Environmental Drivers of Water Quality Variability in Lake Meredith, Texas

Erik Crosman, Maitreyee Mukherjee, Robyn Cuthbert, Heather Ogle, Simon Mbanefo, Afolarin Olatunbosun, Grayson Pool and Darby Taylor
West Texas A&M University

WT Graduate School and Research
WEST TEXAS A&M UNIVERSITY

Abstract

An observational lake physiochemistry study at Lake Meredith, Texas USA was conducted in concert with a microbiological study involving undergraduate and graduate students at West Texas A&M University between March and August 2023. Unique seasonally-varying data was collected.

Background

- Lake Meredith the premier recreational lake in Texas Panhandle and a major source of water for region
- Water quality (high salinity) and availability has been reduced in recent years with low water levels
- Canadian River Municipal Water Authority has a salinity control project upstream to "intercept brine water"
- No previous published studies have quantified the spatial and vertical (with depth) variability in water quality in Lake Meredith

Method and Data Collection

Data Collected

At the Sanford-Yake Marina, pH, dissolved oxygen, conductivity and temperature were measured Every 10 minutes between March and August 2023.

HOBO pH and Temperature Data Logger x 1

HOBO Conductivity Data Logger x 1

HOBO Dissolved Oxygen Data Logger x 1

Vertical temperature at 0.3, 1, 3, 5, 7, 10, 15, m depth. Monthly vertical profiles of pH, dissolved oxygen, Conductivity and salinity.

WT students also collected surface samples of pH, dissolved oxygen, conductivity, salinity and chlorophyll at 6 locations at Lake Meredith every month.

Results

Variations in Lake Meredith Physiochemistry

The observed seasonal variations were driven by changes in water level, salinity, meteorology, and lake temperature.
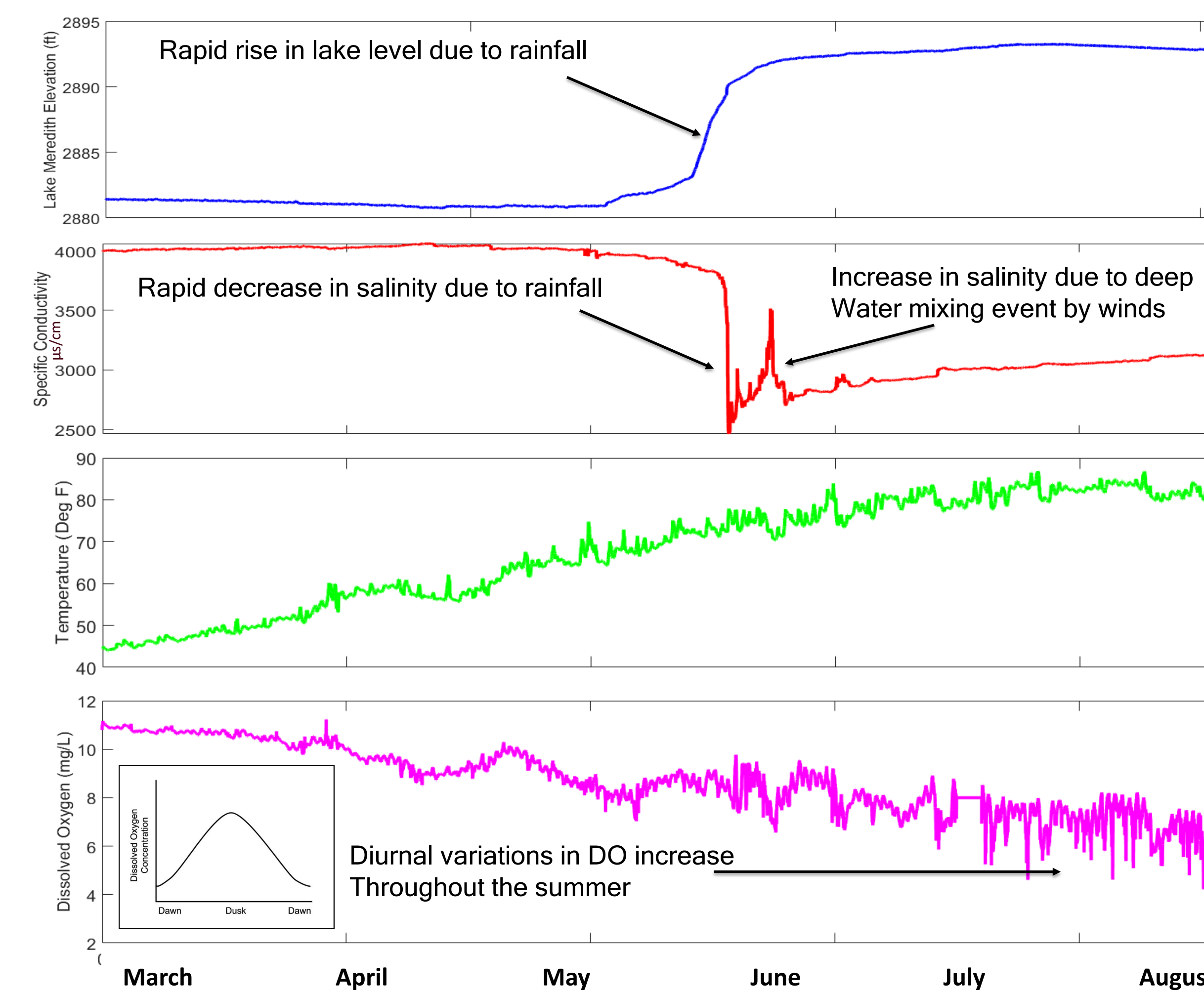

Figure 1. Variations in lake elevation (m), Specific Conductivity (μs/cm), temperature (°F), and dissolved oxygen (mg/L) at Sanford-Yake Marina, Lake Meredith

- Extensive rainfall in May and June 2023 resulted in over 10 ft rise in Lake Meredith. Associated with the rise in lake level and river inflow was a dramatic decrease in the conductivity and salinity of the surface water
- Deeper water mixed in June with surface water to increase salinity somewhat at the surface
- Lake Meredith is an ideal study area to observed the impact of rapid changes in lake level on the physiochemistry and microbiology communities (future work)

Variations in Lake Meredith Thermal Profile

Variations in water clarity, wind-driven mixing, and salinity (higher salinity water below 10 m depth) resulted in variations in thermocline and water temperature during the Summer 2023
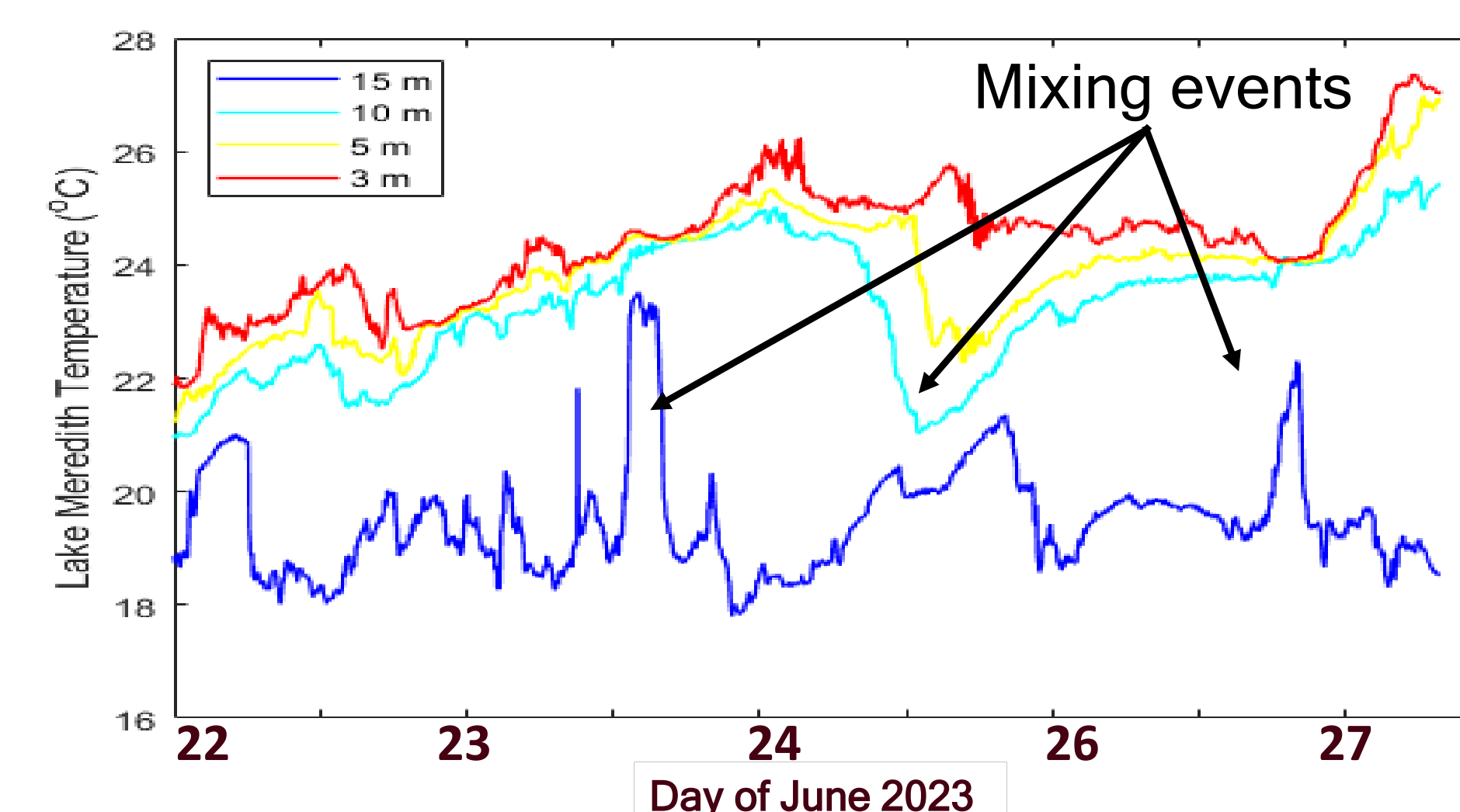

Figure 2. Lake Meredith Water Temperature variations at 3, 5, 10 and 15 m depth between 22 and 27 June 2023
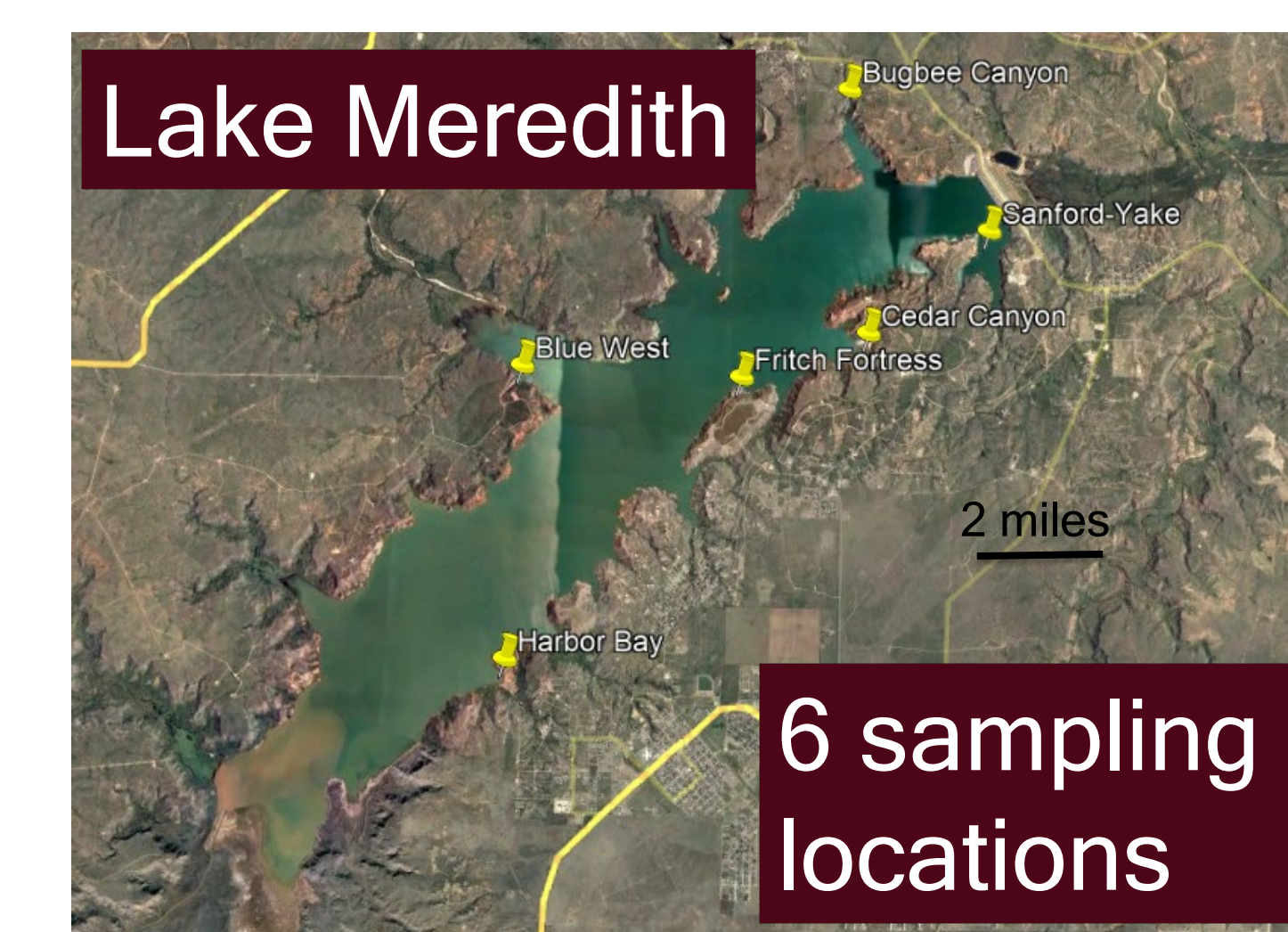
Results (continued)

- Diurnal variability in temperature and dissolved oxygen increased during the warm season from strong solar forcing. Variations in water clarity likely modulated diurnal cycles in surface temperature and dissolved oxygen in upper layer

Date (2023)	Secci Disk Depth (cm)	Salinity at surface (ppt)	Salinity at 15 m depth (ppt)	Chlorophyl (µg/L)
24 Mar	350	2.1	2.1	72.96
21 April	250	2.1	2.1	70.65
30 May	190	2.0	2.1	94.00
20 June	200	1.4	1.9	49.37
17 July	240	1.6	1.8	54.33
14 Aug	140	1.6	1.8	104.6

Discussion

- The results of this study provide new scientific understanding of the spatial and temporal variability in water quality at Lake Meredith, the premier recreational lake in Texas Panhandle
- To our knowledge, no previous detailed study of the spatiotemporal variability in lake physiochemistry has been conducted at Lake Meredith
- The results of the Lake Meredith physiochemical study will be combined in the coming months with the outcomes from the microbiological study analysis of microbial communities at the 6 sampling sites around Lake Meredith.

Lake Meredith

6 sampling locations

Contact Information

Erik T. Crosman, PhD
Assistant Professor of Environmental Science
West Texas A&M University
etcrosman@wtamu.edu

Acknowledgements