

# Regulation of Controls of Cold Water Through the Temperature Control Device of the Shasta Dam as a Means of Supporting Downstream Fish Populations

Study Period  
2021 - 2025

Funded by



## About this Project

This project examined cold water storage and regulation in Shasta Lake through the Shasta Dam Temperature Control Device (TCD). The TCD is a 300-foot structure with multiple gate openings, allowing water from different depths - and thus different temperatures - to be selectively released to manage water temperature in the river downstream. River water temperature is managed to support the imperiled Chinook salmon, a species of fish that is native to California.

This capability is becoming increasingly important because low water years generally means warmer river water temperatures that compromise habitat suitability for different species. In particular, cold pool management is essential for downstream spawning and rearing habitat for winter-run Chinook salmon that rely on cooler water temperatures to survive and reproduce. When the water is too warm, oxygen availability is limited for Chinook salmon and their eggs which contributes to their mortality.

Although the TCD allows reservoir managers to control water release and downstream water temperature, flow contributions into the TCD under day-to-day operations for different gate openings, operations, and thermal conditions within the reservoir are largely unquantified. Further complicating temperature management, TCD leakage (whether within the structure itself or through malfunctioning gates) needs to be better quantified in location and magnitude. This information will improve operational strategies for cold water performance especially during summer and fall months to manage cold water supply for downstream Chinook salmon habitat.

## Lead Investigator

- Alex Forrest, UC Davis



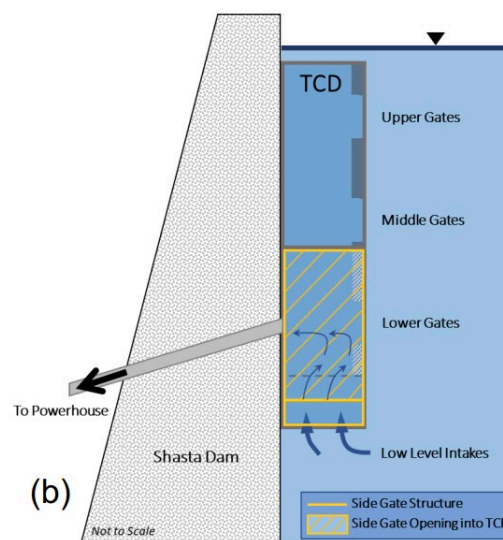
## Project Objectives

1. Measure the performance of the TCD using acoustic techniques.
2. Quantify water velocity dynamics around the gates of the Shasta Dam Temperature Control Device to improve understanding of in-reservoir and dam release water temperatures.
3. Characterize local dynamics of withdrawal zones for TCD gates operating individually or for blending under varying short-term (sub-daily) and long-term (seasonal) conditions.
4. Quantify leakage under different storage and TCD operations.

## Management Application

This project modeled and refined management techniques for the cold water supply in Shasta Lake and downstream Sacramento River reaches by monitoring conditions and quantifying flow over a wide range of TCD operations during a seasonal stratification period. The data and findings from this project will be used to improve TCD representations in models to reduce uncertainty in forecasts and planning, which will lead to more efficient use of cold water supplies for summer and fall temperature management to benefit Chinook salmon.

Understanding the system at this level of detail would allow the management team at the US Bureau of Reclamation, which manages the TCD, to improve their understanding and the operation of the existing infrastructure at Shasta Dam.



*Side view of Shasta Dam Temperature Control Device*

## Next Steps

Public data will be deposited in Merritt (see <https://merritt.cdlib.org/>), a repository service from the University of California Curation Center (UC3) that has capabilities to manage, archive, and share digital content.

## Connections to the 2017-2021 Science Action Agenda

- 2: Capitalize on Existing Data Through Increasing Science Synthesis
- 4: Improve Understandings of Interactions Between Stressors, Managed Species and Communities
- 5: Modernize Monitoring, Data Management and Modeling