University of Houston Clear Lake

Environmental Institute of Houston

Matagorda Bay Mitigation Trust (MBMT)
Quarterly Progress Report (QPR): FY25, Quarter 2 (December 2024 – February 2025)

TITLE OF MBMT CONTRACT No. 033:
Microplastic Distribution and Impacts to Diamond-backed Terrapin, Highlighting Public Education and Future Effects of Sea-Level Rise

Performing Party	University of Houston-Clear Lake (UHCL)
Funding Agency	Matagorda Bay Mitigation Trust (MBMT)
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This QPR describes the FY25 Quarter 2 portion of the MBMT Project undertaken by UHCL under Contract No. 033 between the MBMT and UHCL. Questions about this project or QPR should be directed to Mandi Gordon (gordon@uhcl.edu).

Objective 1: Compile historic and current spatial data related to dispersion and accumulation of microplastic contaminants within Matagorda and San Antonio Bays.

Task 1.1: Compile historic spatial data for use in projection models (see Objective 2 for model description).

FY25 Q2 Progress: Data compilation has begun and will continue through the fiscal year.

TASK STATUS: Ongoing

Task 1.2: Identify locations for field surveys focused on topographic and bathymetric data collection.

FY25 Q2 Progress: Potential locations for topographic field surveys have been preliminarily identified in Matagorda Bay. A final list of field locations in Matagorda Bay may be selected in conjunction with sites that are identified in FY25 for potential diamondback terrapin presence based on species distribution model (SDM) results (Task 4.3).

TASK STATUS: Ongoing

Task 1.3: Procure Federal Aviation Administration (FAA) remote pilot certificates for new project personnel.

FY25 Q2 Progress: Co-PI M. Mokrech is currently FAA Part 107 certified. Other current UHCL project personnel have begun the training and certification process for FAA remote pilot certificates. L. Thurman is planning on taking the certification exam in FY25 Q3. As new project personnel are on-boarded, they will be trained, as needed.

TASK STATUS: Ongoing

Task 1.4: Obtain access permissions for field surveys focused on topographic and bathymetric data collection.

FY25 Q2 Progress: Initial survey locations have been identified. These locations are subject to changes if needed. As survey locations are finalized, access permissions will be coordinated with landowners and/or managers, as needed.

TASK STATUS: Ongoing

Task 1.5: Conduct field surveys in select areas to compile current topographic and bathymetric data.

FY24 Q1 Progress: Task has not been started.

FY24 Q2 Progress: Task has not been started.

FY24 Q3 Progress: Task has not been started.

FY24 Q4 Progress: Task has not been started.

FY25 Q1 Progress: Task has not been started.

FY25 Q2 Progress: Task has not been started.

TASK STATUS: Pending

Objective 2: Investigate the implications of sea-level rise on coastal habitats and evaluate its effect on current and future roles of shoreline habitats in filtering microplastic contaminants.

Task 2.1: Incorporate historic and current spatial data into dispersion and habitat projection models.

FY25 Q2 Progress: Data compilation is ongoing and will be continued through the fiscal year. An initial modeling workflow has been developed (Figure 1) and will be refined as additional data sources are identified.

TASK STATUS: Ongoing

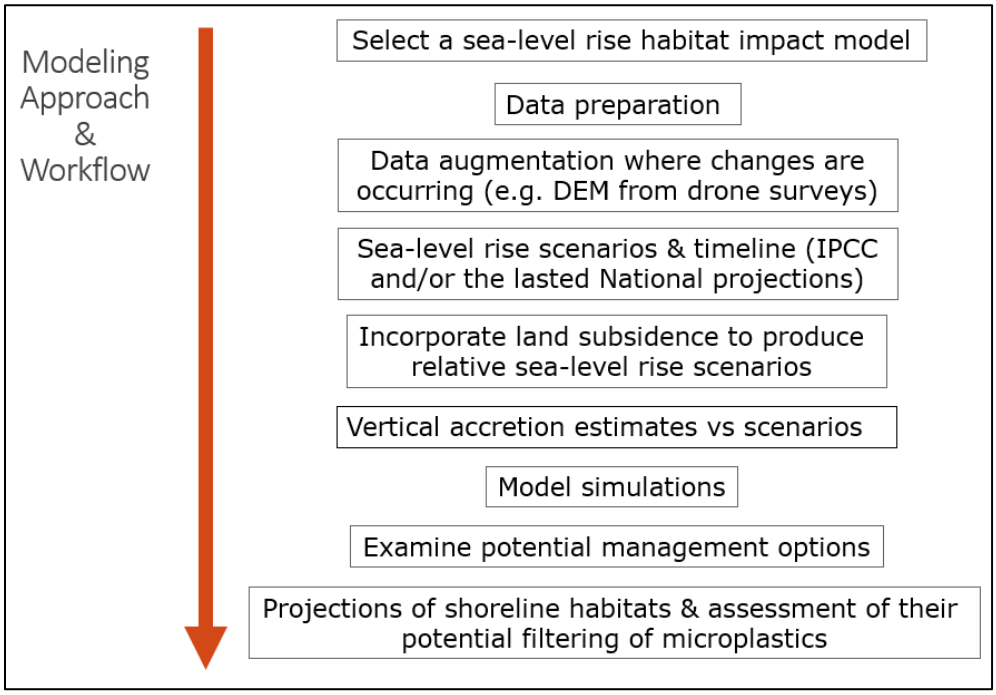

Figure 1 Initial plans for spatial modeling approach and workflow. Note: the modeling steps included are subject to modifications and rearrangement in sequence, as needed.

Task 2.2: Perform models incorporating accommodation space, sediment supply, and rate of relative sea-level rise to simulate wetland losses over time and quantify future habitat changes and distributions.

FY25 Q2 Progress: Two staff gauges have been temporarily installed in Matagorda Bay to monitoring short-term local geomorphological changes during future survey efforts.

TASK STATUS: Ongoing

Task 2.3: Examine use of adaptation options that aim to minimize habitat losses under future conditions.

FY25 Q2 Progress: Preliminary investigation of an adaptation option has begun.

TASK STATUS: Ongoing

Task 2.4: Use current data to conduct micro-level modeling at selected sites and evaluate potential for shoreline habitats in filtering microplastic contaminants.

FY25 Q2 Progress: Non-surface-level sediment cores of depths greater than 5-cm were collected from three sites in Matagorda Bay. Cores were taken in low marsh, high marsh, and unvegetated/channel sediment zones at each site to investigate the potential of coastal saltmarshes in filtering microplastics from the environment. More sampling sites in Matagorda Bay may be selected in conjunction with sites that are identified in FY25 based on SDM results (Task 4.3).

TASK STATUS: Ongoing

Task 2.5: Generate a publicly accessible web application to document historic, current, and projected microplastic dispersion within Matagorda and San Antonio Bays.

FY25 Q2 Progress: Task has not been started.

TASK STATUS: Pending

Objective 3: Expand Nurdle Patrol survey methods to areas otherwise inaccessible to the public within Matagorda and San Antonio Bays and apply newly developed standardized protocols for microplastic shoreline sediment sampling.

Task 3.1: Identify locations for field surveys focused on shoreline sediment sampling.

FY25 Q2 Progress: Pilot study sampling has been conducted at three sites (during FY24 Q3) and as of this QPR, surficial sediment cores have been collected from four spatially distinct sites in Matagorda Bay with additional sites in Matagorda and San Antonio Bay identified for surveys in FY25 Q3 and Q4.

TASK STATUS: Ongoing

Task 3.2: Obtain access permissions for field surveys focused on shoreline sediment sampling.

FY25 Q2 Progress: With the identification of additional sites to be sampled in FY25 Q3 and Q4, access permissions have been obtained through WMA permits for Powderhorn Wildlife Management Area and Welder Flats Wildlife Management Area. All other sites are currently publicly accessible. As access permissions are needed, they will be obtained prior to field sampling.

TASK STATUS: Ongoing

Task 3.3: Conduct expanded Nurdle Patrol surveys and standardized shoreline sampling protocols.

FY25 Q2 Progress: As of this QPR, three Nurdle Patrol surveys have been conducted concurrently with sediment sample collection. Results for these Nurdle Patrol surveys will be submitted to nurdlepatrol.org in FY25 Q3. Additional Nurdle Patrol surveys are planned concurrent with future sampling in FY25 Q3 and Q4.

TASK STATUS: Ongoing

Task 3.4: Submit all nurdle observations directly to the Nurdle Patrol global database.

FY25 Q2 Progress: The results of the opportunistic surveys from August 2024 and December 2024 will be submitted to nurdlepatrol.org in FY25 Q3. Additional surveys conducted in FY25 Q3 and Q4 will be submitted after all field sampling is complete.

TASK STATUS: Ongoing

Task 3.5: Analyze shoreline sediment samples for presence of microplastic particles of varying sizes and types.

FY25 Q2 Progress: Sediment processing protocols have been finalized (Figure 2) and implemented on samples collected in August 2024. Samples will undergo a step-wise process including drying, sieving (using 5-mm and 100-µm sieves), small-scale density separation, organic digestion using 30% hydrogen peroxide (H_2O_2), and finally enumeration using a microscope. Preliminary results from (n = 12) samples total 106 individual microplastics counted (n = 72 fibers, n = 31 fragments, n = 2 pieces of foam, and n = 1 fiber bundle).

TASK STATUS: Ongoing

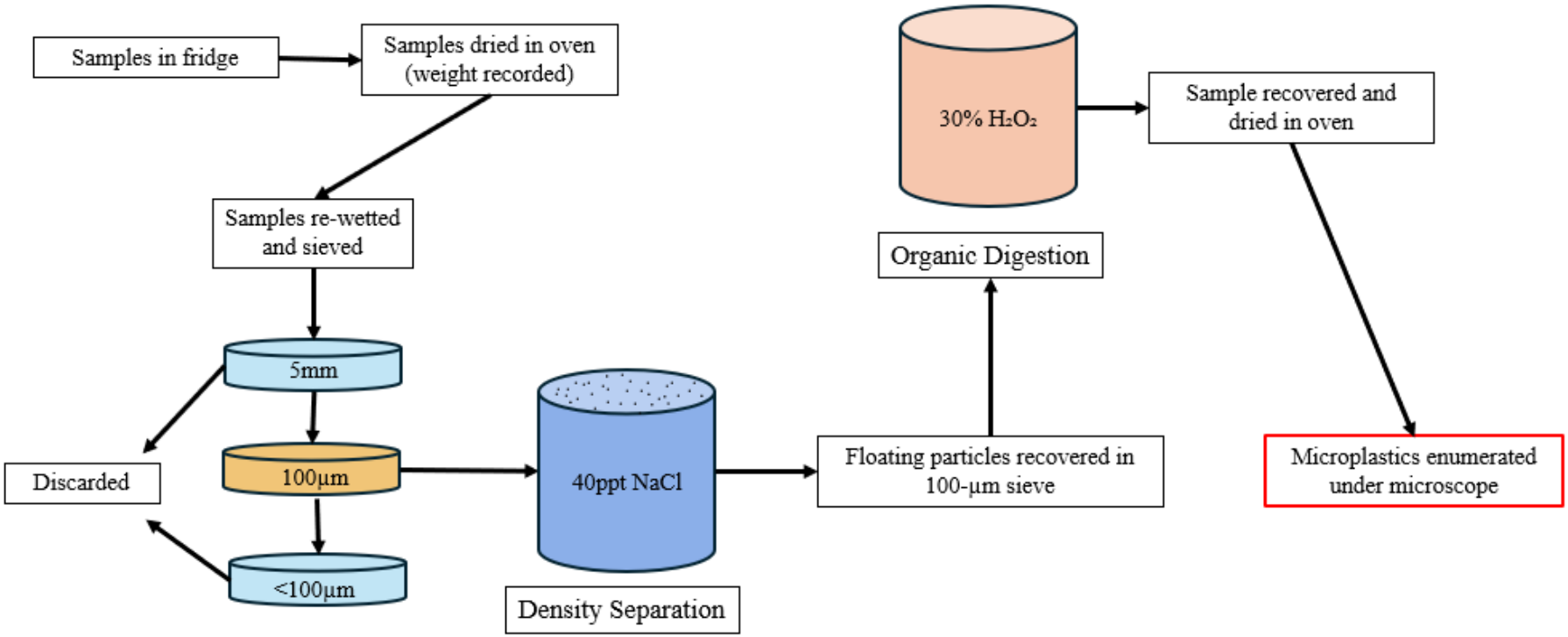

Figure 2 Summary of Laboratory Processing Protocols.

Objective 4: Evaluate the relationship between dispersion, habitat use, and bioaccumulation of microplastic contaminants in a sentinel wildlife species, the Diamondbacked Terrapin (herein referred to as "terrapin", *Malaclemys terrapin littoralis*).

Task 4.1: Obtain an updated Texas Parks and Wildlife (TPWD) Aerial Wildlife Monitoring (AWM) Permit.

FY25 Q2 Progress: Due to state and federal bans of UHCL-owned drone equipment and software, this task was cancelled at the end of FY24 Q4. If state or federally approved equipment are obtained during the study duration, this task may be re-evaluated later in FY25 or FY26.

TASK STATUS: CANCELLED

Task 4.2: Update existing TPWD Scientific Permit for Research (SPR) and current Institutional Animal Care

FY25 Q2 Progress: UHCL currently holds a TPWD SPR permit for wildlife surveys coast-wide in Texas and an approved IACUC protocol for handling and collecting samples from aquatic turtles in Texas. In FY25 Q3, steps to update permits will begin to include holding terrapin overnight for fecal samples. These documents require annual review and will be maintained throughout the project duration.

TASK STATUS: Ongoing

Task 4.3: Identify locations for field surveys focused on terrapin detection and capture.

FY25 Q2 Progress: Two locations in Matagorda Bay were identified in FY24 for field surveys based on prior surveys conducted by Guillen et al. (2015). Project personnel have partnered and are coordinating with researchers from other universities and state agencies to identify other known population locations in the Matagorda Bay complex. These institutions have other ongoing research projects focused on terrapin and surveys will be coordinated to not disrupt ongoing studies.

To select a full complement of survey locations in Matagorda and San Antonio Bays, species distribution models (SDM) are being developed to identify areas of highest likelihood (e.g., "hotspots") of terrapin presence. As of this QPR, historic terrapin occurrence data for use in species distribution models are in the final stages of cleaning, organizing, and duplication removal, with nearly 2,000 occurrences compiled to date. Environmental and habitat co-variates have been identified and retrieved from open-access databases and formatted in ArcGIS Pro for input. Preliminary test runs of the models have been performed using subsets of available data; more robust and final models will be developed in FY25 Q3 and Q4. The final SDM will be used to inform Tasks in Objectives 1, 2, and 3.

As of this QPR, three additional sites in Matagorda and San Antonio Bay have been selected for field surveys in FY25 Q3 and Q4. These sites were selected to expand spatial distribution of the survey locations and are coincident with reports of terrapin observations or activities from external partners.

TASK STATUS: Ongoing

Task 4.4: Conduct field surveys to capture terrapin for assessment of microplastic contaminant bioaccumulation.

FY25 Q2 Progress: In December of 2024, three sites (including one site previously sampled in August of 2024) were visited by project personnel to collect 1-ft sediment core samples. While visiting these sites, no traps were set, and no walking transect surveys were conducted; however, project personnel kept a keen eye for heads and terrapin during sediment sampling. No terrapin were detected at this time, appropriately for winter as most terrapin were likely in brumation.

TASK STATUS: Ongoing

Task 4.5: When conditions allow, conduct surveillance drone flights to pinpoint location(s) of terrapin.

FY25 Q2 Progress: Due to state and federal bans of UHCL-owned drone equipment and software, this task was cancelled at the end of FY24 Q4. If state or federally approved equipment are obtained during the study duration, this task may be re-evaluated in FY25 or FY26.

TASK STATUS: CANCELLED

Task 4.6: Hold captured terrapin overnight (up to 24-hours) in individual containers to collect stomach and/or fecal contents for evaluation of "ingested" microplastic contaminants.

FY25 Q2 Progress: Fecal sample collection protocols are being refined based on a previous study by Alleman and Guillen (2017). As of this QPR, no terrapin have been held overnight for fecal sample collection and updated permits are pending. Supplies for sample collection and processing have been procured.

After discussions with veterinarians from the Houston Zoo, we have decided not to collect stomach contents from live terrapin as this procedure would require anesthesia, is invasive, and has the potential for harm to the animal (J. Flanagan, Chief Veterinarian, Houston Zoo, personal communication). Protocols for obtaining stomach contents from dead terrapin through necropsy are being developed. As of this QPR, no stomach content samples have been collected.

TASK STATUS: Ongoing

Task 4.7: Collect blood and/or tissue samples to perform traditional blood panel "health" analyses to elucidate patterns in changes of health indices resulting from increased particle ingestion.

FY25 Q2 Progress: Standardized blood collection, handling, and processing techniques have been established and current project personnel have received training. Project personnel are continuing to coordinate with internal and external laboratories to identify the most efficient and effective way to analyze samples. As of this QPR, no terrapin have been captured and no blood samples have been collected in Matagorda or San Antonio Bays. During personnel training sessions in Galveston Bay, blood samples from 11 terrapin were collected and will be used with previous UHCL samples to continue refining laboratory procedures.

TASK STATUS: Ongoing

Task 4.8: Examine reproductive structures (follicles and eggs) in female terrapin using a portable ultrasound.

FY25 Q2 Progress: Updated portable ultrasound devices were acquired in FY24 and project personnel have been trained in operation of the new technology. Protocols were updated in reference to the use of the new unit. As of this QPR, no additional exams have been administered to terrapin in Matagorda or San Antonio Bays.

TASK STATUS: Ongoing

Task 4.9: Analyze results of blood and/or tissue collection, health indices, and reproductive data for correlations between microplastic bioaccumulation and/or habitat accumulation.

FY25 Q2 Progress: Task has not been started.

TASK STATUS: Pending

Objective 5: Provide educational opportunities for residents of areas in and around Matagorda and San Antonio Bays to raise awareness of microplastic contaminants and their potential impacts to shoreline habitats.

Task 5.1: Coordinate with local educators to identify areas of interest for education and/or outreach programs.

FY25 Q2 Progress: We have met with the Matagorda Bay Foundation to develop a "virtual field trips" video series. The Matagorda Bay Foundation has agreed to host these videos on their updated website to expand shareability within the Matagorda Bay community.

TASK STATUS: Ongoing

Task 5.2: Develop a program outline for environmental education targeted to communities around Matagorda and San Antonio Bays.

FY25 Q2 Progress: Filming for the first virtual field trip segment was filmed concurrently with collection of sediment samples during field surveys in FY25 Q2. A storyboard has been drafted, and we plan to continue filming in FY25 Q3 and Q4. Script development for the field trip videos is ongoing and film editing continues.

TASK STATUS: Ongoing

Task 5.3: Generate easily incorporated modules on topical areas of interest which utilize data collected (see Objectives 1-4) to make learning exciting and relevant.

FY25 Q2 Progress: Three module topics have been identified, and work has begun on the virtual field trip videos which will be the focus point of each module

TASK STATUS: Ongoing

Task 5.4: Host up to four environmental education workshops for students, teachers, and other interested groups in communities around Matagorda and San Antonio Bays.

FY25 Q2 Progress: Task has not been started

TASK STATUS: Pending

Task 5.5: Partner with the UHCL Pre-Service Educator program to develop a workshop aimed at exposing future educators outside of the Matagorda and San Antonio Bay systems to ongoing environmental topics of interest.

FY24 Q1 Progress: Task has not been started.

FY24 Q2 Progress: Task has not been started.

FY24 Q3 Progress: Task has not been started.

FY24 Q4 Progress: Task has not been started.

FY25 Q1 Progress: Task has not been started.

FY25 Q2 Progress: Task has not been started

TASK STATUS: Pending

Literature Cited

Alleman, B.J., Guillen, G.J. 2017. Prey availability and diet analysis of Texas Diamond-backed Terrapin (*Malaclemys terrapin littoralis*). Chelonian Conservation and Biology. 16(1):52–61.

Guillen, G., Moss, A., Oakley, J., Mokrech, M., George, R., Alleman, B., Bush, D. 2015. Population survey of the Texas Diamondback Terrapin in San Antonio Bay, Matagorda Bay, and Sabine Lake. Environmental Institute of Houston, University of Houston-Clear Lake. EIH Report #15-001. 194 pp.