

# The Effects of Climate Change on the Life History of Spring-run Chinook Salmon Through Time

Study Period  
2021 – 2024

Funded by



Delta  
Science  
Program

DELTA STEWARDSHIP COUNCIL



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RECLAMATION

## Acknowledgments

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## About this Project

Salmon have a long and intricate history in California's Central Valley and the Sacramento-San Joaquin Delta (Delta). One of these native species, Chinook salmon, has thrived here for millennia in a highly variable climate by occupying a diverse habitat mosaic and exhibiting an adaptable life history. This flexibility has made Chinook salmon resilient in the face of historic environmental change, but modern-day habitat loss and modified flow regimes have eroded life history diversity and led to drastic population declines. The once abundant Spring-run Chinook salmon are now constrained to small stronghold populations and are listed as threatened under the Endangered Species Act.

Recovering salmon on our modified landscape requires an understanding of their evolutionary and ecological history. However, our present-day surveys can only provide us with a short temporal snapshot of these data. This can be problematic because the life history diversity observed today, in highly altered and degraded ecosystems, might overlook the full life history potential. Identifying past life history strategies could help predict fish responses to habitat restoration and allow us to understand how species are likely to respond to future ecosystem changes.

The project brought together a multidisciplinary team of ecologists, fisheries scientists, geochemists, and archeologists to reconstruct key life history metrics of modern and ancient Spring-run Chinook salmon.

The researchers combined samples of modern otoliths (ear stones) with published data (2012-2020 CE) and historic and ancient otoliths from the California Gold Rush Period (~1835-1870 CE), the Little Ice Age (~1560-1780 CE), and the Megadrought Period (~1200-1410 CE).

## Lead Investigators

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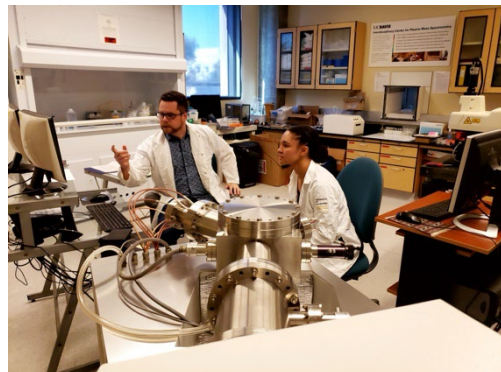


## Project Objectives

- Determine life history metrics for modern, historic, and ancient Spring-run Chinook salmon to assess how salmon have coped with extreme climate conditions.
- Synthesize and combine these data with published Chinook salmon data from the Regional Mark Information System (RMIS) to inform climate-resilient salmon conservation and management strategies.

## Why this Research Matters

Our current framework for recovering salmon is based on data collected after salmon experienced significant population declines and extirpation from a large fraction of historic habitat in the Delta. Consequently, existing management and restoration plans do not consider salmon populations' full adaptive capacity. Instead, using long-term data on changes in salmon life history metrics over a historical to present-day range will better predict the response of salmon populations to shifting climate regimes.



*George Whitman and Kimberly Evans analyzing samples at the Interdisciplinary Center for Plasma Mass Spectrometry at UC Davis.*

This resulting life history framework provides opportunities to evaluate how climatic and anthropogenic modifications affected key life history metrics. This project will provide a context for establishing realistic biological targets for long-term ecological baselines and reduce uncertainty for future Delta restoration objectives.

## 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