

Juvenile Salmonid Monitoring in the Mainstem Trinity River, California, 2019

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Executive Summary — This report presents juvenile salmonid emigration monitoring data collected in 2019 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) near Willow Creek, California, on the mainstem Trinity River. Information collected from this project contributes to assessing the effectiveness of the Trinity River Restoration Program's habitat and flow management actions in restoring salmonid populations of the Trinity River. Monitoring at PTRST is conducted to estimate juvenile salmonid population size passing the site during the sampling season. Monitoring at WCRST is conducted to estimate juvenile salmonid population size and emigration timing during the monitoring period. In 2019, one rotary screw trap was operated at PTRST from January 15 through August 31, with successful sampling for 143 days of the 228-day sampling period. At WCRST, three rotary screw traps were operated from April 15 through August 21, with successful sampling for 68 days of the 128-day sampling period.

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 Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), and steelhead (*O. mykiss*). Catch data of other fishes are also presented.

Efficiency estimates and catch data were used to estimate weekly and seasonal outmigration abundance of both naturally and hatchery-produced sub-populations of age-0 juvenile Chinook Salmon migrating downstream past PTRST and WCRST using a Bayesian time-stratified population estimation method. At PTRST an estimated 5,518,856 (95% Credible Interval (CI): [3,212,643, 9,223,373]) naturally-produced age-0 Chinook Salmon and 4,890,795 (95% CI: [2,756,935, 8,265,218]) age-0 hatchery Chinook Salmon passed the site between January 15 and August 31. At WCRST between April 15 and August 21, an estimated 1,126,965 (95% CI: [802,371, 1,649,494]) naturally-produced age-0 Chinook Salmon and 401,670 (95% CI: [330,937, 481,257]) age-0 hatchery Chinook Salmon passed the site. Catch data of other fishes are also presented.

Juvenile salmonid emigration target dates to assess at what date 80% of the juvenile salmonid population had reached Willow Creek (WC80), and to help manage water

temperatures in the mainstem Trinity River. The WC80 estimate of the week in which 80% of the juvenile Chinook Salmon population passed WCRST, as inferred from the Bayesian time-stratified population estimation, was Week of the Year WOY 27 (July 1 – July 7), which occurred before the TRRP management target date of July 4. The estimate of the week in which 80% of the natural Coho Salmon age-1+ population passed the WCRST, as inferred from the proportional discharge-based abundance index, was WOY 23 (June 3- June 10). The estimate of the week in which 80% of the natural Steelhead age-1+ population passed the WCRST, as inferred from the proportional discharge-based abundance index, was WOY 20 (May 13– May 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 enable evaluation of the production and 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 TRRP Integrated Assessment Plan objective 3, and sub-objective 3.2 (TRRP and ESSA 2009):

Objective 3: Restore and maintain natural production of anadromous fish populations.

Sub-objective 3.2: Increase freshwater production of anadromous fish.

Juvenile salmonid emigration from the mainstem Trinity River has been monitored since 1989 with rotary screw traps. This data series report summarizes the outmigrant monitoring data collected in 2019 cooperatively by the U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Hoopa Valley Tribal Fisheries Department, and Yurok Tribal Fisheries Program at Pear Tree (PTRST) and Willow Creek (WCRST) on the mainstem Trinity River (Figure 1). The intent of this data series report is 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, fish condition and hatchery/natural composition of the outmigrant populations are assessed.

A technical report synthesizing multi-year datasets developed by this project will be periodically published to evaluate trends in outmigrant salmonid production, outmigrant timing, hatchery/natural contribution and condition/health. 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, it is intended that this basic information will be used by the TRRP to aid in development of a salmon production model for the Trinity River.

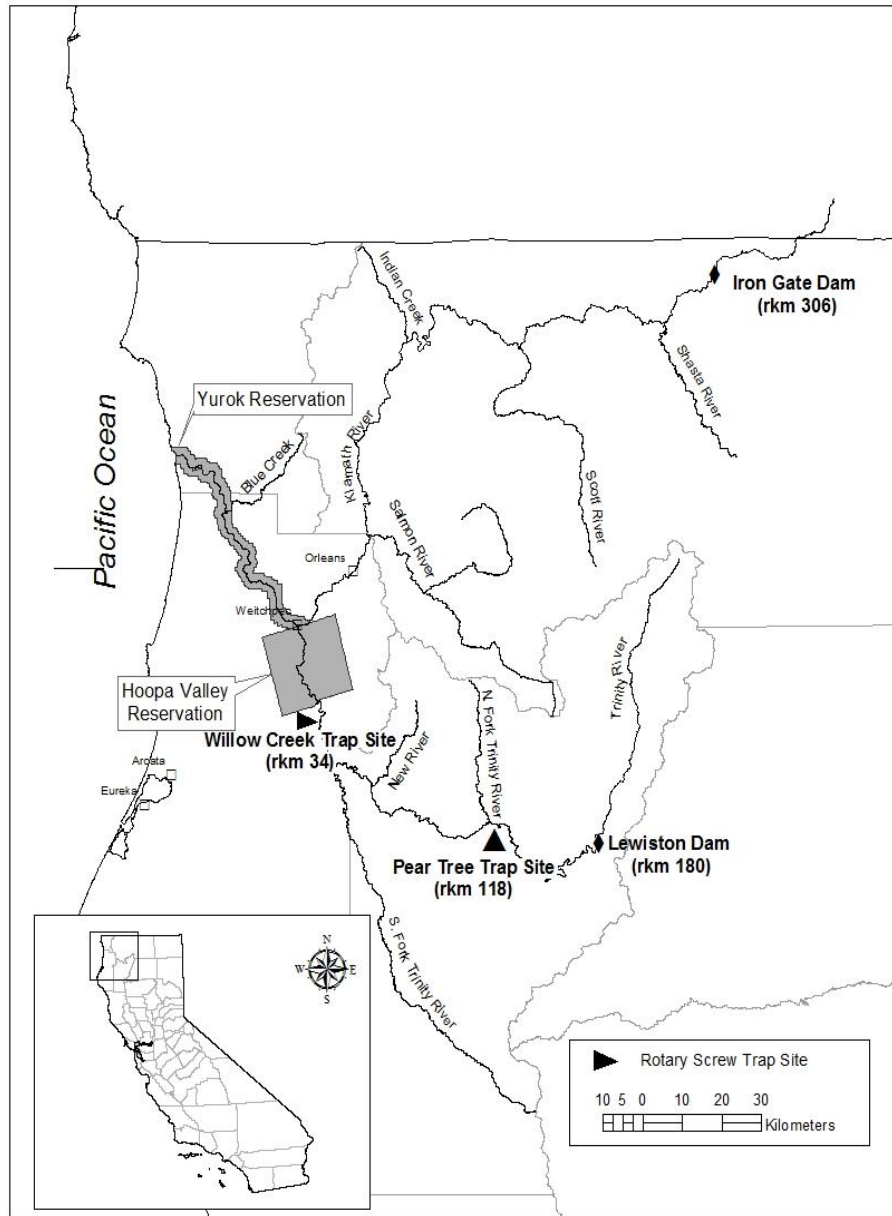


Figure 1. Location of the Trinity River Rotary Screw Trap sites near Willow Creek (rkm 34) and Pear Tree Gulch (rkm 118), California, operated by the Yurok Tribal Fisheries Program, U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Hoopa Valley Tribal Fisheries Department.

Methods

Trap Design and Operation

Sampling at the Pear Tree rotary screw trap (PTRST) site, was conducted using one 2.44 m diameter rotary screw trap. The trap generally operated from early January to late August in order to best observe the greatest portion of the expected emigration of naturally-produced age-0 juvenile Chinook salmon from the study reach (Green and Petros 2005, Schwarz et al. 2009, Petros 2011).

At the Willow Creek rotary screw trap (WCRST) site, sampling was conducted by deploying one to three 2.44 m diameter rotary screw traps, depending on river conditions such as magnitude of river discharge and debris load. Traps are generally deployed March through August. An effort was made to place traps in the river in early spring to sample a majority of outmigrating age-0 Chinook salmon. This allows the evaluation of emigration patterns and relative abundances of natural and hatchery Chinook salmon, as well as portions of the coho salmon and steelhead smolt outmigration.

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 x 0.15 x 6.0 m (4"x6"x10") beams were used to push the traps out from the bank. The number of cone revolutions were used to determine where and when the traps could be operated without inducing unnecessary risk to the trap; 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. A sample day was 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 night hours, when the majority of juvenile salmonids emigrate based on past sampling. Generally, trap checks at PTRST occurred at 5 pm the day the trap was set and 8 am the following morning, with the 8 am check marking the end of one sample day. 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 first day of the year (Table 1). All WOYs are seven days in length except the last WOY of the year and the ninth WOY during leap years, which are both eight days in length.

Water Flow and Temperature Measurements

Normal cone operating depth was 1.21 m for the 2.44m traps and 0.762m for the 1.52m trap. Daily velocity measurements were taken 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). Mean water velocity (ft/s) was calculated for each cell. Each calculated cell area (ft²) was multiplied by its corresponding mean water velocity (ft/s). The values for each cell were summed, yielding an estimate of volume of river discharge sampled (Qs) 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 (Q) at WCRST.

At PTRST, water temperature data was collected using thermometer deployed in the trap live well. Temperature data was recorded once or twice a day at that start of trap checks. At WCRST, water temperature data were collected using a YSI temperature and dissolved oxygen probe once per day at the start of trap checks.

Biological Sampling Procedures

All juvenile fish captured were anesthetized with Aqui-S 20e prior to processing. Up to 30 individuals of each species, age class (based on size), and presence or absence of a hatchery mark, were randomly subsampled (biosampled) from the daily catch. Biosampled salmonids were measured to the nearest mm fork length (FL), weighed to the nearest 0.1g 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.

All anesthetized fish not retained (see paragraph below) were allowed to resuscitate in buckets of ambient river water before being released downstream of the trap. Rarely captured adult salmonids were not anesthetized. Adult salmonid FLs were either measured or approximated based on comparing to a known length object on the trap (i.e. live box lid) before release. 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 an "unknown". Unknown salmonids were not included in catch totals.

When present, daily subsamples of marked hatchery 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. A maximum of five ad-clipped Chinook salmon were collected daily and sacrificed for subsequent CWT retrieval. Collected fish were stored in a freezer until time of dissection. Occasionally, ad-clipped fish were also collected for disease sampling, after which the CWTs were removed. Marked hatchery Chinook salmon were not regularly collected at PTRST.

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, silvery, and lacked distinct parr marks. Steelhead were classified by age based on length-to-age analysis of scales collected from a subsample of steelhead captured (WCRST) or by length frequency distributions (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 to-age relationship derived from aged samples.

Fish other than Chinook salmon, coho salmon, or steelhead were considered non-target species. Non-target fishes captured were identified to species (or genus in some cases), enumerated, and in the case of brown trout, 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.

Hatchery and Natural Stocks Estimate

The catch of Chinook salmon, coho salmon, and steelhead was partitioned into either 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 through 39 and the fall period as WOY 40 through 52 in years when extended sampling was conducted. This project does not sample during the fall Chinook yearling release. Hatchery-reared steelhead and coho salmon are typically volitionally released as smolts or yearling-plus (age-1) in early spring. smolts or yearling-plus (age-1) in early spring.

Chinook salmon

At both PTRST and WCRSR, the proportion of hatchery Chinook salmon in the catch in the weekly catch was estimated using Trinity River Hatchery (TRH) fin-clip rate (approximately 25%) to produce the number of hatchery Chinook salmon captured in any given week. The estimated number of naturally-produced Chinook salmon in the weekly catch were calculated as the difference between the total weekly Chinook salmon catch and the estimated number of hatchery Chinook salmon.

Estimation of weekly hatchery and natural stock contribution was carried out 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.

During the beginning and end of hatchery fish emigration periods it was possible that juvenile Chinook salmon of hatchery origin were 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-clip 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

All hatchery coho salmon released from TRH were marked with a right-maxillary clip (max-clip). The weekly contribution of naturally produced coho salmon to the catch was estimated by subtracting the catch of marked hatchery fish from the total catch.

Steelhead

All hatchery steelhead released from TRH were marked with an ad-clip. The weekly contribution of naturally produced steelhead to the catch was estimated by subtracting the catch of marked hatchery 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-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-produced fish, based on catches of marked fish and marking rates, were used to partition 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 is used to compare relative abundance between weeks during the trapping season, and between years.

Emigration duration is defined as the period 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 and thus require caution in order to compare 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 for emigration timing of a specific species and life stage (Schwarz et al. 2009).

Migration Rate

Migration rates were calculated for hatchery Chinook salmon, hatchery steelhead, and hatchery coho salmon were estimated by dividing the distance (rkm) 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. Due to potential delays in outmigration during volitional releases, mean migration rates were not calculated for volitional release groups.

Population Estimation

An intensive mark-recapture technique was employed to generate population estimates for natural and hatchery age-0 Chinook salmon. Weekly and season totals of natural-origin age-0 Chinook Salmon out-migrating past the Pear Tree, and Willow Creek trap sites were estimated using a Bayesian time-stratified population estimation method (Bonner 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 (weighted sample fraction, described below), marks released, and 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), some daily catches were not completed. 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 to determine sampling fraction (s_j):

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

Mark-Recapture Technique

Hatchery-produced 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 located 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 catch of these species, so production estimates were not generated for these species.

One or two types of marks were utilized in 2018, either freeze branding or Bismark brown. Freeze brands were applied only to hatchery-produced 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 subsample of the freeze branded fish was sampled 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 marking was applied to only hatchery-produced juvenile Chinook salmon from TRH following Rawson (1984). The Bismark was applied at the release site after fish were counted and transported from the hatchery.

Releases generally occurred one hour before sunset approximately 0.9 km upstream near the stream margin (PTRST) or in late afternoon at approximately 0.4 km upstream into a large, still pool (WCRST) to mix with the population of out-migrating 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 recaptures were identified and recorded during normal trapping operations but were not counted as part of the catch for that day.

Results

Data are grouped by Week of the Year (WOY; Table 1). Graphs of water temperature and discharge through the sampling periods are presented in Figure 2.

Sampling Efforts

In 2019, trapping at PTRST began in the third week of January and trapping at WCRST was initiated in mid-April (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 (*O. kisutch*) and steelhead (*O. mykiss*) 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. It is important for readers to note that without sampling year-round, portions of annual production are excluded from estimates and indices presented in this report

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

WOY	Week beginning	WOY	Week beginning	WOY	Week beginning
1	1-Jan	18	30-Apr	35	27-Aug
2	8-Jan	19	7-May	36	3-Sep
3	15-Jan	20	14-May	37	10-Sep
4	22-Jan	21	21-May	38	17-Sep
5	29-Jan	22	28-May	39	24-Sep
6	5-Feb	23	4-Jun	40	1-Oct
7	12-Feb	24	11-Jun	41	8-Oct
8	19-Feb	25	18-Jun	42	15-Oct
9	26-Feb	26	25-Jun	43	22-Oct
10	5-Mar	27	2-Jul	44	29-Oct
11	12-Mar	28	9-Jul	45	5-Nov
12	19-Mar	29	16-Jul	46	12-Nov
13	26-Mar	30	23-Jul	47	19-Nov
14	2-Apr	31	30-Jul	48	26-Nov
15	9-Apr	32	6-Aug	49	3-Dec
16	16-Apr	33	13-Aug	50	10-Dec
17	23-Apr	34	20-Aug	51	17-Dec
				52	24-Dec

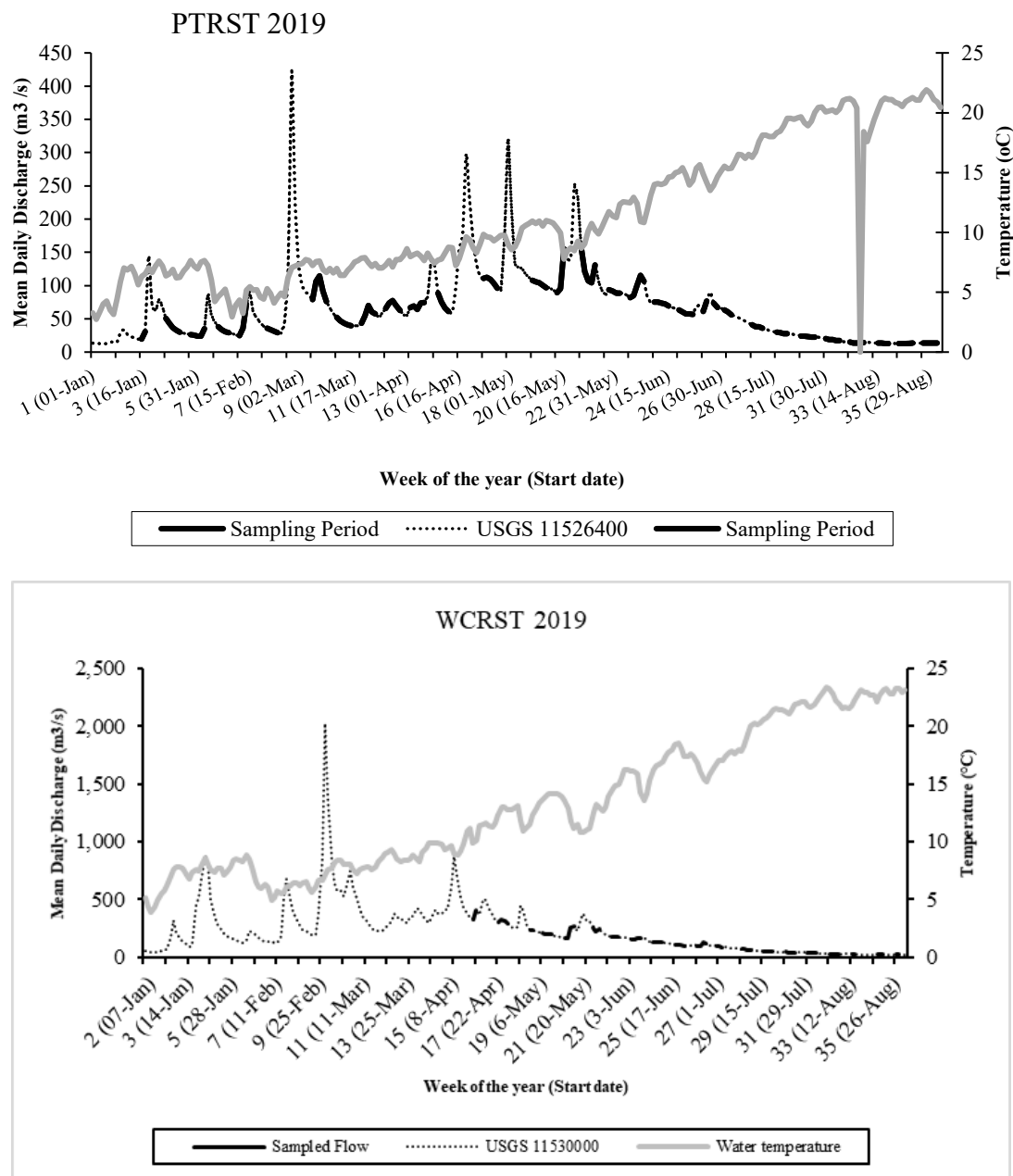


Figure 2. Mean daily discharge (m^3/s) as recorded near Helena (U.S. Geological Survey Water Resource gage station #11-526400) and Hoopa (U.S. Geological Survey Water Resource gage station #11-530000), California, and mean daily water temperatures ($^{\circ}\text{C}$) recorded at USGS gage #11-526400 and the Willow Creek Rotary Screw Trap (WCRST) in 2019. 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 bolded sections on discharge series indicate sampled flows and the lightly dotted sections indicate non-sampled flows.

Table 2. Period and duration of 2019 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).

Distinct days are total number of days sampled with at least one trap.

Site	Trap	Start-end dates	Days trapped	Days r	Trapping Rate
PTRST	1 (2.4m)	Jan 15 – Aug 31	143	228	62.7%
Distinct Days		Jan 15 – Aug 31	143	228	62.7%
WCRST	1 (2.4m)	Apr 15 – Aug 28	68	135	50.4%
WCRST	2 (2.4m)	Apr 23 – Aug 28	62	127	48.8%
WCRST	3 (2.4m)	Apr 15 – Aug 21	58	128	45.3%
Distinct Days		Apr 15 – Aug 28	68	135	50.4%

Catch Totals

Catch totals of the primary salmonids of interest (Chinook Salmon, Coho Salmon, and steelhead) are presented in Table 3. Chinook Salmon were the most commonly captured salmonid at both sites, comprising approximately 95% and 96% of the total anadromous salmonid catch at PTRST and WCRST, respectively. Hatchery salmonid releases from Trinity River Hatchery (TRH) are presented in Table 4. Catch totals of common non-target, fish species are presented in Table 5.

Abundance Indices

The proportional discharge-based abundance indices for natural age-0 Chinook Salmon were 614,383 and 1,376,437 at PTRST and WCRST, respectively (Figure 3; Table 6; Appendix 1, 2). The age-0 hatchery Chinook Salmon abundance indices were 163,229 at PTRST and 533,555 at WCRST. 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 prior to trap installation. A total of 32 age-1 hatchery Chinook salmon were caught at PTRST, while 67 were captured at WCRST.

Age-0 naturally-produced Coho Salmon abundance indices were 766 and 1,175 at PTRST and WCRST, respectively (Figure 4; Table 6, Appendix 3, Appendix 4). The abundance indices for age-1 naturally produced Coho Salmon were 635 and 909 at PTRST and WCRST, respectively. Abundance indices of hatchery age-1 Coho Salmon were 1,685 and 11,478 at PTRST and WCRST, respectively. Natural age-1 Coho Salmon were captured near the beginning of the sampling period at both trap sites, indicating that portions of each respective population emigrated prior to trap installation.

At PTRST, abundance indices of natural age-0 and age-1 steelhead were 8,215 and 13,044, respectively (Figure 5; Table 6; Appendix 5). Abundance indices of age-0 and age-1 steelhead at WCRST were 13,398 and 51,272, respectively (Table 6; Appendix 6). Abundance indices of hatchery age-1 steelhead were 4,308 at PTRST and 52,357 at WCRST. The Age-2 steelhead abundance index was 307 at PTRST. Sampling periods at both trap sites missed portions of each respective population that emigrated prior to or after trapping operations.

Table 3. Juvenile salmonid catch totals in 2019 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+	Natural age-2+	Total
PTRST	Chinook Salmon	6,243	32	11,126	74	NA	17,475
PTRST	Coho Salmon	NA	17	16	22	NA	55
PTRST	Steelhead	NA	35	427	392	11	865
WCRST	Chinook Salmon	12,692	67	32,513	60	NA	45,332
WCRST	Coho Salmon	NA	15	26	15	NA	56
WCRST	Steelhead	NA	765	548	650	NA	1,963

Table 4. California Department of Fish and Game, Trinity River Hatchery juvenile salmonid releases, 2019. AD-clipped = adipose fin clipped fish.

Species	Release season	Number released	Percentage AD-clipped or marked	Release dates
Chinook Salmon ¹	Spring	1,218,711	24.5	5/27 – 10/7
Chinook Salmon ²	Fall	3,126,151	24.2	6/15 – 10/14
Coho Salmon ²	Spring	149,807	99.9	4/15 – NA ³
Steelhead	Spring	418,616	99.9	4/29 – 5/8

¹Chinook Salmon releases includes both spring-run and fall-run races.

²Coho Salmon were marked with a right maxillary clip.

³Coho 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) on the mainstem Trinity River, California, 2019.

Common name	Species	Life stage	PTRST catch	WCRST catch
Lamprey	Entosphenus spp.	Ammocoete	5,307	498
		Eyed		
		juvenile	445	7
		Adult	46	4
Sucker	<i>Catostomus spp.</i>		594	1,567
Speckled Dace	<i>Rhinichthys osculus</i>		1,097	179
Three-Spine				
Stickleback	<i>Gasterosteus aculeatus</i>		115	15
Golden Shiner	<i>Notemigonus crysoleucas</i>		3	1
Sculpin	<i>Cottus spp.</i>		0	34
Green Sturgeon	<i>Acipenser medirostris</i>	Juvenile	0	4
Brown Trout	<i>Salmo trutta</i>	Juvenile	300	4
Sunfish	<i>Lepomis spp.</i>		18	2
Sockeye Salmon	<i>Oncorhynchus nerka</i>	Juvenile	1	3
Fathead Minnow	<i>Pimephales promelas</i>	Juvenile	0	3
Bullhead	<i>Ameiurus spp.</i>		0	0
Chum Salmon	<i>Oncorhynchus keta</i>		0	0
American Shad	<i>Alosa sapidissima</i>		0	1

Table 6. Juvenile salmonid proportional discharge-based abundance indices at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. 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	Natural age-2+	Total
PTRST	Chinook Salmon	163,29	0	448,672	2,482	NA	614,383
PTRST	Coho Salmon	NA	1,685	766	635	NA	3,086
PTRST	Steelhead	NA	4,308	8,215	13,044	307	25,874
WCRST	Chinook Salmon	533,555	3,589	1,376,437	3,187	NA	1,916,767
WCRST	Coho Salmon	NA	11,478	1,175	909	NA	13,562
WCRST	Steelhead	NA	52,357	13,398	51,272	NA	117,027

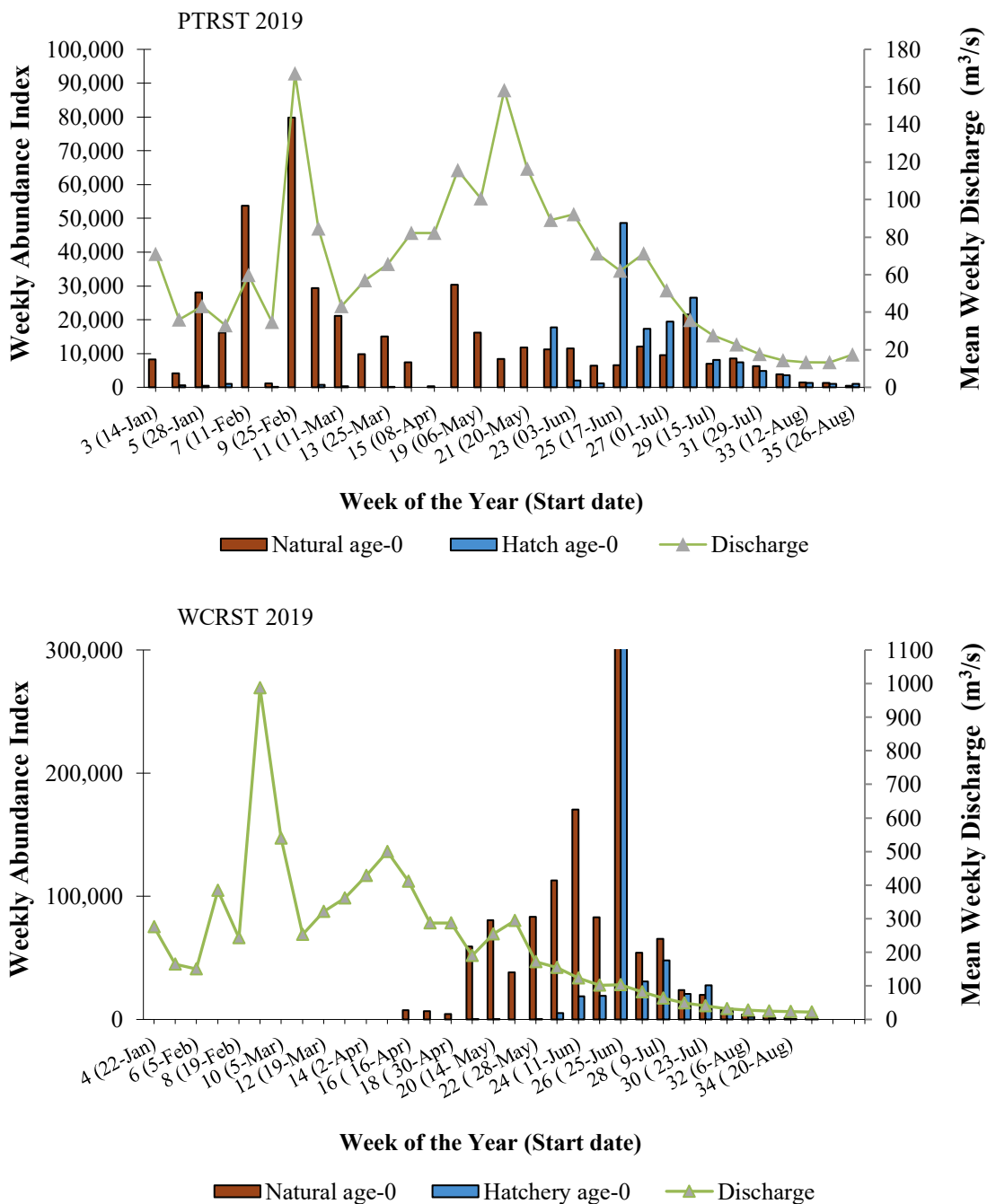


Figure 3. Weekly proportional discharge-based abundance indices for natural age-0 and hatchery age-0 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34) in 2019.

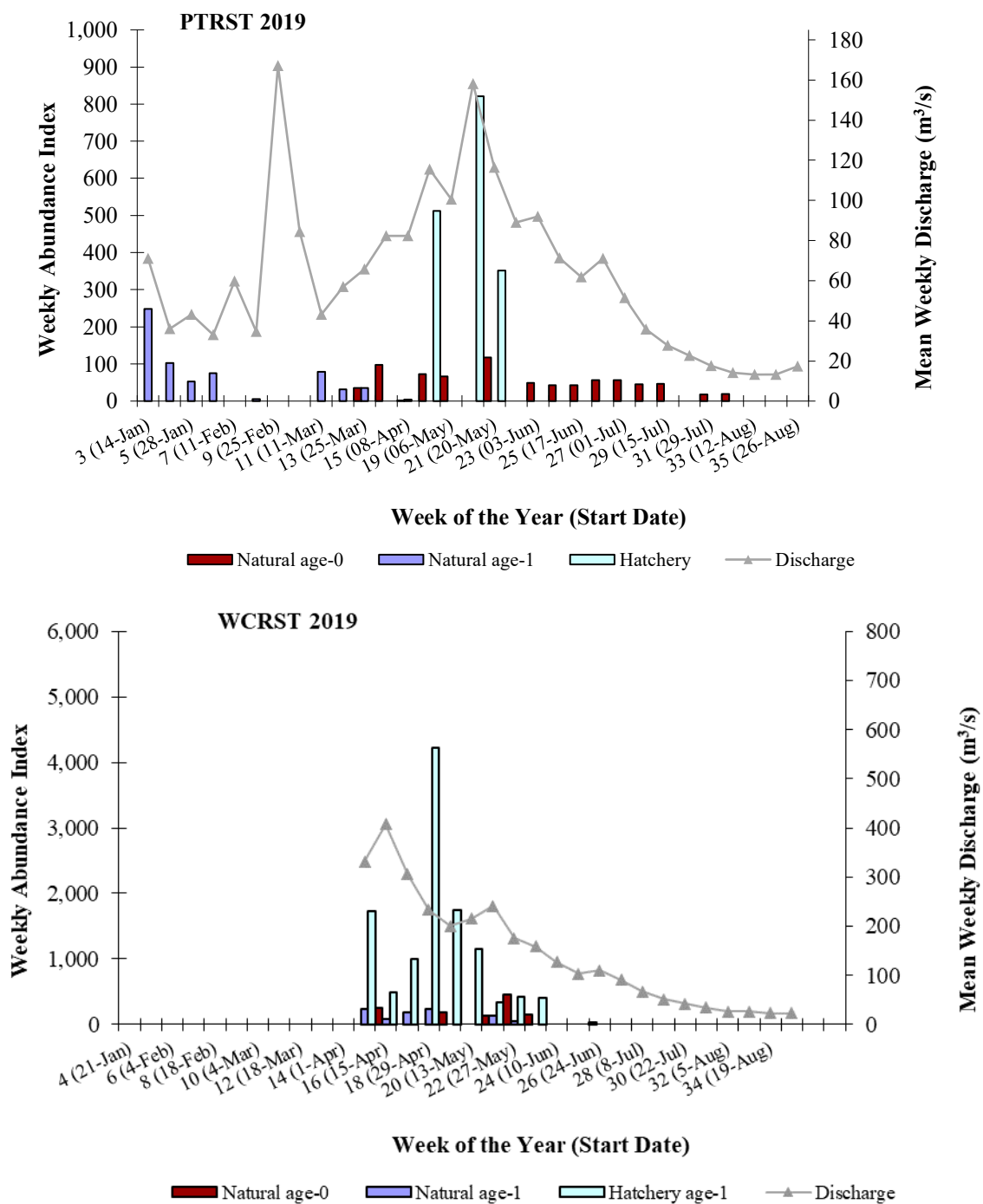


Figure 4. Weekly proportional discharge-based abundance indices for natural age-0, natural age-1, and hatchery age-1 Coho Salmon captured at Pear Tree Rotary Screw Trap (PTRST, rkm 118) and Willow Creek Rotary Screw Trap (WCRST, rkm 34) in 2019.

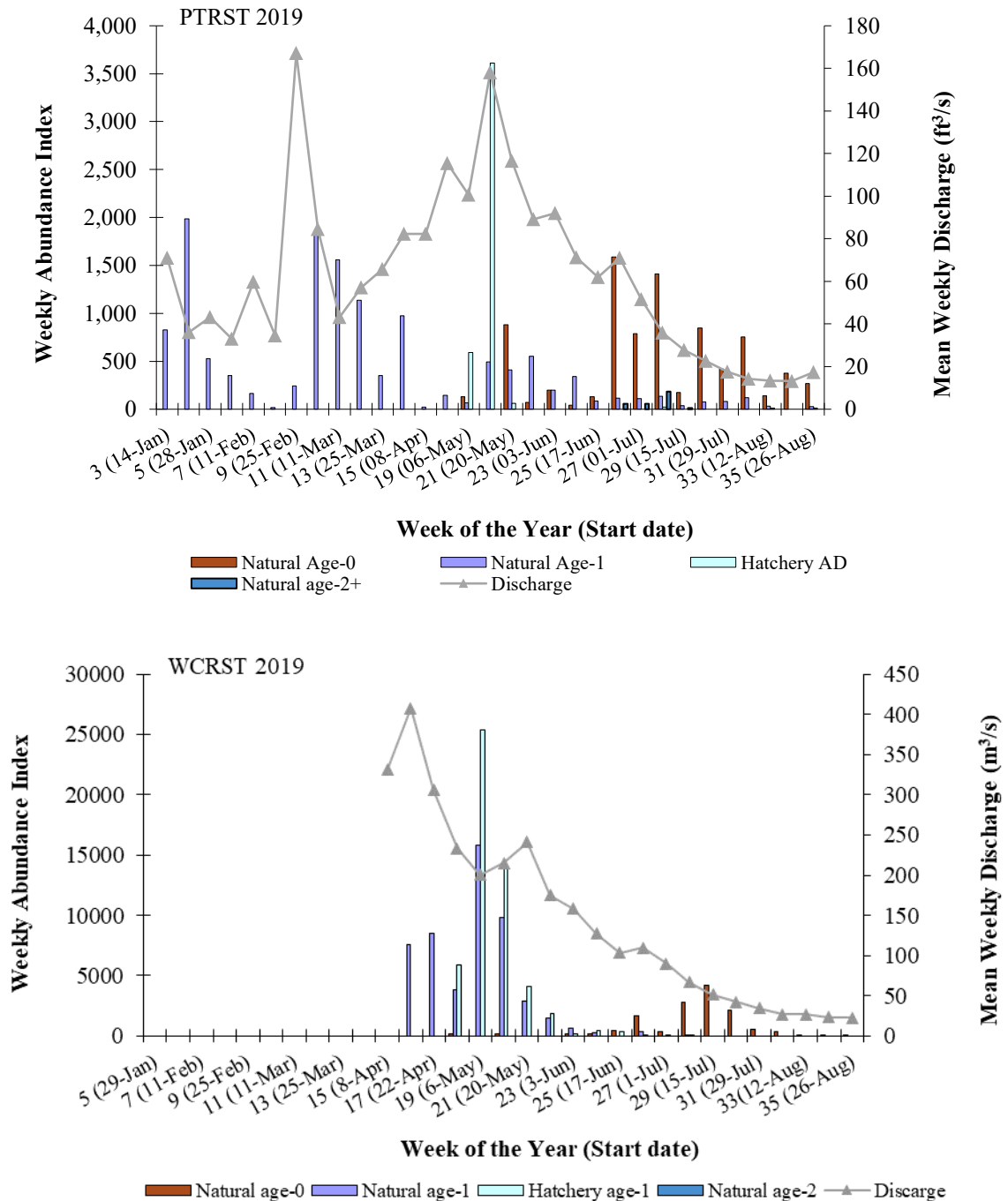


Figure 5. Weekly proportional discharge-based abundance indices for natural age-0, natural age-1, natural age-2, and hatchery age-1 steelhead captured at Pear Tree Rotary Screw Trap (PTRST, rkm 118) and Willow Creek Rotary Screw Trap (WCRST, rkm 34) in 2019.

Hatchery/Natural Contribution

Chinook Salmon were captured at PTRST and WCRST throughout the 2019 sampling season with the spring/summer emigration dominated by naturally-produced fish at PTRST, comprising 73.4% of the total proportional discharge-based Chinook Salmon abundance index. At WCRST, hatchery and natural chinook were more proportional in abundance, with naturally-produced fish comprising 71.8% of the index (Appendix 1, 2).

Age-1 Coho Salmon smolts were predominantly hatchery origin at PTRST and comprised 72.6% of the total age-1 proportional discharge-based index in 2019 (Appendix 3). At WCRST, age-1 Coho Salmon emigrants of hatchery origin comprised 84.6% of the total age-1 proportional discharge-based index in 2019 (Appendix 4).

Based on proportional discharge-based abundance indices at PTRST and WCRST, age-1 hatchery steelhead comprised 75.2% (Appendix 5) and 88.6% (Appendix 6), respectively, of the total age-1 steelhead abundance indices at each respective site.

Chinook Salmon Population Estimation

During the 2019 sampling season, freeze-branded and photonicallly-marked 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-produced sub-populations (Figure 6). At PTRST an estimated 5,518,856 (95% Credible Interval (CI): [3,212,643, 9,223,373]) naturally produced age-0 Chinook Salmon and 4,890,795 (95% CI: [2,756,935, 8,265,218]) age-0 hatchery Chinook Salmon passed the site between January 15 and August 31. At WCRST between April 15 and August 20, an estimated 1,126,965 (95% CI: [802,371, 1,649,494]) naturally produced age-0 Chinook Salmon and 401,670 (95% CI: [330,937, 481,257]) age-0 hatchery Chinook Salmon passed the site.

Outmigrant Timing

The Chinook Salmon population in the Trinity River is composed of both naturally produced and hatchery-produced fish of both spring and fall races. The vast 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). The week marking the cumulative passage of 80% of the natural juvenile Chinook Salmon population at WCRST, as inferred from the proportional discharge-based abundance index, was WOY 27 (July 1 – July 7), which occurred before the TRRP management target date of July 4 (TRRP and ESSA 2009).

Based on proportional discharge-based abundance indices, natural age-0 Chinook Salmon emigration peaked during WOY 5 at PTRST and WOY 26 at WCRST. Hatchery age-0 Chinook Salmon emigration peaked in WOY 25 at PTRST and WOY 26 at WCRST.

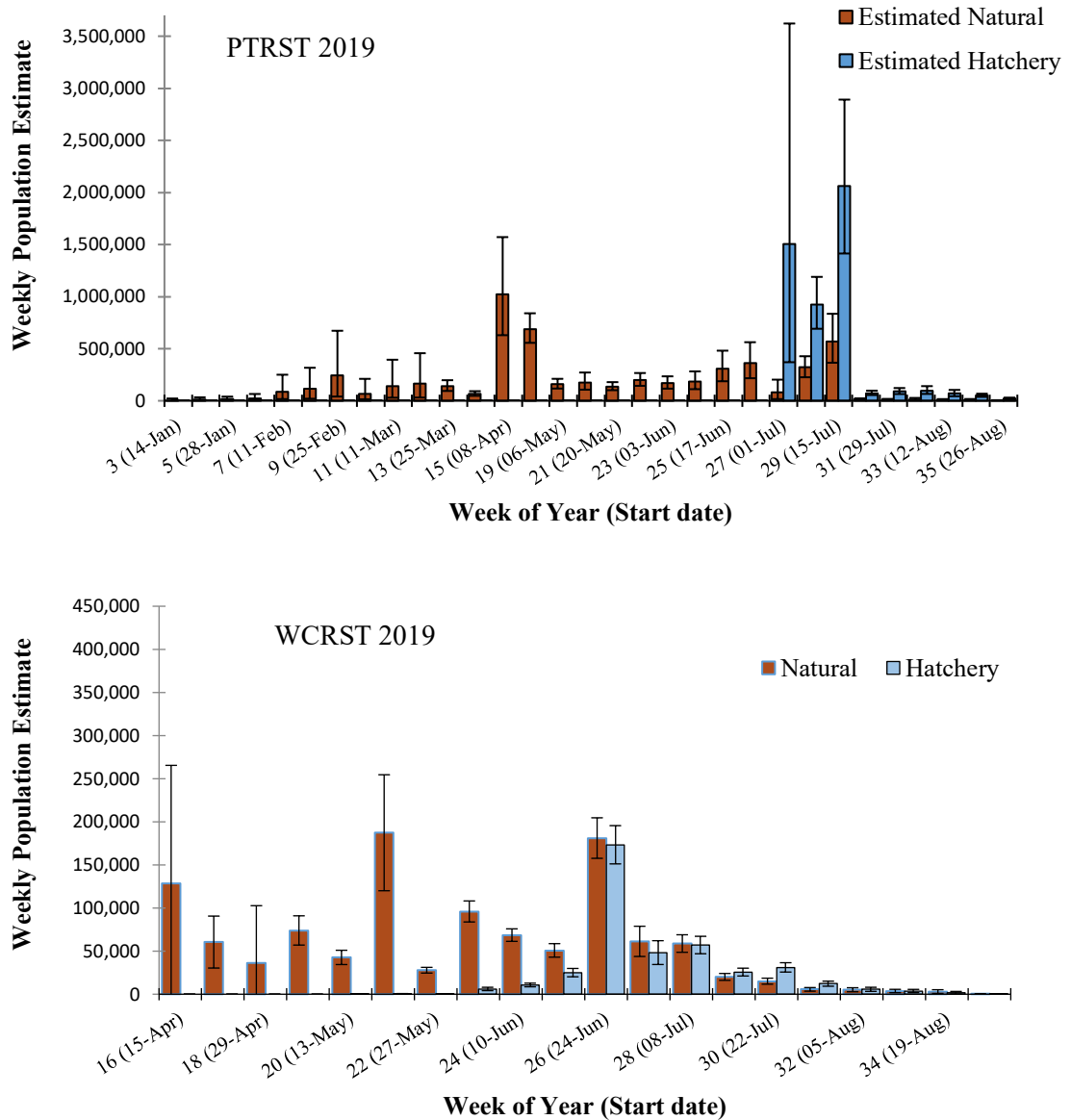


Figure 6. Weekly mark-recapture population estimates of natural age-0 and hatchery age-0 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST; rkm 118) and Willow Creek Rotary Screw Trap (WCRST; rkm 34) in 2019. Error bars represent one standard deviation of the mean weekly estimate.

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), 2019. 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	3-35	NA	22-35	9	NA	25
PTRST	Coho Salmon	13-32	3-15	17-21	21	3	20
PTRST	Steelhead	19-35	3-35	19-35	26	11	20
WCRST	Chinook Salmon	16-35	17-34	17-35	26	19	26
WCRST	Coho Salmon	18-28	17-24	17-25	24	17	20
WCRST	Steelhead	18-35	16-28	18-28	29	19	19

The Coho Salmon population in the Trinity River is composed of both naturally produced and hatchery populations. The vast 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 first week of sampling at PTRST and the second week at WCRST and emigration continued into April (WOY 15) at PTRST, and June (WOY 24) at WCRST. (Table 7; Appendix 4). Interpretation of data and past experience suggests that the sampling period did not encompass the entire naturally produced age-1 Coho Salmon emigration. The week marking the cumulative passage of 80% of the naturally produced age-1 Coho Salmon population at WCRST, as inferred from the abundance index, was WOY 20 (May 13–20). Natural age-1 Coho Salmon emigration peaked in WOY 3 at PTRST and WOY 17 at WCRST. Hatchery Coho Salmon emigration peaked in WOY 20 at PTRST and WOY 20 at WCRST.

The steelhead populations in the Trinity River are composed of both natural populations that exhibit highly variable juvenile life history patterns, as well as a hatchery-produced component. The bulk of age-0 steelhead were captured from early May through August at WCRST and PTRST (Table 6, Appendix 5, 6). Age-1 or older natural steelhead were present throughout the sampling period at PTRST and WCRST. The majority of hatchery-produced age-1 steelhead passed PTRST and WCRST by mid-May. 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 13–20). Natural age-0 steelhead emigration peaked in WOY 26 at PTRST and WOY 29 at WCRST. Natural age-1 steelhead emigration peaked in WOY 11 at PTRST and WOY 19 at WCRST. Hatchery steelhead emigration peaked in WOY 20 at PTRST and WOY 19 at WCRST.

Migration Rate

Maximum migration rates of salmonids released from TRH are presented in Table 8. These values should be considered maximums, as hatchery fish are released on a volitional basis (Table 4).

Fish Size

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

Natural age-0 Coho Salmon fork lengths generally increased as the season progressed at PTRST. Natural age-0 Coho Salmon fork lengths did not follow an obvious trend at WCRST, presumably due to tributary inputs (Appendix 9, 10). Hatchery age-1 Coho Salmon fork lengths showed no weekly or seasonal trend at either trapping site. Natural age-1 Coho Salmon fork lengths sampled at PTRST showed a slight seasonal increase but weekly means were quite variable. WCRST natural age-1 Coho Salmon showed no discernable seasonal trend, likely due to inadequate sample size.

While natural age-0 steelhead fork lengths generally increased through the sampling season at PTRST, natural age-1 steelhead fork length was generally unchanged from week 3 to week 15 and increased steadily from week 15 to the end of the season (Figure 9; Appendix 11, 12). Age-2 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 increased 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, 2019.

Site	Species	Date first released	Date first captured	Number of days	Maximum migration rate (km/day)
PTRST	Chinook Salmon	05/27/2019	05/29/2019	2	32.4
PTRST	Coho Salmon	04/15/2019	04/23/2019	8	8.1
PTRST	Steelhead	04/29/2019	05/07/2019	8	8.1
WCRST	Chinook Salmon	05/27/2019	06/04/2019	6	24.3
WCRST	Coho Salmon	04/15/2019	04/23/2019	8	18.2
WCRST	Steelhead	04/29/2019	05/03/2019	4	36.45

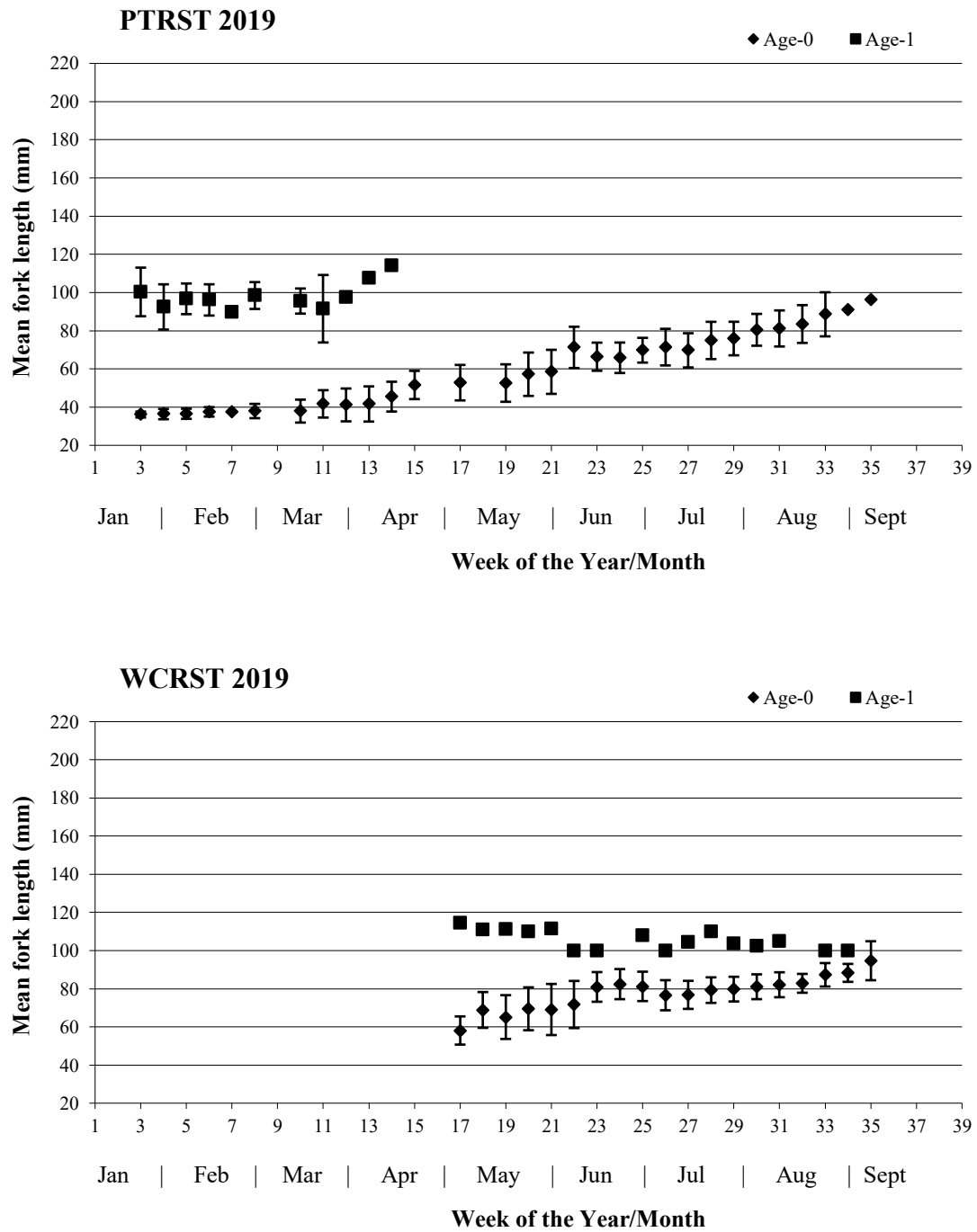


Figure 7. Weekly mean fork lengths of age-0 and age-1 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. Error bars represent one standard deviation of the mean.

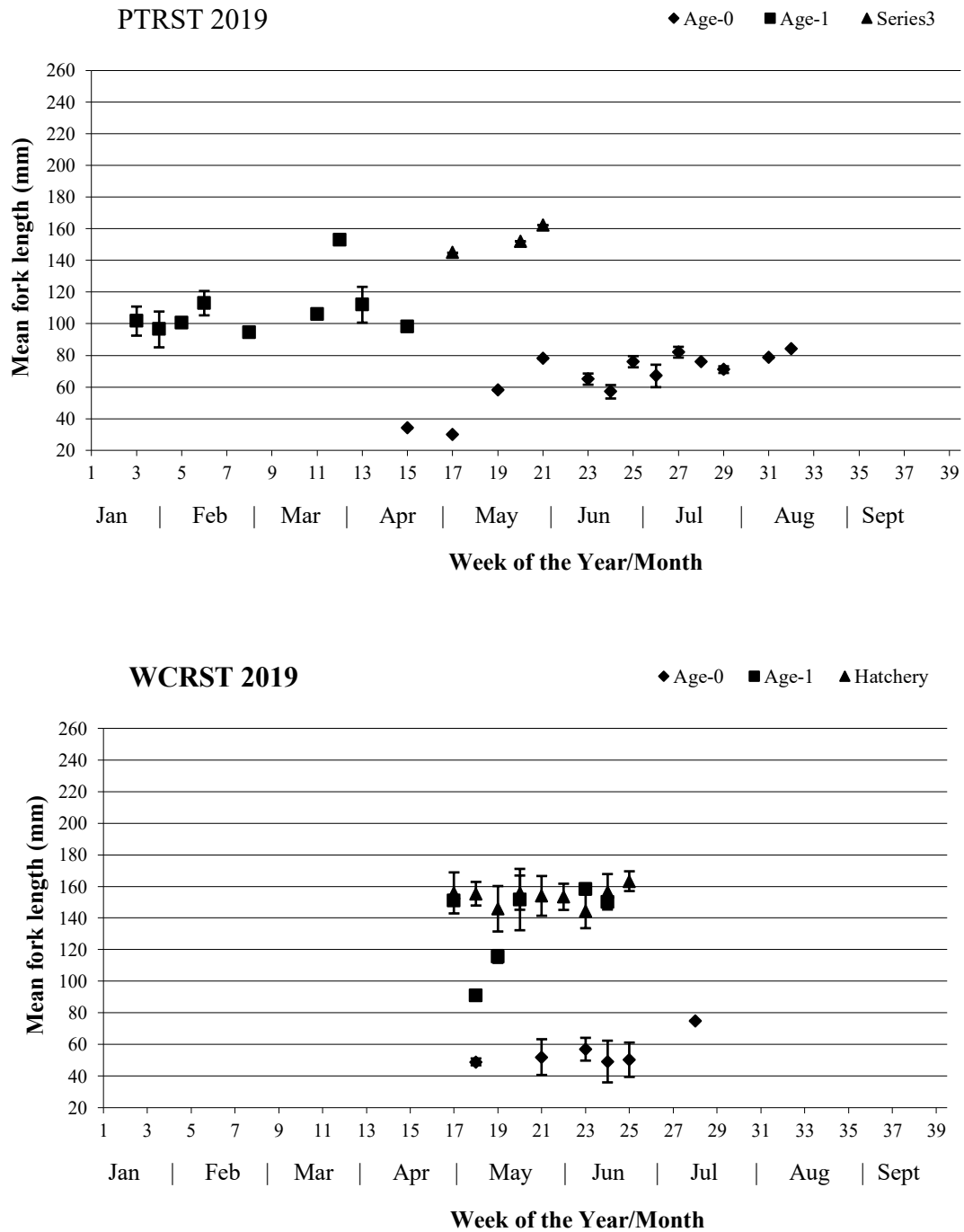


Figure 8. Weekly mean fork lengths for natural age-0, natural age-1, and hatchery Coho Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. Error bars represent one standard deviation of the mean.

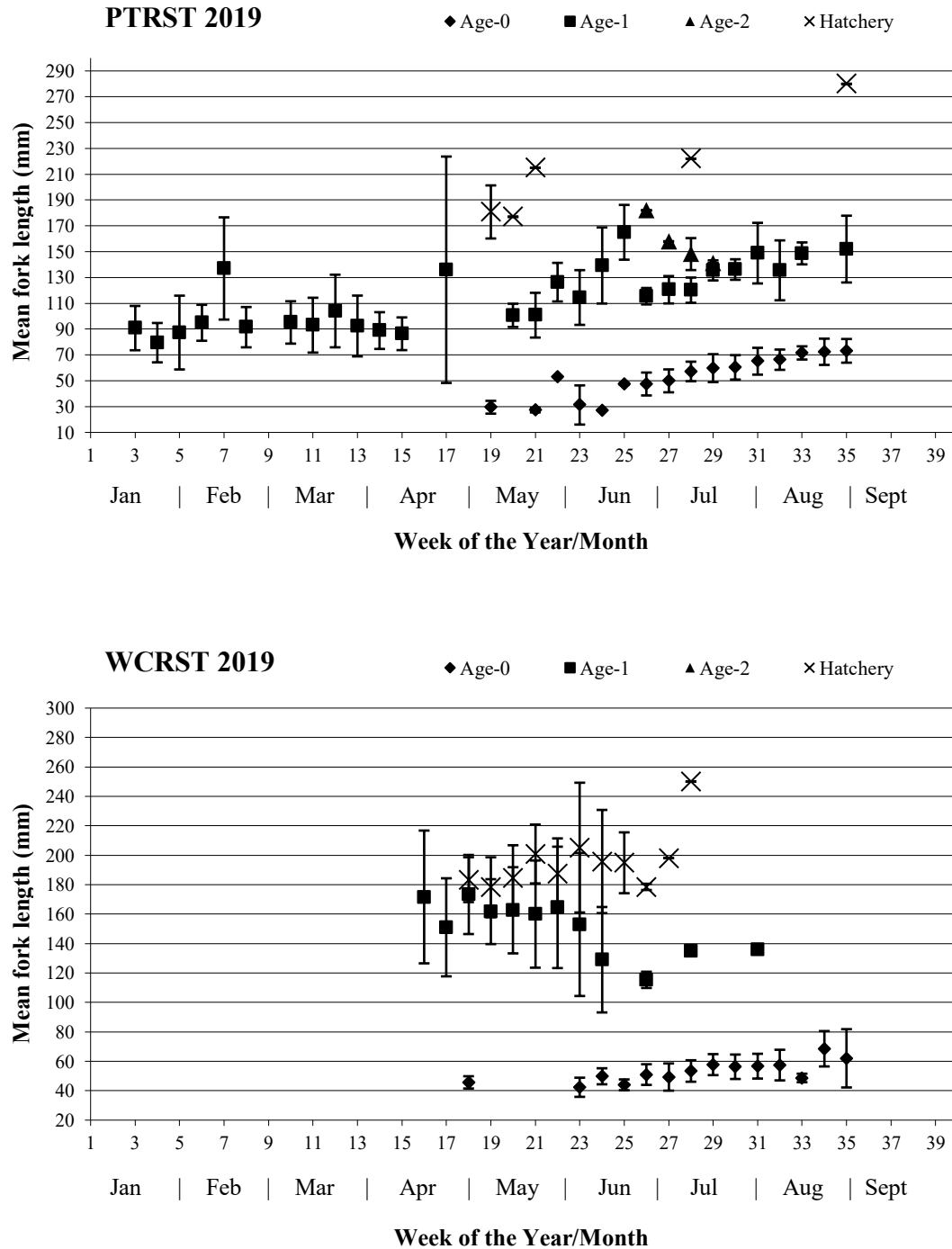


Figure 9. Weekly mean fork lengths for natural age-0, age-1, age-2, and hatchery age-1 steelhead captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. Error bars represent one standard deviation of the mean.

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 in weekly mean calculations.

Chinook 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. Weekly mean condition factor of natural age-1+ steelhead showed no obvious trend at either PTRST or WCRST (Figure 12, Appendix 15).

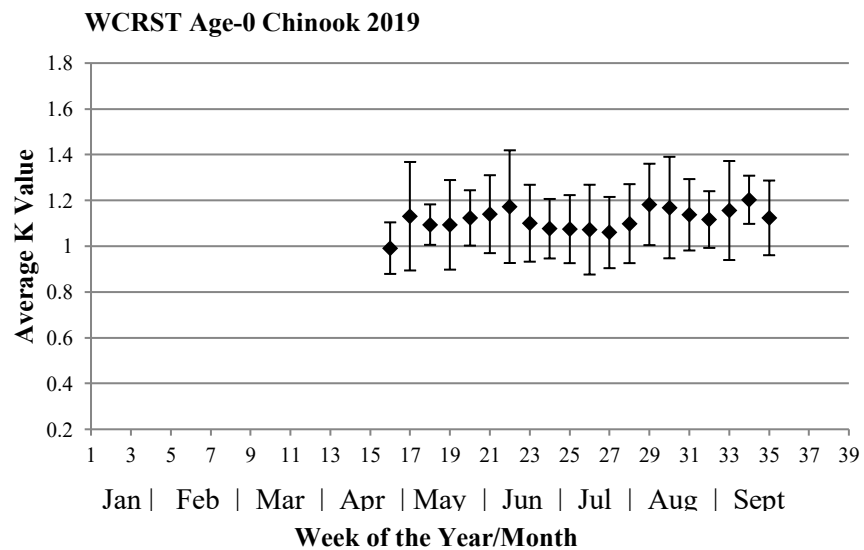
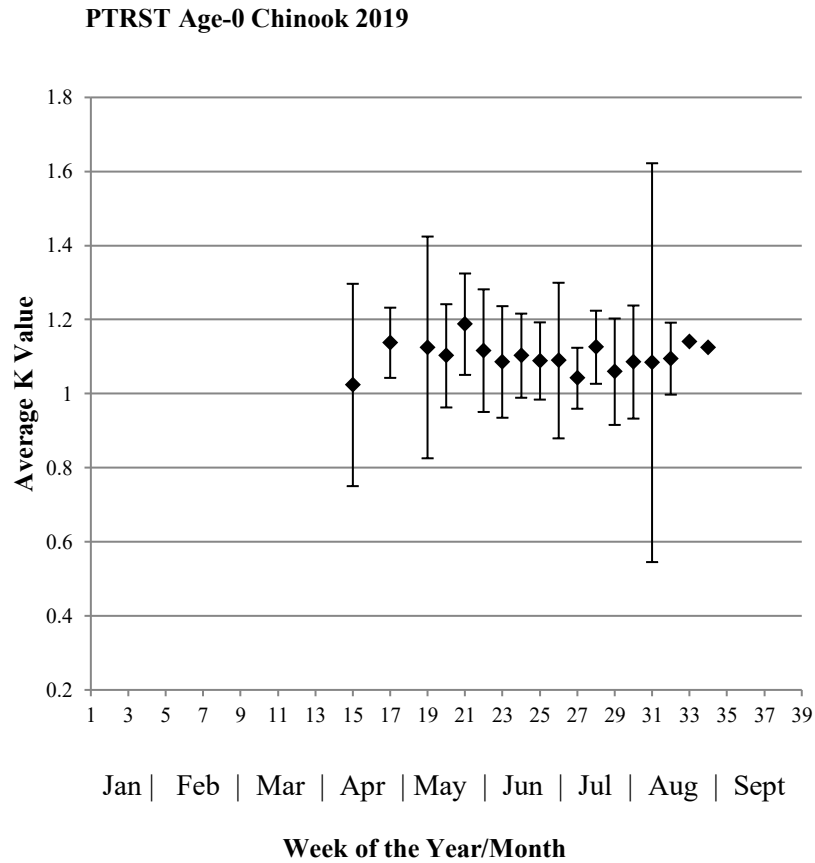


Figure 10. Weekly mean K value for pooled hatchery and natural age-0 Chinook Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. Error bars represent one standard deviation of the mean.

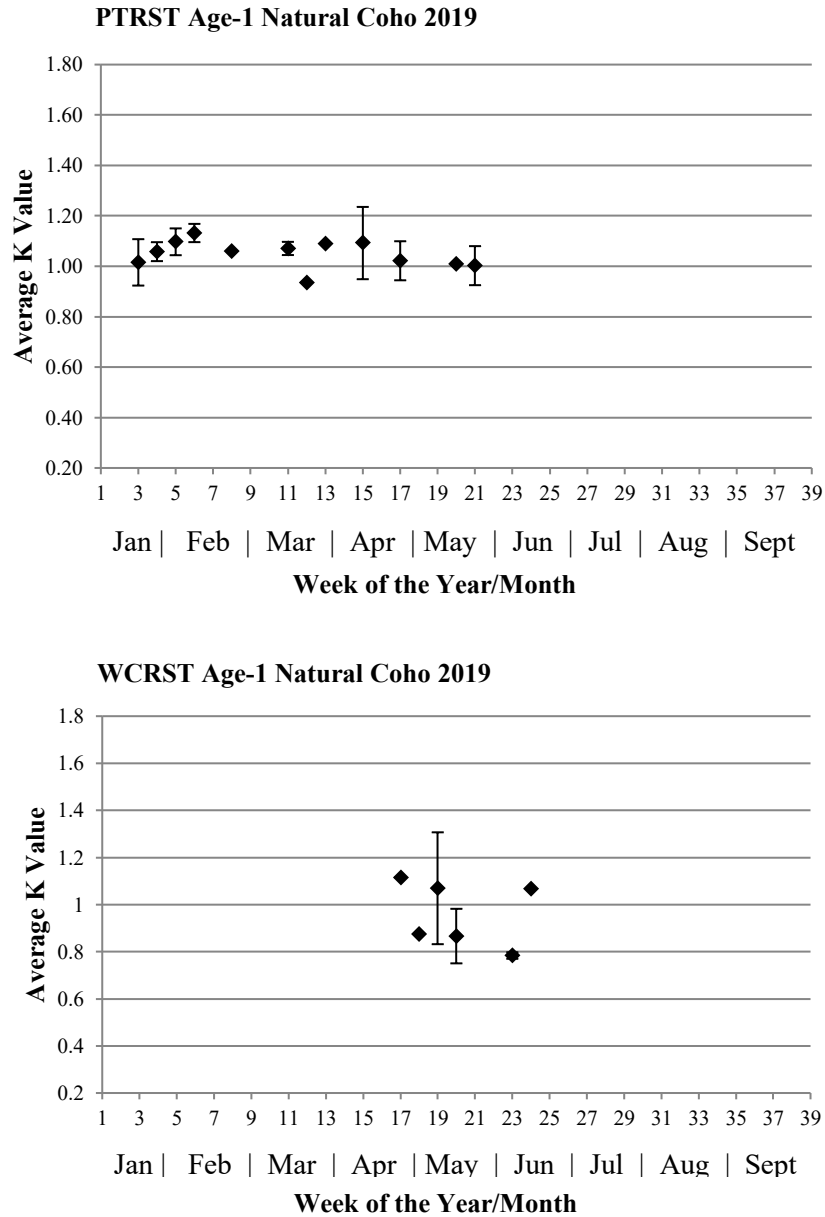


Figure 11. Weekly mean K value for natural age-1 Coho Salmon captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. Error bars represent one standard deviation of the mean.

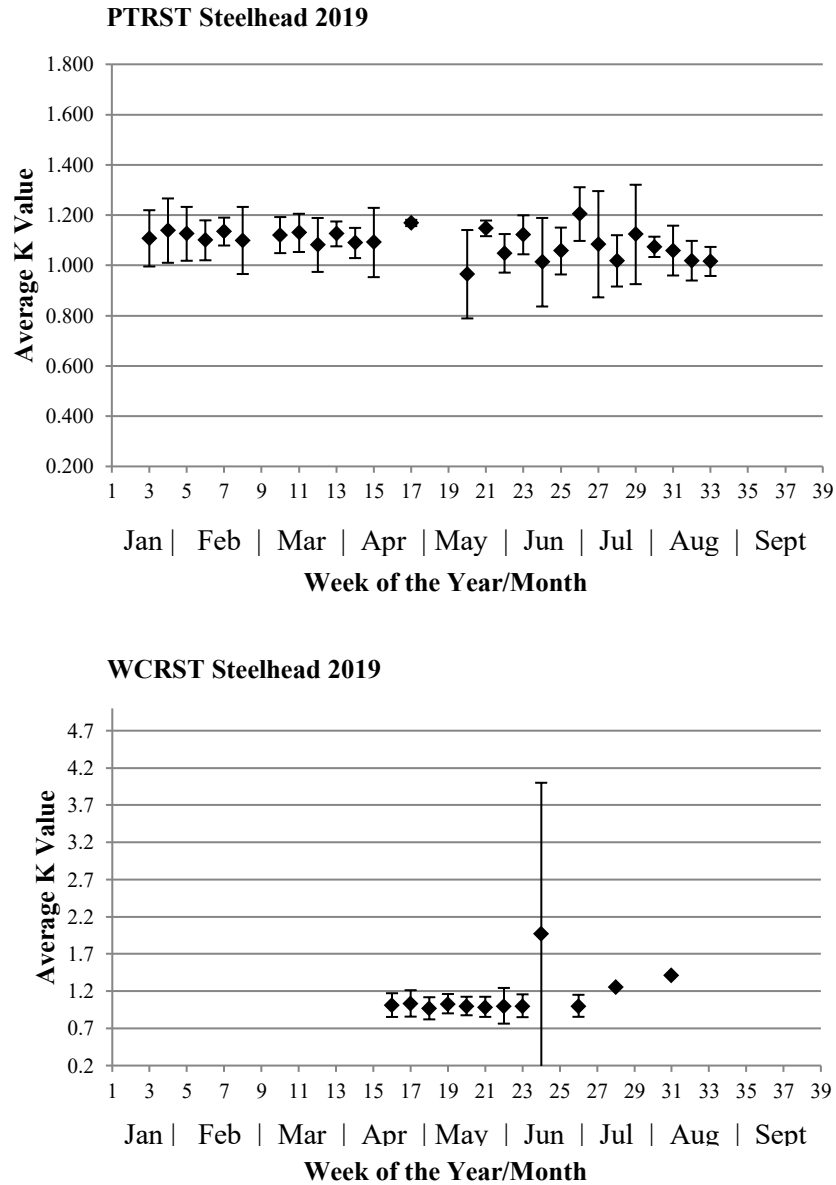


Figure 12. Weekly mean K value for natural age-1+ steelhead captured at Pear Tree Rotary Screw Trap (PTRST) and Willow Creek Rotary Screw Trap (WCRST), 2019. Error bars represent one standard deviation of the mean.

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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, 2019. NC = no clip, AD = adipose fin clip.

Week Starting	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	
1/14/2019	3	70.9	3	0	0	0	99	3	102	0	0	0	8,189	248	8,437
1/21/2019	4	36.1	5	15	7	7	200	10	232	401	145	0	4,140	116	4,802
1/28/2019	5	43.2	5	6	4	4	1,067	15	1,092	291	105	0	28,115	262	28,773
2/4/2019	6	33.0	4	32	11	11	646	4	693	761	275	0	16,139	138	17,313
2/11/2019	7	59.7	3	0	0	0	648	7	655	0	0	0	53,772	581	54,353
2/18/2019	8	34.7	4	6	2	2	430	1	439	17	6	0	1,112	5	1,140
2/25/2019	9	167.1	1	0	0	0	330	1	331	0	0	0	79,769	242	80,011
3/4/2019	10	84.5	5	4	5	5	536	4	549	439	274	0	29,398	0	30,111
3/11/2019	11	43.2	5	5	3	3	800	9	817	219	79	0	21,116	151	21,565
3/18/2019	12	57.0	5	0	0	0	302	17	319	0	0	0	9,791	551	10,342
3/25/2019	13	65.7	5	3	1	0	378	2	384	97	35	0	15,063	139	15,334
4/1/2019	14	82.3	5	0	0	0	131	1	132	0	0	0	7,401	49	7,450
4/8/2019	15	82.2	4	0	0	0	194	0	194	0	0	0	343	0	343
4/22/2019	17	115.5	5	0	0	0	414	0	414	0	0	0	30,293	0	30,293
5/6/2019	19	100.6	5	0	0	0	246	0	246	0	0	0	16,236	0	16,236
5/13/2019	20	158.1	3	0	0	0	51	0	51	0	0	0	8,373	0	8,373
5/20/2019	21	116.5	5	0	0	0	166	0	166	0	0	0	11,851	0	11,851
5/27/2019	22	89.1	4	206	68	0	144	0	418	13,005	4,700	0	11,185	0	28,890
6/3/2019	23	92.1	5	33	11	0	231	0	275	1,497	541	0	11,496	0	13,534
6/10/2019	24	71.2	5	21	7	0	148	0	176	825	298	0	6,364	0	7,487
6/17/2019	25	61.9	5	786	303	0	206	0	1,295	35,715	12,907	0	6,540	0	55,162
6/24/2019	26	71.1	5	246	81	0	191	0	518	12,707	4,592	0	12,068	0	29,367
7/1/2019	27	51.6	2	278	92	0	145	0	515	14,309	5,171	0	9,468	0	28,948
7/8/2019	28	35.8	1	944	310	0	861	0	2,115	19,505	7,049	0	21,538	0	48,092
7/15/2019	29	27.7	1	566	186	0	549	0	1,301	5,977	2,160	0	6,971	0	15,108
7/22/2019	30	22.7	5	466	153	0	622	0	1,241	5,443	1,967	0	8,546	0	15,956
7/29/2019	31	17.6	4	433	142	0	661	0	1,236	3,523	1,273	0	6,284	0	11,080
8/5/2019	32	14.2	5	312	102	0	380	0	794	2,629	950	0	3,815	0	7,394
8/12/2019	33	13.3	4	109	36	0	135	0	280	1,010	365	0	1,464	0	2,839
8/19/2019	34	13.3	2	102	34	0	166	0	302	706	255	0	1,305	0	2,266
8/26/2019	35	17.3	5	84	28	0	49	0	161	739	267	0	527	0	1,533
Totals			125	4,657	1,586	32	11,126	74	17,443	119,815	43,414	0	448,672	2,482	614,383

Appendix 2. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Chinook Salmon catches and abundance indices, 2019. NC = no clip, AD = adipose fin clip.

Week Starting	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		
4/15/2019	16	407.8	4	0	0	0	37	0	37		0	0	0	7,480	0	7,480	
4/22/2019	17	305.8	10	0	0	10	93	10	113		0	0	691	6,607	691	7,989	
4/29/2019	18	233.3	4	0	0	7	68	7	82		0	0	480	4,447	480	5,407	
5/6/2019	19	200.3	12	4	2	18	934	16	974		230	111	1,218	59,147	1,071	61,776	
5/13/2019	20	215.2	9	2	1	1	1236	1	1,241		111	54	64	80,447	64	80,739	
5/20/2019	21	241.3	8	0	0	2	487	2	491		0	0	186	38,083	186	38,455	
5/27/2019	22	175.3	9	2	1	2	1308	2	1,315		92	44	168	83,450	168	83,923	
6/3/2019	23	158.4	12	83	40	2	2699	2	2,826		3,496	1,688	88	114,687	88	120,047	
6/10/2019	24	127.4	12	288	139	0	4020	0	4,447		12,585	6,077	0	176,287	0	194,949	
6/17/2019	25	103.6	10	393	190	4	2606	1	3,194		13,071	6,312	135	90,031	24	109,573	
6/24/2019	26	109.7	12	3572	1725	2	9117	0	14,416		217,959	131,565	138	485,075	0	834,736	
7/1/2019	27	90.3	9	849	410	5	2332	5	3,601		23,435	7,544	141	65,584	141	96,845	
7/8/2019	28	66.5	12	1356	655	1	3597	1	5,610		32,326	15,610	24	84,122	24	132,107	
7/15/2019	29	51.3	12	681	329	7	1474	5	2,496		14,030	6,775	143	30,479	102	51,529	
7/22/2019	30	42.5	12	936	452	5	1462	5	2,860		18,715	9,038	94	29,123	94	57,064	
7/29/2019	31	34.5	12	259	125	1	486	1	872		5,929	2,863	19	10,683	19	19,513	
8/5/2019	32	26.7	12	77	37	0	235	0	349		1,513	730	0	4,595	0	6,838	
8/12/2019	33	26.5	6	39	19	0	149	1	208		809	391	0	3,056	19	4,275	
8/19/2019	34	23.2	7	10	5	0	75	1	91		197	95	0	1,247	15	1,554	
8/26/2019	35	22.4	4	6	3	0	100	0	109		107	52	0	1,809	0	1,968	
Totals			188	8,559	4,133	67	32,513	60	45,332		344,605	188,950	3,589	1,376,437	3,187	1,916,767	

Appendix 3. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly Coho Salmon catches and abundance indices, 2019.
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 R-MAX	Natural		Catch Total	Hatchery R-MAX	Natural		Index Total
					Age-0	Age-1			Age-0	Age-1	
1/14/2019	3	70.9	3	0	0	3	3	0	0	248	248
1/21/2019	4	36.1	5	0	0	5	5	0	0	103	103
1/28/2019	5	43.2	5	0	0	2	2	0	0	53	53
2/4/2019	6	33.0	4	0	0	3	3	0	0	75	75
2/11/2019	7	59.7	3	0	0	0	0	0	0	0	0
2/18/2019	8	34.7	4	0	0	2	2	0	0	6	6
2/25/2019	9	167.1	1	0	0	0	0	0	0	0	0
3/4/2019	10	84.5	5	0	0	0	0	0	0	0	0
3/11/2019	11	43.2	5	0	0	3	3	0	0	79	79
3/18/2019	12	57.0	5	0	0	1	1	0	0	32	32
3/25/2019	13	65.7	5	0	1	1	2	0	35	35	70
4/1/2019	14	82.3	5	0	2	0	2	0	97	0	97
4/8/2019	15	82.2	4	0	1	2	3	0	2	4	6
4/22/2019	17	115.5	5	7	1	0	8	512	73	0	585
5/6/2019	19	100.6	5	0	1	0	1	0	66	0	66
5/13/2019	20	158.1	3	5	0	0	5	821	0	0	821
5/20/2019	21	116.5	5	5	1	0	6	352	117	0	469
5/27/2019	22	89.1	4	0	0	0	0	0	0	0	0
6/3/2019	23	92.1	5	0	1	0	1	0	49	0	49
6/10/2019	24	71.2	5	0	1	0	1	0	43	0	43
6/17/2019	25	61.9	5	0	1	0	1	0	43	0	43
6/24/2019	26	71.1	5	0	2	0	2	0	57	0	57
7/1/2019	27	51.6	2	0	0	0	0	0	56	0	56
7/8/2019	28	35.8	1	0	0	0	0	0	45	0	45
7/15/2019	29	27.7	1	0	1	0	1	0	46	0	46
7/22/2019	30	22.7	5	0	0	0	0	0	0	0	0
7/29/2019	31	17.6	4	0	1	0	1	0	18	0	18
8/5/2019	32	14.2	5	0	2	0	2	0	19	0	19
8/12/2019	33	13.3	4	0	0	0	0	0	0	0	0
8/19/2019	34	13.3	2	0	0	0	0	0	0	0	0
8/26/2019	35	17.3	5	0	0	0	0	0	0	0	0
Total			117	17	16	22	55	1,685	766	635	3,086

Appendix 4. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Coho Salmon catches and abundance indices, 2019. 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	Hatchery	Natural		Index
				R-MAX	Age-0	Age-1	Total	R-MAX	Age-0	Age-1	Total
4/15/2019	16	407.8	4	0	0	0	0	0	0	0	0
4/22/2019	17	305.8	10	24	0	4	28	1,721	0	239	1,960
4/29/2019	18	233.3	4	8	4	1	13	487	243	74	804
5/6/2019	19	200.3	12	13	0	3	16	997	0	189	1,187
5/13/2019	20	215.2	9	62	0	3	65	4,216	0	231	4,447
5/20/2019	21	241.3	8	18	2	0	20	1,741	176	0	1,917
5/27/2019	22	175.3	9	17	0	0	17	1,159	0	0	1,159
6/3/2019	23	158.4	12	8	3	3	14	335	128	125	588
6/10/2019	24	127.4	12	12	10	1	23	423	461	49	934
6/17/2019	25	103.6	10	10	6	0	16	399	142	0	541
6/24/2019	26	109.7	12	0	0	0	0	0	0	0	0
7/1/2019	27	90.3	9	0	0	0	0	0	0	0	0
7/8/2019	28	66.5	12	0	1	0	1	0	25	0	25
7/15/2019	29	51.3	12	0	0	0	0	0	0	0	0
7/22/2019	30	42.5	12	0	0	0	0	0	0	0	0
7/29/2019	31	34.5	12	0	0	0	0	0	0	0	0
8/5/2019	32	26.7	12	0	0	0	0	0	0	0	0
8/12/2019	33	26.5	6	0	0	0	0	0	0	0	0
8/19/2019	34	23.2	7	0	0	0	0	0	0	0	0
8/26/2019	35	22.4	4	0	0	0	0	0	0	0	0
Totals			188	172	26	15	213	11,478	1,175	909	13,562

Appendix 5. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly steelhead catches and abundance indices, 2019

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+	
1/14/2019	3	70.9	3	0	0	10	0	10	0	0	827	0	827
1/21/2019	4	36.1	5	0	0	96	0	96	0	0	1,987	0	1,987
1/28/2019	5	43.2	5	0	0	20	0	20	0	0	527	0	527
2/4/2019	6	33.0	4	0	0	14	0	14	0	0	350	0	350
2/11/2019	7	59.7	3	0	0	2	0	2	0	0	166	0	166
2/18/2019	8	34.7	4	0	0	6	0	6	0	0	19	0	19
2/25/2019	9	167.1	1	0	0	1	0	1	0	0	242	0	242
3/4/2019	10	84.5	5	0	0	34	0	34	0	0	1,865	0	1,865
3/11/2019	11	43.2	5	0	0	59	0	59	0	0	1,557	0	1,557
3/18/2019	12	57.0	5	0	0	35	0	35	0	0	1,135	0	1,135
3/25/2019	13	65.7	5	0	0	8	0	8	0	0	349	0	349
4/1/2019	14	82.3	5	0	0	15	0	15	0	0	974	0	974
4/8/2019	15	82.2	4	0	0	12	0	12	0	0	21	0	21
4/22/2019	17	115.5	5	0	0	2	0	2	0	0	146	0	146
5/6/2019	19	100.6	5	9	2	1	0	12	594	132	66	0	792
5/13/2019	20	158.1	3	22	0	3	0	25	3,612	0	493	0	4,105
5/20/2019	21	116.5	5	1	11	5	0	17	59	880	411	0	1,350
5/27/2019	22	89.1	4	0	1	8	0	9	0	69	553	0	622
6/3/2019	23	92.1	5	0	4	4	0	8	0	197	197	0	394
6/10/2019	24	71.2	5	0	1	8	0	9	0	43	340	0	383
6/17/2019	25	61.9	5	0	3	2	0	5	0	128	85	0	213
6/24/2019	26	71.1	5	0	28	2	1	31	0	1,587	113	57	1,757
7/1/2019	27	51.6	2	0	14	2	1	17	0	787	112	56	955
7/8/2019	28	35.8	1	1	62	6	8	77	23	1,410	136	182	1,751
7/15/2019	29	27.7	1	0	15	3	1	19	0	174	35	12	221
7/22/2019	30	22.7	5	0	66	6	0	72	0	849	77	0	926
7/29/2019	31	17.6	4	0	47	9	0	56	0	421	81	0	502
8/5/2019	32	14.2	5	0	81	13	0	94	0	754	121	0	875
8/12/2019	33	13.3		1	14	3	0	18	10	142	30	0	182
8/19/2019	34	13.3	2	0	50	0	0	50	0	375	0	0	375
8/26/2019	35	17.3	5	1	28	3	0	32	10	267	29	0	306
Total			121	35	427	392	11	865	4,308	8,215	13,044	307	25,874

Appendix 6. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly steelhead catches and abundance indices, 2019.
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-0	Age-1		
4/15/2019	16	407.8	4	0	0	36	0	36	0	0	7,619	0	7,619
4/22/2019	17	305.8	10	0	0	111	0	111	0	0	8,495	0	8,495
4/29/2019	18	233.3	4	92	3	58	0	153	5,921	209	3,866	0	9,997
5/6/2019	19	200.3	12	367	0	226	0	593	25,381	0	15,808	0	41,189
5/13/2019	20	215.2	9	200	2	133	0	335	14,074	154	9,820	0	24,048
5/20/2019	21	241.3	8	48	0	34	0	82	4,075	0	2,879	0	6,953
5/27/2019	22	175.3	9	30	0	26	0	56	1,848	0	1,519	0	3,366
6/3/2019	23	158.4	12	5	3	14	0	22	215	127	600	0	941
6/10/2019	24	127.4	12	11	5	7	0	23	418	196	295	0	908
6/17/2019	25	103.6	10	8	15	0	0	23	313	466	0	0	779
6/24/2019	26	109.7	12	2	27	3	0	32	58	1,712	326	0	2,096
7/1/2019	27	90.3	9	1	11	0	0	12	31	319	0	0	350
7/8/2019	28	66.5	12	1	119	2	0	122	22	2,825	47	0	2,894
7/15/2019	29	51.3	12	0	204	0	0	204	0	4,187	0	0	4,187
7/22/2019	30	42.5	12	0	111	0	0	111	0	2,182	0	0	2,182
7/29/2019	31	34.5	12	0	24	0	0	24	0	558	0	0	558
8/5/2019	32	26.7	12	0	17	0	0	17	0	335	0	0	335
8/12/2019	33	26.5	6	0	3	0	0	3	0	58	0	0	58
8/19/2019	34	23.2	7	0	2	0	0	2	0	37	0	0	37
8/26/2019	35	22.4	4	0	2	0	0	2	0	34	0	0	34
Total			188	765	548	650	0	1,963	52,357	13,398	51,272	0	117,027

Appendix 7. Trinity River at Pear Tree Rotary Screw Trap site (PTRST) weekly age-0 Chinook Salmon population estimate input and results, 2016. NC = no clip, AD = adipose fin clip.

Week Starting	Week of Year	Sampling Fraction ¹	Catch NC	Catch AD	Marks Released	Marks Recapture	Recapture Rate	Estimated Natural	SD Natural	Estimated Hatchery	SD Hatchery
1/3/2016	1	0.71	1,669	0	---	---	---	98,759	55,896	---	---
1/10/2016	2	0.29	2,409	0	---	---	---	119,498	61,810	---	---
1/17/2017	3	0.00	---	---	---	---	---	84,312	67,794	---	---
1/24/2016	4	0.57	1,041	0	---	---	---	79,399	60,571	---	---
1/31/2016	5	0.71	3,196	0	---	---	---	60,877	25,399	---	---
2/7/2016	6	0.71	1,910	0	1,226	123	0.10	56,627	15,831	---	---
2/14/2016	7	0.57	283	0	1,823	42	0.02	22,743	3,614	---	---
2/21/2016	8	0.86	1,546	0	1,480	100	0.07	27,382	2,657	---	---
2/28/2016	9	0.71	1,245	0	1,468	89	0.06	29,606	3,114	---	---
3/6/2016	10	0.71	561	0	1,998	57	0.03	27,994	3,688	---	---
3/13/2016	11	0.71	547	0	2,978	67	0.02	33,939	4,210	---	---
3/20/2016	12	0.71	218	0	2,568	89	0.03	9,273	1,103	---	---
3/27/2016	13	0.71	746	0	1,662	89	0.05	20,015	2,110	---	---
4/3/2016	14	0.57	595	0	964	17	0.02	51,473	10,307	---	---
4/10/2016	15	0.71	1,783	0	1,696	128	0.08	33,105	2,899	---	---
4/17/2016	16	0.71	552	0	1,754	160	0.09	18,753	9,046	---	---
4/24/2016	17	0.57	301	0	2,073	74	0.04	14,934	1,798	---	---
5/1/2016	18	0.71	63	0	3,245	75	0.02	4,152	638	---	---
5/8/2017	19	0.00	---	---	---	---	---	12,744	9,259	---	---
5/15/2016	20	0.71	69	0	3,923	32	0.01	11,399	2,178	---	---
5/22/2016	21	0.71	75	0	2,902	38	0.01	8,055	1,464	---	---
5/29/2016	22	0.57	1,059	312	2,756	35	0.01	9,628	4,359	158,209	23,931
6/5/2016	23	0.71	348	107	1,717	21	0.01	4,865	2,191	50,753	10,571
6/12/2016	24	0.71	193	56	1,495	11	0.01	5,399	2,677	50,039	15,514
6/19/2016	25	0.71	169	49	1,450	2	0.00	6,142	3,426	69,273	18,021
6/26/2016	26	0.71	164	33	1,244	3	0.00	10,257	5,893	55,741	22,576
7/3/2016	27	0.57	252	82	1,083	25	0.02	2,515	1,109	27,526	5,940
7/10/2016	28	0.71	879	217	870	42	0.05	5,710	1,540	27,479	4,321
7/17/2016	29	0.71	548	127	906	37	0.04	4,931	1,415	19,548	3,584
7/24/2016	30	0.71	2,218	684	1,013	173	0.17	3,343	1,824	95,789	31,111
7/31/2016	31	0.71	2,977	918	1,033	110	0.11	3,108	1,843	96,072	42,059
8/7/2016	32	0.71	1,586	480	946	106	0.11	2,800	1,832	80,532	44,016
8/14/2016	33	0.57	388	105	855	192	0.22	2,850	1,949	43,021	24,187
8/21/2016	34	0.71	228	74	---	---	---	1,726	1,399	40,379	20,810
Totals			29,818	3,244	47,128	1,937	0.04	888,313	140,342	814,361	92,226

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 population estimate input and results, 2016. 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	SD Natural	Estimated Hatchery	SD Hatchery
3/27/2016	13	0.43	11	-	2,925	12	0.00	5,775	1,953	---	---
4/3/2016	14	0.86	71	-	3,069	67	0.02	3,703	590	---	---
4/10/2016	15	0.71	68	-	2,255	129	0.06	1,665	217	---	---
4/17/2016	16	0.71	61	-	3,144	263	0.08	1,030	122	---	---
4/24/2016	17	0.67	93	-	3,049	396	0.13	1,087	100	---	---
5/1/2016	18	0.71	52	-	3,095	68	0.02	3,333	545	---	---
5/8/2017	19	0.29	8	-	5,303	68	0.01	2,476	527	---	---
5/15/2016	20	0.52	72	-	3,448	31	0.01	14,965	2,839	---	---
5/22/2016	21	0.71	1,141	-	2,592	40	0.02	96,290	14,515	---	---
5/29/2016	22	0.62	1,880	-	2,263	89	0.04	77,100	8,063	---	---
6/5/2016	23	0.71	3,363	84	2,352	50	0.02	196,445	27,712	22,357	3,794
6/12/2016	24	0.71	2,314	297	1,844	72	0.04	50,830	6,304	45,749	5,716
6/19/2016	25	0.71	2,711	426	1,576	51	0.03	60,129	8,526	77,984	10,756
6/26/2016	26	0.71	6,529	1,064	619	65	0.11	44,912	5,585	63,107	7,733
7/3/2016	27	0.57	8,064	1,616	1,318	134	0.10	51,577	4,756	118,086	10,139
7/10/2016	28	0.71	10,060	2,220	1,218	77	0.06	65,641	7,814	200,780	21,951
7/17/2016	29	0.71	8,709	2,230	897	132	0.15	16,309	1,941	91,062	7,739
7/24/2016	30	0.71	8,578	1,092	1,109	104	0.09	75,583	6,954	67,335	6,212
7/31/2016	31	0.86	2,097	473	---	---	---	13,212	5,676	43,310	17,919
8/7/2016	32	0.50	713	100	1,060	129	0.12	6,616	727	7,055	760
8/14/2016	33	0.57	116	9	1,045	59	0.06	2,585	491	1,465	380
8/21/2016	34	0.57	54	22	---	---	---	143	179	2,458	2,174
Total			56,765	9,633	44,181	2,036	1	791,407	38,537	740,748	36,025

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 and Coho Salmon fork lengths, 2019.

Week Starting	Week of the Year	Chinook Salmon ¹										Natural Coho Salmon										Hatchery Coho Salmon				
		Age-0					Age-1					Age-0					Age-1					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
1/14/2019	3	74	36.1	32	40	1.58	3	100.3	96	104	4.0	0	---	---	---	---	3	101.7	95	110	7.6	0	---	---	---	---
1/21/2019	4	144	36.3	29	41	1.53	32	92.5	73	149	16.7	0	---	---	---	---	5	96.4	88	112	9.7	0	---	---	---	---
1/28/2019	5	150	36.5	31	45	1.55	25	96.7	84	150	12.7	0	---	---	---	---	2	100.5	94	107	9.2	0	---	---	---	---
2/4/2019	6	90	37.5	33	52	2.69	47	96.1	74	146	11.8	0	---	---	---	---	2	113.0	105	121	11.3	0	---	---	---	---
2/11/2019	7	90	37.3	34	48	2.65	7	89.7	80	100	8.0	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
2/18/2019	8	120	38.0	35	47	2.47	9	98.4	89	111	8.2	0	---	---	---	---	2	94.5	89	100	7.7	0	---	---	---	---
2/25/2019	9	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/4/2019	10	141	37.9	31	49	3.74	11	95.5	84	105	7.0	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/11/2019	11	149	41.7	34	59	4.96	17	91.5	76	102	8.0	0	---	---	---	---	3	106.0	101	114	7.0	0	---	---	---	---
3/18/2019	12	113	41.2	33	57	6.01	5	97.4	87	103	6.6	0	---	---	---	---	1	153.0	153	153	NA	0	---	---	---	---
3/25/2019	13	145	41.6	32	66	7.17	2	107.5	95	120	17.7	0	---	---	---	---	1	112.0	112	112	NA	0	---	---	---	---
4/1/2019	14	121	45.5	33	68	8.60	1	114.0	114	114	NA	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
4/8/2019	15	131	51.6	32	71	9.21	0	---	---	---	---	1	34	34	34	NA	2	98.0	90	106	11.3	0	---	---	---	---
4/22/2019	17	212	52.8	33	78	7.80	0	---	---	---	---	1	30	30	30	NA	0	---	---	---	---	7	145	130	160	10
5/6/2019	19	181	52.6	36	80	7.40	0	---	---	---	---	1	58	58	58	NA	0	---	---	---	---	0	---	---	---	---
5/13/2019	20	53	57.2	40	89	9.29	0	---	---	---	---	9	---	---	---	---	0	---	---	---	---	1	152	152	152	NA
5/20/2019	21	161	58.5	34	100	9.81	0	---	---	---	---	1	78	78	78	NA	0	---	---	---	---	4	162.3	151.0	175.0	10.24
5/27/2019	22	216	71.3	43	95	11.35	0	---	---	---	---	9	---	---	---	---	0	---	---	---	---	0	---	---	---	---
6/3/2019	23	192	66.4	44	102	11.54	0	---	---	---	---	1	65	65	65	NA	0	---	---	---	---	0	---	---	---	---
6/10/2019	24	182	65.8	43	91	10.81	0	---	---	---	---	1	57	57	57	NA	0	---	---	---	---	0	---	---	---	---
6/17/2019	25	312	69.8	45	90	7.37	0	---	---	---	---	1	76.0	76.0	76.0	3.5	0	---	---	---	---	0	---	---	---	---
6/24/2019	26	212	71.4	48	96	7.98	0	---	---	---	---	1	67	67	67	4.2	0	---	---	---	---	0	---	---	---	---
7/1/2019	27	181	69.7	51	95	6.48	0	---	---	---	---	1	82.0	82.0	82.0	3.5	0	---	---	---	---	0	---	---	---	---
7/8/2019	28	271	74.9	46	105	9.59	0	---	---	---	---	2	76.0	71.0	81.0	7.1	0	---	---	---	---	0	---	---	---	---
7/15/2019	29	263	75.9	53	102	8.96	0	---	---	---	---	4	71.0	67.0	75.0	3	0	---	---	---	---	0	---	---	---	---
7/22/2019	30	316	80.5	51	108	9.76	0	---	---	---	---	9	---	---	---	---	0	---	---	---	---	0	---	---	---	---
7/29/2019	31	294	81.2	62	104	8.79	0	---	---	---	---	2	78.5	77.0	80.0	2	0	---	---	---	---	0	---	---	---	---
8/5/2019	32	273	83.5	60	110	8.33	0	---	---	---	---	2	84.0	81.0	87.0	4	0	---	---	---	---	0	---	---	---	---
8/12/2019	33	177	88.6	51	113	9.45	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
8/19/2019	34	220	91.0	63	124	9.90	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
8/26/2019	35	183	96.2	47	136	11.54	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---

¹Natural and Hatchery combined

Appendix 10. Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly Chinook Salmon and Coho Salmon fork lengths, 2019.

Week Starting	Week of Year	Chinook Salmon ¹										Natural Coho Salmon										Hatchery Coho Salmon				
		Age-0					Age-1					Age-0					Age-1					Age-1				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
4/15/2019	16	31	56.94	46	70	7.98	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4/22/2019	17	74	58.09	48	74	7.38	10	114.60	101	130	8.75	---	---	---	---	---	1	151.00	151	151	---	24	155.88	128	190	12.98
4/29/2019	18	68	68.87	49	98	9.39	7	111.00	101	120	6.73	4	49	46	51	2.16	1	91.00	91	91	---	8	155.38	147	166	7.46
5/6/2019	19	231	65.14	44	96	11.48	18	111.22	100	130	9.68	---	---	---	---	---	3	115.67	112	120	4.04	13	145.85	115	168	14.37
5/13/2019	20	183	69.49	45	95	11.24	1	110.00	110	110	---	---	---	---	---	---	3	151.67	139	174	19.40	52	156.04	135	180	10.84
5/20/2019	21	162	69.10	44	98	13.40	2	111.50	100	123	16.26	2	52	44	60	11.31	---	---	---	---	---	13	154.00	140	184	12.57
5/27/2019	22	171	71.71	45	95	12.36	2	100	100	100	---	---	---	---	---	---	---	---	---	---	---	17	153.41	135	170	8.28
6/3/2019	23	324	80.94	50	97	7.78	2	100	100	100	---	3	57	51	65	7.21	3	158.33	155	162	3.51	8	144.25	125	155	10.70
6/10/2019	24	358	82.41	50	100	7.89	---	---	---	---	---	10	49.2	34	77	13.19	1	150	150	150	---	12	156.58	145	180	11.21
6/17/2019	25	408	81.22	52	99	7.70	3	108	105	110	2.65	6	50.33	40	67	10.86	---	---	---	---	---	10	163.30	154	175	6.25
6/24/2019	26	638	76.59	42	99	7.89	2	100	100	100	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7/1/2019	27	471	76.77	48	98	7.35	5	104.40	100	110	3.78	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7/8/2019	28	615	79.26	52	99	6.70	1	110	110	110	---	1	75	75	75	---	---	---	---	---	---	---	---	---	---	---
7/15/2019	29	568	79.79	56	99	6.48	7	103.71	100	109	3.73	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7/22/2019	30	543	81.03	53	115	6.51	5	102.40	100	108	3.58	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7/29/2019	31	449	82.08	45	109	6.54	1	105	105	105	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
8/5/2019	32	245	82.84	72	100	4.93	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
8/12/2019	33	124	87.30	70	105	6.14	1	100	100	100	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
8/19/2019	34	63	88.30	77	99	4.70	1	100	100	100	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
8/26/2019	35	6	94.67	80	109	10.21	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

¹Natural and Hatchery combined.

Week	Week of	Natural Steelhead														Hatchery Steelhead					
		Age-0				Age-1				Age-2				Age-1							
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
Starting	Year																				
1/14/2019	3	0	---	---	---	---	10	90.8	65	115	17.2	0	---	---	---	---	0	---	---	---	---
1/21/2019	4	0	---	---	---	---	96	79.5	57	141	15.2	0	---	---	---	---	0	---	---	---	---
1/28/2019	5	0	---	---	---	---	20	87.4	57	170	28.6	0	---	---	---	---	0	---	---	---	---
2/4/2019	6	0	---	---	---	---	11	94.9	72	114	13.9	0	---	---	---	---	0	---	---	---	---
2/11/2019	7	0	---	---	---	---	2	137.0	109	165	39.6	0	---	---	---	---	0	---	---	---	---
2/18/2019	8	0	---	---	---	---	6	91.5	71	115	15.6	0	---	---	---	---	0	---	---	---	---
2/25/2019	9	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
3/4/2019	10	0	---	---	---	---	28	95.2	64	134	16.4	0	---	---	---	---	0	---	---	---	---
3/11/2019	11	0	---	---	---	---	57	93.1	65	151	21.2	0	---	---	---	---	0	---	---	---	---
3/18/2019	12	0	---	---	---	---	25	104.0	63	174	28.1	0	---	---	---	---	0	---	---	---	---
3/25/2019	13	0	---	---	---	---	7	92.4	70	136	23.6	0	---	---	---	---	0	---	---	---	---
4/1/2019	14	0	---	---	---	---	9	88.9	77	123	14.2	0	---	---	---	---	0	---	---	---	---
4/8/2019	15	0	---	---	---	---	12	86.4	63	108	12.7	0	---	---	---	---	0	---	---	---	---
4/15/2019	16	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
4/22/2019	17	0	---	---	---	---	2	136.0	74	198	87.7	0	---	---	---	---	0	---	---	---	---
4/29/2019	18	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---	0	---	---	---	---
5/6/2019	19	2	29.5	26	33	4.95	0	---	---	---	---	0	---	---	---	---	9	180.8	145	216	20.55
5/13/2019	20	0	---	---	---	---	3	100.7	92	110	9.0	0	---	---	---	---	1	177.0	177	177	NA
5/20/2019	21	7	27.3	26	31	1.80	5	100.8	82	125	17.3	0	---	---	---	---	1	215.0	215	215	NA
5/27/2019	22	1	53.0	53	53	NA	8	126.4	112	152	14.9	0	---	---	---	---	0	---	---	---	---
6/3/2019	23	4	31.3	23	54	15.17	4	114.5	100	146	21.2	0	---	---	---	---	0	---	---	---	---
6/10/2019	24	1	27.0	27	27	NA	7	139.3	102	177	29.5	0	---	---	---	---	0	---	---	---	---
6/17/2019	25	2	47.5	47	48	0.71	2	165.0	150	180	21.2	0	---	---	---	---	0	---	---	---	---
6/24/2019	26	28	47.5	27	66	8.86	2	115.5	111	120	6.4	1	182.0	182	182	NA	0	---	---	---	---
7/1/2019	27	14	49.9	27	59	8.87	2	120.5	113	128	10.6	1	158.0	158	158	NA	0	---	---	---	---
7/8/2019	28	59	57.2	42	84	7.56	6	120.2	103	130	9.8	8	148.1								

Appendix 12: Trinity River at Willow Creek Rotary Screw Trap site (WCRST) weekly steelhead fork lengths, 2019.

Week Starting	Week of Year	Natural Steelhead										Hatchery Steelhead				
		Age-0					Age-1					Age-2+				
		n	mean	min	max	SD	n	mean	min	max	SD	n	mean	min	max	SD
4/15/2019	16	---	---	---	---	---	35	171.66	94	360	45.11	---	---	---	---	---
4/22/2019	17	---	---	---	---	---	106	151.03	90	221	33.31	---	---	---	---	---
4/29/2019	18	3	45.67	41	49	4.16	58	173.33	112	233	26.88	---	---	---	---	---
5/6/2019	19	---	---	---	---	---	94	161.67	95	210	22.05	---	---	---	---	---
5/13/2019	20	---	---	---	---	---	75	162.60	91	221	29.28	---	---	---	---	---
5/20/2019	21	---	---	---	---	---	32	160.00	84	255	36.42	---	---	---	---	---
5/27/2019	22	---	---	---	---	---	23	164.57	99	254	41.25	---	---	---	---	---
6/3/2019	23	3	42.33	36	49	6.51	14	152.93	82	258	48.57	---	---	---	---	---
6/10/2019	24	5	49.80	41	56	5.45	7	129.00	92	190	35.82	---	---	---	---	---
6/17/2019	25	15	44.00	36	49	3.66	---	---	---	---	---	---	---	---	---	---
6/24/2019	26	27	50.96	35	67	7.02	3	115.33	110	121	5.51	---	---	---	---	---
7/1/2019	27	11	49.27	35	72	9.24	---	---	---	---	---	---	---	---	---	---
7/8/2019	28	109	53.39	24	72	7.30	1	135	135	135	NA	---	---	---	---	---
7/15/2019	29	125	57.71	42	75	7.13	---	---	---	---	---	---	---	---	---	---
7/22/2019	30	64	56.27	38	77	8.30	---	---	---	---	---	---	---	---	---	---
7/29/2019	31	24	56.67	44	74	8.43	1	136	136	136	NA	---	---	---	---	---
8/5/2019	32	17	57.41	35	75	10.41	---	---	---	---	---	---	---	---	---	---
8/12/2019	33	3	48.67	47	52	2.89	---	---	---	---	---	---	---	---	---	---
8/19/2019	34	2	68.50	60	77	12.02	---	---	---	---	---	---	---	---	---	---
8/26/2019	35	2	62.00	48	76	19.80	---	---	---	---	---	---	---	---	---	---

Appendix 13. 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, 2019.

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
1/14/2019	3	3	1.003	0.020	---	---	---
1/21/2019	4	32	1.051	0.062	---	---	---
1/28/2019	5	24	1.064	0.061	---	---	---
2/4/2019	6	47	1.043	0.081	---	---	---
2/11/2019	7	7	1.049	0.045	---	---	---
2/18/2019	8	8	1.076	0.082	---	---	---
2/25/2019	9	---	---	---	---	---	---
3/4/2019	10	10	1.047	0.049	---	---	---
3/11/2019	11	16	1.063	0.079	---	---	---
3/18/2019	12	5	1.083	0.038	---	---	---
3/25/2019	13	2	1.011	0.088	---	---	---
4/1/2019	14	1	1.120	NA	---	---	---
4/8/2019	15	38	1.024	0.118	---	---	---
4/15/2019	16	---	---	---	25	0.992	0.113
4/22/2019	17	41	1.103	0.156	72	1.131	0.237
4/29/2019	18	---	----	----	67	1.094	0.088
5/6/2019	19	37	1.125	0.095	220	1.093	0.196
5/13/2019	20	7	1.102	0.059	189	1.124	0.121
5/20/2019	21	41	1.144	0.096	170	1.140	0.170
5/27/2019	22	101	1.116	0.139	180	1.173	0.246
6/3/2019	23	122	1.086	0.137	345	1.100	0.168
6/10/2019	24	142	1.092	0.103	383	1.076	0.130
6/17/2019	25	300	1.088	0.151	431	1.075	0.149
6/24/2019	26	200	1.089	0.114	686	1.072	0.196
7/1/2019	27	120	1.042	0.104	489	1.060	0.156
7/8/2019	28	233	1.116	0.159	649	1.099	0.173
7/15/2019	29	239	1.059	0.082	604	1.182	0.178
7/22/2019	30	283	1.085	0.099	572	1.169	0.222
7/29/2019	31	221	1.078	0.111	468	1.137	0.156
8/5/2019	32	247	1.088	0.119	255	1.116	0.124
8/12/2019	33	151	1.090	0.104	130	1.156	0.216
8/19/2019	34	66	1.125	0.097	65	1.203	0.105
8/26/2019	35	---	---	---	10	1.124	0.163

Appendix 14. Fulton's condition factor (K) for natural age-1 Coho Salmon from the Pear Tree and Willow Creek Rotary Screw Trap sites, 2019.

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
1/14/2019	3	3	1.016	0.092	---	---	---
1/21/2019	4	5	1.058	0.038	---	---	---
1/28/2019	5	2	1.097	0.054	---	---	---
2/4/2019	6	2	1.132	0.037	---	---	---
2/11/2019	7	---	---	---	---	---	---
2/18/2019	8	1	1.060	NA	---	---	---
2/25/2019	9	---	---	---	---	---	---
3/4/2019	10	---	---	---	---	---	---
3/11/2019	11	3	1.071	0.026	---	---	---
3/18/2019	12	1	0.935	NA	---	---	---
3/25/2019	13	1	1.089	NA	---	---	---
4/1/2019	14	---	---	---	---	---	---
4/8/2019	15	2	1.092	0.143	---	---	---
4/15/2019	16	---	---	---	---	---	---
4/22/2019	17	7	1.022	0.077	2	1.115	NA
4/29/2019	18	---	---	---	1	0.876	NA
5/6/2019	19	---	---	---	3	1.069	0.237
5/13/2019	20	1	1.008	NA	3	0.866	0.116
5/20/2019	21	5	1.038	0.083	---	---	---
5/27/2019	22	---	---	---	---	---	---
6/3/2019	23	---	---	---	3	0.784	0.014
6/10/2019	24	1	1.242	NA	1	1.067	NA
6/17/2019	25	1	0.911	NA	---	---	---
6/24/2019	26	1	1.064	NA	---	---	---
7/1/2019	27	1	1.306	NA	---	---	---
7/8/2019	28	2	1.166	0.028	---	---	---
7/15/2019	29	4	1.039	0.141	---	---	---
7/22/2019	30	---	---	---	---	---	---
7/29/2019	31	---	---	---	---	---	---
8/5/2019	32	2	1.113	0.049	---	---	---
8/12/2019	33	---	---	---	---	---	---
8/19/2019	34	---	---	---	---	---	---
8/26/2019	35	---	---	---	---	---	---

Appendix 15. Fulton's condition factor (K) for natural age-1+ steelhead from the Pear Tree and Willow Creek Rotary Screw Trap sites, 2019.

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
1/14/2019	3	10	1.108	0.112	---	---	---
1/21/2019	4	96	1.138	0.128	---	---	---
1/28/2019	5	20	1.125	0.107	---	---	---
2/4/2019	6	11	1.100	0.079	---	---	---
2/11/2019	7	2	1.135	0.056	---	---	---
2/18/2019	8	6	1.099	0.134	---	---	---
2/25/2019	9	---	---	---	---	---	---
3/4/2019	10	26	1.121	0.072	---	---	---
3/11/2019	11	57	1.129	0.076	---	---	---
3/18/2019	12	25	1.081	0.107	---	---	---
3/25/2019	13	7	1.125	0.050	---	---	---
4/1/2019	14	9	1.089	0.060	---	---	---
4/8/2019	15	12	1.091	0.138	---	---	---
4/15/2019	16	---	---	---	36	1.013	0.159
4/22/2019	17	2	0.654	0.716	109	1.035	0.177
4/29/2019	18	---	---	---	58	0.969	0.149
5/6/2019	19	---	---	---	98	1.031	0.130
5/13/2019	20	3	0.965	0.176	77	1.000	0.124
5/20/2019	21	5	1.147	0.031	33	0.989	0.135
5/27/2019	22	8	1.048	0.077	25	1.003	0.240
6/3/2019	23	4	1.122	0.077	14	1.004	0.153
6/10/2019	24	6	1.013	0.176	7	1.978	2.022
6/17/2019	25	4	1.113	0.108	---	---	---
6/24/2019	26	18	1.103	0.138	3	1.003	0.148
7/1/2019	27	10	1.040	0.079	---	---	---
7/8/2019	28	64	1.121	0.189	2	1.256	NA
7/15/2019	29	16	0.981	0.123	---	---	---
7/22/2019	30	64	1.025	0.168	---	---	---
7/29/2019	31	38	1.064	0.131	1	1.415	NA
8/5/2019	32	74	1.046	0.195	---	---	---
8/12/2019	33	17	1.053	0.088	---	---	---
8/19/2019	34	13	1.081	0.074	---	---	---
8/26/2019	35	---	---	---	---	---	---