Water Quality Monitoring 2022 Data Summary

Overview

The Gulf Coast Network (GULN) Water Quality Monitoring Program began in September 2007. The program monitors 54 sites across seven parks on a set rotation. The GULN Water Quality Monitoring Program provides an integrated assessment of the spatial and temporal distribution of general water quality conditions of stream and estuary water in relation to hydrologic conditions and major sources.

The network began long-term monitoring of water quality at Padre Island National Seashore (PAIS) with continuous autonomous sampling in May 2008 and monthly grab sampling in October 2010. Two sites in the Upper Laguna Madre, South Bird Island and Baffin Bay (Figure 1), are located on Texas Coastal Oceanic Observation Network structures and operated through a task agreement with the Conrad Blucher Institute at Texas A&M University-Corpus Christi (referred to as cooperators). Autonomous measures, collected every 15 minutes, include water temperature, specific conductance (SpC), pH, dissolved oxygen (DO), and turbidity. Grab samples are collected for a common suite of nutrients standard to the Gulf of Mexico Alliance, a state-led network of partners working on priority issues along the Gulf Coast. These data are integrated into our routine seagrass monitoring program to better understand estuary health.

This brief summarizes data collected from January 1 through December 31, 2022. Water quality data are available upon request to the Gulf Coast Network. Past water quality reports and briefs are available on the Gulf Coast Network website (https://www.nps.gov/im/guln/monitoring-reports.htm). Continuous real-time data are available at 170: National Park Service - Baffin Bay (http://lighthouse.tamucc.edu/qc/170) and 171: National Park Service - Bird Island (http://lighthouse.tamucc.edu/qc/171).

In December of 2022, PAIS monitoring shifted from every-month water sample collections for laboratory analyses to every-other-month sampling schedule for laboratory analyses. Monthly maintenance also shifted to every-other-month which is possible due to an in-house designed, and patented anti-fouling device in use at Padre Island National Seashore.

Significant Findings

Highlights of Calendar Year 2022 Monitoring

The Upper Laguna Madre is seemingly removed from direct human influence aside from a maintained channel (Gulf Intracoastal Waterway) and some fishing camps. Our data show water quality parameters typically exceed state water quality standards (see Table 1 for standards). In 2022, there were multiple violations within the Upper Laguna Madre for chlorophyll-*a*, and ammonia.

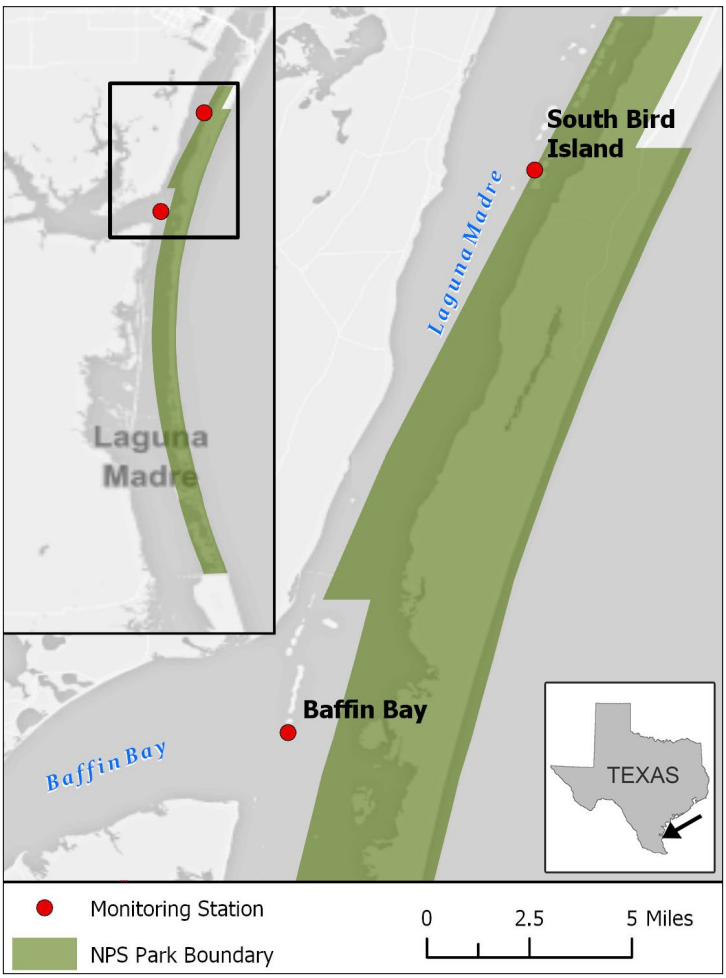


Figure 1. Map of Padre Island National Seashore with sampling sites marked in the Upper Laguna Madre.

Ammonia

Ammonia exceeded water quality limits for the entire year of 2022 at both sampling locations (Figure 2). Ammonia has routinely been in violation (since approximately 2018) based on water samples collected by GULN and analyzed at a certified laboratory. Ammonia is typically found in lower proportions to nitrate due to nitrification processes by bacteria (conversion of NH_3 to NO_2 to NO_3). Persistent ammonia in aquatic ecosystems generally results from persistent sources including waste products by animals (direct deposition and fertilizer runoff), domestic waste sources, and industrial or agricultural pollution. Unfortunately, ammonia is toxic to aquatic organisms and data collected from 2015 to 2022 appears to illustrate a continuing elevated level of ammonia within the Laguna Madre near our monitoring sites.

Significant Findings (continued)

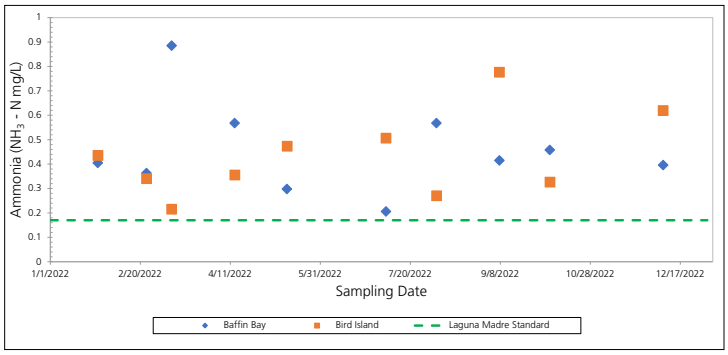


Figure 2. Ammonia measurements for Padre Island National Seashore from January 1, 2015, through December 31, 2022. Ammonia was found to be in repeated violation of state water quality standards for the Laguna Madre.

Chlorophyll-a

Chlorophyll-*a* is a surrogate measure of phytoplankton abundance (microscopic organisms, also generally referred to as algae) in the water column. Increased nutrient availability in a waterbody may result in increases in phytoplankton measurable as an increase in chlorophyll-*a*; however, we routinely find non-detects for many nutrients in our water samples at GULN sampling locations (excluding ammonia, and Total Kjedhal Nitrogen [TKN]) which confounds the simpler explanations for chlorophyll-*a* values resulting from the presence of elevated nutrient availability. There were multiple violations occurring at Padre Island National Seashore at both GULN's monitoring sites. Figure 3 shows chlorophyll-*a* levels at GULN sites at Padre Island National Seashore for 2022.

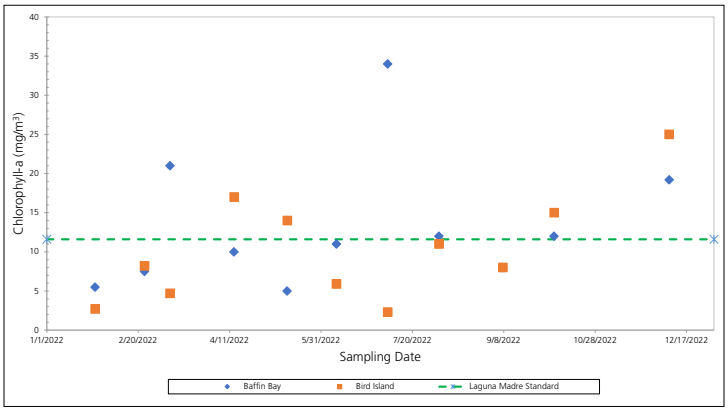


Figure 3. Chlorophyll-*a* measurements for the Upper Laguna Madre for 2022. There were multiple violations of the state water quality standards at both monitoring sites.

Water Quality Standards

Texas designates the Laguna Madre as "Exceptional/Oyster" waters. Although oysters are no longer found in the Upper Laguna Madre, the state gives this estuary the highest possible criteria. Designated uses are used to set water quality standards (Table 1). Details and rationale can be found at Texas Administrative Code Chapter 307: Texas Surface Water Quality Standards §§307.1–307.10.

Table 1. Measured variables and corresponding state standards.

Field Parameters	Water Quality Standard
Ammonia as N	< 0.10 mg/L
Chlorophyll-*a*	< 11 mg/m^3
Dissolved oxygen	> 5 mg/L
Nitrate as N	< 0.17 mg/L
pH	Between 6.5 and 9.0 SU
Total Phosphorous	< 0.21 mg/L
Water temperature	< 35°C

Future Monitoring

Water quality sampling will continue through 2023.

About the Gulf Coast Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as "Vital Signs Monitoring," to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystems,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and Congressional mandates, and
- Provide a means of measuring progress toward performance goals.

Gulf Coast Network Website
(https://www.nps.gov/im/guln/index.htm)
Gulf Coast Network Reports and Publications
(https:// www.nps.gov/im/guln/reports-publications.htm)
About the NPS Inventory & Monitoring Program
(https://www.nps.gov/im/index.htm)
Data Downloads via the Natural Resource Information Portal
(https://irma.nps.gov/Portal/)