

**Quarterly Report for Matagorda Bay Mitigation Trust
December 31, 2024**

Project:

Trophic linkages and habitat connectivity of popular sportfish in the Matagorda Bay system

Organizations:

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Investigators:

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Contract No.: 022

Project Term: 03/01/2022 – 02/28/2025

Reporting Period: 010/1/2024 – 012/31/2024 (11)

The contracted project with the Matagorda Bay Mitigation Trust was initiated as of March 1, 2022. The overall goal of this study is to evaluate the movement patterns, trace element concentrations (i.e., potential contaminants), and trophic linkages between three recreationally exploited sportfish species (black drum, red drum, and spotted seatrout) and their prey items in Matagorda Bay to determine whether movements throughout the bay system identified via acoustic tracking exposes these sportfish to varying concentrations of trace elements.

NOTE: As a result of the Objective 1 findings by PI Banks and Co-PI Streich, the proposed plan to answer Objective 2 and 3 has changed. Since tracking data suggests that red drum and black drum are more residential in the Point Comfort mercury Superfund site (Closed Area) whereas spotted seatrout only remain there for a short period of time, Co-PI Dutton is now expanding the food web study within the Closed Area to better understand how all three sportfish species are exposed to trace elements by including more prey items. In addition, apex predators and other common species found in the Closed Area have been included in the study. Other sites within Matagorda Bay (Palacios, Port O'Connor, Matagorda) will still be investigated, but with the focus only being on spotted seatrout and their prey items, since that is the only sportfish that appear to be moving to other parts of the bay system.

This change to the study will provide a better understanding of how trace elements are trophically transferred within the Closed Area food web. In addition, this study will provide trace element concentration data for a variety of species within the Closed Area. It is important to collect this baseline data now because if the proposed dredging goes ahead, then there will

be an extensive dataset of trace element concentrations for a variety of species prior to dredging which can be compared to post dredging data.

Task 1 - Sample acquisition and TEXAAN maintenance: acoustic tagging of fish, sample acquisition for stable isotope/trace element analyses, receiver array [TEXAAN] installation, expansion, maintenance, and download.

Status: Ongoing

Spring '22

- CSSC purchased acoustic receivers, tags, and batteries to expand the TEXAAN and tag selected fish species as appropriate.
- CSSC received tags and receivers and has begun preparations for deployment of the acoustic transmitters. Tagging and equipment deployment will be initiated in the next quarter.
- CSSC purchased various lab supplies and fishing tackle as preparation for upcoming field operations.
- A field laptop was purchased with contributed funds from this project. This laptop will allow for efficient downloads and troubleshooting of acoustic equipment in the field.

Summer '22

- CSSC deployed 13 receivers to expand the TEXAAN. Eight were deployed in Lavaca Bay, 3 were deployed near Palacios, and 2 near Pass Cavallo.
- Two receivers previously deployed in Port Lavaca were downloaded and redeployed.
- CSSC acoustically tagged 10 red drum and 1 trout.
- TSU has started sampling sportfish in the closed/impacted area and have obtained 2 red drum, 1 trout, and ~10 black drum for toxicological analyses.
- TSU has collected oysters, mullet, and blue crabs representing prey items for toxicological analyses.



Fall '22

- CSSC acoustically tagged 5 red drum, 1 black drum and 5 trout.
- CSSC downloaded and replaced 29 receivers in the TEXAAN.
- TSU has completed sampling for the below listed sportfish in the closed/impacted area: red drum and black drum.
- TSU has completed sampling for oysters and mullet representing prey items for toxicological analyses.

Winter '22

- Nothing to sample for this quarter as field sampling will begin again next quarter.

Spring '23

- CSSC helped TSU sample prey items, including completing sample needs for several species.
- TSU has completed samples for red drum and black drum. Still need a few trout to complete the target sample number.
- CSSC downloaded and replaced 5 receivers in the TEXAAN.

Summer '23

- CSSC completed acoustic tagging in the closed area (14 black drum, 9 trout).
- CSSC began tagging fish in other areas of the bay (5 redfish, 5 trout, 1 black drum).

Fall '23

- CSSC deployed 1 receiver that was lost in the closed area near Port Comfort.
- CSSC downloaded receivers in the Palacios arm of Matagorda Bay.
- CSSC acoustically tagged 10 red drum, 10 black drum, and 10 trout in Palacios and the Colorado River Delta area.
- TSU completed field sampling for toxicological analyses (see Table 1 for species totals).

Table 1. Species collected in the Closed Area along with the corresponding sample size (n) for mercury (Hg) analysis and analysis of the other trace elements (TE).

	Common name	Scientific name	Hg (n)	TE (n)
Vegetation	Saltmarsh cordgrass	<i>Spartina alterniflora</i>	6*	6*
Crustaceans	Grass shrimp	<i>Palaemonetes pugio</i>	6**	6**
	White shrimp	<i>Litopenaeus setiferus</i>	10	10
	Mud crab	<i>Panopeus obesus</i>	5**	5**
	Fiddler crab	<i>Uca rapax</i>	8**	8**
	Blue crab	<i>Callinectes sapidus</i>	10	10
Molluscs	Hooked mussel	<i>Ischadium recurvum</i>	9**	9**
	Eastern oyster	<i>Crassostrea virginica</i>	12	12
Teleosts	Atlantic croaker	<i>Micropogonias undulatus</i>	10	10
	Spot croaker	<i>Leiostomus xanthurus</i>	3	3
	Striped mullet	<i>Mugil cephalus</i>	10	10
	Longnose killifish	<i>Fundulus similis</i>	1	1
	Pinfish	<i>Lagodon rhomboides</i>	10	10
	Gulf menhaden	<i>Brevoortia patronus</i>	20	10
	Gizzard shad	<i>Dorosoma cepedianum</i>	5	5
	Sand seatrout	<i>Cynoscion arenarius</i>	20	10
	Skipjack herring	<i>Alosa chrysochloris</i>	3	3
	Hardhead catfish	<i>Arius felis</i>	10	10
	Gafftopsail catfish	<i>Bagre marinus</i>	7	7
	Southern flounder	<i>Paralichthys lethostigma</i>	10	10
		<i>Archosargus</i>		
		Sheepshead	<i>probatocephalus</i>	8
	Red drum	<i>Sciaenops ocellatus</i>	30	30
Black drum	<i>Pogonias cromis</i>	30	30	

Elasmobranchs	Spotted seatrout	<i>Cynoscion nebulosus</i>	27	27
	Cownose ray	<i>Rhinoptera bonasus</i>	5	5
	Southern stingray	<i>Hypanus americanus</i>	5	5
	Bonnethead shark	<i>Sphyrna tiburo</i>	3	3
	Scalloped hammerhead shark	<i>Sphyrna lewini</i>	9	9
	Bull shark	<i>Carcharhinus leucas</i>	9	9

*root, stem, and blade analyzed

**multiple individuals of similar size in a sample to have enough mass

Winter '24

- Nothing to sample for this quarter as receiver downloads are scheduled for next quarter.

Spring '24

- CSSC downloaded receivers in the TEXXAN.

Summer '24

- CSSC maintained the TEXXAN. After Hurricane Beryl made landfall over Matagorda, CSSC confirmed that the array was still intact and functional.

Fall '24

- CSSC performed acoustic receiver (TEXXAN) maintenance in house for future downloads and deployments. Data downloaded in Summer '24 was imported into database.

Task 2 – Laboratory analyses: stable isotope and trace element analyses.

Status: Ongoing

Spring '22

- Nothing to report for this quarter as field sampling will begin in the next quarter.

Summer '22

- Nothing to report for this quarter as field sampling is on-going.

Fall '22

- Nothing to report for this quarter as field sampling is on-going. Trace element and stable isotope analyses will begin next quarter on species that targeted sampling quota has been met.

Winter '22

- Nothing to report for this quarter as field sampling is on-going.

Spring '23

- Nothing to report for this quarter as field sampling is on-going.

Summer '23

- All samples have been collected, dissected, and freeze-dried. The species included are:
 - Closed Area: sportfish (red drum, black drum, spotted seatrout), prey items (eastern oyster, hooked mussel, grass shrimp, white shrimp, blue crab, fiddler crab, mud crab, Atlantic croaker, striped mullet, pinfish, Gulf menhaden, perch, longnose killifish), other teleosts (hardhead catfish, gafftopsail catfish, southern flounder, gizzard shad, skipjack), elasmobranchs (bull shark, blacktip shark, scalloped hammerhead, southern stingray, cownose ray), and marsh grass.
 - Sediment from three locations has also been collected to determine environmental trace element concentrations.
 - Palacios, Port O'Connor, Matagorda: spotted seatrout, white shrimp, Atlantic croaker, striped mullet
- Trace element analysis: Mercury (Hg) analysis is ongoing and data for several species has been collected for the Closed Area. All Hg data has been collected for Palacios, Port O'Connor, and Matagorda.

Fall '23

- For the Closed Area, all mercury (Hg) analysis has been completed, and all samples have been digested for analysis of the other trace elements [e.g., silver (Ag), aluminum (Al), cadmium (Cd), chromium (Cr), lead (Pb), selenium (Se), zinc (Zn)]. The samples have been shipped to Dartmouth College for ICP-MS analysis and the data is expected mid-late December. The sample size for Hg analysis and the other trace elements for each species are reported in Table 1.
- For the comparative sites (Palacios, Matagorda, Port O'Connor), all samples have been collected. Species included are trout, Atlantic croaker, striped mullet, white

shrimp, blue crab, and eastern oyster. Red drum and black drum will also be included if tracking data from Objective 1 indicates they are moving around Matagorda Bay. Samples were collected at cleaning stations, fishing tournaments, and bait shops in each location. At the time of sample collection, it was verbally confirmed, without prompting, that the species was collected in proximity to the town/city. As a result, individuals collected in Palacios represent trace element concentrations in Tres Palacios Bay, Matagorda represents southeast Matagorda Bay, and Port O'Connor represents southwest Matagorda Bay. All Hg analysis has been completed for all species and locations.

Winter '24

- Data entry and analysis for the Closed Area. This is taking a while because there are ~25 species and 20 elements for the Closed Area. We also selected samples (sportfish, forage fish, blue crab, oyster, white shrimp) for trace element analysis during the next quarter for Port Lavaca, Port O' Connor, and Matagorda.
- Preparing about 300 samples from the Closed Area for stable isotope analysis (C, N, S). All samples need to be lipid extracted, whole crabs need an acid extraction, and elasmobranch samples need to have the urea extracted prior to packaging. The samples should be sent for analysis by the end of the next quarter.

Spring '24

- TSU completed all trace element analysis for the Palacios and Matagorda samples.
- TSU and CSSC are working on data analysis. All samples from the Point Comfort mercury Superfund site have been lipid extracted (all samples), urea extracted (elasmobranchs), and calcium carbonate extracted (mud crabs and fiddler crabs). Samples have been packaged and shipped to the University of Utah for carbon, nitrogen, and sulfur stable isotope analysis. 299 samples were sent for carbon and nitrogen analysis and 278 samples were sent for sulfur analysis.

Summer '24

- All trace element analysis has been completed. Now sorting and analyzing all the data and deciding how to write it up for publication. Starting off with determining the selenium:mercury molar ratios in biota in the Alcoa (Point Comfort) Superfund site.
- Sites - Point Comfort Superfund site, Port Lavaca, Palacios, Port O'Connor, Matagorda

- Species (Port Lavaca, Palacios, Port O'Connor, Matagorda) - red drum, black drum, spotted seatrout, Atlantic croaker, striped mullet, blue crab, white shrimp, Eastern oyster.
- Species (Point Comfort Superfund site) - marsh grass (Spartina), grass shrimp, white shrimp, mud crab, fiddler crab, blue crab, hooked mussel, Eastern oyster, gizzard shad, sand seatrout, pinfish, Gulf menhaden, Atlantic croaker, spot croaker, striped mullet, skipjack, gafftopsail catfish, hardhead catfish, sheepshead, red drum, black drum, spotted seatrout, southern flounder, cownose ray, bonnethead shark, scalloped hammerhead shark, bull shark.
- Elements investigated include: Ag, Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, Sn, U, V, Zn

Fall '24

- All trace element concentration data has been collected and is now being analyzed.
- All stable isotope analysis (C, N, S) has been completed for biota in the Superfund site. I have the S data; the C and N data will be released after invoice has been paid.

Task 3 – Data processing and administrative tasks: data processing and administrative tasks such as writing reports, invoicing, outreach materials, and disseminating results.

Status: Ongoing

Spring '22

- CSSC conducted project management, internal project team meetings, and task coordination.

Summer '22

- CSSC conducted project management, internal project team meetings, and task coordination.
- TSU recruited Miranda Sams, an M.S. student who will complete the project for her thesis.

Fall '22

- CSSC conducted project management, internal project team meetings, and task coordination.

Winter '22

- CSSC conducted project management, internal project team meetings, and task coordination.

Spring '23

- CSSC conducted project management, internal project team meetings, and task coordination.

Summer '23

- CSSC conducted project management, internal project team meetings, and task coordination.

Fall '23

- CSSC conducted project management, internal project team meetings, and task coordination.

Winter '24

- CSSC conducted project management, internal project team meetings, and task coordination.

Spring '24

- CSSC conducted project management, internal project team meetings, and task coordination.

Summer '24

- CSSC conducted project management, internal project team meetings, and task coordination.
- TSU: All samples have been packed and shipped for C, N, and S analysis.
- TSU: Sulfur data received back from analyses (263 samples)
- TSU: Carbon and nitrogen data should be received by the middle of October (299 samples)
- Abstract accepted for a poster presentation on the Hg and stable isotope research at the SETAC North America 45th Annual Meeting in Fort Worth, TX in October 2024.
- Project mentioned at a public meeting. Public presentation “Mercury concentrations in sediment and biota in the Alcoa (Point Comfort) Superfund site”. Hosted by the San Antonio Bay Estuarine Waterkeeper. August 22, 2004, Port Lavaca, TX. Attended by ~200 people (federal and state agencies, city

council, industry, environmental groups, community members). Livestreamed (~1000 views to date). Translated into Spanish and Vietnamese.

Fall '24

- CSSC conducted project management, internal project team meetings, and task coordination.
- CSSC organized, quality controlled, and managed all acoustic receiver data downloaded in Summer '24 and during project lifetime in preparation for data analysis.
- The first publication is in preparation. The working title is "Selenium:mercury molar ratios in biota from a contaminated site in Lavaca Bay, Texas (USA)".
- Data was presented at the SETAC annual meeting in October.

Presentations:

Rehkopf, J., K. Banks, M. Streich, and J. Dutton (2024) Mercury concentrations in biota from the Alcoa Superfund site in Lavaca Bay (Point Comfort, Texas). Society of Environmental Toxicology and Chemistry South-Central Regional Meeting. Kerrville, TX.

Rehkopf, J., K. Banks, M. Streich, W. Nowlin, and J. Dutton (2024) Mercury concentrations in biota from the Alcoa/Point Comfort Superfund site (Lavaca Bay, Texas). Society of Environmental Toxicology and Chemistry North America 45th Annual Meeting. Fort Worth, TX.