Examining the Impacts of Habitat Covariates on Predation and Outmigration Mortality of all Central Valley Chinook Salmon Ecotypes

Study Period
2022 - 2025

Funded By

Delta Science Program
DELTA STEWARDSHIP COUNCIL

BUREAU OF RECLAMATION

About this Project

Juvenile Chinook salmon are exposed to many different stressors that affect their survival as they migrate along the Sacramento River and out of the Sacramento-San Joaquin Delta (Delta) to the ocean. To better inform the management of Chinook salmon, researchers collected data on “covariates,” or independent factors, such as fish size at migration, habitat characteristics (e.g., shoreline cover, water diversions), and environmental conditions experienced by migrating fish (e.g., river flow, temperature). They examined how these factors influence the risk of predation and mortality, or rate of death, across fall, late-fall, winter, and spring-run Chinook ecotypes.

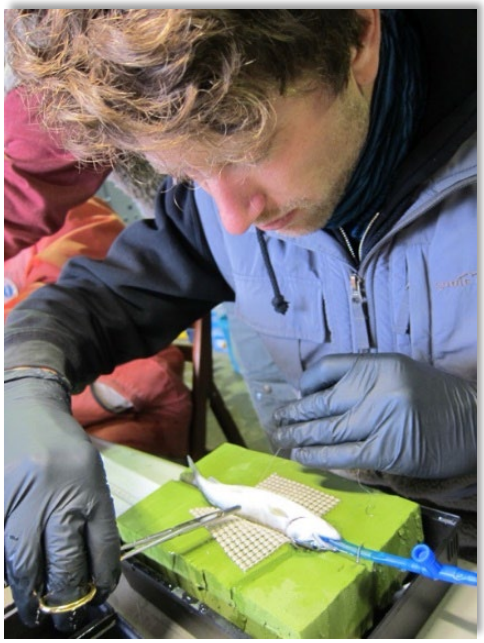
Thousands of juvenile Chinook salmon travel through the Delta, so tracking every individual fish is impossible. To address this issue, the researchers used a mark-recapture model, a method commonly used to estimate population size, by implanting remote sensors in salmon to later analyze as long-term acoustic telemetry data sets for the different runs. The results of this work highlight which parts of the river and the Delta most need restoration actions and inform managers to take water management actions that may support greater survival for juvenile Chinook salmon as they move downstream in the Sacramento River and through the Delta.

Lead Investigators

- Mark Henderson, US Geological Survey

Why This Research Matters

Winter-run Chinook salmon are listed as endangered, and spring-run Chinook as threatened under the federal Endangered Species Act, and all runs have declined relative to their historic levels. These declines have been caused, in part, by changes in their habitat stemming from industrialization and urbanization, water diversion resulting in altered river flows and migratory routes, and predation pressure from non-native species such as striped bass, largemouth bass, and channel catfish, all of which are part of the long history of changes in the waterscape throughout the Delta.



Brendan Lehman implanting an acoustic transmitter into a Chinook salmon smolt. Photo by Jeff Harding, NOAA Fisheries

Management Application

The results from this project will help prioritize areas of the Delta for different management strategies, including restoration, by providing estimates of which factors are the primary drivers of mortality in different reaches of the river. The survival estimates from these models will provide necessary inputs to life-cycle models being developed to understand the impact of different water management strategies and climate change on salmonid populations. Additionally, this research will improve our understanding of how different water management actions may affect the migration pathways and survival of the different ecotypes of juvenile salmon as they migrate through the Delta to the ocean.

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