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

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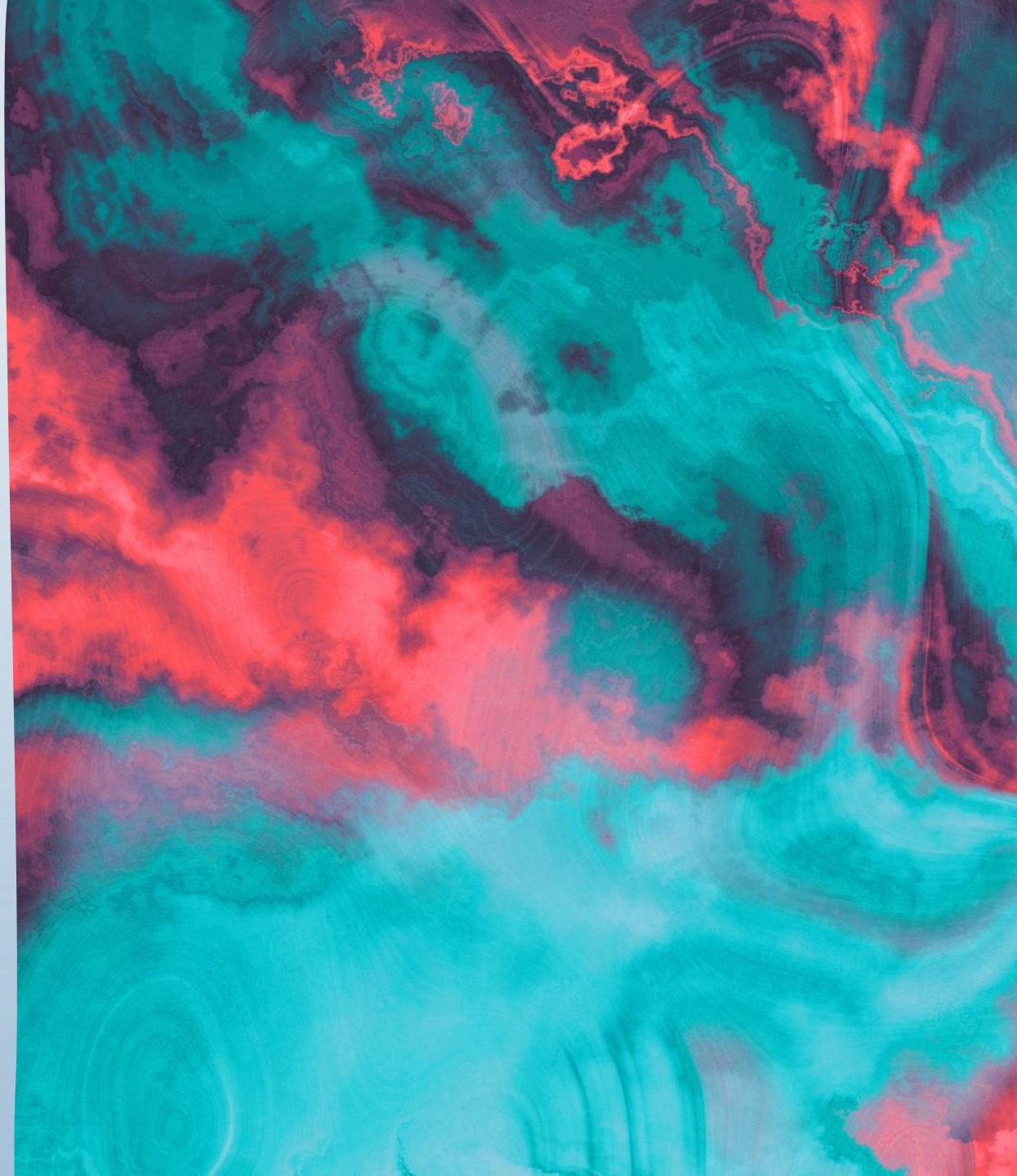
THE WATER SCHOOL

FLORIDA GULF COAST UNIVERSITY



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  - BONEFISH TARPON TRUST (DATA AND FUNDING)
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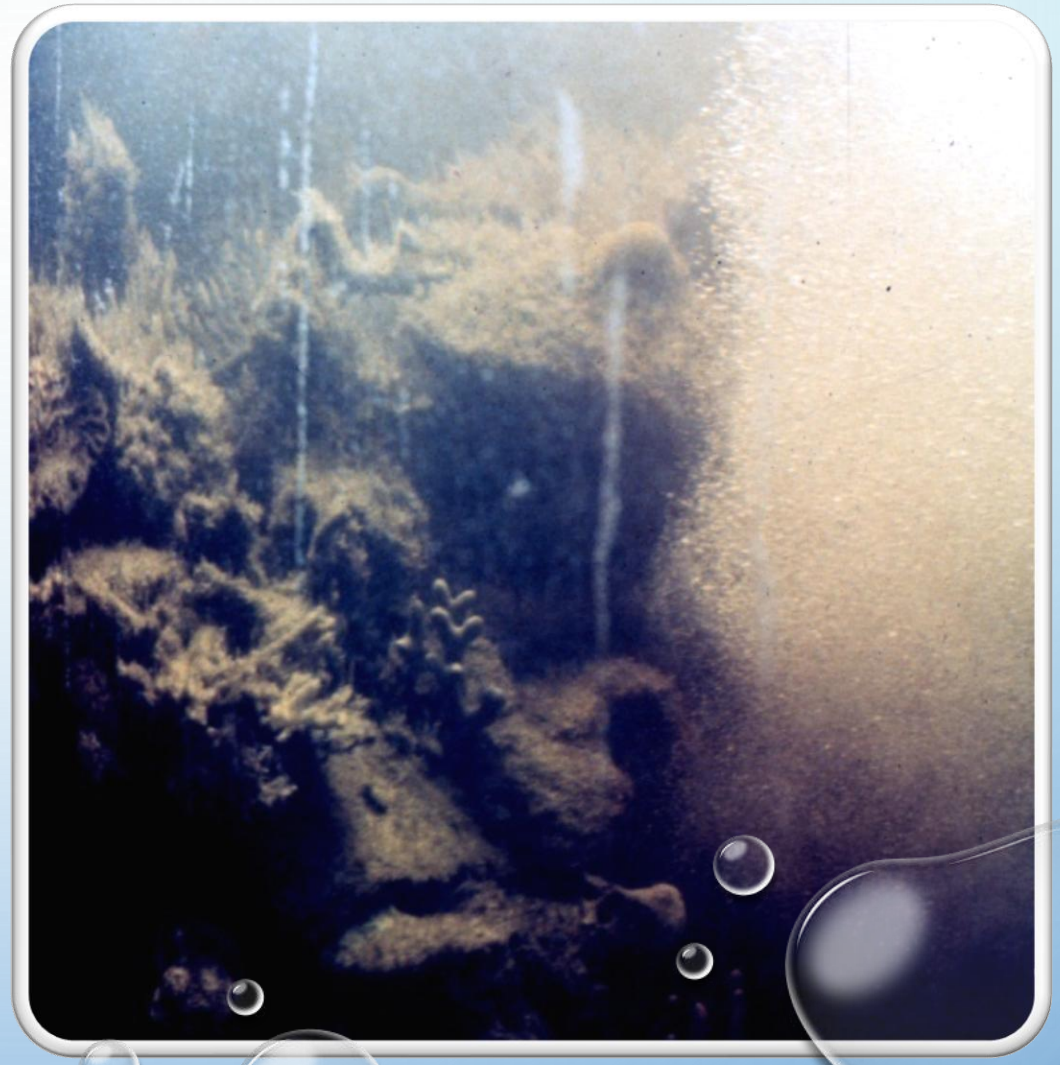
WHAT WE (THINK WE) KNOW:

- MANY DIFFERENT TYPES OF FISH WERE AFFECTED (50+ SPECIES)
  - SUGGESTS THE STRESSOR IS SOMETHING IN THE WATER VERSUS DIET-RELATED
- DOES NOT APPEAR TO BE:
  - FLORIDA RED TIDE (*KARENIA SPP.* 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)

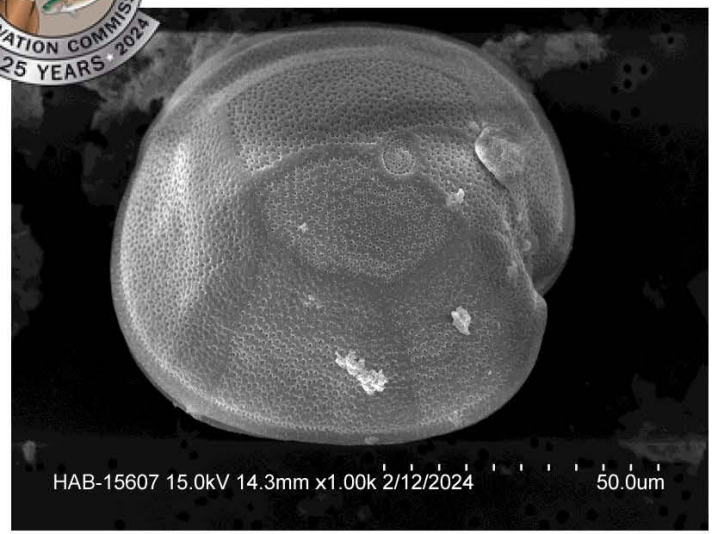
1984 & 1994 PITTSBURGH ZOO AQUARIUM EXHIBIT GAMBIERDISCUS BLOOM

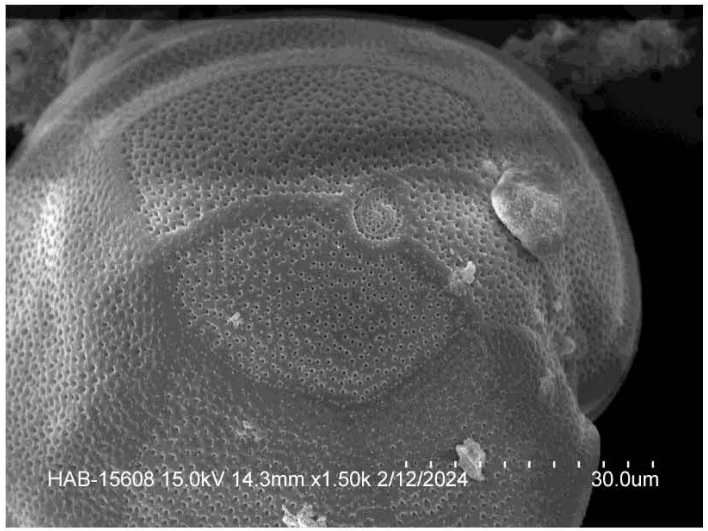


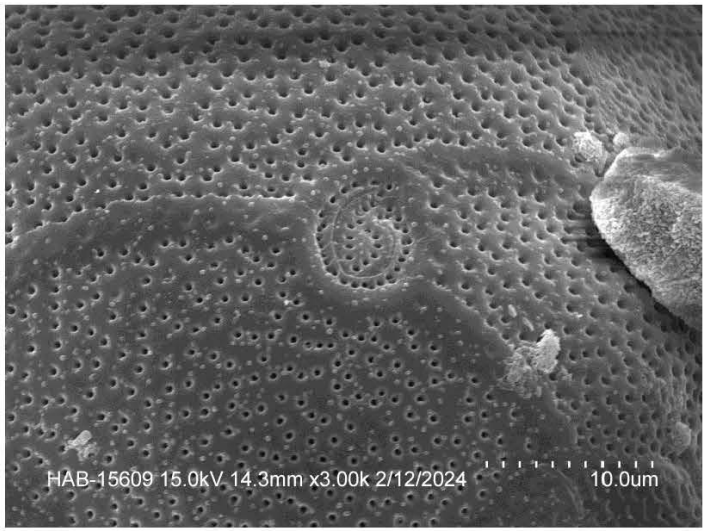
GOODLETT, R. O.; VAN DOLAH, F. M.; & BABINCHAK, J. A.(1994). RE-OCCURRENCE OF A CIGUATERA OUTBREAK IN A CORAL REEF MICROCOSM AT THE PITTSBURGH ZOO. *PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON CIGUATERA AND MARINE NATURAL PRODUCTS*. SOUTH KOHALA, HAWAII

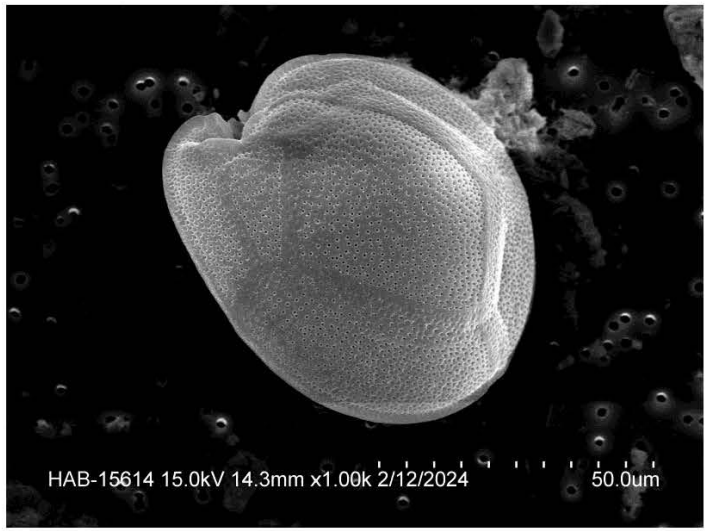
Bow Channel, 2/2/24, 1m, night collection (HABW240206-004, Stub 4432)

Gambierdiscus caribaeus

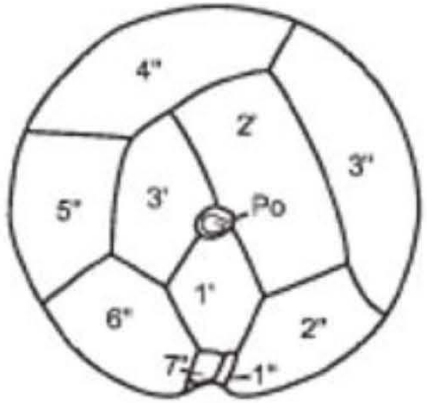




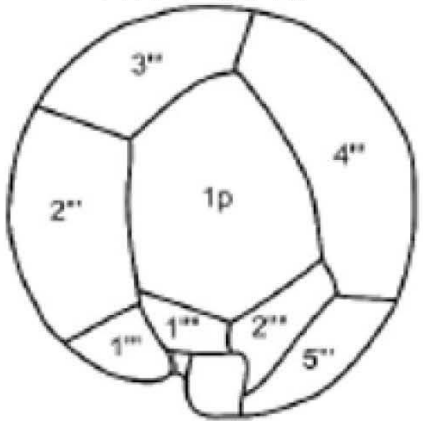




EPICONE



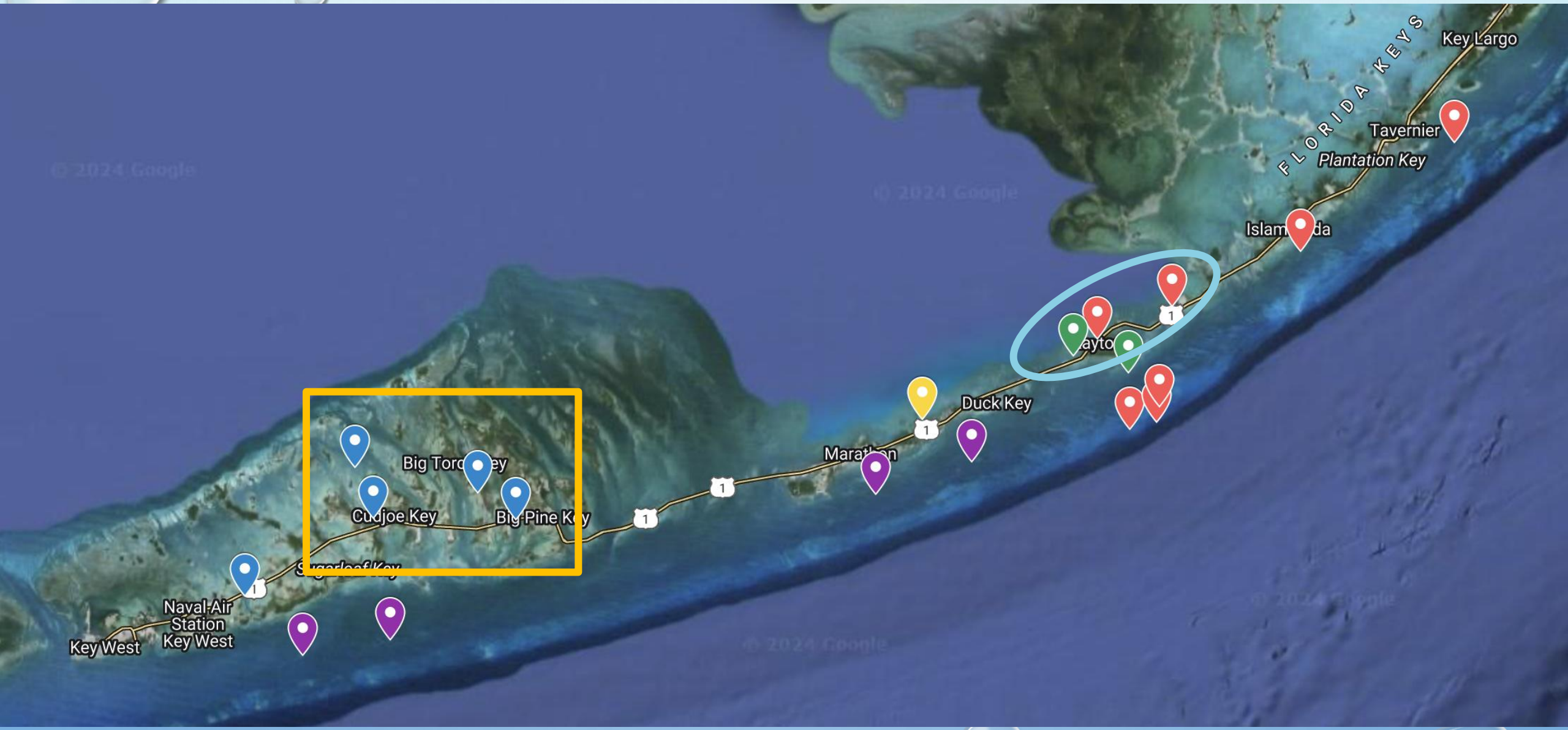
HYPOCONE

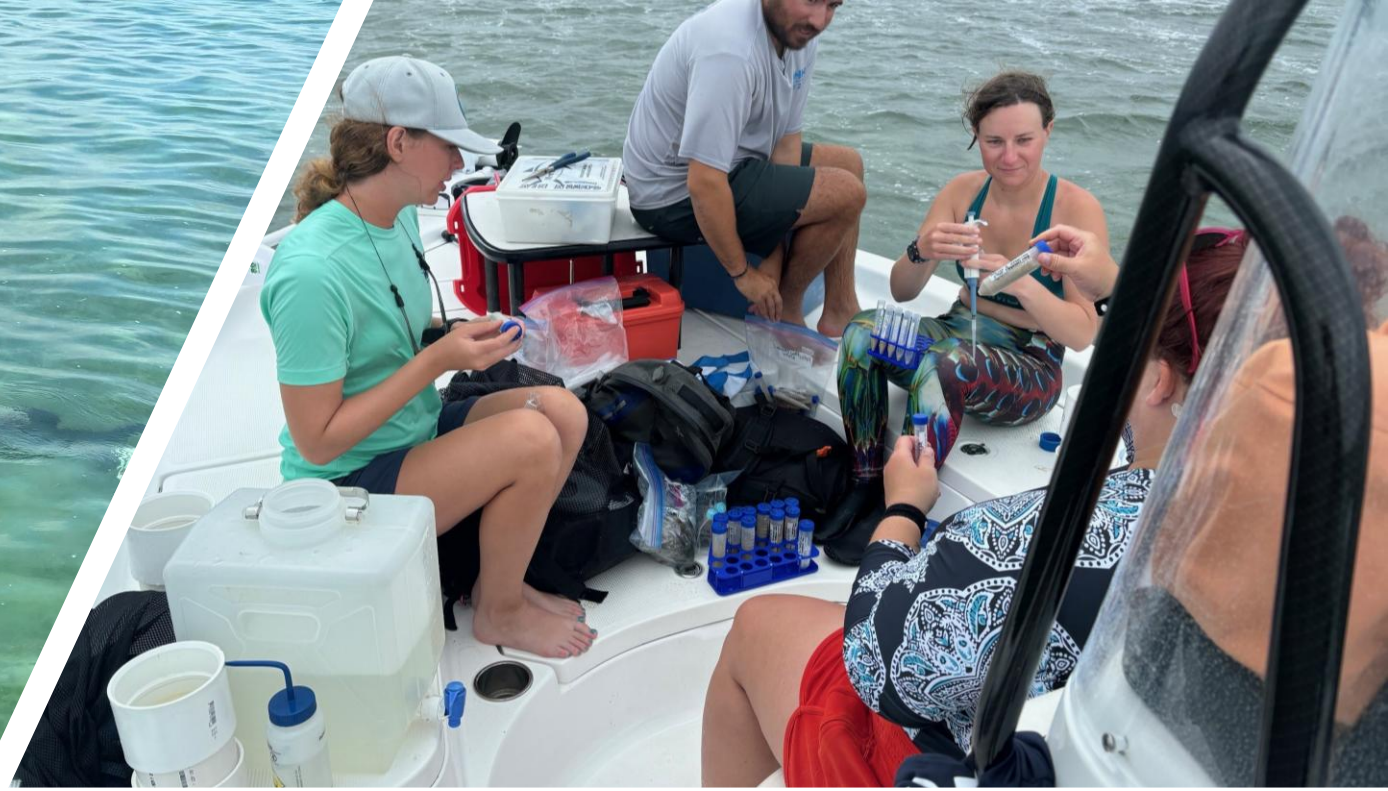


Litaker et al. 2009, for reference

WHY FOCUS ON BENTHIC DINOFLAGELLATES?

- MANY PRODUCE TOXINS (AND TOXIN PRECURSORS)
  - *GAMBIERDISCUS* - CIGUATOXINS (CIGUATERA POISONING); MAITOTOXINS (WATER SOLUBLE)
  - *PROROCENTRUM* – OKADAIC ACID (DIARRHETIC SHELLFISH POISONING)
  - *COOLIA* – GAMBIERONES, YESSOTOXINS, & AZASPRIACIDS
  - *OSTREOPSIS* - PALYTOXIN & OVATOXINS

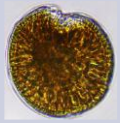
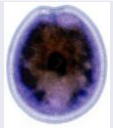
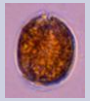
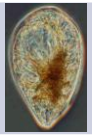

FLORIDA KEYS
Key Largo
Tavernier
Plantation Key
Duck Key
Big Pine Key
Naval Air Station Key West
Key West



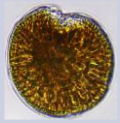
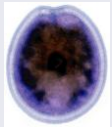
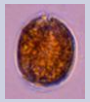
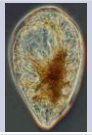
COMPARISONS

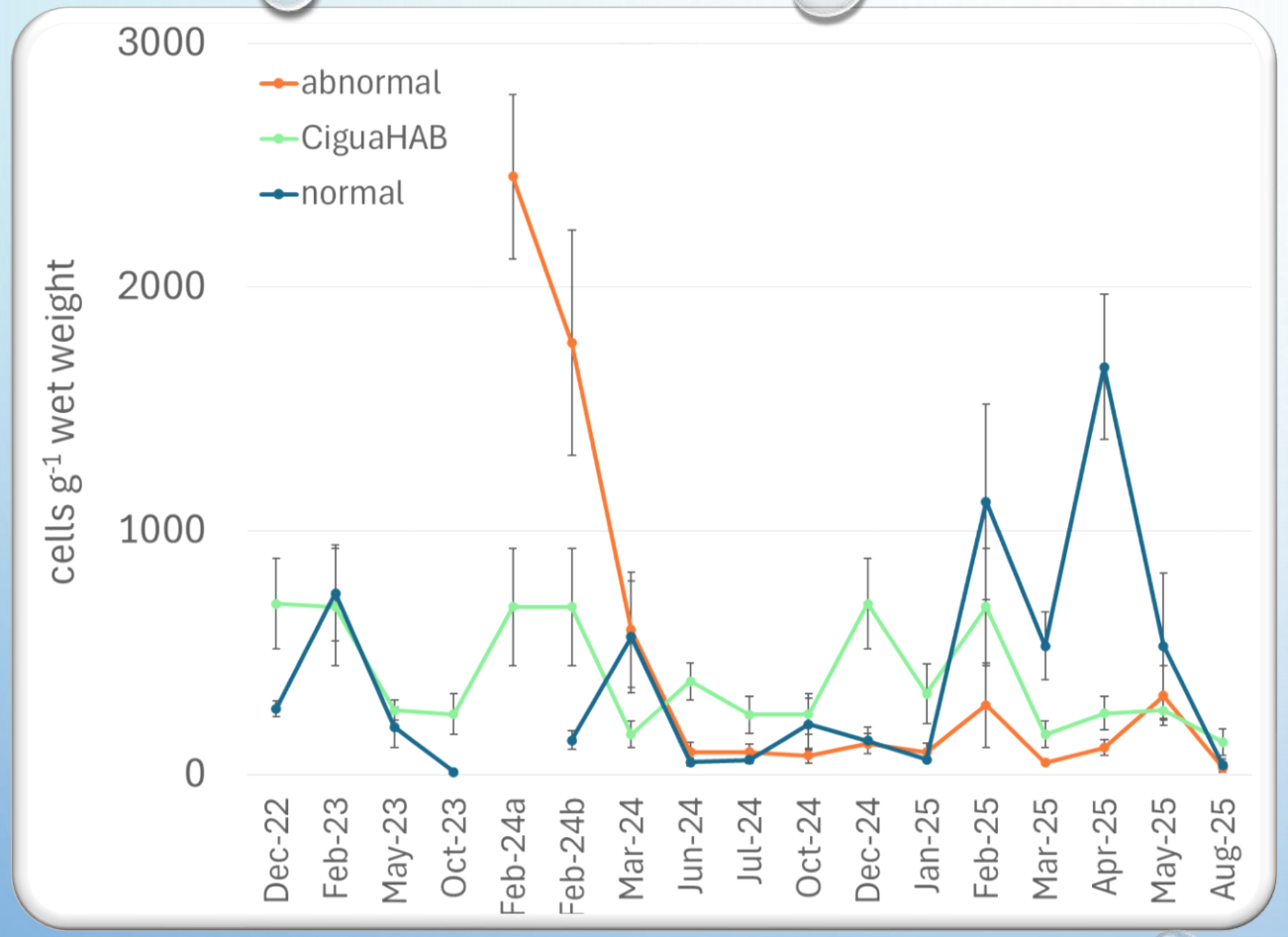
- DURING THE SPINNING EVENT
  - LOWER KEYS SITES VERSUS MIDDLE KEYS SITES
    - EARLY FEBRUARY, LATE FEBRUARY, MID-MARCH
    - *THALASSIA* AND *HALIMEDA*
  - *GAMBIERDISCUS, PROROCENTRUM, OSTREOPSIS, COOLIA, VULCANODINIUM,* AND OTHERS
    - SPECIES-LEVEL RESOLUTION FOR *PROROCENTRUM, OSTREOPSIS, COOLIA*,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

DURING EVENT - SUMMARY OF RESULTS: *HALIMEDA*

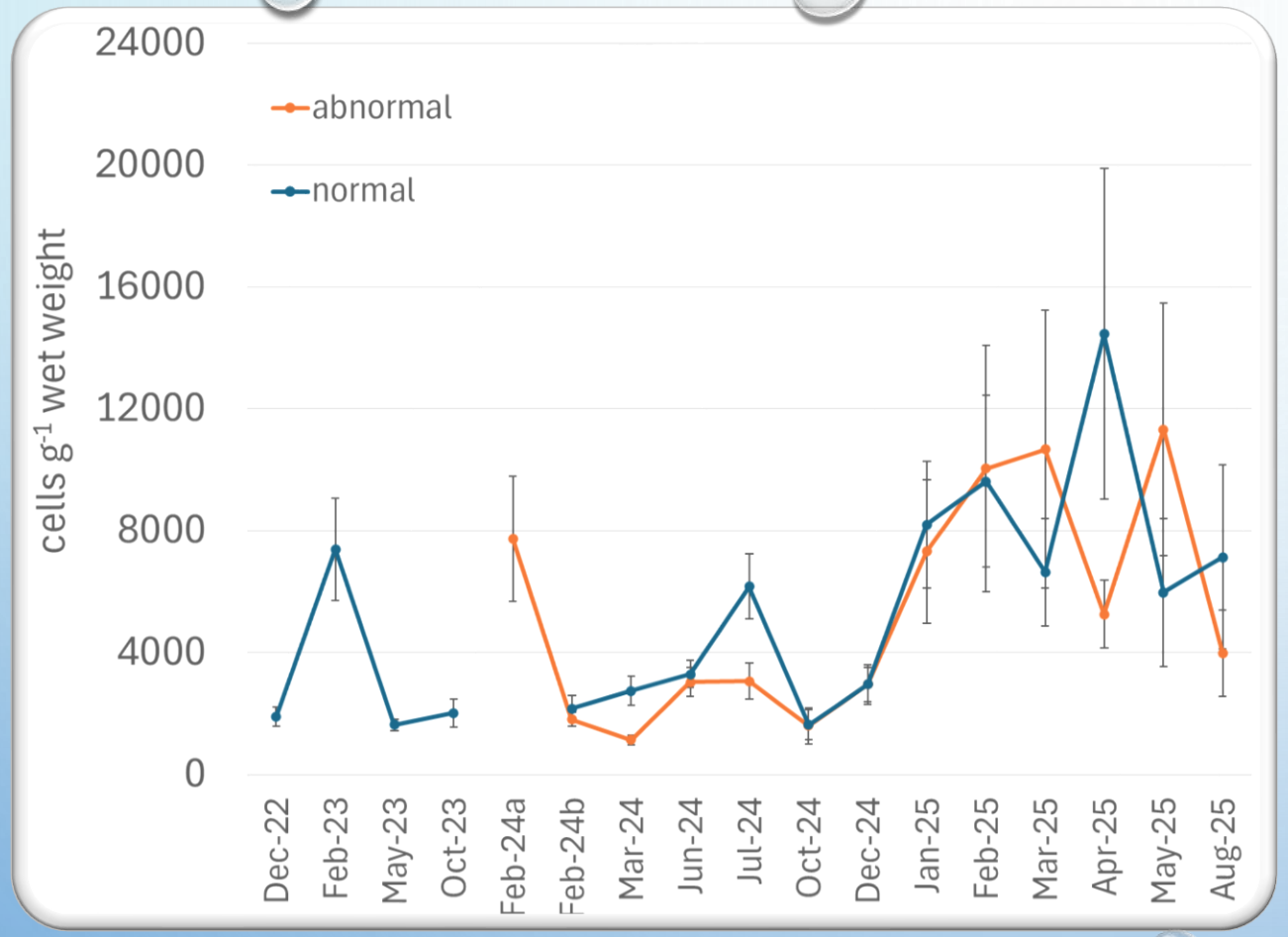
Taxon	Norm_Feb vs Spin_Efeb	Norm_Feb vs Spin_Lfeb	Norm_Feb vs Spin_Mar	Norm_Mar vs Spin_Efeb	Norm_Mar vs Spin_Lfeb	Norm_Mar vs Spin_Mar
Gambierdiscus spp.  1	N < S (<0.001)	N < S (0.006)	N < S (0.021)	N < S (<0.001)	N < S (0.004)	N < S (0.031)
Prorocentrum belizeanum  2	N = S	N = S	N = S	N = S	N = S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

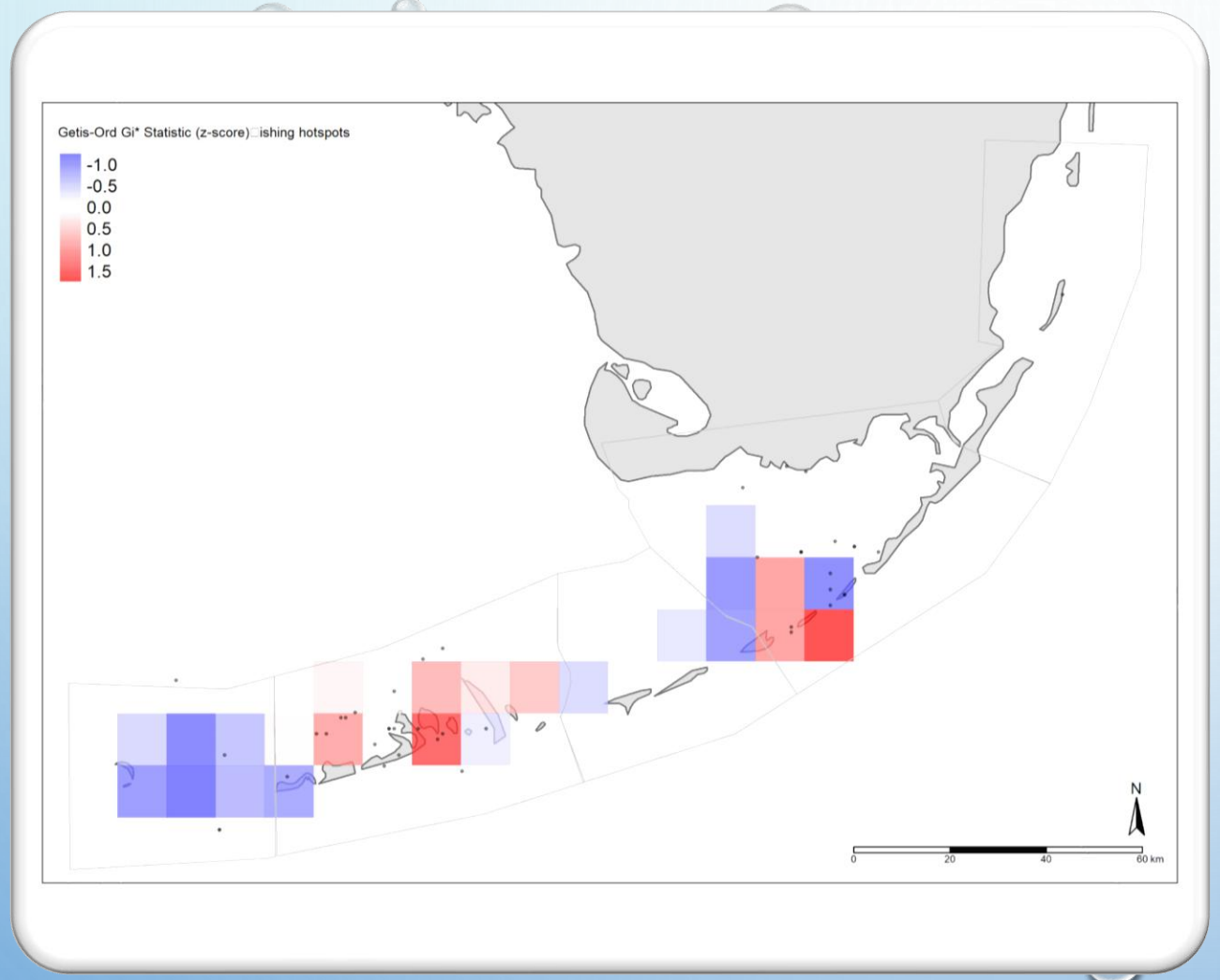
Taxon	Norm_Feb vs Spin_Efeb	Norm_Feb vs Spin_Lfeb	Norm_Feb vs Spin_Mar	Norm_Mar vs Spin_Efeb	Norm_Mar vs Spin_Lfeb	Norm_Mar vs Spin_Mar
Gambierdiscus spp.  1	N < S (<0.001)	N < S (<0.001)	N = S	N < S (<0.001)	N < S (0.009)	N = S
Prorocentrum belizeanum  2	N = S	N = S	N = S	N = S	N > S (0.005)	N = S
Prorocentrum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

Bonefish & Tarpon TRUST

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?