

Juvenile Salmonid Monitoring in the Mainstem Trinity River, California, 2021

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Table of Contents

	page
List of Tables	iv
List of Figures	v
List of Appendices	vii
Juvenile Salmonid Monitoring in the Mainstem Trinity River, California, 2021	1
Introduction.....	2
Methods.....	1
<i>Trap Design and Operation</i>	1
<i>Biological Sampling Procedures</i>	2
<i>Hatchery and Natural Stocks Identification</i>	3
<i>Chinook Salmon Abundance Estimation</i>	4
<i>Coho Salmon Abundance Estimation</i>	4
<i>Steelhead Abundance Estimation</i>	4
<i>Abundance Indices – Emigration Timing</i>	4
<i>Migration Rate</i>	5
<i>Population Estimation</i>	5
Results.....	6
<i>Sampling Efforts</i>	6
<i>Catch Totals</i>	10
<i>Abundance Estimates</i>	10
<i>Abundance Indices</i>	10
<i>Hatchery and Natural Contribution</i>	18
<i>Migration Rate</i>	19
<i>Fish Size</i>	20
<i>Fish Condition</i>	25
References.....	29
Acknowledgements.....	29
Appendices.....	30

List of Tables

	page
Table 1. Week of the Year (WOY) and corresponding first calendar date.	8
Table 2. Period and duration of 2021 spring/summer monitoring and percent of time sampled at Pear Tree Rotary Screw Trap site (PTRST; rkm 118) and Willow Creek Rotary Screw Trap site (WCRST; rkm 34) in the Trinity River, California.....	10
Table 3. Juvenile salmonid catch totals in 2021 for trapping at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34), on the Trinity River, California, operated by the Hoopa Valley Tribal Fisheries Department, U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Yurok Tribal Fisheries Program. Hatchery fish totals are expanded catch based on adipose fin clip rate.....	11
Table 4. California Department of Fish and Game, Trinity River Hatchery juvenile salmonid releases, 2021. AD-clipped = adipose fin clipped fish.	11
Table 5. Catch totals of non-target fish species captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the mainstem Trinity River, California, 2021.	12
Table 6. Juvenile salmonid proportional discharge-based abundance indices at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.	13
Table 7. Juvenile salmonid emigration duration and peak as inferred from proportional discharge-based abundance indices at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.....	19
Table 8. Juvenile salmonid maximum migration rate from Trinity River Hatchery to Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) sampling sites, operated by the Hoopa Valley Tribal Fisheries Department, U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Yurok Tribal Fisheries Program, 2021.	21

List of Figures

	page
Figure 1. Location of the Trinity River Rotary Screw Trap sites near Willow Creek (rkm 34) and Pear Tree Gulch (rkm 118), California, operated by the Yurok Tribal Fisheries Program, U.S. Fish and Wildlife Service, and the Hoopa Valley Tribal Fisheries Department.	1
Figure 2. Mean daily discharge (m^3/s) in the Trinity River recorded near Helena (U.S. Geological Survey Water Resource gage station #11-526400) and Hoopa (U.S. Geological Survey Water Resource gage station #11-530000), California, and mean daily water temperatures ($^{\circ}\text{C}$) recorded at USGS gage #11-526400 and the Willow Creek Rotary Screw Trap (WCRST) in 2021.	9
Figure 3. Weekly Bayesian time-stratified population estimates of natural age-0 and hatchery age-0 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34) in the Trinity River, California, 2021.....	14
Figure 4. Weekly proportional discharge-based abundance indices for natural age-0 and hatchery age-0 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34) in the Trinity River, California, 2021.	15
Figure 5. Weekly proportional discharge-based abundance indices for natural age-0, natural age-1, and hatchery age-1 Coho Salmon captured at Pear Tree Rotary Screw Trap (PTRST, rkm 118) and Willow Creek Rotary Screw Trap (WCRST, rkm 34) in the Trinity River, California, 2021.....	16
Figure 6. Weekly proportional discharge-based abundance indices for natural age-0, natural age-1, natural age-2, and hatchery age-1 steelhead captured at Pear Tree Rotary Screw Trap (PTRST, rkm 118) and Willow Creek Rotary Screw Trap (WCRST, rkm 34) in the Trinity River, California, 2021.	17
Figure 7. Weekly mean fork lengths of age-0 and age-1 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.....	22
Figure 8. Weekly mean fork lengths for natural and hatchery Coho Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.....	23
Figure 9. Weekly mean fork lengths for natural age-0, age-1, age-2, and hatchery age-1 steelhead captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.....	24
Figure 10. Weekly mean K value for pooled hatchery and natural age-0 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.....	26

Figure 11. Weekly mean K value for natural age-1 Coho Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.	27
Figure 12. Weekly mean K value for natural age-1+ steelhead captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021.	28

List of Appendices

	page
Appendix 1. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Chinook Salmon catches and abundance indices, in the Trinity River, California, 2021.....	31
Appendix 2. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Chinook Salmon catches and abundance indices in the Trinity River, California, 2021.....	32
Appendix 3. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Coho Salmon catches and abundance indices in the Trinity River, California, 2021.....	33
Appendix 4. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Coho Salmon catches and abundance indices in the Trinity River, California, 2021.....	34
Appendix 5. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly steelhead catches and abundance indices in the Trinity River, California, 2021.....	35
Appendix 6. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly steelhead catches and abundance indices in the Trinity River, California, 2021.....	36
Appendix 7. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly age-0 Chinook Salmon trapping effort, catch numbers, mark-recapture numbers, and population estimates in the Trinity River, California, 2021.	37
Appendix 8. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly age-0 Chinook Salmon trapping effort, catch numbers, mark-recapture numbers, and population estimates in the Trinity River, California, 2021.	38
Appendix 9. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Chinook Salmon fork lengths in the Trinity River, California, 2021.	39
Appendix 10. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Chinook Salmon fork lengths in the Trinity River, California, 2021.	40
Appendix 11: Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Coho Salmon fork lengths in the Trinity River, California, 2021.....	41

Appendix 12: Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Coho Salmon fork lengths in the Trinity River, California in the Trinity River, California, 2021.....	42
Appendix 13. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly steelhead fork lengths in the Trinity River, California, 2021.....	43
Appendix 14. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly steelhead fork lengths in the Trinity River, California, 2021.	44
Appendix 15. Fulton's condition factor (K) for pooled natural and hatchery age-0 Chinook Salmon with FL > 50 mm from the Pear Tree and Willow Creek Rotary Screw Trap sites in the Trinity River, California, 2021.	45
Appendix 16. Fulton's condition factor (K) for natural age-1 Coho Salmon from the Pear Tree and Willow Creek Rotary Screw Trap sites in the Trinity River, California, 2021.....	46
Appendix 17. Fulton's condition factor (K) for natural age-1+ steelhead from the Pear Tree and Willow Creek Rotary Screw Trap sites in the Trinity River, California, 2021.....	47

Juvenile Salmonid Monitoring in the Mainstem Trinity River, California, 2021

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Executive Summary — This report presents juvenile salmonid emigration monitoring data collected in 2021 at both the Pear Tree rotary screw trap site (PTRST; river kilometer [rkm] 118) and the Willow Creek rotary screw trap site (WCRST; rkm 34) in the mainstem Trinity River, California. Information collected from this project is used to assess the effectiveness of the Trinity River Restoration Program’s habitat and flow management actions for restoring the salmonid populations of the Trinity River. Monitoring at PTRST and WCRST is conducted to estimate juvenile salmonid population size and emigration timing during the monitoring period. In 2021, one 8-ft diameter rotary screw trap was operated at PTRST from January 11 through August 3, with successful sampling for 149 days of the 204-day sampling period. At WCRST, three 8-ft diameter rotary screw traps were operated from March 16 through July 20, with successful sampling for 60 days of the 126-day sampling period.

Efficiency estimates and catch data were used to estimate weekly and seasonal outmigration abundance of both naturally and hatchery-origin sub-populations of age-0 juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) migrating downstream past PTRST and WCRST using a Bayesian time-stratified population estimation method. At PTRST an estimated 553,700 (95% Credible Interval (CI): [468,552, 651,765]) natural-origin age-0 Chinook Salmon and 205,409 (95% CI: [143,525, 277,141]) age-0 hatchery origin Chinook Salmon passed the site between January 11 and August 03. At WCRST between March 16 and July 20, an estimated 540,014 (95% CI: [415,168, 677,314]) naturally origin age-0 Chinook Salmon and 73,288 (95% CI: [44,889, 106,076]) age-0 hatchery-origin Chinook Salmon passed the site. Age of salmonid outmigrants, mean length by week, migration rates, and hatchery contributions were estimated. Catch data were used to calculate proportional discharge-based abundance indices for juvenile Coho Salmon (*O. kisutch*) and steelhead (*O. mykiss*).

Juvenile salmonid emigration target dates to assess the timing at which 80% of the juvenile salmonid population passed Willow Creek (WC80) are used to inform water temperature and discharge management in the mainstem Trinity River. The WC80 estimate at which 80% of the juvenile Chinook Salmon population passed WCRST, inferred from the Bayesian time-stratified population estimates, was Week of the Year (WOY) 25 (June 18–24), which occurred before the TRRP management target date of July 4. The estimated time at which 80% of the natural Coho Salmon age-1+ population passed the WCRST, as inferred from the proportional discharge-based abundance index,

was WOY 21 (May 21–27). The estimated time at which 80% of the natural steelhead age-1+ population passed the WCRST, as inferred from the proportional discharge-based abundance index, was also WOY 20 (May 14–20).

Introduction

This report presents annual data collected to: (1) evaluate the production of juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) from the upper 65 kilometers of the mainstem Trinity River below Lewiston Dam, the primary restoration reach of the Trinity River Restoration Program (TRRP) and (2) provide data to estimate production and determine outmigrant timing of juvenile salmonids through the lower Trinity River in response to managed flow releases, thermal regimes, and restoration efforts. Information collected by this project is needed to address key uncertainties outlined in the TRRP Science Plan (Pickard et al. 2022).

Juvenile salmonid emigration from the mainstem Trinity River has been monitored since 1989 using rotary screw traps. This data series report summarizes the outmigrant monitoring data collected in 2021 cooperatively by the U.S. Fish and Wildlife Service, Hoopa Valley Tribal Fisheries Department, and Yurok Tribal Fisheries Program at Pear Tree (PTRST) and Willow Creek (WCRST) rotary crew trap sites on the mainstem Trinity River (Figure 1). This data series report intends to provide timely dissemination of data to local managers, for inclusion in agency databases, and provide basic biological information to evaluate the effectiveness of habitat restoration and flow management actions undertaken by the TRRP to restore the fishery resources of the Trinity River (USDOI 2000). In addition to quantifying salmonid outmigrant production and timing, other biological data from the outmigrating salmonid populations are recorded and assessed.

Technical reports synthesizing long-term datasets developed by this project will be periodically published to evaluate trends in outmigrant salmonid production, outmigrant timing, hatchery contribution, and health (e.g., Pinnix et al. 2022). Monitoring emigrating juvenile salmonid populations in conjunction with habitat availability and suitability studies is expected to provide a direct evaluation of TRRP restoration efforts because these studies focus on the early freshwater life-history phase which is directly affected by instream conditions and management actions. In addition, this information is intended to be used by the TRRP to aid in development of a salmon production model for the Trinity River.

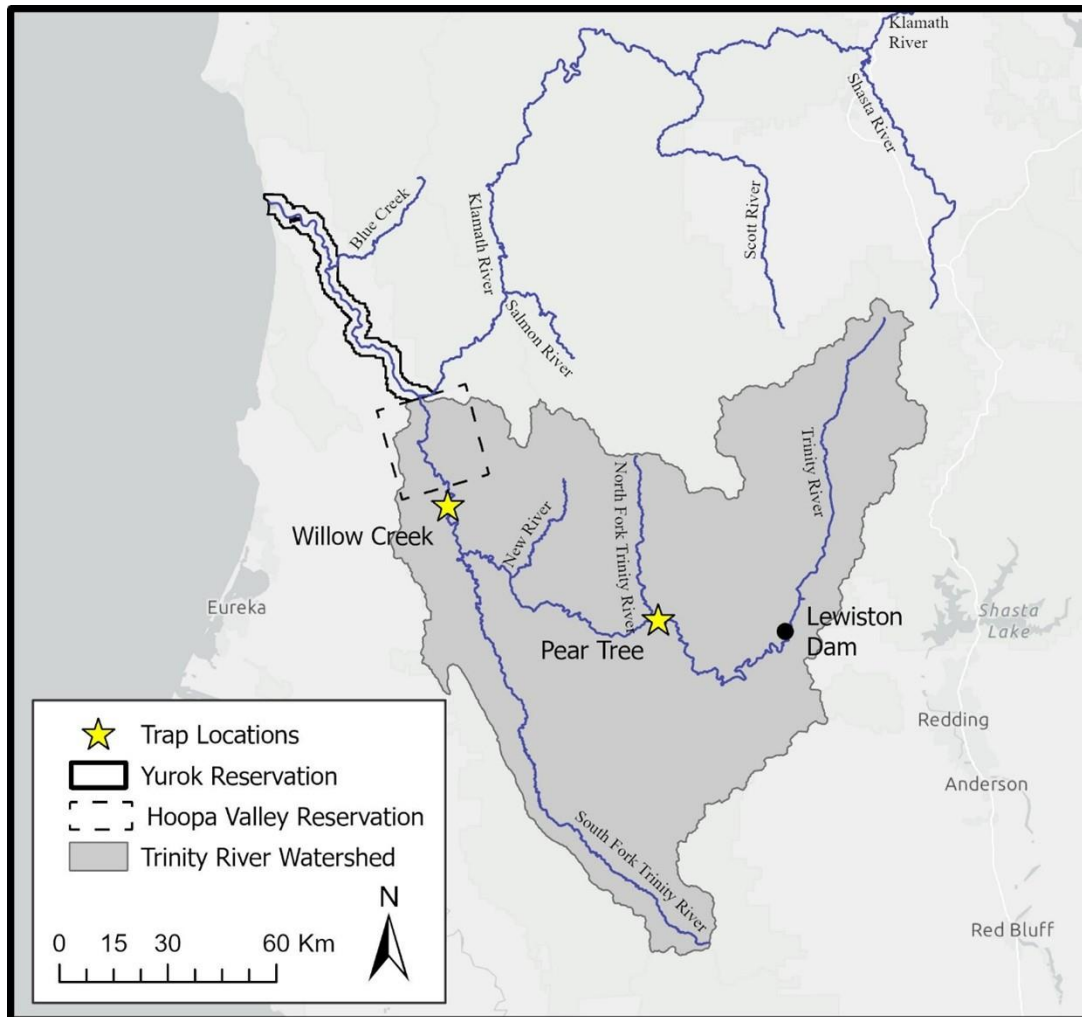


Figure 1. Location of the Trinity River Rotary Screw Trap sites near Willow Creek (rkm 34) and Pear Tree Gulch (rkm 118), California, operated by the Yurok Tribal Fisheries Program, U.S. Fish and Wildlife Service, and the Hoopa Valley Tribal Fisheries Department.

Methods

Trap Design and Operation

At PTRST, sampling was conducted using a single 2.4-m diameter rotary screw trap. The trap was operated from January 11 to August 3 to span the greatest portion of the expected emigration of natural-origin age-0 juvenile Chinook Salmon from the study reach (Green and Petros 2005; Schwarz et al. 2009; Petros 2017).

At WCRST, sampling was conducted by deploying one to three 2.4-m diameter rotary screw traps, depending on river conditions such as magnitude of river discharge and debris load. Traps were deployed from March 16 through July 20 to sample the majority of outmigrating age-0 Chinook Salmon. This timeframe allows sufficient data to be

collected for evaluating emigration patterns and relative abundances of natural- and hatchery-origin age-0 Chinook Salmon, as well as including Coho Salmon and steelhead smolt outmigration periods.

Traps at both sites were anchored with 0.95-cm diameter aircraft cable to a series of steel fence stakes. One or two 0.1 m x 0.15 m x 6.0 m (4 in x 6 in x 10 ft) beams were used to support the traps in place away from the bank. Screw trap cone revolutions per minute were used to determine optimal trap placement at each site; low cone revolutions (i.e., <4 revolutions per minute) necessitated moving the trap into faster water, high revolutions (i.e., >9 revolutions per minute) necessitated moving the trap to slower water or lifting the cone out of the water. Traps were fished on the edge of the thalweg during high river discharge and incrementally moved back into the thalweg as river discharge decreased. When deployed, the bottom of the cone was generally <1 m from the river bottom. The overnight sample period is defined as the time period between the setting of the trap one day and removal of captured fish approximately 24 hours later. This period encompassed all hours between sunset and sunrise, when the majority of juvenile salmonids have been found to emigrate based on past sampling. Generally, trap checks at PTRST occurred around 1700 hours the day the trap was set and 0800 hours the following morning, with the morning check marking the end of one sample period. At WCRST, trap checks in the late morning or early afternoon marked the end of one sample day. At both locations the frequency of daily trap checks increased during peak emigration periods, with the frequency dictated by water temperatures, fish numbers and mortality rates.

Daily trap catch data were summarized by Week of the Year (WOY), with the first day of WOY 1 commencing on the Sunday before January 1 (Table 1). All WOYs are seven days except the ninth WOY during leap years, which is eight days in length.

Water Flow and Temperature Measurements

Normal cone operating depth was 1.2 m for the 2.4-m traps and 0.8 m for the 1.5-m trap. Daily velocity measurements were taken at the time traps were checked directly in front of the cone as follows: the submerged portion of the cone was divided into three cells (right, center, left); within each cell, velocity was measured at 0.2 and 0.8 of the cone operating depth for 60 seconds using a General Oceanics® digital flowmeter (Model 2030, General Oceanics, Inc. 1983). Discharge sampled was calculated at each cell by multiplying cell area (ft²) by its corresponding mean water velocity (ft/s). The values for each cell were then summed to estimate total river discharge sampled in cubic feet per second (ft³/s). Discharge and water temperature records for PTRST were produced by USGS from data collected at USGS Water Resources gauge station #11-526400, which is situated approximately 61 m downstream of the trap site. Discharge data from U.S. Geological Survey Water Resource gauge station Hoopa (#11-530000 at rkm 19.9) on the Trinity River was used as a surrogate measure of mean daily river discharge at WCRST.

At PTRST, water temperature data was collected using thermometer deployed in the trap livewell. Temperature data was recorded with each trap check. At WCRST, water temperature data were collected each day the trap was in operation using a YSI 550 A temperature and dissolved oxygen probe.

Biological Sampling Procedures

All juvenile fish handled were anesthetized with Aqui-S 20e prior to processing. Up to 30 individuals of each species, age class (based on size), with and without hatchery marks, were randomly sampled (biosampled) from the daily catch. Biosampled salmonids were measured to the nearest mm fork length (FL), weighed to the nearest 0.1 g by digital scale, and examined for external marks (stains, fin clips, tattoos, and brands) and physical irregularities. All captured salmonids that were not biosampled were tallied by species, age, and origin, and examined for external marks.

Juvenile Chinook Salmon were classified as age-0 (young-of-year) or age-1, based on size and date of capture. Coho Salmon were classified as either age-0 or age-1; the latter of which were much larger in size, more silvery in color, and lacked distinct parr marks. Steelhead were classified by age based on length–age analysis from a subsample of scales collected from WCRST or by length-frequency distribution from PTRST. Analysis of scale samples collected from unmarked steelhead over the sampling season provided length-to-age relationships. Un-aged steelhead were assigned an age based on the length–age relationship derived from scale-aged samples.

When present, daily samples of hatchery-marked Chinook Salmon were collected at WCRST. A missing adipose fin (ad-clip) was the external marker indicating a Chinook Salmon with a coded-wire tag (CWT) embedded in the snout. Within the Trinity River, a target constant fractional marking rate of 25% is used for Chinook Salmon. A maximum of five ad-clipped Chinook Salmon were collected daily and stored in a freezer for later CWT retrieval. Occasionally, ad-clipped fish were also used for disease analysis, after their CWTs were removed. Hatchery-marked Chinook Salmon were not regularly collected at PTRST.

Any salmonid mortality in the live box was checked for a fin clip and measured if included in the subsample. If a salmonid escaped during netting or handling before it could be identified to species or checked for a hatchery mark (i.e., adipose fin or maxillary clip), it was counted in the sample tally as ‘unknown’. Unknown salmonids were not included in catch totals.

Non-target species, fish other than Chinook Salmon, Coho Salmon, or steelhead, were identified to genus or species and enumerated. Additionally, for Brown Trout, lamprey ammocetes, and sturgeon, up to five specimens of each species were measured to FL. Total length (TL) was measured on species without a forked caudal fin.

All anesthetized fish not collected were allowed to recover in buckets of river water before being released downstream of the trap. If any adult salmonids were captured, their FL was recorded before release.

Hatchery and Natural Stocks Identification

The catch of Chinook Salmon, Coho Salmon, and steelhead was separated by hatchery or natural origin based on their external marks. Hatchery release strategies for Chinook Salmon consist of fingerling releases in the spring and yearling releases in the fall. These two distinct release periods prompted the division of the trapping season into spring and fall monitoring periods. The spring monitoring period was designated as WOY 1–39 and

the fall period as WOY 40–52 in years when extended sampling was conducted. Currently, this project does not sample during the fall monitoring period, though year-round sampling has occurred in past year. Hatchery-origin steelhead and Coho Salmon are typically volitionally released as smolts or yearling-plus (age-1) in early spring.

Chinook Salmon Abundance Estimation

At both PTRST and WCRST, the weekly number of hatchery-origin Chinook Salmon caught was estimated by dividing the number of ad-clipped fish by the Trinity River Hatchery (TRH) fin-clip rate (approximately 25%). The estimated number of natural-origin Chinook Salmon in the weekly catch were calculated as the difference between the total weekly Chinook Salmon catch and the estimated number of hatchery-origin Chinook Salmon.

Weekly hatchery and natural stock contribution was estimated under the assumptions that 1) differential post-release mortality between ad-clipped and non-ad clipped fish of the same release group is negligible, 2) ad-clip and non-clip Chinook Salmon are equally vulnerable to capture, and 3) mark-fraction estimates of Chinook Salmon released from TRH are accurate.

At the beginning and end of the hatchery fish emigration period, juvenile Chinook Salmon of hatchery origin may have been captured but not represented by ad clipped fish. If no ad-clipped hatchery Chinook Salmon were captured within a given week, the hatchery contribution for that week could not be differentiated from the natural component and all Chinook Salmon captured during that week were assumed to be of natural origin. Conversely, when the ad-clipped proportion of the weekly catch equaled or exceeded the clip fraction of the most recent release of Chinook Salmon from TRH, all Chinook Salmon captured during that week were assumed to be of hatchery origin.

Coho Salmon Abundance Estimation

All hatchery Coho Salmon released from TRH were marked with a right-maxillary clip (max-clip). The weekly contribution of natural-origin Coho Salmon to the catch was estimated by subtracting the catch of hatchery-origin fish from the total catch.

Steelhead Abundance Estimation

All hatchery steelhead released from TRH were marked with an ad-clip. The weekly contribution of natural-origin steelhead to the catch was estimated by subtracting the catch of hatchery-origin fish from the total catch.

Abundance Indices – Emigration Timing

A weekly flow-based abundance index for each age class of Chinook Salmon, Coho Salmon, and steelhead was estimated for each WOY based on catch-per-effort data. Daily abundance indices ($Index_{DC}$) for each species and development stage were calculated by the following equation:

$$Index_{DC} = \frac{Catch_{DC}}{Q_c/Q}$$

where:

$Catch_{DC}$ = Sum of daily catch of a species/life stage/age class from all traps.

Q_C = Sum of discharge sampled (ft³/s) by all traps

Q = Mean daily river discharge (ft³/s) at trap site

Weekly abundance indices ($Index_{CWOYi}$) were calculated for each WOY using the following equation:

$$Index_{CWOYi} = \frac{\sum Index_{DC}}{\left(\frac{nt_i}{TD_i}\right)}$$

where:

nt_i = Number of days in the WOY with at least one trap fishing

TD_i = Sum of the days in the WOY

The estimated proportion of hatchery-origin fish, based on catches of marked fish and marking rates, were used to apportion abundance indices into hatchery and natural production. The usefulness of this index as an estimator of abundance is contingent upon assumptions that abundance is directly proportional to the percentage of river flow sampled and that individuals from a given species are equally susceptible to capture. The abundance index is not intended to represent a population estimate, but rather used to compare relative abundance between weeks during the trapping season and between years.

Emigration duration is defined as the period of time between the first and last WOYs that a species of a given age and origin is present in the catch. This definition applies strictly to the sampling period and is potentially longer for species of a given age and origin that have a longer emigration period than the sampling period. Emigration peaks are defined as the largest weekly abundance index for a species of a given age and origin. Abundance indices are greatly influenced by river discharge, which should be considered when comparing indices within or between years for absolute numbers of fish passing a site. However, abundance indices are generally thought to be adequate indicators of emigration timing and duration if sampling occurred in all weeks of the appropriate sampling period (Schwarz et al. 2009).

Migration Rate

Migration rates were estimated for hatchery-origin Chinook Salmon, hatchery-origin steelhead, and hatchery-origin Coho Salmon by dividing the distance (km) traveled by the number of days elapsed between the initial hatchery release date and capture date at each trap site for specific CWT codes or marked fish. Migration rates reported as maximum, average, and median. Due to constant fractional marking rates and volitional releases, mean and median migration rates were not calculated for Chinook Salmon release groups.

Population Estimation

An intensive mark-recapture technique was employed to generate separate population estimates for natural- and hatchery-origin age-0 Chinook Salmon. Weekly and total abundance of natural-origin age-0 Chinook Salmon outmigrating past PTRST and WCRST were estimated using a Bayesian time-stratified population estimation method (Calvert et al. 2009; Payton and Som 2021). This method requires the following weekly data: total age-0 Chinook Salmon with adipose fins, total adipose fin-clipped age-0 Chinook Salmon (and associated hatchery clip rate), trapping effort (sample fraction, described below), trap efficiency marks released, and trap efficiency marks recaptured. The numbers of age-0 Chinook Salmon with and without adipose fins were summarized from the weekly trapping data and fin-clip rates were reported by TRH.

Traps were not operated a full seven days each week, and due to operational logistics and disruptions (e.g., flawed sets due to debris), daily catches were not completed every day as originally planned. To account for variable and less than full effort, the number of days the site was operated within each j^{th} week was divided by seven, termed sampling fraction:

$$s_j = \frac{d_j}{7}$$

Mark-Recapture Technique

Hatchery-origin age-0 Chinook Salmon, provided by TRH, were used for mark-recapture trap efficiency tests at both trap locations. Marked test fish were released approximately 0.5–0.8 km upstream of the trap site to be tested. At least three meso-habitat units, including at least one riffle, were included between the release site and the trap site to allow the fish enough time and space to distribute across the river channel similarly to a natural population passing the trap site. Due to the length of the sampling week, two or three recapture days were available after the release of marked fish. These capture efficiency trials were essential data for estimating abundance via the Bayesian time-stratified model. Mark-recapture efficiency tests could not be conducted for Coho Salmon or steelhead due to the limited availability of these species, so production estimates were not generated for these species.

One or two types of marks were utilized in 2021, either freeze brands or Bismark Brown Y diazo dye. Freeze brands were applied only to hatchery-origin juvenile Chinook Salmon at TRH, which were held in raceways until brands became fully visible (approximately 5-10 days). Branded fish were transported to the appropriate release site in insulated tanks filled with aerated water. At the release site, a sample of the freeze branded fish was evaluated for mark quality; the proportion of fish with poor quality marks was applied to the release total and excluded from the total amount released. Hatchery fish with unique brands for each WOY and site were delivered from the hatchery weekly. Bismark Brown Y marking was applied to only hatchery-origin juvenile Chinook Salmon from TRH following Rawson (1984). The Bismark Brown Y was applied at the release site after fish were counted and transported from the hatchery.

Fish marked for trap efficiency trials were released around one hour before sunset

approximately 0.9 km upstream near the stream margin (PTRST) or in the late afternoon at approximately 0.4 km upstream into a large, still pool (WCRST) to allow mixing with the population of emigrating wild fish yet to pass the sampling site. During periods with low daily captures, fish were held for several days until adequate numbers for estimating trap efficiency were available. All recaptured fish were identified and recorded during normal trapping operations but were not counted as part of the catch for that day.

Results

Sampling Efforts

In 2021, trapping at PTRST began in the second week of January and trapping at WCRST was initiated in late March (Table 2). Sampling occurred at both sites in each sampling week, although occasionally traps were not run for complete sample weeks. To ensure that the greatest portion of the natural Chinook Salmon emigration, as well as portions of the hatchery and natural Coho Salmon and steelhead) smolt emigration were sampled, efforts were made to install the traps as early as possible and continue sampling throughout the summer. Sampling at PTRST has occurred between early January and late August since 2007, and sampling at Willow Creek has occurred from March through August since 2005. Sampling in 2021 did not occur year-round, therefore annual production estimates and indices are only calculated from data collected within the sampling timeframe. Data are grouped by WOY (Table 1). Graphs of water temperature and discharge through the sampling periods are presented in Figure 2.

Table 1. Week of the Year (WOY) and corresponding first calendar date.

WOY	Week start	WOY	Week start	WOY	Week Start
1	Dec 27	18	Apr 25	35	Aug 22
2	Jan 03	19	May 02	36	Aug 29
3	Jan 10	20	May 09	37	Sep 05
4	Jan 17	21	May 16	38	Sep 12
5	Jan 24	22	May 23	39	Sep 19
6	Jan 31	23	May 30	40	Sep 26
7	Feb 07	24	Jun 06	41	Oct 03
8	Feb 14	25	Jun 13	42	Oct 10
9	Feb 21	26	Jun 20	43	Oct 17
10	Feb 28	27	Jun 27	44	Oct 24
11	Mar 07	28	Jul 04	45	Oct 31
12	Mar 14	29	Jul 11	46	Nov 07
13	Mar 21	30	Jul 18	47	Nov 14
14	Mar 28	31	Jul 25	48	Nov 21
15	Apr 04	32	Aug 01	49	Nov 28
16	Apr 11	33	Aug 08	50	Dec 05
17	Apr 18	34	Aug 15	51	Dec 12

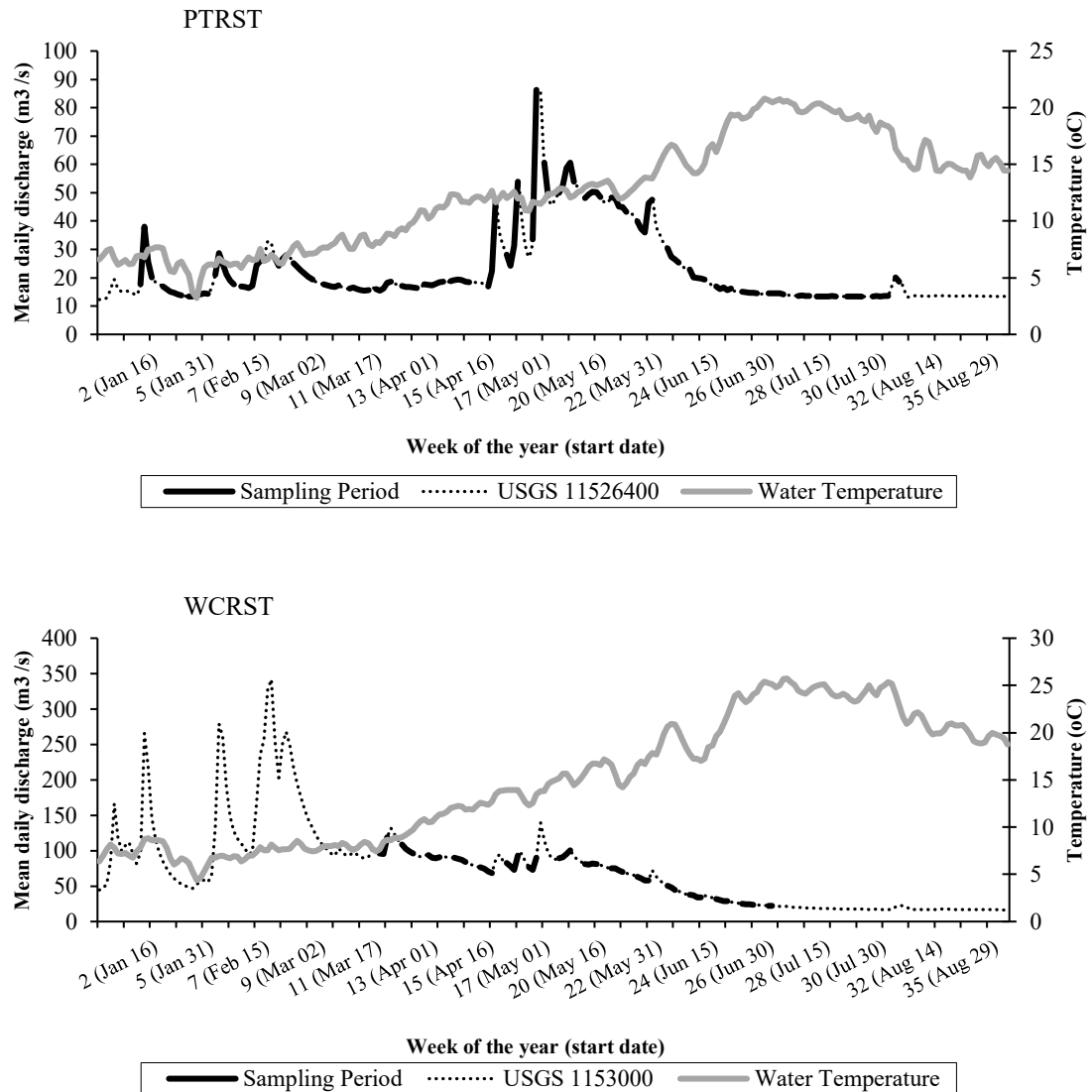


Figure 2. Mean daily discharge (m³/s) in the Trinity River recorded near Helena (U.S. Geological Survey Water Resource gage station #11-526400) and Hoopa (U.S. Geological Survey Water Resource gage station #11-530000), California, and mean daily water temperatures (°C) recorded at USGS gage #11-526400 and the Willow Creek Rotary Screw Trap (WCRST) in 2021. USGS gage #11-526400 is located approximately 100 m downstream of the Pear Tree Rotary Screw Trap (PTRST). USGS gage #11-530000 is located approximately 13.36 km downstream of the Willow Creek Rotary Screw Trap (WCRST). The bold sections on discharge series indicate sampled flows and the lightly dotted sections indicate non-sampled flows.

Table 2. Period and duration of 2021 spring/summer monitoring and percent of time sampled at Pear Tree Rotary Screw Trap site (PTRST; rkm 118) and Willow Creek Rotary Screw Trap site (WCRST; rkm 34) in the Trinity River, California. Distinct days are total number of days sampled with at least one trap.

Site	Trap	Start-end dates	Trapping days	Trapping rate
PTRST	1 (2.4 m)	Jan 13 – Aug 5	149	72.7%
	Distinct days	Jan 13 – Aug 5	149	72.7%
WCRST	1 (2.4 m)	Mar 16 – Jun 30	59	55.7%
	2 (2.4 m)	Mar 17 – Jul 20	60	48.0%
	3 (2.4 m)	Mar 19 – Jul 20	58	47.2%
	Distinct days	Mar 16 – Jul 20	60	47.6%

Catch Totals

Catch totals of salmonids (Chinook Salmon, Coho Salmon, and steelhead) are presented in Table 3. Chinook Salmon were the most captured salmonid at both sites, comprising approximately 90% and 89% of the total anadromous salmonid catch at PTRST and WCRST, respectively. Hatchery salmonid releases from TRH are presented in Table 4. Catch totals of common non-target, fish species are presented in Table 5. Sampling periods at both trap sites missed portions of each respective population that emigrated before or after trapping operations. Natural age-0 Chinook Salmon were captured on the first day of trap operation at both sites, indicating that some age-0 Chinook Salmon emigrated before trap installation. A total of 203 age-1 hatchery Chinook Salmon were caught at PTRST. Natural age-1 Coho Salmon were captured at the beginning of the sampling period at both trap sites, indicating that portions of each respective population emigrated prior to trap installation.

Abundance Estimates

The Bayesian time-stratified population estimates for natural age-0 Chinook Salmon were 553,700 (95% Credible Interval (CI): [468,552, 651,765]) at PTRST and 540,014 (95% CI: [415,168, 677,314]) at WCRST (Figure 3; Table 6; Appendix 1, 2). The age-0 hatchery Chinook Salmon abundance estimates were 205,409 (95% CI: [143,525, 277,141]) at PTRST and 73,288 (95% CI: [44,889, 106,076]) at WCRST.

Abundance Indices

Age-0 natural-origin Coho Salmon abundance indices were 1,083 and 2,364 at PTRST and WCRST, respectively (Figure 4; Table 6, Appendix 3, Appendix 4). The abundance indices for age-1 natural-origin Coho Salmon were 206 and 702 at PTRST and WCRST, respectively. Abundance indices of hatchery-origin age-1 Coho Salmon were 23,949 and 14,786 at PTRST and WCRST, respectively.

At PTRST, abundance indices of natural-origin age-0 and age-1 steelhead were 5,259 and 21,455, respectively (Figure 5; Table 6; Appendix 5). Abundance indices of age-0 and age-1 steelhead at WCRST were 758 and 19,178, respectively (Table 6; Appendix 6). Abundance indices of hatchery age-1 steelhead were 4,411 at PTRST and 13,189 at WCRST. The Age-2 steelhead abundance index was 1,086 at PTRST.

Table 3. Juvenile salmonid catch totals in 2021 for trapping at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34), on the Trinity River, California, operated by the Hoopa Valley Tribal Fisheries Department, U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Yurok Tribal Fisheries Program. Hatchery fish totals are expanded catch based on adipose fin clip rate. NA = Not Applicable (i.e., no fish of a particular age class exist in the Trinity River).

Site	Species	Hatchery Age-0	Hatchery Age-1+	Natural Age-0	Natural Age-1+	Total
PTRST	Chinook Salmon	9,543	0	34,298	203	44,044
	Coho Salmon	NA	2,110	68	12	2,190
	steelhead	NA	199	364	1,250	1,813
WCRST	Chinook Salmon	2,157	0	22,006	58	24,210
	Coho Salmon	NA	809	166	41	1,016
	steelhead	NA	760	56	1,168	1,987

Table 4. California Department of Fish and Game, Trinity River Hatchery juvenile salmonid releases, 2021. AD-clipped = adipose fin clipped fish.

Species	Release season	Number released	Percentage ad- clipped or marked	Release dates
Chinook Salmon	Spring	941,163	24.8	05/10 – 10/10
	Fall	2,471,852	24.5	06/09 – 10/22
Coho Salmon ¹	Spring	289,687	99.9	03/19 ²
Steelhead	Spring	280,072	99.9	04/15 – 04/22

¹Coho Salmon were marked with a right maxillary clip.

²Coho Salmon volitional release end date unavailable

Table 5. Catch totals of non-target fish species captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the mainstem Trinity River, California, 2021.

Common name	Species	Life stage	PTR	WCRST
Lamprey	<i>Entosphenus spp.</i>	Ammocoete	721	139
		Eyed juvenile	231	158
		Adult	2	5
Sucker	<i>Catostomus spp.</i>		221	198
Speckled Dace	<i>Rhinichthys osculus</i>		1,265	410
Three-Spine Stickleback	<i>Gasterosteus aculeatus</i>		73	45
Golden Shiner	<i>Notemigonus crysoleucas</i>		0	3
Sculpin	<i>Cottus spp.</i>		5	42
Green Sturgeon	<i>Acipenser medirostris</i>	Juvenile	0	0
Brown Trout	<i>Salmo trutta</i>	Juvenile	87	4
Sunfish	<i>Lepomis spp.</i>		21	1
Sockeye Salmon	<i>Oncorhynchus nerka</i>	Juvenile	0	44
Fathead Minnow	<i>Pimephales promelas</i>	Juvenile	0	10
Chum Salmon	<i>Oncorhynchus keta</i>		0	5

Table 6. Juvenile salmonid proportional discharge-based abundance indices at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. NA = Not Applicable (i.e., no fish of a particular age class exist in the Trinity River).

Site	Species	Hatcher y Age-0	Hatcher y Age-1	Natural Age-0	Natural Age-1+	Total
PTRST	Chinook Salmon	33,802	0	219,040	1,460	254,303
	Coho Salmon	NA	880	488	124	1,491
	Steelhead	NA	1,987	2,203	11,008	15,197
WCRS T	Chinook Salmon	27,487	0	327,438	1,124	341,735
	Coho Salmon	NA	14,786	2,364	702	17,853
	Steelhead	NA	13,189	758	19,178	33,125

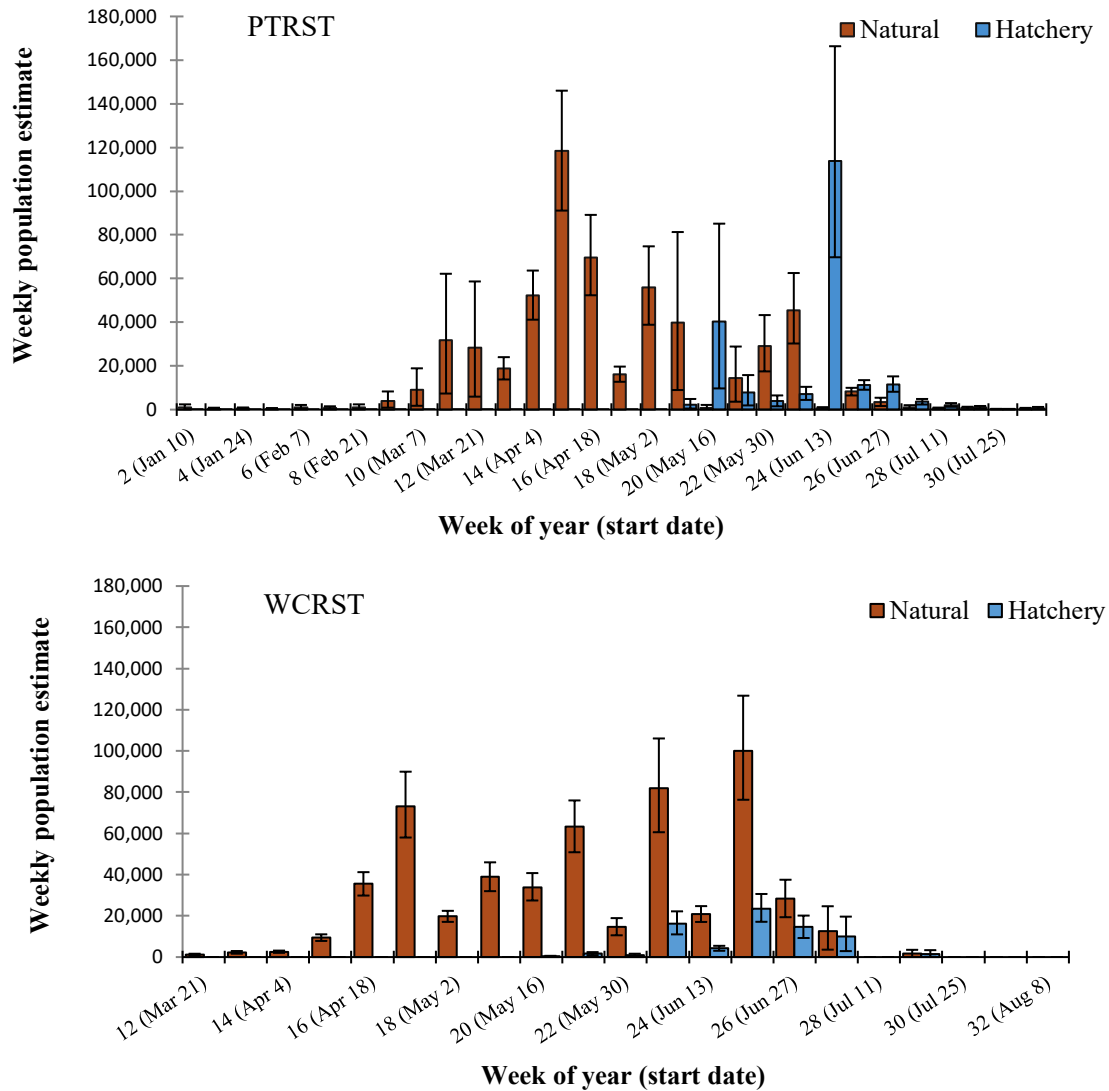


Figure 3. Weekly Bayesian time-stratified population estimates of natural age-0 and hatchery age-0 Chinook Salmon (*Oncorhynchus tshawytscha*) captured at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34) in the Trinity River, California, 2021. Error bars represent the upper and lower credible interval around the mean estimate.

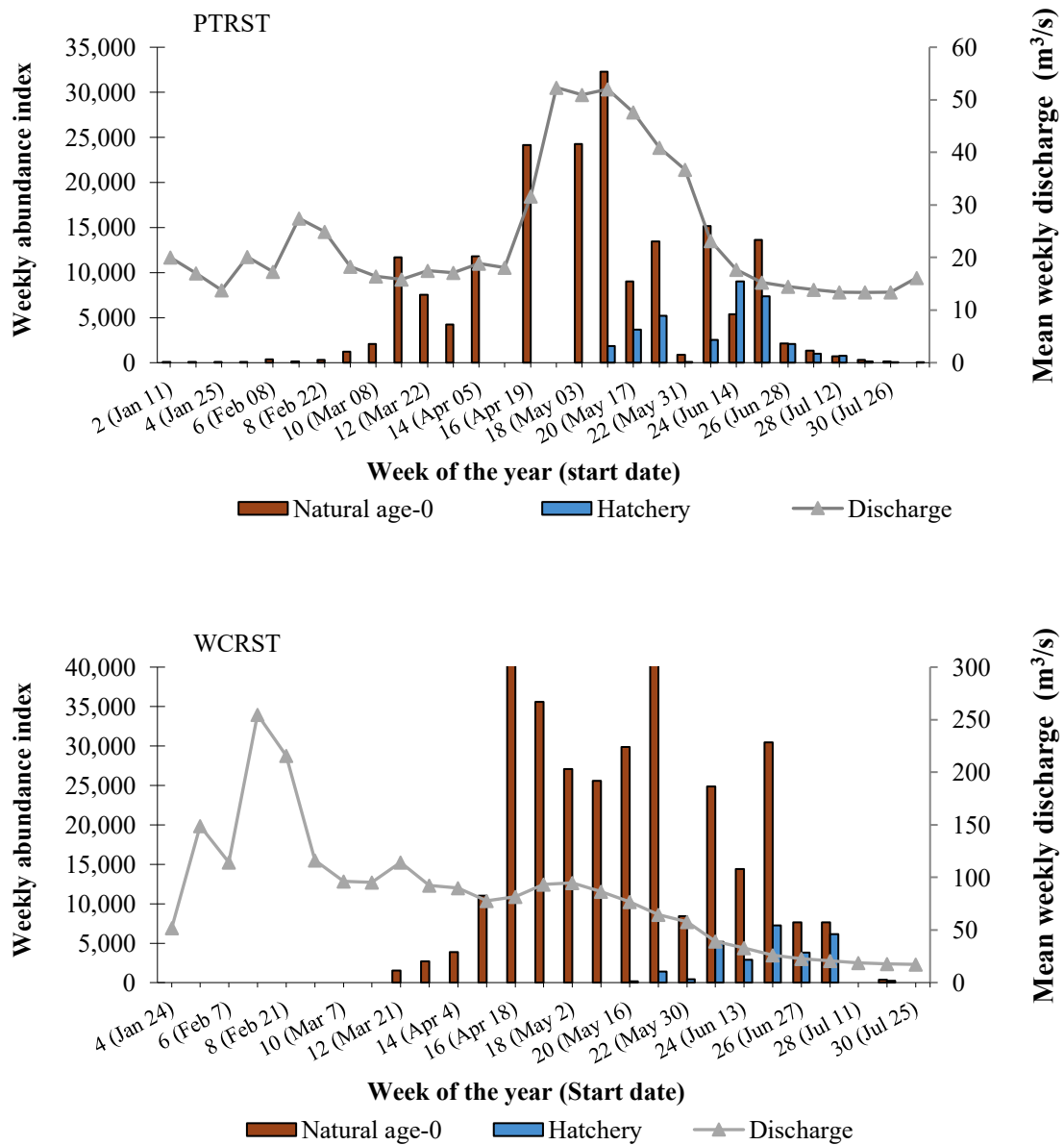


Figure 4. Weekly proportional discharge-based abundance indices for natural age-0 and hatchery age-0 Chinook Salmon (*Oncorhynchus tshawytscha*) captured at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34) in the Trinity River, California, 2021.

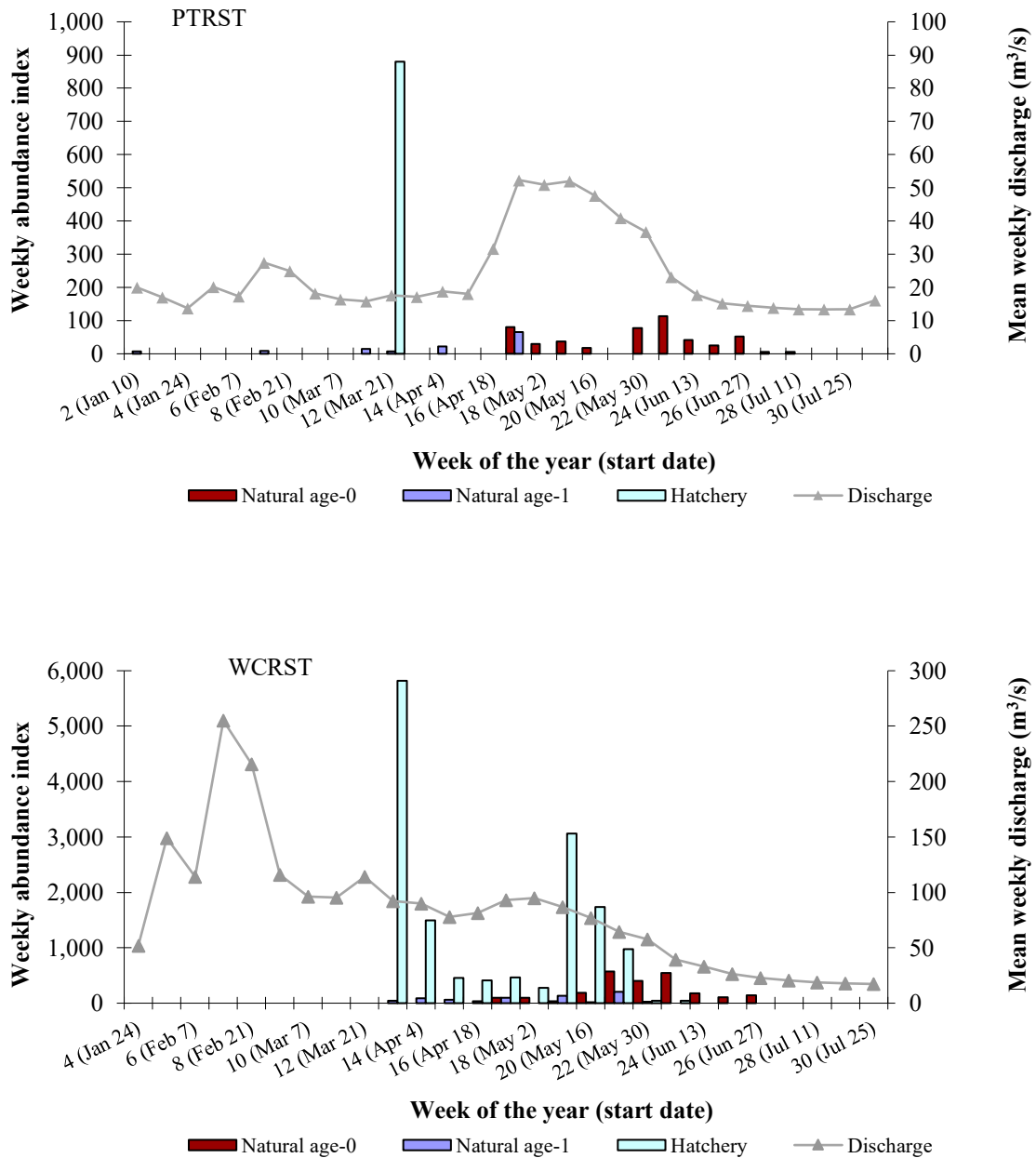


Figure 5. Weekly proportional discharge-based abundance indices for natural age-0, natural age-1, and hatchery age-1 Coho Salmon (*Oncorhynchus kisutch*) captured at Pear Tree Rotary Screw Trap (PTRST, rkm 118) and Willow Creek Rotary Screw Trap (WCRST, rkm 34) in the Trinity River, California, 2021.

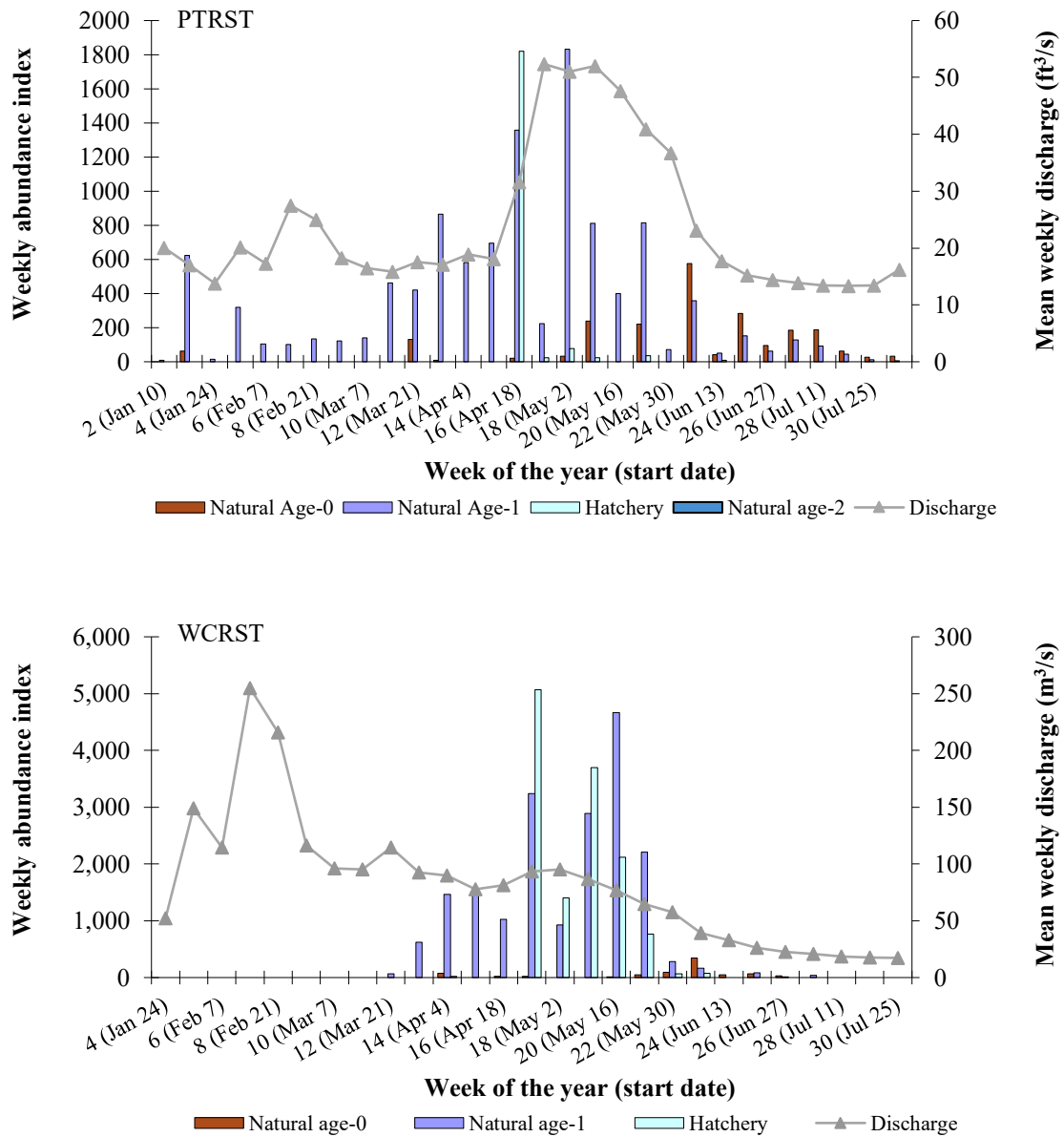


Figure 6. Weekly proportional discharge-based abundance indices for natural age-0, natural age-1, natural age-2, and hatchery age-1 steelhead (*Oncorhynchus mykiss*) captured at Pear Tree Rotary Screw Trap (PTRST, rkm 118) and Willow Creek Rotary Screw Trap (WCRST, rkm 34) in the Trinity River, California, 2021.

Hatchery and Natural Contribution

Chinook Salmon were captured at PTRST and WCRST throughout the 2021 sampling season with the spring/summer emigration dominated by natural-origin fish at PTRST and WCRST, comprising 73.0% and 88.1%, respectively, of the total Bayesian time-stratified population estimates (Appendix 1, 2, 7 8).

Age-1 Coho Salmon smolts were predominantly hatchery origin at PTRST and comprised 99.1% of the total age-1 proportional discharge-based index in 2021 (Appendix 3). At WCRST, age-1 Coho Salmon emigrants of hatchery origin comprised 95.5% of the total age-1 proportional discharge-based index in 2021 (Appendix 4).

Based on proportional discharge-based abundance indices at PTRST and WCRST, age-1 hatchery steelhead comprised 17.1% (Appendix 5) and 40.7% (Appendix 6), respectively, of the total age-1 steelhead abundance indices at each respective site.

Chinook Salmon Population Estimation

During the 2021 sampling season, freeze-branded hatchery Chinook Salmon were delivered to the trap sites to estimate weekly trap efficiencies for generating population estimates (Appendix 7, 8). Weekly stratified mark-recapture population estimates of emigrating age-0 Chinook Salmon were calculated for both naturally and hatchery-origin sub-populations (Figure 6). At PTRST an estimated 708,661 (95% CI: [55,531, 714,147]) natural-origin age-0 Chinook Salmon and 216,659 (95% CI: [173,857, 276,741]) age-0 hatchery Chinook Salmon passed the site between January 15 and August 31. At WCRST between March 16 and July 20, an estimated 540,014 (95% CI: [415,168, 677,314]) natural-origin age-0 Chinook Salmon and 73,288 (95% CI: [44,889, 106,076]) age-0 hatchery Chinook Salmon passed the site.

Outmigrant Timing

The Chinook Salmon population in the Trinity River is composed of both natural-origin and hatchery-origin fish of both spring and fall runs. The majority of juveniles during the spring/summer emigration period emigrate as age-0 fish, with the natural and hatchery emigration periods overlapping (Table 7; Appendix 1, 2). Natural age-0 Chinook Salmon emigration peaked during WOY 15 at PTRST and WOY 21 at WCRST. Hatchery age-0 Chinook Salmon emigration peaked in WOY 23 at PTRST and WOY 25 at WCRST. The week marking the cumulative passage of 80% of the natural juvenile Chinook Salmon population at WCRST (WC80), as inferred from the Bayesian time-stratified population estimate, was WOY 25 (June 18 - June 24), before the TRRP management target date of July 4 (TRRP and ESSA 2009).

Table 7. Juvenile salmonid emigration duration and peak as inferred from proportional discharge-based abundance indices at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Values represent week of the year.

Site	Species	Emigration duration			Emigration peak		
		Natural age-0	Natural age-1+	Hatchery	Natural age-0	Natural age-1+	Hatchery
PTRST	Chinook Salmon	2 – 31	NA	19 – 31	14	NA	24
	Coho Salmon	17 – 28	3 – 20	11 – 21	24	13	12
	Steelhead	11 – 31	2 – 31	15 – 24	23	13	16
WCRST	Chinook Salmon	12 – 30	12 – 30	20 – 30	20	14	25
	Coho Salmon	17 – 26	13 – 22	13 – 23	22	19	15
	Steelhead	14 – 27	12 – 27	14 – 23	23	19	19

The Coho Salmon population in the Trinity River is composed of both naturally produced and hatchery populations. The majority of Trinity River Coho Salmon emigrate to the ocean as age-1 smolts while the emigration of age-0 fish is presumably a redistribution of rearing juveniles. Natural age-1 Coho Salmon were captured in the second week of sampling at PTRST and the first week at WCRST. Emigration continued into May at PTRST (WOY 20), and WCRST (WOY 22) (Table 7; Appendix 4). Capture data and past observations suggest that the sampling period did not encompass the entire natural-origin age-1 Coho Salmon emigration. The week marking the cumulative passage of 80% of the natural-origin age-1 Coho Salmon population at WCRST, as inferred from the abundance index, was WOY 20 (May 14-May 20th). Natural age-1 Coho Salmon emigration peaked in WOY 13 at PTRST and WOY 19 at WCRST (Table 7; Appendix 4). Hatchery Coho Salmon emigration peaked in WOY 12 at PTRST and WOY 15 at WCRST.

The steelhead population in the Trinity River is composed of both natural- and hatchery-origin, both of which can exhibit highly variable juvenile life history patterns. The majority of age-0 steelhead were captured from early May through August at PTRST and early May through July at WCRST (Table 6; Appendix 5, 6). Age-1 and older natural steelhead were present throughout the sampling period at PTRST and WCRST. The majority of hatchery-origin age-1 steelhead passed PTRST and WCRST by WOY 19. The week marking the cumulative passage of 80% of the natural steelhead smolt population at WCRST, as inferred from the proportional discharge-based abundance index, was WOY 20 (May 14–20). Natural age-0 steelhead emigration peaked in WOY 23 at PTRST and WOY 16 at WCRST (Table 7, Appendix 5). Natural age-1 steelhead emigration peaked in WOY 13 at PTRST and WOY 19 at WCRST. Hatchery steelhead emigration peaked in WOY 16 at PTRST and WOY 16 at WCRST.

Migration Rate

Maximum, average, and median migration rates of salmonids released from TRH are presented in Table 8. Average and median migration rates cannot be accurately calculated for Chinook Salmon due to the 25% targeted constant fractional marking rate. Maximum migration rates for hatchery Chinook Salmon were 32.0 and 79.0 km/day at PTRST and

WCRST, respectively (Table 8). Maximum migration rates for hatchery Coho Salmon were 16 and 36 km/day at PTRST and WCRST, respectively (Table 8). Average migration rates for hatchery Coho Salmon were 7.9 and 4.6 km/day at PTRST and WCRST, respectively (Table 8). Median migration rates for hatchery Coho Salmon were 3.0 and 3.2 km/day at PTRST and WCRST, respectively (Table 8). Maximum migration rates for hatchery steelhead were 65.0 and 28.0 km/day at PTRST and WCRST, respectively (Table 8). Average migration rates for hatchery steelhead were 13.0 and 8.4 km/day at PTRST and WCRST, respectively (Table 8). Median migration rates for hatchery steelhead were 3.4 and 7.3 km/day at PTRST and WCRST, respectively (Table 8).

Fish Size

Age-0 Chinook Salmon weekly mean fork length at PTRST was relatively constant from WOY 3 through WOY 8, apparently due to continued fry emergence, then increased through the remainder of the season (Figure 7; Appendix 9, Appendix 10). Age-0 Chinook Salmon weekly mean fork length increased steadily at WCRST through mid-June and stabilized through the summer with the arrival of hatchery fish. Little change in the fork lengths of age-1 Chinook Salmon at PTRST was detected from week 3 to week 14. Age-1 Chinook Salmon showed little change in fork lengths throughout the season at WCRST.

Natural age-0 Coho Salmon fork lengths generally increased as the season progressed at PTRST and WCRST (Appendix 11, Appendix 12). Hatchery age-1 Coho Salmon fork lengths showed no weekly or seasonal trend at PTRST and a steady decrease at WCRST. Natural age-1 Coho Salmon fork lengths sampled at PTRST showed a slight seasonal increase across the season, but weekly means were quite variable. WCRST natural age-1 Coho showed no discernable seasonal trend, likely due to inadequate sample size and tributary inputs.

At the PTRST, natural age-0 and age-1 steelhead fork lengths generally increased as the sampling season progressed (Figure 9; Appendix 13, Appendix 14). Age-1+ steelhead fork lengths at PTRST remained relatively consistent throughout the season. At WCRST, age-0 steelhead fork lengths increased as the season progressed, age-1 steelhead showed a slight decrease in fork length in the middle of the season and increased at the end of the season. Hatchery steelhead fork lengths decreased slightly across the few weeks they were observed at PTRST. Hatchery steelhead fork lengths were variable throughout the season at WCRST.

Table 8. Juvenile salmonid maximum migration rate from Trinity River Hatchery to Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) sampling sites, operated by the Hoopa Valley Tribal Fisheries Department, U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Yurok Tribal Fisheries Program, 2021.

Site	Species	Date first released	Date first captured	Duration (days)	Migration rates (km/day)		
					Maximum	Average	Median
PTRST	Chinook Salmon	5/10/2021	5/12/2021	2	32.0	NA	NA
	Coho Salmon	3/19/2021	3/23/2021	4	16.0	7.9	3.0
	Steelhead	4/15/2021	4/16/2021	1	65.0	13.0	3.4
WCRST	Chinook Salmon	5/10/2021	5/12/2021	2	79.0	NA	NA
	Coho Salmon	3/19/2021	3/23/2021	4	36.0	4.6	3.2
	Steelhead	4/15/2021	4/20/2021	5	28.0	8.4	7.3

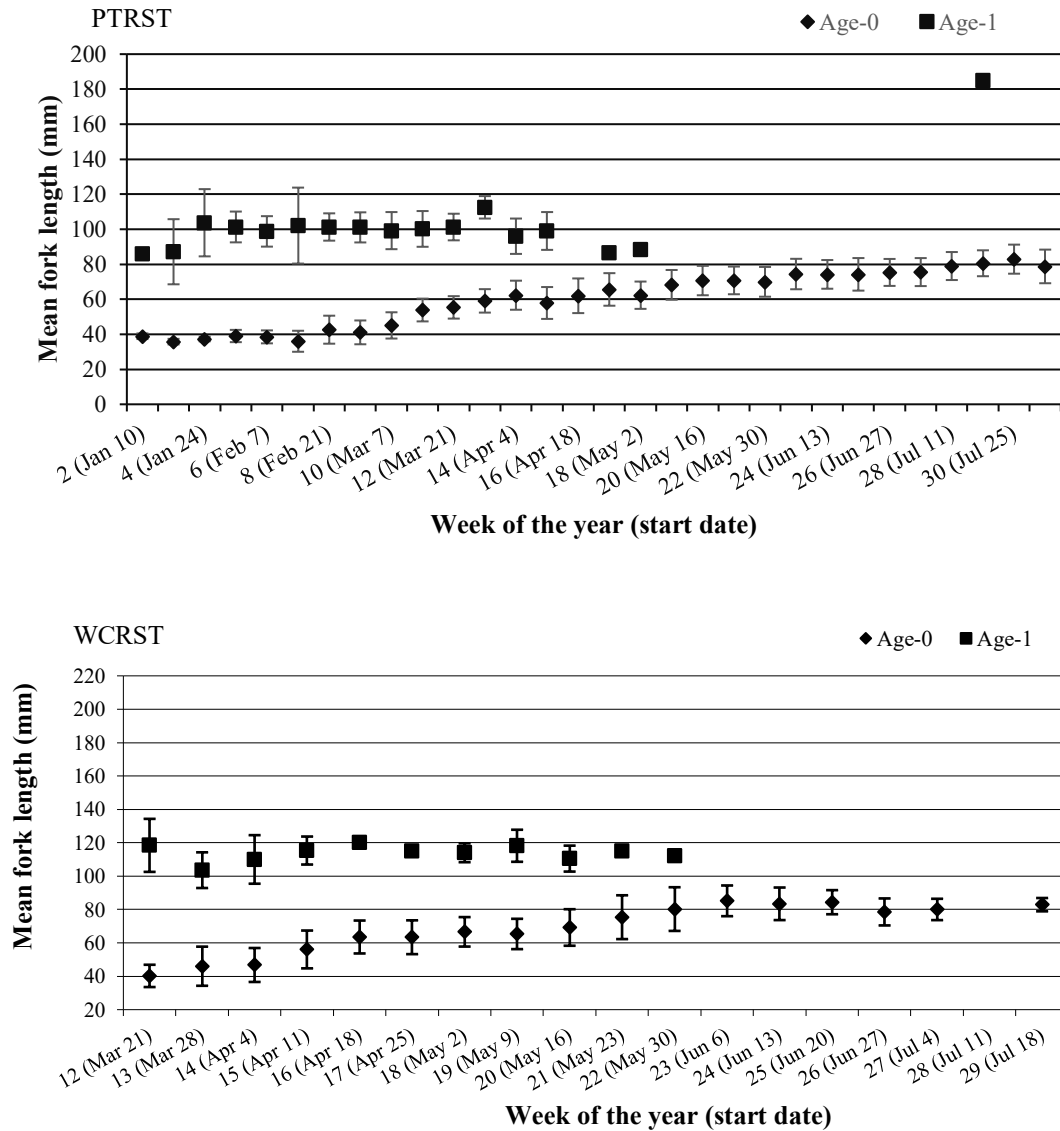


Figure 7. Weekly mean fork lengths of age-0 and age-1 Chinook Salmon (*Oncorhynchus tshawytscha*) captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Error bars represent one standard deviation of the mean.

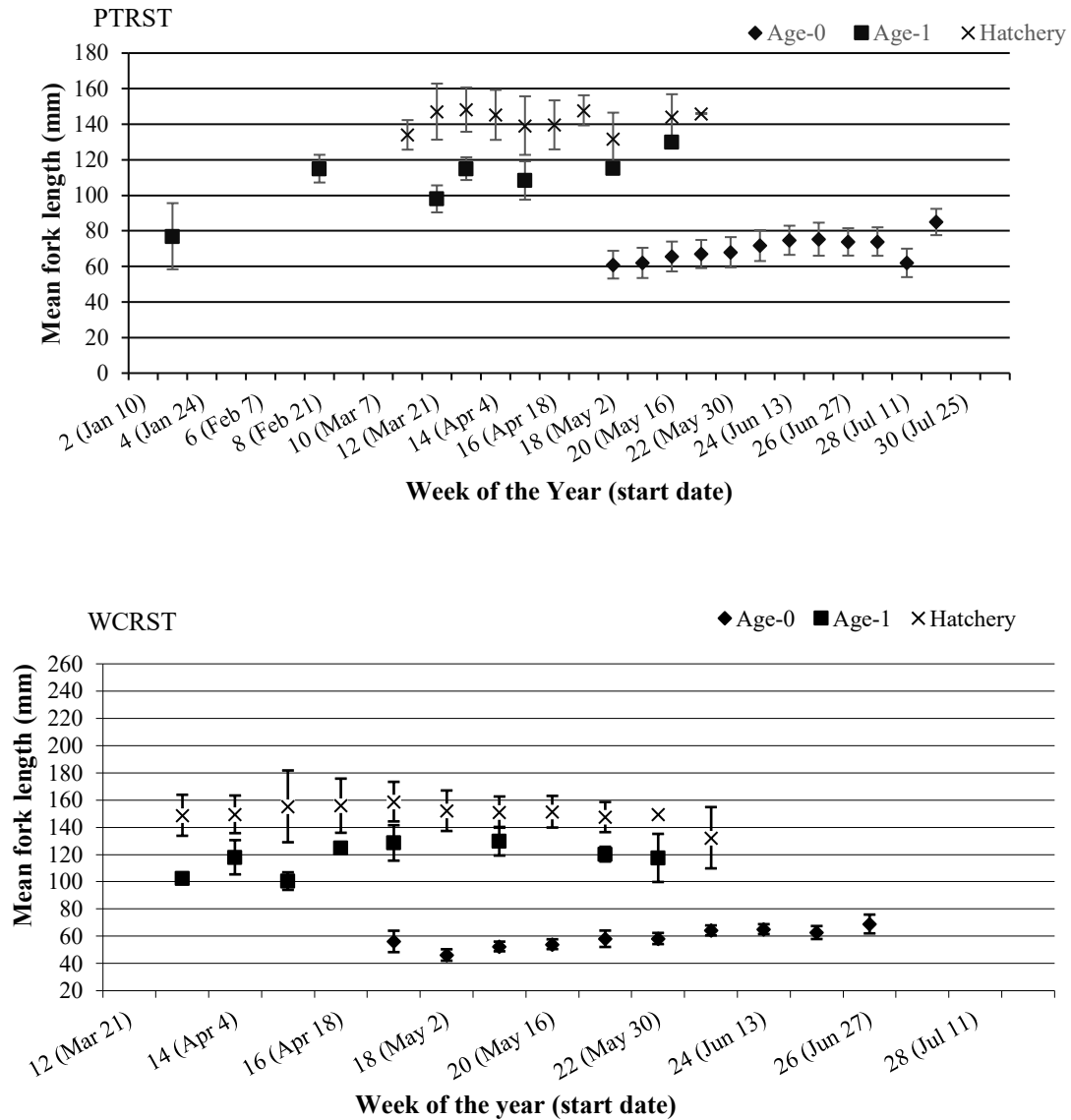


Figure 8. Weekly mean fork lengths for natural and hatchery Coho Salmon (*Oncorhynchus kisutch*) captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Error bars represent one standard deviation of the mean.

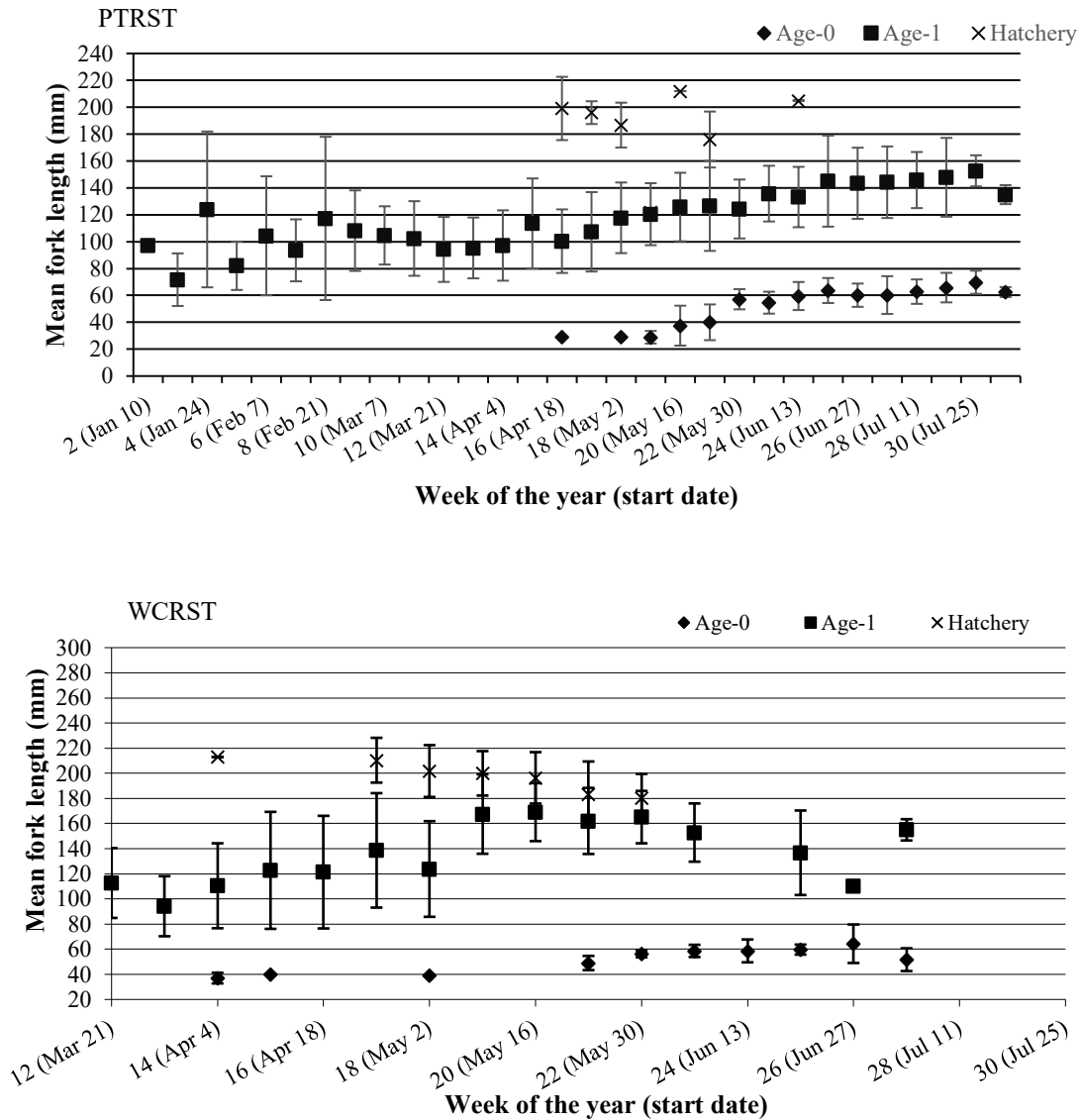


Figure 9. Weekly mean fork lengths for natural age-0, age-1, age-2, and hatchery age-1 steelhead (*Oncorhynchus mykiss*) captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Error bars represent one standard deviation of the mean.

Fish Condition

Fulton's condition factor ($K = 100,000 * (\text{weight}/\text{length}^3)$) was calculated on a subsample of age-0 (pooled natural and hatchery) Chinook Salmon larger than 50 mm, age-1 natural Coho Salmon, and age 1+ natural steelhead. Due to the inability to determine the origin of unmarked individuals, clipped and non-clipped juvenile Chinook Salmon were pooled for weekly mean calculations.

Chinook Salmon age-0 mean weekly condition factors were variable at the onset of sampling and showed no obvious seasonal trend at either site (Figure 10, Appendix 13). Age-1 natural Coho Salmon weekly mean condition factors were variable throughout the season at both PTRST and WCRST (Figure 11, Appendix 14), however, it should be noted that there were several weeks in which only one individual was captured at either site. The weekly mean condition factor of natural age-1+ steelhead showed no obvious trend at either PTRST or WCRST (Figure 12, Appendix 15).

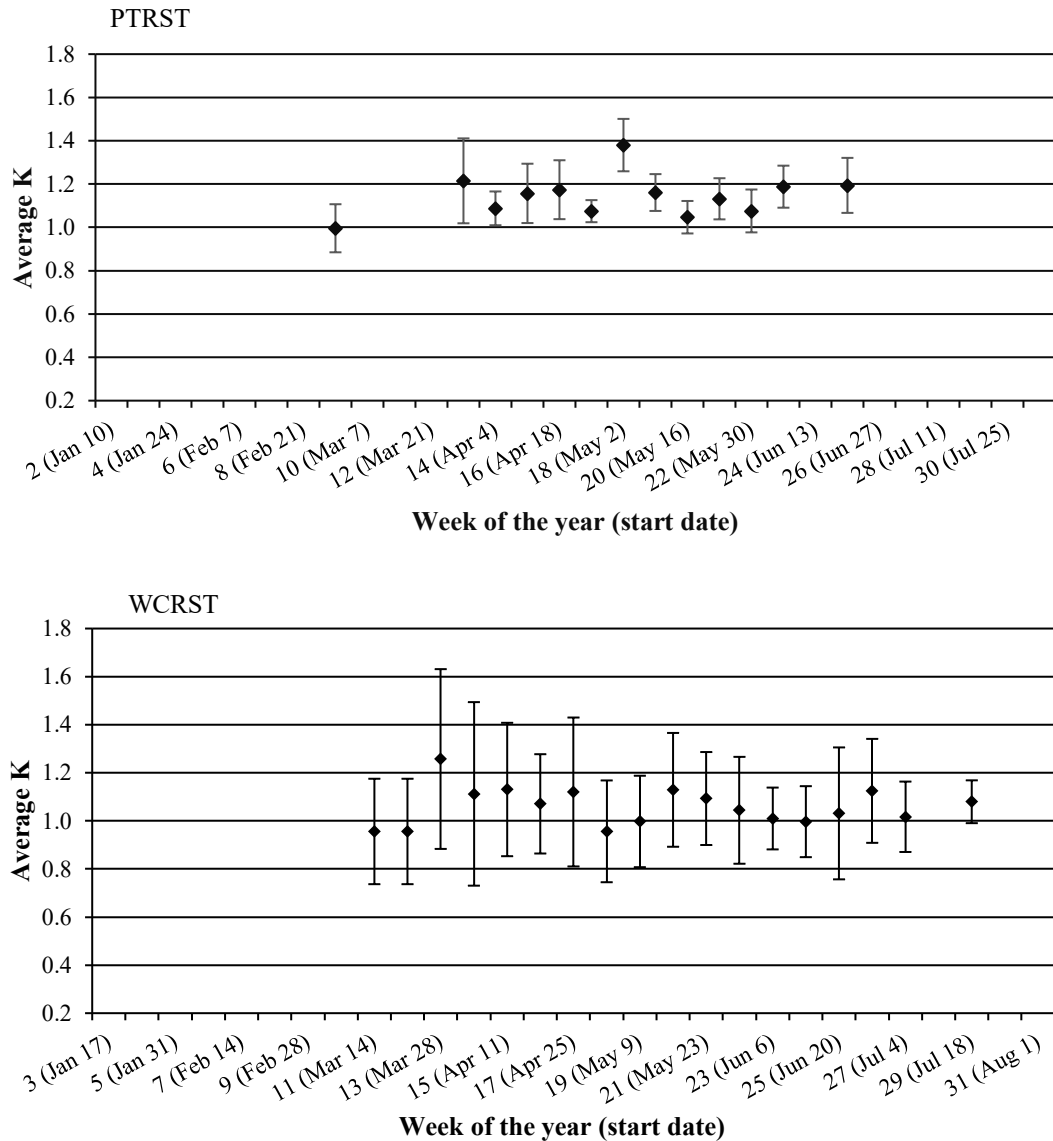


Figure 10. Weekly mean K value for pooled hatchery and natural age-0 Chinook Salmon (*Oncorhynchus tshawytscha*) captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Error bars represent one standard deviation of the mean.

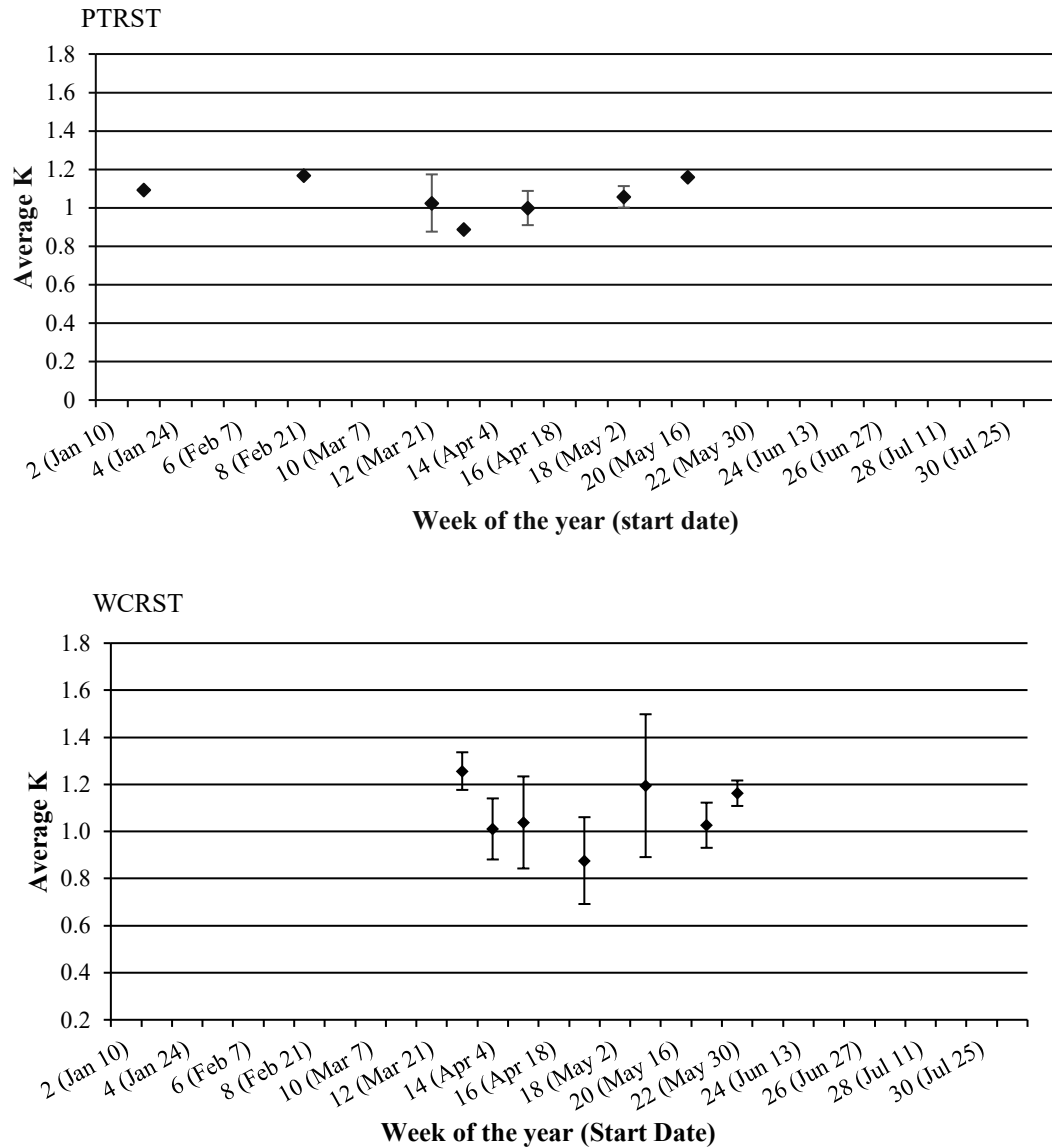


Figure 11. Weekly mean K value for natural age-1 Coho Salmon (*Oncorhynchus kisutch*) captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Error bars represent one standard deviation of the mean.

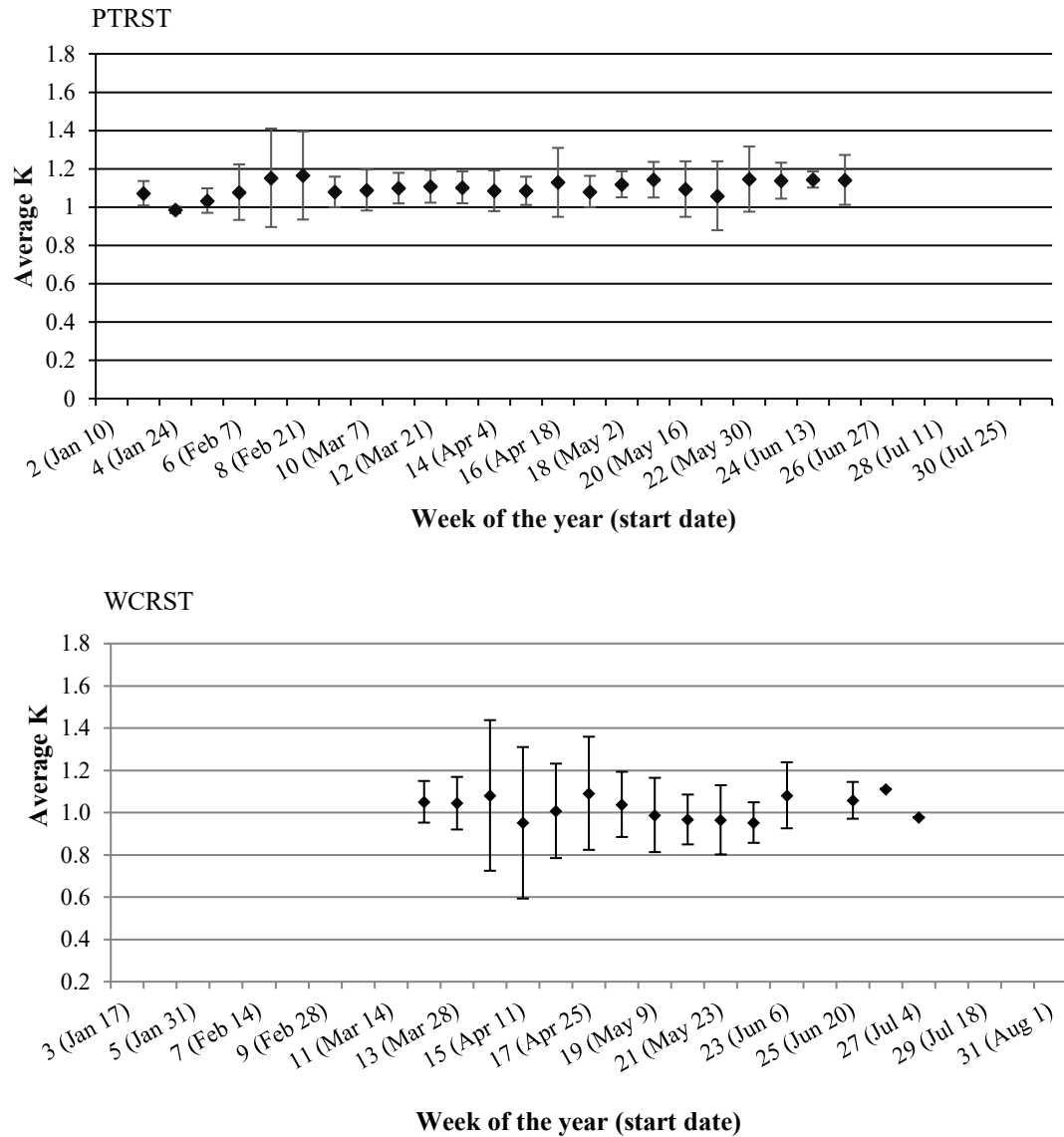


Figure 12. Weekly mean K value for natural age-1+ steelhead (*Oncorhynchus mykiss*) captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST) in the Trinity River, California, 2021. Error bars represent one standard deviation of the mean.

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Acknowledgements

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Appendices

Appendix 1. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Chinook Salmon catches and abundance indices, in the Trinity River, California, 2021. NC = no clip, AD = adipose fin clip.

Week start	Week of year	Mean daily discharge m ³ /s	Trap days sampled	Weekly Chinook Salmon catch						Weekly Chinook Salmon index					
				Hatchery			Natural		Catch total	Hatchery			Natural		Index total
				NC	AD	Age-1	Age-0	Age-1		NC	AD	Age-1	Age-0	Age-1	
1/10/2021	2	20.0	1	0	0	0	16	4	20	0	0	0	0	50	50
1/17/2021	3	17.0	2	0	0	0	21	29	50	0	0	0	702	340	1,042
1/24/2021	4	13.8	5	0	0	0	7	15	22	0	0	0	323	239	562
1/31/2021	5	20.2	4	0	0	0	14	20	34	0	0	0	128	223	351
2/7/2021	6	17.3	5	0	0	0	51	20	71	0	0	0	161	164	326
2/14/2021	7	27.4	4	0	0	0	19	15	34	0	0	0	465	320	786
2/21/2021	8	24.9	5	0	0	0	105	24	129	0	0	0	303	239	542
2/28/2021	9	18.3	5	0	0	0	165	20	185	0	0	0	508	230	738
3/7/2021	10	16.5	5	0	0	0	460	21	481	0	0	0	1,585	101	1,686
3/14/2021	11	15.8	6	0	0	0	2,189	17	2,206	0	0	0	3,143	174	3,316
3/21/2021	12	17.5	5	0	0	0	812	3	815	0	0	0	12,987	119	13,105
3/28/2021	13	17.1	5	0	0	0	1,024	2	1,026	0	0	0	11,340	19	11,359
4/4/2021	14	18.9	5	0	0	0	4,316	12	4,328	0	0	0	6,563	93	6,656
4/11/2021	15	18.1	5	0	0	0	3,304	0	3,304	0	0	0	27,541	29	27,570
4/18/2021	16	31.9	4	0	0	0	1,444	0	1,444	0	0	0	44,189	0	44,189
4/25/2021	17	51.5	3	0	0	0	725	0	725	0	0	0	37,347	0	37,347
5/2/2021	18	52.1	4	0	0	0	1,042	0	1,042	0	0	0	20,581	0	20,581
5/9/2021	19	51.9	5	1,055	346	0	1,402	0	2,803	1,848	606	0	40,513	0	42,967
5/16/2021	20	47.6	5	360	118	0	1,287	0	1,765	39,071	12,815	0	43,992	0	95,878
5/23/2021	21	40.9	5	64	21	0	271	0	356	4,755	1,560	0	26,829	0	33,144
5/30/2021	22	36.7	3	91	30	0	1,095	0	1,216	1,112	365	0	16,226	0	17,702
6/6/2021	23	23.1	5	2,604	854	0	2,308	0	5,766	2,452	804	0	12,579	0	15,835
6/13/2021	24	17.7	5	1,445	474	0	2,133	0	4,052	34,315	11,255	0	23,743	0	69,313
6/20/2021	25	15.2	5	1,198	393	0	1,540	0	3,131	9,475	3,108	0	17,007	0	29,590
6/27/2021	26	14.4	5	189	62	0	309	0	560	4,574	1,500	0	18,886	0	24,960
7/4/2021	27	13.9	4	134	44	0	175	0	353	1,789	587	0	6,493	0	8,870
7/11/2021	28	13.4	5	24	8	0	73	0	105	720	236	0	2,672	0	3,627
7/18/2021	29	13.4	5	12	4	0	32	1	49	174	57	0	904	9	1,144
7/25/2021	30	13.4	5	9	3	0	5	0	17	9	18	0	446	0	473
8/1/2021	31	16.2	5	0	0	0	7	0	7	94	9	0	234	0	337
Total			135	7,186	2,357	0	26,350	203	36,096	100,386	32,920	0	378,392	2,348	514,047

Appendix 2. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Chinook Salmon catches and abundance indices in the Trinity River, California, 2021. NC = no clip, AD = adipose fin clip.

Week starting	Week of year	Mean daily discharge m3/s	Trap days sampled	Weekly Chinook Salmon catch						Weekly Chinook Salmon index					
				Hatchery			Natural		Catch total	Hatchery			Natural		Index total
				NC	AD	Age-1	Age-0	Age-1		NC	AD	Age-1	Age-0	Age-1	
3/21/2021	12	114.3	8	0	0	0	48	7	55	0	0	0	1,536	229	1,765
3/28/2021	13	92.4	12	0	0	0	113	14	127	0	0	0	2,682	295	2,977
4/4/2021	14	90.0	11	0	0	0	200	10	210	0	0	0	3,895	168	4,064
4/11/2021	15	77.8	12	0	0	0	692	3	695	0	0	0	11,035	48	11,083
4/18/2021	16	81.5	12	0	0	0	3,079	2	3,081	0	0	0	46,268	29	46,298
4/25/2021	17	93.2	12	0	0	0	1,842	9	1,851	0	0	0	35,624	143	35,768
5/2/2021	18	95.0	9	0	0	0	1,235	2	1,237	0	0	0	27,097	41	27,138
5/9/2021	19	86.8	12	0	0	0	1,555	5	1,560	0	0	0	25,576	81	25,657
5/16/2021	20	76.9	12	9	3	0	2,043	2	2,057	133	43	0	29,865	29	30,069
5/23/2021	21	64.6	12	70	23	0	3,403	2	3,498	1,049	340	0	50,081	30	51,500
5/30/2021	22	57.6	12	21	7	0	544	2	574	324	105	0	8,406	30	8,866
6/6/2021	23	39.2	9	253	83	0	1,657	0	1,993	3,912	1,270	0	24,864	0	30,046
6/13/2021	24	33.1	12	213	70	0	1,418	0	1,701	2,201	714	0	14,403	0	17,319
6/20/2021	25	26.2	12	546	179	0	3,071	0	3,796	5,473	1,776	0	30,488	0	37,737
6/27/2021	26	22.8	12	277	91	0	712	0	1,080	2,882	935	0	7,630	0	11,448
7/4/2021	27	20.6	6	232	76	0	387	0	695	4,625	1,501	0	7,642	---	---
7/11/2021	28	18.7	0	---	---	---	---	---	---	---	---	---	---	---	---
7/18/2021	29	17.8	0	---	---	---	---	---	---	---	---	---	---	---	---
7/25/2021	30	17.3	2	3	1	0	7	0	0	153	49.6	0	343	---	---
Total			177	1,624	533	0	22,006	58	24,210	20,752	6,736	0	327,438	1,124	341,735

Appendix 3. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Coho Salmon catches and abundance indices in the Trinity River, California, 2021. R-MAX = right maxillary clip.

Week starting	Week of year	Mean daily discharge	Trap days sampled	Weekly Coho Salmon catch				Weekly Coho Salmon index			
				Hatchery	Natural		Catch	Hatchery	Natural		Index
				R-MAX	Age-0	Age-1	total	R-MAX	Age-0	Age-1	total
1/10/2021	2	20.0	1	0	0	0	0	0	0	0	0
1/17/2021	3	17.0	2	0	0	1	1	0	0	12	12
1/24/2021	4	13.8	5	0	0	0	0	0	0	0	0
1/31/2021	5	20.2	4	0	0	0	0	0	0	0	0
2/7/2021	6	17.3	5	0	0	0	0	0	0	0	0
2/14/2021	7	27.4	4	0	0	0	0	0	0	0	0
2/21/2021	8	24.9	5	0	0	1	1	0	0	14	14
2/28/2021	9	18.3	5	0	0	0	0	0	0	0	0
3/7/2021	10	16.5	5	0	0	0	0	0	0	0	0
3/14/2021	11	15.8	6	8	0	0	8	67	0	0	67
3/21/2021	12	17.5	5	1,525	0	2	1,527	17,255	0	23	17,278
3/28/2021	13	17.1	5	508	0	1	509	5,356	0	11	5,367
4/4/2021	14	18.9	5	29	0	1	30	321	0	11	332
4/11/2021	15	18.1	5	16	0	2	18	218	0	27	245
4/18/2021	16	31.9	4	8	0	0	8	236	0	0	236
4/25/2021	17	51.5	3	5	1	0	6	181	36	0	217
5/2/2021	18	52.1	4	7	3	3	13	196	84	84	364
5/9/2021	19	51.9	5	0	3	0	3	0	99	0	99
5/16/2021	20	47.6	5	3	3	1	7	71	71	24	166
5/23/2021	21	40.9	5	1	0	0	1	48	0	0	48
5/30/2021	22	36.7	3	0	4	0	4	0	111	0	111
6/6/2021	23	23.1	5	0	6	0	6	0	90	0	90
6/13/2021	24	17.7	5	0	21	0	21	0	266	0	266
6/20/2021	25	15.2	5	0	11	0	11	0	123	0	123
6/27/2021	26	14.4	5	0	10	0	10	0	127	0	127
7/4/2021	27	13.9	4	0	5	0	5	0	68	0	68
7/11/2021	28	13.4	5	0	1	0	1	0	8	0	8
7/18/2021	29	13.4	5	0	0	0	0	0	0	0	0
7/25/2021	30	13.4	5	0	0	0	0	0	0	0	0
8/1/2021	31	16.2	5	0	0	0	0	0	0	0	0
Total			135	2,110	68	12	2,190	23,949	1,083	206	25,238

Appendix 4. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Coho Salmon catches and abundance indices in the Trinity River, California, 2021. R-MAX = right maxillary clip.

Week starting	Week of year	Mean daily discharge m ³ /s	Trap days sampled	Weekly Coho Salmon catch				Weekly Coho Salmon index			
				Hatchery	Natural		Catch total	Hatchery	Natural		Index total
				R-MAX	Age-0	Age-1		R-MAX	Age-0	Age-1	
3/21/2021	12	114.3	8	0	0	0	0	0	0	0	0
3/28/2021	13	92.4	12	271	0	2	273	5,821	0	40	5,861
4/4/2021	14	90.0	11	68	0	4	72	1,498	0	91	1,588
4/11/2021	15	77.8	12	28	0	4	32	456	0	63	519
4/18/2021	16	81.5	12	27	0	2	29	411	0	31	442
4/25/2021	17	93.2	12	26	5	4	35	462	101	94	656
5/2/2021	18	95.0	9	13	4	0	17	276	93	0	369
5/9/2021	19	86.8	12	186	2	8	196	3,063	33	132	3,227
5/16/2021	20	76.9	12	118	13	1	132	1,735	185	15	1,936
5/23/2021	21	64.6	12	66	39	14	119	974	574	206	1,754
5/30/2021	22	57.6	12	3	26	2	31	48	402	30	480
6/6/2021	23	39.2	9	3	36	0	39	44	544	0	588
6/13/2021	24	33.1	12	0	18	0	18	0	182	0	182
6/20/2021	25	26.2	12	0	11	0	11	0	109	0	109
6/27/2021	26	22.8	12	0	12	0	12	0	141	0	141
7/4/2021	27	20.6	6	0	0	0	0	0	0	0	0
7/11/2021	28	18.7	0	0	0	0	0	0	0	0	0
7/18/2021	29	17.8	0	0	0	0	0	0	0	0	0
7/25/2021	30	17.3	2	0	0	0	0	0	0	0	0
Total			177	809	166	41	1,016	14,786	2,364	702	17,853

Appendix 5. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly steelhead catches and abundance indices in the Trinity River, California, 2021. AD = adipose fin clip.

Week starting	Week of year	Mean daily discharge	Trap days sampled	Weekly steelhead catch					Weekly steelhead index				
				Hatchery	Natural			Catch	Hatchery	Natural			Index
				AD	Age-0	Age-1	Age-2	total	AD	Age-0	Age-1	Age-2	total
1/10/2021	2	20.0	1	0	8	50	3	61	0	241	1,509	91	1,841
1/17/2021	3	17.0	2	0	0	29	6	35	0	0	336	70	406
1/24/2021	4	13.8	5	0	0	0	0	0	0	0	0	0	0
1/31/2021	5	20.2	4	0	0	41	1	42	0	0	487	12	499
2/7/2021	6	17.3	5	0	0	18	3	21	0	0	189	32	221
2/14/2021	7	27.4	4	0	2	10	0	12	0	35	174	0	209
2/21/2021	8	24.9	5	0	0	15	5	20	0	0	215	72	287
2/28/2021	9	18.3	5	0	0	6	6	12	0	0	70	70	140
3/7/2021	10	16.5	5	0	0	30	3	33	0	0	330	33	363
3/14/2021	11	15.8	6	0	18	85	10	113	0	150	710	84	944
3/21/2021	12	17.5	5	0	0	48	1	49	0	0	543	11	554
3/28/2021	13	17.1	5	0	1	144	6	151	0	11	1,518	63	1,592
4/4/2021	14	18.9	5	0	3	121	13	137	0	33	1,337	144	1,514
4/11/2021	15	18.1	5	91	0	56	5	152	1,239	0	762	68	2,069
4/18/2021	16	31.9	4	96	2	111	3	212	2,837	59	3,280	89	6,265
4/25/2021	17	51.5	3	2	1	55	2	60	73	36	1,996	73	2,178
5/2/2021	18	52.1	4	4	7	68	0	79	112	196	1,907	0	2,215
5/9/2021	19	51.9	5	2	7	43	0	52	66	231	1,417	0	1,714
5/16/2021	20	47.6	5	2	10	45	3	60	47	237	1,068	71	1,423
5/23/2021	21	40.9	5	1	2	28	2	33	24	48	966	48	1,086
5/30/2021	22	36.7	3	0	21	37	0	58	0	581	1,024	0	1,605
6/6/2021	23	23.1	5	0	86	33	0	119	0	1292	496	0	1,788
6/13/2021	24	17.7	5	1	28	26	0	55	13	354	329	0	696
6/20/2021	25	15.2	5	0	57	20	3	80	0	635	223	33	891
6/27/2021	26	14.4	5	0	30	15	0	45	0	381	191	0	572
7/4/2021	27	13.9	4	0	31	18	1	50	0	424	246	14	684
7/11/2021	28	13.4	5	0	23	10	1	34	0	191	83	8	282
7/18/2021	29	13.4	5	0	12	8	0	20	0	51	34	0	85
7/25/2021	30	13.4	5	0	10	2	0	12	0	25	5	0	30
8/1/2021	31	16.2	5	0	5	1	0	6	0	48	10	0	58
Total			135	199	364	1,173	77	1,813	4,411	5,259	21,455	1,086	32,211

Appendix 6. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly steelhead catches and abundance indices in the Trinity River, California, 2021. AD = adipose fin clip.

Week starting	Week of year	Mean daily discharge m ³ /s	Trap days sampled	Weekly steelhead catch					Weekly steelhead index				
				Hatchery AD	Natural			Catch total	Hatchery AD	Natural			Index total
					Age-0	Age-1	Age-2+			Age-0	Age-1	Age-2+	
3/21/2021	12	114.3	8	0	0	3	0	3	0	0	67	0	67
3/28/2021	13	92.4	12	0	0	29	0	29	0	0	622	0	622
4/4/2021	14	90.0	11	1	2	76	0	79	17	73	1,468	0	1,559
4/11/2021	15	77.8	12	0	1	92	0	93	0	0	1,483	0	1,483
4/18/2021	16	81.5	12	0	0	68	0	68	0	21	1,029	0	1,051
4/25/2021	17	93.2	12	267	1	172	0	440	5,067	18	3,236	0	8,321
5/2/2021	18	95.0	9	64	1	44	0	109	1,401	0	929	0	2,331
5/9/2021	19	86.8	12	224	0	177	0	401	3,694	0	2,891	0	6,585
5/16/2021	20	76.9	12	144	0	317	0	461	2,115	14	4,665	0	6,794
5/23/2021	21	64.6	12	52	2	150	0	204	762	45	2,204	0	3,011
5/30/2021	22	57.6	12	4	4	18	0	26	62	95	279	0	436
6/6/2021	23	39.2	9	4	8	11	0	23	71	346	167	0	584
6/13/2021	24	33.1	12	0	25	0	0	25	0	51	0	0	51
6/20/2021	25	26.2	12	0	6	8	0	14	0	62	84	0	146
6/27/2021	26	22.8	12	0	3	1	0	4	0	33	10	0	43
7/4/2021	27	20.6	6	0	3	2	0	5	0	0	42	0	42
7/11/2021	28	18.7	0	0	0	0	0	0	0	0	0	0	0
7/18/2021	29	17.8	0	0	0	0	0	0	0	0	0	0	0
7/25/2021	30	17.3	2	0	0	0	0	0	0	0	0	0	0
Total			177	760	56	1,168	0	1,984	13,189	758	19,178	0	33,125

Appendix 7. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly age-0 Chinook Salmon trapping effort, catch numbers, mark-recapture numbers, and population estimates in the Trinity River, California, 2021. NC = no clip, AD = adipose fin clip.

Week starting	Week of year	Sampling fraction ¹	Catch NC	Catch AD	Marks released	Marks recaptured	Recapture rate	Estimated natural	Natural LCI	Natural UCI	Estimated hatchery	Hatchery LCI	Hatchery UCI
1/10/2021	2	0.29	14	0	0	0	--	1,054	160	2,405	0	0	0
1/17/2021	3	0.71	14	0	0	0	--	397	79	867	0	0	0
1/24/2021	4	0.57	15	0	0	0	--	444	91	978	0	0	0
1/31/2021	5	0.71	11	0	0	0	--	327	50	715	0	0	0
2/7/2021	6	0.71	49	0	0	0	--	1,026	210	2,131	0	0	0
2/14/2021	7	0.57	20	0	0	0	--	703	124	1,511	0	0	0
2/21/2021	8	0.71	42	0	0	0	--	1,121	223	2,404	0	0	0
2/28/2021	9	0.71	162	0	0	0	--	3,922	883	8,310	0	0	0
3/7/2021	10	0.71	341	0	0	0	--	9,098	1,740	18,891	0	0	0
3/14/2021	11	0.86	1,790	0	0	0	--	31,751	7,360	62,186	0	0	0
3/21/2021	12	0.71	1,162	0	0	0	--	28,329	5,927	58,671	0	0	0
3/28/2021	13	0.71	693	0	958	50	0.052	18,771	13,798	24,008	0	0	0
4/4/2021	14	0.71	2,704	0	1,034	76	0.074	52,257	41,158	63,652	0	0	0
4/11/2021	15	0.57	4,588	0	891	61	0.068	118,380	91,103	146,009	0	0	0
4/18/2021	16	0.43	2,342	0	583	47	0.081	69,685	52,347	89,141	0	0	0
4/25/2021	17	0.57	471	0	1,623	84	0.052	16,141	12,732	19,695	0	0	0
5/2/2021	18	0.71	1,063	0	1,191	29	0.024	56,015	38,843	74,751	0	0	0
5/9/2021	19	0.71	1,455	18	466	1	0.002	39,768	8,953	81,296	2,279	482	4,868
5/16/2021	20	0.71	915	394	675	2	0.003	867	29	2,142	40,296	9,700	85,125
5/23/2021	21	0.57	748	71	968	1	0.001	14,363	3,614	28,870	7,917	1,909	15,810
5/30/2021	22	0.57	485	14	596	14	0.023	29,002	17,497	43,278	3,863	1,507	6,487
6/6/2021	23	0.71	2,091	72	425	24	0.056	45,402	30,265	62,526	7,202	4,426	10,422
6/13/2021	24	0.71	1,803	1,163	447	16	0.036	503	44	1,121	113,798	69,742	166,360
6/20/2021	25	0.71	2,166	356	594	112	0.189	8,222	6,485	9,973	11,211	9,093	13,482
6/27/2021	26	0.71	748	173	498	44	0.088	3,436	1,644	5,431	11,616	8,164	15,204
7/4/2021	27	0.57	259	57	454	56	0.123	1,129	285	2,022	3,624	2,325	4,868
7/11/2021	28	0.71	111	29	584	47	0.080	440	11	923	2,102	1,294	2,981
7/18/2021	29	0.71	55	7	601	31	0.052	717	6	1,298	908	289	1,663
7/25/2021	30	0.71	24	2	572	67	0.117	186	19	356	160	27	325
8/1/2021	31	0.14	5	1	0	0	--	244	0	786	433	5	1,223
Total			26,346	2,357	13,160	762		553,700	468,552	651,765	205,409	143,525	277,141

¹ Fraction of possible trap days successfully sampled each week

Appendix 8. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly age-0 Chinook Salmon trapping effort, catch numbers, mark-recapture numbers, and population estimates in the Trinity River, California, 2021. NC = no clip, AD = adipose fin clip.

Week starting	Week of year	Sampling fraction ¹	Catch NC	Catch AD	Marks released	Marks recaptured	Recapture rate	Estimated natural	Natural LCI	Natural UCI	Estimated hatchery	Hatchery LCI	Hatchery UCI
3/21/2021	12	0.57	48	0	1,545	110	0.07	1,224	831	1,619	0	0	0
3/28/2021	13	0.57	113	0	739	65	0.09	2,278	1,651	2,946	0	0	0
4/4/2021	14	0.57	200	0	922	128	0.14	2,594	2,066	3,148	0	0	0
4/11/2021	15	0.57	692	0	975	128	0.13	9,424	7,834	11,045	0	0	0
4/18/2021	16	0.57	3,079	0	847	131	0.15	35,547	29,851	41,207	0	0	0
4/25/2021	17	0.57	1,842	0	1,685	72	0.04	73,178	58,006	89,948	0	0	0
5/2/2021	18	0.43	1,235	0	1,445	214	0.15	19,845	17,088	22,441	0	0	0
5/9/2021	19	0.57	1,555	0	1,662	116	0.07	39,007	31,985	45,968	0	0	0
5/16/2021	20	0.57	2,052	3	862	95	0.11	33,718	27,464	40,761	324	85	615
5/23/2021	21	0.57	3,473	23	970	91	0.09	63,240	50,856	75,994	1,647	944	2,411
5/30/2021	22	0.57	565	7	770	53	0.07	14,594	10,578	18,905	954	358	1,630
6/6/2021	23	0.43	1,910	83	978	42	0.04	81,942	60,584	106,070	16,276	11,014	22,195
6/13/2021	24	0.57	1,631	70	894	111	0.12	20,861	17,039	24,726	4,255	3,057	5,471
6/20/2021	25	0.57	3,617	179	949	48	0.05	100,022	76,319	126,811	23,545	17,119	30,613
6/27/2021	26	0.57	989	91	814	35	0.04	28,251	19,345	37,527	14,699	9,262	20,138
7/4/2021	27	0.29	619	76	1,089	4	0.00	12,542	3,601	24,668	10,020	2,908	19,628
7/11/2021	28	0.00	---	---	---	---	---	---	---	---	---	---	---
7/18/2021	29	0.00	---	---	---	---	---	---	---	---	---	---	---
7/25/2021	30	0.14	10	1	1,084	29	0.03	1,747	72	3,530	1,568	143	3,374
Total			23,630	533	18,230	1,472		540,014	415,168	677,314	73,288	44,889	106,076

¹ Fraction of possible trap days successfully sampled each week

Appendix 9. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Chinook Salmon fork lengths in the Trinity River, California, 2021.

Week starting	Week of year	Chinook Salmon ¹									
		Age-0					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD
1/10/2021	2	14	38.9	34	40	1.6	1	86.0	86	86	---
1/17/2021	3	14	35.8	33	39	1.6	15	87.1	60	114	18.6
1/24/2021	4	14	37.3	35	40	1.3	20	103.7	76	156	19.2
1/31/2021	5	11	39.0	35	45	3.5	14	101.3	80	115	8.8
2/7/2021	6	47	38.5	35	55	3.7	12	98.8	86	115	8.7
2/14/2021	7	14	36.0	28	54	6.0	14	102.1	75	160	21.7
2/21/2021	8	36	42.6	33	63	8.0	15	101.3	88	115	7.8
2/28/2021	9	98	41.1	31	59	6.8	24	101.0	85	119	8.6
3/7/2021	10	119	45.1	30	61	7.5	10	99.2	84	121	10.6
3/14/2021	11	180	53.9	36	71	6.5	23	100.2	87	117	10.2
3/21/2021	12	150	55.4	38	71	6.4	12	101.3	90	113	7.6
3/28/2021	13	121	59.1	36	79	6.7	2	112.5	108	117	6.4
4/4/2021	14	190	62.3	37	84	8.3	3	96.0	85	105	10.1
4/11/2021	15	119	57.9	34	77	9.1	3	99.0	90	111	10.8
4/18/2021	16	150	62.0	44	84	9.9	0	---	---	---	---
4/25/2021	17	57	65.6	42	80	9.3	3	86.7	85	90	2.9
5/2/2021	18	148	62.3	47	85	7.8	2	88.5	88	89	0.7
5/9/2021	19	193	68.2	48	88	8.5	0	---	---	---	---
5/16/2021	20	222	70.7	49	92	8.4	0	---	---	---	---
5/23/2021	21	120	70.8	50	91	7.9	0	---	---	---	---
5/30/2021	22	197	70.0	49	93	8.5	0	---	---	---	---
6/6/2021	23	149	74.4	50	97	8.7	0	---	---	---	---
6/13/2021	24	210	74.2	57	98	8.2	0	---	---	---	---
6/20/2021	25	240	74.2	52	99	9.3	0	---	---	---	---
6/27/2021	26	157	75.3	54	95	7.7	0	---	---	---	---
7/4/2021	27	161	75.5	48	98	8.0	0	---	---	---	---
7/11/2021	28	119	79.0	44	97	8.0	0	---	---	---	---
7/18/2021	29	74	80.6	59	97	7.4	1	185	185	185	---
7/25/2021	30	29	82.9	62	100	8.3	0	---	---	---	---
8/1/2021	31	8	78.8	62	91	9.6	0	---	---	---	---

¹Natural and Hatchery combined

Appendix 10. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Chinook Salmon fork lengths in the Trinity River, California, 2021.

Week starting	Week of year	Chinook Salmon ¹									
		Age-0					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD
3/14/2021	11	0	---	---	---	---	0	---	---	---	---
3/21/2021	12	49	40.2	25	52	6.7	7	118.4	103	141	15.9
3/28/2021	13	113	46.0	32	85	11.7	14	103.6	92	123	10.7
4/4/2021	14	177	46.8	31	80	10.2	10	110.0	88	132	14.5
4/11/2021	15	332	56.1	34	81	11.3	3	115.3	110	125	8.4
4/18/2021	16	358	63.5	35	88	9.9	2	120.0	120	120	0.0
4/25/2021	17	320	63.4	38	88	10.1	1	115.0	115	115	NA
5/2/2021	18	268	66.6	41	95	8.8	2	114.0	110	118	5.7
5/9/2021	19	305	65.3	47	99	9.1	5	118.2	110	134	9.6
5/16/2021	20	361	69.2	48	105	10.9	2	110.5	105	116	7.8
5/23/2021	21	376	75.4	45	107	13.1	2	115.0	115	115	0.0
5/30/2021	22	359	80.3	42	109	13.1	2	112.0	111	113	1.4
6/6/2021	23	347	85.2	55	104	9.2	0	---	---	---	---
6/13/2021	24	430	83.4	52	110	9.8	0	---	---	---	---
6/20/2021	25	533	84.4	53	104	7.2	0	---	---	---	---
6/27/2021	26	416	78.6	29	105	8.1	0	---	---	---	---
7/4/2021	27	216	80.0	58	96	6.4	0	---	---	---	---
7/11/2021	28	0	---	---	---	---	0	---	---	---	---
7/18/2021	29	0	---	---	---	---	0	---	---	---	---
7/25/2021	30	11	82.9	76	88	4.0	0	---	---	---	---

¹Natural and Hatchery combined.

Appendix 11: Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Coho Salmon fork lengths in the Trinity River, California, 2021.

Week starting	Week of year	Natural Coho Salmon										Hatchery Coho Salmon				
		Age-0					Age-1					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
1/10/2021	2	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
1/17/2021	3	0	---	---	---	---	1	77.0	77	77	NA	1	77.0	77	77	NA
1/24/2021	4	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
1/31/2021	5	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
2/7/2021	6	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
2/14/2021	7	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
2/21/2021	8	0	---	---	---	---	1	115.0	115	115	NA	1	115.0	115	115	NA
2/28/2021	9	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/7/2021	10	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/14/2021	11	0	---	---	---	---	0	---	---	---	---	8	134.0	122	145	8.3
3/21/2021	12	0	---	---	---	---	2	98.0	96	100	2.8	122	147.1	96	205	15.8
3/28/2021	13	0	---	---	---	---	1	115.0	115	115	NA	151	148.2	95	193	12.5
4/4/2021	14	0	---	---	---	---	0	---	---	---	---	30	145.2	112	186	14.1
4/11/2021	15	0	---	---	---	---	3	108.3	102	112	5.5	18	139.2	102	161	16.5
4/18/2021	16	0	---	---	---	---	0	---	---	---	---	8	139.6	116	163	13.8
4/25/2021	17	0	---	---	---	---	0	---	---	---	---	5	147.8	135	156	8.5
5/2/2021	18	3	61.0	55	64	5.2	3	115.3	110	125	8.4	10	131.6	110	158	14.9
5/9/2021	19	1	62.0	62	62	NA	0	---	---	---	---	0	---	---	---	---
5/16/2021	20	5	65.6	60	70	4.6	1	130.0	130	130	NA	4	144.3	130	160	12.6
5/23/2021	21	1	67.0	67	67	NA	0	---	---	---	---	1	146.0	146	146	---
5/30/2021	22	2	68.0	66	70	2.8	0	---	---	---	---	0	---	---	---	---
6/6/2021	23	8	71.8	61	80	6.5	0	---	---	---	---	0	---	---	---	---
6/13/2021	24	17	74.7	62	86	6.2	0	---	---	---	---	0	---	---	---	---
6/20/2021	25	9	75.3	60	82	6.8	0	---	---	---	---	0	---	---	---	---
6/27/2021	26	10	73.8	63	83	5.9	0	---	---	---	---	0	---	---	---	---
7/4/2021	27	10	74.0	67	87	6.9	0	---	---	---	---	0	---	---	---	---
7/11/2021	28	1	62.0	62	62	NA	0	---	---	---	---	0	---	---	---	---
7/18/2021	29	1	85.0	85	85	NA	0	---	---	---	---	0	---	---	---	---
7/25/2021	30	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
8/1/2021	31	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---

Appendix 12: Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Coho Salmon fork lengths in the Trinity River, California in the Trinity River, California, 2021.

Week starting	Week of year	Natural Coho Salmon										Hatchery Coho Salmon				
		Age-0					Age-1					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
3/14/2021	11	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/21/2021	12	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/28/2021	13	0	---	---	---	---	2	102.5	100	105	3.5	123	149	120	196	15.1
4/4/2021	14	0	---	---	---	---	4	118.0	100	128	12.6	68	150	125	188	13.8
4/11/2021	15	0	---	---	---	---	4	100.5	96	110	6.5	27	155	130	245	26.4
4/18/2021	16	0	---	---	---	---	1	125.0	125	125	NA	27	156	119	230	19.9
4/25/2021	17	5	56.2	48	67	7.9	4	128.5	110	140	13.0	26	159	134	200	14.5
5/2/2021	18	4	46.3	40	49	4.2	0	---	---	---	---	13	152	120	175	14.9
5/9/2021	19	2	52.5	50	55	3.5	4	129.8	121	142	10.5	141	151	125	210	11.5
5/16/2021	20	13	54.2	47	60	3.6	0	---	---	---	---	113	151	115	185	11.6
5/23/2021	21	39	58.2	48	72	6.0	14	120.3	110	130	5.4	63	147	126	177	11.1
5/30/2021	22	27	58.3	52	70	4.1	2	117.5	105	130	17.7	3	150	148	151	1.5
6/6/2021	23	36	64.3	58	74	3.7	0	---	---	---	---	3	132	110	155	22.5
6/13/2021	24	18	65.2	60	70	3.6	0	---	---	---	---	0	---	---	---	---
6/20/2021	25	11	62.7	53	70	4.8	0	---	---	---	---	0	---	---	---	---
6/27/2021	26	12	69.0	59	84	6.9	0	---	---	---	---	0	---	---	---	---
7/4/2021	27	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
7/11/2021	28	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
7/18/2021	29	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
7/25/2021	30	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---

Appendix 13. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly steelhead fork lengths in the Trinity River, California, 2021.

Week starting	Week of year	Natural steelhead										Hatchery steelhead				
		Age-0					Age-1					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
1/10/2021	2	0	---	---	---	---	1	97.0	97	97	---	0	--	--	--	--
1/17/2021	3	0	---	---	---	---	83	71.7	40	145	19.6	0	--	--	--	--
1/24/2021	4	0	---	---	---	---	2	124.0	83	165	58.0	0	--	--	--	--
1/31/2021	5	0	---	---	---	---	30	82.1	51	127	18.0	0	--	--	--	--
2/7/2021	6	0	---	---	---	---	14	104.4	58	200	44.3	0	--	--	--	--
2/14/2021	7	0	---	---	---	---	11	93.6	63	144	23.1	0	--	--	--	--
2/21/2021	8	0	---	---	---	---	14	117.3	64	300	60.7	0	--	--	--	--
2/28/2021	9	0	---	---	---	---	16	108.2	68	163	30.0	0	--	--	--	--
3/7/2021	10	0	---	---	---	---	20	104.7	67	159	21.7	0	--	--	--	--
3/14/2021	11	0	---	---	---	---	69	102.4	62	178	27.8	0	--	--	--	--
3/21/2021	12	0	---	---	---	---	67	94.2	60	164	24.2	0	--	--	--	--
3/28/2021	13	0	---	---	---	---	86	95.3	66	192	22.7	0	--	--	--	--
4/4/2021	14	0	---	---	---	---	124	97.1	61	185	26.2	0	--	--	--	--
4/11/2021	15	0	---	---	---	---	96	113.6	65	243	33.5	0	--	--	--	--
4/18/2021	16	1	29.0	29	29	---	91	100.4	70	181	23.7	102	199.1	110	250	23.5
4/25/2021	17	0	---	---	---	---	19	107.3	72	170	29.6	2	196.0	190	202	8.5
5/2/2021	18	1	29.0	29	29	---	73	117.7	65	174	26.3	4	186.8	168	207	16.7
5/9/2021	19	8	28.9	22	35	4.7	37	120.4	80	182	23.1	1	122.0	122	122	NA
5/16/2021	20	2	37.5	27	48	14.9	47	125.8	78	208	25.5	1	212.0	212	212	NA
5/22/2021	21	13	40.0	26	64	13.3	37	126.6	66	208	33.5	3	176.0	163	200	20.8
5/30/2021	22	13	57.2	43	71	7.5	23	124.3	82	155	21.9	0	---	---	---	---
6/6/2021	23	68	54.6	37	72	8.2	44	135.7	99	184	20.7	0	---	---	---	---
6/13/2021	24	39	59.5	42	82	10.4	14	133.2	98	177	22.5	1	205.0	205	205	---
6/20/2021	25	55	63.7	47	84	9.3	20	145.1	91	240	33.9	0	--	--	--	--
6/27/2021	26	27	60.2	45	76	8.7	9	143.4	111	194	26.5	0	--	--	--	--
7/4/2021	27	35	60.3	28	87	14.1	18	144.2	118	228	26.6	0	--	--	--	--
7/11/2021	28	26	62.8	49	89	9.1	12	145.8	113	180	20.9	0	--	--	--	--
7/18/2021	29	16	65.8	48	84	11.0	8	147.9	115	205	29.3	0	--	--	--	--
7/25/2021	30	5	69.8	59	83	8.6	3	152.7	142	165	11.6	0	--	--	--	--
8/1/2021	31	10	62.5	58	70	3.7	2	135.0	130	140	7.1	0	--	--	--	--

Appendix 14. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly steelhead fork lengths in the Trinity River, California, 2021.

Week starting	Week of year	Natural steelhead										Hatchery steelhead				
		Age-0					Age-1					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
3/14/2021	11	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/21/2021	12	0	---	---	---	---	3	112.7	91	144	27.8	0	---	---	---	---
3/28/2021	13	0	---	---	---	---	29	94.2	70	163	23.9	0	---	---	---	---
4/4/2021	14	2	37.0	34	40	4.2	71	110.5	71	245	33.8	1	213.0	213	213	NA
4/11/2021	15	1	40.0	40	40	NA	91	122.7	64	248	46.6	0	---	---	---	---
4/18/2021	16	0	---	---	---	---	67	121.3	72	270	44.8	0	---	---	---	---
4/25/2021	17	0	---	---	---	---	141	138.6	71	260	45.5	133	210.4	167	260	17.8
5/2/2021	18	1	39.0	39	39	NA	44	123.8	80	218	38.1	65	201.8	140	240	20.7
5/9/2021	19	0	---	---	---	---	139	167.5	80	250	31.6	132	199.9	150	240	17.7
5/16/2021	20	0	---	---	---	---	141	169.1	83	230	23.1	127	196.4	109	250	20.5
5/23/2021	21	2	49.0	45	53	5.7	130	162.1	82	246	26.3	48	183.4	110	248	26.0
5/30/2021	22	4	56.3	53	59	2.8	18	165.1	118	208	20.8	4	180.3	161	205	19.2
6/6/2021	23	8	58.6	48	65	4.9	11	152.8	125	190	23.2	0	---	---	---	---
6/13/2021	24	25	58.6	36	74	9.1	0	---	---	---	---	0	---	---	---	---
6/20/2021	25	6	59.7	55	66	4.0	8	136.8	100	203	33.6	0	---	---	---	---
6/27/2021	26	3	64.3	47	76	15.3	1	110.0	110	110	NA	0	---	---	---	---
7/4/2021	27	3	51.7	45	62	9.1	2	155.0	149	161	8.5	0	---	---	---	---
7/11/2021	28	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
7/18/2021	29	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
7/25/2021	30	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---

Appendix 15. Fulton's condition factor (K) for pooled natural and hatchery age-0 Chinook Salmon with FL > 50 mm from the Pear Tree and Willow Creek Rotary Screw Trap sites in the Trinity River, California, 2021.

Week starting	Week of year	Pear Tree trap site			Willow Creek trap site		
		n	Average K	Standard deviation of K	n	Average K	Standard deviation of K
1/10/2021	2	---	---	---	---	---	---
1/17/2021	3	---	---	---	---	---	---
1/24/2021	4	---	---	---	---	---	---
1/31/2021	5	---	---	---	---	---	---
2/7/2021	6	---	---	---	---	---	---
2/14/2021	7	119	1.191	0.127	---	---	---
2/21/2021	8	---	---	---	---	---	---
2/28/2021	9	86	1.118	0.118	---	---	---
3/7/2021	10	---	---	---	---	---	---
3/14/2021	11	---	---	---	3	0.956	0.219
3/21/2021	12	---	---	---	3	0.956	0.219
3/28/2021	13	35	1.084	0.122	36	1.257	0.374
4/4/2021	14	57	1.211	0.196	60	1.112	0.382
4/11/2021	15	90	1.157	0.085	223	1.130	0.277
4/18/2021	16	30	1.114	0.075	318	1.071	0.207
4/25/2021	17	3	1.073	0.021	240	1.120	0.310
5/2/2021	18	---	---	---	263	0.956	0.212
5/9/2021	19	143	1.183	0.097	287	0.997	0.190
5/16/2021	20	12	0.993	0.112	353	1.129	0.237
5/23/2021	21	84	1.128	0.110	297	1.093	0.193
5/30/2021	22	207	1.088	0.096	346	1.044	0.222
6/6/2021	23	75	1.192	0.149	260	1.010	0.129
6/13/2021	24	68	1.066	0.085	357	0.997	0.148
6/20/2021	25	---	---	---	359	1.031	0.274
6/27/2021	26	---	---	---	324	1.125	0.216
7/4/2021	27	---	---	---	144	1.017	0.146
7/11/2021	28	---	---	---	---	---	---
7/18/2021	29	---	---	---	10	1.079	0.089
7/25/2021	30	---	---	---	---	---	---
8/1/2021	31	---	---	---	---	---	---

Appendix 16. Fulton's condition factor (K) for natural age-1 Coho Salmon from the Pear Tree and Willow Creek Rotary Screw Trap sites in the Trinity River, California, 2021.

Week starting	Week of year	Pear Tree trap site			Willow Creek trap site		
		n	Average K	Standard deviation of K	n	Average K	Standard deviation of K
1/10/2021	2	---	---	---	---	---	---
1/17/2021	3	2	0.950	0.071	---	---	---
1/24/2021	4	---	---	---	---	---	---
1/31/2021	5	---	---	---	---	---	---
2/7/2021	6	---	---	---	---	---	---
2/14/2021	7	---	---	---	---	---	---
2/21/2021	8	1	1.160	NA	---	---	---
2/28/2021	9	---	---	---	---	---	---
3/7/2021	10	---	---	---	---	---	---
3/14/2021	11	---	---	---	---	---	---
3/21/2021	12	2	1.025	0.148	---	---	---
3/28/2021	13	1	1.090	NA	2	1.257	0.080
4/4/2021	14	1	1.080	NA	4	1.011	0.130
4/11/2021	15	1	1.170	NA	4	1.038	0.196
4/18/2021	16	---	---	---	---	---	---
4/25/2021	17	---	---	---	4	0.876	0.184
5/2/2021	18	1	0.880	NA	---	---	---
5/9/2021	19	---	---	---	4	1.195	0.303
5/16/2021	20	3	1.053	0.055	---	---	---
5/23/2021	21	---	---	---	12	1.026	0.096
5/30/2021	22	---	---	---	2	1.162	0.054
6/6/2021	23	---	---	---	---	---	---
6/13/2021	24	---	---	---	---	---	---
6/20/2021	25	---	---	---	---	---	---
6/27/2021	26	---	---	---	---	---	---
7/4/2021	27	---	---	---	---	---	---
7/11/2021	28	---	---	---	---	---	---
7/18/2021	29	---	---	---	---	---	---
7/25/2021	30	---	---	---	---	---	---
8/1/2021	31	---	---	---	---	---	---

Appendix 17. Fulton's condition factor (K) for natural age-1+ steelhead from the Pear Tree and Willow Creek Rotary Screw Trap sites in the Trinity River, California, 2021.

Week starting	Week of year	Pear Tree trap site			Willow Creek trap site		
		n	Average K	Standard deviation of K	n	Average K	Standard deviation of K
1/10/2021	2	54	1.106	0.067	---	---	---
1/17/2021	3	79	1.102	0.099	---	---	---
1/24/2021	4	---	---	---	---	---	---
1/31/2021	5	32	1.085	0.093	---	---	---
2/7/2021	6	18	1.125	0.182	---	---	---
2/14/2021	7	27	1.041	0.103	---	---	---
2/21/2021	8	116	1.081	0.078	---	---	---
2/28/2021	9	31	1.123	0.086	---	---	---
3/7/2021	10	8	1.046	0.057	---	---	---
3/14/2021	11	38	1.109	0.079	---	---	---
3/21/2021	12	112	1.094	0.109	3	1.051	0.099
3/28/2021	13	25	1.059	0.058	29	1.044	0.124
4/4/2021	14	10	1.130	0.257	71	1.081	0.356
4/11/2021	15	59	1.089	0.087	90	0.952	0.358
4/18/2021	16	8	1.050	0.074	65	1.008	0.223
4/25/2021	17	92	1.112	0.086	136	1.091	0.268
5/2/2021	18	36	1.118	0.077	43	1.039	0.154
5/9/2021	19	11	1.138	0.103	139	0.989	0.176
5/16/2021	20	21	1.066	0.064	141	0.967	0.118
5/23/2021	21	23	1.144	0.116	111	0.966	0.164
5/30/2021	22	39	1.073	0.193	18	0.953	0.096
6/6/2021	23	8	1.095	0.097	11	1.082	0.156
6/13/2021	24	9	1.156	0.205	---	---	---
6/20/2021	25	---	---	---	8	1.058	0.087
6/27/2021	26	---	---	---	1	1.112	NA
7/4/2021	27	---	---	---	1	0.978	NA
7/11/2021	28	---	---	---	---	---	---
7/18/2021	29	---	---	---	---	---	---
7/25/2021	30	---	---	---	---	---	---
8/1/2021	31	---	---	---	---	---	---