

**Quarterly Progress Report
(March 2022)**

Project Title

Mercury and Plastic in Commercial and Recreational Fisheries in Lavaca, Matagorda, and San Antonio Bays: Risk Assessment and Interaction between the Two Contaminants

Submitted to

Matagorda Bay Mitigation Trust

Domicile Laboratories

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Objectives of the proposed project

Objective 1. Quantify the abundance and spatial distribution of plastic debris, Hg, and Hg sorbed to plastic in water, sediment, and fisheries throughout the three bays

Objective 2. Investigate the influence of water chemistry (salinity and dissolved organic matter concentration), temperature, plastic-type, and age on the accumulation of Hg on plastic through a series of controlled laboratory experiments

Objective 3. Determine environmental rates of Hg sorption to new and fouled plastics in the three bays over one year.

Objective 4. Undertake a Hg risk assessment to determine the percentage of each species that exceed federal and state Hg advisory levels in each bay, determine how much of each species a person can consume per week, and calculate the Se:Hg molar ratios in fishes and shellfishes to determine whether Se has a protective role against Hg toxicity, how Se:Hg molar ratios vary with body length, and whether the ratios can be used as a seafood safety criterion in risk assessment.

Project Summary

Lavaca Bay is a hotspot for plastic and mercury, which can be transported to surrounding bays. This study will investigate the prevalence of plastic, measure Hg concentrations, and calculate the selenium:mercury molar ratios in commercial and recreational fisheries (e.g., red drum, black drum, spotted seatrout, shrimp, blue crab, oyster) in Lavaca, Matagorda, and San Antonio Bay. Experiments will investigate the extent Hg can bind to plastic and its potential role as a source of mercury to biota. This will help to improve ecosystem and human health while aiding the recovery of economically important fisheries in the three bays.

Introduction

It is common knowledge and a public concern that Lavaca Bay is highly contaminated with pre-production plastic pellets and flakes as well as anthropogenic plastic litter. Lavaca Bay is also contaminated with mercury (Hg) from Alcoa's Point Comfort facility. This project will investigate plastic and Hg interactions and the extent of Hg in these systems.

The knowledge from this study will be used to inform the public and decision-makers in the region to guide future policies and actions on plastic debris and Hg in these bay systems.

Project Update

Objective 1. Quantify the abundance and spatial distribution of plastic debris, Hg, and Hg sorbed to plastic in water, sediment, and fisheries throughout the three bays

The most recent sampling trip was conducted on December 15 and 16th, 2021. Samples were collected from 13 locations in San Antonio (SA) and Matagorda Bay (MB) (please see Table 1). Water/sediment parameters, sampling locations GPS, and photographs of each sampled location were appropriately documented (Figure 1). Collected plastic litter is now being processed at TAMUCC (Figure 2&3).

Objective 2. Investigate the influence of water chemistry (salinity and dissolved organic matter concentration), temperature, plastic-type, and age on the accumulation of Hg on plastic through a series of controlled laboratory experiments

No activities started. We have, however, started preliminary discussions on logistics and experimental design.

Objective 3. Determine environmental rates of Hg sorption to new and fouled plastics in the three bays over one year.

Method development is in progress.

Objective 4. Undertake a Hg risk assessment to determine the percentage of each species that exceed federal and state Hg advisory levels in each bay, determine how much of each species a person can consume per week, and calculate the Se:Hg molar ratios in fishes and shellfishes to determine whether Se has a protective role against Hg toxicity, how Se:Hg molar ratios vary with body length, and whether the ratios can be used as a seafood safety criterion in risk assessment.



Figure 1: Field survey in Lavaca and Matagorda bays from December 2021. Additional pictures and videos are available upon request.

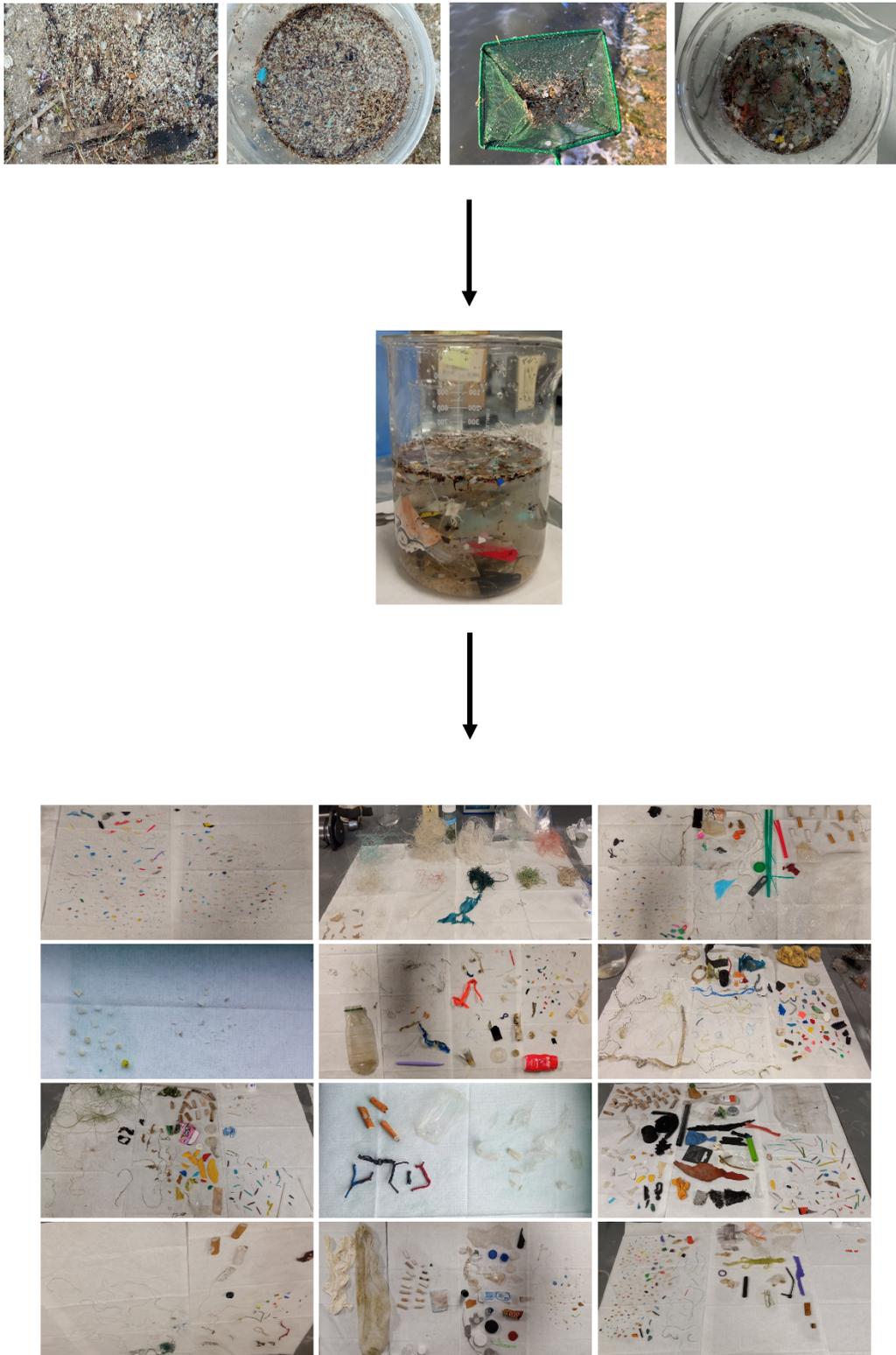


Figure 2: Sampling processing in the PI's lab at TAMUCC

Table 1. GPS of the sampling sites with few observations during sampling.

Bay	Sites (n=13)	Name	Coordinates	Remarks
SA	Austwell	AU	28 23'24"N, 96 50'15"W	Typically high debris content, mostly fishing line.
SA	Seadrift	SD	28 24'34"N, 96 43'31"W	High clay content in the sediment sample.
MB	Point Comfort	PC	28 40'00"N, 96 34'27"W	This site is located next to Route 35, just across the causeway on the Point Comfort side of the bay. It's imperative to time the sampling of this site with low tides or weak tides during the winter months to ensure that a "beach" is present. While there was beach past the barbed wire fence, which had lots of debris but also considerable broken glass and fishing tackle, we did not cross that boundary.
MB	Point Comfort - Cross Road	CR	28.667278, -96.575641	This site is across the causeway from the site above. There is a steep incline from the road to the beach.
MB	Boggy Creek National Park	BC	28 27'35"N, 96 24'46"W	Lots of glass at this site. High clay content and many burrowed crabs.
MB	Palacios	PA	28 41'53"N, 96 12'54"W	A lot of fishing line and other debris. Located right next to the pier. Fairly heavy foot traffic. High amounts of cigarette butts.
MB	Bayfront Peninsula Park (Port Lavaca Harbor)	BP	28 36'59"N, 96 37'19"W	High oyster shell content, it was challenging to get the full bag for all samples because of the sediment type.
MB	6 Mile	SM	28 41'37"N, 96 39'45"W	A lot of organic matter on the beach, not too much litter.
MB	Texas Parks & Wildlife Beach	TP	28 38'30"N, 96 19'23"W	This was a <i>very</i> dirty beach.
MB	Lighthouse Beach RV Park	LH	28 38'21"N, 96 36'39"W	Easy beach to access, lots of people using it, high debris (mostly kids toys)
MB	Magnolia Beach	MG	28 33'36"N, 96 32'14"W	No visible debris.
MB	Holiday Inn	HI	28 38'24"N, 96 36'56"W	The sediment was not too bad. There is a small creek running into the bay from this area.
MB	Port Lavaca - "Corner Beach"	CB	28.612329, -96.620149	Very high amount of large debris.

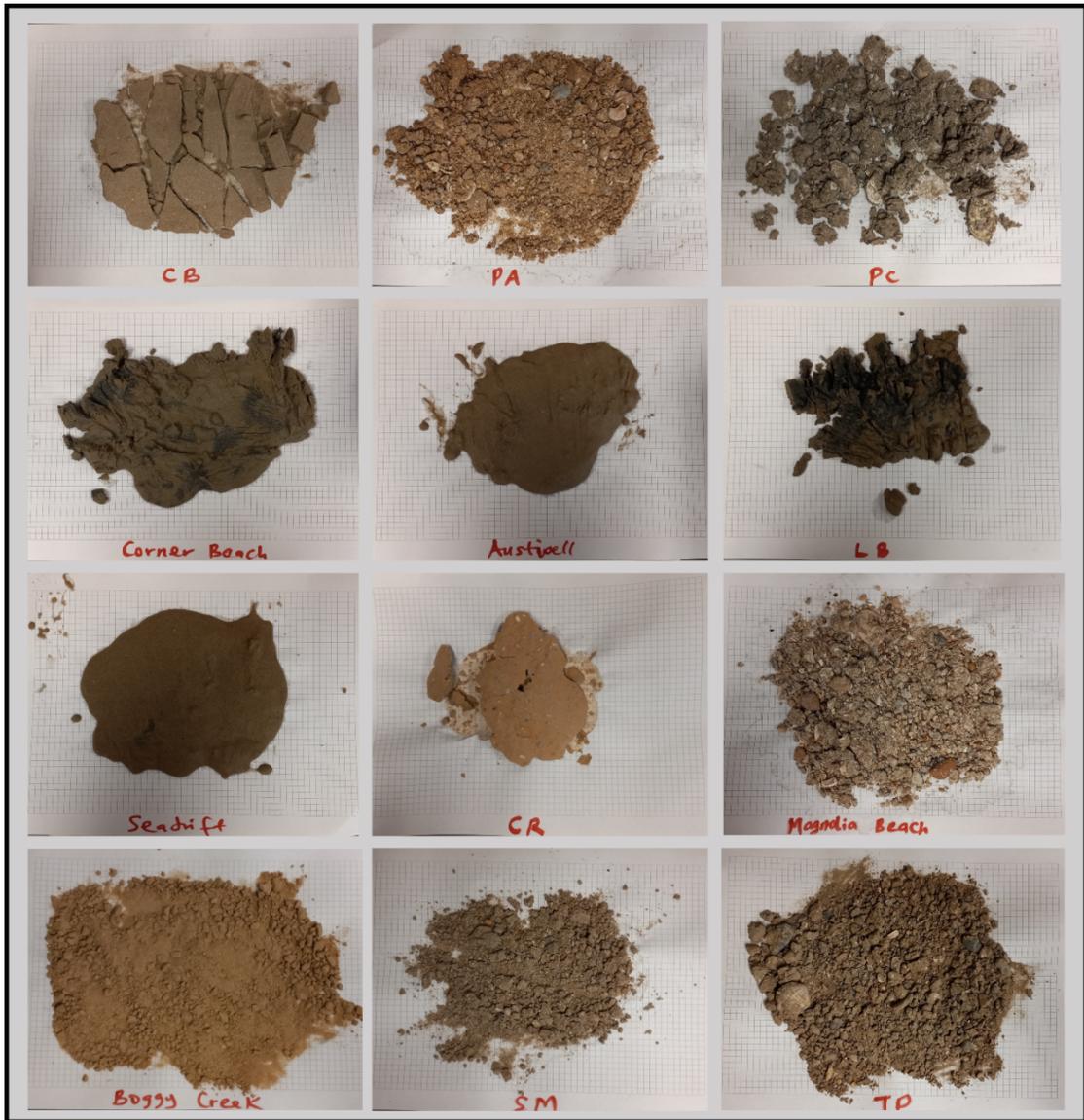


Figure 3: Sediment samples collected during the field survey.

- Red drum, black drum, spotted seatrout, flounder, striped mullet, and Atlantic croaker collected from Seadrift, Matagorda Harbor, Port O'Connor, Port Lavaca, and Palacios. The required sample size for some species at some sites has been reached.

- Shrimp, blue crab, and oysters have been collected from Seadrift, Matagorda Harbor, Port O'Connor, Port Lavaca, and Palacios. The required sample size for most species at most sites has been reached. These samples are now being processed for freeze-drying in preparation for Hg and Se analysis. Freeze drying and Hg analysis will start in January for species with the required sample size. Dr. Dutton is also working with Diane Wilson to obtain fish and shellfish from the closed area of Lavaca Bay

Lavaca Bay collections will start in April once water temperatures get warmer. Last, they are trying to find a way to get muscle samples from black drum and sheepshead, as they have not been caught during sampling so far. Gafftopsail catfish are challenging to find, so they are switching to hardhead catfish. Potential long-term issues going forward. As mentioned above, we have not found much material in fish stomachs so far. We will look at more in the coming quarters, but we may reduce this aspect of the research. This reduced workload will also lessen some spending, which would partially compensate for the increased costs associated with field research due to higher fuel prices, rental cars, and lab consumables due to inflation/etc.

Work Anticipated in the Next Quarter

In the upcoming quarter, project meetings will continue. TAMUCC will collect samples in late March 2022. These samples will be processed in the lab during the quarter. At Texas State, Dr. Dutton's group will continue fish sampling and begin Hg and Se analysis.