Investigation of the presence and impacts of heavy metals in the Trinity River

Background

- The Trinity River is a vital waterway providing drinking water for the DFW and Houston areas, a site for **recreational** activities, and a habitat for a diverse group of organisms.
- Potential sources of heavy metal pollution include discharge from wastewater treatment plants and industrial facilities, as well as runoff from roads, roofs, and lawns.
- Heavy metals can induce generalized stress and oxidative stress and lead to neurotoxicity, immunotoxicity, and mortality.

Methods & Sample Collection

Sample Collection

- Surface water and sediment samples were collected from Trinity River at three different sites across the DFW Metroplex.
- All sites were chosen specifically for their downstream proximity to wastewater treatment plants, industrial facilities, and highway intersections.
- Collections were completed at eight different time points across the summer and fall months of June to November.

Exposure

- Larval fathead minnows were exposed to surface water and sediment samples for seven days.
- After the exposure, qPCR analysis was conducted to assess metallothionein (*mtt*), catalase (cat), and heat shock protein 70 (*hsp70*) gene expression.





Objective: Assess gene expression of three biomarkers of heavy metals in larval fathead minnows exposed to sediment and surface water samples from the Trinity River.







Funding and Acknowledgements

This project was funded by a Texas Christian University SERC Grant awarded to Drew Carlton as well as a grant from the John V. Roach Honors College. A special thanks to the TCU Biology Department and the Dr. Jeffries Environmental Toxicology lab.



Goal: Evaluate the presence and biological impacts of heavy metals in sediment and surface water collected from the Trinity River.

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Results



Figure 2. Graphs showing differential gene expression of three biomarkers of heavy metals (mtt = metallothionein, hsp70 = heat shock protein 70, and *cat* = catalase) across four 2024 sampling dates (July 26, September 2, September 25, and October 16. Asterisks indicate significant differences relative to the controls within each sampling date. For visualization, all gene expression data are normalized to that of the late July control group.

Conclusions & Future Directions



Temporal and spatial differences in biomarker responses were observed suggesting variation in the presence and effects of contaminants as a function of time and location.

Though exposure to heavy metals is associated with both oxidative and generalized stress, the upregulation of *mtt* did not appear to be correlated with the upregulation of *cat* or *hsp70*. This suggests that a different environmental stressor capable of inducing oxidative and generalized stress is present in late September and mid October.

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Scrap Metal Recycling



The upregulation of *cat* suggests the occurrence of oxidative stress among fish exposed to water and sediments from the naval air station site in late September and October

The upregulation of *hsp70* indicates generalized stress in fish exposed to naval air station water and sediments in July, late September, as well as in fish exposed to water and sediments from all sites in October.

• An analysis of weather patterns and chemical use (e.g., fertilizer application) may reveal the source of temporal differences.

• Targeted chemical analysis may reveal the source of spatial differences.





