
# FSUCML Real-time and Continuous Seawater Monitoring System: Annual Report 2025 - 2026

## 1. Executive Summary

### a) Background and Purpose:

The Florida State University Coastal and Marine Laboratory (FSUCML) has developed a Real-time and Continuous Seawater Monitoring System to track coastal water quality at three stations in the northeastern Gulf of Mexico in Florida's Panhandle: Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB). Operational since May 2023, this high-frequency network records temperature, salinity, pH, dissolved oxygen, and turbidity every 15 minutes. The system supports research, aquaculture, and environmental decision-making in a dynamic coastal zone increasingly affected by storms, sea-level rise, and development.

### b) Monitoring Network Overview:

The network integrates YSI EXO3 multiparameter sondes with Campbell dataloggers and cellular telemetry for near real-time data transmission. All sensors are calibrated before deployment following FSUCML and manufacturer protocols. To maintain continuity and minimize data gaps, instruments are rotated on a 4– to 6–week schedule. Stations are installed on PVC pilings with solar-powered platforms and guarded housing to protect sondes from fouling and damage.

### c) Research Objectives and Applications:

This monitoring system enables FSUCML to study estuarine and coastal processes affected by tides, rainfall, and anthropogenic pressures. Its data are actively used to:

- Detect short-term environmental anomalies associated with rainfall, tides, and other disturbances,
- Support aquaculture, oyster hatchery operations, and coastal habitat restoration,
- Enable inter-network comparisons (e.g., with ANERR),
- Inform coastal resource management and research.

Data from the monitoring system have also supported peer-reviewed research on high-frequency coastal water quality dynamics (Mejía-Mercado, 2026), with previous monitoring periods documented in annual reports (Mejía-Mercado et al., 2025a, 2025b).

### d) Data Quality Assurance and Workflow Overview:

A rigorous three-tiered QAQC workflow ensures data reliability:

1. Primary QAQC is automated through the NERRS CDMO platform (NERRS, 2024).
2. Secondary QAQC is conducted manually by FSUCML staff using CDMO Excel macros (NOAA Centralized Data Management Office, n.d.) and metadata review.
3. Tertiary QAQC is completed by FSUCML staff before public release.

### e) Notable findings from the 2025-2026 monitoring year include:

- Numerous significant rainfall events produced measurable changes in water-quality conditions across the three stations, highlighting the network's ability to capture short-term environmental variability.
- Hypoxic conditions (DO < 3 mg/L) were detected at all three stations, with minimum DO concentrations of 0.6 mg/L at SI, 0.2 mg/L at AH, and 0.8 mg/L at OB.
- Oyster Bay continued to show the greatest environmental sensitivity, particularly during very low tides, when the sonde was periodically exposed and conductivity and salinity measurements were rejected. These events were documented repeatedly between January and April 2026. Overall uptime approached 99% across all stations, with approximately 98.9% at SI, 98.7% at AH, and 99.0% at OB, demonstrating strong operational continuity despite isolated equipment and environmental disruptions.

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## 2. Project Overview

### a) Principal investigators and contact information:

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### b) Sensor calibration:

*Calibration Procedures*
The FSUCML YSI monitoring program began on April 26, 2023, with the installation of the Seawater Intake (SI) station. The other two sites, Alligator Harbor (AH) and Oyster Bay (OB), were deployed shortly thereafter. All stations utilize YSI EXO3 multiparameter sondes, mounted near the water surface and connected to a Campbell CR310 or DL310 datalogger, which transmits data via a cellular uplink every 15 minutes.

Before each deployment, sondes are calibrated according to the YSI operating manual and the FSUCML Xylem EXO3 Multi-Parameter Water Quality Monitoring Procedure SOP, Version 1 (Mejia-Mercado, 2023). Calibrations are performed in the lab using certified standards:

- Conductivity: One-point calibration with 50 mS/cm YSI standard.
- pH: Two-point calibration with pH 7 and pH 10 buffers.
- Dissolved Oxygen: Optical sensor calibrated in air-saturated water.
- Turbidity: Two-point calibration with deionized water (0 NTU) and YSI 124 NTU standard.
- Depth: Set using barometric pressure measurements from a Kestrel 4000 pocket weather tracker and offset tables from the Water Quality SOP.
- Temperature: Verified based on internal thermistor; no manual calibration required.

Once calibrated, a plastic mesh guard is attached to the datalogger housing. Mesh is placed at both the bottom and outer shell of the guard to reduce biological fouling and protect the sensors from damage caused by aquatic organisms.

*Transport and Handling*
Following calibration, each sonde is placed in a 5-gallon bucket with water and allowed to rest overnight to stabilize. The morning of deployment, the sondes are checked for proper function.
During transport to and from the field:

- The sonde is wrapped in a wet white towel to maintain humidity.
- It is carried inside a large, vented cooler cushioned with Styrofoam to prevent physical shock and overheating.
- These handling procedures help maintain calibration integrity and protect sondes during transport to and from the field.

*Deployment Routine*

On deployment day, sondes are programmed to begin recording at exactly 07:00 AM Eastern Time (no daylight saving applied). Each unit is mounted on a PVC deployment tube with large holes near the probe region to ensure adequate water circulation.

Field personnel also collect manual water quality measurements at each site using a handheld YSI ProDSS. These measurements (DO, salinity, temperature, turbidity, and pH) are used to verify sonde performance at the time of deployment and retrieval.

Sondes remain deployed for approximately five to six weeks. At the end of each deployment cycle:

- Instruments are retrieved, cleaned, inspected, and recalibrated.
- Freshly calibrated sondes are deployed immediately, minimizing or eliminating data gaps in the 15-minute sampling interval.

Each sonde is connected to a Campbell datalogger, which logs and transmits readings in real-time to the Xylem cloud platform: https://cloud.xylem.com. Once received, data undergoes the primary QAQC process as described in Section 5, before progressing through secondary and tertiary quality control for long-term data validation.

**c) QAQC Workflow:**

The QAQC process for the FSUCML Seawater Monitoring data involves three sequential stages—Primary, Secondary, and Tertiary QAQC—each designed to ensure the accuracy and reliability of environmental datasets.

Raw sensor data are first uploaded from the YSI EXO3 data logger to a personal computer in the lab. Using KOR Software, the data are then exported as comma-separated value (.csv) files for processing and quality control.

***Primary QAQC*** is conducted automatically by the Centralized Data Management Office (CDMO) after data are exported from KOR Software in .csv format and uploaded. At this stage:

- All pre- and post-deployment records are removed.
- The system flags any missing values or readings outside of sensor operating ranges using codes such as -5 (above range), -4 (below range), and -2 (missing data).

Once the automated review is complete, the dataset is sent back to FSUCML for ***Secondary QAQC***, which is performed manually by the FSUCML information manager. Using Microsoft Excel and the CDMO QAQC macro tool (NOAA Centralized Data Management Office, n.d.), staff:

- Insert station-specific codes and create metadata worksheets.
- Review summary statistics and graphical plots generated by the macro.
- Apply additional QAQC flags such as 1 (suspect), -3 (rejected), and 5 (corrected).
- Remove overlapping deployment periods and append approved datasets.

The cleaned dataset that is marked as "provisional plus" data is revised one more time by the FSUCML information manager for the final step—***Tertiary QAQC***. In this stage:

- FSUCML staff conduct a final validation check for consistency and accuracy.
- The approved dataset is then used to generate the annual report and remains accessible to researchers, resource managers, and the public through the FSUCML website (https://marinelab.fsu.edu/research/seawater-monitoring-system/).

For detailed information on QAQC flags and metadata codes used during this process, see Section 5 of this report.

**d) Application in Research:**

- **Grubbs Lab at FSUCML**
  ***Focus Area:*** Long-term monitoring of fish community structure and its environmental drivers in the Apalachicola Bay – St. George Sound region.
  ***Use of FSUCML Data*:** Continuous measurements of temperature, salinity, dissolved oxygen, turbidity, and phytoplankton dynamics are integrated into ongoing research on bony fishes and sharks that frequent the FSUCML area.
  ***Expected Impact or Outcome:*** The data will help refine predictive models of fish community structure and strengthen future proposals by identifying how abiotic and biotic variables influence marine populations over time.

- **Breithaupt Lab at FSUCML**
  ***Focus Area:*** Biogeochemical cycling of carbon, nitrogen, and phosphorus in intertidal and coastal systems.
  **Use of FSUCML Data:** Water quality data, including pH, turbidity, and nutrient-related parameters, provide a critical baseline for evaluating stocks and fluxes across intertidal zones and the influence of upland habitats on nearshore processes.
  **Expected Impact or Outcome:** The high-frequency dataset complements monthly ISCO auto sampling and supports expanded investigations of carbon cycling in barrier islands and tidal creeks, enhancing the lab's capacity to secure future funding.

- **Huettel Lab at FSU–EOAS**
  ***Focus Area:*** Coastal biogeochemical processes and the role of hydrodynamics in carbon and nutrient cycling.
  ***Use of FSUCML Data:*** The new data stream extends a historical monitoring transect (terminated in 2011) by providing updated measurements of salinity, oxygen, temperature, and chlorophyll along the northeastern Gulf of Mexico shelf.
  ***Expected Impact or Outcome:*** Comparing the current dataset with legacy records enables the lab to assess long-term shifts in chemical and physical conditions and contributes to ongoing Northern Gulf Institute research on benthic processes.

- **Burgess Lab at FSU–Biology**
  ***Focus Area:*** Environmental variability and its influence on organismal fitness in seagrass and oyster/marsh habitats.
  ***Use of FSUCML Data:*** Real-time monitoring of pH, nutrients, and phytoplankton abundance supports spectral analyses of environmental predictability and facilitates controlled experiments on suspension-feeding animals in flow-through systems.
  ***Expected Impact or Outcome:*** The system allows early detection of harmful water quality conditions that impact lab organisms, enabling timely adjustments and strengthening the infrastructure supporting NSF-funded research on phenotypic adaptation.

- **Apalachicola Bay System Initiative (ABSI)**
  ***Focus Area:*** Oyster biology, restoration, and hatchery operations in Apalachicola Bay and surrounding estuaries.
  ***Use of FSUCML Data:*** The monitoring system supports hatchery infrastructure by providing dependable, high-resolution seawater quality data for managing water intake and assessing environmental suitability for oyster growth.
  ***Expected Impact or Outcome:*** The system addresses critical gaps in ABSI's broader monitoring program and enhances the resilience of hatchery operations. Its integration ensures sustained, high-quality inputs for research and restoration activities.

## 3. Station Description

### a) Overview of Study Area:

Florida State University Coastal and Marine Laboratory (FSUCML) is located ~ 80 km south of Tallahassee, Florida. This area is well-known for both diffuse seeps near the coast, originating from an unconfined aquifer, and submarine springs further offshore, coming from a confined karstic aquifer. The area sits on a layered dolomite and limestone platform that is home to the Floridan Aquifer, considered one of the most prolific aquifers in the world. This aquifer is covered by an unconfined aquifer with clay, silt, and sand, which is recharged locally by precipitation. Annual mean rainfall for the region is ~150 cm, but in 2006 and 2007 it was considerably lower with values of 87 and 62 cm, respectively (Santos et al., 2009), resulting in extensive drought in the area. Peak rainfall is typically from June to October, while the lowest precipitation rates occur in November/December and March/May. The tides in the area are mixed and semi-diurnal with an average range of 0.85 m. The seafloor is characterized by a gently sloping topography away from the coast, resulting in a water depth of ~2 m as far as 1000 m offshore (Cable et al., 1997; Lambert and Burnett, 2003). FSUCML includes 82 acres, with 70 acres on the north side of US Highway 98 and 12 acres on the south. The totality of FSUCML's infrastructure is located on the seaward side of US 98, with a dredged channel and boat basin acting as a divider. Of the acreage north of US 98, nearly 36 acres are forested, and 17 acres contain long-leaf pine habitat that is being restored.

### b) Detailed Station Descriptions:

The FSUCML Real-time Seawater Monitoring System consists of three strategically located coastal stations in the northeastern Gulf of Mexico: Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB) (Figure 1). These stations span a gradient of tidal exchange, salinity variability, and aquaculture activity. Station coordinates, deployment dates, and QAQC codes are summarized in Table 1.

The SI station is positioned approximately 300 meters offshore of the FSUCML at 29° 54.799' N, 84° 30.697' W. Constructed in 2023 on a single, 3-meter-tall piling, this station operates at a sampling depth of 2.4 meters, with the depth sensor mounted 0.3 meters above the benthic substrate. Water depth at this location ranges from 0.5 to 2.7 meters, depending on tidal conditions. The site experiences mixed semi-diurnal tides with amplitudes between 1.2 and 2.5 meters. Salinity is generally high and characteristic of a marine-influenced coastal environment, although freshwater inputs and precipitation events can produce substantial short-term variability. The seafloor is composed of fine silty mud, a typical substrate in this low-energy, nearshore environment.

Located at 29° 55.145' N, 84° 24.576' W, the AH station was installed in 2023 on a single piling within a designated oyster aquaculture lease area managed by FSUCML. This lease is also utilized by the Apalachicola Bay System Initiative (ABSI) for hatchery research and spat deployment, initiated in 2022. The station records data at a depth of approximately 1.7 meters, with sensors positioned 0.3 meters above the sediment-water interface. Salinity at this site is generally high and characteristic of a marine-influenced coastal environment, although freshwater inputs and precipitation events can produce short-term variability. The substrate is characterized by shell hash, consistent with active oyster farming zones.

The OB station, installed in April 2023, is located at 30° 3.187' N, 84° 20.279' W within a region dedicated to oyster aquaculture. Like AH, this station was constructed on a single piling to support collaborative field studies with commercial oyster growers. The sampling depth is approximately 1.5 meters, with the sonde mounted 0.3 meters above the sediment. Salinity is highly variable, reflecting the combined influence of freshwater inputs, precipitation, and tidal conditions in this shallow estuarine environment. The benthic substrate is primarily composed of shell hash, a byproduct of shellfish activity and aquaculture operations.


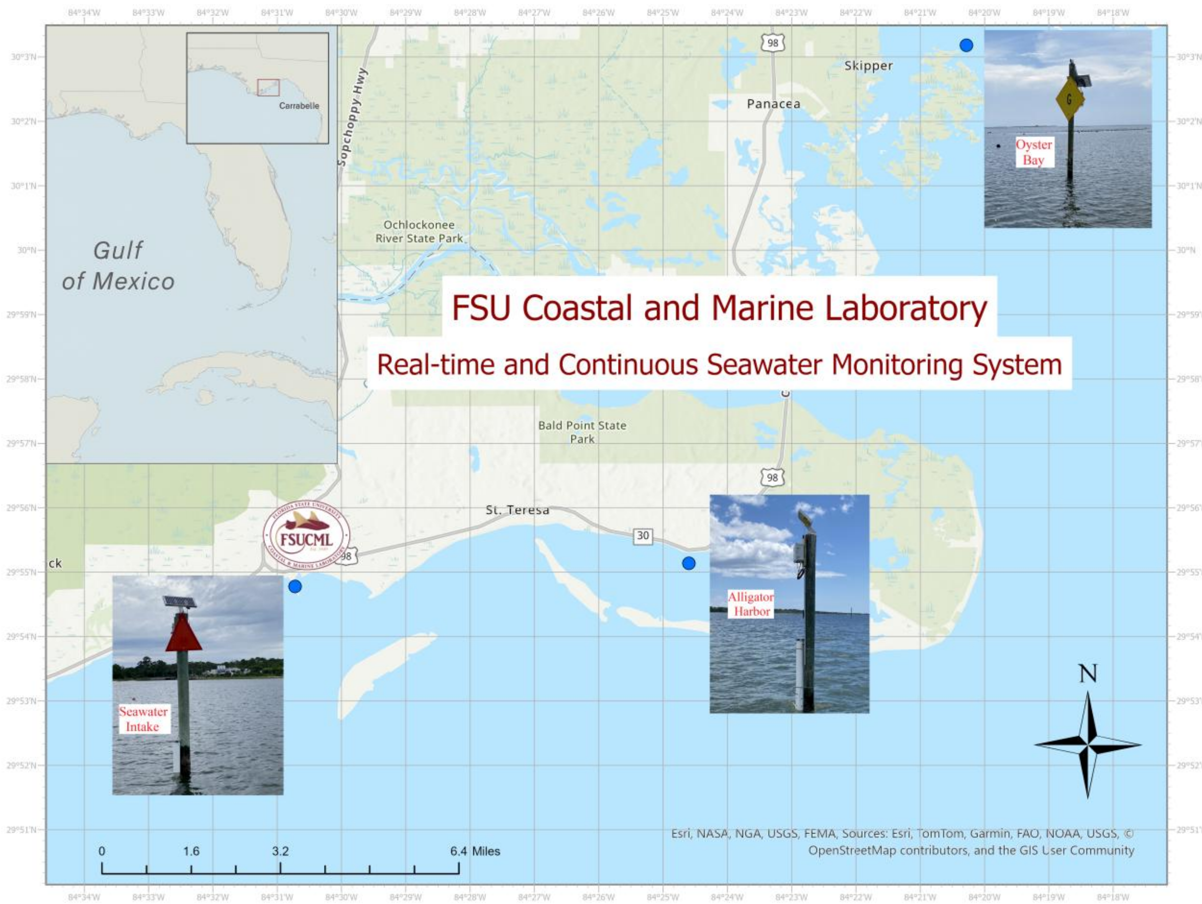


**Figure 1.** Geographic locations of FSUCML's three real-time seawater monitoring stations in the northeastern Gulf of Mexico: Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB). These stations are strategically positioned to capture coastal water quality dynamics across gradients of salinity, tidal exchange, and human activity.

**Table 1.** Geographic coordinates, active dates, and QAQC station codes for FSUCML's real-time seawater monitoring stations.

| Station Code | Station Name | Location | Active Dates | QAQC Station Code |
|---|---|---|---|---|
| SI | Seawater Intake | 29° 54.799'N 084° 30.697'W | 2023-Present | cmlsiwq |
| AH | Alligator Harbor | 29° 55.145'N 084° 24.576'W | 2023-Present | cmlahwq |
| OB | Oyster Bay | 30° 3.187'N 084° 20.279'W | 2023-Present | cmlobwq |

## 4. Sensor Setup and Calibration

### a) YSI EXO3 Sonde: Sensor Specifications and Calibration Parameters:

- Parameter: Temperature

Units: Celsius (C)
Sensor Type: Thermistor
Model#: 599827
Range: -5 to 50°C
Accuracy: ± 0.2°C
Resolution: 0.001°C

- Parameter: Conductivity

Units: milli-Siemens per cm (mS/cm)
Sensor Type: 4-electrode cell with auto-ranging
Model#: 599827
Range: 0 to 100 mS/cm
Accuracy: ± 1% of reading or 0.002 mS/cm, whichever is greater
Resolution: 0.0001 mS/cm to 0.01 mS/cm (range dependent)

- Parameter: Salinity

Units: practical salinity units (psu)/parts per thousand (ppt)
Sensor Type: Calculated from conductivity and temperature
Range: 0 to 70 psu/ppt
Accuracy: ± 2% of the reading or 0.2 ppt, whichever is greater
Resolution: 0.01 psu/ppt

- Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe with mechanical cleaning
Model#: 599100-01
Range: 0 to 500% air saturation
Accuracy: 0-200% air saturation: ± 1% of the reading or 1% air saturation, whichever is greater, 200-500% air saturation: ± 5% or reading
Resolution: 0.1% air saturation

- Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)

Units: % Saturation, milligrams/Liter (mg/L)
Sensor Type: Optical, luminescence lifetime
Model#: 599100-01
Range: 0 to 500% air sat, 0 to 50 mg/L
Accuracy: 0-200% = ±1% reading or 1%, air sat., whichever is greater; 200-500% = ±5% reading; 0-20 mg/L = ± 0.1 mg/L or 1% of the reading, whichever is greater; 20 to 50 mg/L = ± 5% of the reading
Resolution: 0.1% air sat, 0.01 mg/L

- Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)
Sensor Type: Stainless steel strain gauge
Range: 0 to 33 ft (10 m)
Accuracy: ± 0.013 ft or ± 0.004 m)
Resolution: 0.001 ft (0.001 m)

- Parameter: pH

Units: pH units
Sensor Type: Glass combination electrode
Model#: 577602 (unguarded)
Range: 0 to 14 units
Accuracy: ± 0.1 units within ± 10° of calibration temperature, ± 0.2 units for entire temperature range
Resolution: 0.01 units

- Parameter: Turbidity

Units: formazin nephelometric units (FNU)/ Nephelometric Turbidity Units (NTU)
Sensor Type: Optical, 90-degree scatter
Model#: 599101-01
Range: 0 to 4000 FNU/NTU
Accuracy: 0 to 999 FNU = 0.3 FNU or ± 2% of reading (whichever is greater); 1000 to 4000 FNU = ± 5% of reading
Resolution: 0 to 999 FNU = 0.01 FNU, 1000 to 4000 FNU = 0.1 FNU/NTU

- Parameter: Total Algae-PE (Chlorophyll and Phycoerythrin)

Units: Micrograms per Liter (µg/L), Relative Fluorescence Units (RFU)
Sensor Type: Optical, fluorescence
Model#: 599103-01
Range: Chlorophyll = 0-100 RFU, 0-400 µg/l chlorophyll; BGA-PE: 0-100 RFU, 0-280 µg/l
Accuracy:
Resolution: Chlorophyll = 0,01 RFU, 0,01 µg/l chlorophyll; BGA-PE: 0,01 RFU, 0,01 µg/l

**Salinity Units Qualifier:**
The EXO sondes report on practical salinity units (psu). These units are essentially the same as ppt and, for FSUCML purposes, are understood to be equivalent; however, psu is considered the more appropriate designation. The FSUCML System will assign psu as a unit for salinity.

**Turbidity Qualifier:**
EXO sondes report turbidity in formazin nephelometric units (FNU). These units are essentially the same as nephelometric turbidity units (NTU) but indicate a difference in sensor methodology; for FSUCML purposes, they will be considered equivalent. The FSUCML System will use NTU as the designated unit for all turbidity data.

**b) Calibration Adjustments and Special Notes:**

Data gaps labeled as NAN (Not a Number) indicate missing observations caused by one or more of the following: non-deployed or failed sensors, periods of active equipment maintenance or calibration, or the repair/replacement of a station platform. For inquiries related to specific missing records, users should contact the FSUCML information manager.

Turbidity spikes are observed year-round across all monitoring stations. These events are likely driven by episodic factors such as rainfall, riverine discharge, and wind-driven sediment resuspension.

In line with QAQC protocols, dependent parameters are flagged or rejected when one or more foundational variables are compromised. Specifically:

- If Temperature fails QAQC, all parameters except Turbidity are flagged.

- If Specific Conductivity or Salinity fails QAQC, then both DO (mg/L) and Depth are also rejected.

**5. QAQC Flag Definitions and Metadata Codes**

This section provides the full reference for QAQC flags and associated metadata codes used in the FSUCML seawater dataset. QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). During primary automated QAQC (performed by the CDMO macro; NOAA, n.d.), -5, -4, and -2 flags are applied automatically to indicate data that is missing and above or below the sensor range. All remaining data are then flagged 0, passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range
-4 Outside Low Sensor Range
-3 Data Rejected due to QAQC
-2 Missing Data
-1 Optional Supported Parameter
0 Data Passed Initial QAQC Checks
1 Suspect Data
2 Open - reserved for later flag
3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
4 Historical Data: Pre-Auto QAQC
5 Corrected Data

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories: general, sensor, and comment. General errors document general problems with the deployment or YSI data sonde, sensor errors are sensor-specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors
GIC No instrument deployed due to ice
GIM Instrument malfunction
GIT Instrument recording error; recovered telemetry data
GMC No instrument deployed due to maintenance/calibration
GNF Deployment tube clogged / no flow
GOW Out of water event
GPF Power failure / low battery
GQR Data rejected due to QAQC checks
GSM See metadata

Sensor Errors
SBO Blocked optic
SCF Conductivity sensor failure
SCS Chlorophyll spike
SDF Depth port frozen
SDG Suspect due to sensor diagnostics
SDO DO suspect
SDP DO membrane puncture
SIC Incorrect calibration / contaminated standard

| | |
|---|---|
| SNV | Negative value |
| SOW | Sensor out of water |
| SPC | Post calibration out of range |
| SQR | Data rejected due to QAQC checks |
| SSD | Sensor drift |
| SSM | Sensor malfunction |
| SSR | Sensor removed / not deployed |
| STF | Catastrophic temperature sensor failure |
| STS | Turbidity spike |
| SWM | Wiper malfunction/loss |

Comments

| | |
|---|---|
| CAB* | Algal bloom |
| CAF | Acceptable calibration/accuracy error of the sensor |
| CAP | Depth sensor in water, affected by atmospheric pressure |
| CBF | Biofouling |
| CCU | Cause unknown |
| CDA* | DO hypoxia (<3 mg/L) |
| CDB* | Disturbed bottom |
| CDF | Data appear to fit the conditions |
| CFK* | Fishkill |
| CIP* | Surface ice present at the sample station |
| CLT* | Low tide |
| CMC* | In-field maintenance/cleaning |
| CMD* | Mud in probe guard |
| CND | New deployment begins |
| CRE* | Significant rain event |
| CSM* | See metadata |
| CTS | Turbidity spike |
| CVT* | Possible vandalism/tampering |
| CWD* | Data collected at the wrong depth |
| CWE* | Significant weather event |

**6. Data Acquisition and Telemetry**

Data from the FSUCML monitoring stations is collected using YSI EXO3 sondes connected to Campbell dataloggers. These systems are configured to log high-frequency environmental measurements and transmit the data in near real time to a secure cloud-based platform. The primary mode of transmission is via cellular telemetry.

Once collected, data is made available through the Xylem cloud interface called HydroSphere, which can be accessed at https://cloud.xylem.com/hydrosphere/. This platform provides visualizations of real-time water quality metrics, station status, and historical trends for all three monitoring sites. Users can explore customizable time-series plots and export data for further analysis.

In addition to cloud-based access, all raw data is redundantly stored onboard the dataloggers using SD cards. These internal logs serve as a backup in case of telemetry failure and are retrieved during routine redeployments. Data backups are performed biweekly and reviewed for completeness and continuity.

Communication interruptions due to power loss, environmental disturbances (e.g., hurricanes, rain events), or sensor malfunction are expected and documented. These interruptions are documented in deployment logs and summarized in Appendix B (Environmental Events and Anomalies).

### 7. Deployment Performance Summary (2025 – 2026 monitoring period)

Between June 2025 and August 2026, the FSUCML coastal monitoring program continued routine sonde deployments at three fixed stations—Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB)—on a rotating schedule, typically lasting 4 to 6 weeks per deployment. Based on deployment and recovery records, a total of 11 deployments were conducted at SI, 11 at AH, and 10 at OB. For detailed deployment dates, times, and field notes, see Appendix A – Deployment Schedule (Tables A-1 to A-3). A visual summary of deployment counts and average station uptime is provided in Figure 2.

SI completed 11 deployments with generally regular servicing intervals and high data continuity. Most interruptions were brief and associated with routine sonde exchanges or isolated missing observations. Several significant rainfall events occurred during the monitoring period, but no major prolonged station failure was documented.

AH also completed 11 deployments and maintained strong data continuity. Most gaps were isolated or associated with routine sonde exchanges. The main operational disruption occurred on June 1–2, 2026, when water intrusion into the battery compartment caused sonde failure and approximately 20 hours of missing data.

At OB, 10 deployments were completed through June 8, 2026. Operations were more affected by site-specific environmental conditions, particularly very low tides that periodically left the sonde out of water and resulted in rejected conductivity and salinity measurements. A short deployment occurred in January 2026, while the final deployment lasted 49 days.

Overall, the monitoring program maintained consistent deployment frequency and strong data continuity across all three stations. Regular maintenance and timely field servicing limited extended data gaps and supported reliable high-resolution environmental monitoring.

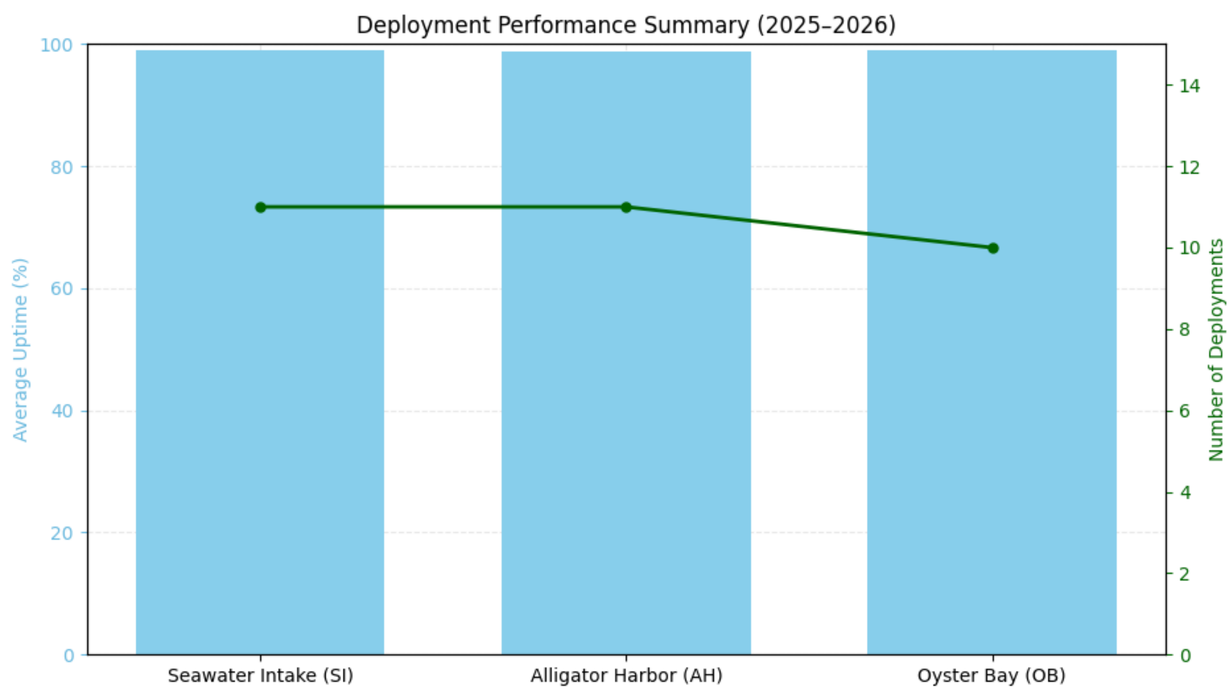


**Figure 2.** Deployment performance summary from June 2025 to August 2026. Blue bars indicate average uptime per station; green line shows total number of deployments.

## 8. Station-Level Field Observations and Operational Insights

A detailed review of deployments at the Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB) stations during the 2025–2026 monitoring period revealed distinct site-level operational patterns. These observations, documented in Appendix B, provide context for data gaps, sensor performance, and environmental influences.

SI completed 11 deployments and remained operationally stable. Most data gaps were brief and associated with routine sonde recovery and redeployment, although several isolated gaps of unknown cause were also recorded. Numerous significant rainfall events occurred throughout the monitoring period, but no major equipment failure or prolonged interruption was documented.

AH completed 11 deployments and also maintained strong continuity. Operational issues included isolated missing observations, a period of inaccurate depth measurements from approximately August 10 to September 10, 2025, and a sonde failure on June 1–2, 2026 caused by water intrusion into the battery compartment. Data collection resumed following service.

OB completed 10 deployments and maintained high operational continuity despite experiencing the greatest site-specific environmental effects. Repeated short-term fluctuations in conductivity and salinity were observed during the December 1, 2025–January 12, 2026 deployment, suggesting a possible intermittent field effect on the conductivity cell; affected observations were flagged as suspect during QA/QC. A depth sensor drift from January 12–29, 2026 resulted in rejection of the associated depth data. During several periods between January and April, very low tides produced near-zero conductivity and salinity readings, indicating that the sonde was likely out of water; affected data were rejected. The final deployment extended to 49 days.

Overall, the three stations maintained strong operational performance and high uptime despite station-specific environmental and equipment-related challenges. Routine servicing and rapid response helped minimize data loss and maintain continuity. Additional details are provided in Appendix B, with station-level performance summarized in Table 2.

**Table 2.** Summary of deployment activity, average uptime, and operational challenges across FSUCML monitoring stations (June 2025 – August 2026).

| Station | # of Deployments | Avg. Uptime (%) | Common Issues | Notable Events |
|---|---|---|---|---|
| Seawater Intake (SI) | 11 | ~98.9% | Brief deployment-related and isolated data gaps | Multiple significant rainfall events; no major equipment failure |
| Alligator Harbor (AH) | 11 | ~98.7% | Isolated gaps and depth measurement issues | Depth anomaly Aug.–Sep. 2025; battery-compartment water intrusion and sonde failure in June 2026 |
| Oyster Bay (OB) | 10 | ~99.0% | Low-tide exposure, depth drift, rejected conductivity/salinity data | Conductivity/salinity anomaly Dec. 2025–Jan. 2026; depth drift Jan. 2026; repeated low-tide/out-of-water events; 49-day final deployment |

## 9. Post-deployment Calibration Values

To ensure data accuracy and instrument reliability, post-deployment calibrations were conducted after each sonde recovery at the three FSUCML monitoring stations: Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB). These calibrations assessed four key parameters: dissolved oxygen (DO), specific conductivity, pH, and turbidity.

Across all stations, calibration checks demonstrated generally strong agreement with standard reference values, with most measurements remaining close to expected targets. These results generally support the effectiveness of pre-deployment calibration protocols and routine field maintenance.

At SI, 11 calibrations were performed. DO values were generally stable near the 100% standard, although one reading reached 104.7% in June 2026. Conductivity measurements remained tightly clustered around the 50 mS/cm reference, while pH values consistently remained near the reference standards. Turbidity checks showed greater variability, with the highest zero-standard offset (12.30 NTU) recorded in the final deployment, but no persistent drift was evident.

AH displayed high calibration consistency across 11 deployments. Most DO readings remained close to the 100% standard, with values ranging from 98.4% to 102.8%. Specific conductivity remained close to the 50 mS/cm reference, while pH values were generally consistent, except for an elevated reading of 7.59 in October 2025. Turbidity values showed some variability among deployments, but no repeated anomalies were observed.

OB calibrations showed some variability in DO, ranging from 88.3% to 105.7%, while pH and conductivity remained generally consistent with reference standards. Turbidity also performed well overall, although an elevated reading of 140.87 NTU against the 124 NTU standard was recorded in January 2026. Subsequent checks returned near the reference value, suggesting an isolated deviation.

Overall, the calibration records confirm reliable post-deployment sensor performance across all three sites. Isolated deviations were observed, but they did not indicate persistent instrument drift. For full calibration records and comparison to standard values, see Appendix C: Post-deployment Calibration Tables (Tables C-1 to C-3).

**10. Descriptive Water Quality Statistics (QC-Filtered)**

Quality-controlled water quality data, excluding observations flagged as suspect (flag 1), collected during the 2025–2026 monitoring period at the three FSUCML coastal monitoring stations—Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB)—reveal distinct spatial variability and consistent seasonal patterns across parameters. The available records span July 8, 2025–August 3, 2026, at SI, July 2, 2025–August 3, 2026, at AH, and June 5, 2025–June 8, 2026, at OB.

Temperature remained similar across sites, with mean values ranging from 23.1 to 24.0 °C. Seasonal variation was pronounced, with minimum temperatures of 5.6 °C at SI, 0.6 °C at AH, and 2.3 °C at OB, while summer maxima reached approximately 34 °C at all three stations. These fluctuations reflect the strong seasonal temperature cycle across the monitoring network.

Salinity showed clear site-level differences. SI and AH maintained relatively high and stable salinities, averaging 33.0 and 33.7 psu, respectively. OB exhibited substantially fresher and more variable conditions, averaging 29.1 psu, with values ranging from 13.8 to 33.3 psu, consistent with greater estuarine and freshwater influence.

Dissolved oxygen (DO) conditions also differed among stations. Mean DO saturation was 82.8% at SI, 85.2% at AH, and 90.2% at OB, with corresponding mean concentrations of 5.9, 6.1, and 6.7 mg/L. Minimum DO concentrations reached 0.6 mg/L at SI, 0.2 mg/L at AH, and 0.8 mg/L at OB, indicating that periods of hypoxic conditions (<3 mg/L) occurred at all three stations.

Turbidity was typically low, with mean values of approximately 8 NTU at SI, 7 NTU at AH, and 5 NTU at OB. However, all stations recorded short-lived extreme values, with maxima of 484 NTU at SI, 232 NTU at AH, and 494 NTU at OB. These episodic peaks highlight the importance of continuous high-resolution monitoring for capturing short-term changes that may not be detected through discrete sampling.

pH remained relatively stable across the network, averaging approximately 7.9–8.0, with a standard deviation of about 0.1 at all three stations. Values ranged from 7.3 to 8.3 at SI, 7.5 to 8.7 at AH, and 7.1 to 8.2 at OB, indicating generally well-buffered conditions despite occasional lower values.

Depth patterns reflected differences in station configuration. SI was the deepest station, with an average depth of approximately 1.94 m, followed by AH at 1.16 m and OB at 0.96 m. OB reached depths as low as 0.03 m, consistent with the documented low-tide exposure and occasional out-of-water conditions at this shallow station.

These statistics demonstrate the system's capacity to characterize both baseline environmental conditions and short-term extremes across contrasting coastal settings. The continuous, quality-controlled dataset provides valuable information for ecological research, aquaculture planning, and coastal management.

For full statistical summaries and QC thresholds, refer to Appendix D: Descriptive Statistics Tables (D-1 to D-3). For visualization of seasonal patterns and anomalies, see Appendix E: Station Time Series.

## 11. Data Distribution Policy

**a) Use and Liability Disclaimer:**
According to the FSUCML Policy, the FSUCML Seawater Monitoring System retains the right to analyze, synthesize, and publish data summaries. The PI maintains the right to be fully credited for collecting and processing the data. Following academic courtesy standards, the PI and FSUCML site, where the data were collected, will be contacted and fully acknowledged in any subsequent publications in which any part of the data is used. The dataset included within this package is only as good as the quality assurance and quality control procedures described by the enclosed metadata reporting statement. The user assumes all responsibility for any subsequent use or misuse of the data in further analyses or comparisons. FSUCML does not assume liability to the recipient or any third parties and will not indemnify the recipient for any losses resulting from the use of this dataset.

**b) Requested data citation format:**
Florida State University Coastal and Marine Laboratory (FSUCML). Real-time and Continuous Seawater Monitoring System. Data accessed from the FSUCML website: https://marinelab.fsu.edu/research/seawater-monitoring-system/; accessed August 17, 2026.

**c) Data Access Links:**
FSUCML water quality data and metadata can be obtained online at the FSUCML – Seawater Monitoring System website (https://marinelab.fsu.edu/research/seawater-monitoring-system/).

## 12. References

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**Appendix A. Deployment Schedule**

Deployment history and operational notes for each FSUCML monitoring station (Seawater Intake, Alligator Harbor, and Oyster Bay), including deployment and recovery dates, special conditions, and interruptions.

**A1. Seawater Intake (SI)**

| Deployment Start | Time | Deployment End | Time | Notes |
|---|---|---|---|---|
| 07/08/2025 | 16:04 | 08/12/2025 | 12:25 | |
| 08/12/2025 | 12:34 | 09/10/2025 | 13:03 | |
| 09/10/2025 | 13:15 | 10/15/2025 | 14:09 | |
| 10/15/2025 | 14:22 | 11/25/2025 | 10:12 | |
| 11/25/2025 | 10:21 | 01/06/2026 | 15:42 | |
| 01/06/2026 | 15:49 | 02/17/2026 | 14:32 | |
| 02/17/2026 | 14:37 | 03/30/2026 | 12:51 | |
| 03/30/2026 | 12:59 | 05/11/2026 | 13:56 | |
| 05/11/2026 | 14:04 | 06/02/2026 | 09:25 | |
| 06/02/2026 | 09:33 | 06/25/2026 | 10:42 | |
| 06/25/2026 | 10:50 | 08/03/2026 | 12:29 | |

**A2. Alligator Harbor (AH)**

| Deployment Start | Time | Deployment End | Time | Notes |
|---|---|---|---|---|
| 07/02/2025 | 09:12 | 08/04/2025 | 12:21 | |
| 08/04/2025 | 12:30 | 09/10/2025 | 13:57 | |
| 09/10/2025 | 14:09 | 10/20/2025 | 13:40 | |
| 10/20/2025 | 14:05 | 11/25/2025 | 11:03 | |
| 11/25/2025 | 11:11 | 01/07/2026 | 13:35 | |
| 01/07/2026 | 13:47 | 02/17/2026 | 13:45 | |
| 02/17/2026 | 13:52 | 03/30/2026 | 13:32 | |
| 03/30/2026 | 13:40 | 05/11/2026 | 13:09 | |
| 05/11/2026 | 13:17 | 06/02/2026 | 10:18 | |
| 06/02/2026 | 10:26 | 06/25/2026 | 09:46 | |
| 06/25/2026 | 09:58 | 08/03/2026 | 13:19 | |

**A3. Oyster Bay (OB)**

| Deployment Start | Time | Deployment End | Time | Notes |
|---|---|---|---|---|
| 06/05/2025 | 11:24 | 07/02/2025 | 10:18 | |
| 07/02/2025 | 10:27 | 8/04/2025 | 13:37 | |
| 08/04/2025 | 13:49 | 09/11/2025 | 13:28 | |
| 09/11/2025 | 13:39 | 10/20/2025 | 12:10 | |
| 10/20/2025 | 12:21 | 12/01/2025 | 12:33 | |

| | | | | |
|---|---|---|---|---|
| 12/01/2025 | 12:38 | 01/12/2026 | 14:58 | |
| 01/12/2026 | 15:06 | 01/29/2026 | 14:49 | Short deployment |
| 01/29/2026 | 14:54 | 03/09/2026 | 13:54 | |
| 03/09/2026 | 14:00 | 04/21/2026 | 12:48 | |
| 04/21/2026 | 12:55 | 06/08/2026 | 11:00 | 49 days |

## Appendix B. Environmental Events and Anomalies

### B1. Seawater Intake (SI)

- 07/14/2025 23:00 – 23:45. Significant rain event in the area 0.5” – 0.9”.
- 07/22/2025 16:00 – 19:00. Significant rain event in the area 0.7” – 0.8”.
- 08/03/2025 13:00 – 16:00. Significant rain event in the area 1.2” – 1.4”.
- 08/11/2025 10:00. Significant rain event in the area 3.1” – 3.8”.
- 08/12/2025 12:30. Missing data caused by the recovery and deployment of the sonde.
- 08/23/2025 16:00 – 19:00. Significant rain event in the area 0.9” – 1.1”.
- 09/15/2025 11:00, 09/24/2025 20:15, 10/04/2025 05:30, 10/13/2025 14:45. Missing data. Cause unknown.
- 09/26/2025 10:00. Significant rain event in the area 0.6”.
- 10/15/2025 14:15. Missing data caused by the recovery and deployment of the sonde.
- 10/19/2025 13:00 – 16:00. Significant rain event in the area 1.6” – 1.8”.
- 11/25/2025 10:15. Missing data caused by the recovery and deployment of the sonde.
- 11/30/2025 07:00, 12/09/2025 16:15, 12/19/2025 01:30, 12/28/2025 10:45. Missing data. Cause unknown.
- 10/27/2025 10:00 – 13:00. Significant rain event in the area 0.6” – 0.8”.
- 12/07/2025 07:00 – 10:00, 13:00 – 16:00. Significant rain event in the area 0.5” – 0.7”.
- 12/18/2025 16:00 – 19:00. Significant rain event in the area 0.6”.
- 01/03/2026 16:00 – 19:00. Significant rain event in the area 0.5” – 0.8”.
- 01/06/2026 15:45. Missing data caused by the recovery and deployment of the sonde.
- 02/15/2026 13:00 – 15:00. Significant rain event in the area 1.0” – 1.1”.
- 03/16/2026 04:00 – 06:00. Significant rain event in the area 0.4” – 0.5”.
- 05/02/2026 07:00 – 09:00. Significant rain event in the area 0.6” – 0.7”.
- 05/09/2026 14:00 – 18:00. Significant rain event in the area 0.6”.
- 05/11/2026 14:00. Missing data caused by the recovery and deployment of the sonde.
- 05/12/2026 18:00 – 21:00. Significant rain event in the area 0.3” – 0.5”.
- 06/02/2026 09:30. Missing data caused by the recovery and deployment of the sonde.
- 06/19/2026 16:00 – 18:00. Significant rain event in the area 0.7” – 0.8”.
- 07/20/2026 13:00 – 15:00. Significant rain event in the area 0.5” – 0.6”.
- 07/29/2026 17:00 – 21:00. Significant rain event in the area 0.3” – 0.4”.
- 08/01/2026 10:00 – 12:00. Significant rain event in the area 0.4” – 0.5”.

### B2. Alligator Harbor (AH)

- 07/02/2025 20:00 – 23:00. Significant rain event in the area 1.0” – 1.2”.
- 07/07/2025 07:00 Missing data. Unknown cause.
- 07/16/2025 16:15 Missing data. Unknown cause.
- 07/22/2025 16:00 – 19:00. Significant rain event in the area 0.5”.
- 07/26/2025 07:30 Missing data. Unknown cause.
- 08/03/2025 13:00 – 16:00. Significant rain event in the area 1.4” – 1.5”.

- 08/04/2025 10:45 Missing data. Unknown cause.
- 08/11/2025 07:00 – 10:00. Significant rain event in the area 0.6" – 2.3".
- 08/23/2025 16:00 – 19:00. Significant rain event in the area 1.0".
- Approximately from 08/10/25 to 09/10/25. Depth measurements were inaccurate.
- 09/07/2025 22:00 – 23:45. Significant rain event in the area 0.6" – 0.9".
- 09/26/2025 10:00. Significant rain event in the area 0.6".
- 10/19/2025 13:00 – 16:00. Significant rain event in the area 1.6" – 1.8".
- 10/20/2025 14:00. Missing data caused by the recovery and deployment of the sonde.
- 12/07/2025 07:00 – 10:00, 13:00 – 16:00. Significant rain event in the area 0.5" – 0.6".
- 12/18/2025 16:00 – 19:00. Significant rain event in the area 0.4" – 0.5".
- 01/03/2026 16:00 – 19:00. Significant rain event in the area 0.5" – 0.6".
- 01/07/2026 13:45. Missing data caused by the recovery and deployment of the sonde.
- 02/15/2026 13:00 – 15:00. Significant rain event in the area 0.92" – 0.96".
- 02/22/2026 11:00, 03/03/26 20:15, 03/13/26 05:30, 03/22/26 14:45. Missing data. Cause unknown.
- 03/30/2026 13:30. Missing data caused by the recovery and deployment of the sonde.
- 05/02/2026 07:00 – 09:00. Significant rain event in the area 0.7" – 0.9".
- 05/09/2026 14:00 – 18:00. Significant rain event in the area 0.5".
- 05/11/2026 13:15. Missing data caused by the recovery and deployment of the sonde.
- 05/12/2026 18:00 – 21:00. Significant rain event in the area 0.5" – 0.7".
- 05/16/2026 11:30, 05/25/2026. Missing data. Cause unknown.
- 6/01/2026 13:45 – 06/02/2026 10:15 Missing data resulted from a sonde malfunction caused by water intrusion in the battery compartment, leading to instrument failure.
- 06/19/2026 16:00 – 18:00. Significant rain event in the area 1.0" – 1.1".
- 06/25/2026 10:00. Missing data caused by the recovery and deployment of the sonde.
- 07/20/2026 13:00 – 15:00. Significant rain event in the area 0.3".

**B3. Oyster Bay (OB)**

- 06/08/2025 17:00 – 20:00. Significant rain event in the area 0.4" – 0.5".
- 06/10/2025 11:00 – 14:00. Significant rain event in the area 0.4" – 0.5".
- 07/08/2025 14:00 – 17:00. Significant rain event in the area 0.4" – 0.5".
- 07/11/2025 14:00 – 23:00. Significant rain event in the area 0.6" – 0.7".
- 07/22/2025 16:00 – 19:00. Significant rain event in the area 2.5" – 2.8".
- 07/23/2025 22:00 – 23:45. Significant rain event in the area 0.7".
- 07/24/2025 07:00 – 10:00. Significant rain event in the area 0.6" – 1.4".
- 08/03/2025 13:00 – 16:00. Significant rain event in the area 0.9".
- 08/04/2025 07:00 – 10:00. Significant rain event in the area 0.7" – 1.9".
- 08/04/2025 13:45. Missing data caused by the recovery and deployment of the sonde.
- 08/05/2025 19:00 – 22:00. Significant rain event in the area 0.9" – 1.0".
- 08/16/2025 19:00 – 22:00. Significant rain event in the area 0.8".
- 08/23/2025 16:00 – 19:00. Significant rain event in the area 1.5".
- 08/30/2025 16:00 – 19:00. Significant rain event in the area 0.9" – 1.0".
- 09/07/2025 22:00 – 23:45. Significant rain event in the area 1.4" – 2.3".
- 09/26/2025 10:00. Significant rain event in the area 0.5".
- 10/19/2025 13:00 – 16:00. Significant rain event in the area 1.1".
- 10/20/2025 12:15 Missing data caused by the recovery and deployment of the sonde.
- 12/01/2025 – 01/12/2026. Repeated short-term fluctuations in conductivity and salinity were observed, suggesting a possible intermittent field effect on the conductivity cell. Post-deployment calibration was within the acceptable range, indicating no persistent sensor drift.
- 12/02/2025 10:00 – 13:00. Significant rain event in the area 0.4" – 0.8".

- 12/07/2025 07:00 – 10:00, 13:00 – 16:00. Significant rain event in the area 0.4” – 0.8”.
- 12/18/2025 16:00 – 19:00. Significant rain event in the area 0.5”.
- 01/03/2026 16:00 – 19:00. Significant rain event in the area 0.5” – 0.7”.
- 01/12/2026 15:15 – 01/29/2026 14:45 Depth sensor drift. All depth data rejected for this period.
- 01/30/2026 07:00–08:15 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 01/31/2026 07:15–11:00, 19:15 – 22:30 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 02/01/2026 03:45–13:00 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 02/02/2026 07:45–11:30 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 02/15/2026 13:00 – 15:00. Significant rain event in the area 0.4”.
- 02/22/2026 23:15 – 02/23/2026 04:30 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 02/24/2026 00:15–04:15 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 03/17/2026 07:30–09:15 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 04/19/2026 21:45– 04/20/2026 00:45 Very low conductivity and salinity with shallow readings depth due to very low tide. Values close to 0. All data was rejected, and the sonde was likely out of water.
- 04/21/2026 13:00 – 06/08/2026 11:00 Deployment longer than 45 days (49 days).
- 05/02/2026 07:00 – 09:00. Significant rain event in the area 0.7”.
- 05/09/2026 14:00 – 18:00. Significant rain event in the area 0.4”.
- 05/29/2026 13:00 – 17:00. Significant rain event in the area 0.4” – 0.5”.

## Appendix C. Post-deployment Calibration Values

Post-deployment calibration values to verify the accuracy of DO, specific conductivity, pH, and turbidity measurements.

### C1. Seawater Intake (SI)

| Deployment Date | DO_pct | SpCond_mS/cm | pH | | Turb_NTU | |
|---|---|---|---|---|---|---|
| | (Std: 100%) | (Std: 50@25°) | (Std: 7) | (Std: 10) | (Std: 0) | (Std: 124) |
| 07/08/2025 | 100.3 | 49.92 | 6.90 | 10.04 | 1.14 | 124.00 |
| 08/12/2025 | 99.5 | 50.10 | 6.97 | 10.00 | 2.00 | 125.17 |
| 09/10/2025 | 99.5 | 49.87 | 7.01 | 9.95 | -1.40 | 124.70 |
| 10/15/2025 | 100.0 | 49.52 | 7.10 | 10.00 | 2.68 | 124.00 |
| 11/25/2025 | 100.5 | 50.07 | 6.91 | 9.87 | 1.88 | 123.51 |
| 01/06/2026 | 101.4 | 49.62 | 7.02 | 10.03 | -2.54 | 126.26 |
| 02/17/2026 | 101.2 | 49.63 | 7.03 | 10.13 | 0.20 | 124.09 |
| 03/30/2026 | 99.4 | 49.94 | 6.94 | 10.00 | 3.57 | 124.30 |
| 05/11/2026 | 100.0 | 49.87 | 7.13 | 10.08 | 1.62 | 123.76 |
| 06/02/2026 | 104.7 | 50.21 | 7.13 | 10.20 | 4.00 | 122.00 |
| 06/25/2026 | 102.1 | 49.88 | 6.99 | 10.01 | 12.30 | 123.06 |

### C2. Alligator Harbor (AH)

| Deployment Date | DO_pct | SpCond_mS/cm | pH | | Turb_NTU | |
|---|---|---|---|---|---|---|
| | (Std: 100%) | (Std: 50@25°) | (Std: 7) | (Std: 10) | (Std: 0) | (Std: 124) |
| 07/02/2025 | 100.2 | 49.88 | 6.94 | 10.00 | 3.60 | 125.28 |
| 08/04/2025 | 99.2 | 49.88 | 7.09 | 10.06 | 3.28 | 124.35 |
| 09/10/2025 | 98.4 | 50.34 | 7.00 | 9.99 | 2.30 | 123.98 |
| 10/20/2025 | 100.2 | 49.19 | 7.59 | 10.33 | 0.38 | 115.30 |
| 11/25/2025 | 100.2 | 49.99 | 7.03 | 9.93 | 0.60 | 126.54 |
| 01/07/2026 | 100.6 | 49.76 | 6.99 | 10.03 | -0.50 | 122.14 |
| 02/17/2026 | 100.7 | 49.72 | 6.89 | 9.88 | 2.26 | 126.45 |
| 03/30/2026 | 99.1 | 50.07 | 7.05 | 10.13 | -0.66 | 127.02 |
| 05/11/2026 | 100.8 | 50.00 | 7.14 | 10.20 | 2.27 | 123.37 |
| 06/02/2026 | 102.8 | 50.06 | 7.06 | 10.10 | 6.81 | 118.78 |
| 06/25/2026 | 102.1 | 50.16 | 7.00 | 9.97 | 6.46 | 124.57 |

### C3. Oyster Bay (OB)

| Deployment Date | DO_pct | SpCond_mS/cm | pH | | Turb_NTU | |
|---|---|---|---|---|---|---|
| | (Std: 100%) | (Std: 50@25°) | (Std: 7) | (Std: 10) | (Std: 0) | (Std: 124) |
| 07/02/2025 | 88.3 | 50.06 | 7.01 | 10.04 | 0.55 | 124.60 |
| 08/04/2025 | 100.1 | 49.83 | 7.00 | 9.96 | 1.76 | 124.02 |
| 09/10/2025 | 99.6 | 50.11 | 6.85 | 9.74 | 0.70 | 124.90 |
| 10/20/2025 | 100.5 | 50.26 | 7.04 | 10.15 | -2.23 | 126.30 |
| 12/01/2025 | 101.4 | 50.26 | 6.97 | 9.93 | 0.82 | 122.34 |
| 01/12/2026 | 100.6 | 50.28 | 7.13 | 10.07 | 0.69 | 140.87 |
| 01/29/2026 | 101.1 | 49.98 | 7.12 | 10.09 | 0.03 | 125.03 |
| 03/09/2026 | 100.9 | 49.97 | 7.06 | 10.09 | -0.15 | 124.90 |
| 04/21/2026 | 100.8 | 49.72 | 7.01 | 10.11 | 0.42 | 124.00 |
| 06/08/2026 | 105.7 | 49.78 | 6.98 | 10.03 | -0.19 | 124.24 |

## Appendix D: Descriptive Statistics

Summary statistics for depth, temperature, salinity, dissolved oxygen, pH, and turbidity at each monitoring station after quality control filtering. Statistics excluding flag 1 (suspect) observations are used for the descriptive summaries presented in Section 10.

### D1. Seawater Intake (SI) ---> 07/08/2025 – 08/03/2026

| Stats with QC flag >= 0 n = 37,409 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Depth_m | Temp_C | SpCond_mS/cm | Sal_psu | DO_pct | DO_mg/L | pH | Turb_NTU |
| Min | 0.52 | 5.6 | 30.11 | 18.6 | 8.9 | 0.6 | 7.3 | -2 |
| Max | 2.90 | 34.1 | 54.23 | 35.8 | 137.7 | 10.2 | 8.3 | 484 |
| Average | 1.94 | 23.7 | 50.48 | 33.0 | 82.8 | 5.9 | 8.0 | 7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Std Dev | 0.30 | 6.5 | 2.21 | 1.7 | 18.0 | 1.7 | 0.1 | 17 |
| Stats with QC flag >= 0 excluding 1 flags n = 35,155 | | | | | | | | |
| | Depth_m | Temp_C | SpCond_mS/cm | Sal_psu | DO_pct | DO_mg/L | pH | Turb_NTU |
| Min | 0.52 | 5.6 | 34.92 | 22.0 | 8.9 | 0.6 | 7.3 | 0 |
| Max | 2.90 | 34.1 | 54.23 | 35.8 | 137.7 | 10.2 | 8.3 | 484 |
| Average | 1.94 | 23.7 | 50.49 | 33.0 | 82.8 | 5.9 | 8.0 | 8 |
| Std Dev | 0.30 | 6.5 | 2.20 | 1.6 | 18.0 | 1.7 | 0.1 | 17 |

**D2. Alligator Harbor (AH) ---> 07/02/2025 – 08/03/2026**

| Stats with QC flag >= 0 n = 37,837 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Depth_m | Temp_C | SpCond_mS/cm | Sal_psu | DO_pct | DO_mg/L | pH | Turb_NTU |
| Min | 0.10 | 0.6 | 26.32 | 15.9 | 3.9 | 0.2 | 7.5 | -4 |
| Max | 2.73 | 34.8 | 55.17 | 36.3 | 142.9 | 11.0 | 8.7 | 232 |
| Average | 1.22 | 24.0 | 51.40 | 33.7 | 85.2 | 6.1 | 8.0 | 6 |
| Std Dev | 0.39 | 6.6 | 1.91 | 1.4 | 18.9 | 1.7 | 0.1 | 7 |
| Stats with QC flag >= 0 excluding 1 flags n = 27,610 | | | | | | | | |
| | Depth_m | Temp_C | SpCond_mS/cm | Sal_psu | DO_pct | DO_mg/L | pH | Turb_NTU |
| Min | 0.10 | 0.6 | 26.32 | 15.9 | 3.9 | 0.2 | 7.5 | 0 |
| Max | 2.25 | 34.8 | 55.17 | 36.3 | 142.9 | 11.0 | 8.7 | 232 |
| Average | 1.16 | 24.0 | 51.40 | 33.7 | 85.2 | 6.1 | 7.9 | 7 |
| Std Dev | 0.33 | 6.6 | 1.91 | 1.4 | 18.9 | 1.7 | 0.1 | 7 |

**D3. Oyster Bay (OB) ---> 06/05/2025 – 06/08/2026**

| Stats with QC flag >= 0 n = 33,105 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Depth_m | Temp_C | SpCond_mS/cm | Sal_psu | DO_pct | DO_mg/L | pH | Turb_NTU |
| Min | 0.03 | 2.3 | 16.05 | 9.4 | 11.8 | 0.8 | 7.1 | -3 |
| Max | 1.84 | 33.9 | 50.70 | 33.3 | 121.5 | 10.8 | 8.2 | 494 |
| Average | 0.96 | 23.1 | 44.50 | 28.7 | 90.2 | 6.7 | 7.9 | 4 |
| Std Dev | 0.36 | 6.5 | 5.79 | 4.1 | 12.9 | 1.5 | 0.1 | 17 |
| Stats with QC flag >= 0 excluding 1 flags n = 24,874 | | | | | | | | |
| | Depth_m | Temp_C | SpCond_mS/cm | Sal_psu | DO_pct | DO_mg/L | pH | Turb_NTU |
| Min | 0.03 | 2.3 | 22.83 | 13.8 | 11.8 | 0.8 | 7.1 | 0 |
| Max | 1.84 | 33.9 | 50.70 | 33.3 | 121.5 | 10.8 | 8.2 | 494 |
| Average | 0.96 | 23.1 | 45.01 | 29.1 | 90.2 | 6.7 | 7.9 | 5 |
| Std Dev | 0.36 | 6.5 | 5.38 | 3.9 | 12.9 | 1.5 | 0.1 | 17 |


### Appendix E. Station Time Series

Time-series plots illustrate water quality dynamics at Seawater Intake (SI), Alligator Harbor (AH), and Oyster Bay (OB) during their respective 2025–2026 monitoring periods. These figures highlight seasonal variability, storm events, and sensor responses over the monitoring period.

- **Seawater Intake (SI) ---> 07/08/2025 – 08/03/2026**

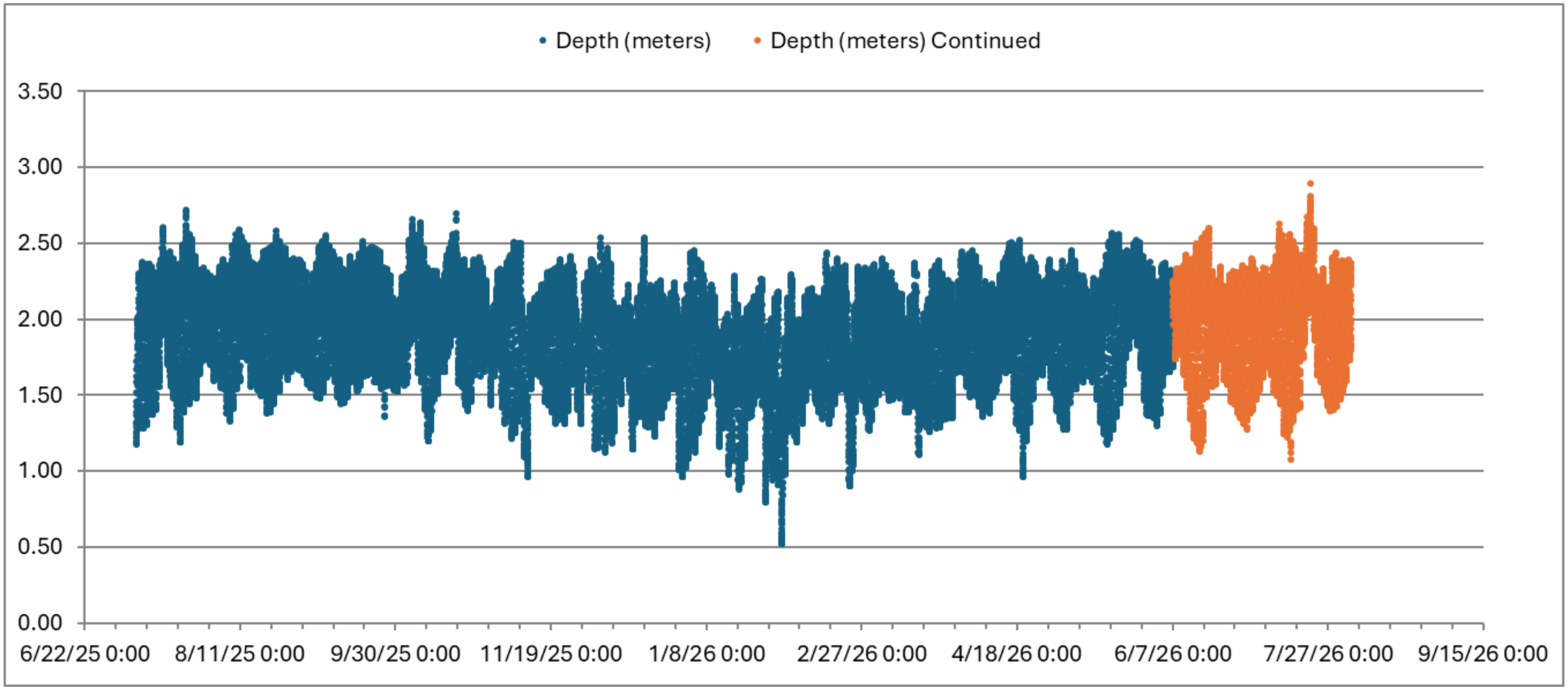


**Figure E1.** Seawater Intake – Depth Time Series


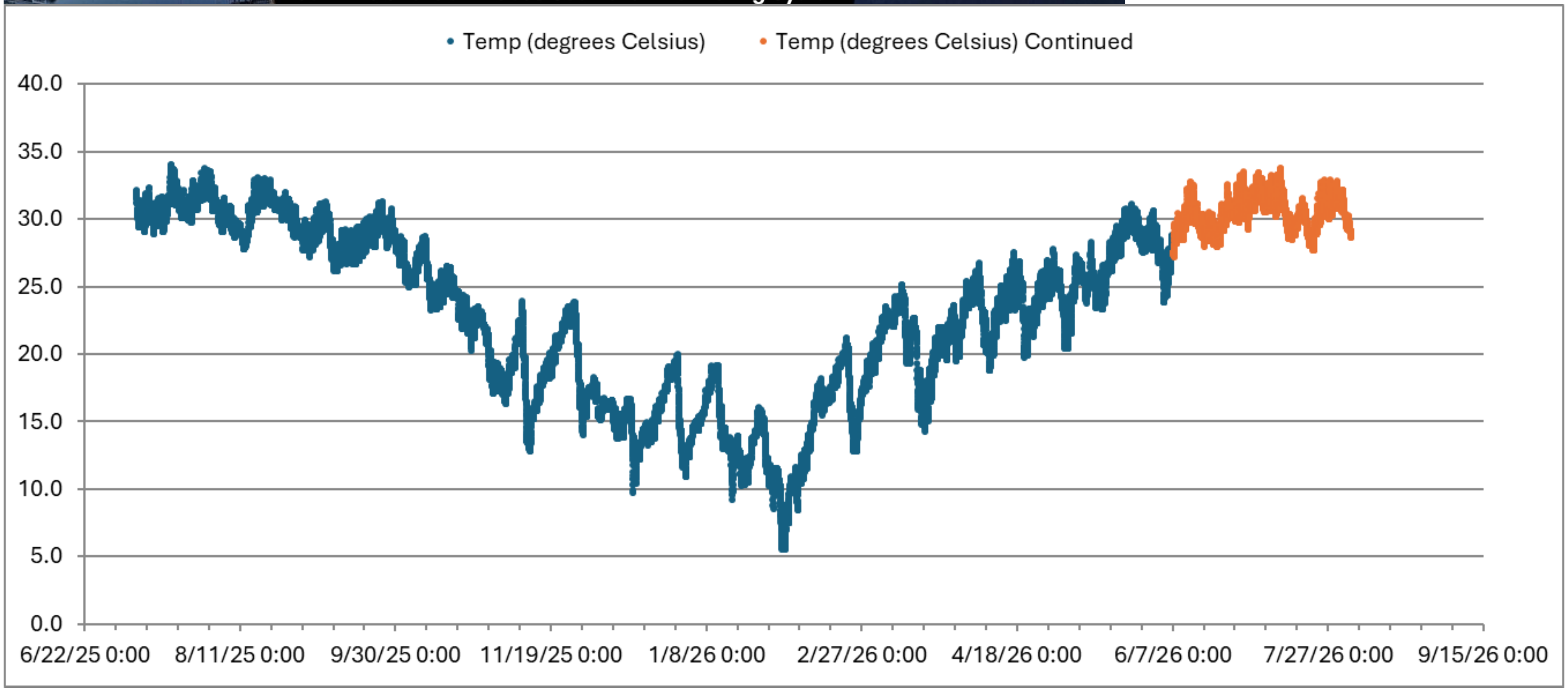


**Figure E2.** Seawater Intake – Temperature Time Series


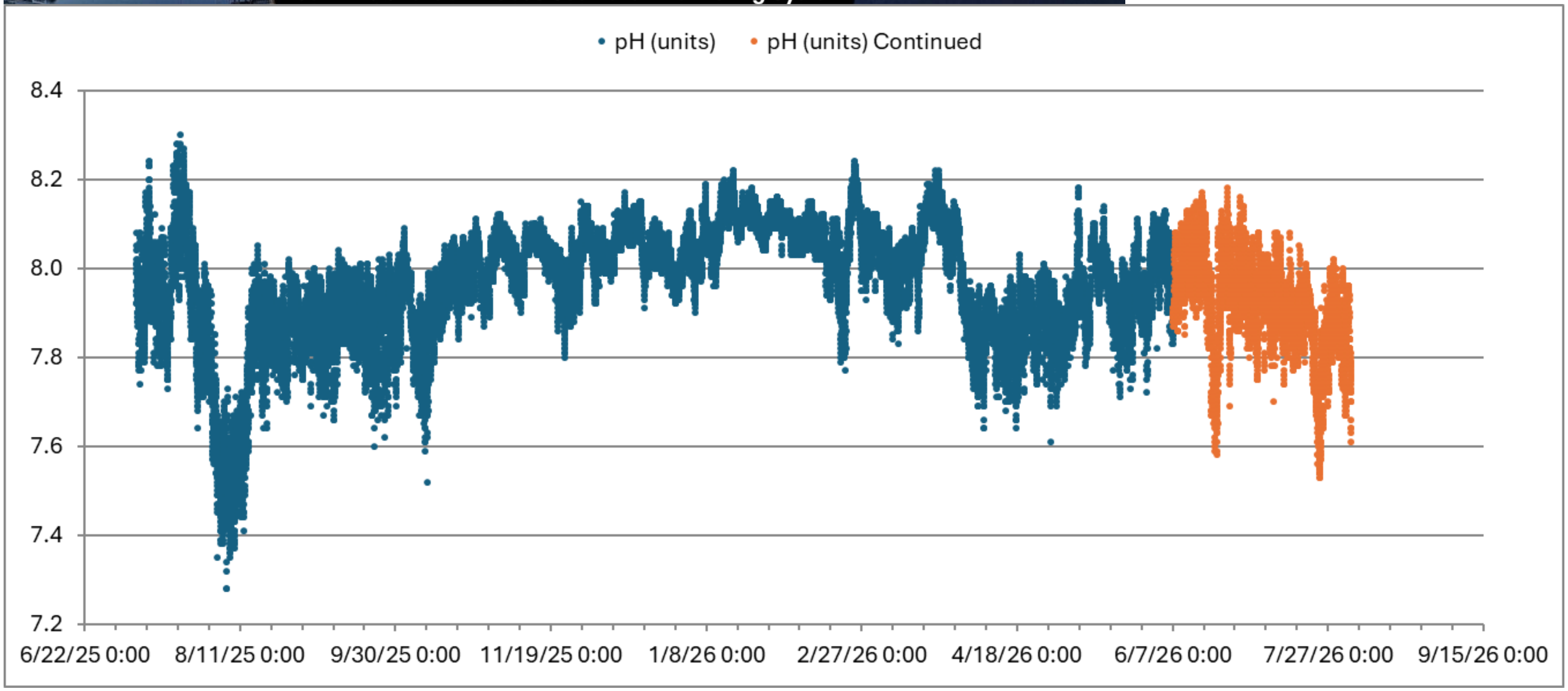


**Figure E3.** Seawater Intake – pH Time Series


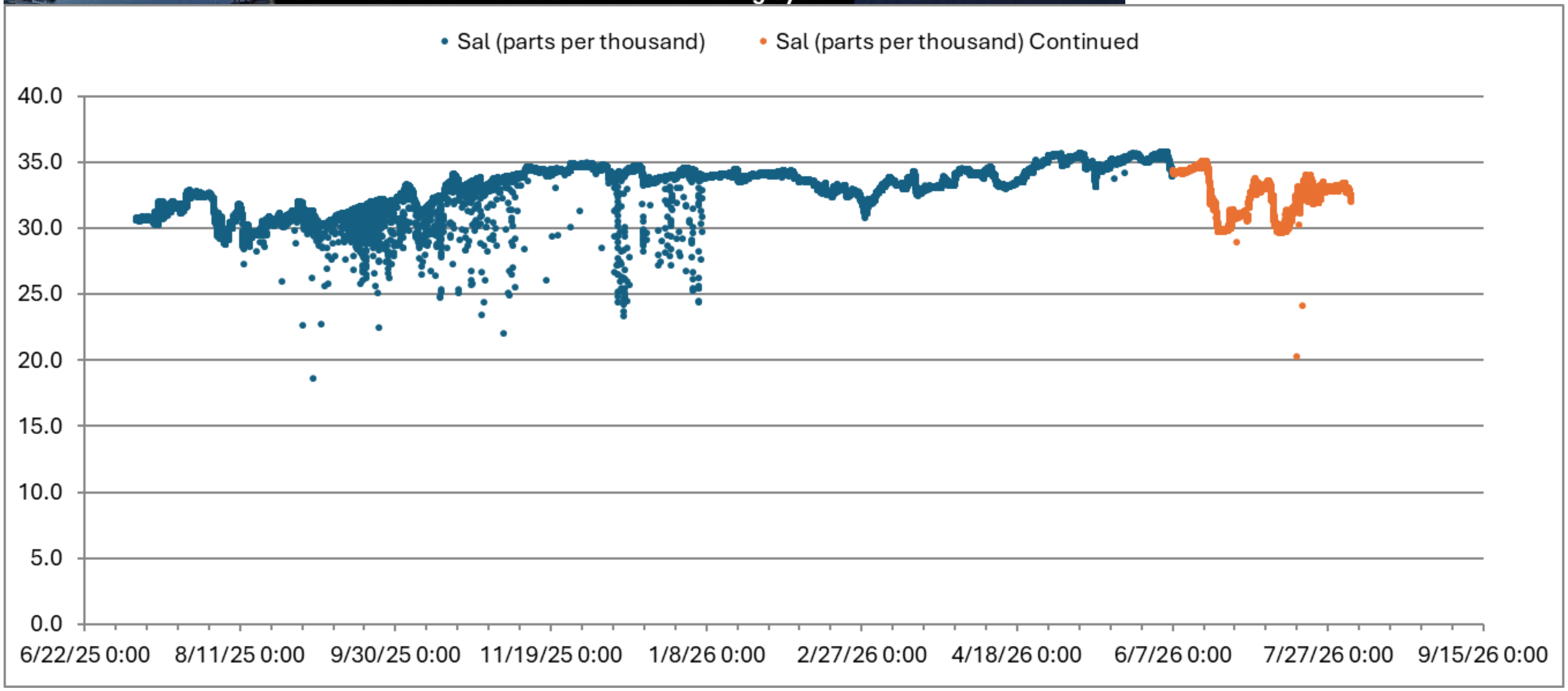


**Figure E4.** Seawater Intake – Salinity Time Series

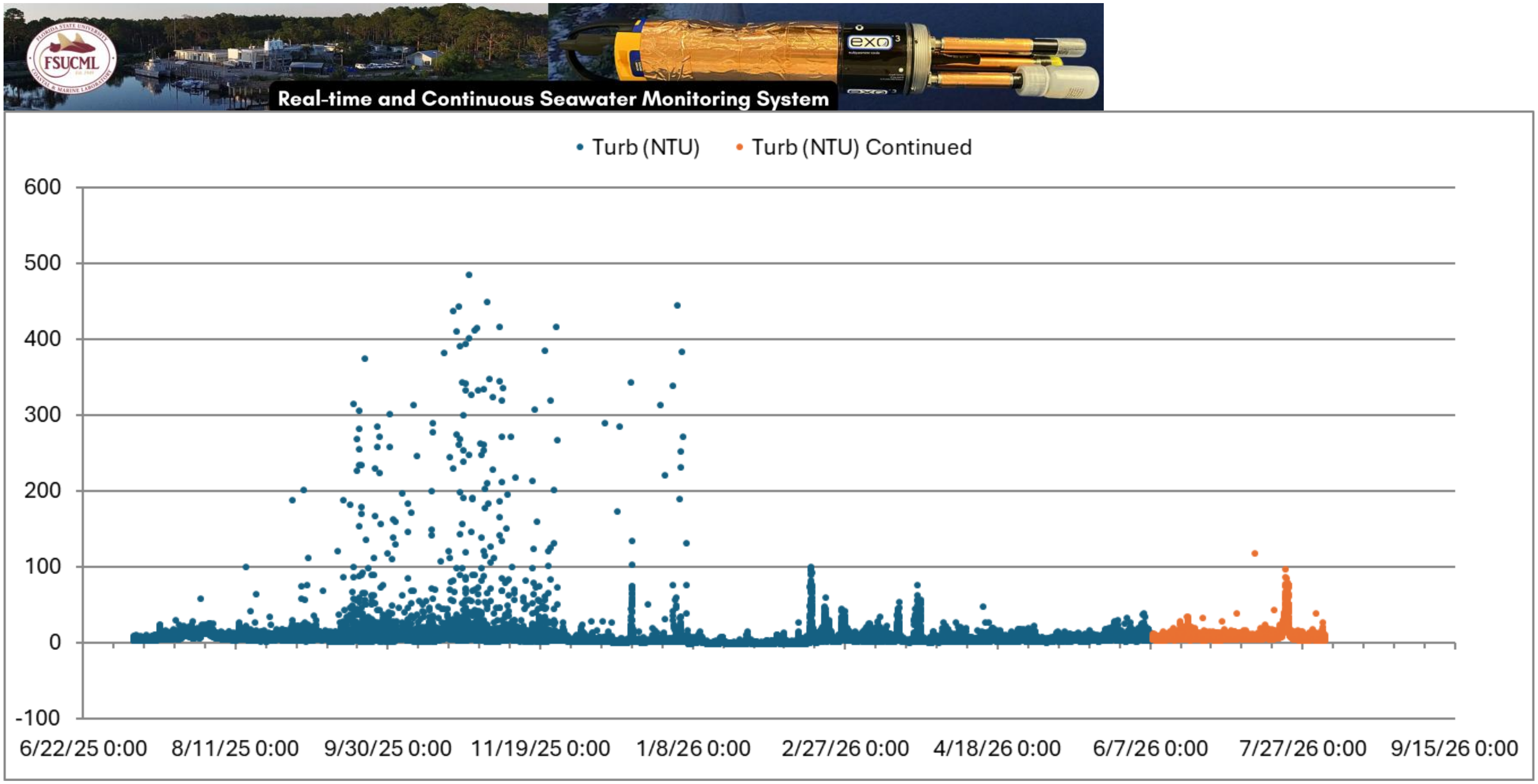


**Figure E5.** Seawater Intake – Turbidity Time Series

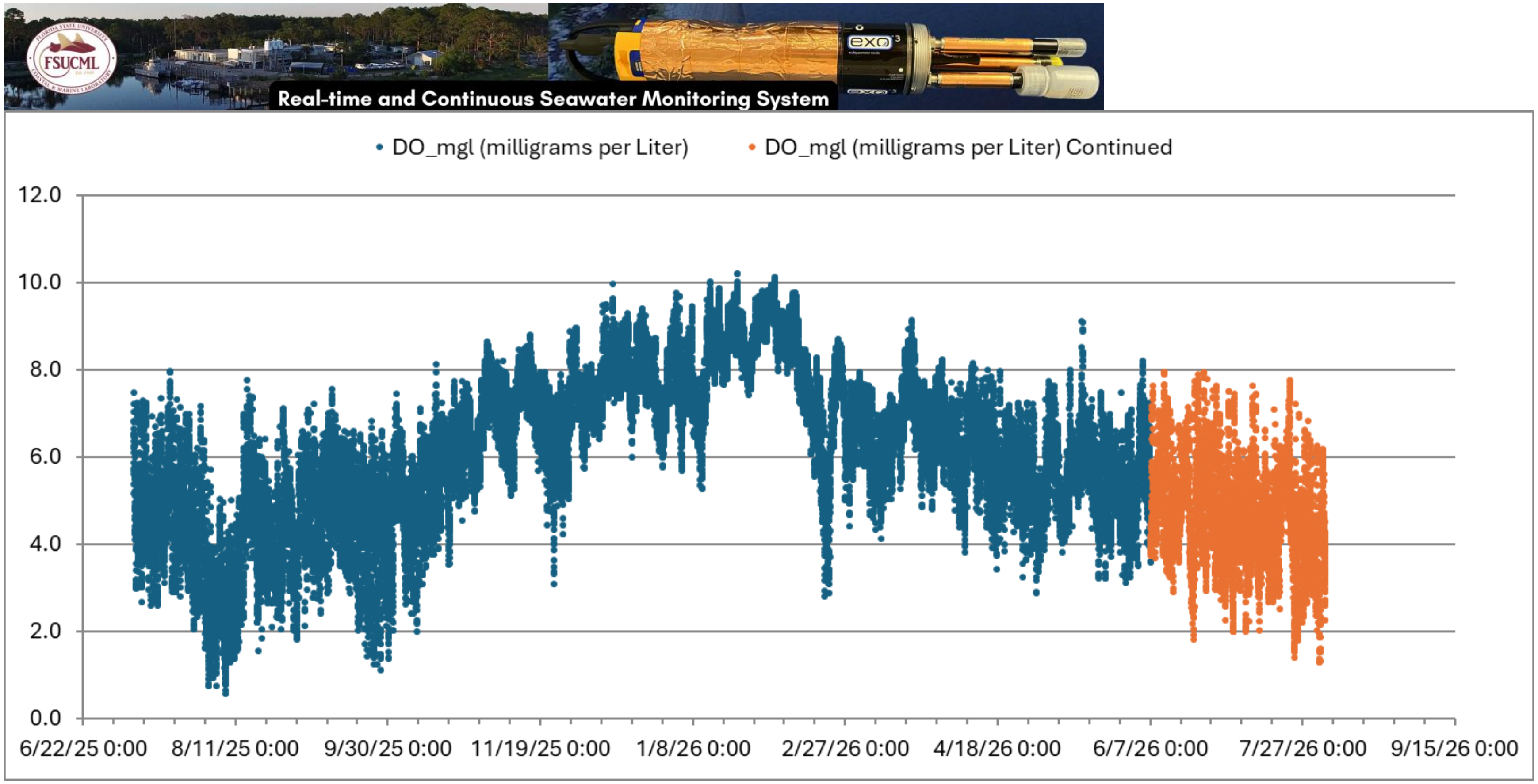


**Figure E6.** Seawater Intake – Dissolved Oxygen Time Series


- **Alligator Harbor (AH) ---> 07/02/2025 – 08/03/2026**

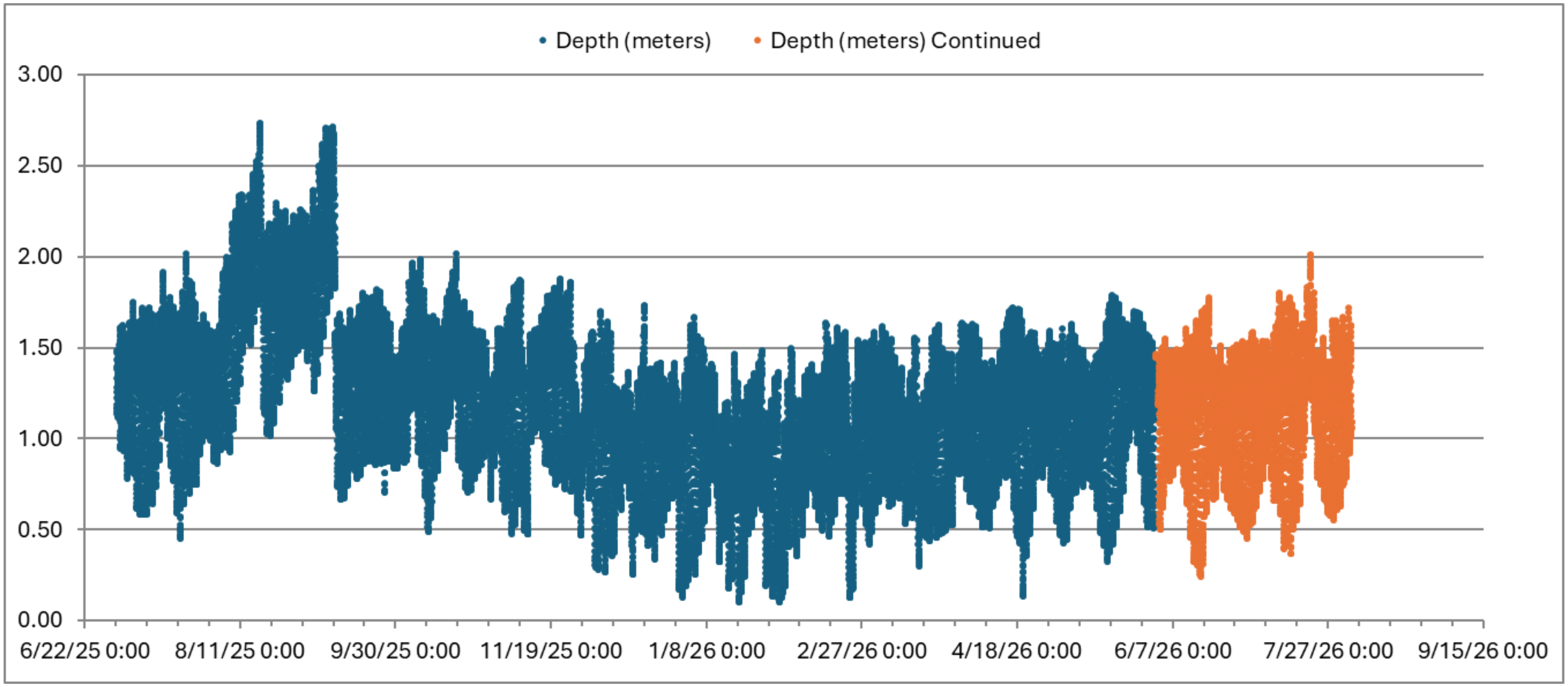


**Figure E7.** Alligator Harbor – Depth Time Series

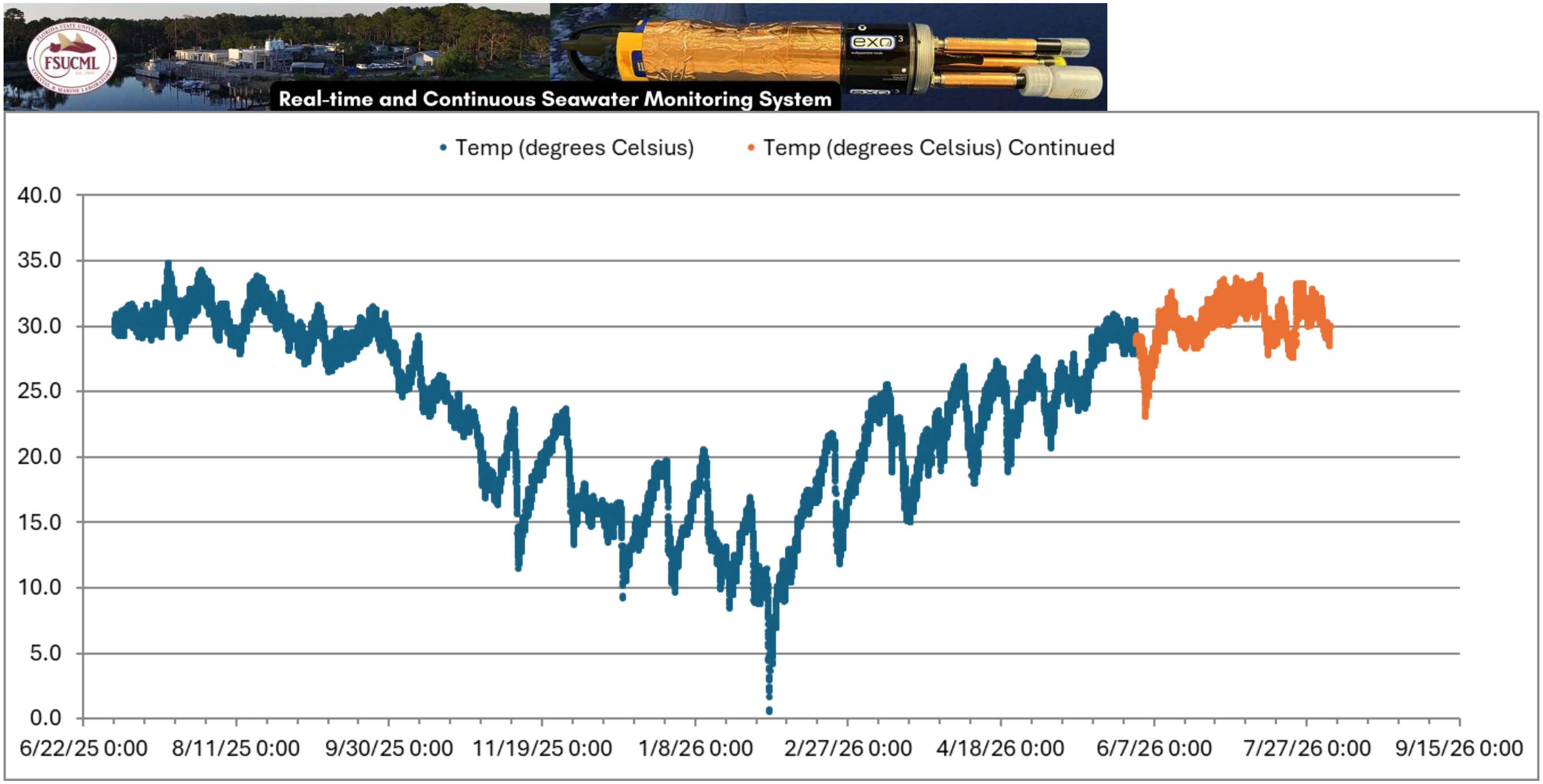


**Figure E8.** Alligator Harbor – Temperature Time Series


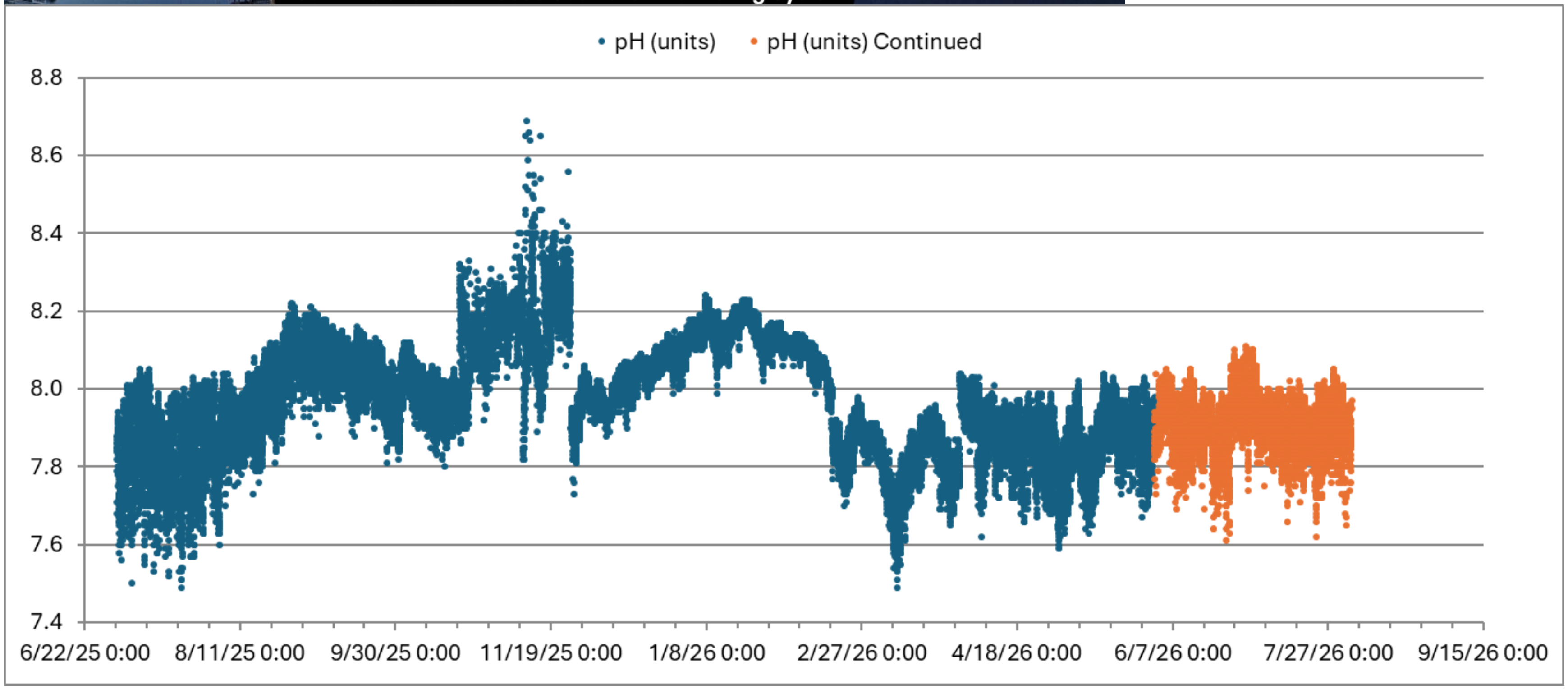


**Figure E9.** Alligator Harbor – pH Time Series

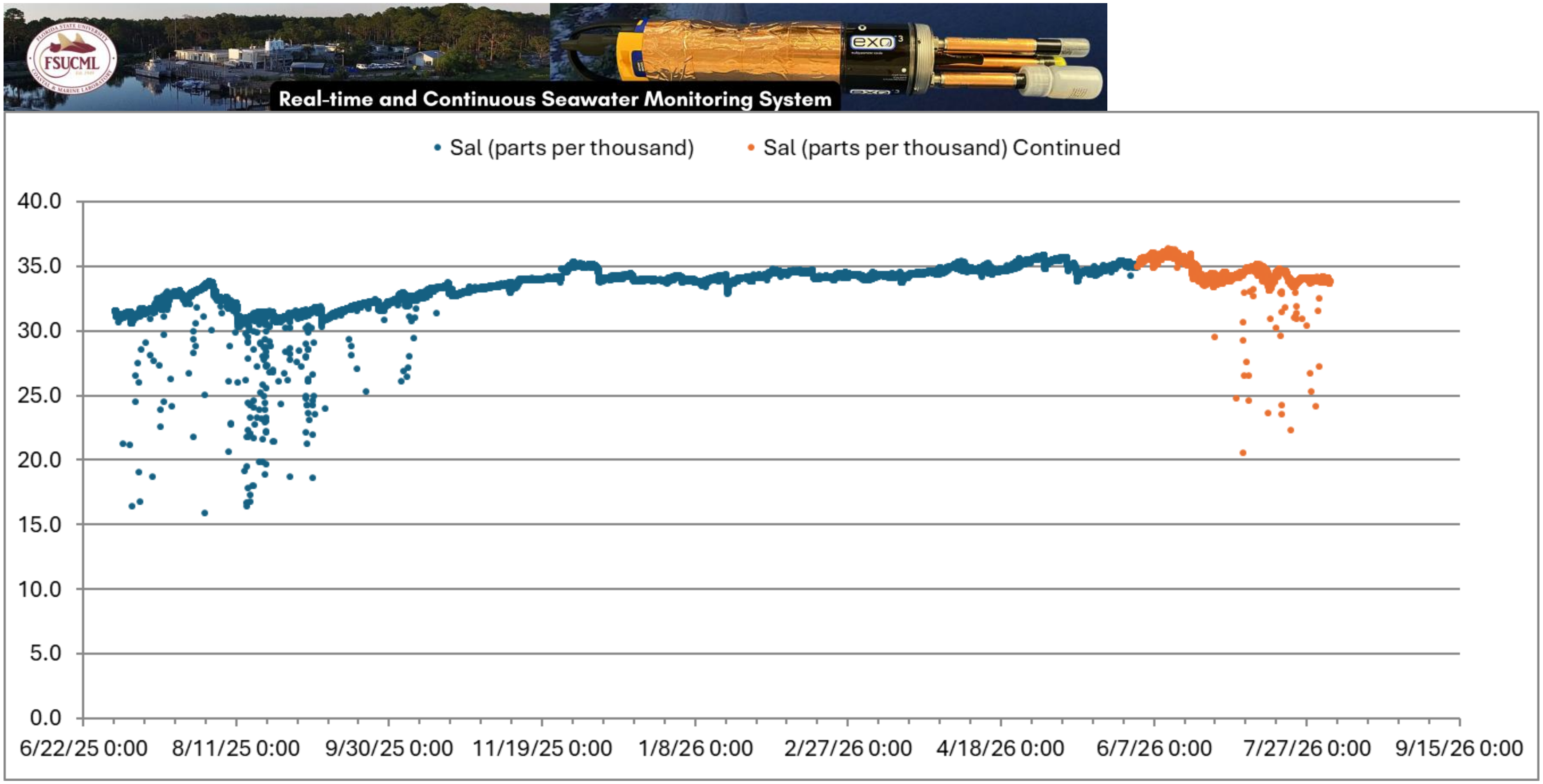


**Figure E10.** Alligator Harbor – Salinity Time Series


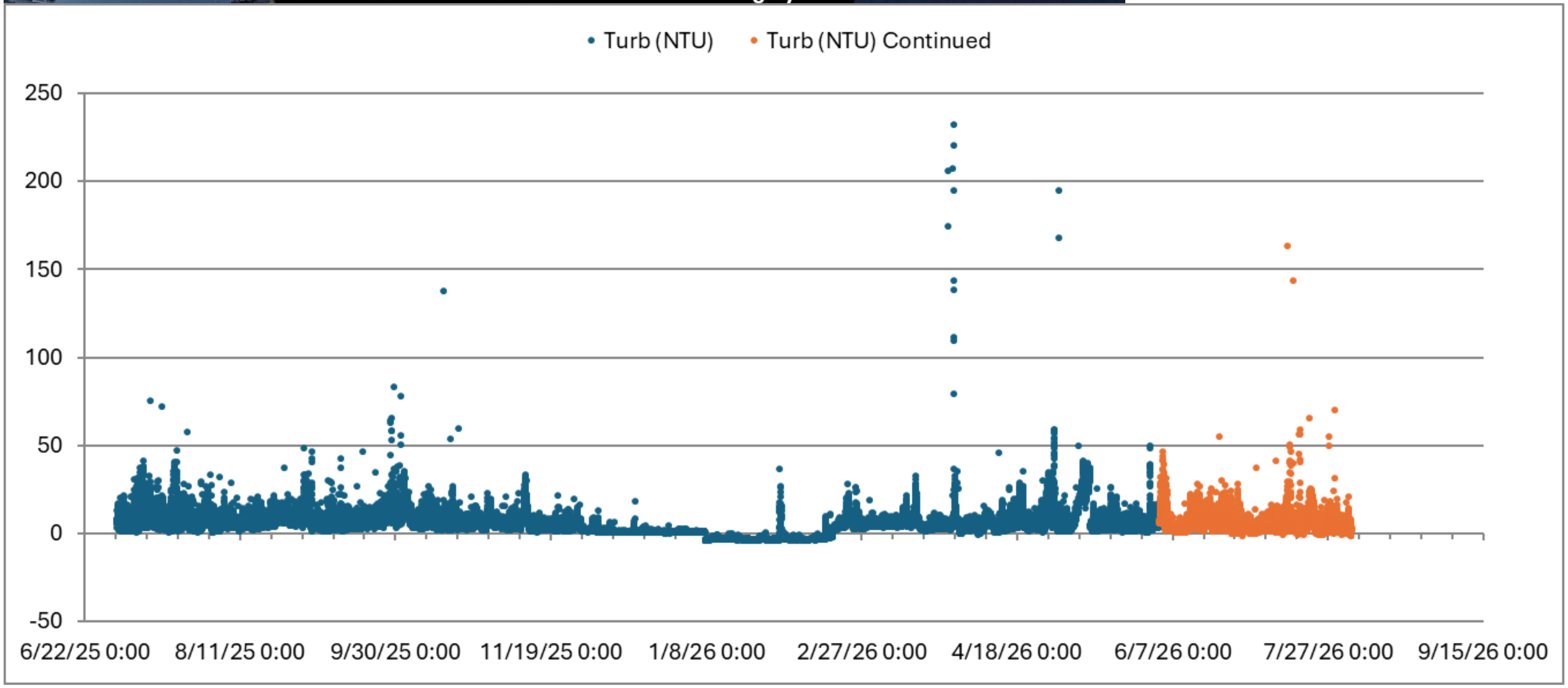


**Figure E11.** Alligator Harbor – Turbidity Time Series

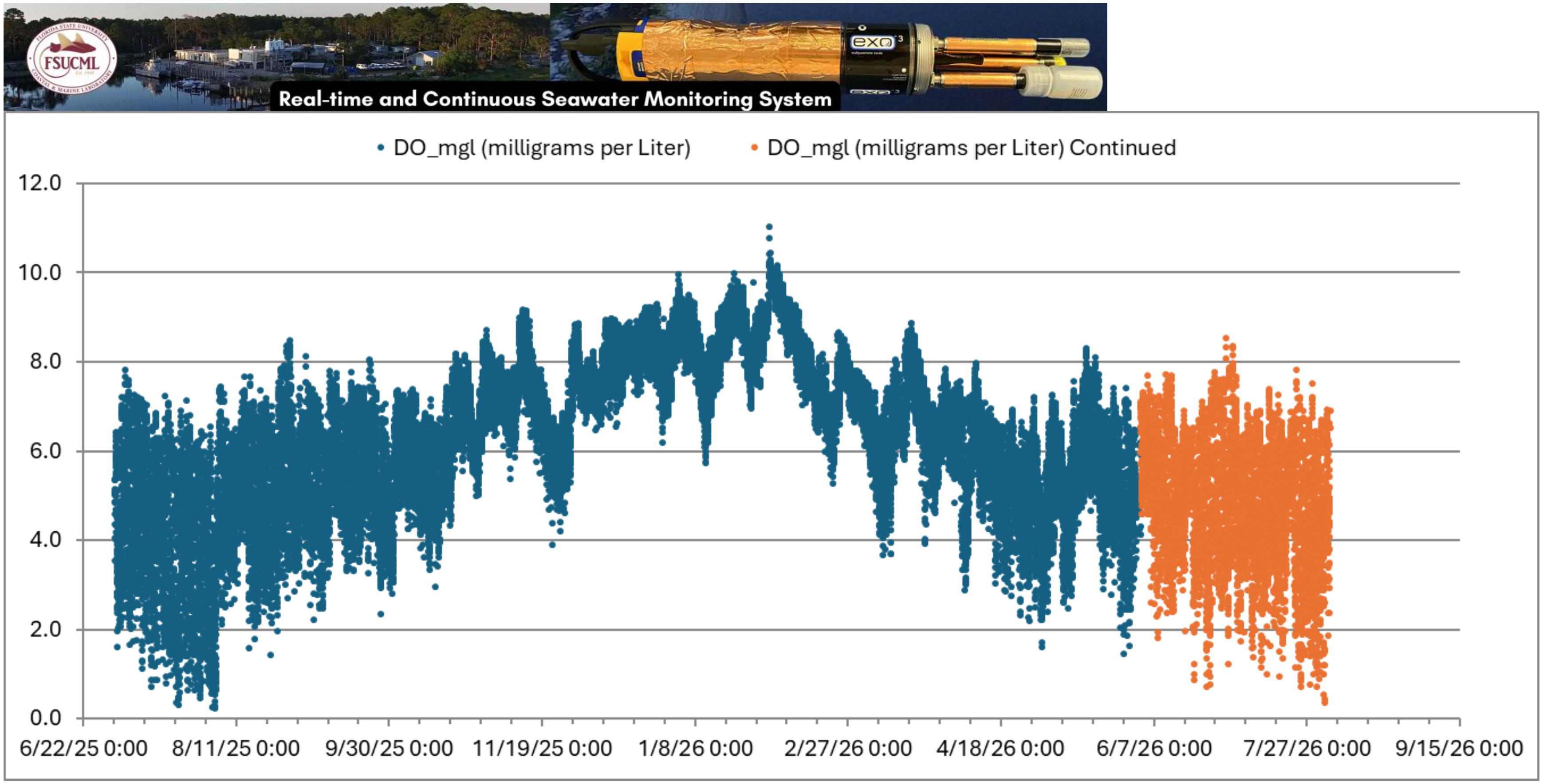


**Figure E12.** Alligator Harbor – Dissolved Oxygen Time Series

**Oyster Bay (OB) ---> 06/05/2025 – 06/08/2026**

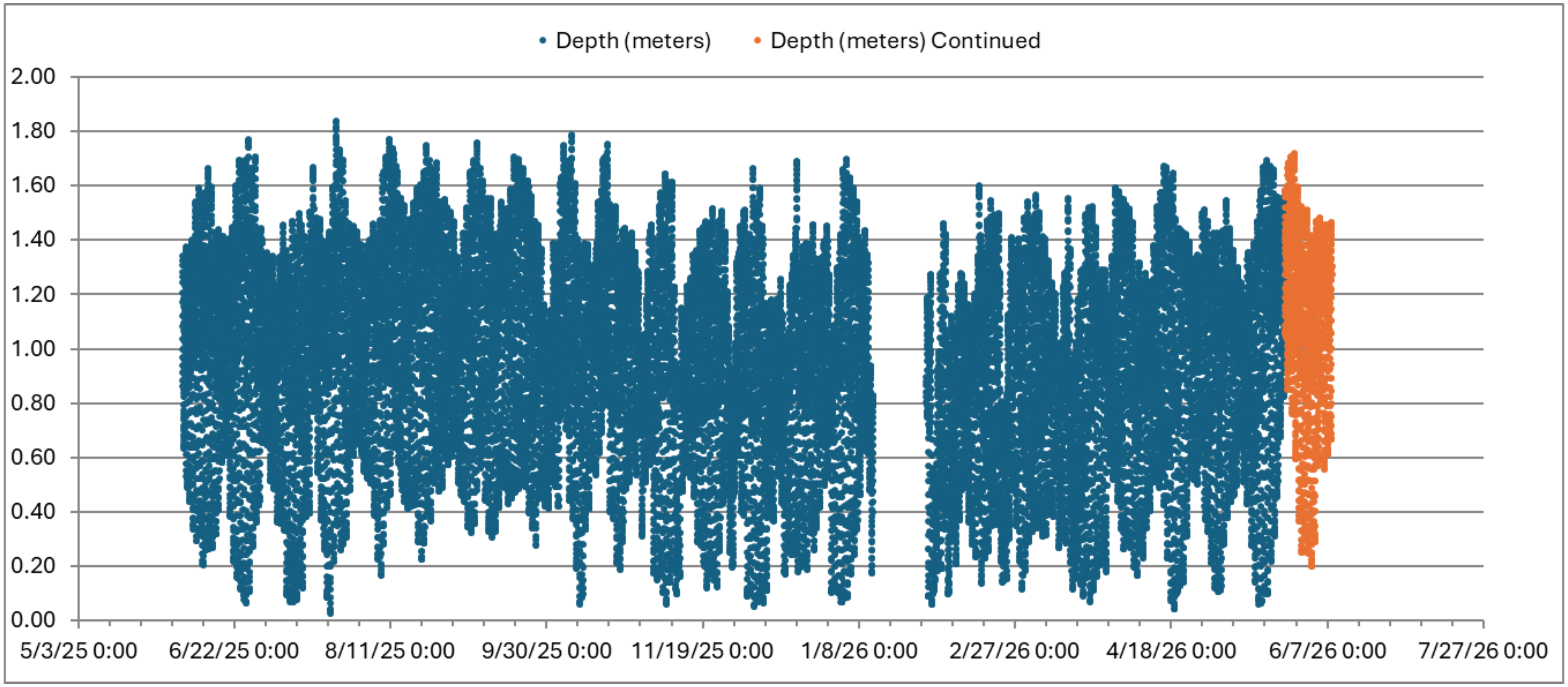


**Figure E13.** Oyster Bay – Depth Time Series

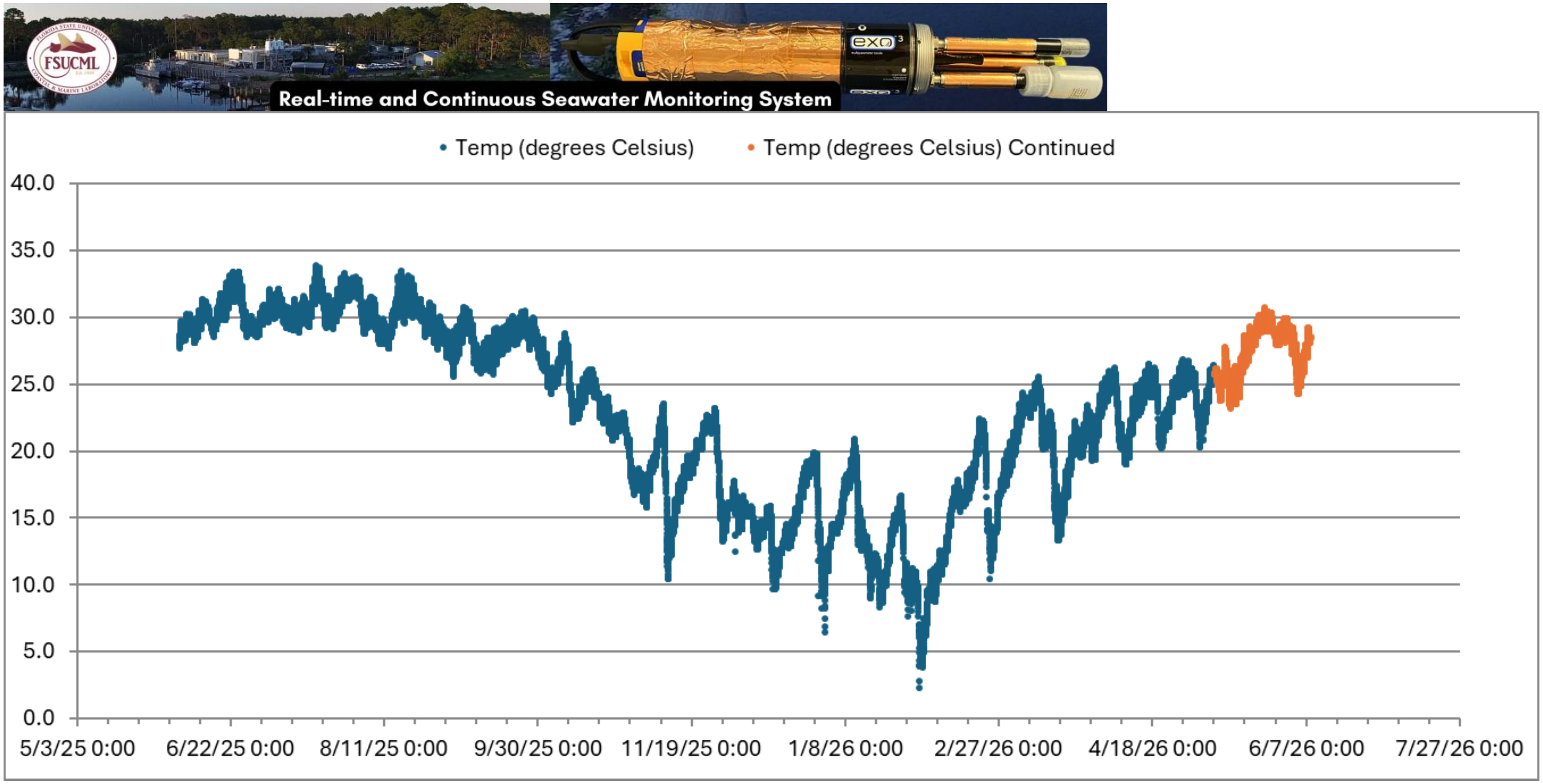


**Figure E14.** Oyster Bay – Temperature Time Series


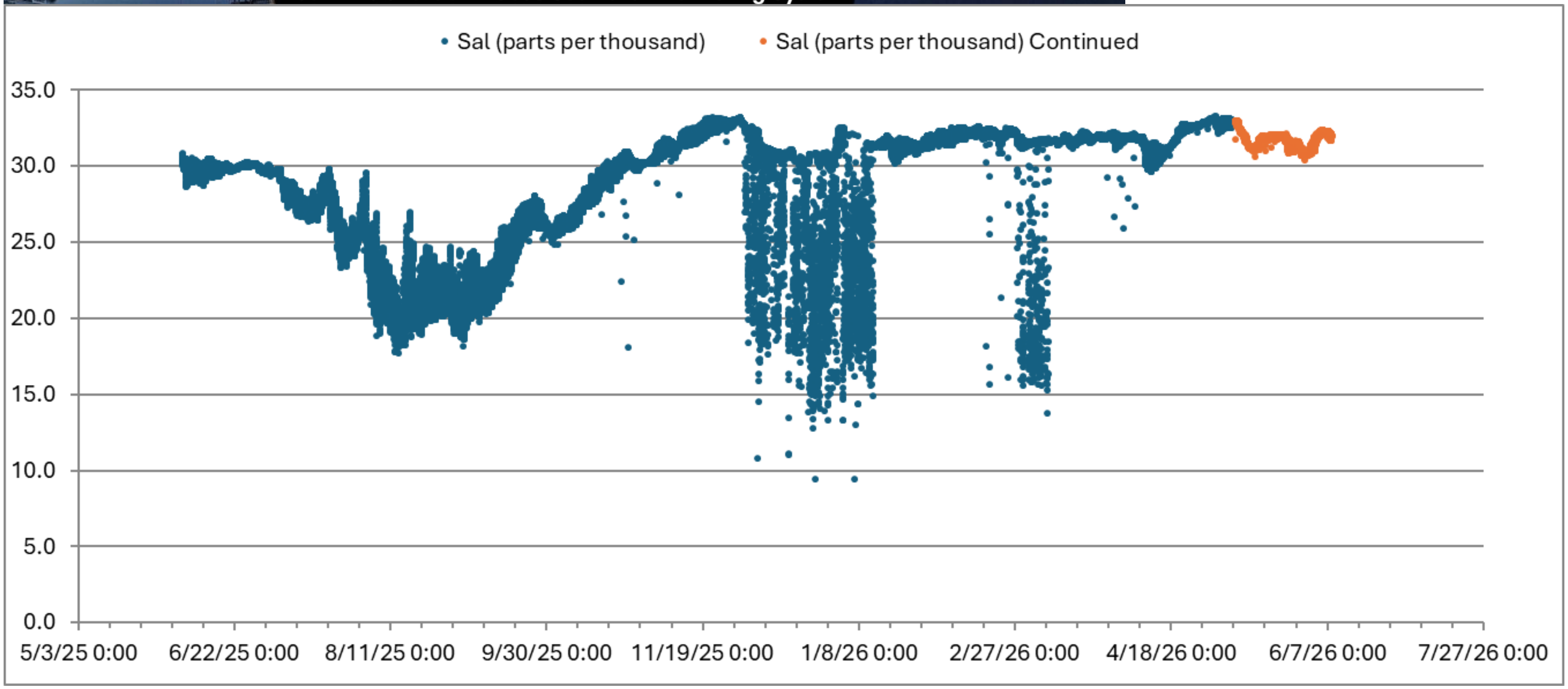


**Figure E15.** Oyster Bay – pH Time Series

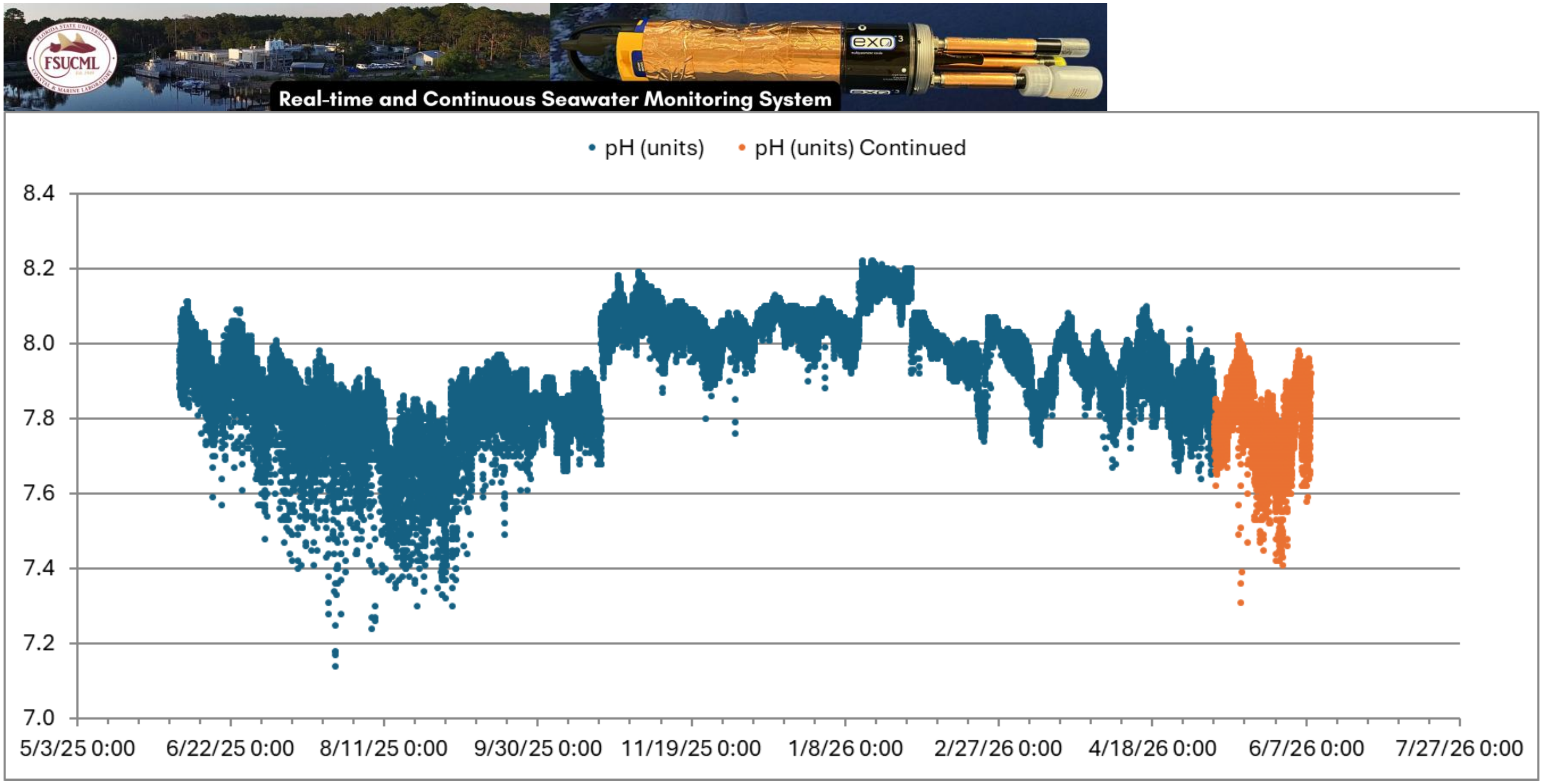


**Figure E16.** Oyster Bay – Salinity Time Series


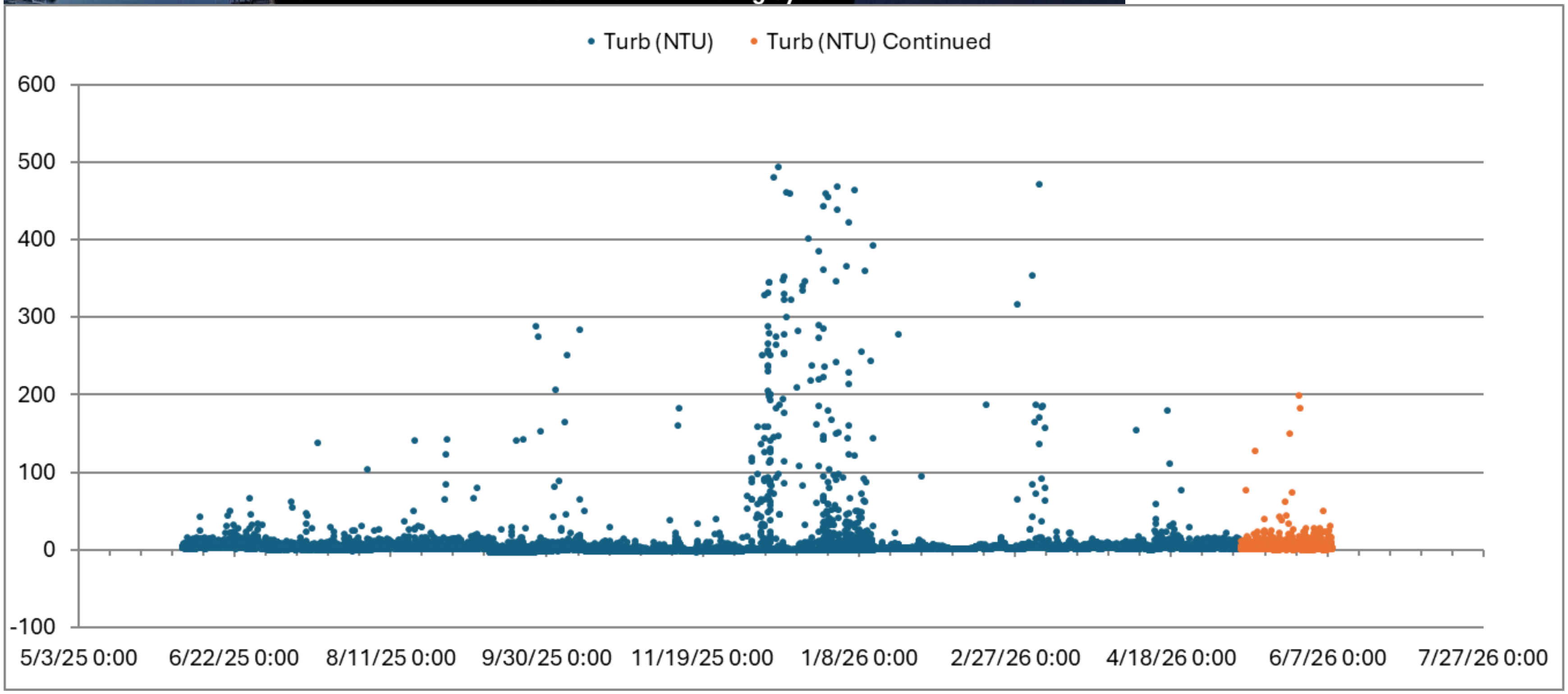


**Figure E17.** Oyster Bay – Turbidity Time Series

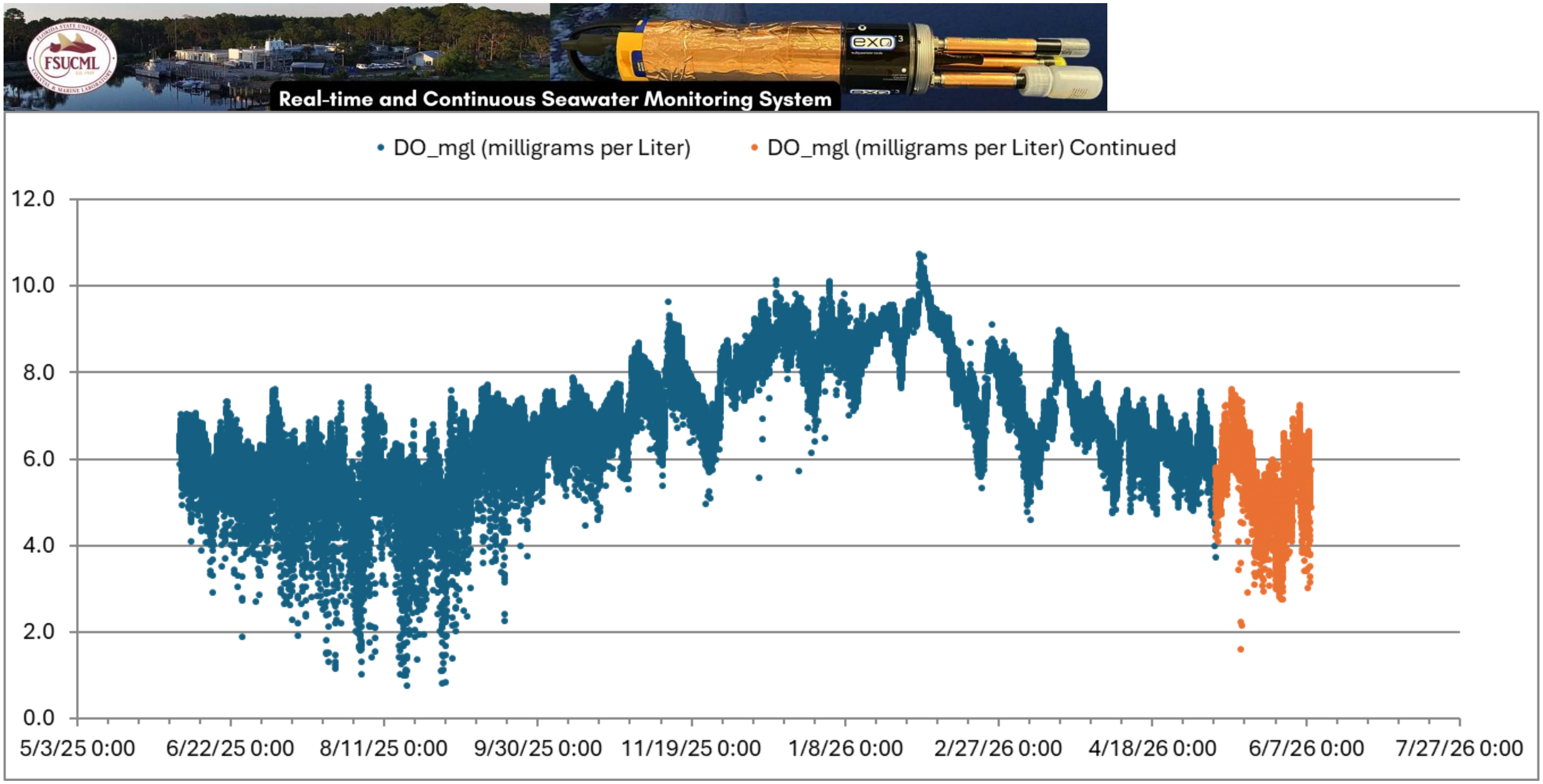


**Figure E18.** Oyster Bay – Dissolved Oxygen Time Series