Multi-year, high-frequency assessment of water quality in Biscayne Bay, Florida.

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Key Findings

Continue monitoring

Management action required to maintain marine habitat health

Nutrient Concerns

Reduce levels before eutrophication tipping point

Bacterial Contamination

Fecal bacteria widespread in study area

Primary Sources

Miami River, Little River, and Miami Central Outfall

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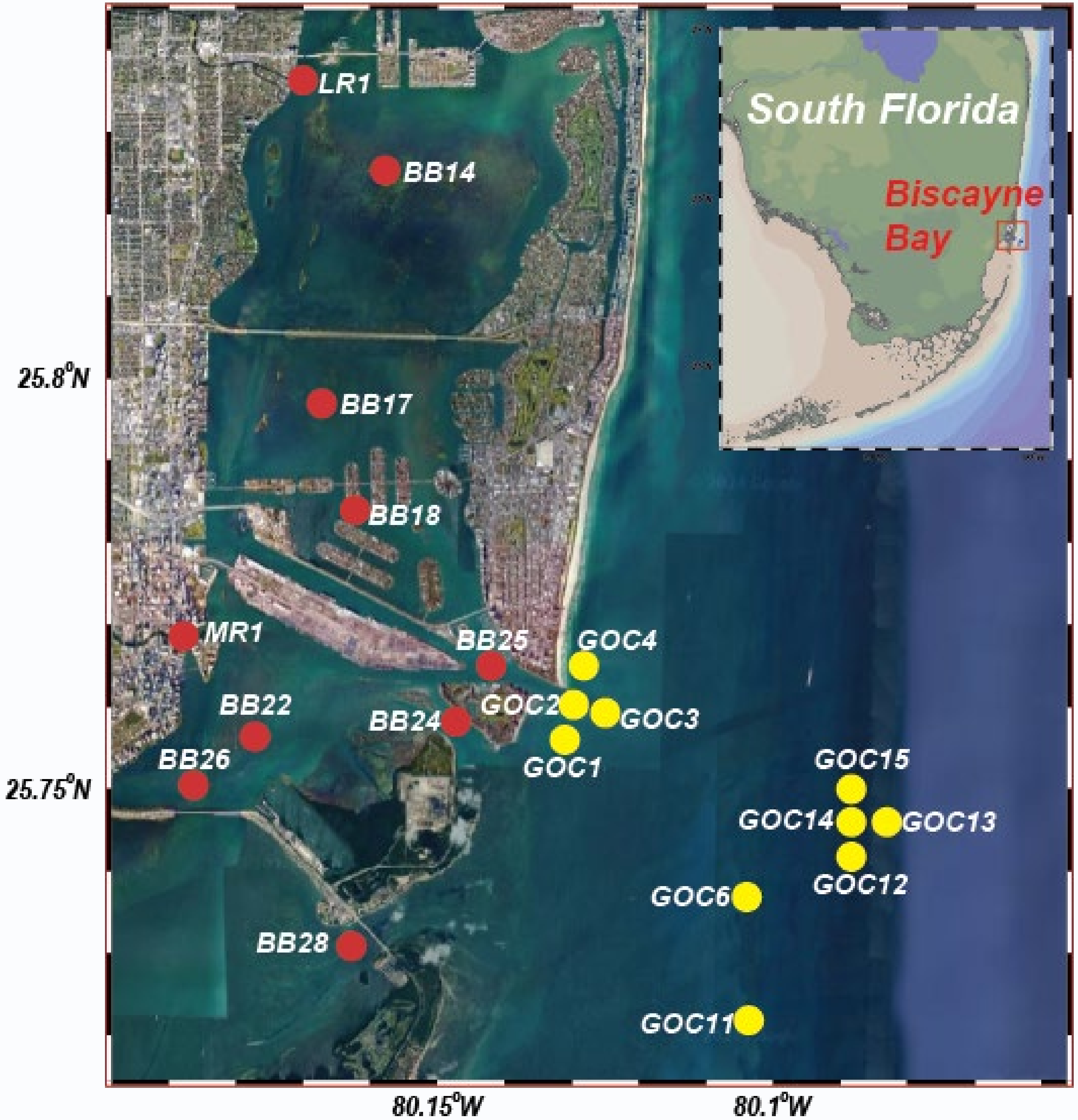
Study Area

Northern Biscayne Bay adjacent to Miami's urban areas

20 sampling stations across inshore and offshore sites

Inshore 1-18 m depth
Offshore 5-30 m depth

Semi-diurnal tide pattern.
Tidal range 0.4-0.8 m



Methods

Collection

Surface and bottom samples at each station

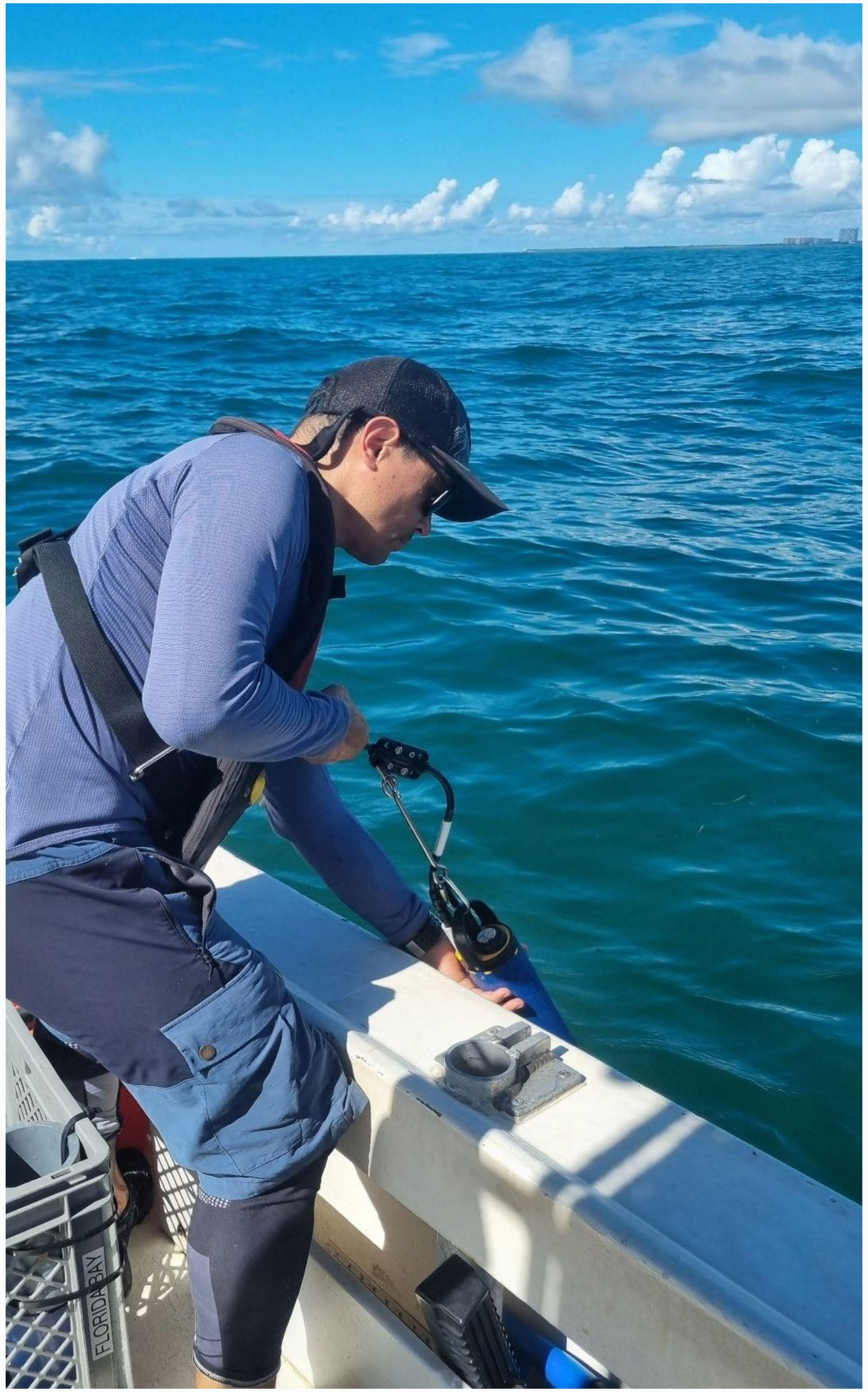
Instruments

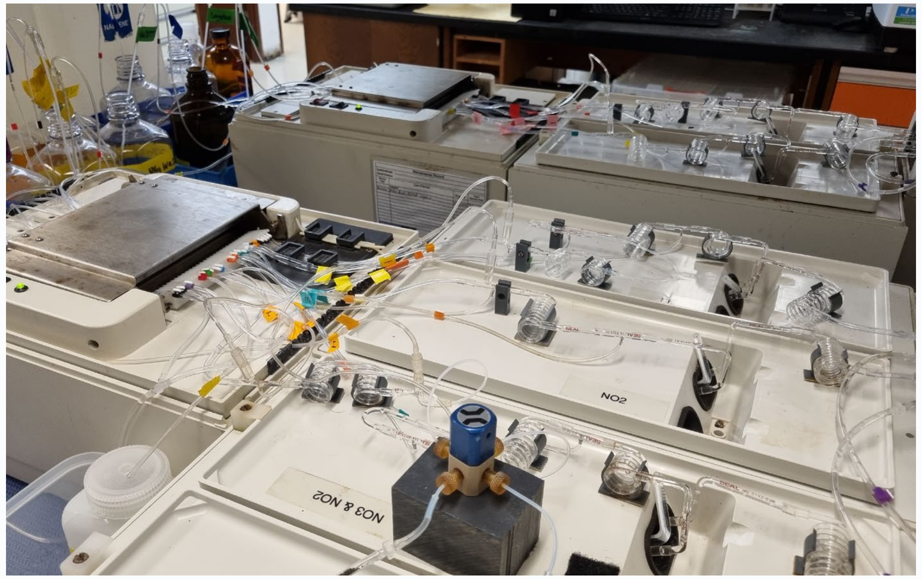
EXO2, pH sensor, Secchi disk, Niskin bottles (water samples)

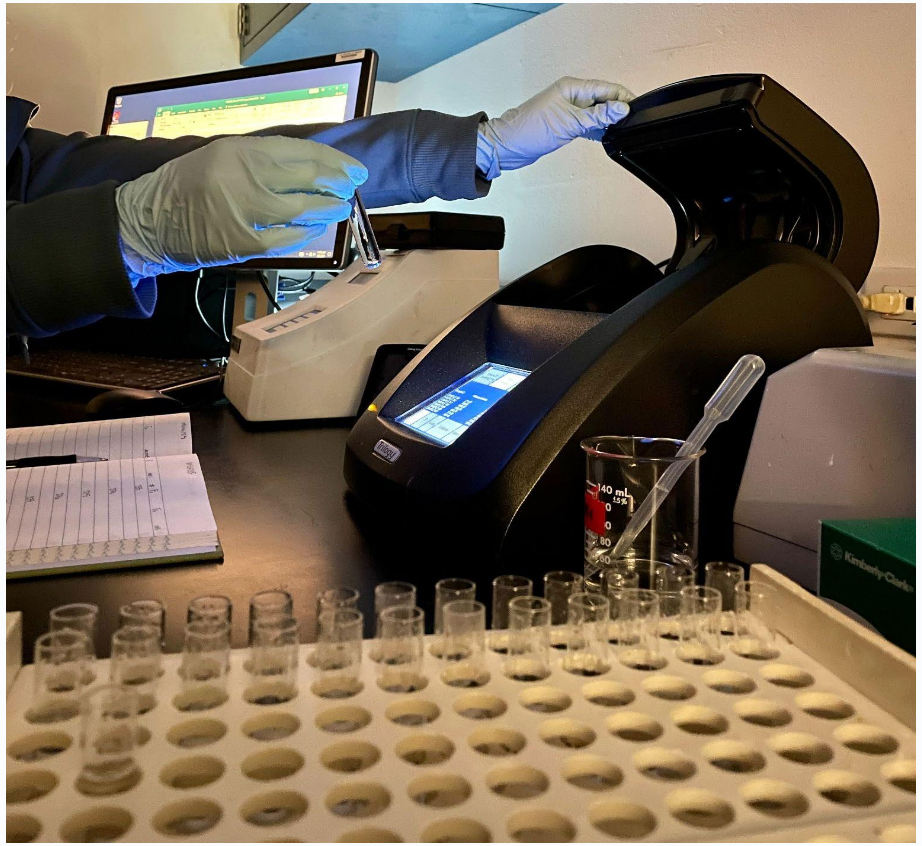
Parameters

Nutrients, chlorophyll-a, pH, temperature, salinity, dissolved oxygen, microbial distribution

NELAC standards







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Seasonal Water Quality Patterns

Wet Season

Lower salinity levels

Higher chlorophyll-a concentrations

Dry Season

Higher salinity levels

Lower oxygen concentrations

Heat Waves

Alter salinity distribution

Increase evaporation

River Discharge

Significant influence on salinity

Major source of nutrients

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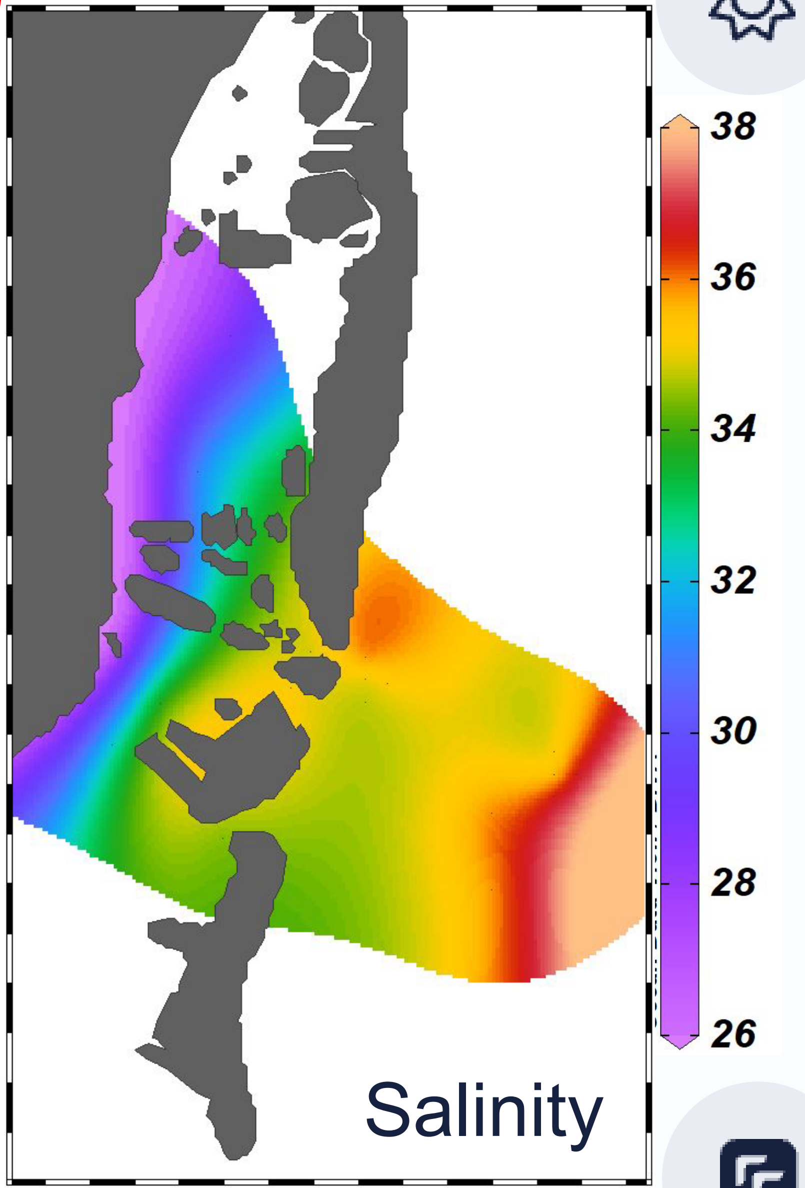

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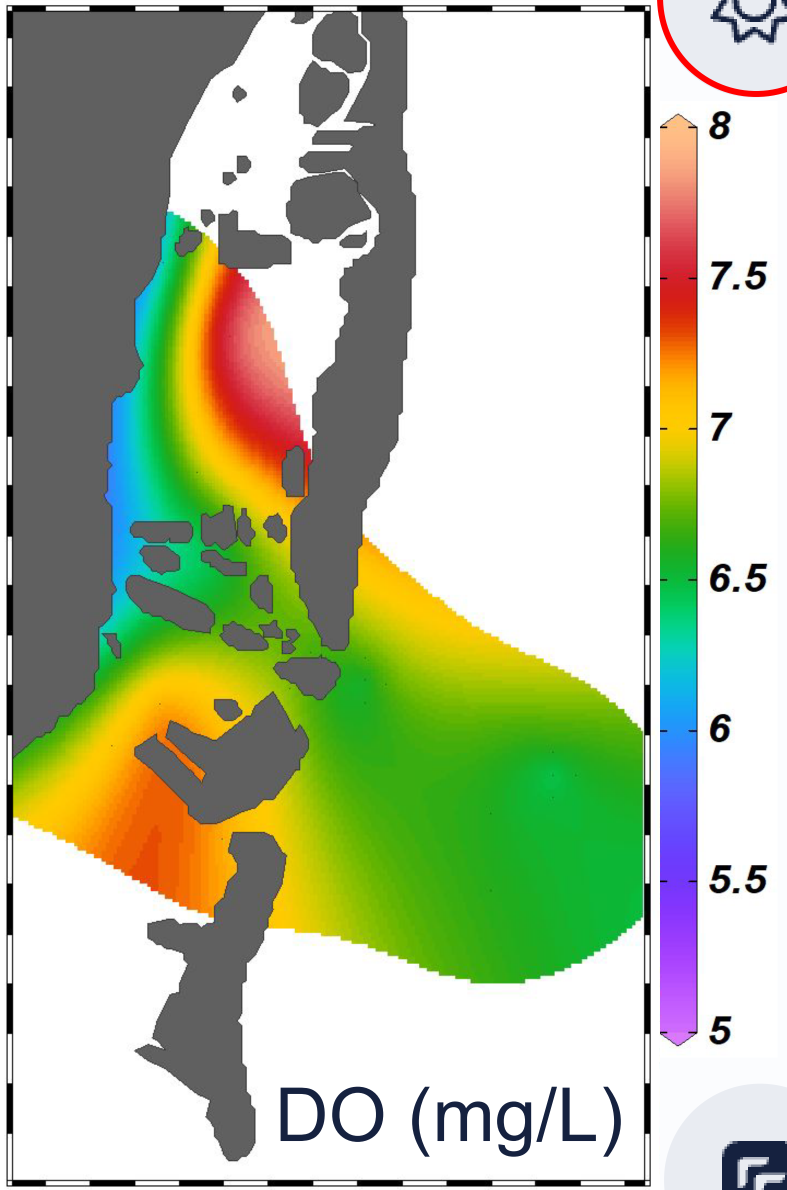

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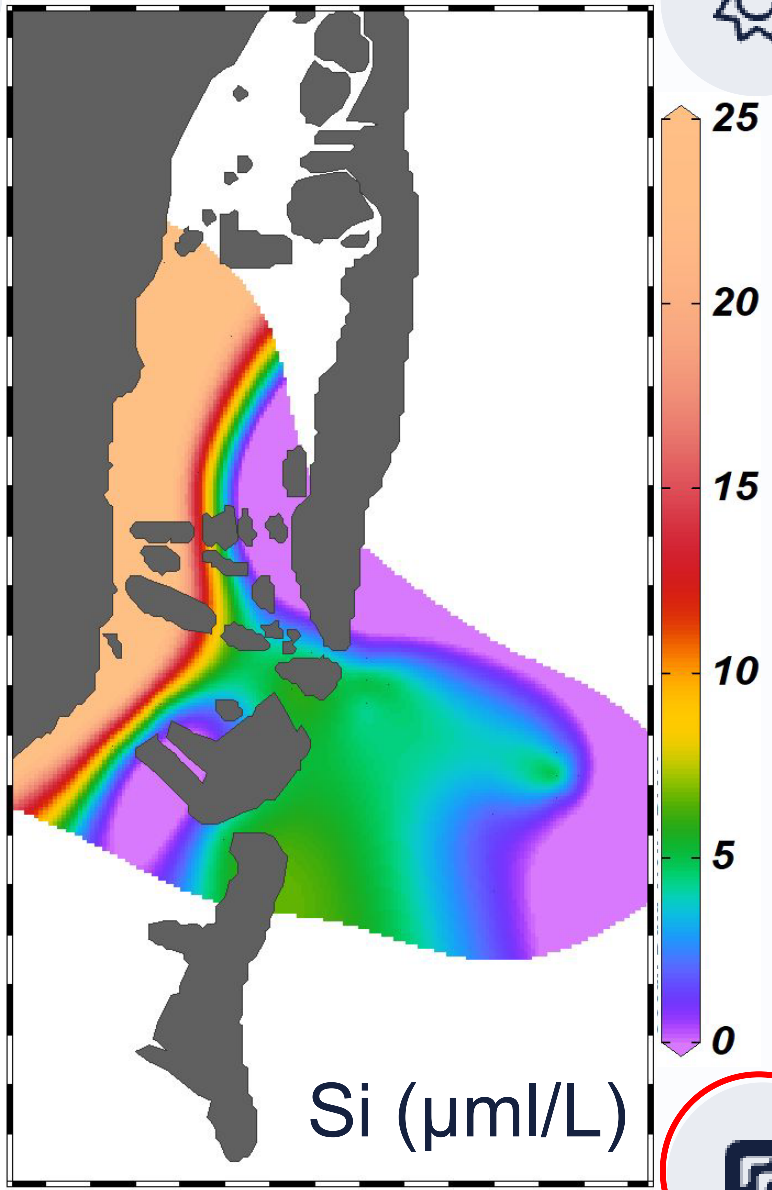

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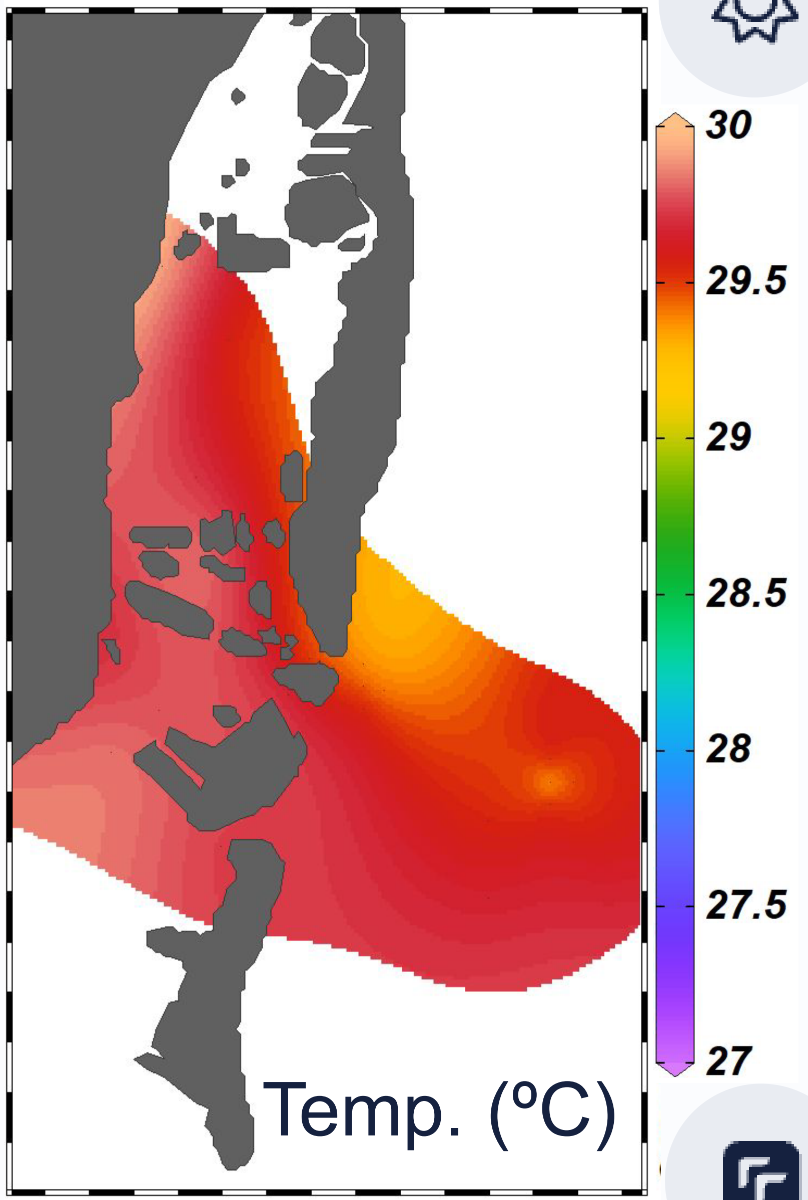

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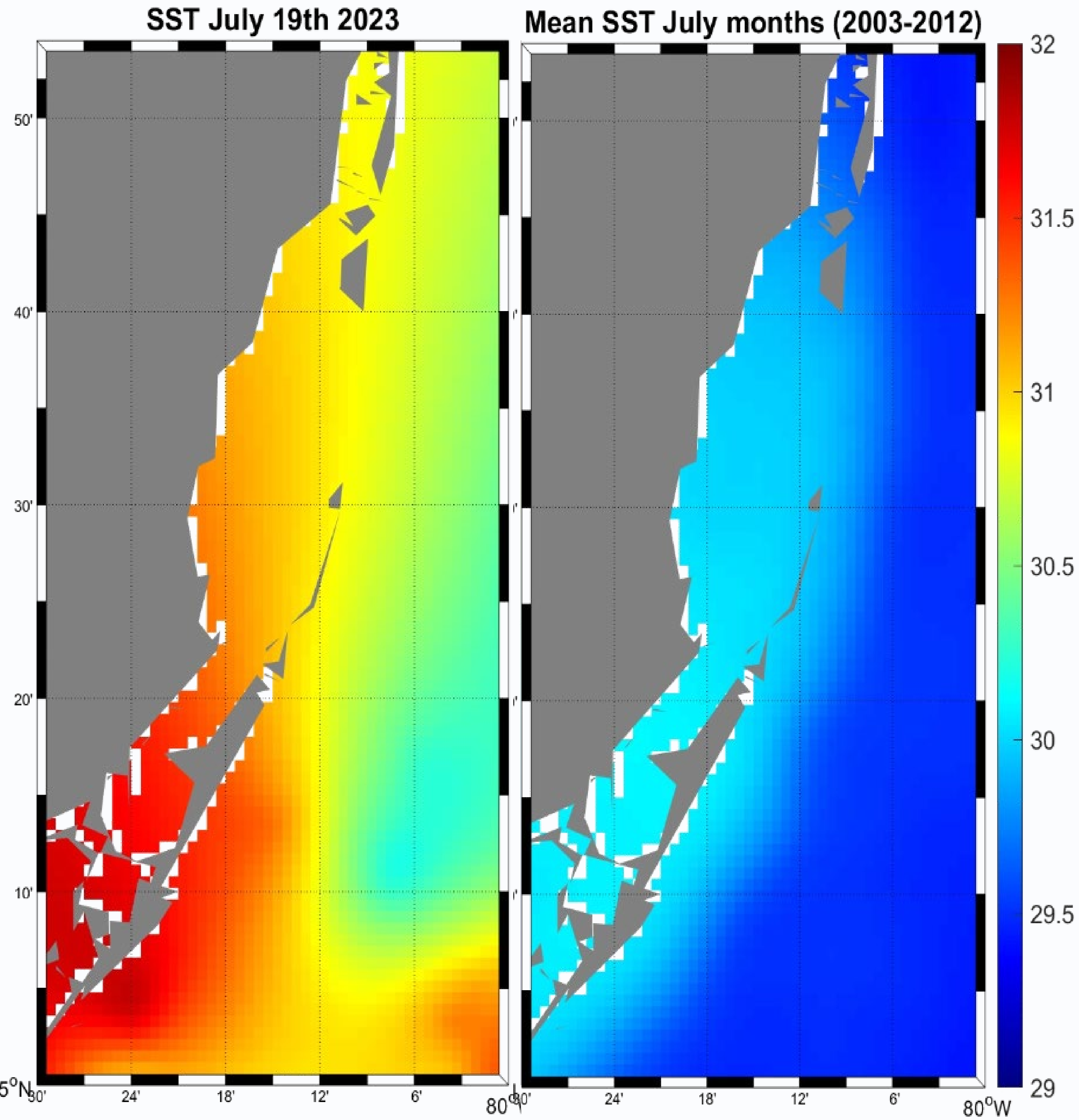

2023 Heat Wave Impact

33.32°C

Peak Temperature

Recorded at station BB-14 on July 24, 2023

30.61°C

Previous Year

Same station on July 21, 2022

2°C+

Temperature Increase

Throughout the bay

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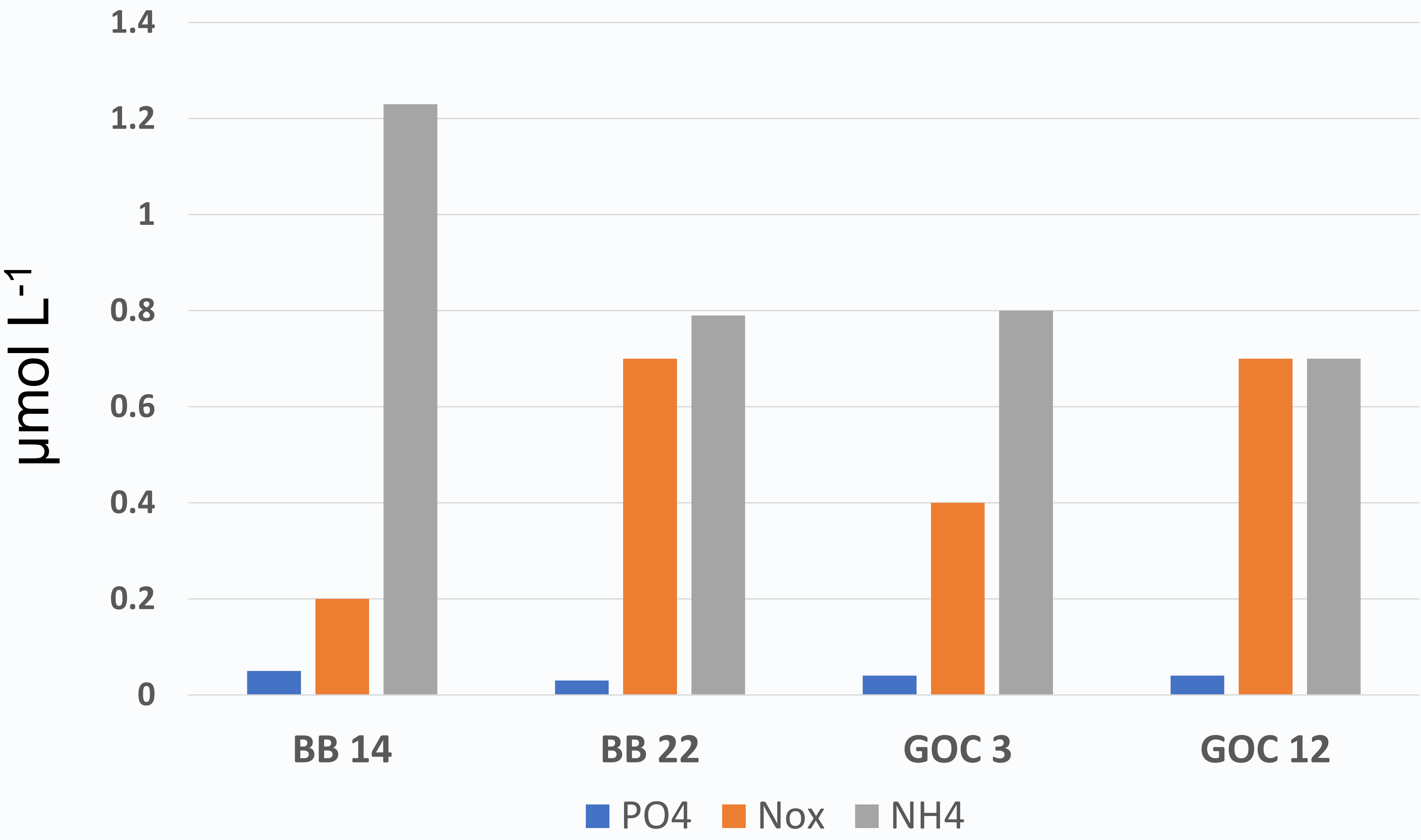
Nutrients

PO4. Nutrient criterion by MDC 0.104 µmol/L

NOx. Nutrient criterion by MDC 1.64 µmol/L

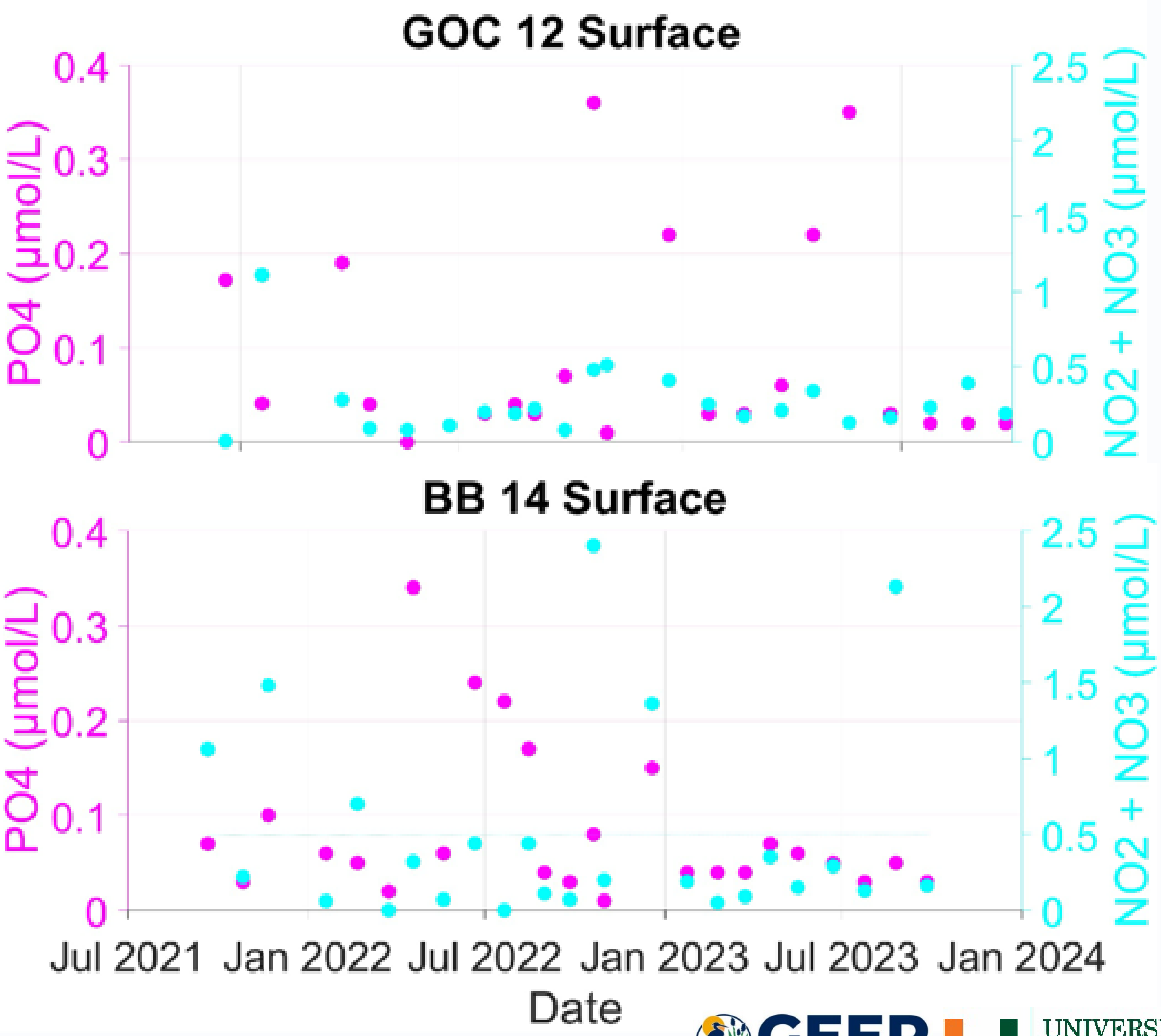
Levine 2020.



Nutrient Trends

- **Higher concentrations**

  - **Increasing trend**
  (Mann-Kendall test)



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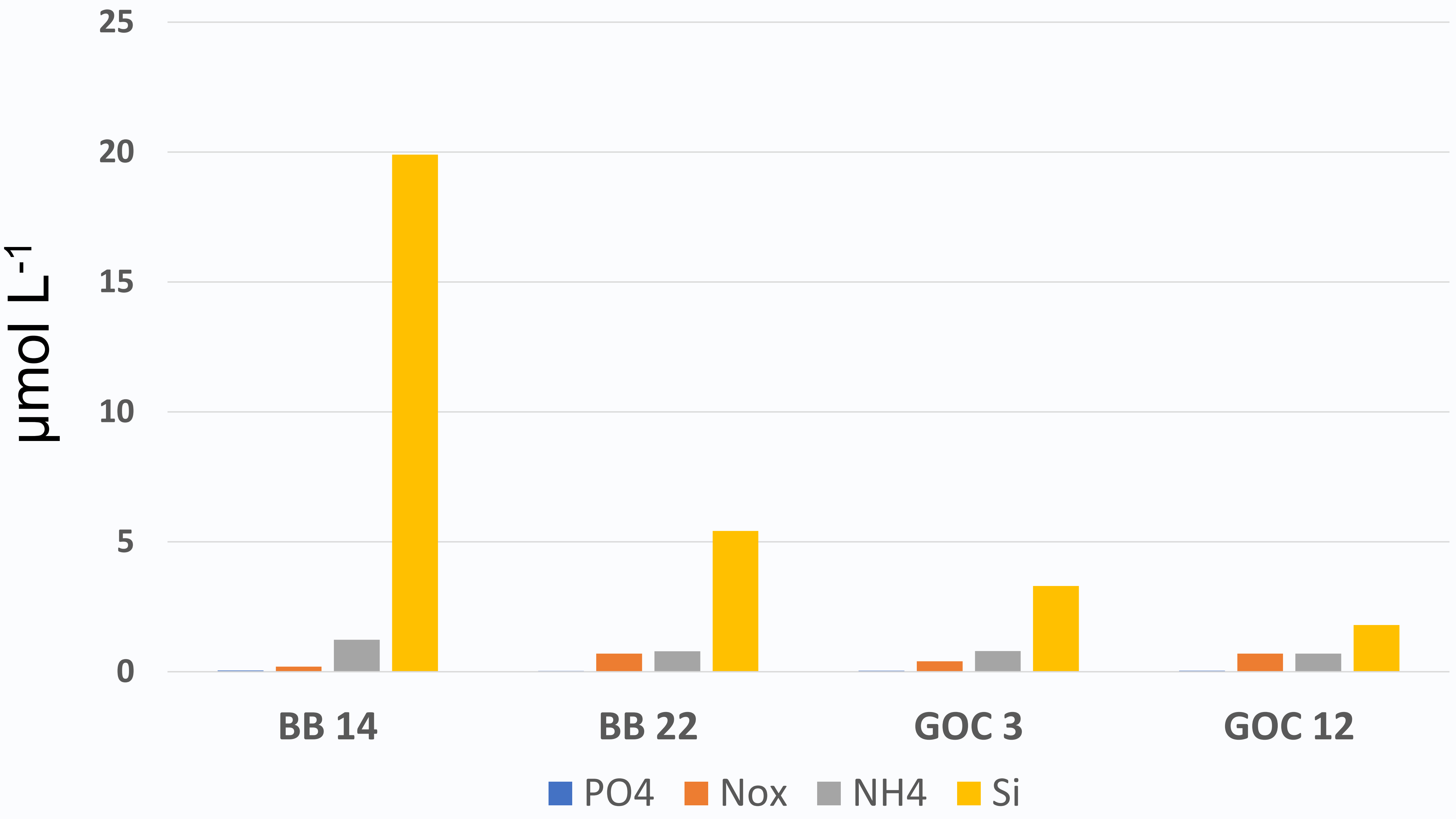
Nutrients

Inshore stations show higher nutrient variability than offshore stations

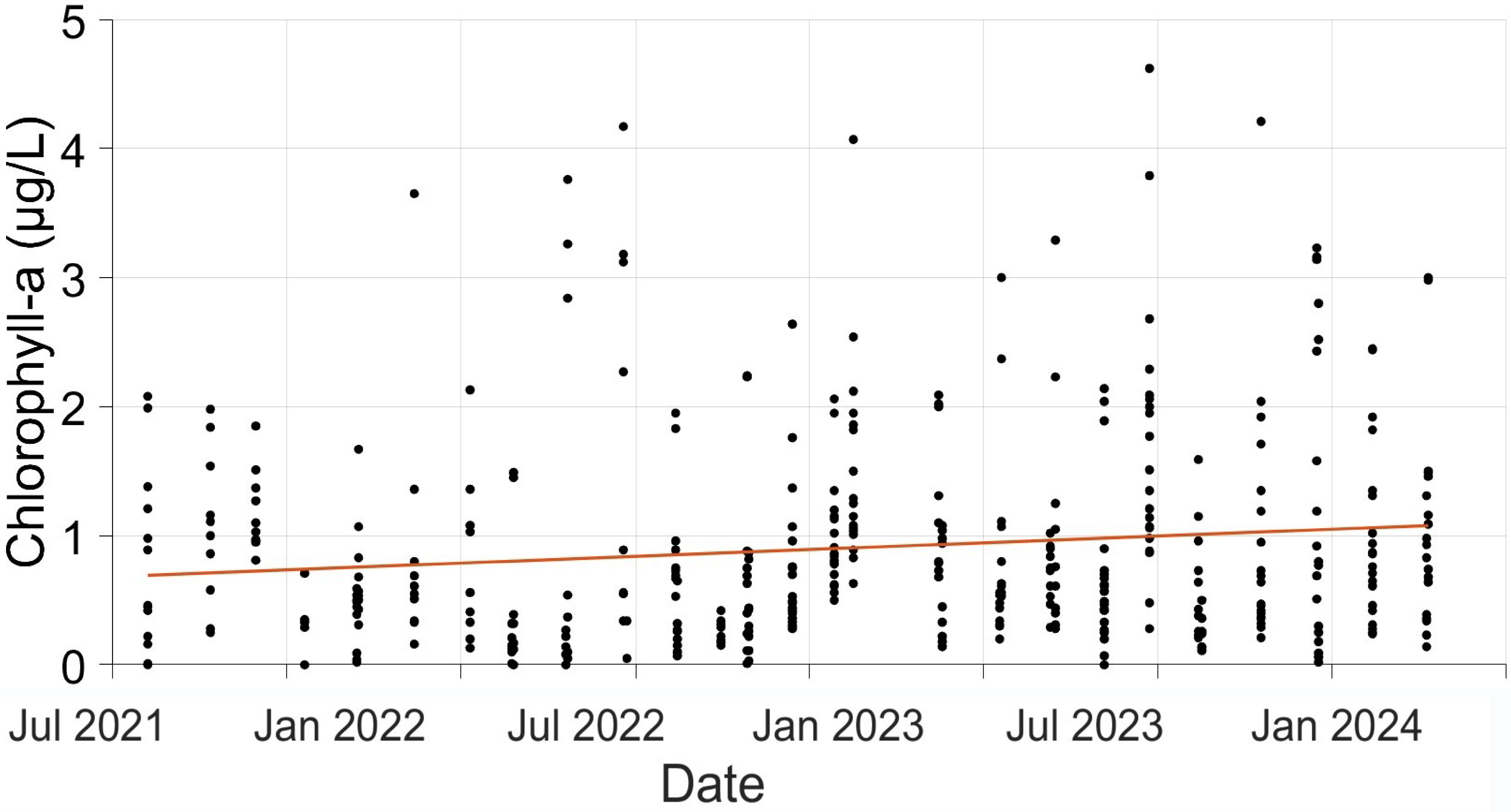
Highest levels of ammonium and silicate recorded at inshore stations



CHL-a Trends

CHL-a. Criterion by MDC 1.7 µg/L

Levine 2020.



Concentration trends
(Mann-Kendall) from average representative stations

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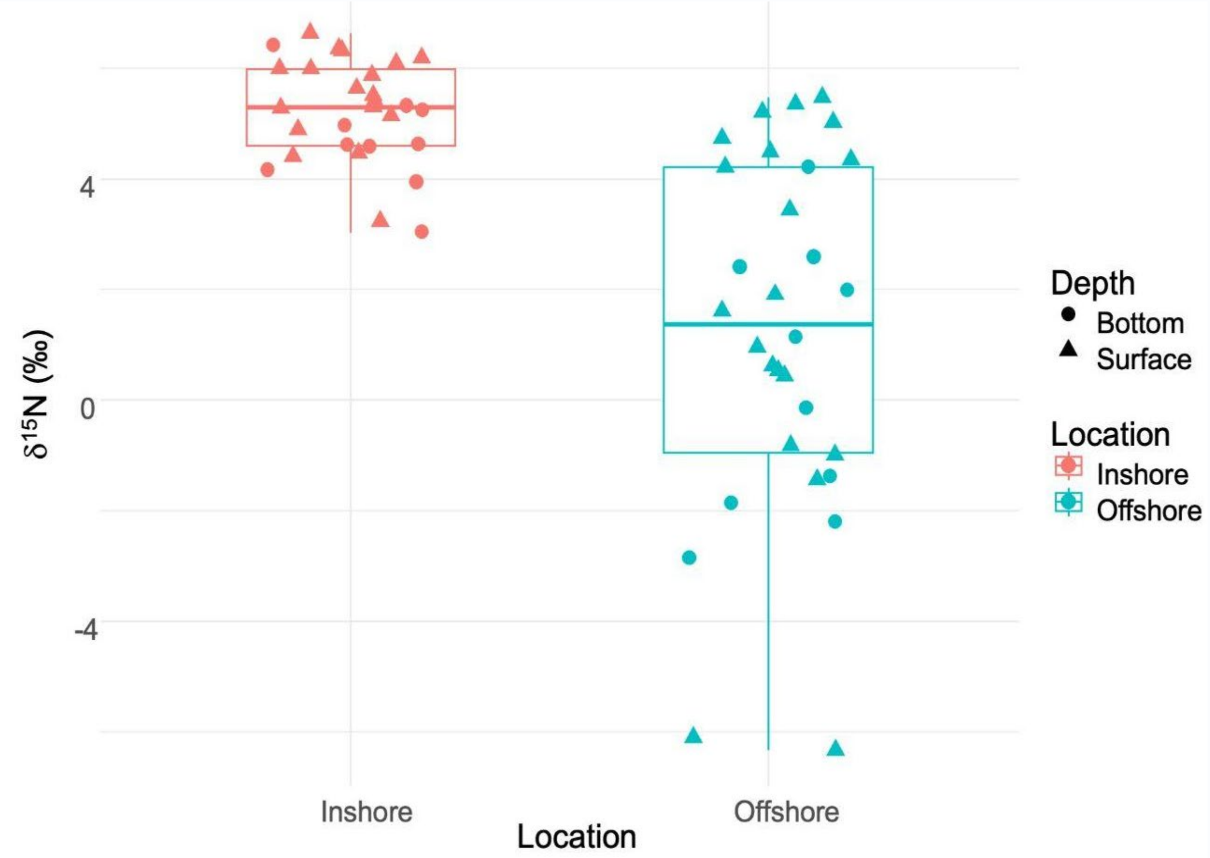
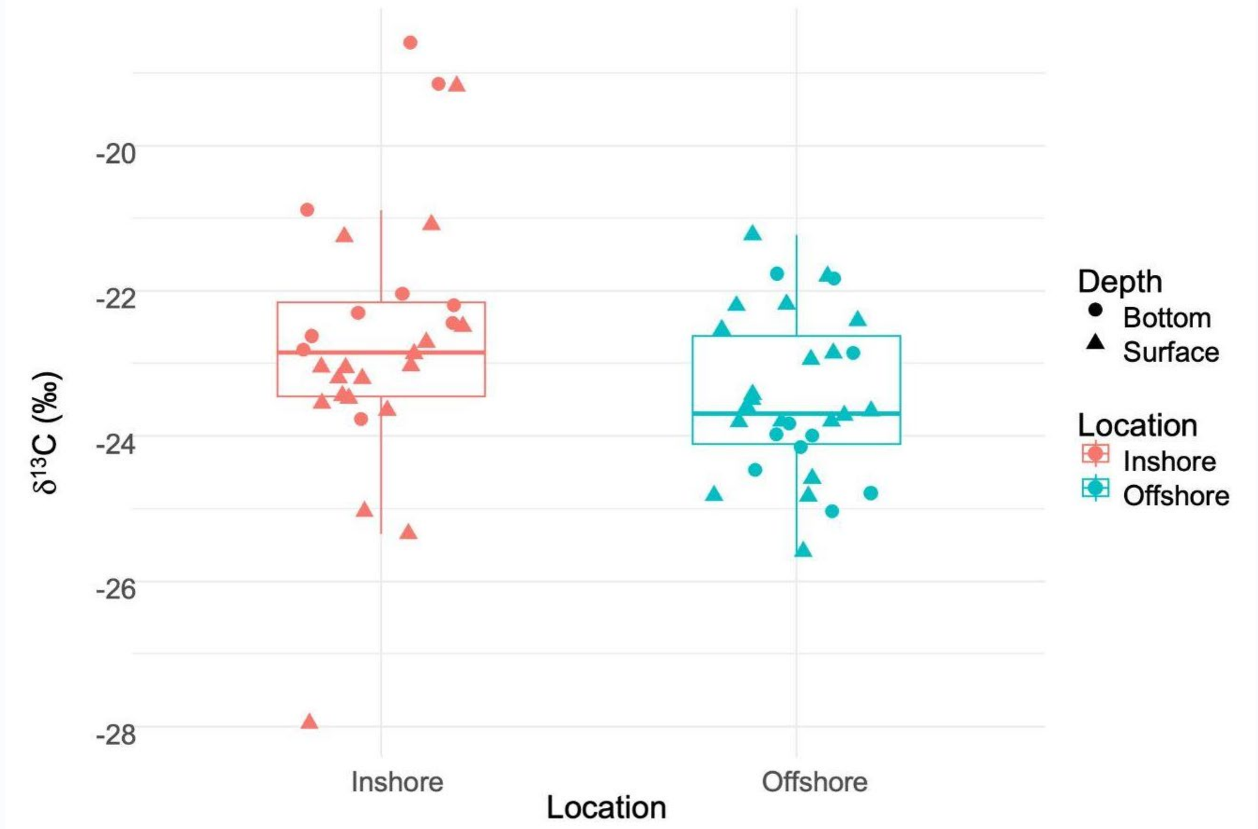




Stable Isotope Analysis

Inshore vs. Offshore

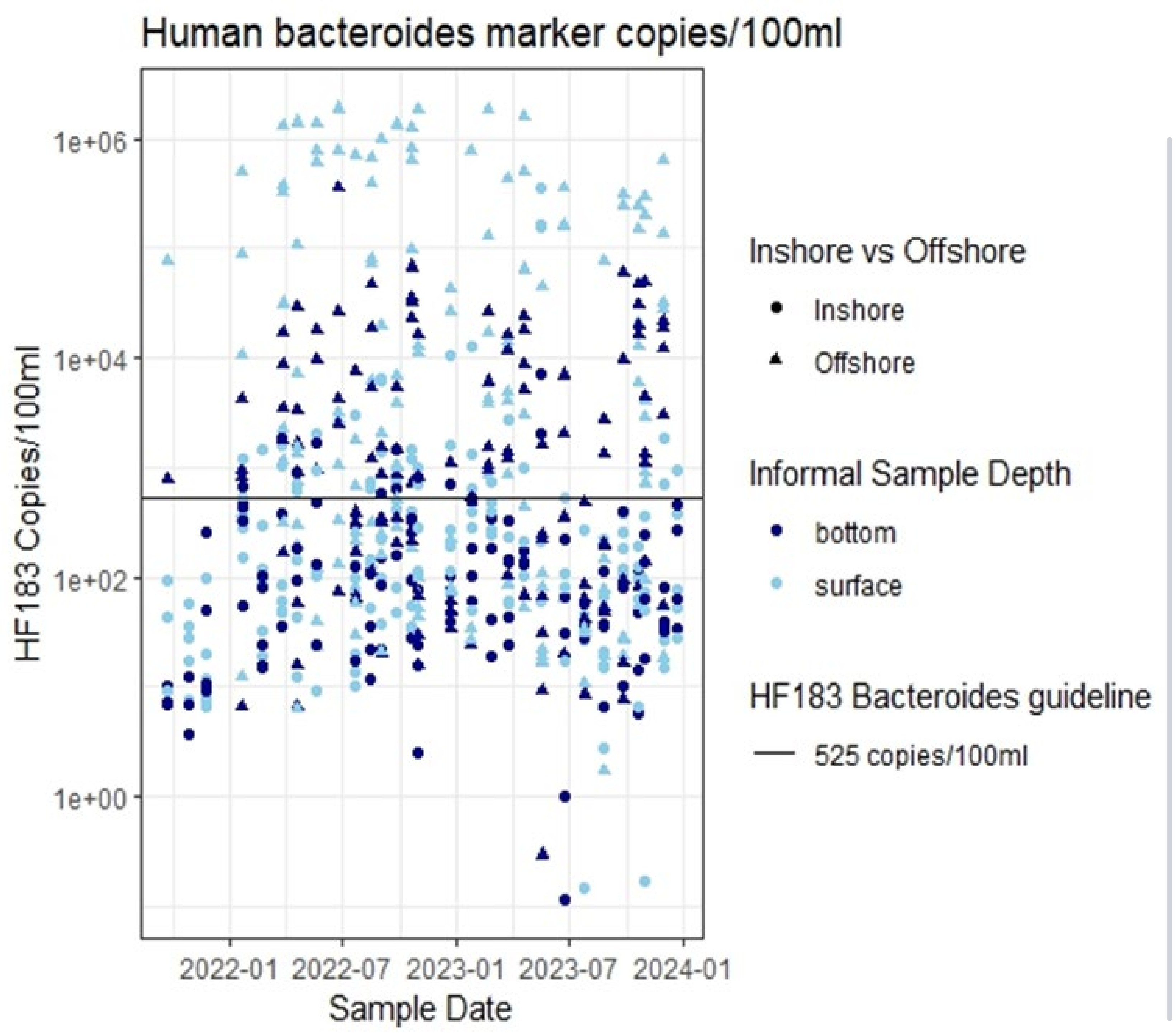
Distinct differences in isotope composition between locations

Nitrogen Enrichment

Inshore stations ~3‰ more enriched in $\delta^{15}N$ than offshore

Anthropogenic Sources

Enrichment indicates inputs from sewers and leaky septic tanks



Fecal Bacteria Detection

1 Enterococci

Widespread throughout study area

Highest at Miami River, Little River, and Outfall

2 Human-specific Bacteroides

Indicates sewage/septage contamination

Frequently exceeds health risk thresholds

3 Canine-specific Bacteroides

Less prevalent than human markers

Highest at Outfall and river discharges

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Microbial Contamination Sources

River Discharge

Miami River and Little River primary sources

Wastewater Outfall

Miami Central Outfall significant contributor

Bay Transport

Contaminants move through Government Cut

Reef Impact

Elevated bacteria levels detected at offshore reefs

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Recommendations

Actions

Reduce nutrient inputs before eutrophication tipping point

Continued Monitoring

Maintain high-frequency measurements throughout the Bay

Continue Agency Coordination

Continue collaboration with county, state, and federal partners

Updated Standards

Revise concentration limits and Total Daily Load regulations

Multi-year, high-frequency assessment of water quality in Biscayne Bay, Florida.

Thanks

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Mojica et al 2024.
CoRIS

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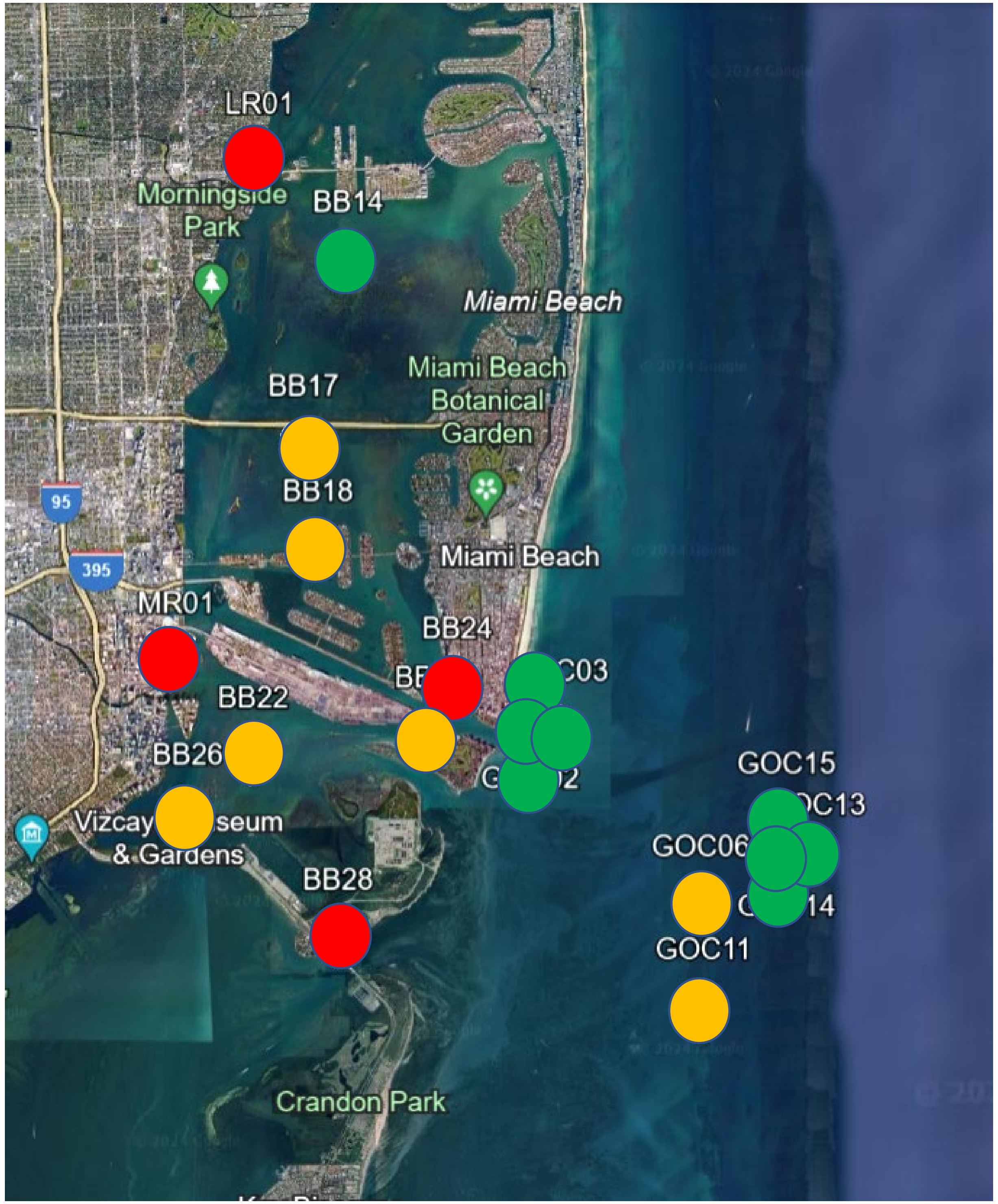
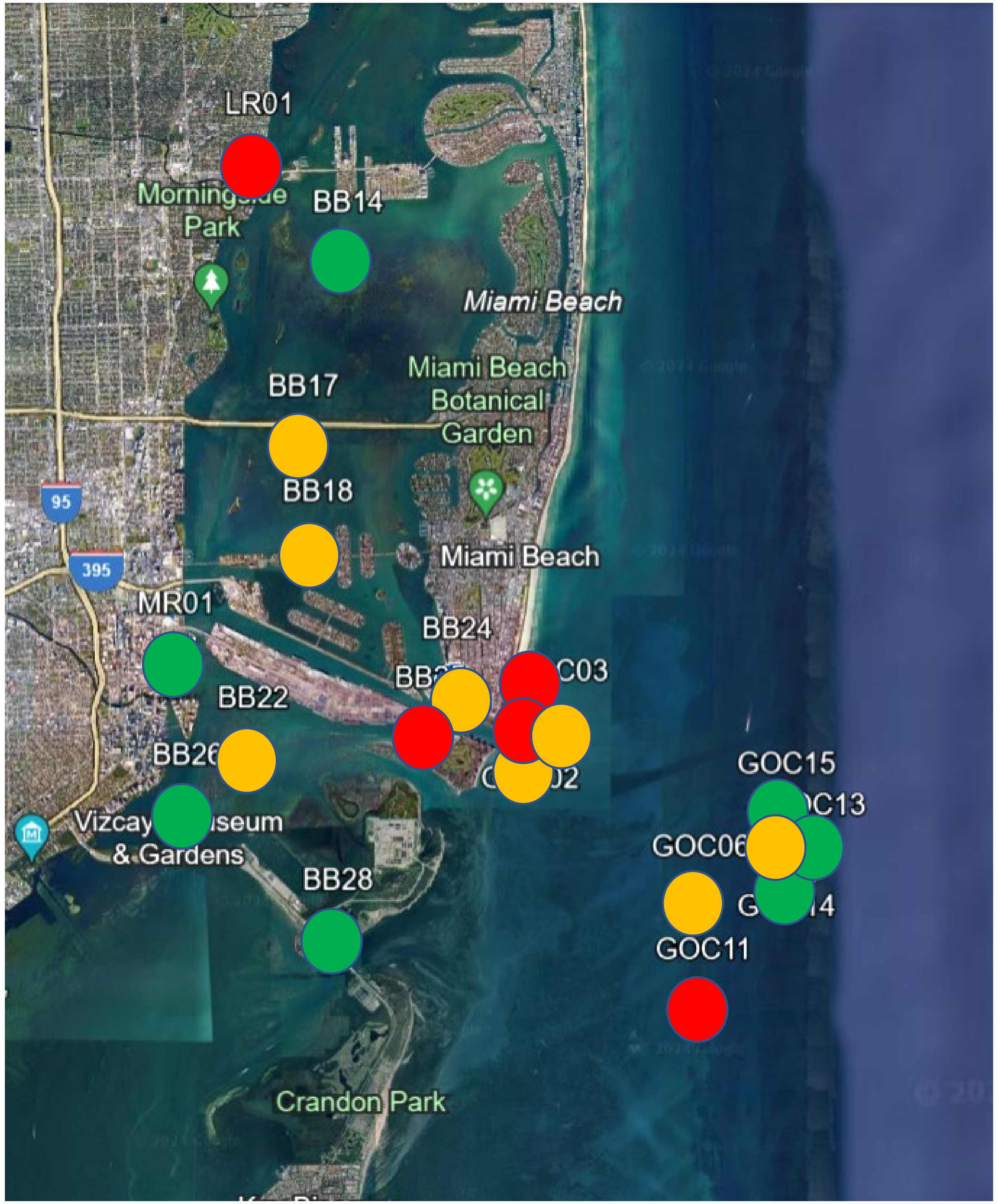
Concentration trends (Mann-Kendall)

PO4



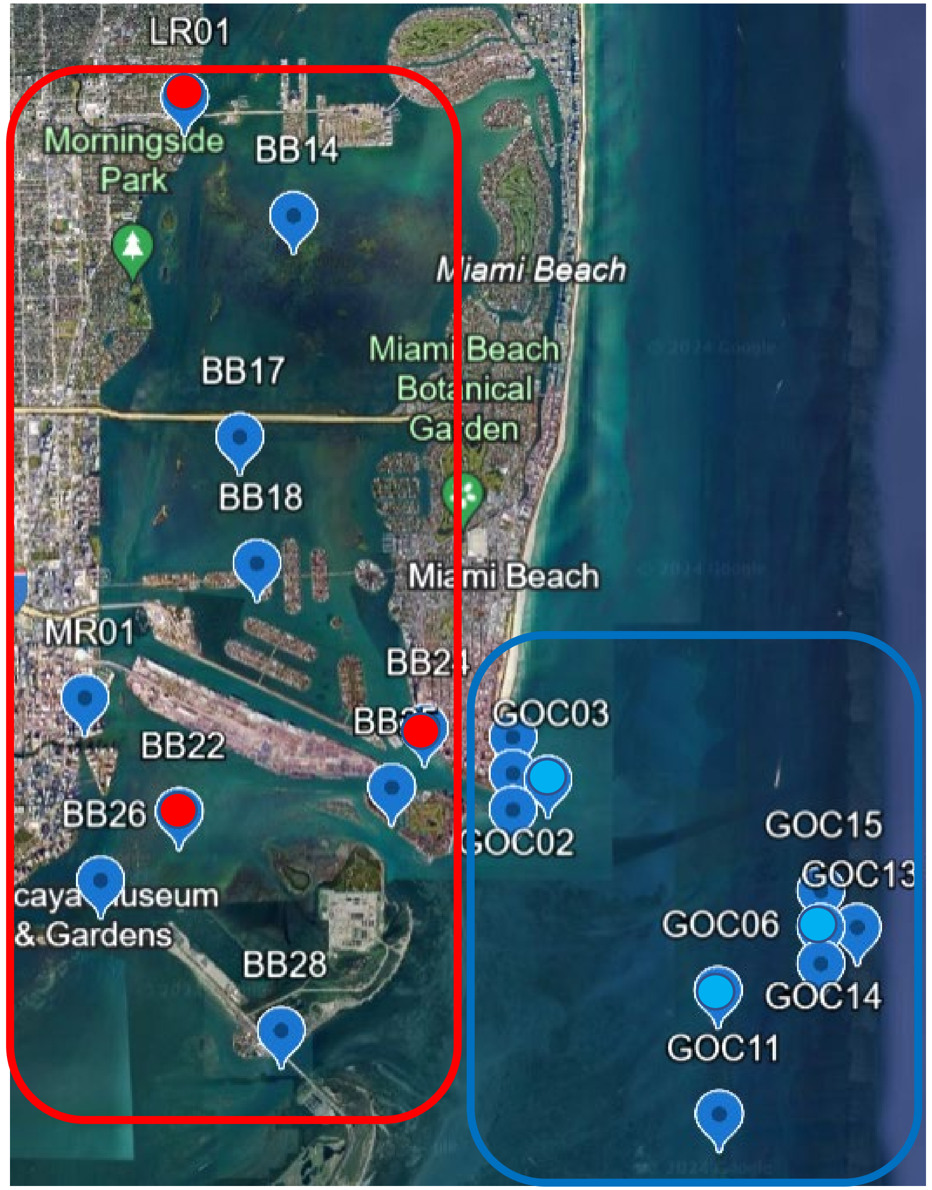
- High Decreasing
- Low Decreasing
- Stable
- Low Increasing
- High Increasing

CHL-a



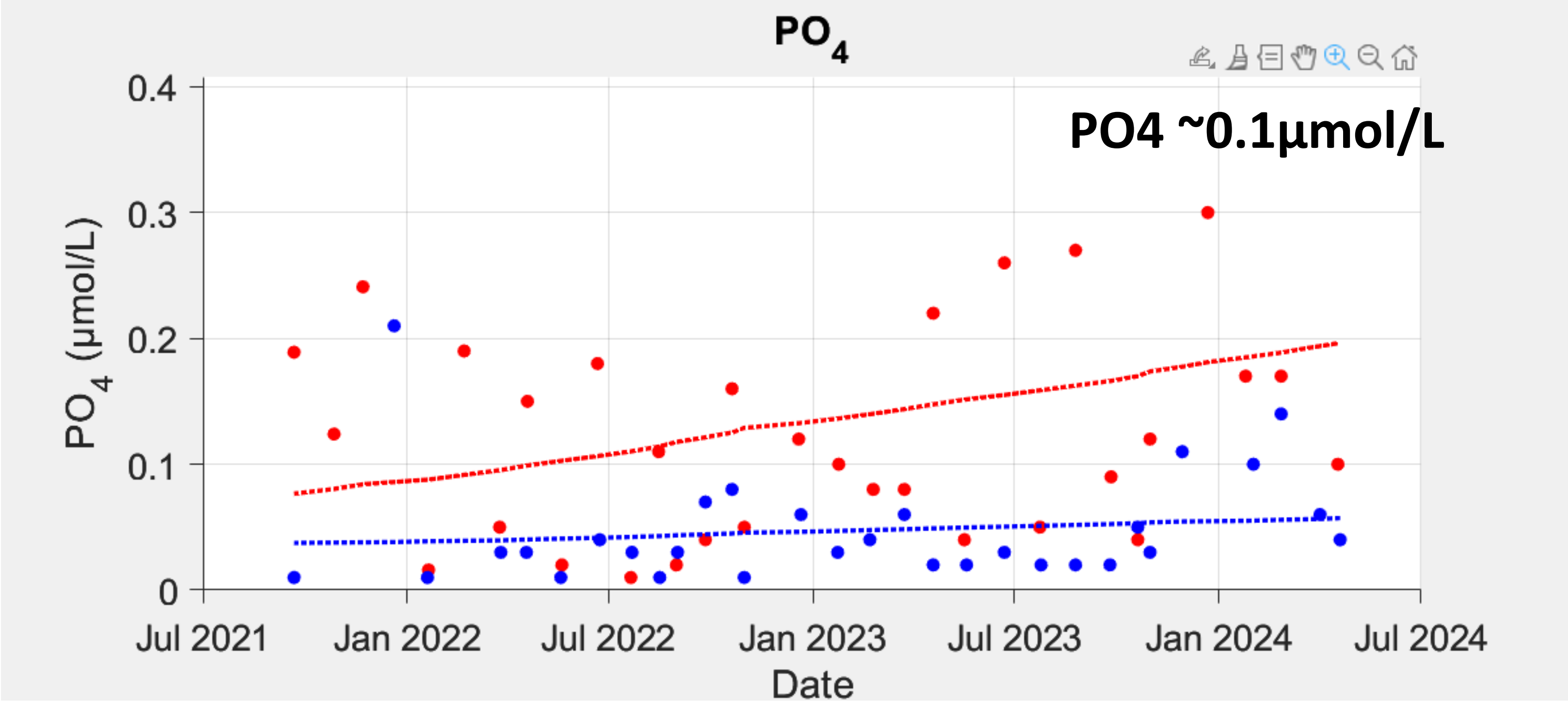
Concentration trends (Mann-Kendall) from average representative stations

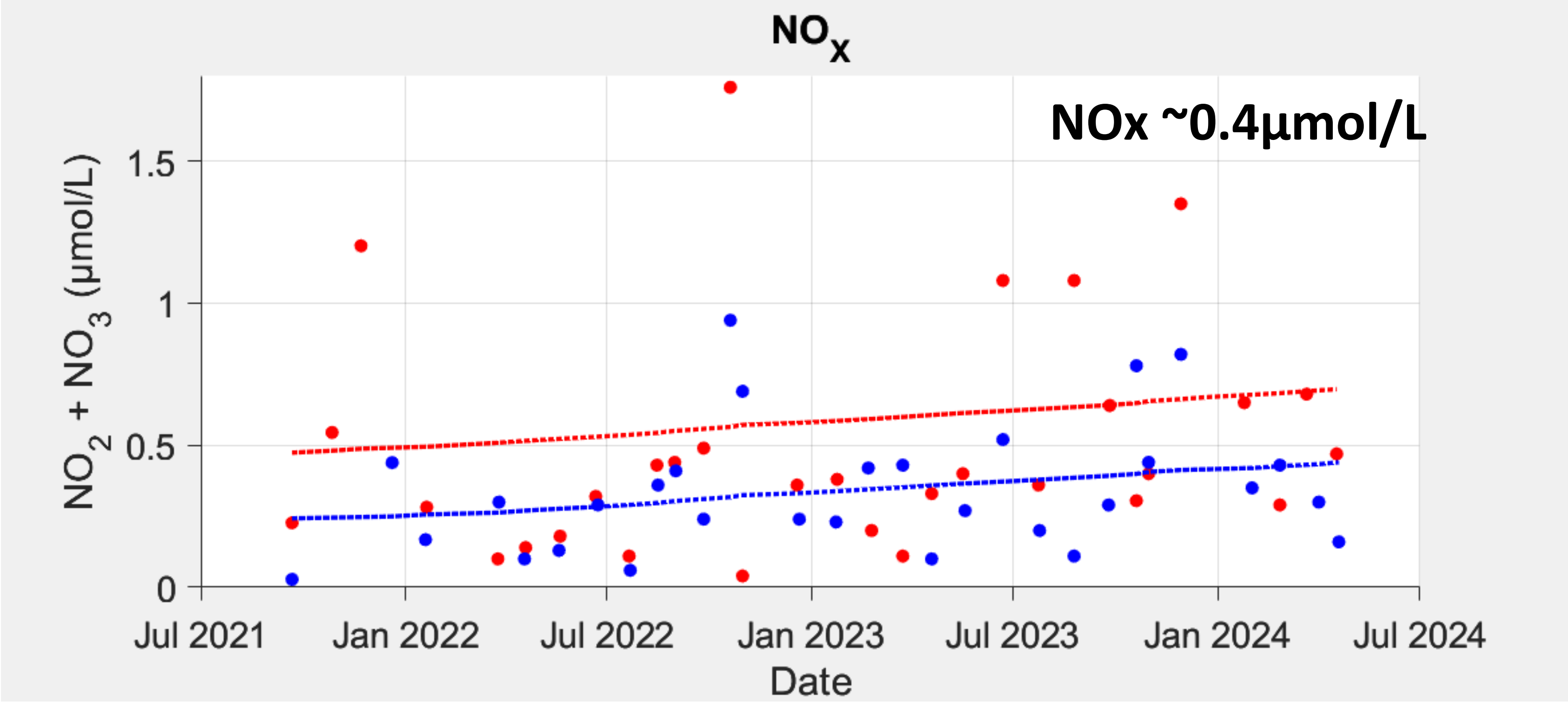
* Higher concentrations
* Increasing trend



(Millete et. al.; 2019). PO4 ~0.04µg/L
NOx ~ similar

Inshore ---   Offshore ---





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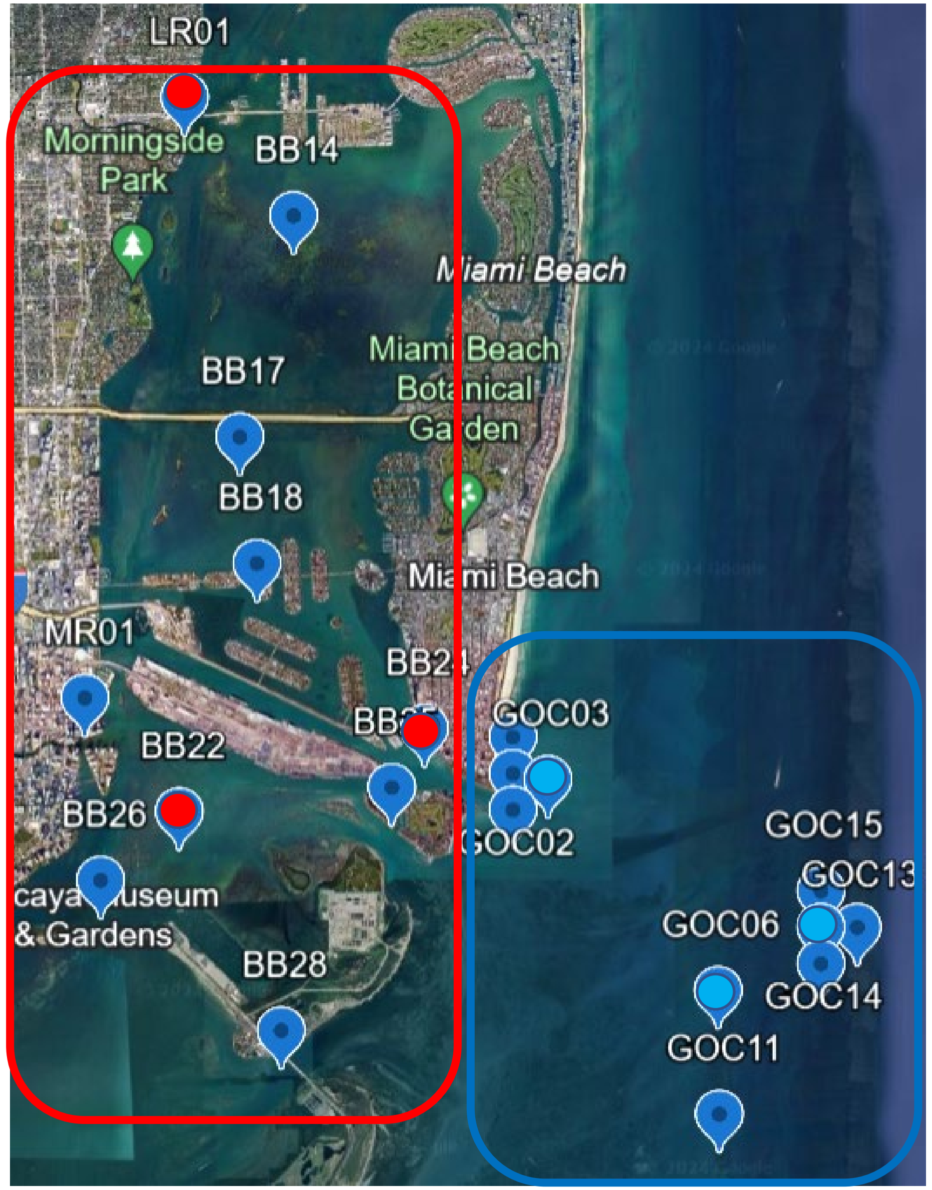
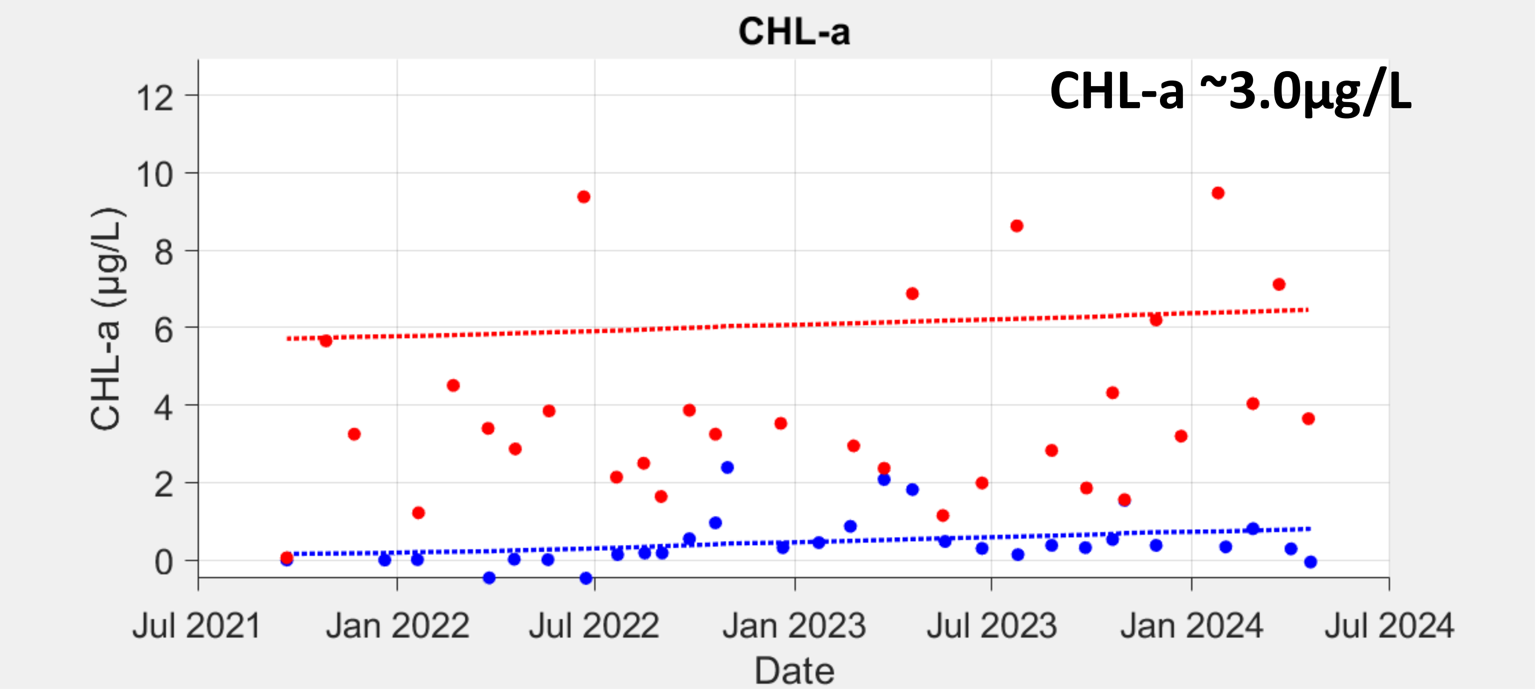
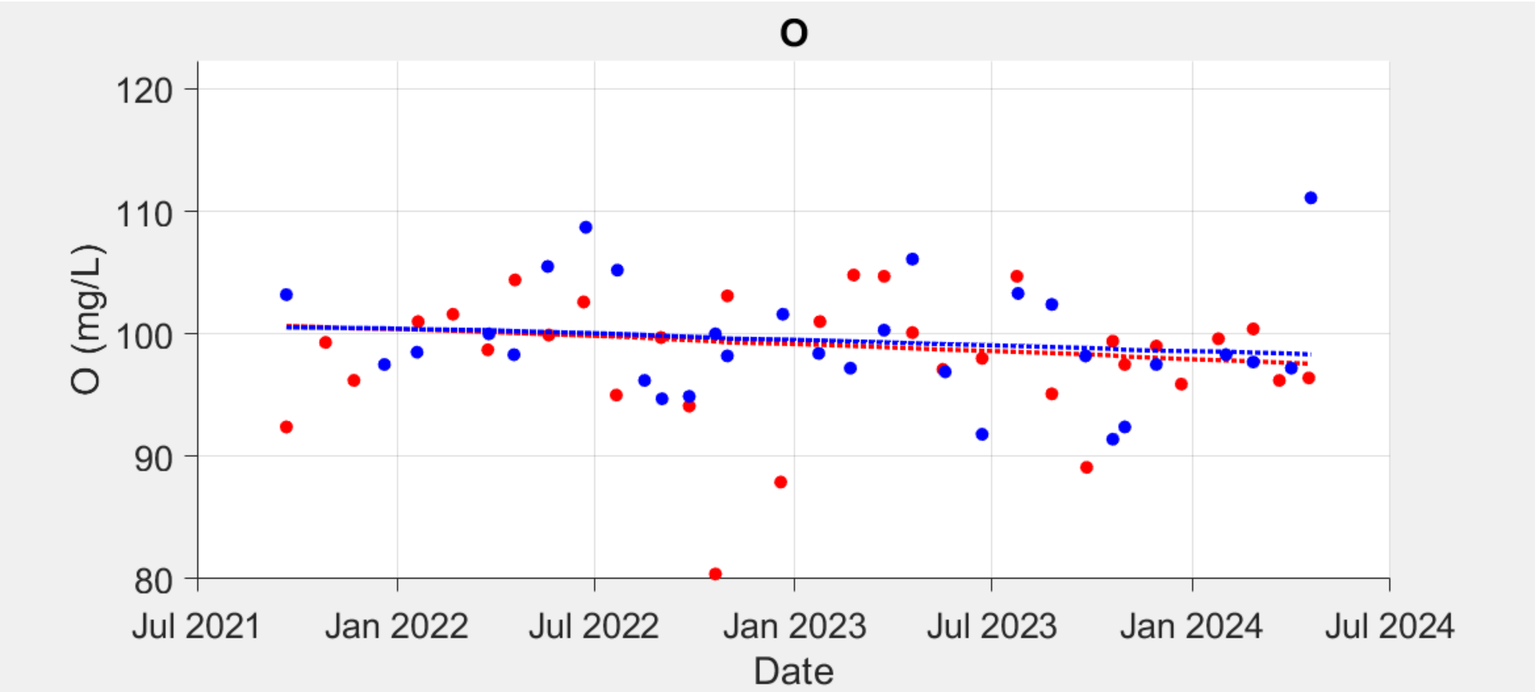


(Millete et. al.; 2019). CHL-a ~1.4µg/L





* Decreasing trend