

Enhanced understanding about spatial and temporal variation of water quality in Guam's coastal

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Objectives....

July 8, 2024

Hotel Nikko

Westin Resort

June 24, 2024 - Northern end of Tumon Bay

July 16, 2025

July 16, 2025

Tentative sources



Water Quality Management plans are critical for Guam's coastal ecosystem and coral reefs conservation!



**Water
Quality
Modeling**

**Water
Quality
Monitoring**

**Water
Quality
Management**

- What is modeling?

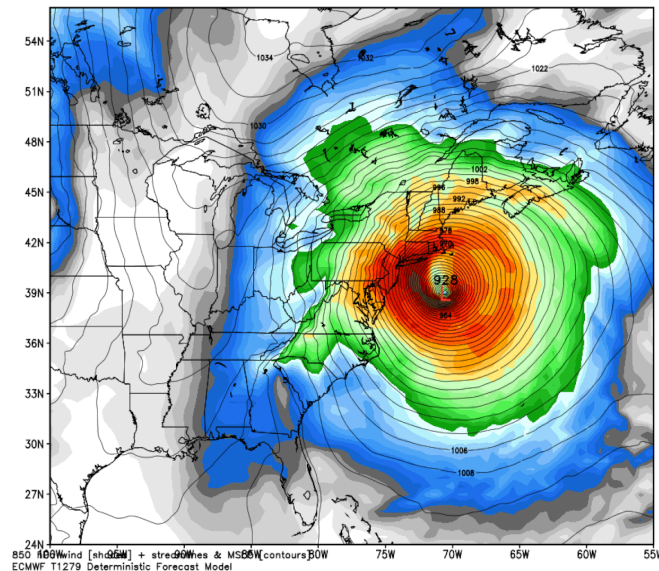
- the representation, often mathematical, of a process, concept, or operation of a system, often implemented by a computer program (Dictionary.com)

⇒ describe a process, concept, operation, or natural system using mathematical equations

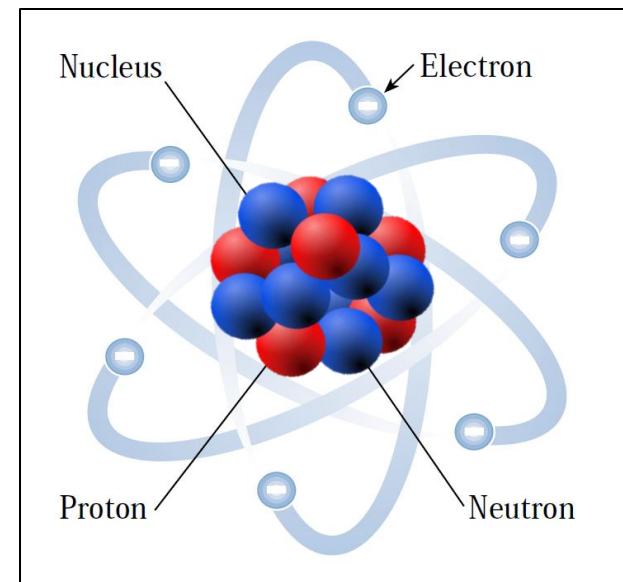
⇒ help visualize something that cannot be directly observed

ECMWF 850 hPa Wind Speed [knots] and MSLP [hPa]
Init: 12Z22OCT2012 -- [216] hr --> Valid Wed 12Z31OCT2012

Min/Max SLP: 927.8 hPa | 1036.6 hPa
Max Wind: 97.0 knots



Weather forecasting (Washington Post)



Atom

- Why water quality modeling?

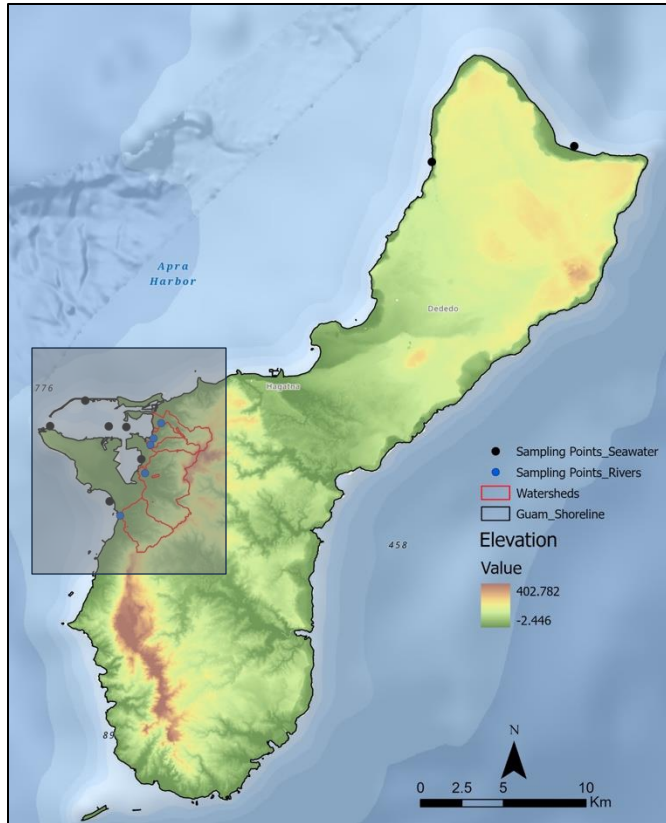
- for the following water quality monitoring programs, *to determine*
 - locations, frequency, and method of data collection

- *to figure out water quality dynamics*
 - in watershed and water body
- *to predict future water conditions associated with*
 - unrecorded extreme weather conditions,
 - human action or natural changes, or
 - in flow patterns or incoming waste loads.

- for improving water quality, *to suggest suitable best management practices (BMPs)*
 - to identify the locations of concerns
 - to determine the suitable watershed BMPs or restoration plans.

- Coral reefs in the Joint Region Marianas (JRM) play a crucial role in *maintaining marine biodiversity, serving as vital habitats* for fish and other marine organisms, and *providing natural protection* against coastal erosion.
- The ecological management practices at JRM are, therefore, essential for preserving these critical habitats and ensuring the sustainability of the region's rich natural resources.
- Without any modeling concept, the initial inquiry was to continue the monitoring program (**Phase 1**) → **Phase 2** with the water quality modeling starts
- The Water and Environmental Research Institute of UOG (UOG-WERI) has been operating the first phase of the monitoring program since 2022.

Water Quality Monitoring Project – Phase 1



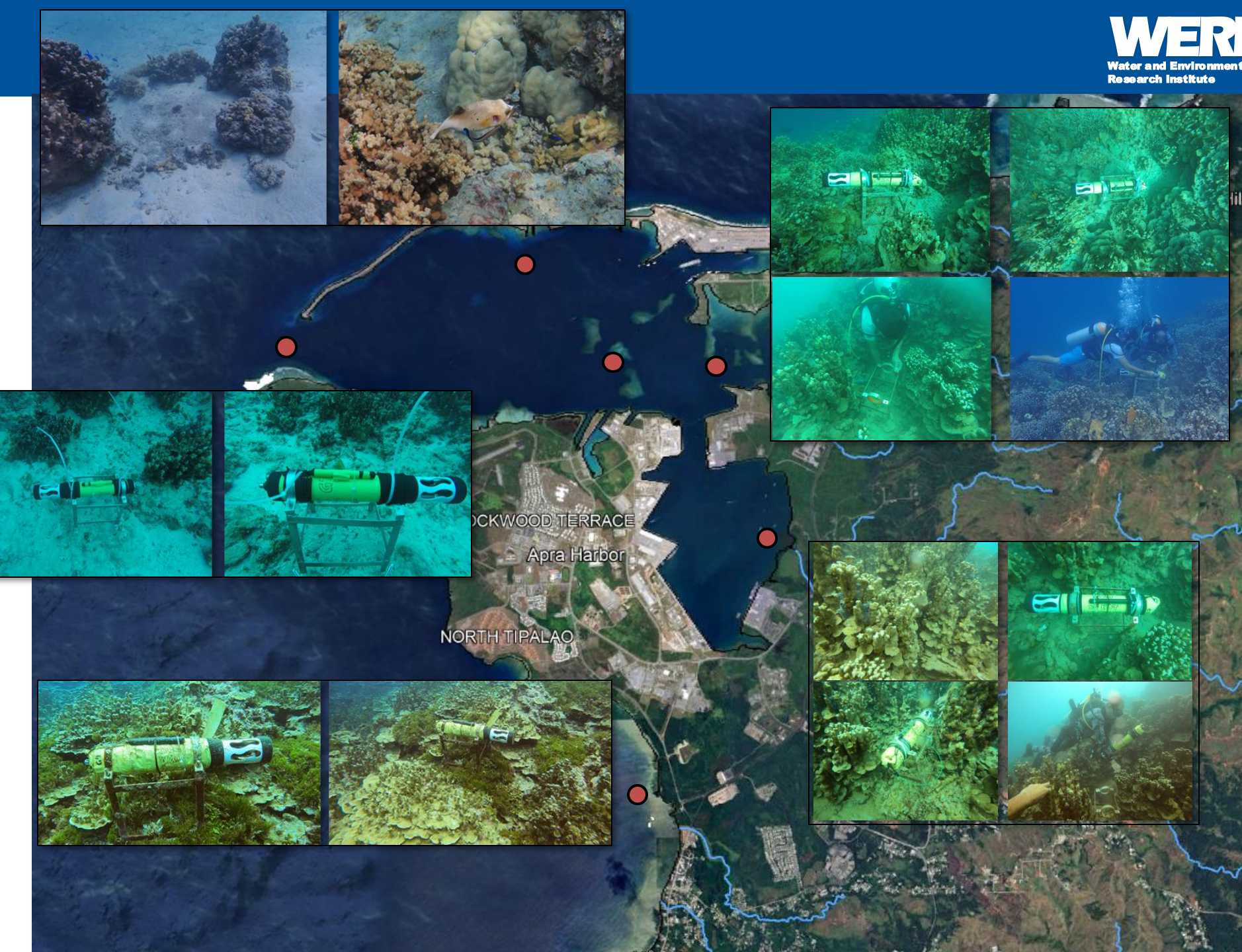
(a)



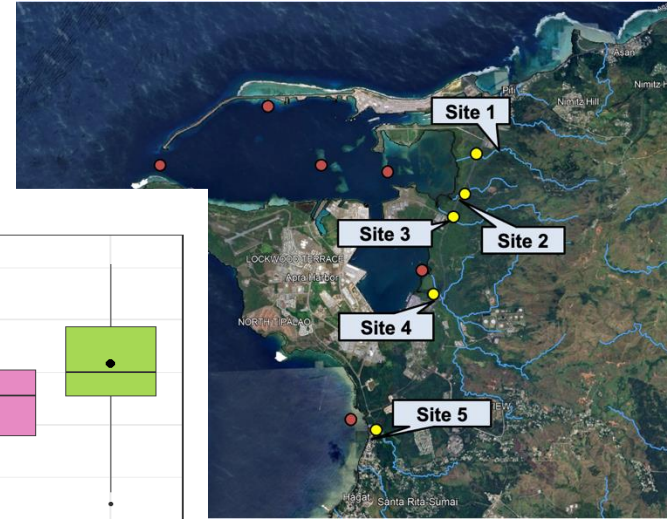
(b)

River-linked closed system



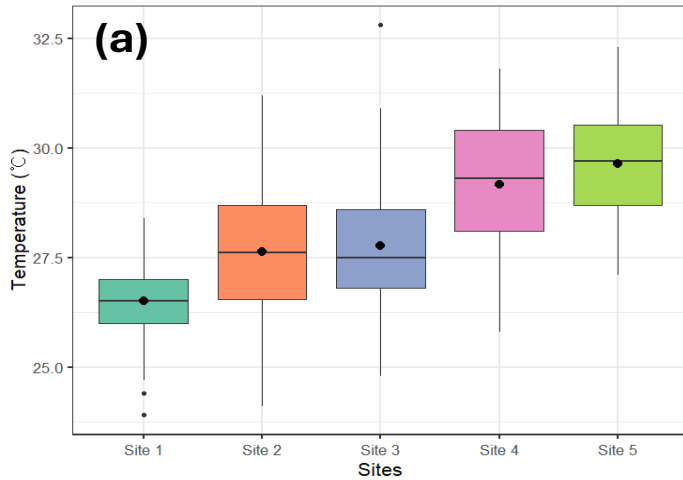


Data analysis - Freshwater



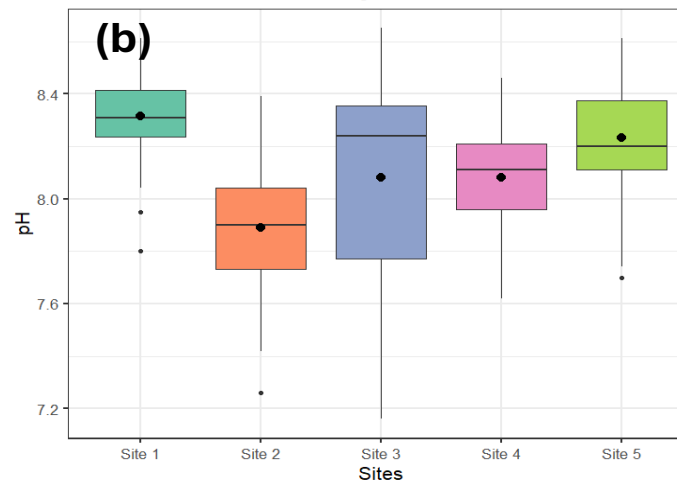
Temperature

(a)



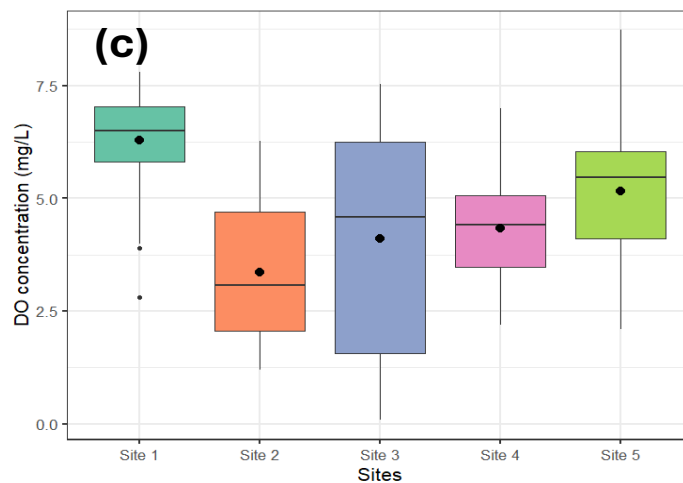
pH

(b)



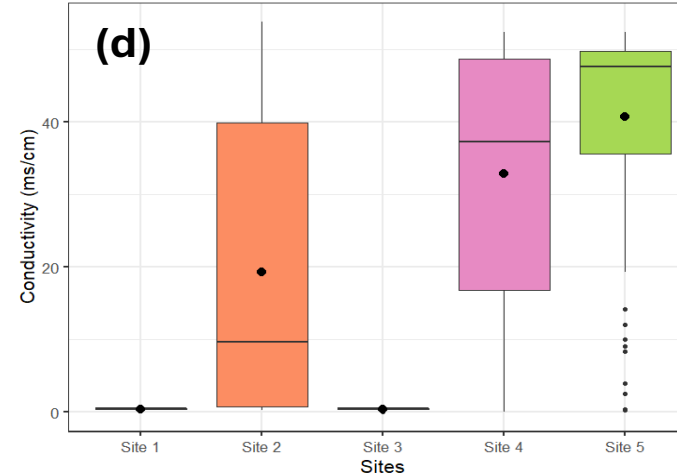
DO Concentration

(c)

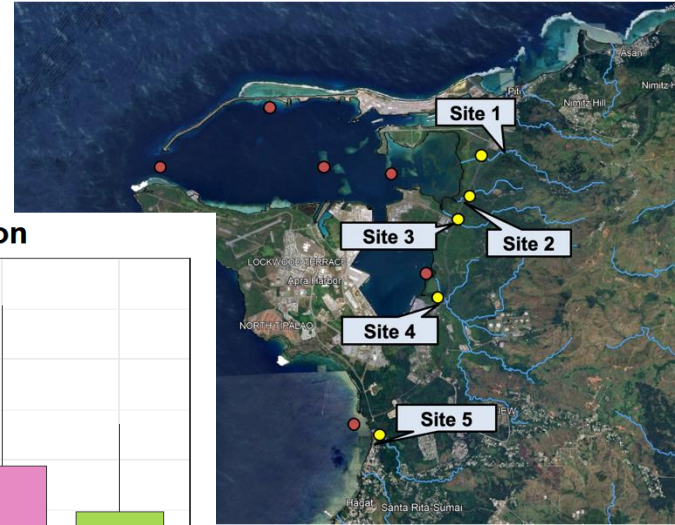


Conductivity

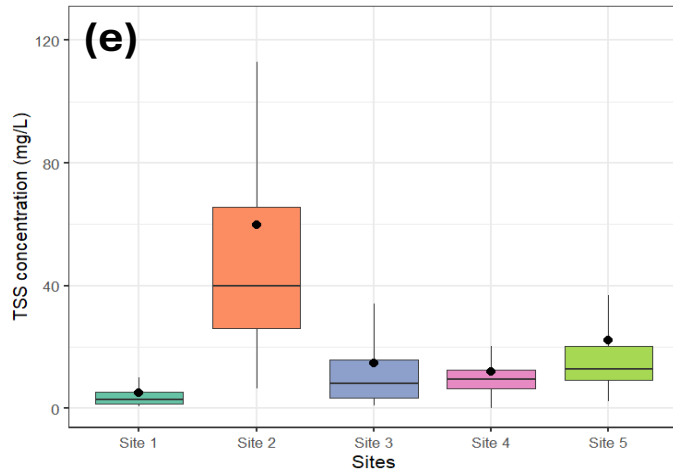
(d)



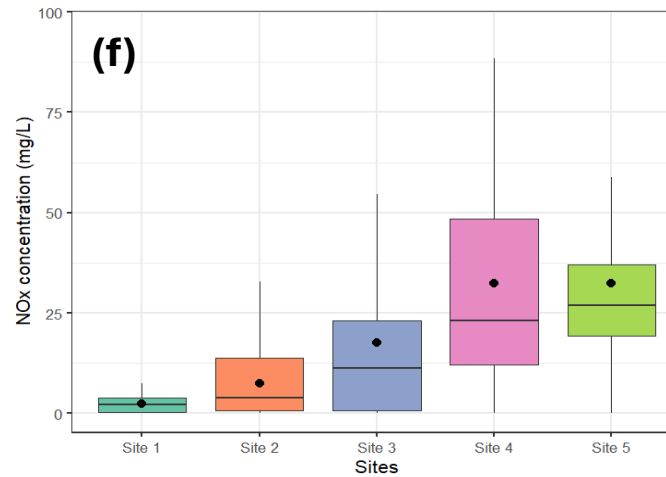
Data analysis - Freshwater



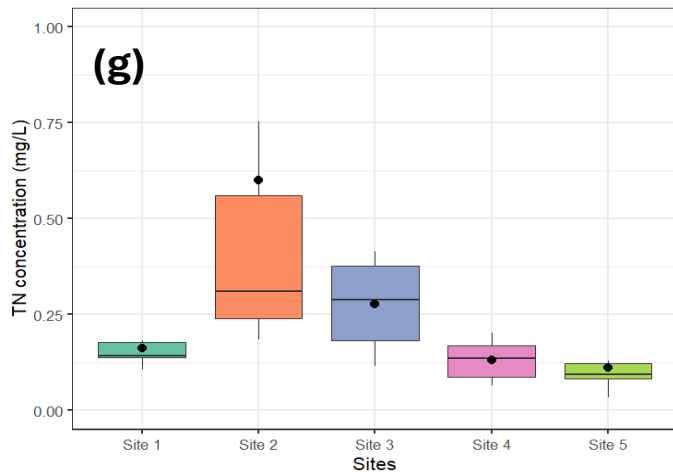
TSS Concentration



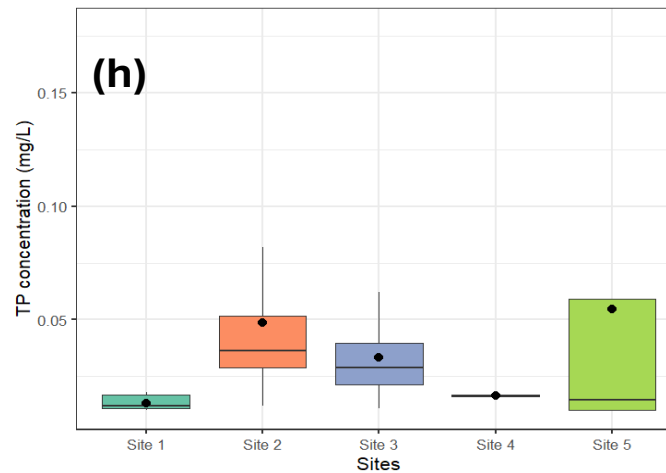
NOx Concentration



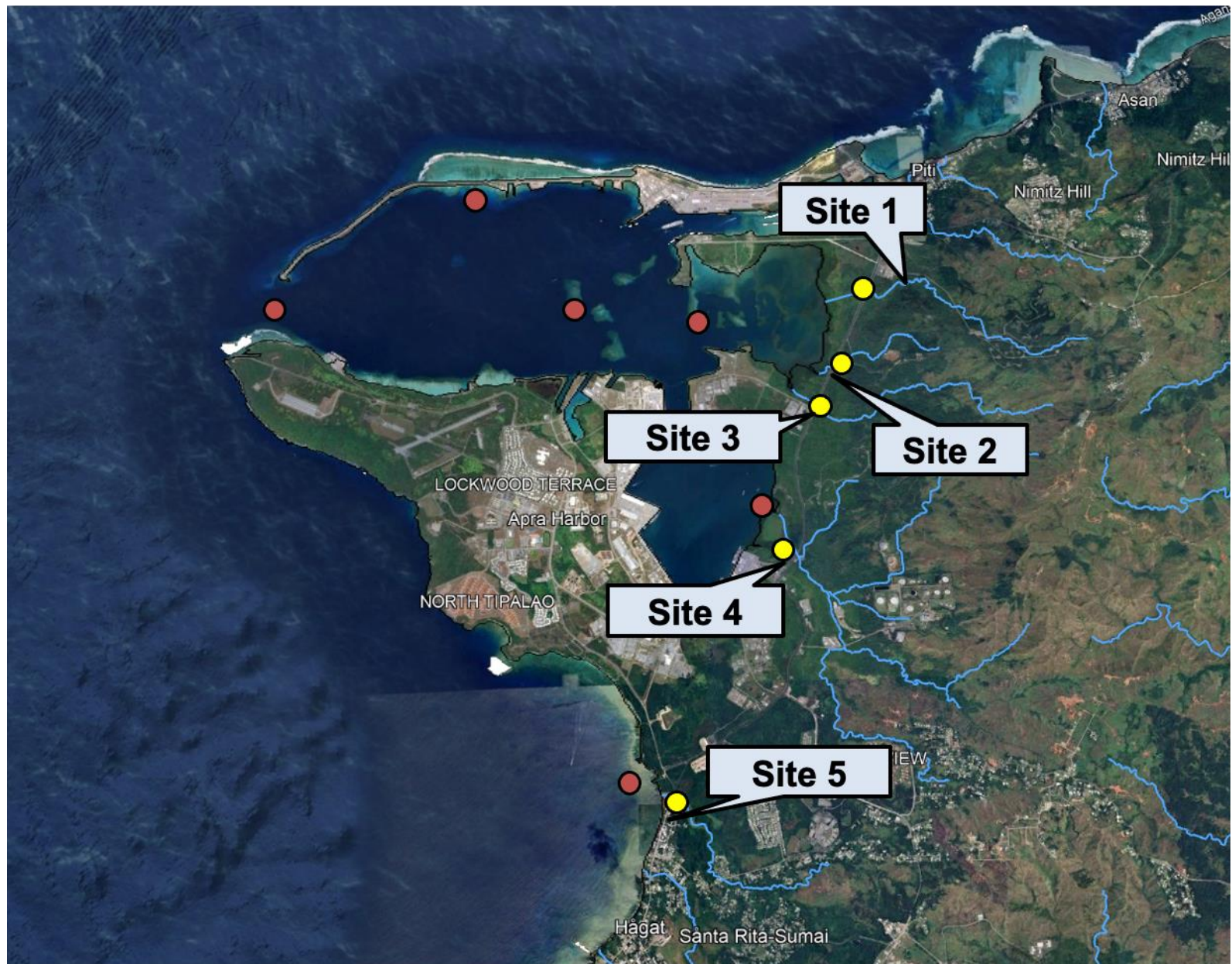
TN Concentration



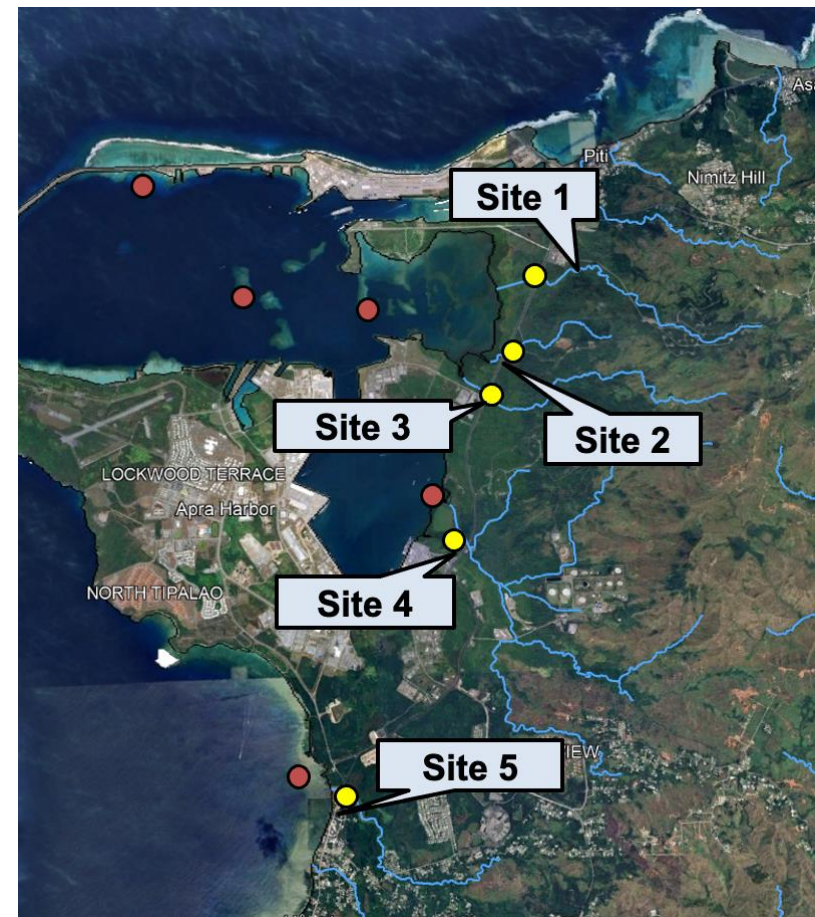
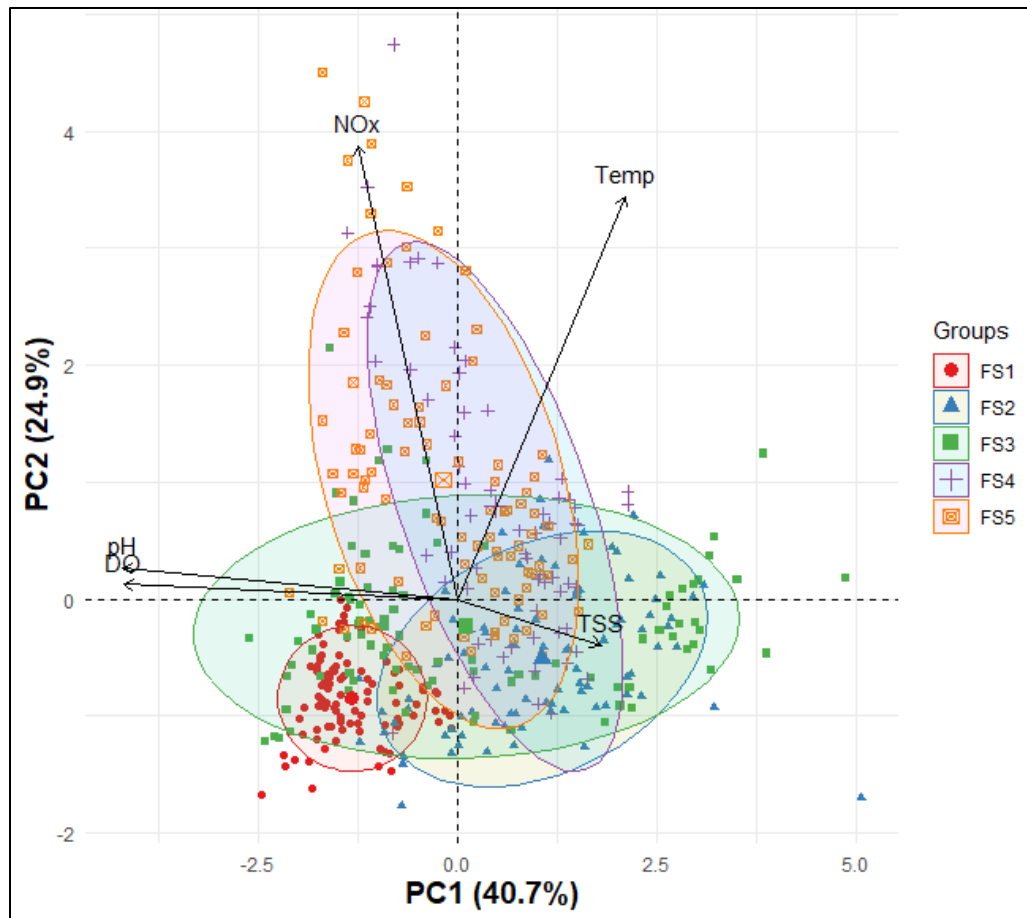
TP Concentration



Ammonia sources at Site 2???



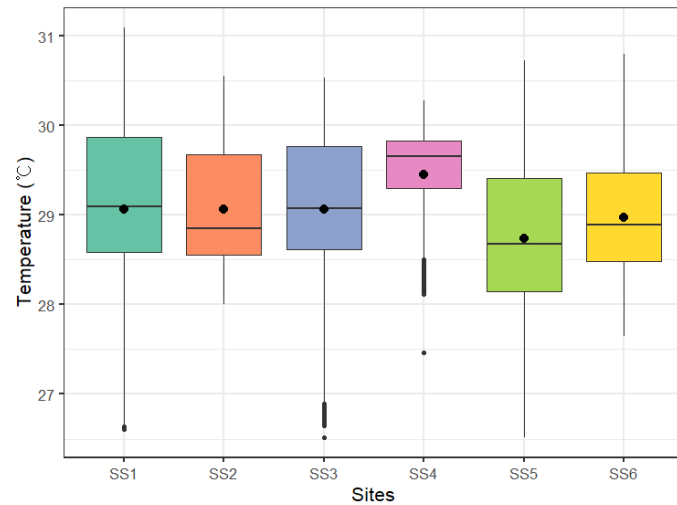
Watershed BMPs?



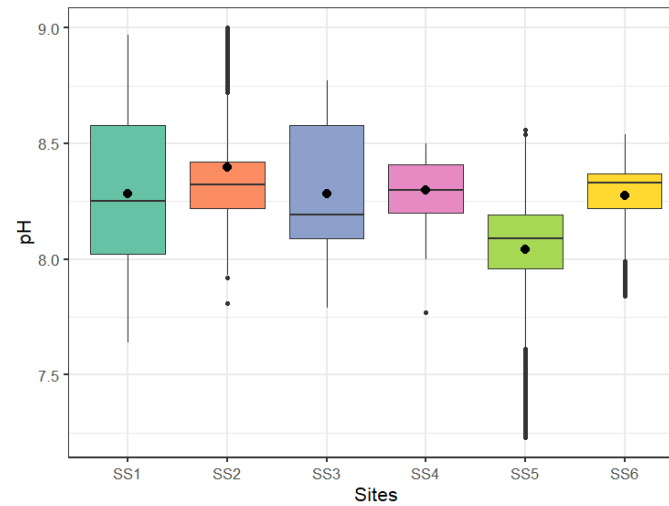
- Nutrients
 - Sites 4 and 5: Antantino River and Namu River
- Turbidity (Sediments)
 - Sites 2 and 3: Laguas River and Aguada River

Data analysis - Seawater

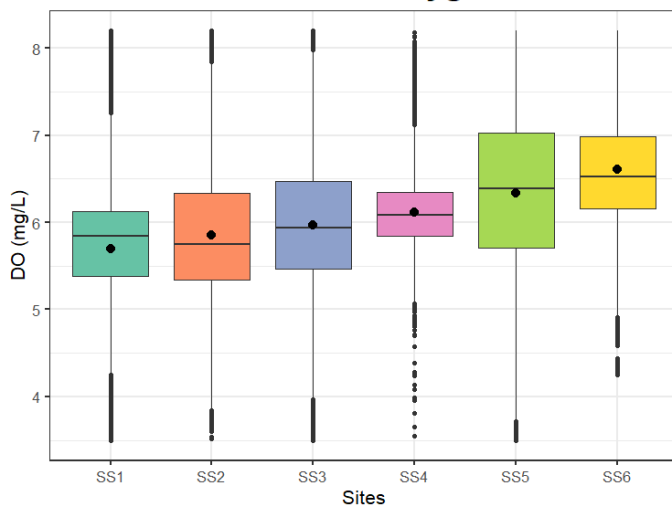
Temperature



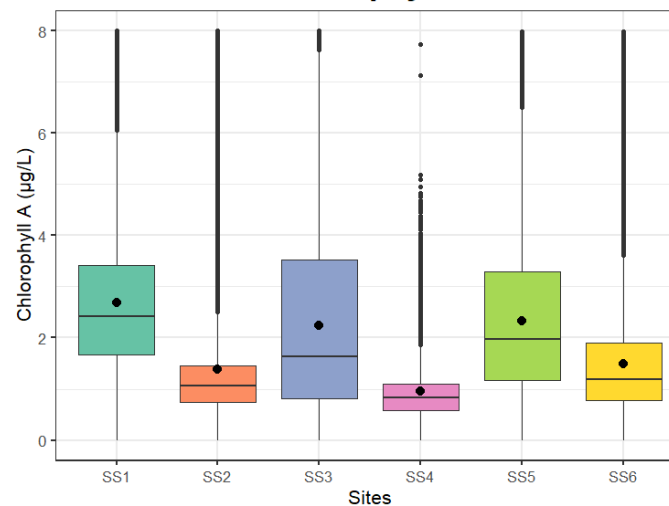
pH



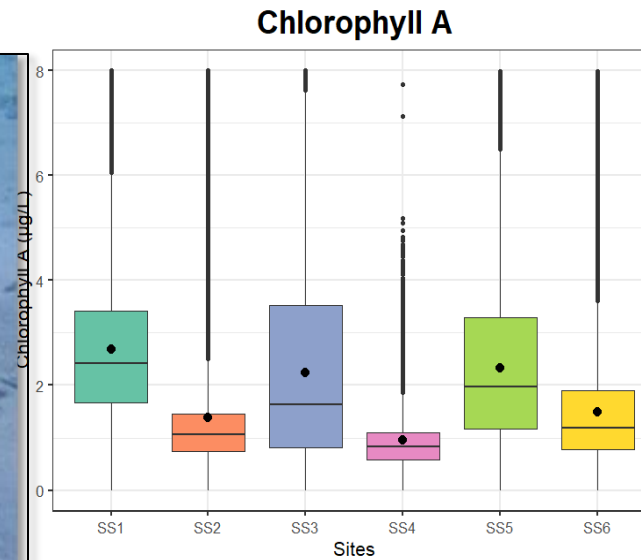
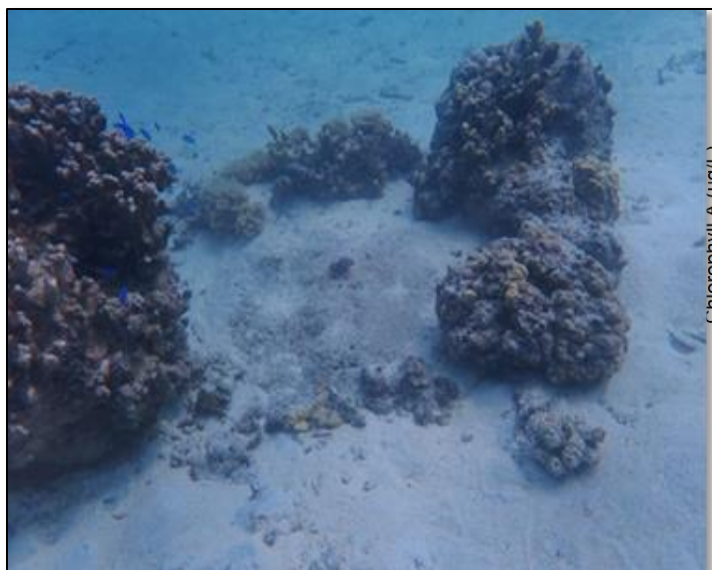
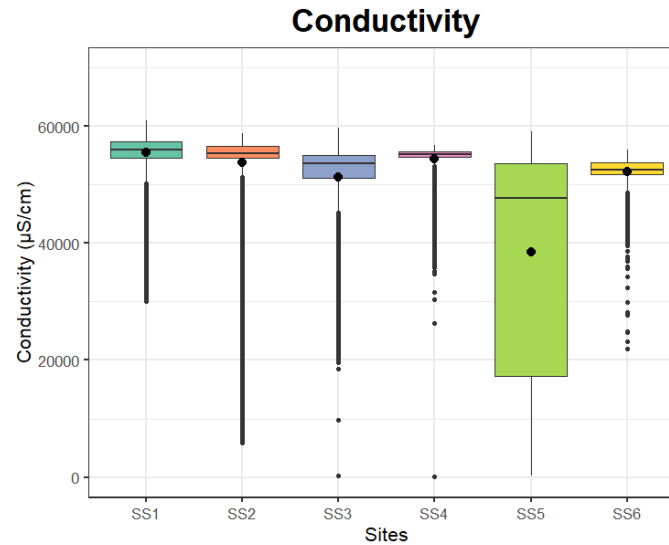
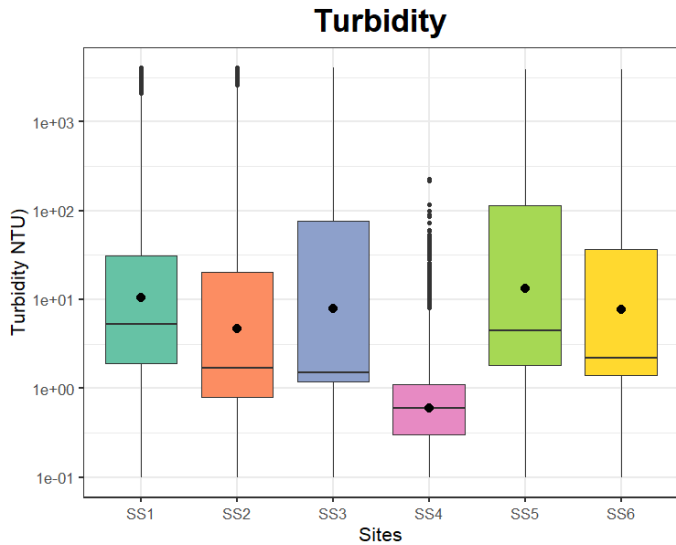
Dissolved Oxygen

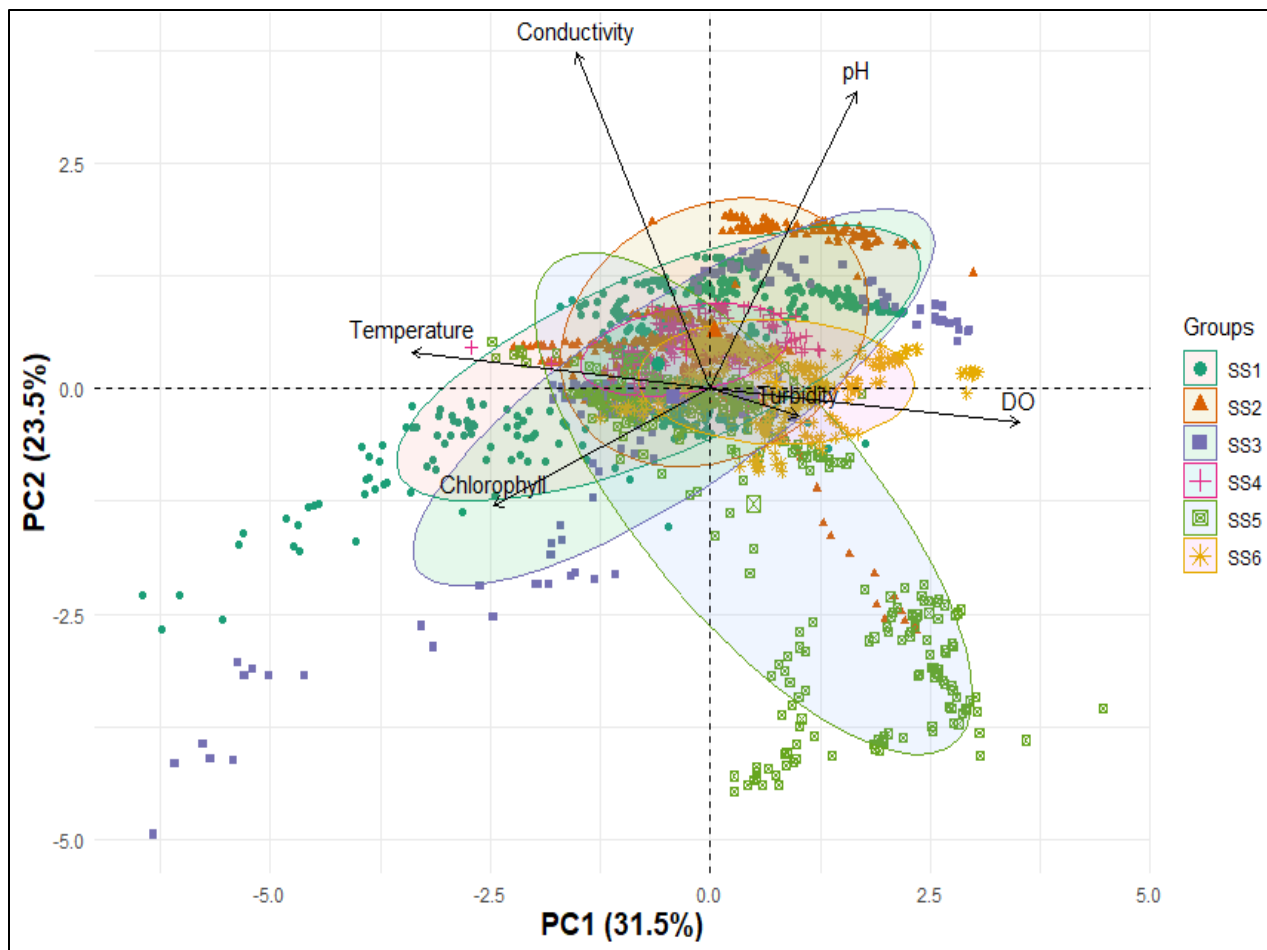


Chlorophyll A



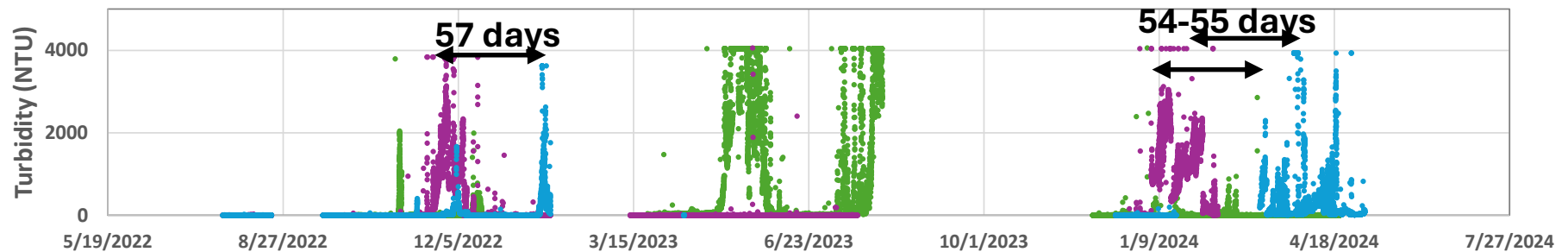
Data analysis - Seawater





- Turbidity (sediments)
 - Family Beach
 - **Anchor Reef (SS3)**
linked to Laguas River (FS2)
 - Dadi Beach from groundwater
- Chlorophyll A (nutrients)
 - **Inner Harbor (SS1)**
linked to Antantino River (FS4)
 - Middle Shoals
 - **Dadi Beach (SS6)**
linked to Namo River (FS5)

Sediments traveling



- An integrated Ridge-to-Reef (R2R) approach is implemented to evaluate how land-based sources of pollution affect freshwater and marine ecosystems in Apra Harbor.
- From the data analyses, key spatial and temporal patterns in water quality that are linked to both natural processes and anthropogenic influences.
⇒ *to introduce the prioritized the watershed BMP applications* for each watershed regarding the reduction of nutrient and sediment loads.
- Current watershed model developments for Apra Harbor, Tumon area, and Ugum Watershed are ongoing
⇒ I plan to present the results next year

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1) Cooperative Agreement Number: N40192-21-2-8006