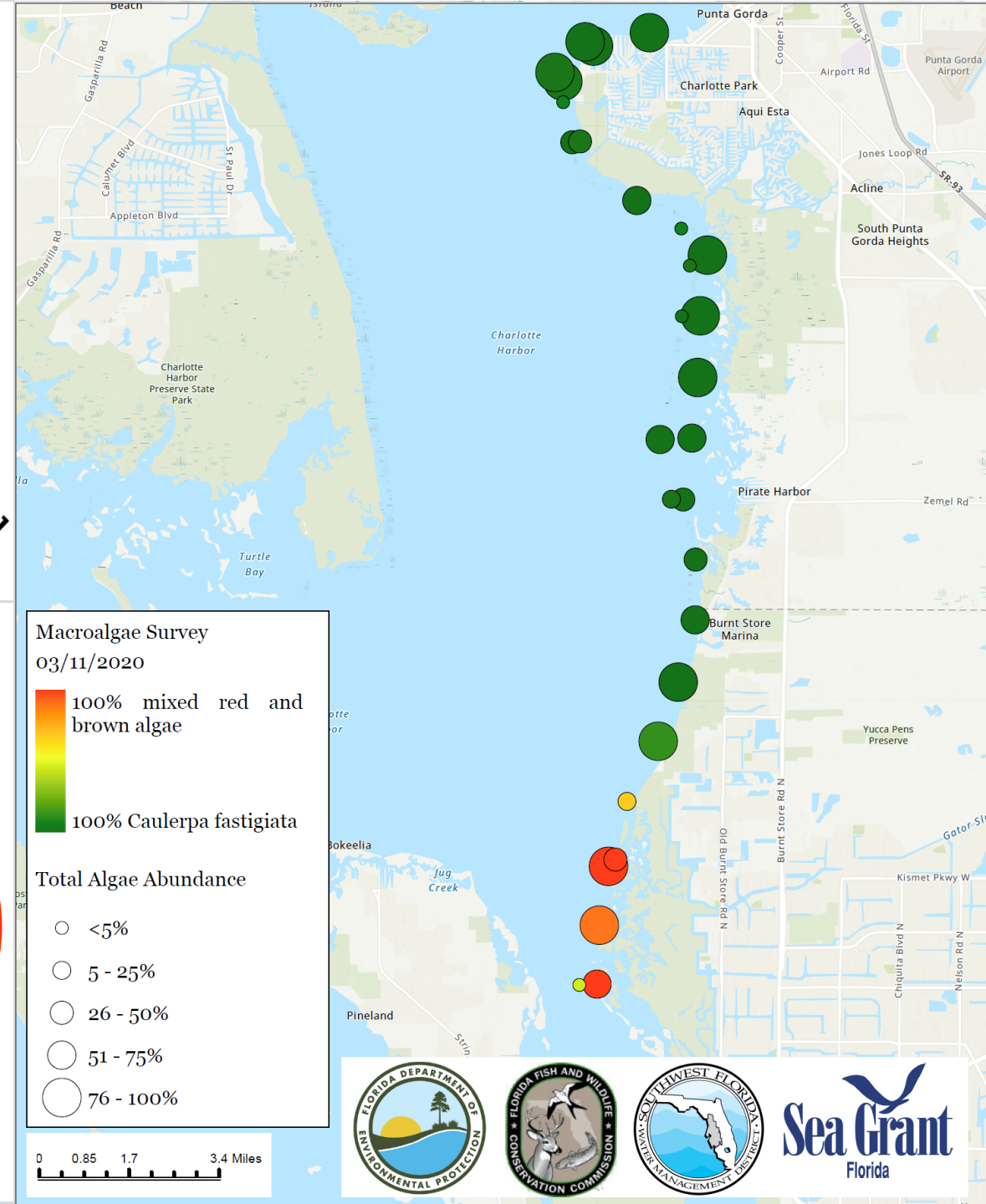


# Seagrass Abundance

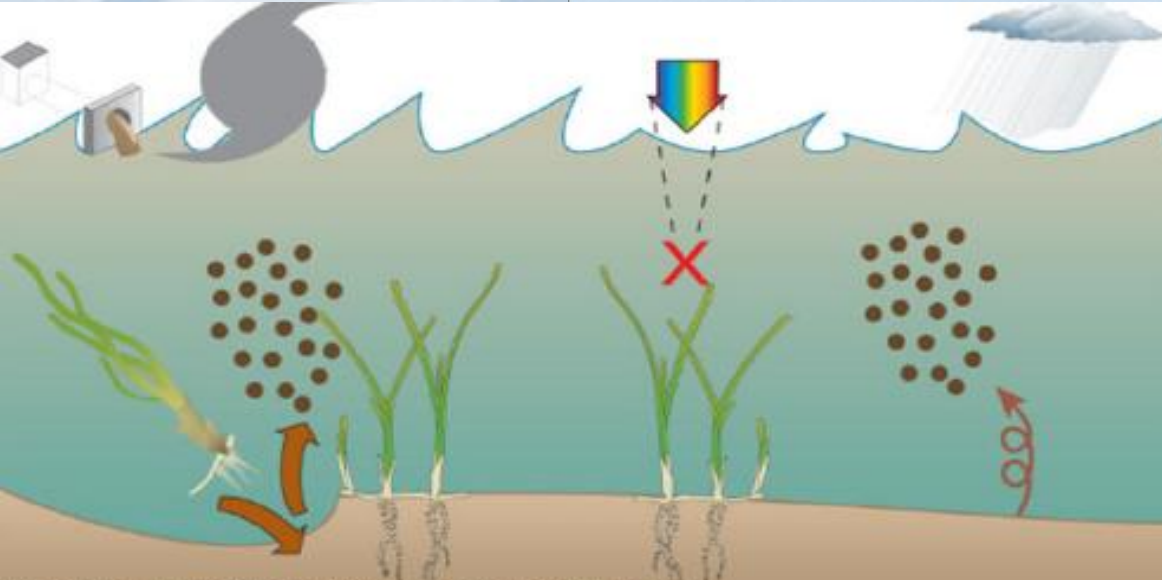
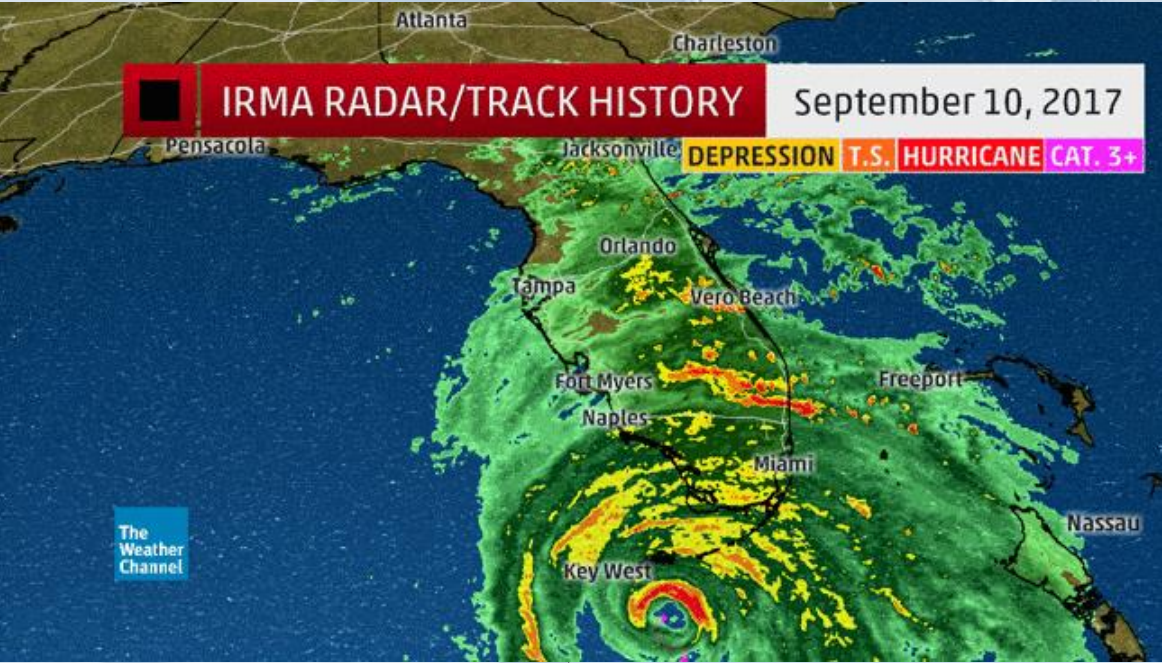
Site MC03



Charlotte Harbor Aquatic Preserves (2020)

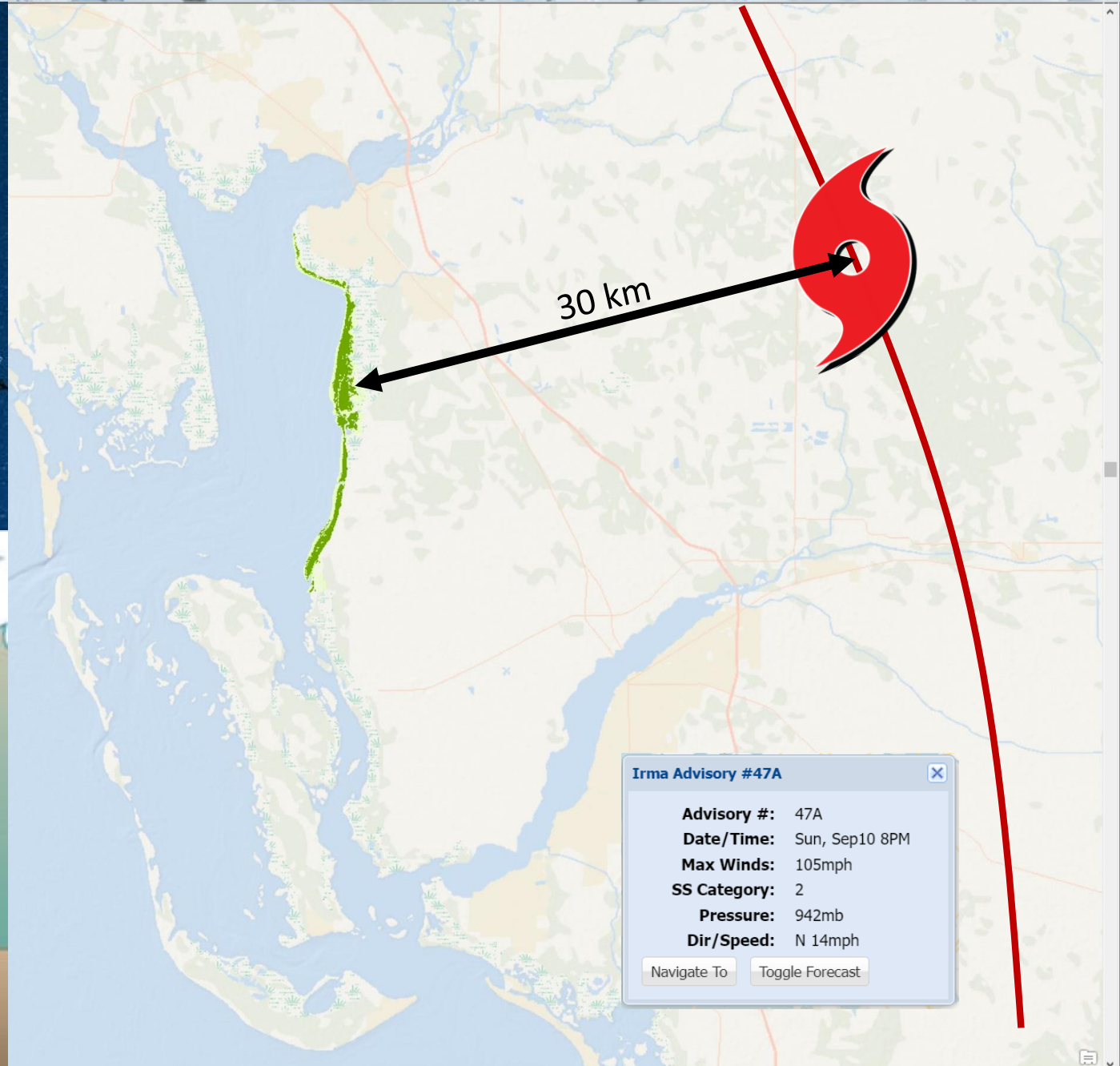


# Hurricane Irma (September 2017)

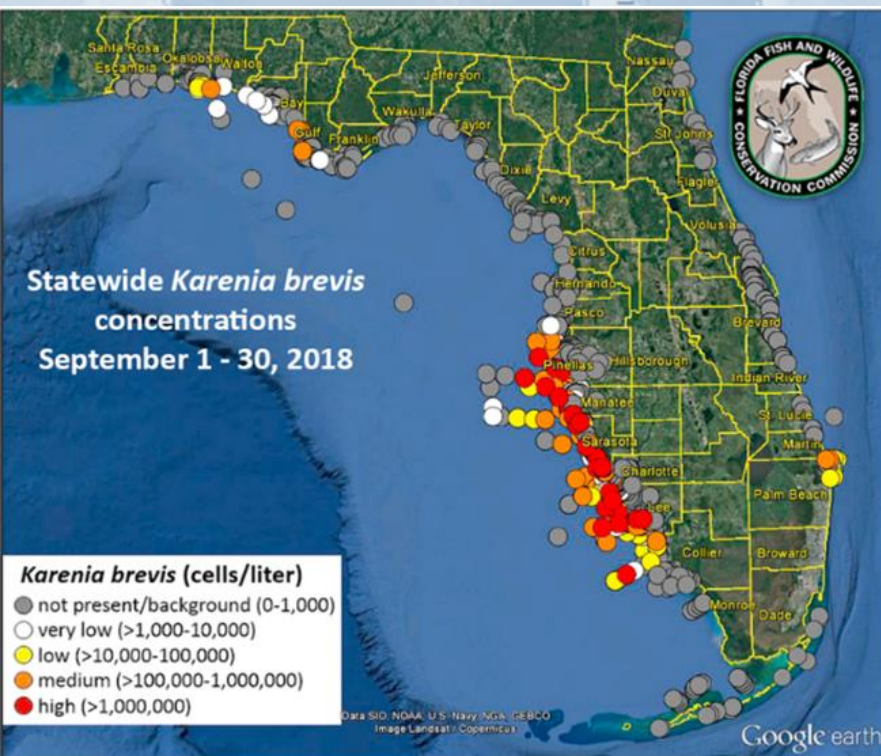


Symbols courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science ([ian.umces.edu/symbols/](http://ian.umces.edu/symbols/)).

Tomasko, et al. (2020)



# Red Tide (Oct 2017 – Jan 2019)

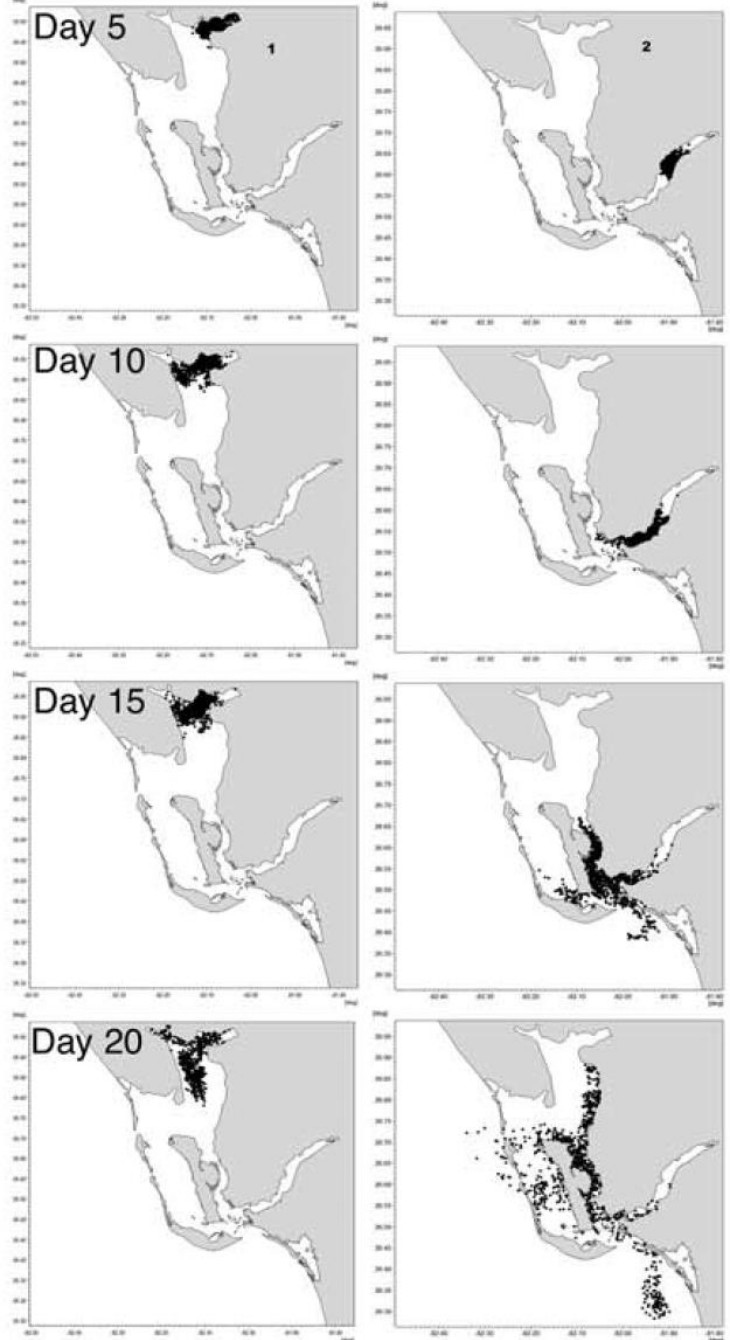


Florida: Harmful Algal Blooms ([noaa.gov](http://noaa.gov))

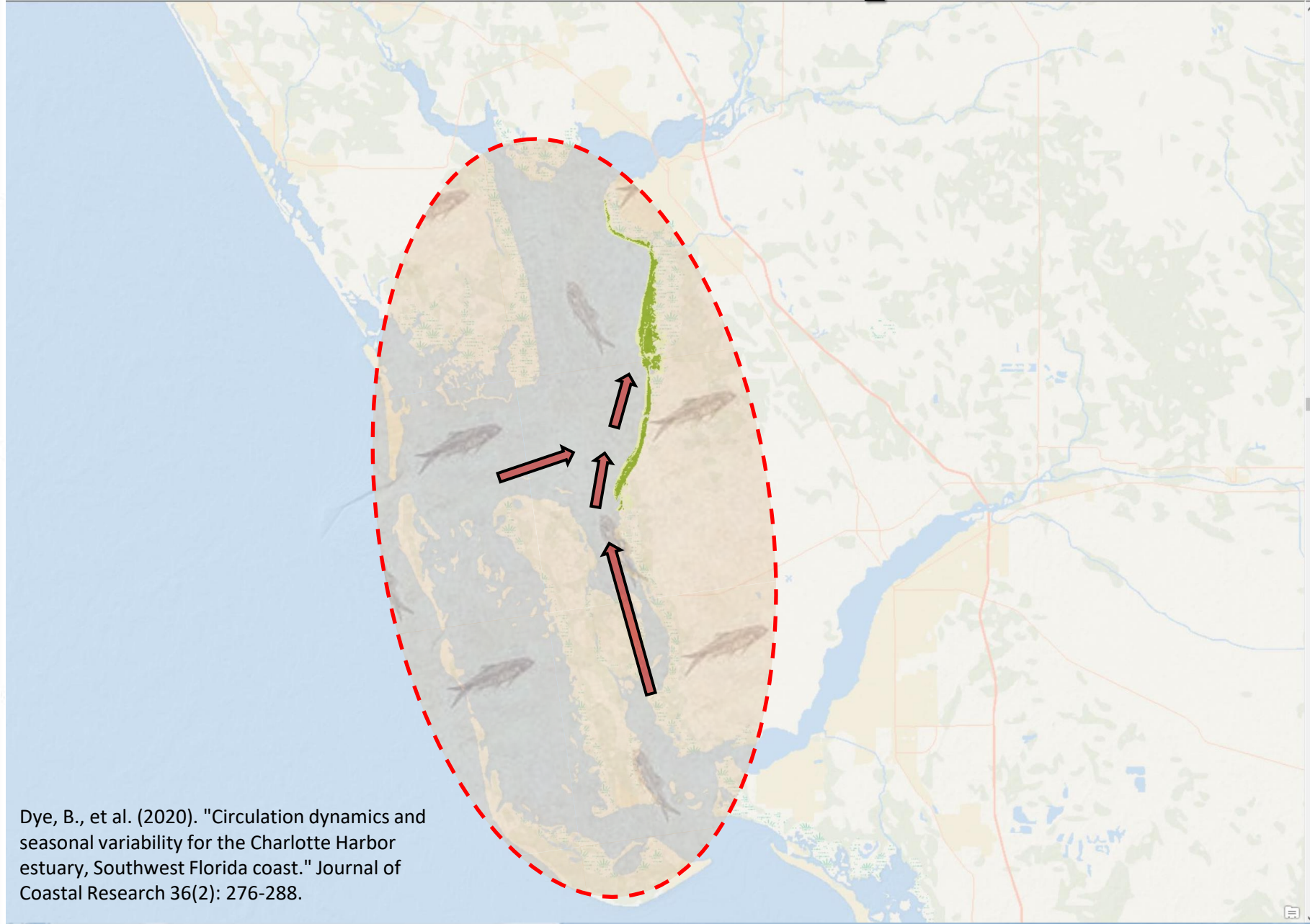


Charlotte Harbor was spared the brunt of the red tide event

# Wet Season



# Post-Red Tide Decomposition



Dye, B., et al. (2020). "Circulation dynamics and seasonal variability for the Charlotte Harbor estuary, Southwest Florida coast." *Journal of Coastal Research* 36(2): 276-288.

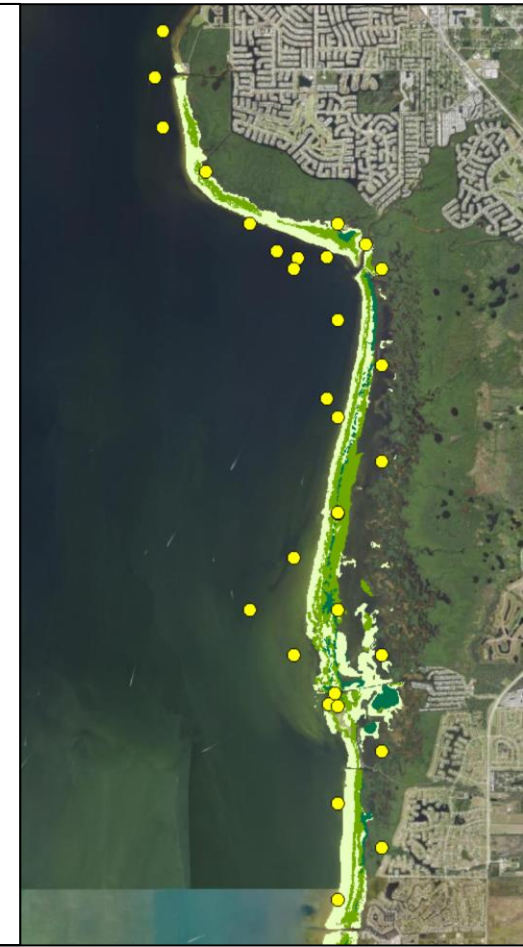
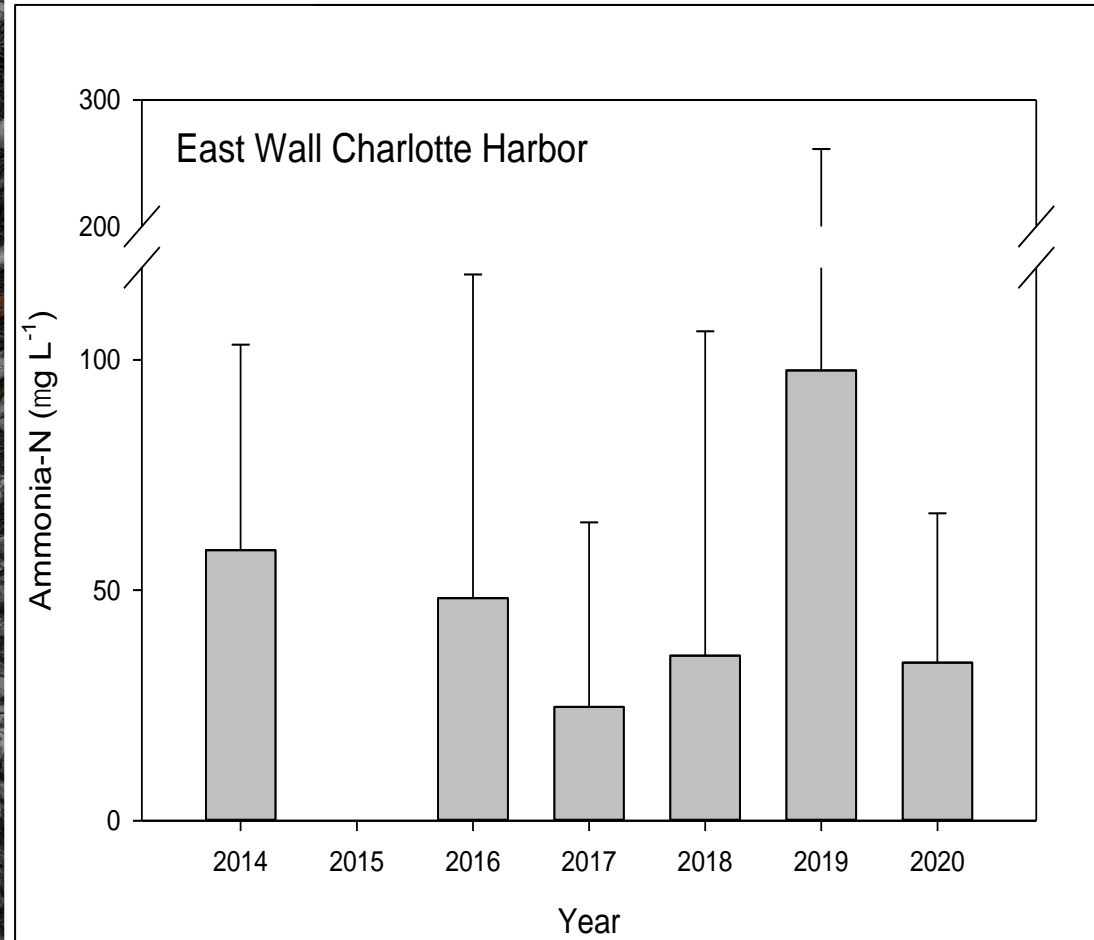
# Red Tide Aftermath

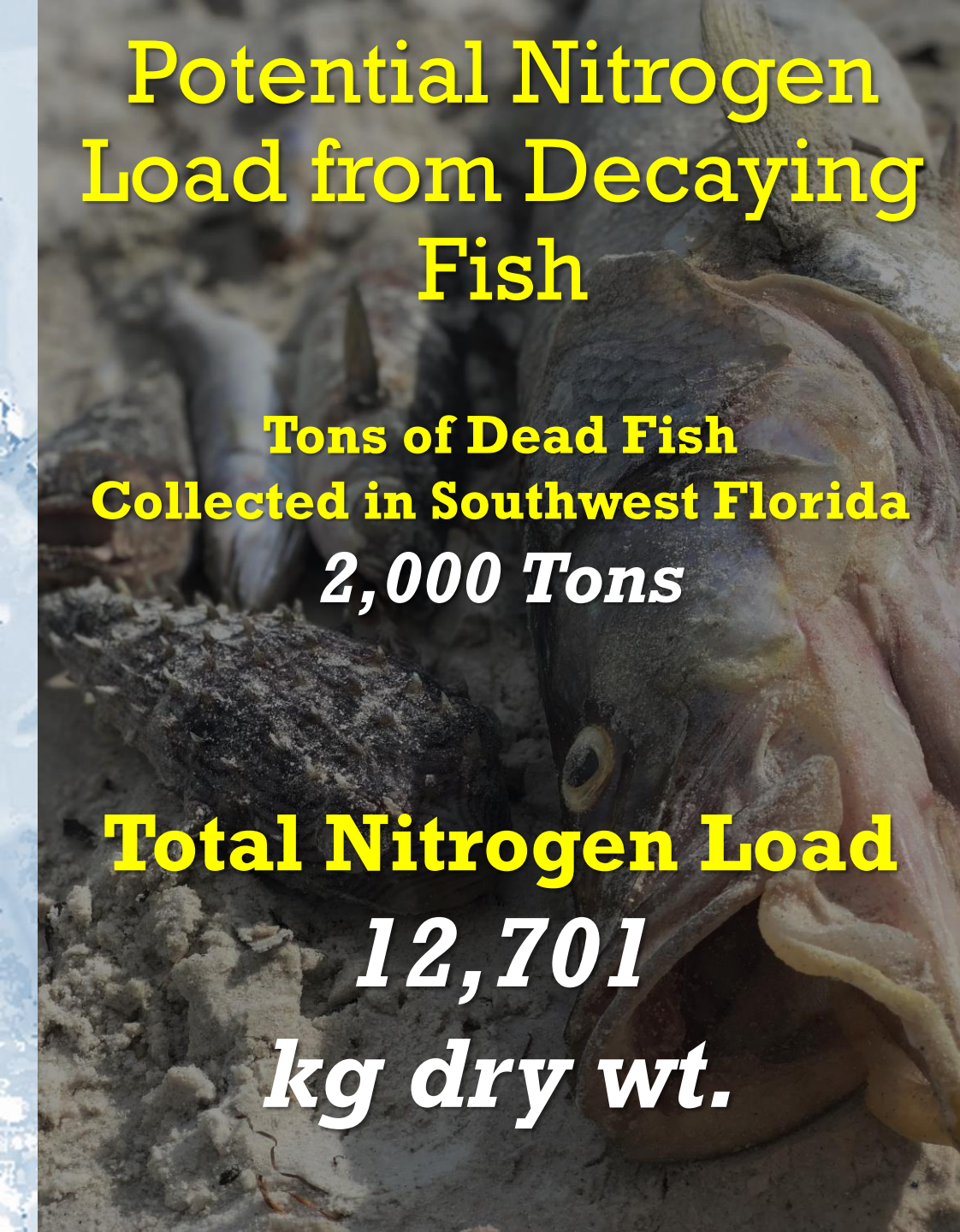
- Ammonium release from decaying fish can be a significant and acute nutrient source
- *Caulerpa prolifera*: 81% of total nitrogen acquisition in the form of ammonium

*Alexandre & Santos (2020)*

Fish carcasses have the potential to release large quantities of highly bioavailable nutrients, especially Ammonium ( $\text{NH}_4^+$ )

*Killberg-Thoreson, et al. (2014)*



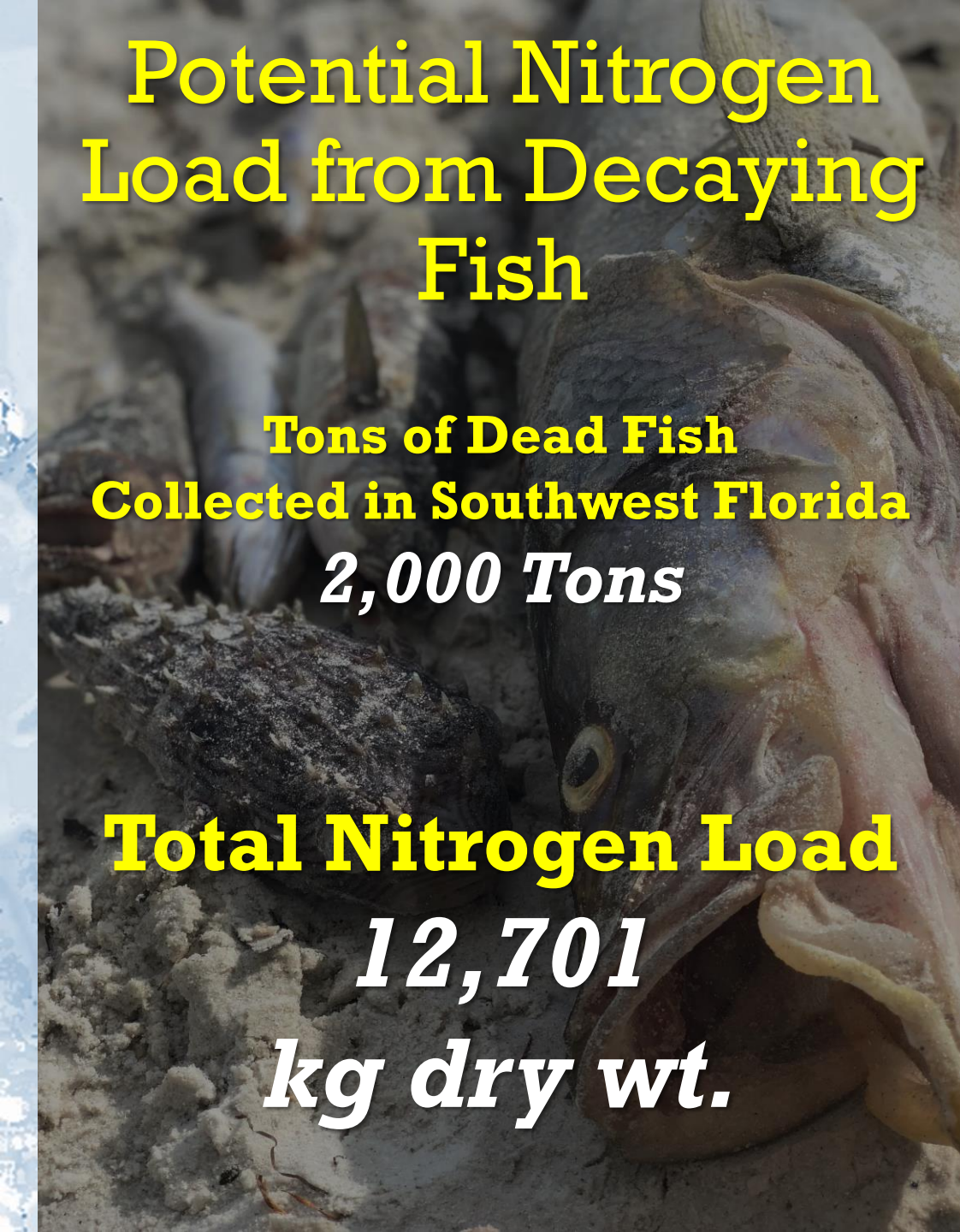


# Potential Nitrogen Load from Decaying Fish

**Tons of Dead Fish  
Collected in Southwest Florida  
*2,000 Tons***

**Total Nitrogen Load  
*12,701*  
*kg dry wt.***





# Potential Nitrogen Load from Decaying Fish

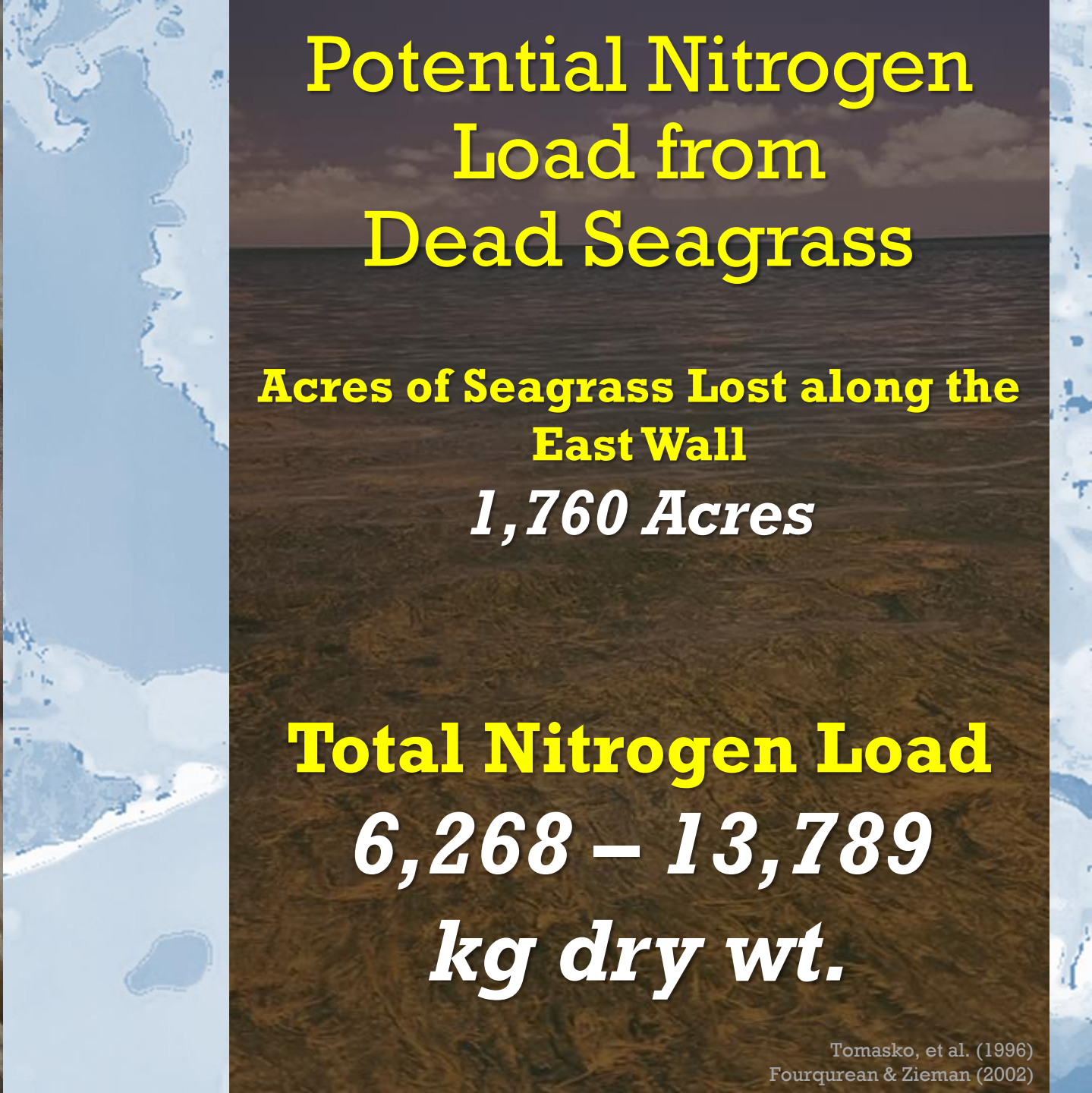
**Tons of Dead Fish Collected in Southwest Florida**

***2,000 Tons***

**Total Nitrogen Load**

***12,701***

***kg dry wt.***



# Potential Nitrogen Load from Dead Seagrass

**Acres of Seagrass Lost along the East Wall**

***1,760 Acres***

**Total Nitrogen Load**

***6,268 – 13,789***

***kg dry wt.***



# The Hangover Effect

- Unprecedented seagrass loss and macroalgal proliferation
- Charlotte Harbor largely spared direct impact from 2017-2018 red tide
- Large increase in ammonia-rich waters occurred after red tide event
- Dead fish + dead seagrass a one-two nutrient punch



# Thanks to all our partners!



Charlotte Harbor Aquatic Preserves



**UF** | **IFAS Extension**  
UNIVERSITY of FLORIDA





**Chris J Anastasiou, Ph.D.**

**Chief Scientist**

**Surface Water Improvement and Management Program**

**Southwest Florida Water Management District**

**[chris.anastasiou@swfwmd.state.fl.us](mailto:chris.anastasiou@swfwmd.state.fl.us)**