TEXAS A&M UNIVERSITY
CORPUS CHRISTI

HARTE RESEARCH INSTITUTE
6300 OCEAN DRIVE, UNIT 5869
CORPUS CHRISTI, TEXAS 78412-5869
O 361.825.2000 · F 361.825.2050
www.harteresearch.org

Matagorda Bay Mitigation Trust
Final Report

Restoring Oyster Reef Habitat in Mesquite Bay
Award # 020

Submitted by:
Jennifer Beseres Pollack, Ph.D.
Natasha Breaux, M.S.
Terry Palmer, Ph.D.

Harte Research Institute
Texas A&M University-Corpus Christi
6300 Ocean Drive
Corpus Christi, TX 78412
(361) 825-2041

Submitted to:
Matagorda Bay Mitigation Trust

MATAGORDA BAY MITIGATION TRUST

February 2026

Project Overview

In Spring 2023, MBMT funds originally designated for restoration in Tres Palacios Bay were reallocated to the Mesquite Bay Complex. This decision was made in response to significant increases in restoration costs at the original site and the opportunity to maximize project impact by partnering with the Texas Parks and Wildlife Department (TPWD) on a planned restoration effort at Carlos Reef (Figure 1). The Carlos Reef site is located within waters closed to oyster harvest, ensuring that ecological benefits from restoration efforts can be maintained over the long term.

Planning and Permitting

Throughout 2023, the project team coordinated closely with TPWD as they advanced permitting and initiated the contractor bidding process for the Carlos Reef restoration. Pre-restoration monitoring was conducted to establish baseline conditions for future comparison, and the team worked directly with federal permitting staff to facilitate approvals. Regular coordination ensured that restoration activities could be completed within TPWD's funding deadlines.

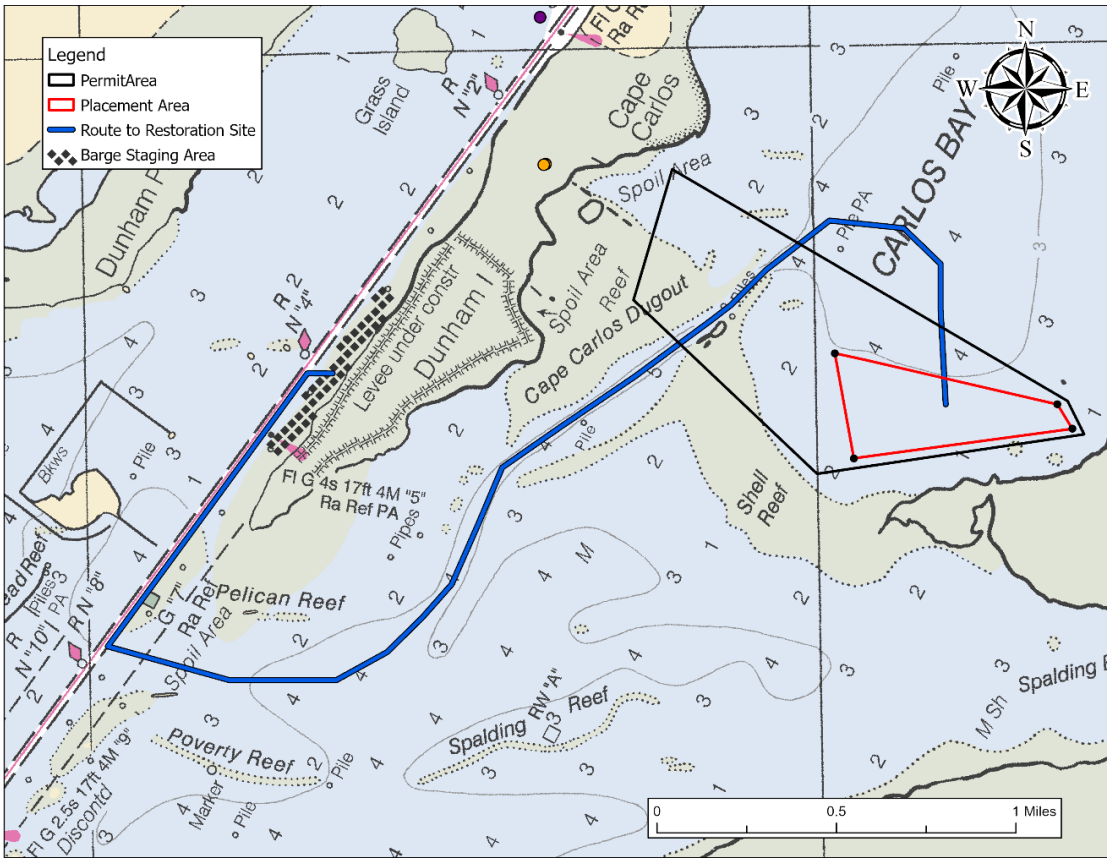

Figure 1. TPWD-provided map of the 2024 Carlos Reef restoration in Mesquite Bay.

Construction Activities

Construction began on May 8, 2024, and was completed ahead of schedule on May 17, 2024. Multiple oyster luggers and barges were used to transport and distribute cultch material across the site. After construction, TPWD conducted a side-scan sonar survey to verify proper placement of the restored reef substrate. In total, approximately 70 acres of oyster reef habitat were restored in Mesquite Bay using a maintenance restoration strategy, where a thin layer of cultch material was placed across the bay bottom to promote natural oyster settlement and growth.

Post-Construction Monitoring

Oyster Growth

Monitoring of the restored reef began in June 2024 and continued through October 2025. Initial post-construction reef assessments in June 2024 documented the expected mix of rocks and live oysters consistent with the maintenance restoration strategy. Subsequent monitoring was conducted in August and November 2024 and in June, August, and October 2025 to evaluate changes over time. Sampling was carried out at the restored site, an adjacent unrestored area, and a nearby natural portion of the reef to provide reference comparisons.

The monitoring program included assessments of oyster density, oyster size distribution, and testing for *Perkinsus marinus* (dermo disease). Water quality parameters, including salinity, water temperature, dissolved oxygen, pH, and turbidity, were measured during each oyster sampling event. All data were digitized, quality-checked, and prepared for analysis.

Water quality conditions (Figure 2) were similar at the restored and adjacent natural reef sites. Salinity levels were moderate following construction and increased to a peak in August 2025. Water temperature followed a seasonal pattern, also peaking in August 2025, when dissolved oxygen levels were lowest. Measured pH remained within the normal range for estuarine systems during the sampling period, and turbidity fluctuated, peaking in October 2025.

By November 2024, (post-spat; >25 mm) oyster density on the restored reef was similar to that observed on the natural reef, and by June 2025, oyster densities on the restored site exceeded those recorded at the natural reef (Figure 3). The density of market-sized oysters (≥76 mm) on the restored reef also increased steadily over time, becoming comparable to that of the natural reef by June 2025 (Figure 4). A decline in oyster density was observed following the June 2025 sampling event, which may be related to elevated salinity and temperature conditions in the bay that can stress oyster populations. Oyster size distribution data indicate that three and six months after restoration, oysters at the restored site were primarily small. By June 2025 and beyond, size distributions at the restored site more closely matched those measured on the natural reef (Figure 5).

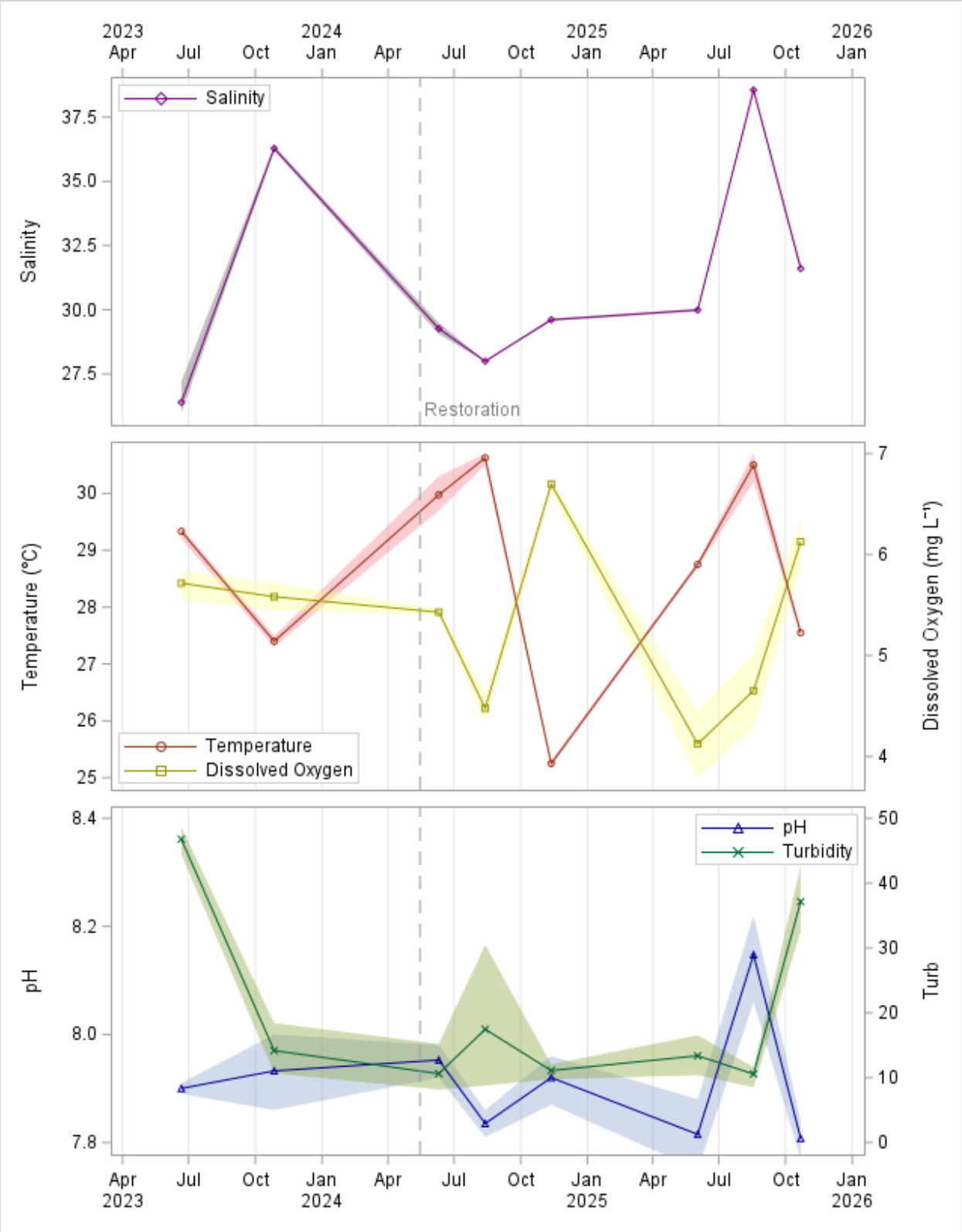

Figure 2. Salinity, water temperature, dissolved oxygen, pH, and turbidity measured at Carlos Reef before and after restoration. The dashed grey line indicates the restoration date.

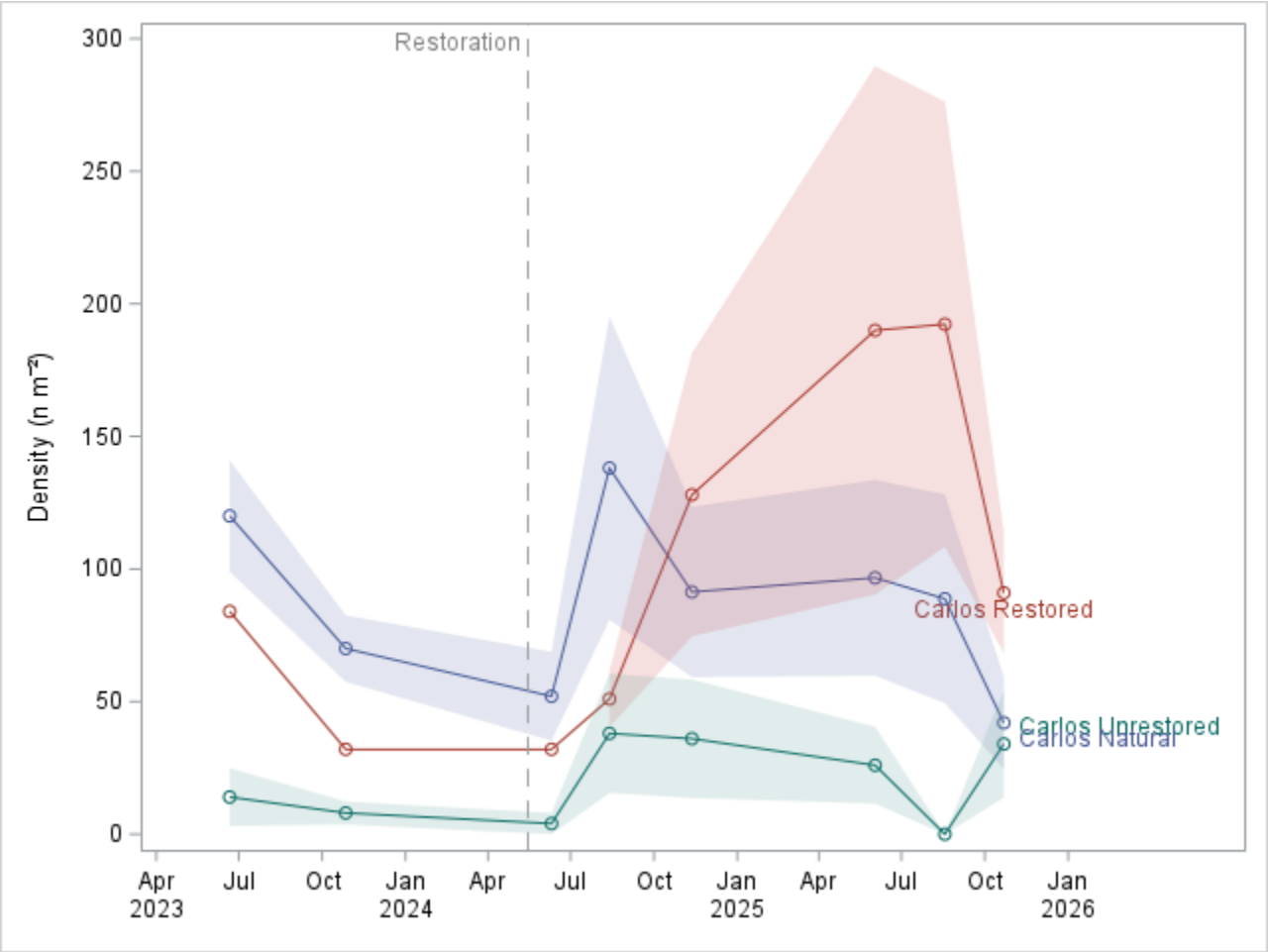

Figure 3. Post-spat (>25 mm) oyster density on the restored Carlos Reef and nearby reference sites. The dashed grey line indicates the restoration date.

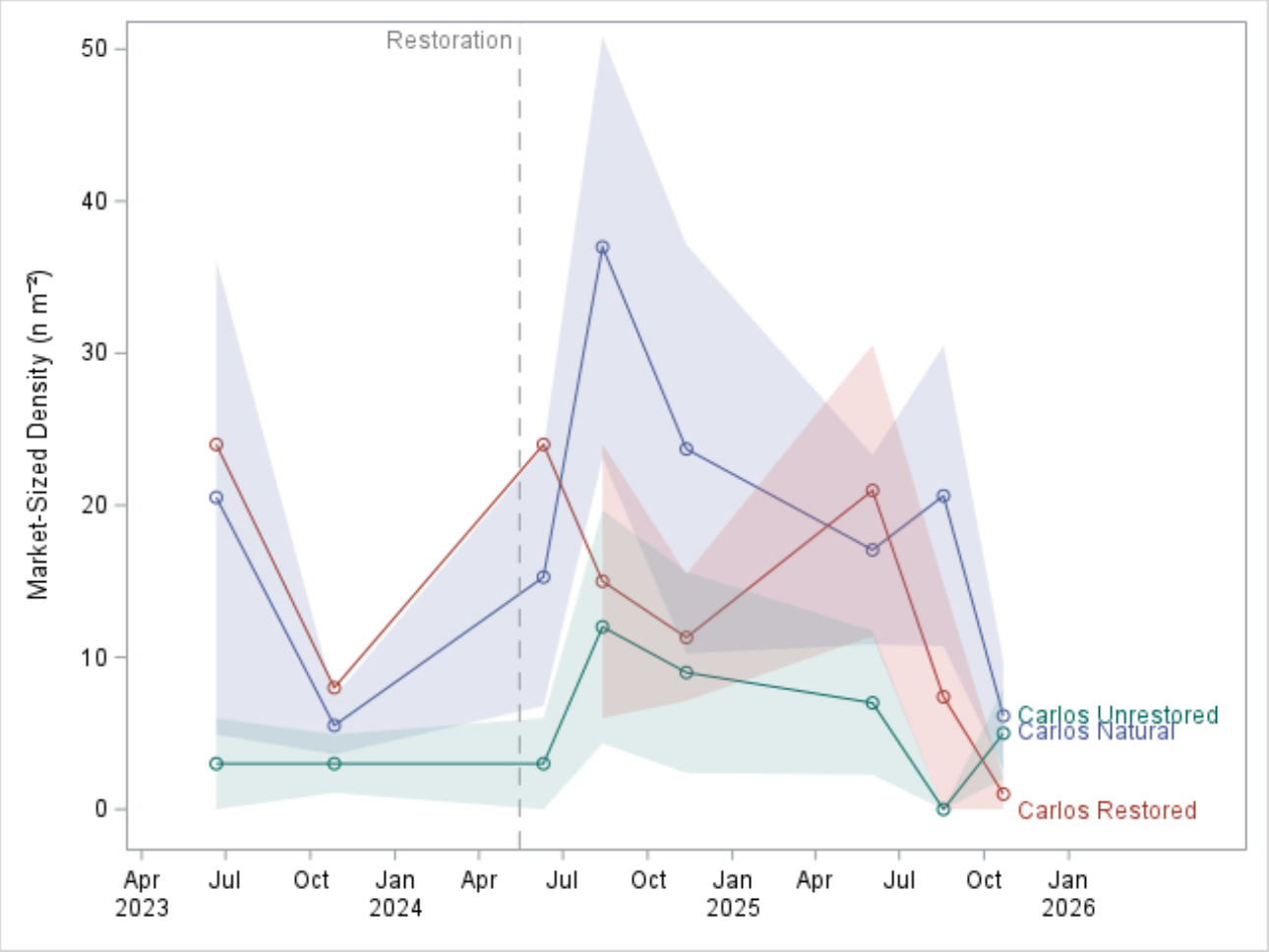

Figure 4. Market-sized (≥76 mm) oyster density on the restored Carlos Reef and nearby reference sites. The dashed grey line indicates the restoration date.

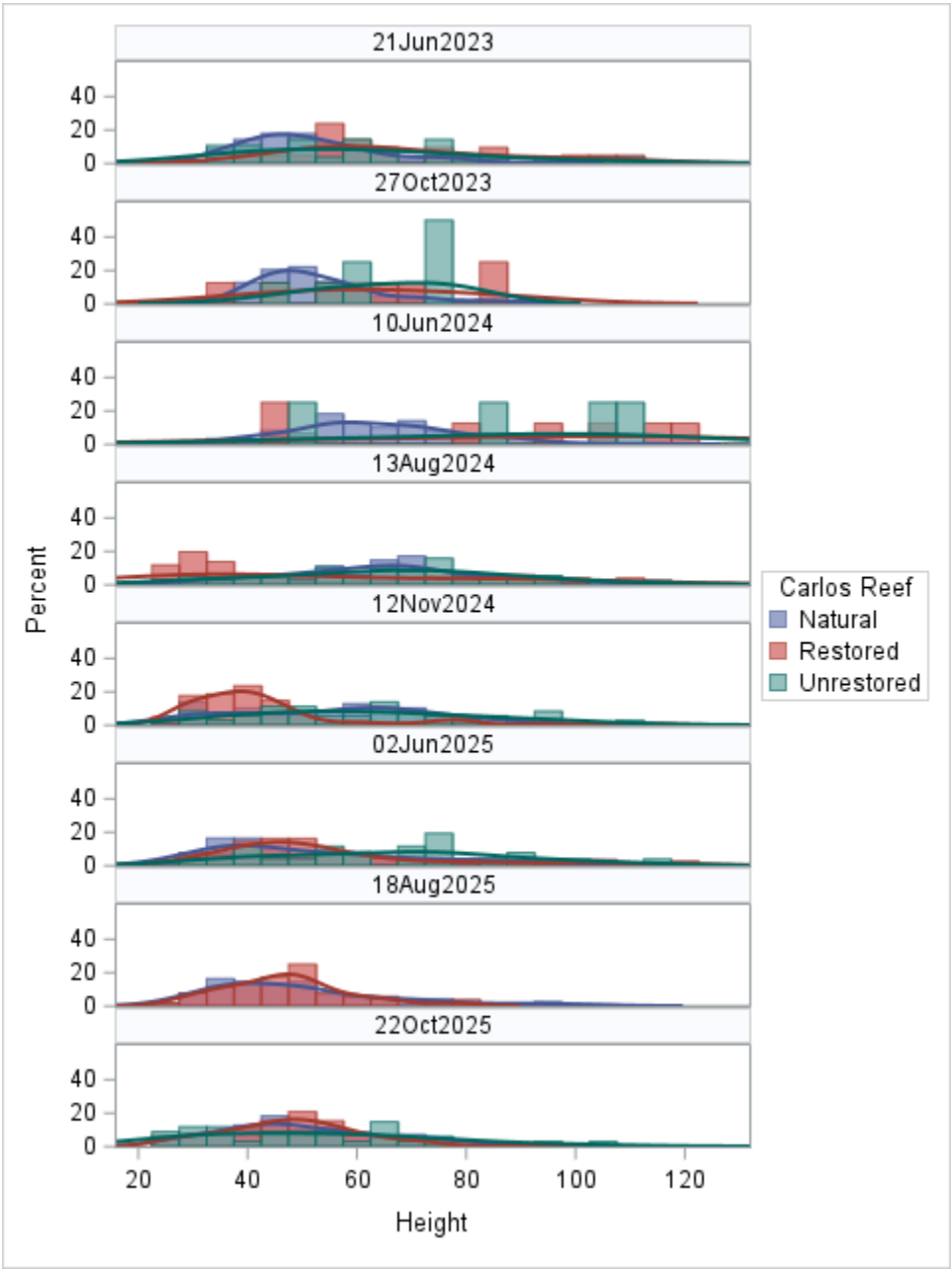

Figure 5. Histogram of oyster size distribution at the restored Carlos Reef and nearby reference locations.

Disease Prevalence

Testing for *Perkinsus marinus* (dermo) indicated generally low infection intensity, with mean intensity values similar at both the restored and natural reef sites. This result is consistent with a maintenance restoration approach, as oysters present at the restoration site prior to cultch placement likely contributed to baseline dermo presence.

Dermo prevalence, defined as the proportion of oysters infected, was high, with infections detected in most oysters sampled at both sites (Figure 6). However, weighted prevalence, calculated using the Mackin scale (0–5), which categorizes infection intensity from no infection (0) to heavy infection (5), remained low across all samples. Mean weighted prevalence values were below 1.5, corresponding to light infections (Figure 7). Overall, dermo infection intensity remained low across sites during the monitoring period, with no consistent differences between restored and natural reefs or indication of elevated disease pressure.

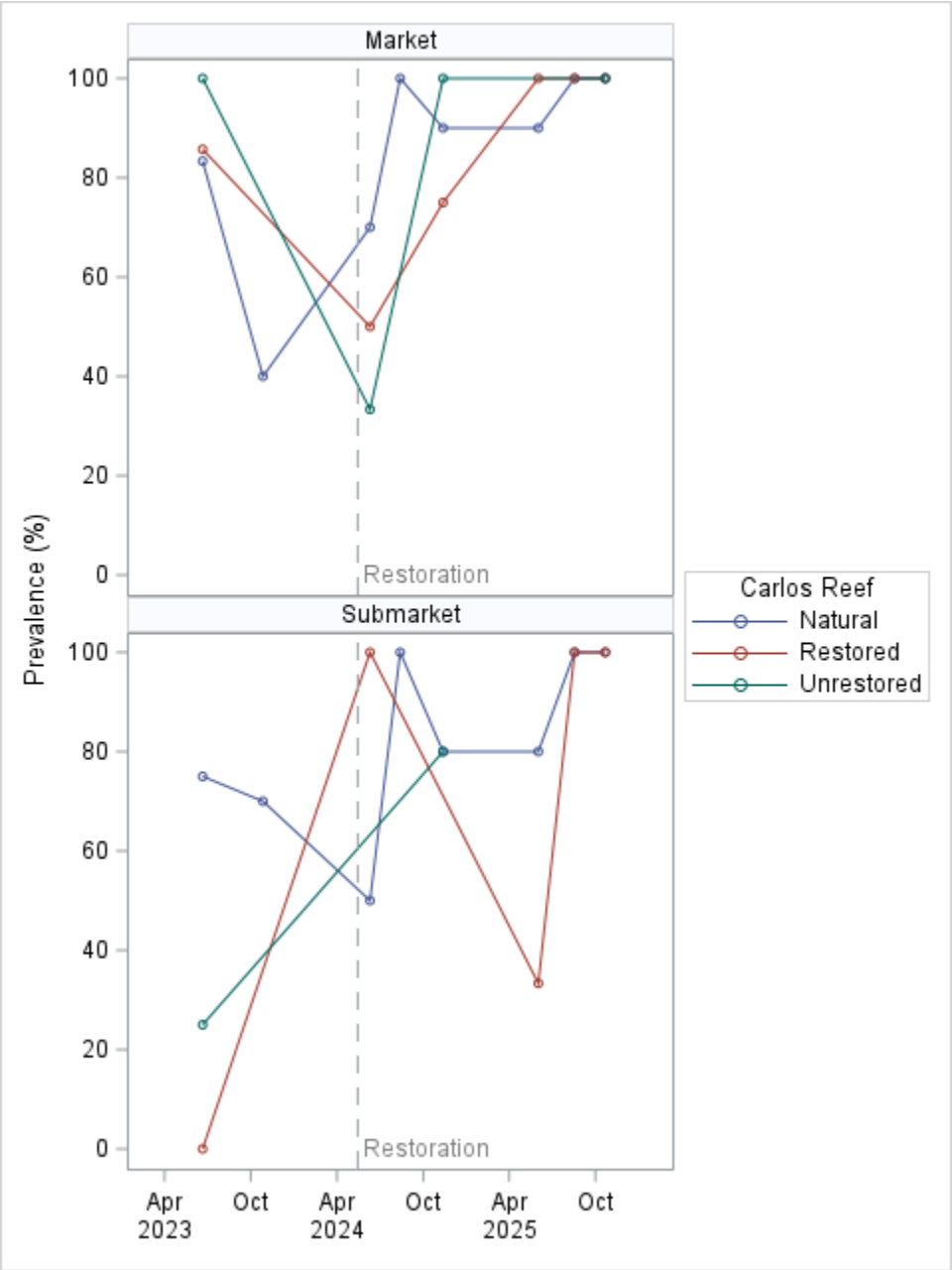

Figure 6. Dermo infection prevalence in market-size (≥76 mm) and submarket-size (26–75 mm) oysters measured at restored and reference locations on Carlos Reef. Dashed grey line indicates the restoration date.

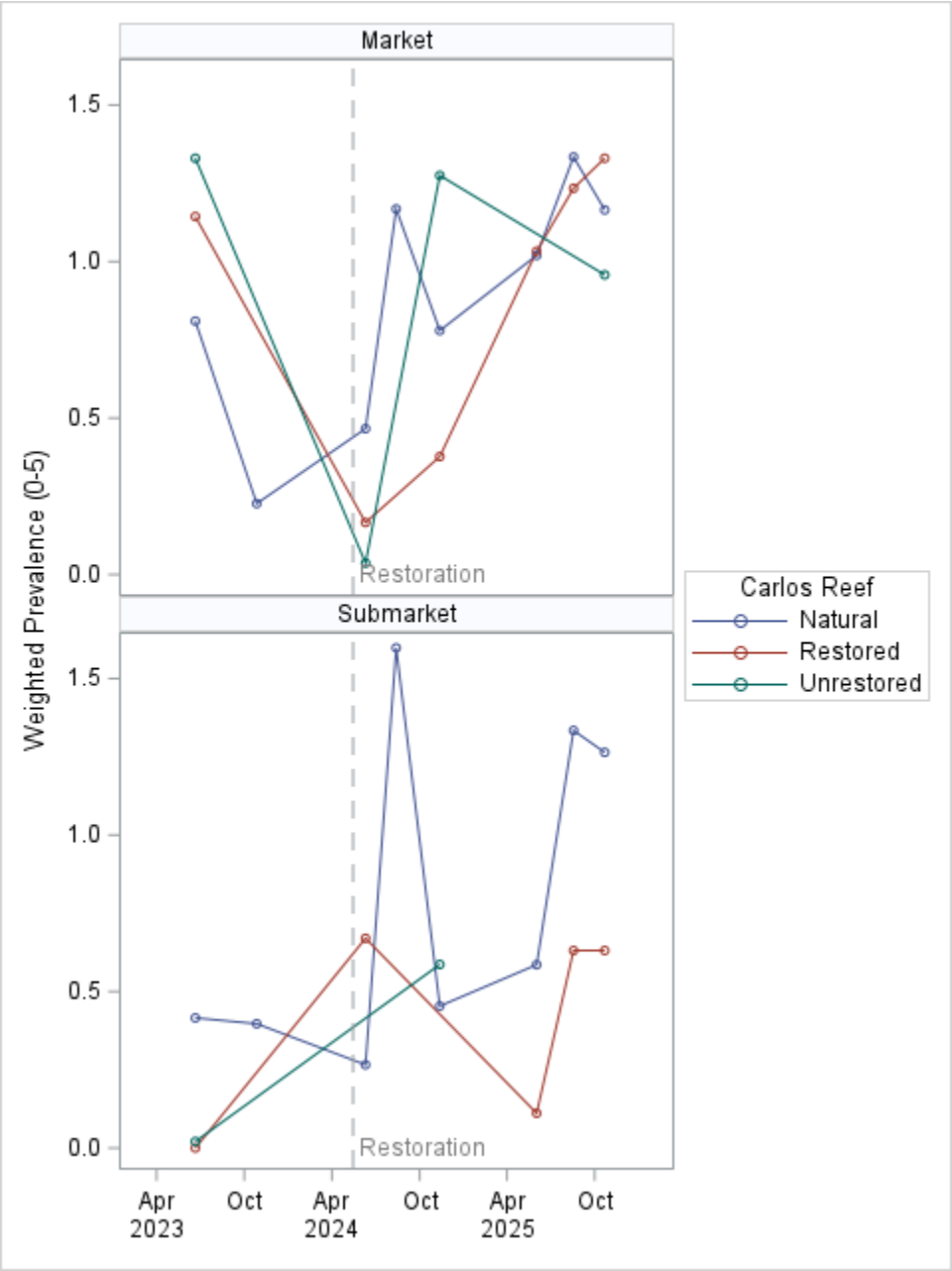

Figure 7. Weighted dermo infection prevalence in market-size (≥76 mm) and submarket-size (26–75 mm) oysters measured at restored and reference locations on Carlos Reef. Dashed grey line indicates the restoration date.

Conclusion

The Carlos Reef restoration project successfully restored approximately 70 acres of oyster reef habitat in Mesquite Bay in partnership with TPWD. Monitoring supported by MBMT funding continued through October 2025 and documented that the restored reef developed largely as intended during the first year following construction, with oyster densities and size distributions approaching or exceeding those observed at nearby natural reefs by June 2025.

Declines in oyster density observed during the August and October 2025 monitoring events likely reflect seasonal stress associated with elevated temperature and salinity conditions in the bay. The restored area is not subject to harvest pressure, and additional hard substrate remains available to support post-disturbance recovery. More broadly, oyster reef systems are characterized by cycles of disturbance and recovery, with remaining hard substrate providing settlement habitat for larvae from surrounding areas following stress events.

With the conclusion of MBMT-funded activities through 2025, the data collected provide a valuable record of early reef development, oyster population dynamics, and system response to environmental variability. These findings will inform future oyster habitat restoration and maintenance strategies along the Texas coast.