

## Quarterly Report for Matagorda Bay Mitigation Trust June 30, 2023

### **Project:**

Colorado River Delta Ecosystem Assessment: Gathering Key Baseline Data to Guide Future Habitat Restoration in Matagorda Bay

### **Organizations:**

<sup>1</sup>Center for Sportfish Science and Conservation (CSSC) at Harte Research Institute for Gulf of Mexico Studies Texas A&M University at Corpus Christi

<sup>2</sup>BIOWEST, INC.

### **Investigators:**

Gregory W. Stunz, Ph.D.<sup>1</sup> (PI)

Matthew K. Streich, Ph.D.<sup>1</sup> (Co-PI)

Edmund L. Oborny, Jr. Project Manager, ELO/eo<sup>2</sup>

**Contract No.:** 0015

**Project Term:** 03/01/2021 – 07/31/2023

**Reporting Period:** 3/1/2021 – 5/31/2023 (9)

The contracted project with the Matagorda Bay Mitigation Trust was initiated as of March 1, 2021. After this date, we identified and got approval for a subcontractor with expertise in areas not covered by researchers at Texas A&M University-Corpus Christi. Areas for subcontract expertise include Benthic Habitat Characterization, and a portion of the Hydrological and Ecological Assessment work. The chosen contractor was BIOWEST, Inc. and a subaward was issued to this group in April 2021 (with a start date of March 1) in the amount of \$230,000.

**Task 1 - Benthic Habitat Mapping:** Perform a detailed benthic habitat characterization of the Colorado River Delta study area to provide an updated habitat baseline.

Status: Ongoing

Spring '21

- BIO-WEST conducted project management, internal project team meetings, task coordination, and invoicing.
- BIO-WEST conducted a site reconnaissance with CSSC scientist on May 25<sup>th</sup>, 2021.
- BIO-WEST initiated map preparation and conducted site selection analysis to facilitate ecological sampling.

Summer '21

- BIO-WEST initiated benthic habitat mapping during this quarter, this included
  - 1) an evaluation of existing aerial imagery for the Colorado River Delta project area and
  - 2) field surveys using side-scan sonar to map benthic habitats including oyster reefs, submerged aquatic vegetation and open bay bottom. Benthic habitat field mapping activities will continue to be conducted as the project progresses.

#### Fall '21

- BIO-WEST continued benthic habitat mapping in the Colorado River Delta during this quarter when tidal conditions were appropriate. Field surveys involved side-scan sonar to map benthic habitats including oyster reefs, submerged aquatic vegetation and open bay bottom. Benthic habitat mapping will continue this winter and into the spring as tidal conditions are appropriate.

#### Winter '22

- BIO-WEST continued benthic habitat mapping in the Colorado River Delta using side-scan sonar during this quarter when tidal conditions were appropriate. Benthic habitat mapping will continue this spring as tidal conditions are appropriate.
- BIO-WEST conducted aerial oyster reef mapping in the Colorado River Delta. These surveys were initiated in February 2022 and performed during low tide conditions when oyster reefs were most visible. As weather and tidal conditions permit, aerial oyster reef mapping will continue this spring.

#### Spring '22

- BIO-WEST continued benthic habitat mapping in the Colorado River Delta during this quarter when tidal conditions and weather were appropriate. Field surveys involved side-scan sonar to map benthic habitats including oyster reefs, submerged aquatic vegetation and open bay bottom.
- BIO-WEST continued aerial oyster reef mapping in the study area. Aerial mapping involved a 2-person crew (registered drone pilot and visual observer) imaging select areas with a drone. Benthic habitat field mapping completed to date is highlighted in Figure 1. Benthic habitat mapping will continue this summer and fall as tidal conditions and weather (winds) allow.

#### Summer '22

- BIO-WEST continued benthic habitat map and drone imagery processing. Limited field surveys were conducted this quarter due to tide and wind conditions. Field mapping will be completed this winter following appropriate northers and subsequent low tide conditions in the delta.

#### Fall '22

- BIO-WEST continued benthic habitat map analysis and development. Field mapping should be finished this winter following appropriate northers and subsequent low tide conditions in the delta. Following the completion of field mapping, the ground-truthing phase will be conducted.

#### Winter '23

- BIO-WEST continued benthic habitat map analysis and development. Landcover classification of high-resolution satellite imagery collected over multiple periods in the last three years was analyzed to identify oyster beds and compared to hard shell surfaces located during sonar mapping of the area. Areas of possible

oyster beds or shell hash across the delta were extracted and mapped (see Figure 2). Following the completion of the imagery assessment, a field ground-truthing event will be conducted next quarter.

#### Spring '23

- BIO-WEST mapped and delineated areas of oyster reef and mixed reef/shell hash benthic habitat using side-scan sonar and high-resolution satellite imagery. To test the accuracy of these methods of oyster reef delineation, BIO-WEST deployed biologists to ground-truth the presence/absence of oyster reef at random points throughout the Colorado River Delta project area in May. Tide levels were extremely low on May 25, 2023 when BIO-WEST surveyed delineated oyster reef zones across the study area. BIO-WEST found extensive oyster reef across all sites where it was mapped, even including river channel cuts and the Old River north of the GIWW, the northernmost ecological survey site for this study.

**Task 2 – Ecological Assessment:** Conduct a comprehensive ecological assessment linking the distribution of species and their habitats spatially within the Colorado River Delta study area.

Status: Ongoing

#### Spring '21

- BIO-WEST conducted the Spring 2021 coastal bird surveys for the six established study sites in the delta on May 26-27, 2021.
- BIO-WEST initiated analysis of species and habitat data collected during Spring 2021 coastal bird surveys.
- CSSC conducted first of two sampling events for Spring on June 2<sup>nd</sup>, 2021. Three epibenthic sled samples were taken at six sampling sites. In addition, water quality was taken at two additional sites, see map.
- CSSC conducted the second Spring sampling event on June 11<sup>th</sup>, 2021. Three epibenthic sled samples were taken at six sampling sites along with water quality at sentinel sites. At present, CSSC has 36 samples in house representing Spring samples.

#### Summer '21

- BIO-WEST continued data reduction and analysis for the Avian Survey conducted in Spring '21.
  - Examined acoustic recordings from six sites for the presence of Eastern Black Rails (*Laterallus jamaicensis*), and Whooping Cranes (*Grus americana*).
- CSSC conducted two summer sampling events on August 27<sup>th</sup> and September 8<sup>th</sup>. This included the usual three epibenthic tows at each site except for site 6 which we were unable to reach due to very low water levels typical of the summer months.

- CSSC also deployed three HOBO ware data loggers designed to monitor Temperature and Water Levels at three locations (see map).

#### Fall '21

- BIO-WEST conducted Fall avian point count surveys from October 13-15, 2021, with a team of two biologists covering all six study sites established within the Colorado River Delta. Timed point count surveys (8 points per site) were conducted for each site, with two sites completed per day. In addition to other relevant climate parameters, salinity (ppt) was recorded at the time of each survey. Additionally, acoustic recorders were deployed and set to record continuously at each of the six sample sites. Recorders were set prior to the onset of avian point counts and retrieved at the conclusion of the full survey effort.
- BIO-WEST initiated data reduction and analysis for the Avian point count surveys conducted in October. Acoustic analysis for fall sampling was also initiated by reviewing recordings for evidence of calling Eastern Black Rails (*Laterallus jamaicensis jamaicensis* and Whooping Crane (*Grus americana*).
- CSSC conducted the first Fall sampling event on November 1<sup>st</sup>. This included three epibenthic tows at sites 1-5. Site 6 was still too shallow to sample due to low tides. Water level data loggers were downloaded from sites 1,2, and 5. Our air pressure data logger from site 1 was stolen. Salinity loggers were deployed at sites 2 and 5. PVC mounting poles for data loggers were revamped with a slip-on design.
- CSSC conducted the second Fall sampling event November 8<sup>th</sup>. The same five sites were sampled for a total of 15 samples. Water levels at data loggers were measured at sites 1, 2, and 5.

#### Winter '22

- BIO-WEST conducted Winter avian point count surveys from February 9-11, 2022. This included 8 timed point counts at six established sites and acoustic recordings for the full survey. Relevant climate parameters in addition to salinity (ppt) were recorded.
- BIO-WEST observed over 4,000 individual birds represented by 89 species, with the highest diversity and abundance present along exposed mud flats and oyster beds. Among these, several iconic species were observed including Magnificent Frigatebird, Clapper Rail, and American Avocet. Species largely considered to be indicators of marsh ecosystem stability (i.e., Seaside Sparrow) were also commonly recorded during surveys.
- BIO-WEST initiated data reduction and analysis for the Avian point count surveys conducted in February. Acoustic analysis for Winter sampling was also initiated by reviewing recordings for evidence of calling Eastern Black Rail and Whooping Crane.
- CSSC conducted the first Winter sampling event on February 15<sup>th</sup>. The tide was extremely low on this day and most of our sites were unreachable. In addition, marsh edge habitat was non-existent at all sites. We did manage to pull three samples at our first site which was largely exposed oyster reef. Water level data loggers were downloaded from sites 1 and 5, site 2 was unreachable.

- CSSC conducted the second Winter sampling event on February 22<sup>nd</sup>. The tide was higher, and we were able to sample our regular five sites for a total of 15 samples. Site 6 is still unreachable. Water levels at data logger sites 1, 2, and 5 were measured.

#### Spring '22

- BIO-WEST conducted Spring avian point count surveys from April 27-28, 2022. This effort involved a team of two biologists performing timed point counts (8 per site) at each of the six previously established Colorado River Delta sites. Acoustic recorders were also deployed and set to record continuously at each of the six sample sites. This Spring survey exhibited moderate avian abundance and diversity, with 1,119 individual birds represented by 61 species observed. Contrary to Winter survey observations, diversity was highest at the more inland sites, where relatively large numbers of migratory passerines were observed (e.g., painted bunting, gray catbird, vireos, and warblers). This was most likely due to recent seasonal storm fronts forcing migratories to utilize these areas for refuge.
- BIO-WEST continued data reduction and analysis for the avian point count surveys conducted in April. Acoustic analysis for Spring sampling was also initiated by reviewing recordings for evidence of calling Eastern Black Rail and Whooping Crane.
- CSSC conducted the first Spring sampling event on May 11<sup>th</sup>. This included three epibenthic tows at sites 1-5. Water level data loggers were downloaded from sites 1,2, and 5. Salinity loggers were downloaded from sites 2 and 5.
- CSSC conducted the second Spring sampling event May 27<sup>th</sup>. The same five sites were sampled for a total of 15 samples. Water levels at data loggers were measured at sites 1, 2, and 5. Water levels on this date were the highest we have seen to date.

#### Summer '22

- BIO-WEST continued data reduction and analysis for the avian point count surveys and acoustic analysis for winter and spring avian data. The Fall avian point count surveys are scheduled for late October / early November.
- CSSC conducted the first Summer sampling event on August 12<sup>th</sup> taking three epibenthic tows at sites 1-5. Water level data loggers were downloaded from sites 1,2, and 5. Salinity loggers were downloaded from sites 2 and 5. The Delta experienced heavy rain this day.
- CSSC conducted the second Summer sampling event on August 23<sup>rd</sup>. All sites were sampled and water levels at data loggers at sites 1, 2, and 5 were measured.

#### Fall '22

- BIO-WEST conducted Fall avian point count surveys from November 2-3, 2022. This effort involved a team of two biologists performing timed point counts (8 per site) at each of the six previously established Colorado River Delta sites. Acoustic recorders were also deployed and set to record continuously at each of

the six sample sites. This Fall survey exhibited included 749 individual birds represented by 60 species observed.

- BIO-WEST continued data reduction and analysis for all avian point count surveys conducted in 2022. Acoustic analysis for Fall sampling was also initiated by reviewing recordings for evidence of calling Eastern Black Rail and Whooping Crane. The final avian survey for this project will be conducted next quarter (Winter 2023).
- CSSC conducted the first of two Fall sampling events on October 27<sup>th</sup>. Three epibenthic tows were taken at all five sites for a total of 15 marsh edge samples. Water level data loggers were downloaded from sites 1 and 5. Hobo at site 2 is not working and will be replaced in Winter. Salinity data logger was downloaded from site 5. Salinity was taken from site 2 using a YSI data sonde.
- CSSC conducted the second Fall sampling event on November 11<sup>th</sup>. All sites were sampled for a total of 15 marsh edge epibenthic tows. Water levels were measured at sites 1, 2, and 5. Salinity was taken from site 2 using YSI in lieu of working salinity HOB0 data logger.

#### Winter '23

- BIO-WEST conducted Winter 2023 avian point count surveys from January 25-27, 2023. This effort involved a team of two biologists performing timed point counts (8 per site) at each of the six previously established Colorado River Delta sites. Acoustic recorders were also deployed and set to record continuously at each of the six sample sites. This Winter survey exhibited included 2,023 individual birds represented by 66 species observed.
- BIO-WEST continued data reduction and analysis for all avian point count surveys conducted in this study. Acoustic analysis for Winter sampling was also initiated by reviewing recordings for evidence of calling Eastern Black Rail and Whooping Crane. This concludes all avian sampling for the ecological portion of this project.
- CSSC attempted the first sampling event for Winter on February 15<sup>th</sup>, 2023 but were unable to sample at any of our sites due to extremely low water levels. Over the course of this study, we have learned that a minimum water level of 0.6 feet is required for the marsh edge to be utilized as a habitat for nekton (see graph 1). February tides are historically the lowest of the year which makes sampling marsh edge challenging as the habitat itself is temperamental.
- CSSC tried again on March 2<sup>nd</sup> and again were unable to sample marsh edge due to extreme low water levels.

#### Spring '23

- BIO-WEST concluded all avian data reduction and analysis for the ecological portion of this project in Spring 2023.
- CSSC did not perform any sampling events for the Spring of 2023.

**Task 3 – Hydrological Assessment:** Complete a hydrological assessment to better understand water availability, flow paths, and topography in the Colorado Delta.

Status: Ongoing

Spring '21

- Nothing to report for this quarter.

Summer '21

- Nothing to report for this quarter.

Fall '21

- BIO-WEST initiated the hydrological assessment via data compilation and review of existing imagery and topography of the Colorado River delta study area. BIO-WEST also initiated an examination of flow paths within the Colorado River delta region.

Winter '22

- BIO-WEST continued the hydrological assessment and review of existing imagery and topography of the Colorado River delta study area. Activities associated with this assessment will continue this spring.

Spring '22

- BIO-WEST continued the hydrologic and topographic assessment of the Colorado River delta study area. Activities associated with this flow path desktop assessment will continue this summer and fall.

Summer '22

- BIO-WEST met with relevant stakeholders to discuss water management opportunities in the Colorado River Delta. BIO-WEST organized and compiled TAMU-CC's land cover imagery describing the land / water interface and delta development over time. Activities associated with this desktop hydrologic and topographic assessment of the Colorado River delta study area will continue this fall.

Fall '22

- BIO-WEST continued to analyze available land cover imagery describing the land / water interface and delta development over time. The desktop hydrologic and topographic assessment of the Colorado River delta study area will continue this winter.

Winter '23

- BIO-WEST continued the desktop hydrologic and topographic assessment of the Colorado River delta study area. A site investigation in conjunction with the Task 1 ground truthing field effort is scheduled for next quarter.

Spring '23

- BIO-WEST continued the desktop hydrologic and topographic assessment of the study area. This assessment along with the site investigation performed in May helped to highlight standout avenues that are being considered for further evaluation with respect to potential freshwater inflow refuges during extreme drought.

**Task 4 – Data Analysis, Compilation and Reporting:** Collective data analysis, interim/quarterly reporting, input solicitation, and final reporting.

Status: Ongoing

Spring '21

- 06/30/2021 - Quarterly report No. 1 completed for project.

Summer '21

- 09/30/2021 - Quarterly report No. 2 completed for project.
- CSSC has 66 marsh edge epibenthic samples in house.

Fall '21

- 12/30/2021 - Quarterly report No. 3 completed for project.
- CSSC has 96 marsh edge epibenthic samples in house.

Winter '22

- 3/31/2022 – Quarterly report No. 4 completed for project.
- CSSC has 114 marsh edge epibenthic samples in house.

Spring '22

- 6/30/2022 – Quarterly report No. 5 completed for project.
- CSSC has 144 marsh edge epibenthic samples in house.

Summer '22

- 9/30/2022 – Quarterly report No. 6 completed for project.
- CSSC has 174 marsh edge epibenthic samples in house.

Fall '22

- 12/31/2022 – Quarterly report No. 7 completed for project.
- CSSC has 204 marsh edge epibenthic samples in house.

Winter '23

- 3/31/2023 – Quarterly report No. 8 completed for project.
- CSSC has 204 total marsh edge epibenthic samples in house.
- All 204 samples have been processed. All animals were identified to species when possible, enumerated, and measured to the nearest .01 mm.

Spring '23



- 6/30/2023 – Quarterly report No. 9 completed for project.
- CSSC has begun analyzing all biological data in preparation for the final report due Summer of 2023.
- BIO-WEST will be assisting TAMU-CC in the preparation of a Final Report during Summer 2023.

Figure 1.

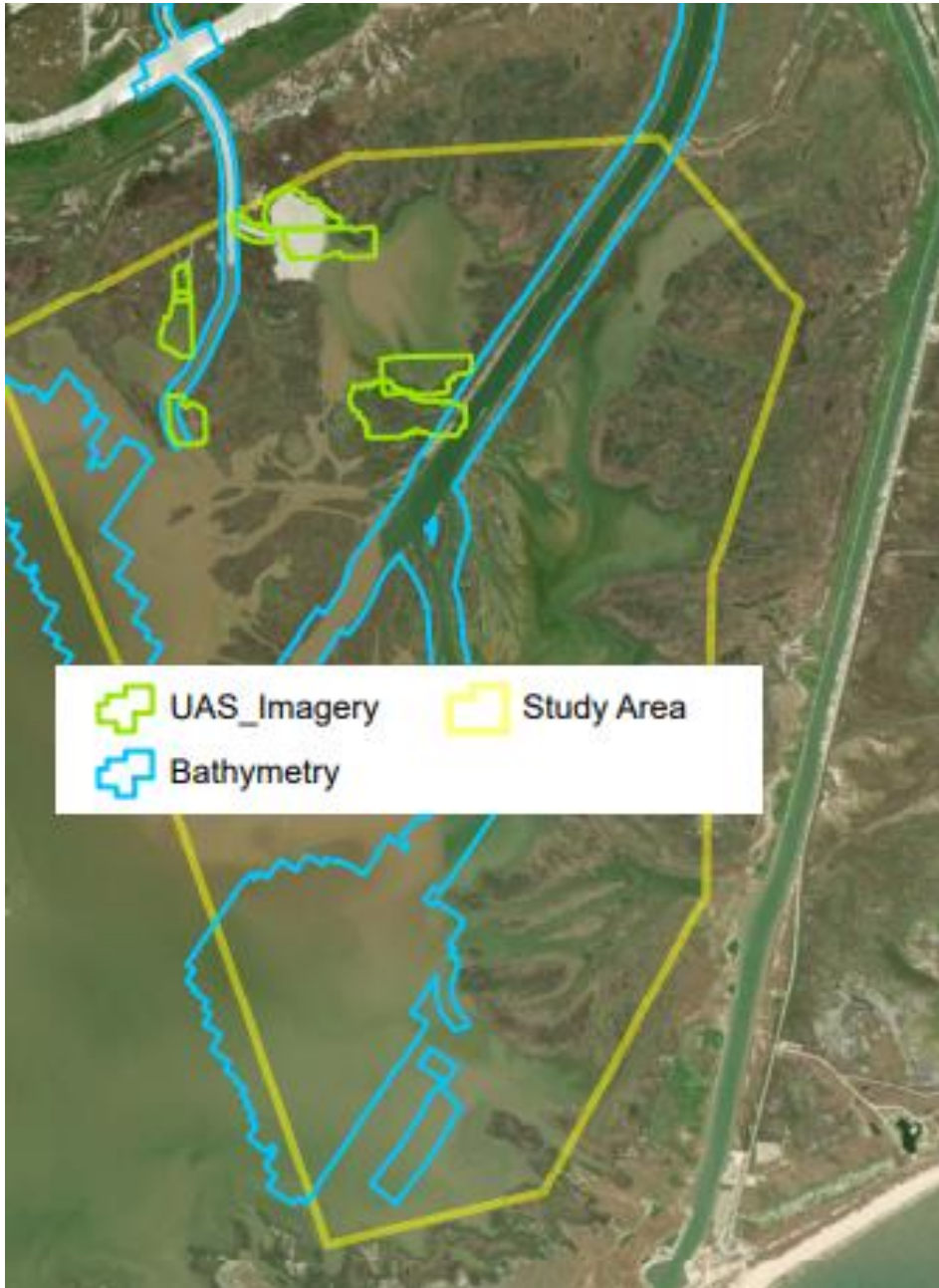
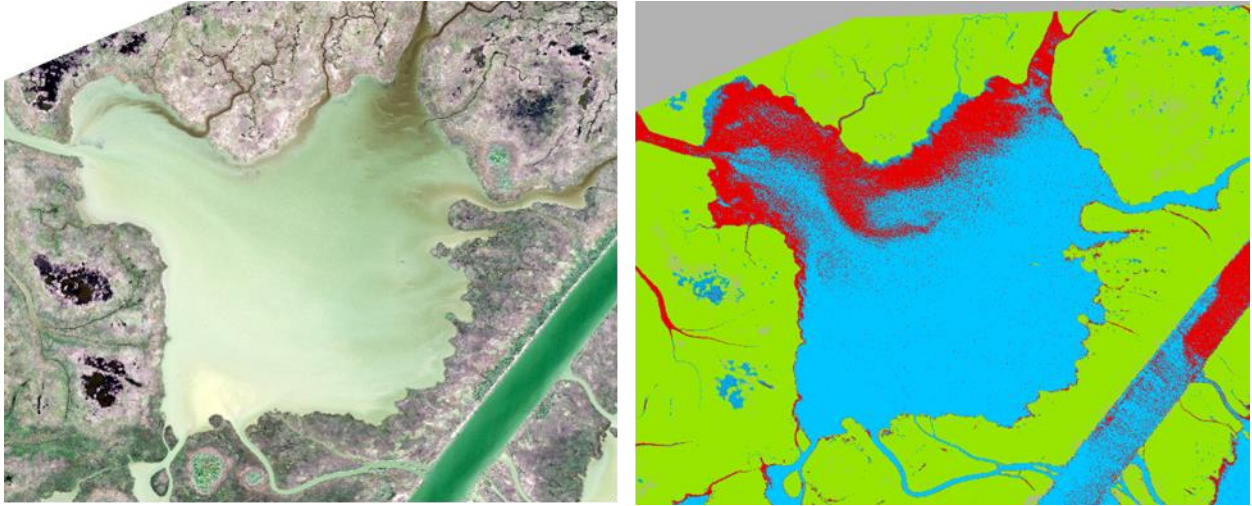
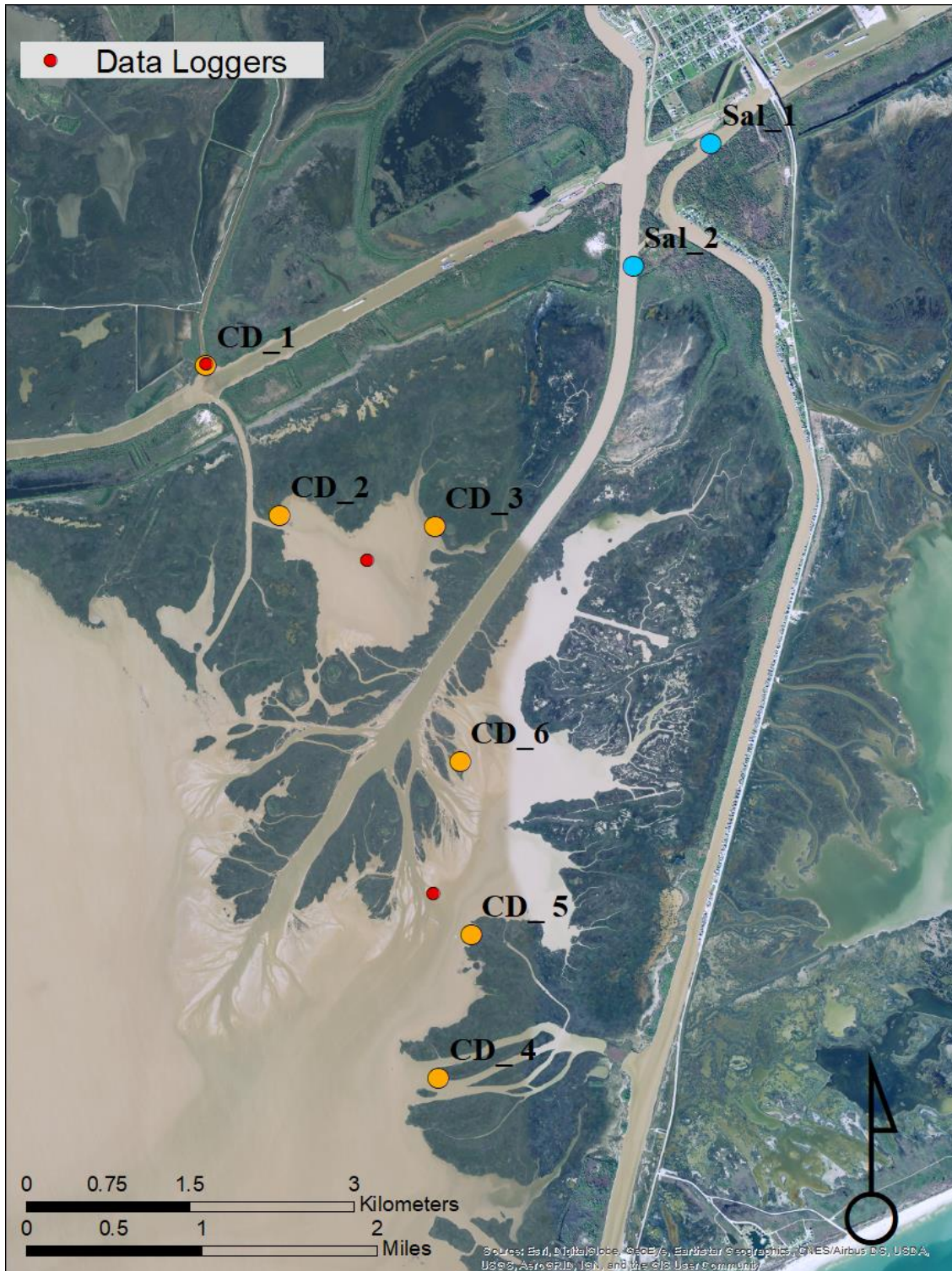


Figure 2.



High resolution satellite imagery from November 2022 and groundcover classification to extract oyster bed areas for comparison against sonar imaging.

Map 1.



Graph 1.

