Methods Overview

Clear Creek methodology from USFWS 2018

Adult Upstream

The Clear Creek video monitoring system has been in operation at the mouth of Clear Creek since 2012 and is operated August through December. Fish are funneled through a resistance board weir. Inside the weir there is one overhead camera and three underwater cameras. Cameras operate 24 hours a day, using red lights at night. Footage is viewed and entered into excel at the end of each monitoring season. When fish counts are unclear from the footage, it is reviewed by up to three experts. Missing data is interpolated using Generalized Additive Models (GAM).

Video data is focused on count of fish passage through the resistance board weir upstream. Additional information describing fish biology is collected by the Clear Creek monitoring program: date, time, count, run, adipose fin clip status, sex, passage direction, jack size, and spawning condition. Viewing condition is collected less consistently (75% NAs). Run assignment of chinook salmon is recorded based on date of passage observation. Some limitations of the video system and passage estimates based on the video system include identification challenges because of camera placement, turbidity visibility challenges, run determination by date inaccuracies, video outages in high flow years, and GAM model performance when there are low counts or uneven daily counts.

Snorkel Surveys

Surveys have been conducted to collect adult data on Clear Creek since 2000. Each year crews perform an August index and then perform surveys on either side of pulse flow releases. An additional 3 - 4 surveys are conducted throughout the spawning season. The first 7 years of surveys were focused on Redd and Carcass data but in 2008 surveys expanded to include holding data. The snorkel sampling reach is from Lower Clear Creek from Whiskeytown Dam located at river mile 18.1, (40.597786N latitude, -122.538791W longitude) to the Clear Creek Video Station located at river mile 0.0 (40.504836N latitude, -122.369693W longitude ) near the confluence with the Sacramento River (Figure 6). Data displayed below are filtered to Spring Run and reaches 6 & 7 are excluded because they primarily contain Fall or Late Fall Run populations.

* **Holding:** Holding surveys began in 2008 and are ongoing, FlowWest acquired data from 2008 - 2019. Clear Creek consistently collects date, reach, river mile, count of fish, jacks, latitude, longitude, year, survey intent, and picket weir location information.
* **Redd:** Redd datasets span from 2000-2022 (ongoing). Variables collected consistently by Clear Creek include: date, latitude, longitude, reach, river mile, year, method, and run. Species is collected less consistently (57% NAs). Redd data is considered an accurate count of the spawning population. Redd data most accurately counts total spawning population in years with fewer redds and is a less reliable measure in years with large spawning populations.
* **Carcass:** Carcass datasets span from 2000-2022 (ongoing). Carcasses are sampled when they are encountered on a snorkel survey. Crews collect the following data on the carcass: tissue for genetics, scales for age, fork length, sex, egg retention, adipose clip status, and tagging. Heads are collected for any clipped or unknown fish for CWT extraction. No mark recovery is conducted for carcasses so do not know carcass sampling efficiency. There are typically very few carcass recoveries on clear creek so do not quantify prespawn mortality.

Annual Adult Counts

Redd surveys have been conducted since 2000; whereas holding surveys started in 2008, and upstream passage began in 2012. Upstream passage is generally greater than holding and redd counts except in 2017-2019.