INTEGRATING THERMAL PROFILING AND BATHYMETRIC MAPPING TO SUPPORT ENVIRONMENTAL CHEMISTRY ANALYSIS AT THE TRINITY RIVER CONFLUENCE

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Introduction

At the confluence of the Clear Fork and West Fork of the Trinity River in Fort Worth, understanding how physical factors influence water chemistry is critical for ecosystem health.

This collaborative research project between Texas Christian University (TCU) Environmental Chemistry students and Texas Academy of Biomedical Sciences (TABS) AP Environmental Science students investigates how physical characteristics—specifically temperature variation and river depth—affect water chemistry before and after the mixing of the two river forks.

Temperature plays a key role in aquatic systems because warmer water holds less dissolved oxygen, which can stress aquatic organisms and promote harmful algal blooms. Additionally, river depth and channel structure influence flow patterns, habitat diversity, and chemical distribution. By studying these physical drivers, this project supports a deeper understanding of water quality dynamics in an urban river system.

Materials and Methodology

1 Temperature Profiling

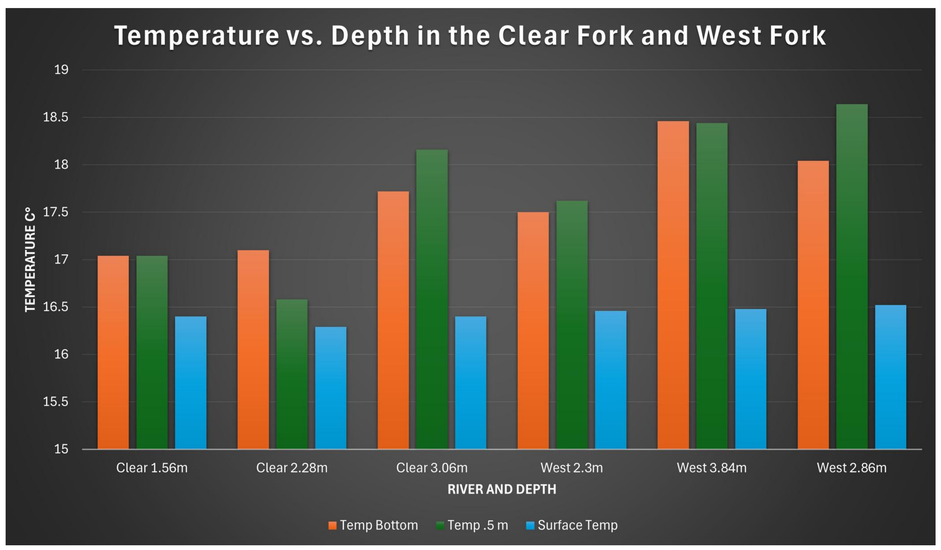
- Temperature measurements were taken at three depths: Surface, 0.5 meters, and just above the benthic zone. Ambient temperatures were also taken.
- Weighted 4 oz lead fishing sinkers were used to reach specific depths.
- Sinkers were deployed 10 minutes for the first trial and 5 minutes for subsequent trials.
- After retrieval, temperatures were recorded using an infrared thermometer.

2 Depth Measurement and Mapping

- A Garmin sonar device (260 kHz) was used to measure water depth and generate bathymetric (depth) maps.
- Sonar data allowed identification of the main river channel, variations in depth, and habitat structure.

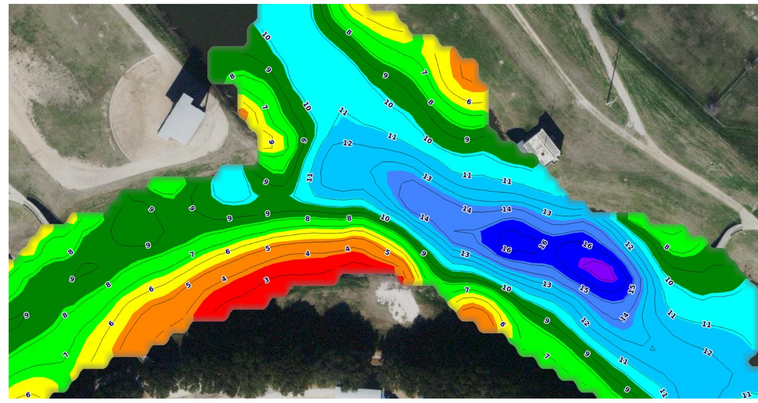
3 Collaboration Context

- TCU students conduct chemical analyses (e.g., cation analysis) separately.
- This study focuses only on physical data to support interpretation of chemical results.



Results

- Temperature varied across depths of river forks.
- Surface temperatures tended to be higher compared to deeper regions, indicating vertical thermal stratification.
- Depth mapping revealed variations in riverbed structure, identification of deeper main channels, and differences in habitat zones based on depth and light penetration.



Discussion

The results show the importance of physical factors in shaping water chemistry at river confluences. Temperature differences at varying depths influences dissolved oxygen levels, which are critical for aquatic life. Warmer surface waters reduce oxygen availability, stressing fish species and other organisms like insect larvae. Bathymetric mapping enhances understanding by showing how river depth and structure affect water flow and mixing. This helps explain how chemical components may distribute unevenly across the river system. With ongoing urban development in Fort Worth and rising global temperatures, these changes may intensify, increasing the risk of reduced water quality and ecological imbalance.

By combining physical and chemical analyses, this collaboration provides a greater understanding of river dynamics. Additionally, this project demonstrates the value of cross-institutional research by allowing high school students to contribute to a larger scientific study.

Acknowledgements