

State of California
Department of Fish and Wildlife

Memorandum

Date: October 12, 2023

To: Colin Purdy
Environmental Program Manager
North Central Region Fisheries Program
Rancho Cordova

From: Grant Henley
Environmental Scientist
North Central Region Fisheries Program
Chico Field Office

Subject: 2023 Butte Creek Adult Spring-run Chinook Salmon Holding Snorkel Survey

The annual Butte Creek adult spring-run Chinook salmon (*Oncorhynchus tshawytscha*; spring-run) holding snorkel survey was conducted August 4-10, 2023. This survey is used to estimate the number of adult spring-run Chinook salmon holding over summer and their distribution in Butte Creek prior to spawning in the fall. The survey was conducted using a standard swimming snorkel methodology from Centerville Head Dam (CHD) to Parrot-Phelan Diversion Dam (PPDD) (Figure 1). One reach between the Honey Run Covered Bridge (HRCB) and PPDD was surveyed on August 4 and three reaches between Quartz Bowl Pool and HRCB were surveyed on three consecutive days, August 8-10.

Data collection and analyses have been standardized for this survey since 2001.¹ The survey protocol requires each pool to be surveyed once by each crew member (either swimming the pool or observing from above the pool), and each crew member records a count separately for each pool. To increase accuracy of the count, snorkel surveys are conducted in an upstream to downstream direction, and the number of snorkelers entering a pool at a time is dictated by the width of the pool. This approach utilizes the swimming direction of the adult salmon to minimize double counting within a pool and prevents groups of fish from swimming around individual crewmembers and avoiding detection. Upon analysis of individual pool specific counts, uncertain or obvious outliers are excluded, and the

¹ Prior to 2001, each crew member developed an independent estimate for each holding pool, and before proceeding, a single estimate was made by group consensus and recorded in the field.

estimated number of fish observed for an individual pool is calculated by averaging individual crewmember counts. The total estimate of holding salmon is calculated by summing the averages for each pool. **The estimate for the 2023 adult snorkel survey was 95 salmon holding in Butte Creek.** The 2023 snorkel survey produced the lowest estimate of adult spring-run holding in Butte Creek since standardized survey methodologies were established in 2001 (see ¹; Figure 2), and the lowest estimate since 1987 when the holding population was estimated to be 14. During the 2023 survey, the majority (83.16%) of adult spring-run Chinook salmon were observed holding between Whiskey Flat and Centerville Powerhouse. The remaining 16% of adult spring-run Chinook salmon were observed holding between Centerville Powerhouse and Honey Run Covered Bridge in 2023. Table 1 displays the range, average number, and percent total of adult spring-run Chinook salmon observed holding within each of the four survey reaches in Butte Creek in 2023.

Table 1. Range, average number, and percent total of spring-run Chinook salmon observed in each surveyed reach from Quartz Bowl to Parrot-Phelan Diversion Dam during the 2023 Butte Creek adult spring-run Chinook salmon holding snorkel survey.

Date	Reach	Range	Average	% Total
8/8	Quartz Bowl Pool to Whisky Flat	0	0	0%
8/9	Whiskey Flat to Centerville Powerhouse	66-100	79	83.16%
8/10	Centerville Powerhouse to Honey Run Covered Bridge	16	16	16.84%
8/4	Honey Run Covered Bridge to Parrot-Phelan Diversion Dam	0	0	0%
	Totals	82-116	95	100%

A Vaki RiverWatcher Fish Counter (Vaki) has been installed in Butte Creek at Durham Mutual Fish Ladder since 2014 to monitor passage of adult salmon and steelhead returning to Butte Creek. The Vaki is utilized to estimate the number of adult spring-run entering the holding and spawning reaches of Butte Creek. This is particularly important data for spring-run Chinook salmon in Butte Creek as the number of adults entering the creek is often greater than the estimate of adult spawners due to prespawn mortality during the summer holding period. Additionally, due to regularly occurring prespawn mortality during the summer, passage counts, along with snorkel estimates, may be a better indicator of overall escapement as well as relative smolt to adult return rates for a given cohort. The first adult spring-run documented to pass through the Vaki for the 2023 migration season occurred on March 13; the last adult spring-run passed through on August 2. Historical Vaki data on Butte Creek demonstrates adult spring-run passage into upper Butte Creek can take place from February through

June depending on the water year and flow. When compared to previous years, the first and last salmon observed passing through the Vaki in 2023 were later than average. This may have been associated with the extremely wet winter and resulting high flows in the system. The Vaki was operational for the entire spring-run migration season and documented a total of 263 SRCS traveling upstream through the ladder and migrating into the summer holding habitat. It is important to note that salmon can ascend over the Durham Mutual Dam during high flow events bypassing the Vaki. With several high flow events occurring during the 2023 migration period, 263 salmon is likely a minimum estimate. Historical data trends demonstrate variability with Vaki estimates when compared to snorkel and carcass survey estimates (Figure 2).

A prespawn mortality survey is conducted annually from June through mid-September to assess the number of adult spring-run that did not survive to spawn over the summer holding period. Once the first sign of spawning is observed, usually in mid-September, a mark-recapture post-spawn carcass survey (Cormack Jolly-Seber model) is conducted through October to estimate the number of adult spring-run that survived to spawn during the fall. The estimated number of prespawn mortalities along with the estimate of spawning adults are combined to produce the official escapement estimate for Butte Creek. This number is reported annually to Grand Tab, the California Central Valley Chinook Escapement Database Report (see <https://wildlife.ca.gov/Conservation/Fishes/Chinook-Salmon/Anadromous-Assessment>). This will be the twenty-third year in which a mark re-capture carcass survey estimate will be used to compare escapement estimates against the traditional swimming snorkel methodology. Long-term data suggests snorkel survey methodology likely underestimates the number of spring-run adults in Butte Creek when there are large populations (Figure 2); however, adult holding estimates can provide valuable data to assess long-term population trends and holding patterns.

This year's participants of the holding snorkel survey included Department of Fish and Wildlife employees: Anna Allison, Drew Huneycutt, Claire Bryant, Mike Healey, and Skyler Burson. Please address any questions regarding the survey to Grant Henley at (916) 272-4152.

ec: DFW North Central Region
Morgan Kilgour
Anna Allison
Tracy McReynolds

DFW Fisheries Branch
Jonathan Nelson
Erin Ferguson
Jason Azat

DFW Northern Region
Matt Johnson
Ryan Renvak

NOAA Fisheries
Steve Edmondson
Ellen McBride
Allison Bosworth

Pacific Gas & Electric Company
Catalina Reyes
Ed Cheslak
Andrew Anderson

Figure 1. Map of Butte Creek showing survey reaches from Centerville Head Dam (CHD) to Parrot-Phelan Diversion Dam (PPDD) for spring-run Chinook salmon holding and spawning surveys.

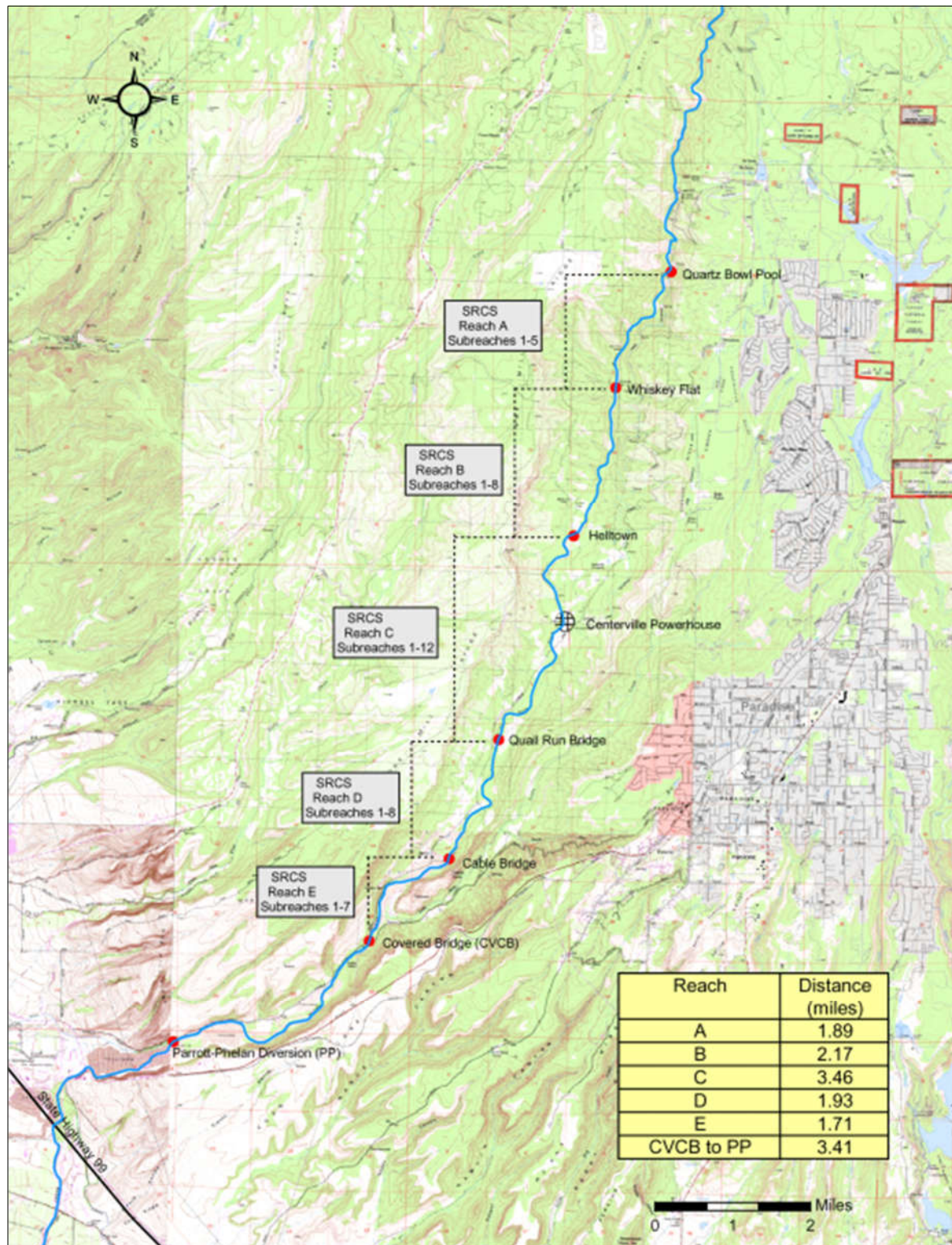


Figure 2. Butte Creek adult spring-run Chinook salmon escapement estimates (red bars) from 2001-2022, holding snorkel survey estimates (blue bars) from 2001-2023, and Vaki estimates (gray bars) from 2015, 2016, and 2019-2023. Escapement estimates are not currently available for 2023.

