

Project Name: Assessing multi-trophic impacts of microplastic pollutants across macroinvertebrate food webs in Matagorda Bay, Texas

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Contract No: 0046

Reporting Period: 3/01/2025-05/31/2025

Task I: Collect free plastic pollutants found along coastal and wetland environments in Matagorda Bay to develop baseline information on chemical composition and pollution level within microplastic loads.

Status of the task during this reporting period: not started in progress completed

- Describe the major accomplishments for this reporting period
 - *Performed Fourier Transform Infrared Spectroscopy (FTIR) to process samples (water, sediment, vegetation, macroinvertebrate) from Spring 2025 sampling period. All samples have been processed for past sampling periods. Processing of water, sediment, vegetation, and macroinvertebrate samples for Spring 2025 is ongoing.*
 - *Graduate student associated with Task I defended thesis February 2025 and graduated May 2025. Additional graduate student has been hired at University Houston-Clear Lake for ongoing analysis for Task I as part of second phase of research.*
 - *Findings from graduate student thesis showed considerable variability in MP abundance among bays; particle size ranged from 0.046-4.269 mm and abundance ranged 1462.14 ± 1053.66 particles/100 ml water. Fragments were the predominant MP type in water due to mechanical and environmental degradation; SEM and FTIR analysis identified polyvinyl chloride (PVC), nylon, polymethylmethacrylate (PMMA), and polytetrafluoroethylene (PTFE), alongside industrial additives, as dominant chemical composition.*

- List the deliverable(s)/milestone(s) completed during this reporting period
 - *Developed manuscript of standard protocol for filtering, sorting, and calibrating sediment and saltwater samples for microplastic and nanoplastic assessment. Manuscript submitted for publication and currently in revision.*
 - *Graduate student thesis “Marine Microplastics Removal Using Plant-Based Polymers and Machine-Learning Models” submitted to ProQuest for open access publication.*
 - *Developed manuscript based on graduate student thesis for submission to open access journal ACS Environmental Science & Technology. Working Citation: Srinivasan, R., M. A. Azadah, A. Mitchell, C. Mitchell, R. Al-Mezrakchi, G.E. Millsap, E. Everett, E. Fringpong, D. Adrian, and A.S.A. Kodua. 2025. Marine microplastics removal using plant-based polymers and machine learning models. ACS EST XX:XXXX.*

- Were there any problems or obstacles encountered during this reporting period (e.g., delays, remedial action taken, schedule revision). Yes No If Yes, please explain:
 - *Sampling period for water, sediment, vegetation, and macroinvertebrates for Summer 2025 partially completed; severe weather inhibited sampling for western bays. Personnel will coordinate another sampling period for June 2025 to complete survey of remaining bays.*
- Briefly describe plans for the next reporting period.
 - *Will complete analysis of sediment, vegetation, and macroinvertebrates from Matagorda Bay and adjacent bays (East/West Matagorda, Tres Palacios, Turtle, Vaes, Keller, Cox, Lavaca, and Chocolate) for Spring 2025 for continued calibration and assessment of chemical composition and pollution loads.*
 - *Will complete Summer 2025 field survey to collect water, sediment, vegetation, and macroinvertebrates from Matagorda Bay and adjacent bays.*
 - *Continue development of manuscripts for submission to scientific journals based on completed work in Task I.*

Task II: Determine the presence, identity, and concentration of toxic or unique chemicals/elements found in plant tissues following the introduction of free plastic pollutants and how these pollutants impact plant growth, development, and nutritional content.

Status of the task during this reporting period: not started in progress completed

- Describe the major accomplishments for this reporting period
 - *Graduate student research associated with Task II (i.e., field sampling and experimental microcosm) is ongoing. Micro and macrophyte tissues obtained from field surveys for Task I. FTIR, SEM, and DSC is ongoing.*
 - *Microphyte and macrophyte taxa undergoing colonization for microcosm experiment prep as part of Task III. Experiments will be underway by June 2025.*
- List the deliverable(s)/milestone(s) completed during this reporting period
- Were there any problems or obstacles encountered during this reporting period (e.g., delays, remedial action taken, schedule revision). Yes No If Yes, please explain:
- Briefly describe plans for the next reporting period.
 - *We will purchase additional tanks and other materials necessary for microcosm study for Spring and Summer 2025.*
 - *We will monitor response of vegetation to microplastic pollutant concentrations in microcosm study Summer and Fall 2025.*
 - *Will continue to collect additional water, sediment, vegetation, and macroinvertebrates from Matagorda Bay and adjacent bays (East/West Matagorda, Tres Palacios, Turtle, Vaes, Keller, Cox, Lavaca, and Chocolate) for continued calibration and assessment of chemical composition and pollution loads for Spring and Summer 2025.*

Task III: Determine the presence, identity, and concentration of toxic or unique chemicals/elements of free plastic pollutants found in macroinvertebrates (herbivores, detritivores, and their predators) and how these pollutants impact macroinvertebrate growth, development, and behavior.

Status of the task during this reporting period: not started in progress completed

- Describe the major accomplishments for this reporting period
 - Graduate student associated with partial completion of Task III (assessment of microplastics on Calanoid copepods, *Acartia* spp., and cannonball jellyfish, *Stomolophus meleagris*) defended thesis April 2025 and graduated May 2025.
 - Findings from graduate student thesis reported variation among MP concentrations among bays and seasons; these trends were reflected in MP concentrations observed within surveyed copepods, but higher concentrations were observed in adults than nauplii stages independent of bay or season. Copepod survival decreased under sustained MP exposure at high concentrations. Additionally, laboratory toxicity assessments confirmed trophic transfer of MPs from copepod to jellyfish, with body burden of jellyfish increasing over time.
 - Microcosm experiment animal use protocols (AUP) approved at primary institution for macroinvertebrates (e.g., crustaceans, gastropods, insects).
 - Macroinvertebrate taxa undergoing colonization for microcosm experiment prep as part of Task III. Experiment will begin June 2025.
- List the deliverable(s)/milestone(s) completed during this reporting period
 - Graduate student researcher presented proof of concept of microcosm experiment (crustaceans, insects) for Task III at Entomological Society of America's Southwestern Branch Meeting, March 2025, in Round Rock TX.
 - Graduate student thesis "Microplastics as a disturbance to food web dynamics in Texas Gulf Coastal bays" submitted to ProQuest for open access publication.
- Were there any problems or obstacles encountered during this reporting period (e.g., delays, remedial action taken, schedule revision). Yes No If Yes, please explain:
- Briefly describe plans for the next reporting period.
 - Microcosm associated with crustaceans and insects ongoing; study to continue into Summer and Fall 2025
 - We will begin developing manuscript for scientific publication associated with assessment of microplastics on Calanoid copepods and cannonball jellyfish in Summer 2025.
 - We will purchase additional tanks and other materials necessary for microcosm study for Summer 2025.