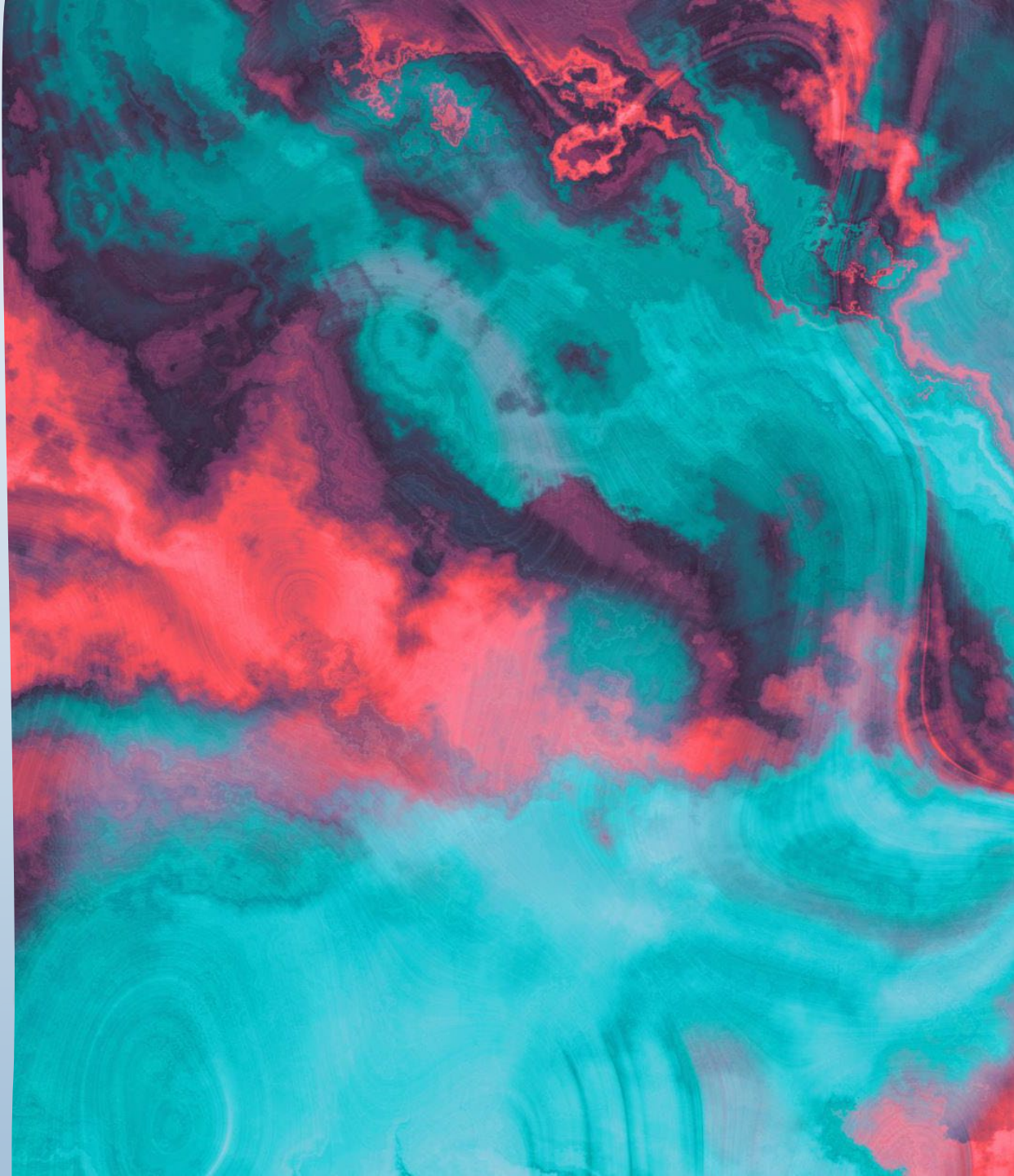


**BENTHIC
DINOFLAGELLATES,
SPINNING FISH, AND
SAWFISH MORTALITIES: IS
THERE A CONNECTION?**

MICHAEL PARSONS, PH.D.

THE WATER SCHOOL

FLORIDA GULF COAST UNIVERSITY



ACKNOWLEDGMENTS

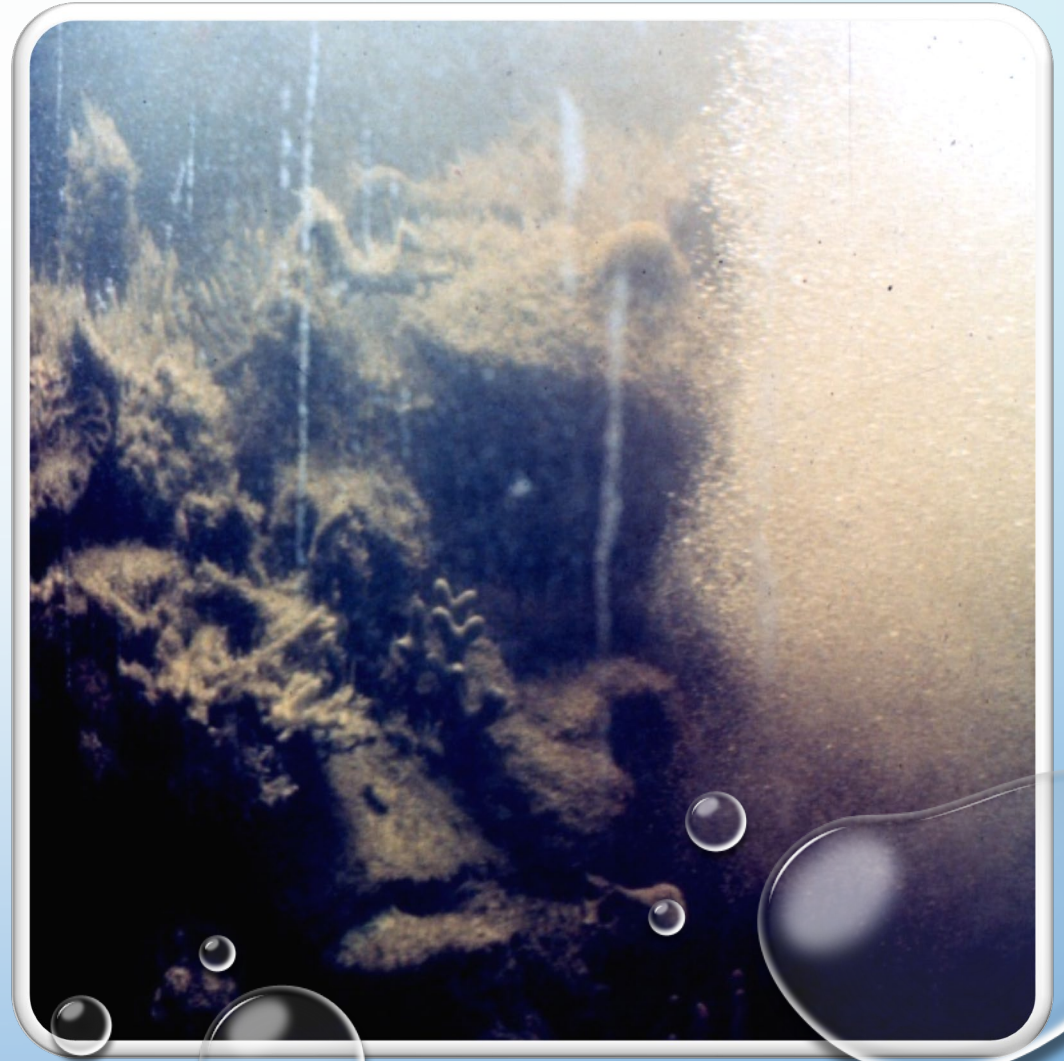
- RACHAEL SCHINBECKLER (FLORIDA GULF COAST UNIVERSITY); TYNISHA MARTIN (FLORIDA GULF COAST UNIVERSITY); ADAM CATASUS (FLORIDA GULF COAST UNIVERSITY)
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- ROSS BOUCEK (BONEFISH & TARPON TRUST)
- FLORIDA FISH AND WILDLIFE COMMISSION
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 - FLORIDA FISH AND WILDLIFE COMMISSION (DATA AND FUNDING)
 - BONEFISH TARPON TRUST (DATA AND FUNDING)
 - LOWER KEYS GUIDES ASSOCIATION
 - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

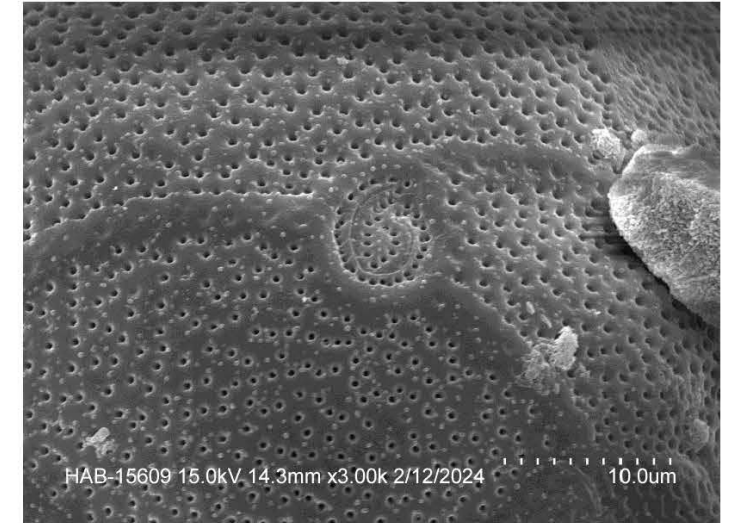


WHAT WE (THINK WE) KNOW:

- MANY DIFFERENT TYPES OF FISH WERE AFFECTED
 - SUGGESTS THE STRESSOR IS SOMETHING IN THE WATER VERSUS DIET-RELATED
- DOES NOT APPEAR TO BE:
 - RED TIDE (ABSENT; NO BREVETOXINS DETECTED)
 - LOW OXYGEN (OXYGEN LEVELS ARE TYPICAL)
 - LOW SALINITY OR TEMPERATURE (VALUES ARE TYPICAL)
 - DISEASE OR PARASITES
 - TYPICAL POLLUTANTS OF CONCERN
- THE BENTHIC DINOFLAGELLATE, *GAMBIERDISCUS*, OBSERVED IN THE WATER COLUMN (1,000 CELLS L⁻¹) AND IN THE GUT CONTENTS OF ONE MULLET (FL FWC)
 - THIS WAS MUCH HIGHER THAN FGCU RESEARCHERS OBSERVED IN 10+ YEARS OF STUDY IN THE MIDDLE KEYS (AVERAGE OF 39 CELLS/L; MAXIMUM OF 238 CELLS/L)

**PITTSBURGH
ZOO
AQUARIUM
EXHIBIT**

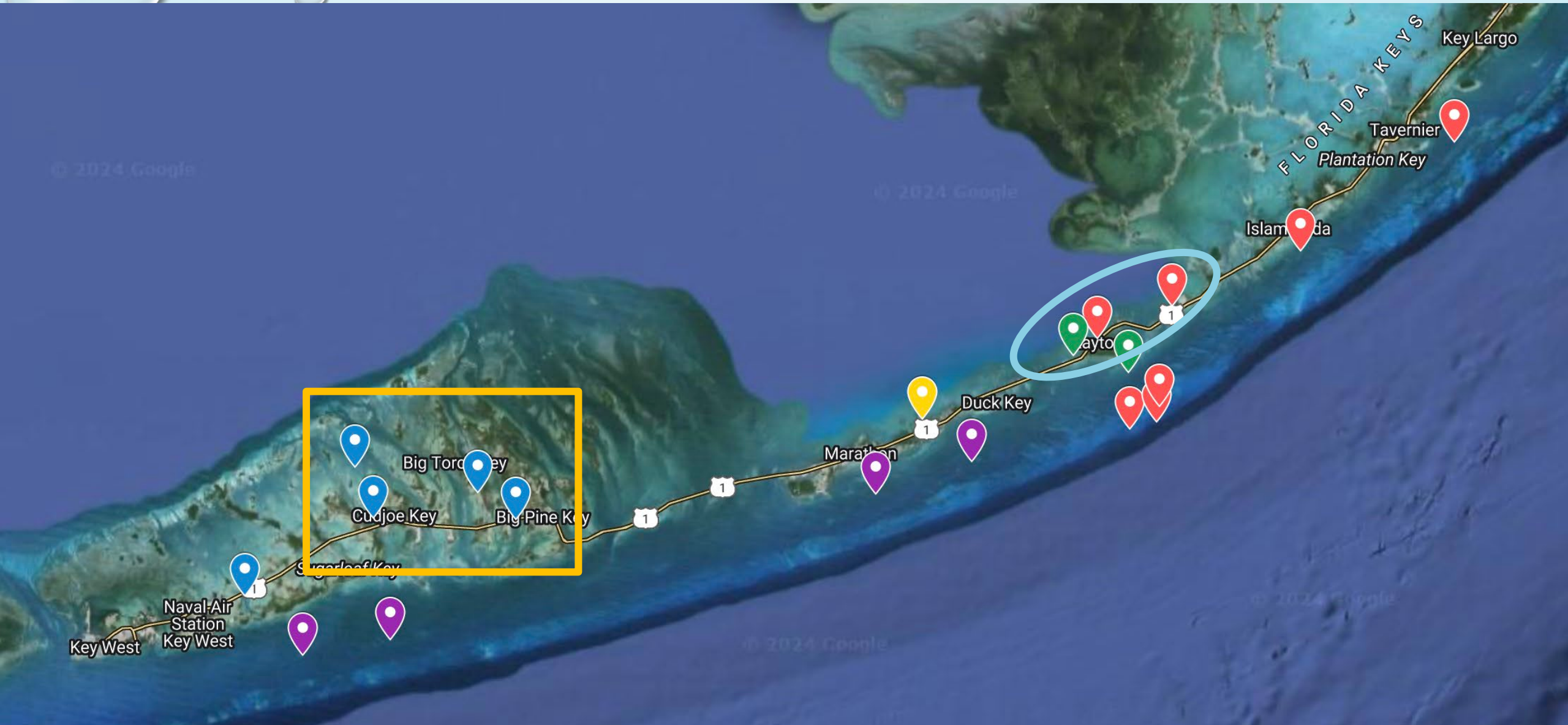


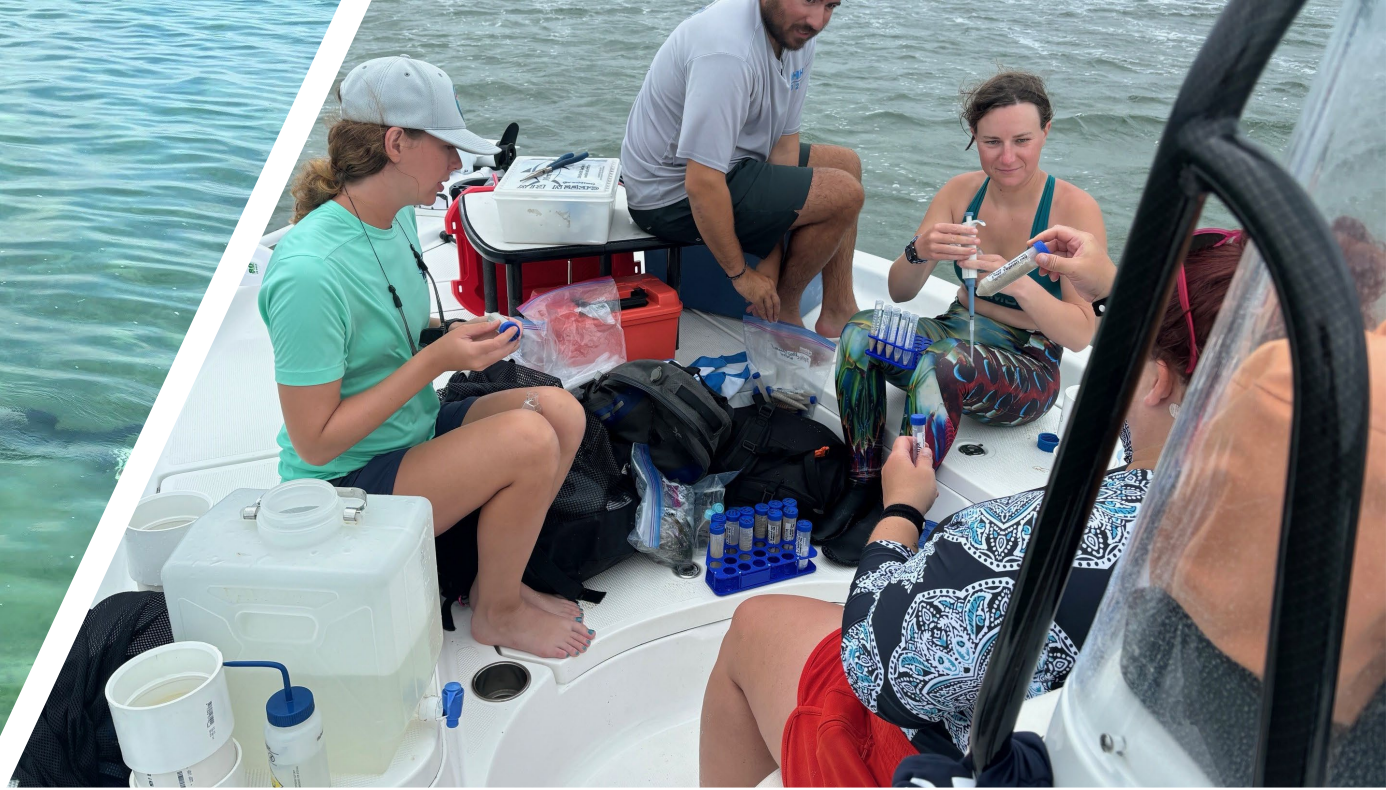


Litaker et al. 2009, for reference

WHY FOCUS ON BENTHIC DINOFLAGELLATES?

- MANY PRODUCE TOXINS (AND TOXIN PRECURSORS)
 - *GAMBIERDISCUS* - CIGUATOXINS (CIGUATERA POISONING); MAITOTOXINS (WATER SOLUBLE)
 - *PROROCENTRUM* – OKADAIC ACID (DIARRHETIC SHELLFISH POISONING)
 - OTHERS

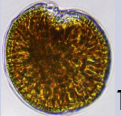
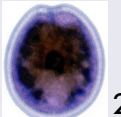
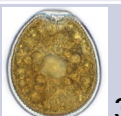
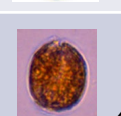
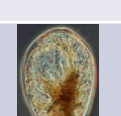




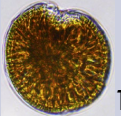
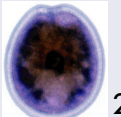
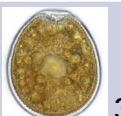
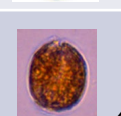
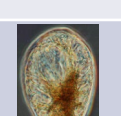
COMPARISONS

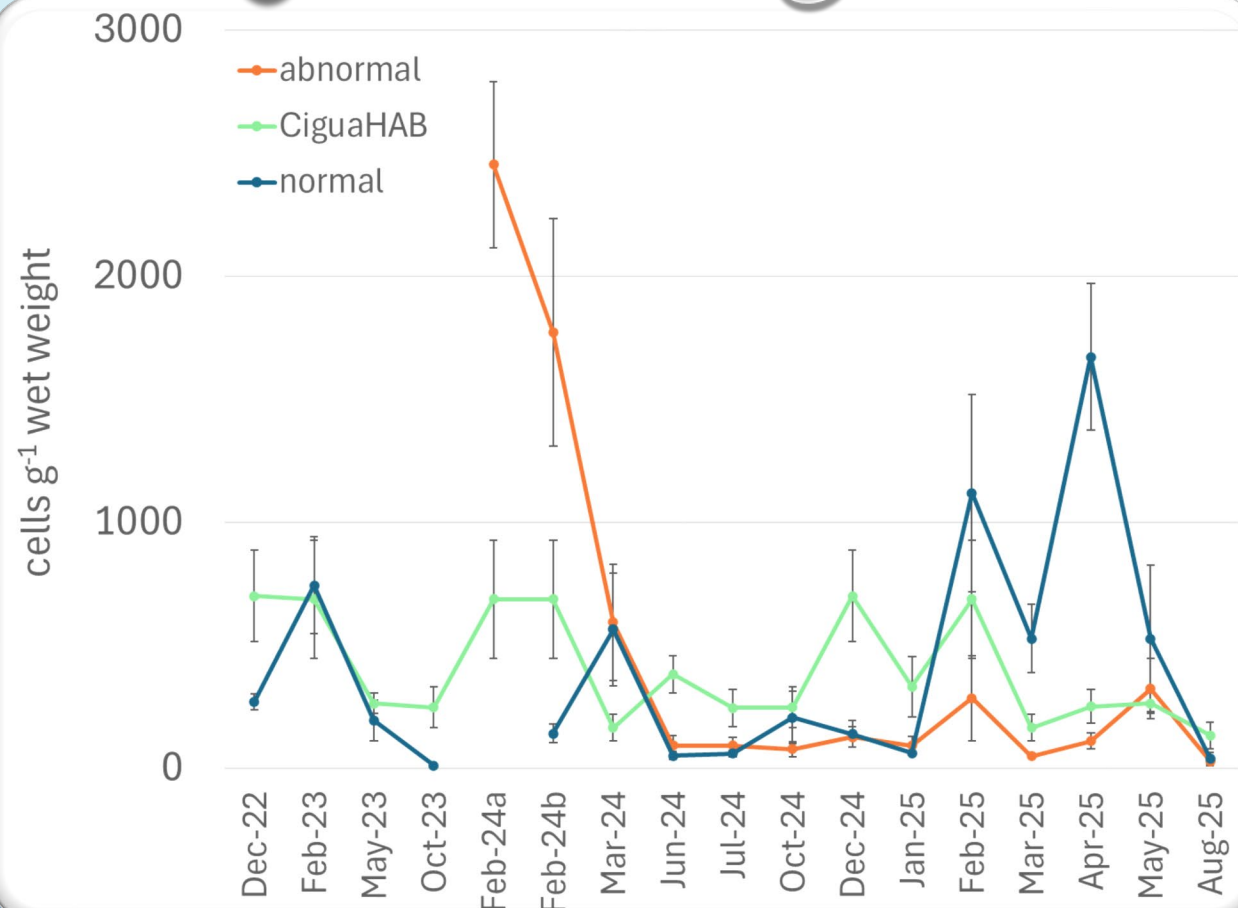
- DURING THE SPINNING EVENT
 - LOWER KEYS SITES VERSUS MIDDLE KEYS SITES
 - EARLY FEBRUARY, LATE FEBRUARY, MID-MARCH
 - *THALASSIA* AND *HALIMEDA*
 - *GAMBIERDISCUS*, *PROROCENTRUM*, *OSTREOPSIS*, *COOLIA*, *VULCANODINIUM*, AND OTHERS
 - SPECIES-LEVEL RESOLUTION FOR *PROROCENTRUM*, *OSTREOPSIS*, *COOLIA*, AND SOME OTHERS (E.G., *SINOPHYSIS*)
 - INDEPENDENT SAMPLES KRUSKAL WALLACE TESTS

DURING EVENT - SUMMARY OF RESULTS: *HALIMEDA*

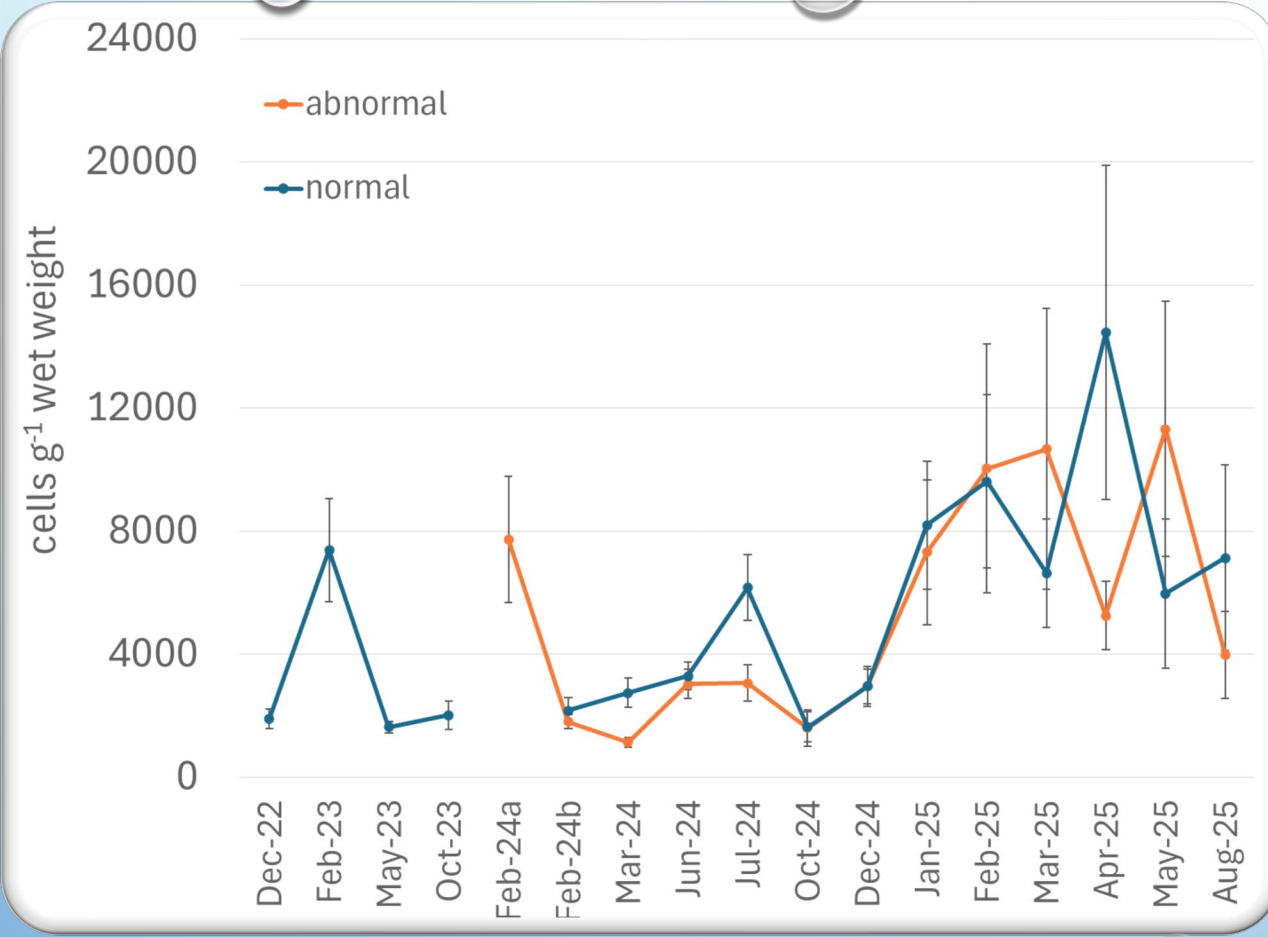
Taxon		Norm_Feb vs Spin_Efeb	Norm_Feb vs Spin_Lfeb	Norm_Feb vs Spin_Mar	Norm_Mar vs Spin_Efeb	Norm_Mar vs Spin_Lfeb	Norm_Mar vs Spin_Mar
<i>Gambierdiscus</i> spp.	 1	N < S (<0.001)	N < S (0.006)	N < S (0.021)	N < S (<0.001)	N < S (0.004)	N < S (0.031)
<i>Prorocentrum</i> <i>belizeanum</i>	 2	N = S	N = S	N = S	N = S	N = S	N = S
<i>Prorocentrum</i> <i>hoffmannianum</i>	 3	N = S	N = S	N = S	N > S (0.04)	N = S	N < S (0.006)
<i>Prorocentrum</i> <i>rhathymum</i>	 3	N = S	N = S	N = S	N = S	N = S	N = S
<i>Coolia</i> <i>monotis</i>	 4	N = S	N = S	N = S	N = S	N = S	N = S
<i>Coolia</i> <i>tropicalis</i>	 5	N = S	N = S	N = S	N = S	N = S	N = S
<i>Ostreopsis</i> <i>heptagona</i>	 6	N = S	N = S	N > S (0.013)	N = S	N > S (0.032)	N > S (<0.001)

DURING EVENT - SUMMARY OF RESULTS: *THALASSIA*

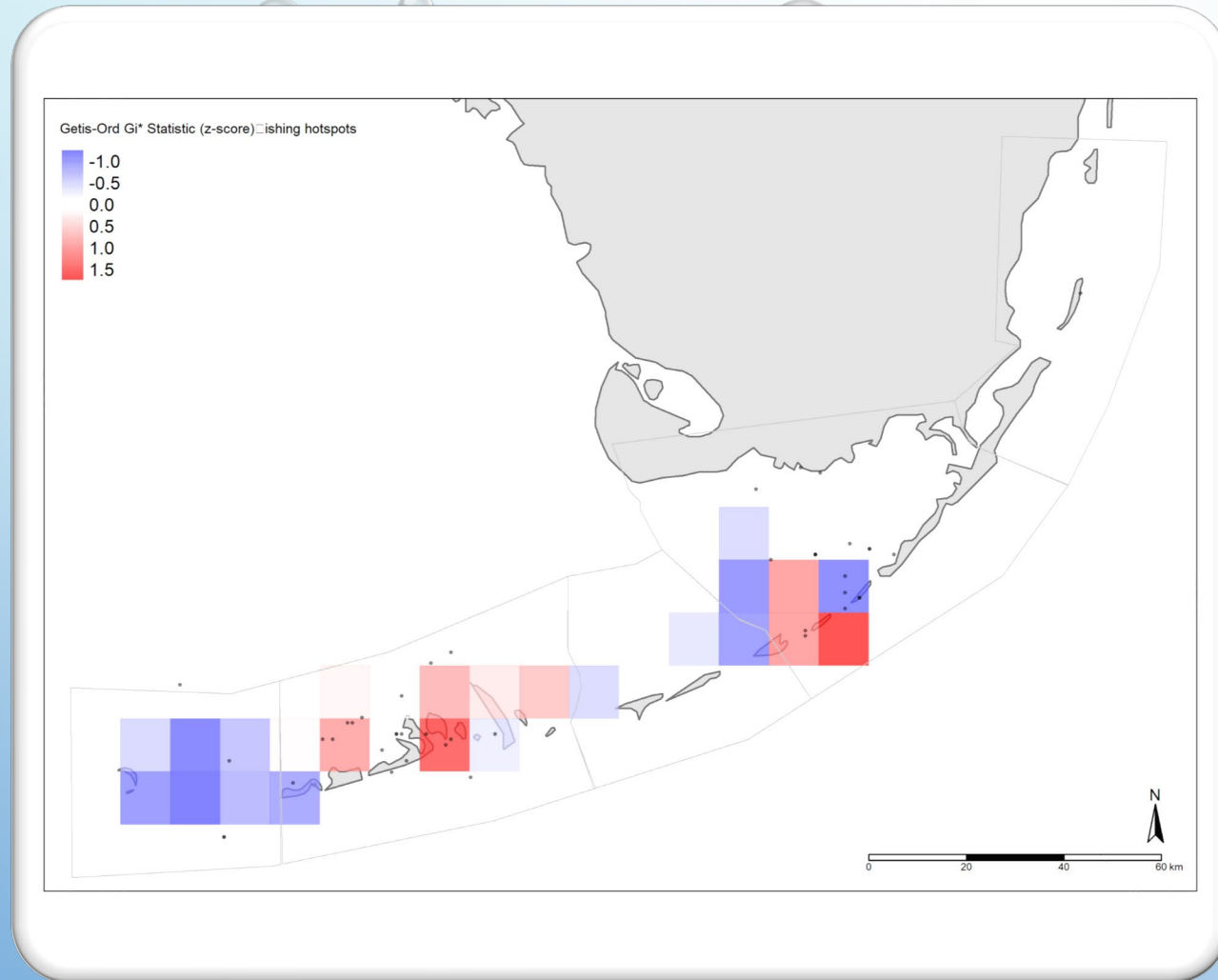
Taxon		Norm_Feb vs Spin_Efeb	Norm_Feb vs Spin_Lfeb	Norm_Feb vs Spin_Mar	Norm_Mar vs Spin_Efeb	Norm_Mar vs Spin_Lfeb	Norm_Mar vs Spin_Mar
<i>Gambierdiscus</i> spp.	 1	N < S (<0.001)	N < S (<0.001)	N = S	N < S (<0.001)	N < S (0.009)	N = S
<i>Prorocentrum</i> <i>belizeanum</i>	 2	N = S	N = S	N = S	N = S	N > S (0.005)	N = S
<i>Prorocentrum</i> <i>hoffmannianum</i>	 3	N < S (0.003)	N = S	N = S	N < S (0.037)	N = S	N = S
<i>Prorocentrum</i> <i>rhathymum</i>	 3	N < S (0.016)	N = S	N = S	N < S (0.011)	N = S	N = S
<i>Coolia</i> <i>monotis</i>	 4	N < S (0.011)	N = S	N = S	N < S (0.049)	N = S	N > S (0.004)
<i>Coolia</i> <i>tropicalis</i>	 5	N = S	N = S	N = S	N = S	N = S	N = S
<i>Ostreopsis</i> <i>heptagona</i>	 6	N > S (<0.001)	N > S (0.003)	N > S (0.001)	N = S	N = S	N = S



AVERAGE *GAMBIERDISCUS* CELL DENSITIES ON *THALASSIA*



AVERAGE *PROROCENTRUM* CELL DENSITIES ON *THALASSIA*



SPINNING FISH HOTSPOTS (COURTESY OF ROSS BOUCEK)

CONCLUSIONS

- *GAMBIERDISCUS* CELL DENSITIES WERE “ELEVATED” IN THE LOWER KEYS (FEBRUARY 2024)
 - PRIMARILY EVIDENT ON *THALASSIA* AND IN THE WATER COLUMN
- OTHER BENTHIC DINOFLAGELLATES (THAT WERE FOCUSED ON) WERE NOT
- DENSITIES DECREASED IN THE SUMMER MONTHS (AS EXPECTED)
- HIGHER DENSITIES SEEN IN MIDDLE KEYS IN 2025
 - SOME SPINNING FISH REPORTED IN THE VICINITY
- MULTIPLE BHAB SPECIES INVOLVED?
- ROLE OF COASTAL MORPHOLOGY AND BATHYMETRY?