Quarterly Progress Report

(June 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. The 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 an issue of public concern that Lavaca Bay is highly polluted with plastics of various sizes, colors, and shapes which has been traced to the sharp practices of Formosa Plastics Cooperation and other anthropogenic activities. Also, Lavaca Bay was contaminated with mercury (Hg) from the industrial process of aluminum by the then Alcoa Point Comfort plant in the Superfund Site which was shut down in the 1980s. Therefore, this project investigates the extent and impact of plastics-mobilized mercury in different environmental matrices across the Lavaca and its surrounding bays.

The knowledge from this study will advise on the possible impact of both plastics and mercury on the biota, and its implication on the ecosystem as well as human health.

Project Update

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

The periodic sampling continues with the most recent sampling carried out on March 26 and 27, 2022. Samples were collected from all 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). Processing of newly collected plastic litter is ongoing at TAMU-CC, the samples collected in previous surveys await mercury quantification and data analysis.

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

Recruited student to complete the Hg and plastic lab experiments.

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

A preliminary sampling is expected to start in July 2022.

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.

2022 field season ongoing. Aim for sampling to be completed October 2022. Samples are being prepared for Hg and Se analysis.

Figure 1: Field survey in Lavaca and Matagorda bays

Figure 2: Sample preparation at TAMUCC laboratory

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 on the site of the road with the food truck. It's imperative to hit this site with low tides or weak tides to get a larger space. We did not sample past the barbed wire. Very high debris, broken glass and hooks inclusive.
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 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 Harbour)	BP	28 36'59"N 96 37'19"W	High oyster shell content, it was difficult 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 *very* 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.

Work Anticipated in the Next Quarter

In the upcoming quarter, project meetings will continue. TAMUCC will collect samples in early July ending 2022 (date to be determined based on the weather report). These samples will be processed in the lab during the quarter. Mercury analysis of the processed sample is expected to commence in the upcoming quarter at Texas State, Dr. Dutton's group will continue fish sampling and begin Hg and Se analysis.