Matagorda Bay Mitigation Trust (MBMT)
Quarterly Progress Report (QPR): Fiscal Year (FY) 25, Quarter 3 & 4 (March – August 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 3 & 4 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 Q3 & Q4 Progress:

We have begun data compilation which will continue through Q1 and Q2 of FY26.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

We have preliminarily identified potential locations for topographic field surveys in Matagorda Bay. After multiple delays in quoting, ordering, and procurement, we received a LiDAR equipped UAV unit in FY25 Q4. Final registration and document processing are ongoing with data collection flights planned for Q1 and Q2 of FY26. The final timing of these surveys is weather and condition dependent.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

M. Mokrech (project co-PI) and L. Thurman (graduate research assistant), are currently FAA Part 107 certified. We are continuing to train field observers and have planned additional training flights for Q1 of FY26, prior to final field data collection. We will continue to train new project personnel as they are hired, as needed.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

We have identified initial survey locations and will coordinate access permissions 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.

FY25 Q3 & Q4 Progress:

After multiple delays in quoting, ordering, and procurement, we received a LiDAR equipped UAV unit in FY25 Q4. Final registration and document processing are ongoing with data collection flights planned for Q1 and Q2 of FY26. The final timing of these surveys is weather and condition dependent.

TASK STATUS: Ongoing

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 historical and current spatial data into dispersion and habitat projection models.

FY25 Q3 & Q4 Progress:

We are continuing to compile and smooth data for modeling purposes. This will continue through Q1 and Q2 of FY26. We have developed an initial modeling workflow (Figure 1) and we will refine this workflow as additional data sources are identified and model parameters are refined.

TASK STATUS: Ongoing

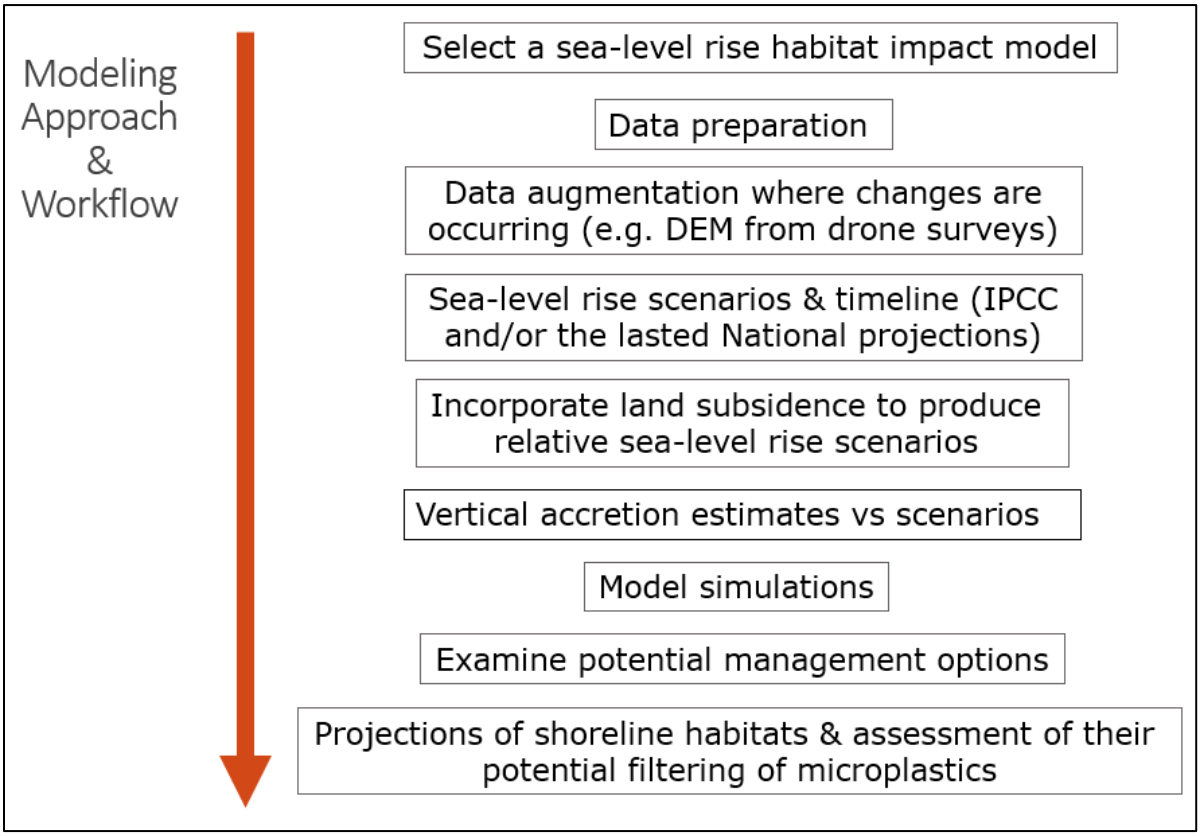

Figure 1 Initial plans for spatial modeling approach and workflow. Note: the modeling steps included are subject to modifications and rearrangement in sequence, as needed.

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 Q3 & Q4 Progress:

We have decided to utilize a modeling approach based on augmenting existing datasets to improve the quality of the modeling data. We conducted model comparisons in FY24 Q3 and Q4 to identify the best model for investigating the impacts of sea-level rise on coastal saltmarshes in Matagorda and San Antonio Bay. We will continue data preparation and model setting in to Q1 and Q2 of FY26.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

We have begun preliminary investigation of an adaptation option.

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 Q3 & Q4 Progress:

We collected non-surface sediment cores following preliminary methods in Matagorda Bay in August 2024 to examine sediment composition at depths greater than 5-cm. Using the results of these experimental samples, we refined and standardized the non-surface sediment core sample collection protocols for later sampling events.

In December of 2024, we collected non-surface sediment cores at depths greater than 5-cm from three sites in Matagorda Bay (Table 1; Figure 2). We collected these cores in the low marsh, high marsh, and unvegetated channel sediment zones at each site to investigate the potential of coastal saltmarshes for filtering microplastics from the environment.

We have developed and are refining the lab workflow for quantifying microplastics in the non-surface sediment cores will continue this work into Q1 and Q2 of FY26.

TASK STATUS: Ongoing

Table 1 Final list of sites selected for sediment sample collection.

Site ID	Site Name	Primary Bay	Core Type	Terrapin Confirmed
CIB	Coon Island Bay	Matagorda	5-cm surface and 1-ft depth	2015[a]
HB	Hynes Bay	San Antonio	5-cm surface	--
KC	Keller Creek	Matagorda	5-cm surface	2025[b]
MIL	Mad Island Lake	Matagorda	5-cm surface	--
OL	Oyster Lake	Matagorda	1-ft depth	--
PC	Placedo Creek	Matagorda	5-cm surface	2025[b]
PH	Powderhorn WMA	Matagorda	5-cm surface	--
SL	Salt Lake	Matagorda	5-cm surface	2025[b]
TPB	Tres Palacios Bay	Matagorda	1-ft depth	--
WF	Welder Flats WMA	San Antonio	5-cm surface	2024[c]

[a]Guillen et al. 2015; [b]Current study; [c]S. McCracken, TAMU-CC, *personal communication*

Figure 2 Map of sediment sample collection locations in Matagorda and San Antonio Bays.

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

FY25 Q3 & Q4 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 Q3 & Q4 Progress:

We collected 5-cm depth surface sediment cores following preliminary methods in Matagorda Bay in March 2024 at three spatially distinct areas within Matagorda Bay to examine sediment composition and refine laboratory protocols for processing samples. Using the results of these experimental samples, we refined and standardized the core sample collection protocols for later sampling events.

Over a 12-month period from August 2025 to August 2025, we collected 5-cm depth surface sediment cores at eight sites in Matagorda and San Antonio Bays (Table 1; Figure 2). We collected these cores along the shoreline and at randomized locations within the low marsh to investigate the potential of coastal saltmarshes for filtering microplastics from the environment. Sites were visited a minimum of two times with as much time between sampling events as possible to aid in detecting potential for temporal variation in microplastic detection or loading.

We have developed and are refining the lab workflow for quantifying microplastics in the 5-cm depth surface sediment cores and will continue this work into Q1 and Q2 of FY26.

TASK STATUS: COMPLETE

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

FY25 Q3 & Q4 Progress:

During FY25 Q3, we requested and obtained access permits through Texas Parks and Wildlife Department (TPWD) for Powderhorn and Welder Flats Wildlife Management Areas (WMA). All other sites included as part of the sediment sample collection portion of this study were publicly accessible.

As of this progress report, we have completed sediment sample collection, therefore we do not anticipate needing access permissions in the future.

TASK STATUS: COMPLETE

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

FY25 Q3 & Q4 Progress:

As of this progress report, we have conducted 27 Nurdle Patrol surveys in concurrent survey areas around Matagorda and San Antonio Bays. As we conduct additional field surveys for other tasks throughout the remainder of the project period, we may conduct more Nurdle Patrols.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

Of the twenty-seven Nurdle Patrols conducted to date, two surveys resulted in observation of twenty-five total nurdles (23 at one site on 08/15/2024 and 2 at another site on 06/10/2025).

We have submitted data for all Nurdle Patrol surveys conducted throughout the end of FY25 Q3 to nurdlepatrol.org.

During FY26 Q1, we intend to submit the remaining Nurdle Patrol survey data to nurdlepatrol.org. As we conduct additional field surveys for other tasks throughout the remainder of the project period, we may conduct more Nurdle Patrols and complete data submission.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

During FY24 and early FY25, we developed, refined, and tested sediment processing protocols for microplastic enumeration and identification. We have utilized these protocols on samples collected since August 2024.

In FY26, sediment samples will undergo a step-wise process (Figure 3) including drying, sieving (using 5-mm and 100-µm sieves), small-scale density separation, organic digestion (using 30% hydrogen peroxide; H_2O_2), and we will enumerate and identify microplastic particles using a dissection microscope.

As of this progress report, preliminary results from the 5-cm depth surface sediment samples (*n* = 45) have resulted in 268 observed microplastic particles (fibers: *n* = 173; fragments: *n* = 91; foam: *n* = 2; and fiber bundles: *n* = 2). Results from the 1-ft depth sediment cores are still pending. See Figure 1 for examples of each particle type.

TASK STATUS: Ongoing

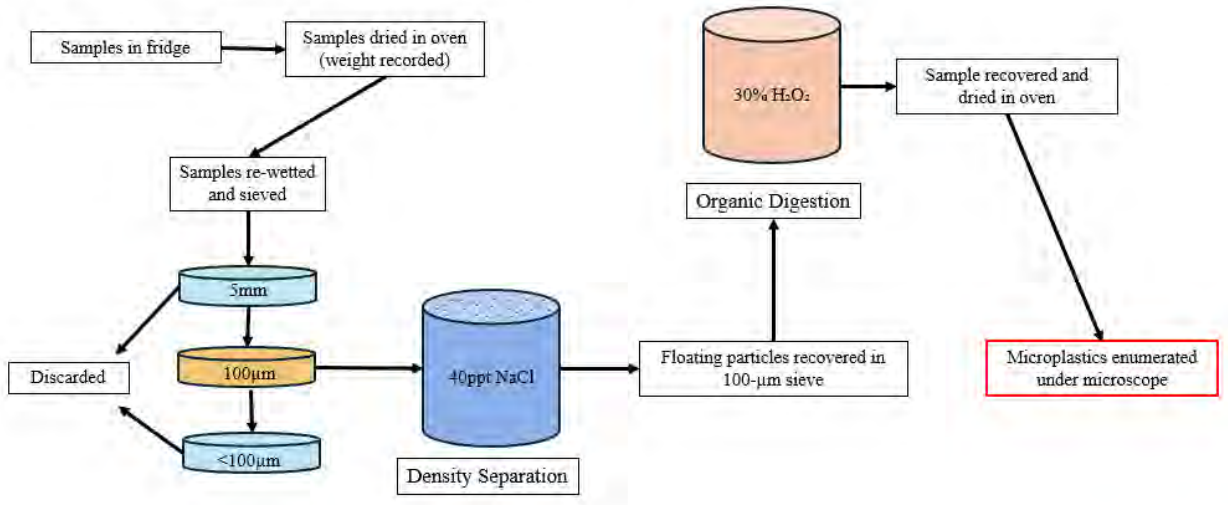

Figure 3 Summary of laboratory processing protocols for sediment samples.

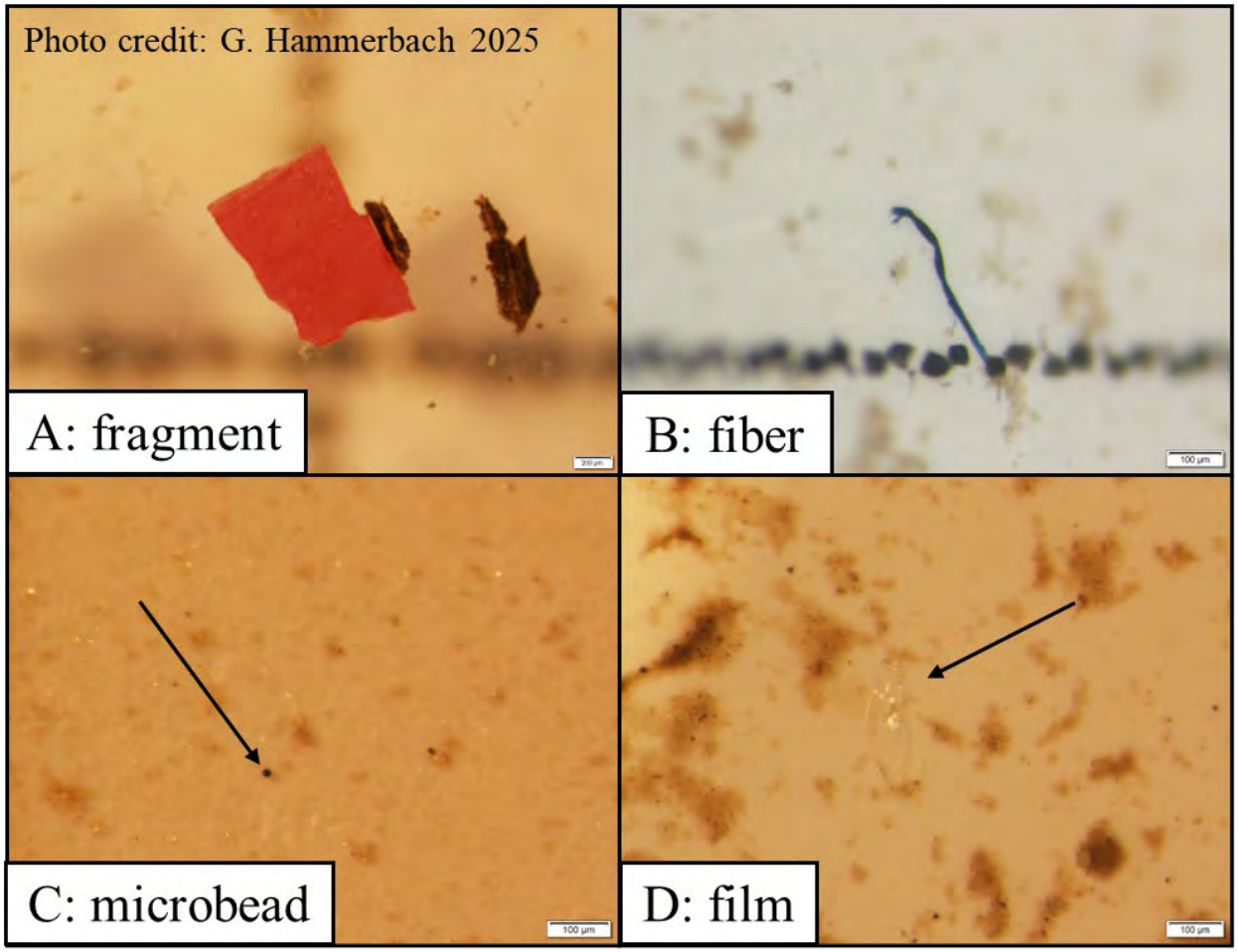

Figure 4 Examples of microplastic particles observed under a dissection microscope.

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 Q3 & Q4 Progress:

Due to state and federal bans on UHCL-owned drone equipment and software, we decided to cancel this task at the end of FY24 Q4. If we are successful in obtaining state or federally approved equipment through other funding sources 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 and Usage Committee (IACUC) Protocols.

FY25 Q3 & Q4 Progress:

M. Gordon (Lead project PI) currently holds a TPWD Scientific Permit for Research (SPR-0321-026) for wildlife surveys coast-wide in Texas and an approved IACUC protocol for handling and collecting samples from aquatic turtles in Texas. These documents have been and will continue to be maintained throughout the project period.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

We identified two locations in Matagorda Bay for field surveys based on prior surveys conducted by Guillen et al. (2015) (KB and CIB in Figure 2). We selected two additional locations in Matagorda Bay based on recommendations from TPWD biologists or researchers from other universities (PC and PH in Figure 2). We selected one location in San Antonio Bay (WF in Figure 2) based on recommendations by researchers from other universities. Three additional locations were selected in Matagorda (SL, MIL, and HB in Figure 2) based on available habitat types and to expand surveys into areas where terrapin activities were unknown.

We intend to use the results of our field surveys to further develop and refine species distribution models (SDM) for likelihood of terrapin occurrence in the Matagorda and San Antonio Bay Areas. As of this QPR, historic terrapin occurrence data for use in these models are in the final stages of cleaning, organizing, and duplication removal with almost 2,000 occurrences compiled to date. We have identified environmental and habitat co-variates and retrieved data from open-access databases and formatted in ArcGIS Pro for input.

TASK STATUS: COMPLETE

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

FY25 Q3 & Q4 Progress:

Across all visits, we were successful in capturing terrapin at two locations (KC and SL in Figure 2) and evidence (carcass or head observation) of terrapin activity was documented at a third (PC in

Figure 2). Both terrapin captured were adults (one male and one female). We collected blood samples from the two captured individuals and results of analyses are pending as of this progress report.

TASK STATUS: COMPLETE

Table 2 Summary of terrapin captures for duration of study.

Site ID	Notch Number	Capture Method	Sex	mid-SCL (mm)	Weight (kg)
KC	N1092	Hand	Female	203	1.40
PC*	N/A	Dead	Unknown	N/A	N/A
SL	N1093	Trap	Male	126	0.35
SL*	N/A	Head	N/A	N/A	N/A

*Either carcass fragments (PC) or observed during a visual head survey (SL)

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

FY25 Q3 & Q4 Progress:

Due to state and federal bans on UHCL-owned drone equipment and software, we decided to cancel this task at the end of FY24 Q4. If we are successful in obtaining state or federally approved equipment through other funding sources during the study duration, this task may be re-evaluated later 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 Q3 & Q4 Progress:

We held both captured individuals (Table 2) overnight for fecal sample collection following approve permit and IACUC protocols. We have processed these fecal samples using the same protocol for sediment processing and as of this progress report, enumeration results are pending.

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 Q3 & Q4 Progress:

We have established standardized blood collection, handling, and processing techniques and trained project personnel in these procedures. We collected blood samples from the two captured individuals (Table 2) and results of analyses are pending as of this progress report. Due to low sample size from turtles in the Matagorda and San Antonio Bay areas, we may supplement health indices data using results of analyses from terrapin captured in the Galveston Bay area as part of routine, long-term monitoring efforts.

TASK STATUS: Ongoing

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

FY25 Q3 & Q4 Progress:

We purchased updated portable ultrasound devices in FY24 and trained project personnel in its operation and use. During FY25 Q4, one of the two individuals captured was a mature female, so we conducted an ultrasound examination. No obvious reproductive structures (e.g., follicles or eggs) were observed during the examination.

TASK STATUS: COMPLETE

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 Q3 & Q4 Progress:

As of this progress report, results of blood panel analyses are still pending.

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 Q3 & Q4 Progress:

In FY24 Q3 and Q4, we met with non-formal Environmental Education providers in the Matagorda and San Antonio Bay areas. During these meetings and after an initial review of currently available educational modules, we identified a gap in readily available "virtual field trip" options. We are continuing to review available education modules through the remainder of the contract period as we develop our outreach materials further.

In FY25 Q2 we met with the Matagorda Bay Foundation to develop a "virtual field trip" 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 Q3 & Q4 Progress:

After identifying a need for readily available "virtual field trip" options, we began developing storyboards for our first virtual field trip on the topic of "Modelling the extent and impact of sea level rise." Filming for this initial video in the series began in FY25 Q1 and continued through FY25 Q3. We have developed a script for this video are continuing to edit the film and audio through FY26 Q1 and Q2.

We are developing additional video topics and plan to continue throughout the remainder of the contract period.

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 Q3 &Q4 Progress:

As of this QPR, we have identified three video module topics and are further developing and refining these modules throughout the remainder of the contract period.

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 Q3 & Q4 Progress:

Task as 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.

FY25 Q3 & Q4 Progress:

Task as 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.