# Juvenile Salmonid Emigration Monitoring on the Mainstem Trinity River, California, 2009

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*Abstract* This report describes juvenile salmonid emigration monitoring conducted in 2009 at both Pear Tree Bar (PTRST; rkm 118) and Willow Creek (WCRST; rkm 34), California. Monitoring at PTRST is conducted to estimate juvenile salmonid population size passing PTRST during the sampling season. Monitoring at WCRST is conducted to estimate juvenile salmonid population size and emigration timing during the monitoring period. In 2009, two rotary screw traps were operated at PTRST from January 13 through August 28, with successful sampling for 215 of the 228-day sampling period. At WCRST three rotary screw traps were operated in 2009 from March 12 through September 2, with successful sampling for 159 days of the 175- day sampling period.

Age of salmonid outmigrants, length frequency distributions, migration rates, and hatchery contributions were estimated. Catch data were used to calculate flow 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.

Weekly stratified mark-recapture population estimates of emigrating age-0 Chinook salmon were calculated for both naturally and hatchery-produced sub-populations. At PTRST between January 13 and August 28, an estimated 1,740,438 (SD=77,966; CV = 0.04) naturally-produced age-0 Chinook salmon and 734,625 (SD = 44,831; CV = 0.06) age-0 hatchery Chinook salmon passed the site. At WCRST between March 12 and September 2, an estimated 2,987,837 (SD = 212,008; CV = 0.07) naturally-produced age-0 Chinook salmon and 784,557 (SD = 88,501; CV = 0.11) age-0 hatchery Chinook salmon passed the site.

Juvenile salmonid emigration target dates were developed by the Trinity River Restoration Program (TRRP) to assess at what date 80% of the juvenile salmonid population had left the Trinity River and to help manage water temperatures in the mainstem Trinity River. The estimate of the week in which 80% of the juvenile Chinook salmon population passed WCRST, as inferred from the flow based abundance index was Week of the Year (WOY) 26 (June 25-July1), which occurred prior to the TRRP management target date of July 9. The estimate of the week in which 80% of the steelhead smolt population passed the WCRST, as inferred from flow based abundance indices, was WOY 17 (April 23-April 29), which occurred prior to the TRRP management target date of May 22. The estimate of the week in which 80% of the natural coho salmon smolt population passed the WCRST was WOY 22 (May 28-June 3), which occurred prior to the TRRP management target date of June 4.

## Introduction

This report presents the annual data collected to: (1) evaluate the production of juvenile salmonids, primarily Chinook salmon, from the upper 65 kilometers of the mainstem Trinity River below Lewiston Dam, the primary restoration reach and (2) evaluate the production and outmigrant timing of juvenile salmonids through the lower Trinity River in response to managed flow releases, the new thermal regimes, and restoration efforts. In addition to quantifying salmonid outmigrant production and timing, fish condition and health, as well as hatchery/natural composition of the outmigrants are assessed.

Quantification of annual juvenile fish production has been identified as a key performance measure to evaluate effectiveness of habitat restoration and flow management actions in increasing juvenile salmonid production (TRRP and ESSA 2009). Monitoring emigrating juvenile salmonid populations in conjunction with habitat availability and suitability studies is expected to provide a direct evaluation of restoration efforts because these studies focus on the early freshwater life-history phase which is directly affected by instream conditions and management actions. While this data series report presents the monitoring results from a single year, these data will be evaluated along with outmigrant monitoring results from other years to evaluate population responses to varying conditions (i.e.: hydrology, thermal regimes, spawning escapement) and provide feedback on the effectiveness of management actions through the Trinity River Restoration Program's adaptive management process (TRRP and ESSA 2009).

## Background

The Klamath and Trinity Rivers once supported large runs of Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*) that contributed to economically and culturally important tribal, ocean troll, and recreational fisheries. Declines in the Klamath Basin anadromous fish populations due to floods, water and land management, and fish harvest management (Klamath River Basin Fisheries Task Force 1991), led Congress to enact the Trinity River Basin Fish and Wildlife Restoration Act (PL 98-541) in 1984 and the Klamath River Basin Conservation Area Fishery Restoration Program (PL 99-552) in 1986. These acts directed the Secretary of the Interior to take actions necessary to restore the fishery resources of the Klamath Basin, primarily by addressing restoration of freshwater habitat.

In 2000, the Secretary of the Interior signed the Record of Decision (ROD) for the Trinity River Mainstem Fishery EIS/EIR which outlined the actions necessary to restore the natural production of anadromous salmonids in the mainstem Trinity River (USDOI 2000). The primary cause for dramatic decline in salmonid populations was attributed to loss of habitat due to decreased flows, channel simplification, excess fine sediment input, and unsuitable thermal regimes (USFWS and Hoopa Valley Tribe 1999). The strategy adopted to restore natural production of anadromous salmonids in the mainstem Trinity River is to restore a functioning alluvial river ecosystem (USFWS and Hoopa Valley Tribe 1999, USDOI 2000). Due to several flow and sediment constraints imposed by the Trinity River Division as well as other infrastructure constraints (residences in the floodplain) the new alluvial channel morphology is expected to be smaller in scale, but exhibit most of the dynamic characteristics of a healthy alluvial river (USFWS and

Hoopa Valley Tribe 1999). The primary restoration actions being undertaken are: (1) mechanical channel rehabilitation to reform the degraded channel, (2) management of flows to support habitat and temperature needs of anadromous salmonids and support physical processes necessary to create and maintain habitat in an alluvial river, and (3) coarse sediment augmentation to support physical processes that create and maintain riverine features and habitats.

A fundamental hypothesis relating to the restoration strategy is that improving spawning and rearing habitat and providing suitable thermal regimes will lead to increased juvenile salmonid production (USFWS and Hoopa Valley Tribe 1999, TRRP and ESSA 2009). Creation and maintenance of habitat should increase the production potential of the mainstem Trinity resulting in a greater number of outmigrants and suitable thermal regimes, especially water year specific temperature objectives in the lower Trinity River for outmigrating salmonids, should increase rearing and outmigration success due to increased size/health of outmigrants. A major objective of the spring/early summer flow releases is to provide optimal temperatures for outmigrating salmonids in Normal or wetter water years and to provide least marginal temperatures during Dry and Critically Dry water years (USFWS and Hoopa Valley Tribe 1999). This, in turn, will contribute to meeting the programmatic goal of increased spawning populations and increased harvest opportunity.

## Study Area

The Klamath River is the second largest river system in California, draining about 26,000 square kilometers ($km^2$) in California, and 14,400 $km^2$ in Oregon. The Trinity River is the largest tributary to the Klamath River, draining approximately 7,690 $km^2$ in California. Lewiston Dam on the Trinity River (rkm 180), is the upper limit of anadromous fish migration. The Trinity River Hatchery (TRH) was constructed to mitigate for losses of anadromous fish habitat and production upstream of Lewiston dam and is managed by California Department of Fish and Game (CDFG).

Trinity River juvenile salmonid outmigrant trapping was conducted at the Pear Tree Gulch (rkm 118) near Helena, California, and the Riverdale Campground (rkm 34) near Willow Creek, California (Figure 1).

## Methods

*Trap Design and Operation*

At the Pear Tree rotary screw trap (PTRST) site, sampling was conducted using one 1.52 m diameter rotary screw trap and one 2.44 m diameter rotary screw trap. The traps were installed January 12 and operated from January 13 through August 28 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. In 2009, the first two traps were installed on March 12, and the third was installed on March 14 and all three traps

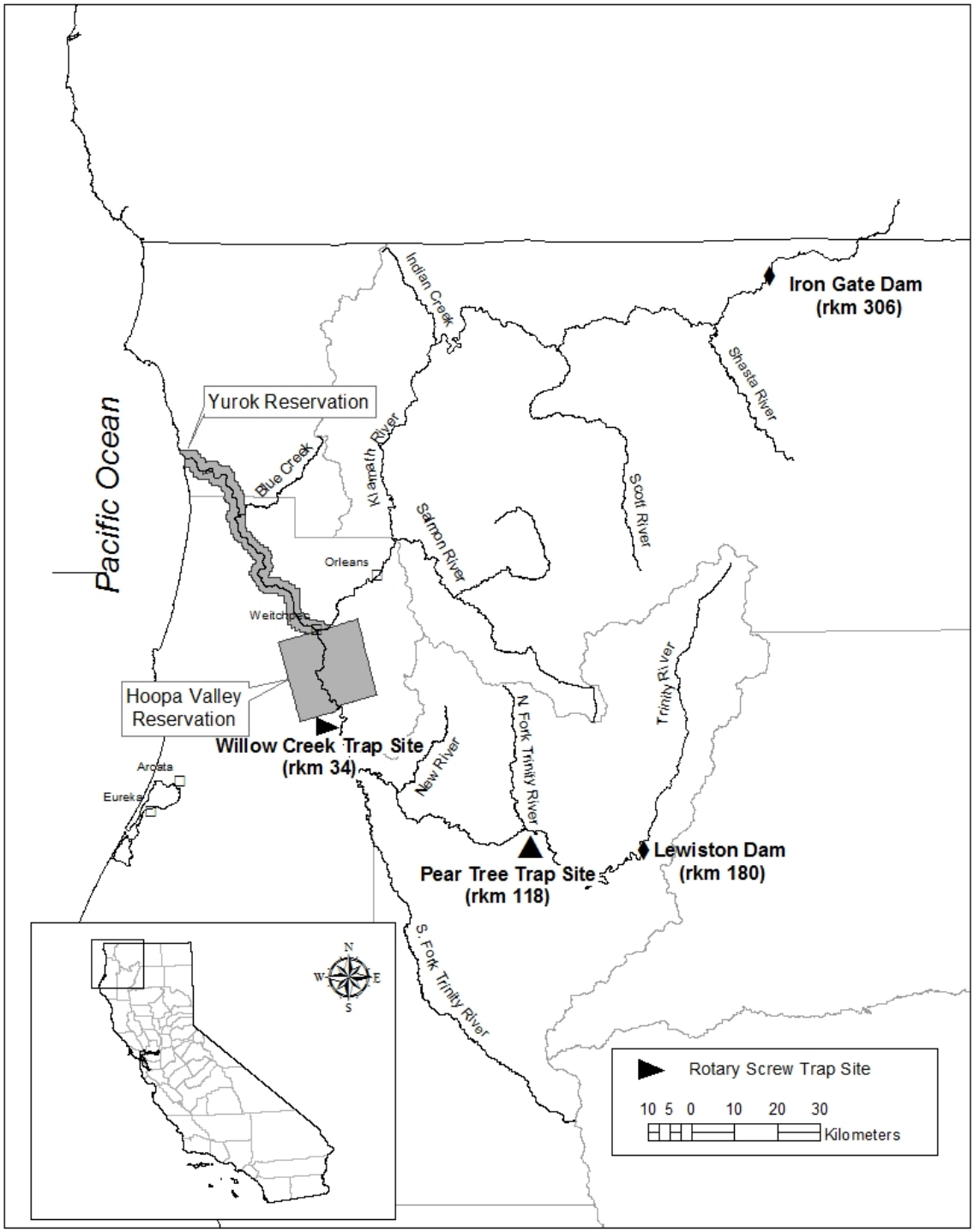


Figure 1. Location of the Trinity River rotary screw trap sites near Willow Creek (rkm 34) and Pear Tree Gulch (rkm 118), California, operated by the Yurok Tribal Fisheries Program, United States Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Hoopa Valley Tribal Fisheries Department.

monitored through September 2. An effort was made to place traps in the river early in the spring so to sample the majority of outmigrating age-0 Chinook salmon to evaluate 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 ($ft^2$) 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 ($ft^3/s$). 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 WCRST, water temperature data were collected using an Onset Stow Away Tidbit® temperature logger attached to the back of a trap's portside pontoon. Water temperature was recorded once per hour for the entire sampling season. Mean daily water temperatures were calculated by averaging over 24-hour periods.

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

| Week of the Year | Week beginning | Week of the Year | Week beginning | Week of the Year | Week Beginning |
|---|---|---|---|---|---|
| 1 | 1/1 | 18 | 4/30 | 35 | 8/27 |
| 2 | 1/8 | 19 | 5/7 | 36 | 9/3 |
| 3 | 1/15 | 20 | 5/14 | 37 | 9/10 |
| 4 | 1/22 | 21 | 5/21 | 38 | 9/17 |
| 5 | 1/29 | 22 | 5/28 | 39 | 9/24 |
| 6 | 2/5 | 23 | 6/4 | 40 | 10/1 |
| 7 | 2/12 | 24 | 6/11 | 41 | 10/8 |
| 8 | 2/19 | 25 | 6/18 | 42 | 10/15 |
| 9 | 2/26 | 26 | 6/25 | 43 | 10/22 |
| 10 | 3/5 | 27 | 7/2 | 44 | 10/29 |
| 11 | 3/12 | 28 | 7/9 | 45 | 11/5 |
| 12 | 3/19 | 29 | 7/16 | 46 | 11/12 |
| 13 | 3/26 | 30 | 7/23 | 47 | 11/19 |
| 14 | 4/2 | 31 | 7/30 | 48 | 11/26 |
| 15 | 4/9 | 32 | 8/6 | 49 | 12/3 |
| 16 | 4/16 | 33 | 8/13 | 50 | 12/10 |
| 17 | 4/23 | 34 | 8/20 | 51 | 12/17 |
| | | | | 52 | 12/24 |

*Biological Sampling Procedures*

All juvenile fish captured were anesthetized with tricaine methanesulfonate (MS-222) prior to processing. Up to 30 individuals of each species, age class (based on size), ad-clipped and unclipped, 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. NovAqua® water conditioner was added to recovery buckets to help protect fish during handling, minimize infection, reduce stress and aid in recovery. 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 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 external marks, CWT data, and hatchery marking rates. 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.

*Chinook salmon*

All collected ad-clipped Chinook salmon from WCRST were passed through a magnetic field detector manufactured by Northwest Marine Technology® to determine the presence or absence of a CWT. The snout of each fish that registered positive for a tag was dissected until the CWT was recovered. If the tag was not recovered, the fish was considered an ad-clipped fish that had shed its tag. Recovered tags were decoded using a dissection microscope. Coded Wire Tag recoveries were summed by specific CWT code for each WOY.

The number of CWT fish captured for each code was estimated by multiplying the number of CWTs recovered by an expansion factor (E) which accounts for all subsampling, CWTs that were lost during dissection, and unreadable tags. The expansion factor (E) for a given WOY(j) was calculated using the formula:

$$E_{WOY(j)} = (C/MS)(AD/H)(T/TR)$$

Where: C = Total # of Chinook salmon captured,
MS = Number of Chinook salmon examined for ad-clips,
AD = Number of ad-clipped Chinook salmon observed,
H = Number of ad-clipped Chinook salmon collected,
T = Number of collected ad-clipped Chinook salmon with a CWT,
TR = Total number of CWTs recovered and decoded after processing.

To account for unmarked hatchery fish in the catch over a WOY, the expanded estimates for each CWT code (i) were multiplied by a production multiplier ($PM_{code\ (i)}$) specific to each CWT code. Each $PM_{code(i)}$ was calculated from hatchery release data (Pacific States Marine Fisheries Commission 2009), using the following formula:

$$PM_{(code(i)} = (\#\ Tagged + \#\ Poor\ Tagged + \#\ Unmarked)/\ \#\ Tagged$$

Where: # Tagged = The actual number of ad-clipped Chinook salmon released with a CWT,
# Poor Tagged = The number of ad-clipped Chinook salmon that were tagged and shed the tag (No-Tags),
# Unmarked = The number of unmarked Chinook salmon in a release group.

The estimated contribution of hatchery Chinook salmon attributable to a specific CWT code for a given WOY was calculated by the following formula:

$$\#\ Hatchery_{code(i)WOY(j)} = (\#\ recovered\ _{code(i)}) * (E_{WOY(j)}) * (PM\ _{code(i)})$$

The total weekly estimated hatchery contribution to the catch was the sum of all daily estimated hatchery Chinook salmon attributable to CWT codes. The weekly contribution of naturally-produced Chinook salmon to the catch was estimated by subtracting the estimated hatchery contribution from the total weekly catch. Occasionally, the daily estimated hatchery contribution exceeded the total daily catch. In these instances, the estimated hatchery contribution was limited to the actual daily catch.

At PTRST, CWTs were not recovered for the purpose of estimating the proportion of hatchery Chinook salmon in the catch. Instead, the number of ad-clipped fish in the weekly catch was expanded by the TRH fin-clip rate (approximately 25%) to produce an estimate of 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 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:

$$Index_{DC} = Catch_{DC} / (Q_C/Q)$$

Where: $Catch_{DC}$ = Sum of daily catch of a species/life stage/age class from all traps.
$Q_C$ = Sum of discharge sampled ($ft^3/s$) by all traps
$Q$ = Mean daily river discharge ($ft^3/s$) at trap site

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

$$Index_{CWOYi} = \sum Index_{DC} (nt_i/( \sum TD_i)$$

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 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, 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 marked Chinook salmon released at PTRST and recaptured at WCRST (see mark-recapture technique section below for marking methods). In addition, maximum migration rates 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 in 2009. Population estimates were generated using a Bayesian time-stratified spline-based method (Schwarz et al. 2009; hereafter Schwarz method) stratified by WOY. Juvenile Chinook salmon were obtained from TRH to conduct mark-recapture trap efficiency tests early in the season when numbers of natural fish were too low to obtain adequate sample sizes to accurately calculate trap efficiency. Mark-recapture population estimates were not calculated for coho salmon and steelhead due to inadequate numbers necessary for valid estimates.

*Mark-Recapture Technique*

Two types of marks were utilized in 2009, photonic marks and freeze brands. Photonic marks unique to each sampling week and trap site were applied to anesthetized Chinook salmon utilizing a BMX 1000 POW'R-Jet marking unit with photonic marking formula manufactured by NewWest Technologies®. Trap-caught Chinook salmon at each site were generally the source for photonic-marked fish, which were assumed to be of natural origin prior to the hatchery release in June, where after they became an unknown mix of naturally-produced age-0 and hatchery-produced age-0 fish. Marks were made by subcutaneously injecting photonic solution at the base of various fins specific to the color and fin mark designated for that week. After marking, fish were allowed to recover in in-river holding pens or bait tanks filled with river water aerated and iced to remain within 1.7°C of ambient river temperatures. Following recovery, marked fish were investigated for bad marks and mortalities, which were removed from the number of marks released.

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, all the freeze-branded fish were examined for mark quality, and those with poorly defined marks received either a secondary photonic mark or were excluded from the number of marked fish released. Hatchery fish with unique brands for each WOY and site were delivered from the hatchery weekly.

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 outmigrating 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. Some TRH-source Chinook salmon also received photonic marks instead of freeze brands, but marks were unique to ensure that release location and time could be identified upon recovery. All recaptures were identified and recorded during normal trapping operations, but were not counted as part of the catch for that day.

## Results

*Sampling Season Overview*

Monitoring at PTRST was conducted from January 13 to August 28, a 228-day period encompassing the bulk of annual non-hatchery age-0 Chinook salmon emigration from the study reach. Due to occasional sampling disruptions caused by large woody debris, high flows and mechanical difficulties, the site was effectively operated for 215 days, or 94%, of the 228-day sampling period (Table 2).

Monitoring at WCRST was conducted from March 12 to September 2, a 175-day period. In combination, traps were effectively fished for 159 of the 175 possible trap days (91%), while individual trap rates ranged from 71% to 88% (Table 2). Consistent daily data collection was disrupted (flawed set) intermittently by large woody debris, high flows, and mechanical difficulties, but sampling occurred in each of the WOYs during the sampling period.

Table 2. Period and duration of spring/summer monitoring and percent of time sampled at PTRST (rkm 118) and WCRST (rkm 34). Combined value is total number of days sampled with at least one trap.

| Site | Trap | Start-End dates | Days Trapped | Days possible | Trapping Rate |
|---|---|---|---|---|---|
| PTRST | 1 (2.4m) | 13 Jan- 28 Aug | 210 | 228 | 92% |
| PTRST | 2 (1.5m) | 13 Jan- 28 Aug | 215 | 228 | 94% |
| Combined | | 13 Jan- 28 Aug | 215 | 228 | 94% |
| WCRST | 1 (2.4m) | 12 Mar- 2 Sept | 155 | 175 | 89% |
| WCRST | 2 (2.4m) | 12 Mar- 2 Sept | 151 | 175 | 86% |
| WCRST | 3 (2.4m) | 14 Mar- 2 Sept | 124 | 173 | 72% |
| Combined | | 12 Mar- 2 Sept | 159 | 175 | 91% |

Maximum mean daily discharge at PTRST was 7120 $ft^3/s$, and the minimum was 464 $ft^3/s$. Maximum mean daily water temperature was 20.4$^oC$ and minimum mean daily water temperature was 4.3$^oC$ (Figure 2)

Maximum mean daily discharge at WCRST was 18,963 $ft^3/s$ and minimum mean daily discharge was 644 $ft^3/s$. Maximum mean daily water temperature, as recorded at the trap site, was 25.1 $^oC$ and minimum mean daily water temperature was 7.4 $^oC$ (Figure 2).

*Catch Totals*

*Chinook salmon*

Pear Tree

At total of 84,428 Chinook salmon were captured at PTRST in 2009 and the catch was composed predominantly of naturally-produced age-0 fish, which accounted for 65% of the total season Chinook salmon catch (Table 3, Appendix 1). There were 28,113 hatchery-produced age-0 Chinook salmon captured, which made up 33% of the total season Chinook salmon catch. Naturally-produced age-1 and hatchery-produced age-1 Chinook salmon were relatively uncommon, and comprised only 1% and 0.4% of the total season catch of Chinook salmon, respectively.

There were two distinctly different capture periods for Chinook salmon at PTRST. Prior to the arrival of brood year 2008 hatchery Chinook salmon (released from TRH as age-0 on June 1, 2009), the Chinook salmon catch was composed predominantly of naturally-produced age-0 fry mixed with small numbers of hatchery-produced and naturally-produced age-1 pre-smolts. In samples collected prior to the hatchery release, from WOY 2 through WOY 22, naturally-produced age-0 fish accounted for 97% of the total Chinook catch. Following the hatchery release, there was a dramatic shift in relative abundance through the remainder of the season, as age-0 hatchery fish accounted for 70% of the Chinook salmon catch and naturally produced age-0 Chinook accounted for 31% of the Chinook catch. Age-1 Chinook were virtually absent from the catch following the hatchery release, as only one individual was captured.

Willow Creek

Catches of Chinook salmon in 2009 at WCRST were predominately natural fish with a catch of 127,074, comprising 78% of the total catch. Except for 166 age-1 fish, the entire Chinook salmon catch was composed of age-0 fish. A total of 36,284 hatchery age-0 fish were captured during the monitoring period, comprising 22% of the total catch (Table 3, Appendix 2).

Natural age-0 Chinook salmon were captured throughout the sampling period (WOY 11-WOY 35), peaking in WOY 26 with 31,880 natural age-0 Chinook salmon caught. The majority of hatchery-produced Chinook salmon were captured from early June through the end of July. Presence of age-0 Chinook salmon during the first week of sampling indicates that emigration past the site had already begun, with an unknown number of fish migrating past the trap site prior to the initiation of sampling (Appendix 2).

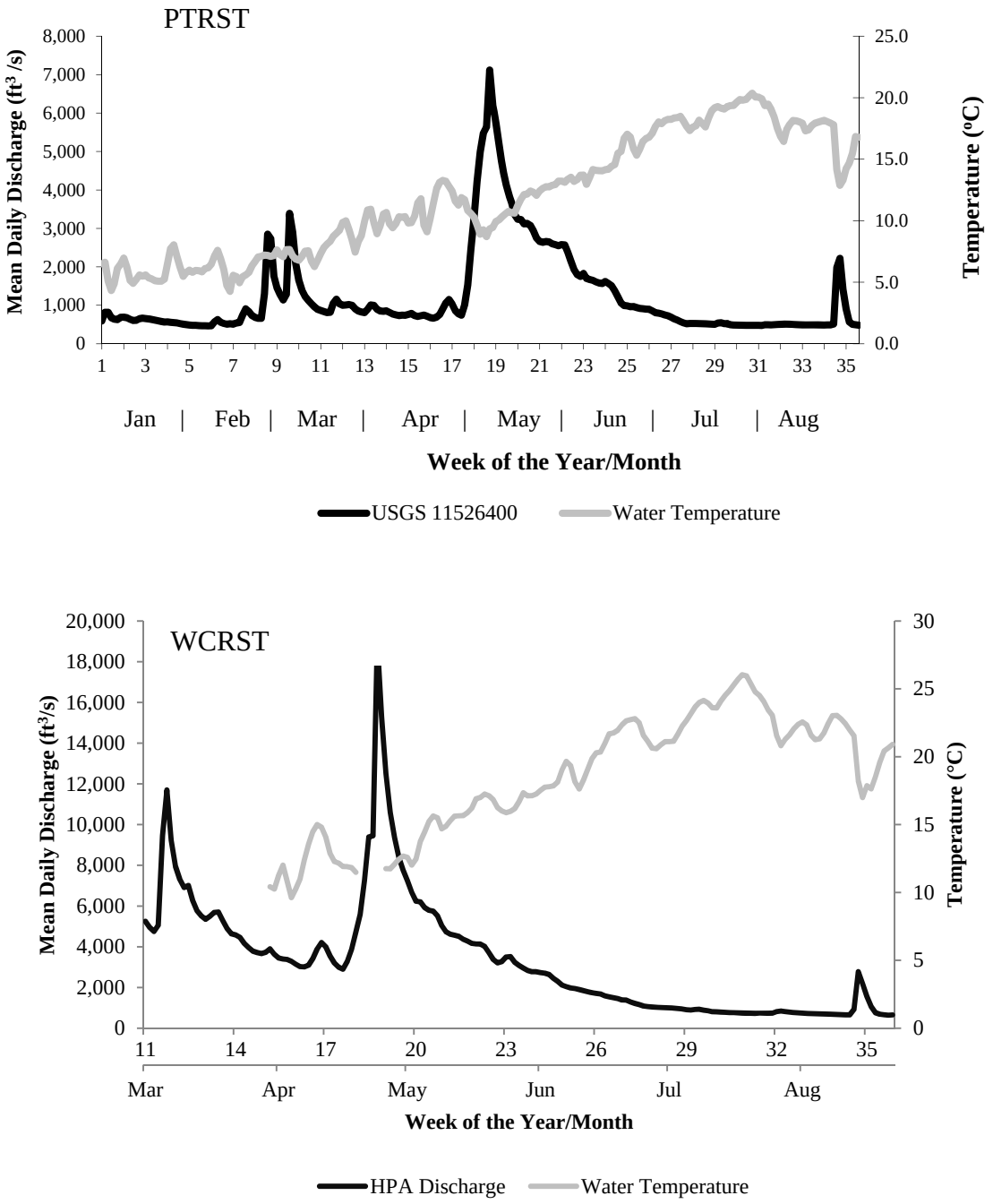


Figure 2. Mean daily discharge ($ft^3/s$) as recorded at Pear Tree Bar (US Geological Survey Water Resource gauge station #11-526400) and Hoopa (HPA; US Geological Survey Water Resource gauge station #11-530000), California. Mean daily water temperatures ($^oC$) recorded at PTRST and WCRST in 2009.

Table 3. Juvenile salmonid catch totals in 2009 for trapping at PTRST (rkm 118) and WCRST (rkm 34), on the Trinity River, California, operated by the Hoopa Valley Tribal Fisheries Department, United States Fish and Wildlife Service, Arcata Fish and Wildlife Office and the Yurok Tribal Fisheries Program.

| Site | Species | Hatchery Age-0 | Hatchery Age-1+ | Natural Age-0 | Natural Age-1+ | Natural Age-2+ | Total |
|---|---|---|---|---|---|---|---|
| PTRST | Chinook salmon | 28,113 | 300 | 55,187 | 828 | N/A | 84,428 |
| PTRST | coho salmon | N/A | 255 | 336 | 658 | N/A | 1,249 |
| PTRST | steelhead | N/A | 4,149 | 1,293 | 3,419 | 66 | 8,927 |
| WCRST | Chinook salmon | 36,284 | 0 | 126,908 | 166 | N/A | 163,358 |
| WCRST | coho salmon | N/A | 246 | 58 | 209 | N/A | 513 |
| WCRST | steelhead | N/A | 4,287 | 275 | 4,356 | 100 | 9,018 |

Approximately 2.9 million age-0 Chinook salmon (spring- and fall-run) were released from TRH in the spring of 2009. Spring releases included ad-clip CWT groups, representing 25% of released Chinook salmon. In the fall of 2009, TRH released approximately 1.4 million age-0 Chinook salmon, of which 24% were ad-clip CWT groups (Table 4).

Table 4. California Department of Fish and Game, TRH juvenile salmonid releases, 2009.

| Species | Release Season | Number Released | Percentage AD-clipped or Marked | Release Dates |
|---|---|---|---|---|
| Chinook salmon | Spring | 2,959,517 | 24.8 | 06/01/2009-06/15/2009 |
| Chinook salmon | Fall | 1,471,059 | 24.8 | 10/01/2009-10/15/2009 |
| coho salmon | Spring | 459,546 | 100 | 03/16/2009-03/27/2009 |
| steelhead | Spring | 820,430 | 100 | 03/16/2009-03/27/2009 |

*Coho salmon*

Pear Tree

The coho salmon catch at PTRST was predominantly composed of naturally-produced fish. A total of 658 naturally-produced age-1 coho salmon were captured, comprising 53% of the total coho salmon catch of 1,249 (Table 3, Appendix 3). Additionally, 336 naturally-produced age-0, and 255 age-1+ hatchery coho salmon were captured, comprising 27% and 20%, respectively, of the total season coho salmon catch

The majority of age-1 naturally-produced coho salmon were captured between WOY 2 and 13, with 65% of the total season catch occurring in WOY 8 through WOY 10. Age-0 coho salmon first appeared at the site in WOY 10 and small numbers were captured nearly every week of the remaining season, with 63% of captures occurring WOY 28 through WOY 32. Hatchery-produced coho salmon smolts arrived in WOY 11 and passed the site abruptly, with 74% of the total season catch of hatchery coho occurring in WOY 12.

Willow Creek

Catches of coho salmon at WCRST in 2009 were nearly evenly split between hatchery and natural fish. A total of 246 hatchery age-1 coho salmon were captured, comprising 48% of the total catch. A total of 267 natural coho salmon were captured, comprised of 209 age-1 and 58 age-0 fish, or 40% and 11% of the total catch, respectively (Table 3, Appendix 4).

The majority of age-1 coho salmon, both hatchery and naturally-produced, were captured from WOY 11 through WOY 30. Trapping was initiated a week prior to the release of hatchery-produced coho salmon, and age-1 hatchery coho salmon did not appear in traps until the second week of sampling, indicating that emigration past the site had not yet begun. Natural age-0 coho salmon also did not appear in sampling until the second week; however, natural age-1 coho salmon were captured during the initial week of trapping, with an unknown number of fish having passed the traps prior to their operation (Appendix 4).

The largest numbers of age-0 coho salmon were captured from WOY 12 through WOY 27. Natural age-1 coho salmon were captured through WOY 31, but total numbers dropped below ten per week by WOY 25. The majority of hatchery age-1 coho salmon were captured between WOY 12 and WOY 24 (Appendix 4).

TRH released 459,000 yearling coho salmon during March, 2009 (Table 4). All hatchery coho salmon were marked with a right maxillary clip (max-clip).

*Steelhead*

Pear Tree

A total of 8,927 steelhead were captured at PTRST in 2009 (Table 3, Appendix 5). Most of the steelhead captured were age-1+ and age-2 smolts and pre-smolts, which combined accounted for 86% of the total season steelhead catch. Approximately 54% of the steelhead smolts captured were age-1+ hatchery fish. There were 1,293 naturally-produced age-0 steelhead captured (Table 3) which accounted for 15% of the total season steelhead catch.

Prior to the hatchery steelhead smolt release from TRH on March 15, 2009, the steelhead catch was composed entirely of naturally-produced age-1+ and age-2 pre-smolts and smolts, which accounted for 99% and 1% of the catch, respectively. From WOY 12, the week marking the arrival of TRH steelhead, through WOY 35, the steelhead catch was composed of 62% hatchery age-1 smolts, 18% age-1 naturally-produced smolts and presmolts, 0.6% naturally produced age-2 smolts, and 19% naturally produced age-0 fry.

Willow Creek

Catches of steelhead at WCRST during 2009 were nearly evenly split between natural and hatchery fish, though natural fish were predominantly age-1 or older (94%). A catch total of 9,018 included 4,287 hatchery age-1 steelhead (48%), 275 natural age-0 (3%), 4,356 natural age-1+ (48%), and 100 natural age-2+ (1%; Table 3, Appendix 6).

The majority of age-1 hatchery steelhead were captured from late March through mid-June, while the majority of natural age-1+ steelhead were captured from early March through late July. Trapping was initiated the week prior to the release of hatchery-produced steelhead, and catches of age-1 hatchery steelhead did not occur until the third week of trapping (WOY 13). The majority of age-0 steelhead were captured from mid-June through late July, but a small peak appeared in mid-March shortly after trapping began (Appendix 6).

TRH released 820,430 yearling steelhead during March of 2009 (Table 4). All hatchery steelhead were marked with an adipose fin clip prior to release from the hatchery.

*Non-Target Species*

*Pear Tree*

Lamprey ammocetes (*Entosphenus* spp.) were by far the most common non-target genus/life-stage captured at PTRST in 2009 (Table 5) and were most abundant in weekly samples conducted during rising stream conditions caused by winter storms and controlled dam releases. Juvenile brown trout (*Salmo trutta*), speckled dace (*Rhinichthys osculus)* and the Klamath smallscale sucker (*Catostomus rimiculus*) were also relatively abundant in the catch. Brown trout were most abundant in winter and early spring samples, and were more common than naturally-produced age-0 and age-1 coho salmon.

*Willow Creek*

Suckers (*Catostomus spp.*) were the most common non-target fish captured during 2009 at WCRST. Other abundant species included Lamprey ammocetes (*Entosphenus spp.*), speckled dace (*Rhinichthys osculus*), three-spined stickleback (*Gasterosteus aculeatus*), and sculpin (*Cottus* spp.; Table 5).

*Abundance Indices, Emigration Timing and Duration*

*Chinook salmon*

Pear Tree

The total season abundance index for Chinook salmon at PTRST was 606,930 (Table 6), and was composed predominantly of naturally-produced age-0 fish, which accounted for 70% of the total season Chinook index. The total season index of hatchery-produced age-0 Chinook salmon was 173,849, which made up 29% of the total season Chinook index. Naturally-produced and hatchery-produced age-1 Chinook salmon were relatively uncommon, and comprised only 1% and 0.3% of the total season Chinook salmon index, respectively

There were two distinctly different capture periods for Chinook salmon at PTRST (Figure 3). Prior to the arrival of brood year 2008 hatchery Chinook salmon (released as age-0 on June 1, 2009), the Chinook salmon catch was composed predominantly of naturally-produced age-0 fry mixed with small numbers of hatchery-produced and naturally-produced age-1 pre-smolts. During the pre-hatchery release period, from WOY 2 through WOY 22, naturally-produced age-0 fish accounted for 98% of the total Chinook index.

Table 5. Catch totals of non-target fish species captured at PTRST and WCRST on the mainstem Trinity River, California, 2009.

| Common name | Species | Life stage | Pear Tree Catch(n) | Willow Creek Catch (n) |
|---|---|---|---|---|
| Lamprey | *Entosphenus* spp. | Ammocete | 3,848 | 428 |
| | | Eyed juvenile | 83 | 0 |
| Pacific Lamprey | *Entosphenus tridentata* | Ammocete | 0 | 1,364 |
| | | Eyed juvenile | 0 | 8 |
| | | Adult | 14 | 10 |
| Sucker | *Catostomus* spp. | | 225 | 3,562 |
| Speckled Dace | *Rhinichthys osculus* | | 663 | 673 |
| Three-spine Stickleback | *Gasterosteus aculeatus* | | 87 | 187 |
| Marbled Sculpin | *Cottus klamathensis* | | 0 | 59 |
| Golden Shiner | *Notemigonus crysoleucas* | | 13 | 15 |
| Coastrange Sculpin | *Cottus aleuticus* | | 0 | 83 |
| Prickly Sculpin | *Cottus asper* | | 1 | 106 |
| Green Sturgeon | *Acipenser medirostris* | | 0 | 71 |
| Brown Trout | *Salmo trutta* | Juvenile | 1,278 | 55 |
| Sunfish | *Lepomis* spp. | | 0 | 6 |
| Fathead Minnow | *Pimephales promelas* | | 0 | 22 |
| Sockeye salmon | *Oncorhynchus nerka* | | 0 | 8 |
| American Shad | *Alosa sapidissima* | | 0 | 3 |
| **Season Total** | | | **6,212** | **6,660** |

Table 6. Juvenile salmonid proportional discharge based abundance indices, at PTRST and WCRST, 2009.

| Site | Species | Hatchery Age-0 | Hatchery Age-1 | Natural Age-0 | Natural Age-1+ | Natural Age-2+ | Total |
|---|---|---|---|---|---|---|---|
| PTRST | Chinook salmon | 171,984 | 1,865 | 427,126 | 5,955 | N/A | 606,930 |
| PTRST | coho salmon | N/A | 1,894 | 1,834 | 6,785 | N/A | 10,513 |
| PTRST | steelhead | N/A | 24,976 | 11,716 | 34,951 | 530 | 72,173 |
| WCRST | Chinook salmon | 251,094 | 0 | 1,277,357 | 7,070 | N/A | 1,535,521 |
| WCRST | coho salmon | N/A | 8,132 | 1,010 | 4,098 | N/A | 13,240 |
| WCRST | steelhead | N/A | 81,409 | 3,180 | 82,955 | 7,471 | 175,015 |

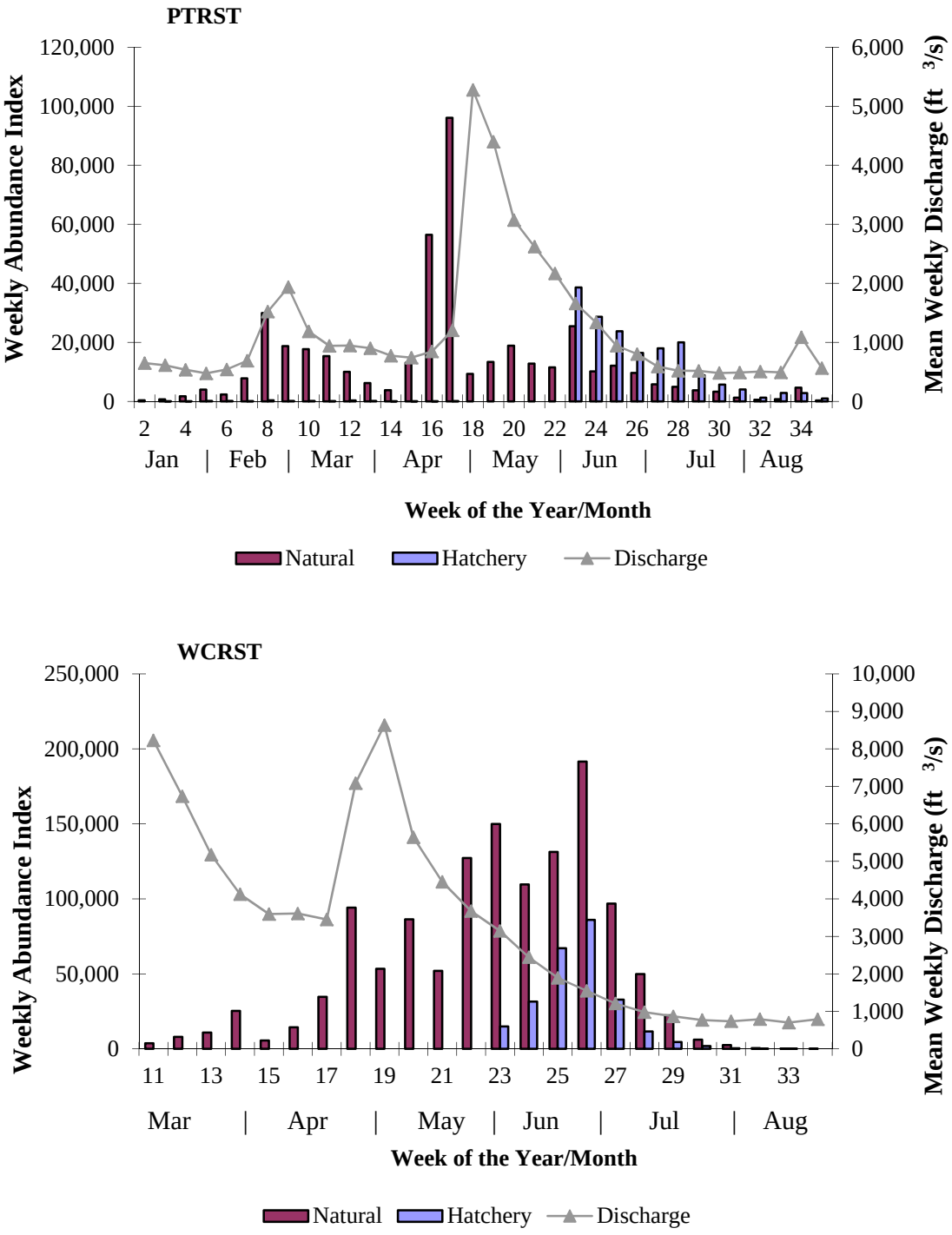


Figure 3. Weekly proportional discharge based abundance indices for natural age-0 and hatchery age-0 Chinook salmon captured at PTRST (rkm 118) and WCRST (rkm 34). Mean daily discharge ($ft^3/s$) was recorded near Helena, California (US Geological Survey Water Resource gauge station #11-526400) and at Hoopa, California (US Geological Survey Water Resource stream gage station #11-530000). Please note differences in scale of axes.

Following the hatchery release there was a dramatic shift in relative abundance through the remainder of the season, as age-0 hatchery fish accounted for 68% of the Chinook salmon index, and only 28% of the indexed Chinook were of natural origin. Age-1 Chinook were virtually absent following the hatchery release, as only nine individuals were indexed.

Naturally-produced age-0 Chinook salmon emigration duration spanned the entire season, with peak emigration occurring in WOY 17 (Table 7, Figure 3, Appendix 1).

Hatchery-produced age-0 Chinook salmon first arrived at the site in WOY 23, and were captured every week through the remainder of the season. Emigration of hatchery-produced Chinook peaked in WOY 23 (Table 7, Figure 3, Appendix 1).

Naturally-produced age-1 Chinook salmon were captured at the onset of sampling, and relatively large catches occurred in the early weeks of the season indicating that an unknown proportion of emigrating fish passed the site prior to the initiation of sampling. Peak emigration occurred in WOY 8 (Table 7), though a substantial portion of the total season index occurred in WOY 9 as well (Figure 3, Appendix 1). Emigration duration, as observed within the season, occurred from WOY 2-24.

Hatchery produced age-1 Chinook salmon were captured in small numbers near the onset of sampling. CWTs collected from several individuals indicated that most of these were brood year 2007 fall race individuals released from TRH as age-1 pre-smolts on October 1, 2008. Emigration duration, occurred from WOY 3-17.

Table 7. Juvenile salmonid emigration duration and peak as inferred from proportional discharge based abundance indices, at PTRST and WCRST, 2009. Values represent week of the year.

| | | Emigration Duration | | | Emigration Peak | | |
|---|---|---|---|---|---|---|---|
| Site | Species | Natural Age-0 | Natural Age-1+ | Hatchery Age-0 | Natural Age-0 | Natural Age-1+ | Hatchery Age-0 |
| PTRST | Chinook salmon | 2-35 | 2-24 | 23-35 | 17 | 8 | 23 |
| PTRST | coho salmon | 10-35 | 2-33 | 11-31 | 30 | 9 | 12 |
| PTRST | steelhead | 12-35 | 2-35 | 12-33 | 21 | 9 | 13 |
| WC | Chinook salmon | 11-35 | 11-19 | 23-35 | 26 | 11 | 26 |
| WC | coho salmon | 12-31 | 11-31 | 12-30 | 18 | 15 | 18 |
| WC | steelhead | 12-35 | 11-35 | 13-29 | 12 | 14 | 18 |

Willow Creek

The total abundance index for natural age-0 Chinook salmon was 1,277,357 (Table 6). Natural age-0 Chinook salmon had one distinct emigration period from WOY 11-35 peaking in WOY 26, but also two smaller peaks appear relative to surrounding weeks in WOY 14 and 18 (Appendix 2, Table 7). The date at which 80% of the natural age-0 Chinook salmon population, based on the flow based abundance index, passed the site was June 22, 2009 or WOY 26 which met the TRRP management target date of July 9.

Natural age-1 Chinook salmon were collected from WOY 11-19 with an abundance index of 7,070. The peak occurred in the first week of sampling, WOY 11, suggesting that natural age-1 Chinook were emigrating past the site in unknown numbers prior to trap operation (Appendix 2, Table 7).

The 2009 abundance index total for hatchery age-0 Chinook salmon was 251,094 (Table 6, Appendix 2). Emigration duration of hatchery age-0 Chinook salmon was WOY 23-35 with a peak in WOY 26 (Table 7, Appendix 2). Weekly abundance indices of hatchery age-0 Chinook salmon increased through June, then decreased from the start of July through the end of August.

*Coho salmon*

Pear Tree

The total season coho salmon abundance index at PTRST was 10,513 (Table 6), and included 1,894 (18% of the total index) hatchery-produced age-1 fish, 6,785 naturally-produced age 1 fish (65% of the total coho index), and 1,834 naturally-produced age-0 fish (17% of the total coho index).

Natural age-0 coho salmon emigration duration was WOY 10-35, with a peak in WOY 30 (Table 7) that accounted for 15% of the total season indexed passage.

Natural age-1 coho salmon smolt peak emigration occurred in WOY 9, after which their weekly abundance index dropped off rapidly. Emigration duration for age-1 non-hatchery coho salmon was WOY 2-33, with 60% of the total indexed passage occurring by WOY 9, and 82% of the indexed passage occurring by the end of WOY 11.

Hatchery age-1 coho salmon smolt emigration duration was WOY 11-23 (Table 7, Figure 4), though there were a few captured later in the season (pooled WOY 24-31 index = 16, or 1% of the annual passage index). Peak emigration was abrupt, with 64% of the indexed passage occurring in WOY 12, after which the catch dropped off dramatically.

Willow Creek

In 2009, age-0 coho salmon abundance index total was 1,010 (Table 6), and the emigration duration was WOY 12-31, peaking in WOY 18 with a smaller peak in WOY 22 (Table 7, Appendix 4).

Natural age-1 coho abundance index was 4,098 (Table 6). Emigration duration for natural age-1 coho salmon was WOY 11-31, with several similar peaks in WOY 15, WOY 18 and 22 (Table 7, Figure 4, Appendix 4). The date at which 80% of the natural age-1 coho salmon population, based on the flow based abundance index, passed the site was May 25, 2009 or WOY 21 which met the TRRP management target date of June 4.

Hatchery age-1 coho salmon abundance index total was 8,132 (Table 6). Emigration duration for hatchery age-1 coho salmon was WOY 12-30 with two distinct emigration periods, one from WOY 12-14 peaking WOY 12, and another from WOY 17-30 peaking WOY 18 (Table 7, Figure 4, Appendix 4).

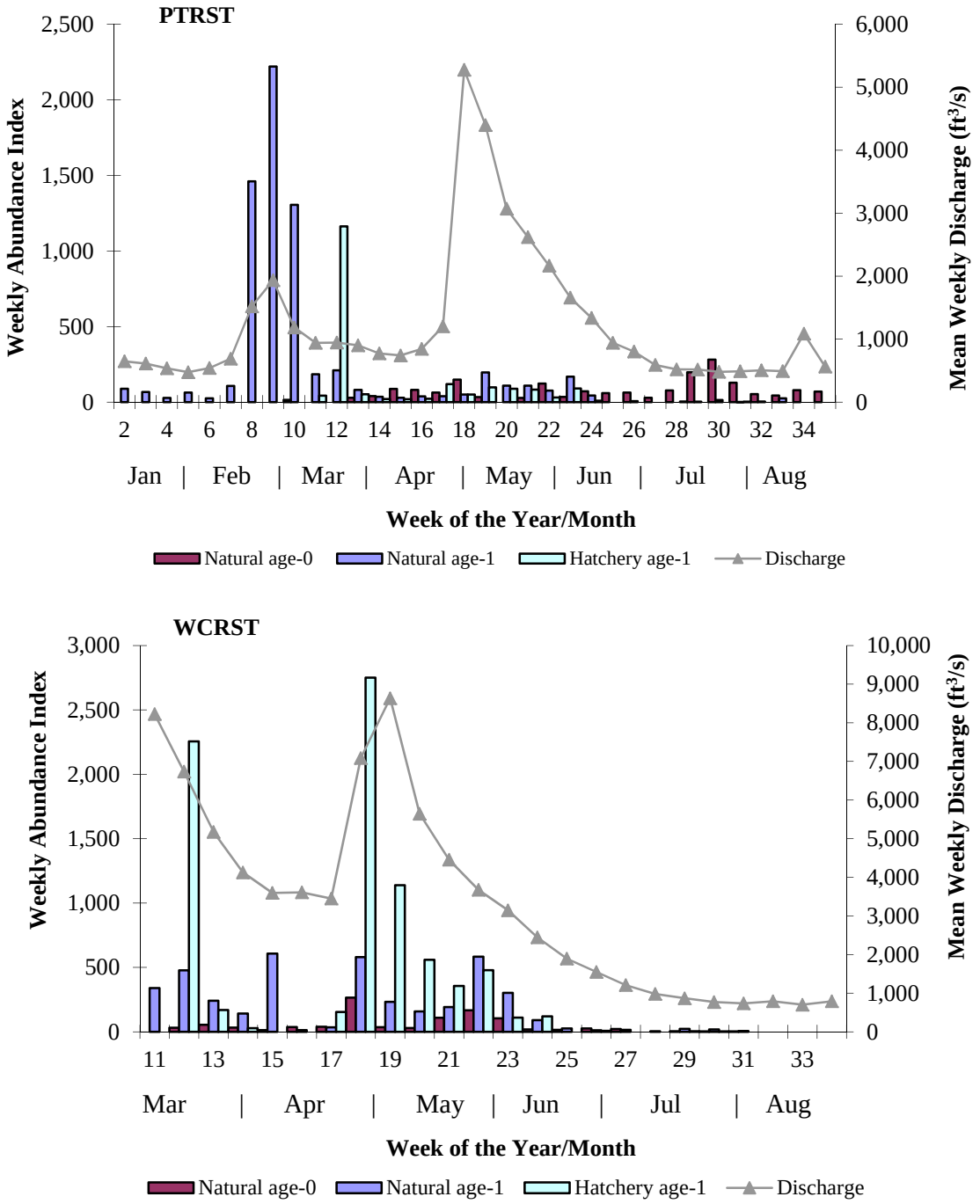


Figure 4. Weekly proportional discharge based abundance indices for natural age-0, age-1, and hatchery age-1 coho salmon captured at PTRST and WCRST. Mean daily discharge ($ft^3/s$) was recorded by US Geological Survey Water Resource gauge station #11-526400, near Helena (rkm 118), California, and US Geological Survey Water Resource gauge station #11-530000 at Hoopa (rkm 34), California, 2009. Please note differences in scale of axes.

*Steelhead*

Pear Tree

The total season steelhead abundance index at PTRST was 72,173 (Table 6, Appendix 5). The abundance index of naturally-produced age-1 smolts was 34,951, which accounted for 48% of the total steelhead index. The total season age-1 hatchery steelhead index was 24,976, which accounted for 35% of the total steelhead index. Natural age-2 steelhead accounted for only 1% of the total index. The age-0 steelhead index was 11,716, and accounted for16% of the total season steelhead abundance index.

The emigration duration of age-1 natural steelhead smolts at PTRST was WOY 2-35 (Figure 5, Table 7, Appendix 5), with a sharp peak in emigration occurring in WOY 9, and 70% of the indexed passage occurring in WOY 8-10. Emigration duration of natural age-2 steelhead smolts at PTRST was WOY 2-30, with a poorly defined peak occurring WOY 22. The emigration duration of natural age-0 steelhead at PTRST was WOY 12-35, with a peak occurring in WOY 21 and 44% of the indexed passage occurring in WOY 18-22.

Hatchery steelhead smolts were absent from the catch at the onset of sampling and did not appear at the site until March 19 (WOY 12), four days after being released from TRH. Emigration peaked dramatically in WOY 13, with 36% of the indexed passage occurring in that week. Emigration duration was WOY 12-33, though relatively few, approximately 0.1% of the annual index, passed the site after WOY 25.

Willow Creek

In 2009, age-0 steelhead abundance index total was 3,180 (Table 6). Emigration duration was WOY 12-35, peaking WOY 12 (Table 7, Appendix 6).

Natural age-1+ steelhead abundance index total was 82,955 (Table 6). Natural age-1+ steelhead had one distinct emigration period (WOY 11-35) peaking in WOY 14 (Figure 5, Table 7, Appendix 6). The date at which 80% of the natural age-1 steelhead population, based on the flow based abundance index, passed the site was April 28, 2009 or WOY 17 which met the TRRP management target date of May 22.

Hatchery age-1+ steelhead abundance index total was 81,409 (Table 6). The emigration duration of natural age-1+ steelhead had one distinct period (WOY 13-29) with a peak in WOY 18 (Figure 5, Table 7, Appendix 6).

*Migration Rates*

*Chinook salmon*

Mean migration rate of marked juvenile Chinook salmon released at PTRST and recaptured at WCRST was 16.8 rkm/day, (SD 9.3 rkm/day). No significant correlation (t-test) was found between migration rate and release date ($p=0.38$), fork length ($p=0.71$), or river discharge at the Pear Tree gauge ($p=0.45$).

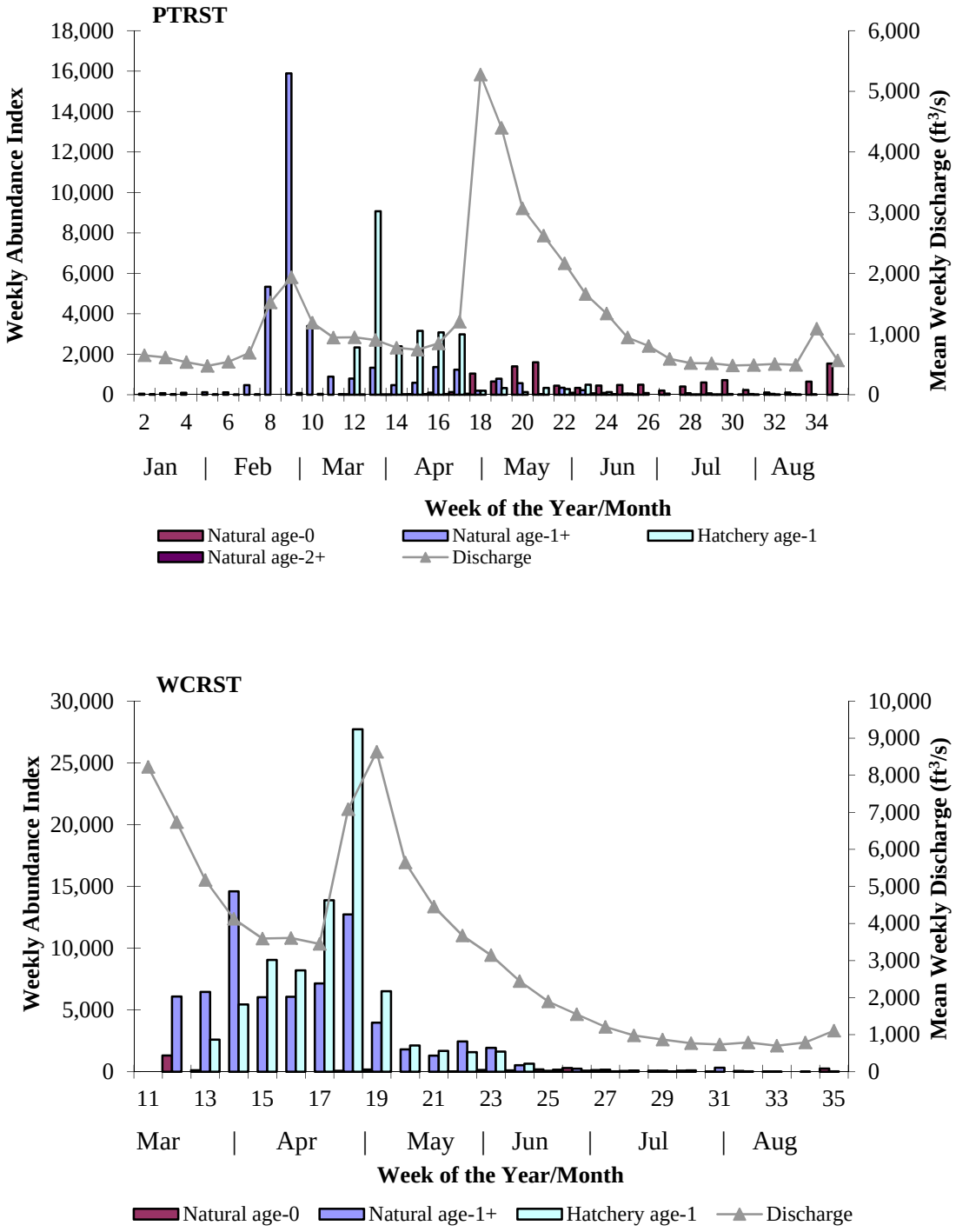


Figure 5. Weekly proportional discharge based abundance indices for natural age-0, natural age-1+, and hatchery age-1 steelhead captured at PTRST and WCRST. Mean daily discharge ($ft^3/s$) was recorded by US Geological Survey Water Resource gauge station #11-526400, near Helena (rkm 118), California, and US Geological Survey Water Resource gauge station #11-530000 at Hoopa (rkm 34), California, 2009. Please note differences in scale of axes.

Juvenile Chinook salmon were released from TRH on June 1, 2009, and first captured at PTRST on June 4, 2009. The initial/maximum migration rate at PTRST for hatchery Chinook salmon calculated from the initial release date and first ad-clip captured was 21.3 rkm/day (Table 8). Juvenile Chinook salmon released from TRH were first captured at WCRST on June 6, 2009. The initial/maximum migration rate at WCRST for hatchery Chinook salmon calculated from the initial release date and first ad-clip captured was 29.2 rkm/day (Table 8).

*Coho salmon*

Coho salmon yearlings released from TRH on March 15, 2009, were first captured at PTRST on March 18, 2009. The maximum migration rate calculated from the initial release date and first max-clip captured was 21.3 rkm/day (Table 8). Coho salmon yearlings released from TRH were first captured at WCRST on March 21, 2009. The maximum migration rate calculated from the initial release date and first max-clip captured was 24.3 rkm/day (Table 8).

*Steelhead*

Steelhead yearlings released from TRH on March 15, 2009, were first captured at PTRST on March 19, 2009. The migration rate calculated from the initial release date and first ad-clip captured was 16.0 rkm/day (Table 8). Steelhead yearlings released from TRH were first captured at WCRST on March 29, 2009. The migration rate calculated from the initial release date and first ad-clip captured was 10.4 rkm/day (Table 8).

Table 8. Juvenile salmonid maximum migration rate from TRH to PTRST and WCRST California, operated by the Hoopa Valley Tribal Fisheries Department, United States Fish and Wildlife Service, Arcata Fish and Wildlife Office, and the Yurok Tribal Fisheries Program, 2009.

| Site | Species | Date First Released | Date First Captured | # of Days | Maximum Migration Rate |
|---|---|---|---|---|---|
| PTRST | Chinook salmon | 6/01/2009 | 6/04/2009 | 3 | 21.3 rkm/day |
| PTRST | coho salmon | 3/15/2009 | 3/18/2009 | 3 | 21.3 rkm/day |
| PTRST | steelhead | 3/15/2009 | 3/19/2009 | 4 | 16.0 rkm/day |
| WCRST | Chinook salmon | 6/01/2009 | 6/06/2009 | 5 | 29.2 rkm/day |
| WCRST | coho salmon | 3/15/2009 | 3/21/2009 | 6 | 24.3 rkm/day |
| WCRST | steelhead | 3/15/2009 | 3/29/2009 | 14 | 10.4 rkm/day |

*Population Estimate*

Pear Tree

Mark recapture tests were conducted WOY 4-34 (Appendix 7). A total of 72,813 marked age-0 Chinook salmon were released and 2,991 marks were recovered for a season-wide recapture rate of 4%. The average weekly recapture rate was 5% and weekly recapture rates ranged from 0.2% during periods of high discharge, to 16% at base flows (481 cfs). The total season population estimate of age-0 non-hatchery Chinook salmon passing the site from WOY 2-35 was 1,740,438, (SD 152,814). The total season estimate of hatchery Chinook salmon age-0 was 743,625, (SD 87,987).

Willow Creek
Mark-recapture tests were conducted from WOY 24-31 (Appendix 8). A total of 23,040 marked age-0 Chinook salmon were released and the season-wide recapture rate was 5% with 1,227 recaptures. The age-0 Chinook salmon population estimate for the period from WOY 11-35 was 2,987,837 (SD 212,008). The total season estimate of hatchery Chinook salmon age-0 was 784,557, (SD 88,501).

*Fork Lengths*

*Chinook salmon*

Pear Tree
During the pre-hatchery release sampling period (WOY 2 - WOY 22), weekly mean FL ranged from 40 mm to 66 mm and there was a general increase in mean FL, although the pattern of increasing FL was not consistent (Figure 6, Appendix 9). Between WOY 2 and WOY 12 mean weekly FL increased by only 5 mm as newly emerged fish were common in the catch. Between WOY 12-22 mean weekly fork length increased by 22 mm. Between WOY 22-23, with hatchery Chinook first arriving at the site, age-0 mean weekly FL increased by 22 mm and continued to increase steadily as the season progressed, ranging from 86 mm to 97 mm.

Mean weekly FL of age-1 Chinook salmon, for weeks where three or more were sampled, ranged from 87 mm to 108 mm. There was no discernible trend in mean weekly FL as the season progressed, as mean and maximum weekly FL fluctuated from week to week with no apparent pattern (Figure 6, Appendix 9).

Willow Creek
Mean FL of age-0 Chinook salmon at WCRST was fairly stable with a gradual increase from 42 mm to 63 mm between WOY 11-22, before jumping quickly in WOY 23 and 24 to 79 mm and 86 mm, respectively, with the arrival of hatchery fish. This increase in mean FL was maintained and fork lengths fluctuated moderately in the high 70's and low 80's until the end of sampling, when a jump was seen in the average FL (Figure 6, Appendix 10).

*Coho salmon*

Pear Tree
Mean weekly FL of naturally-produced age-0 coho salmon, for weeks when three or more were measured, ranged from 35 mm in April, to 109 mm in August, and increased steadily through much of the season. Mean weekly FL of naturally-produced age-1 coho salmon, for weeks when three or more were measured, ranged from 88 mm to 170 mm, and remained fairly stable from January through late April before increasing inconsistently through the remainder of the season. Mean weekly FL of hatchery coho salmon ranged from 150 mm to 210 mm, and fluctuated without increasing as the season progressed (Figure 7, Appendix 9).

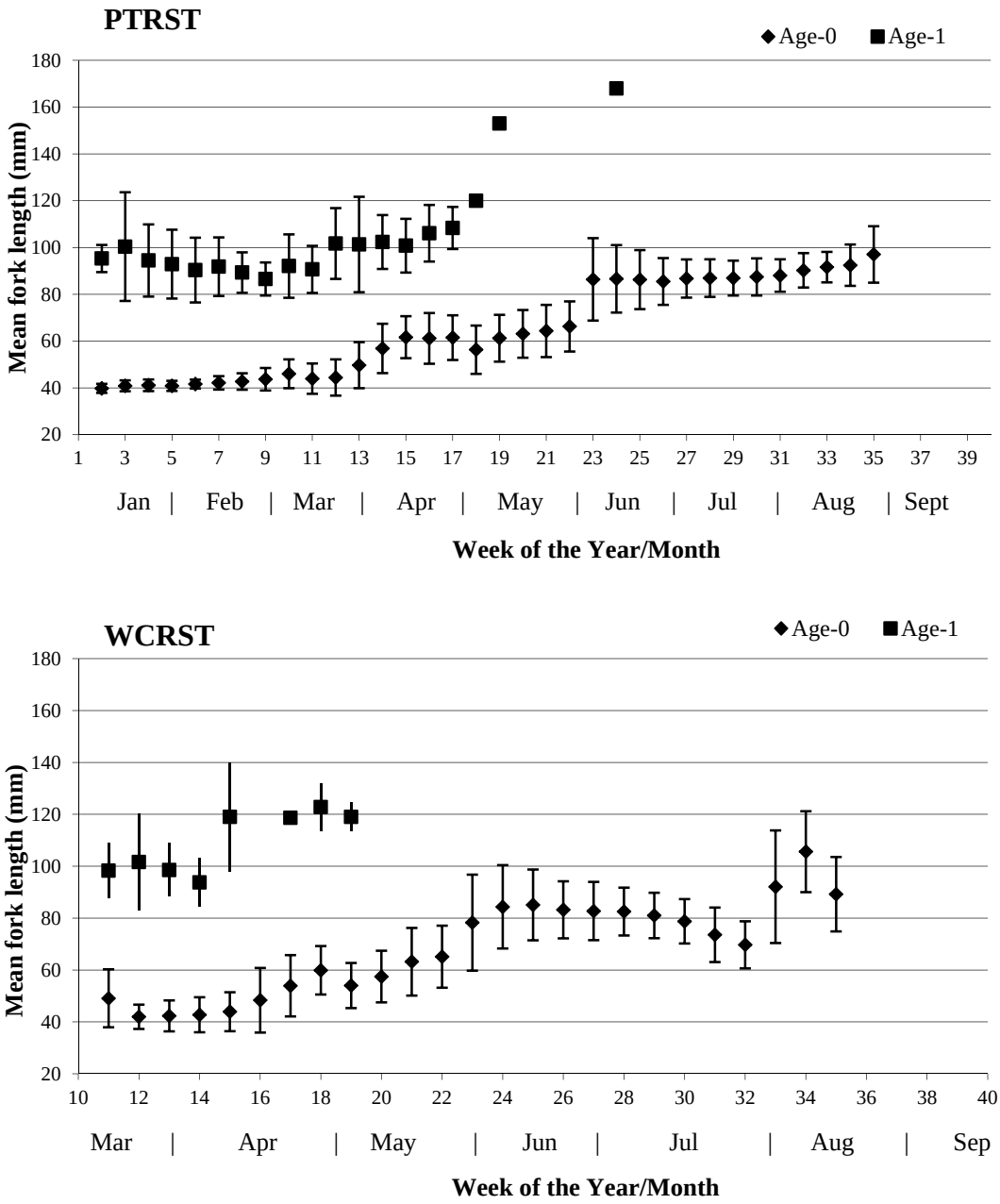


Figure 6. Weekly mean fork lengths of age-0 and age-1 Chinook salmon captured at PTRST and WCRST, 2009. Error bars represent one standard deviation of the mean.

Willow Creek

Mean FL of age-0 coho salmon generally increased over the 2009 sampling season, but averages fluctuated greatly due to low catch rates, e.g., only WOY 21 and 22 had catches of more than three age-0 coho. Mean FL of hatchery age-1 coho salmon was generally steady between 154 and 181 mm with no discernible pattern. Mean FL of natural age-1 coho salmon generally varied between 93 and 175 mm, with the three highest averages all in the month of April (Figure 7, Appendix 10).

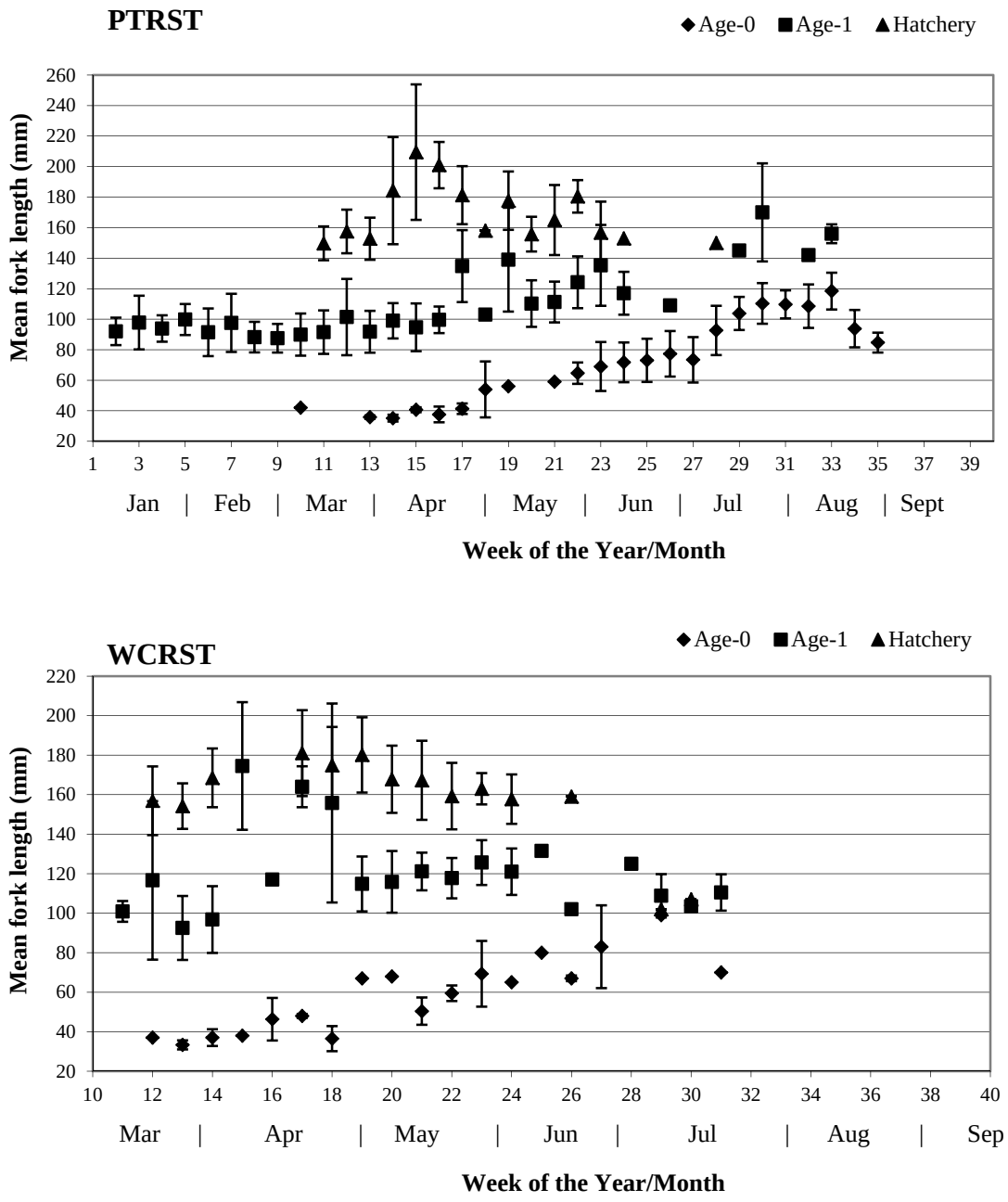


Figure 7. Weekly mean fork lengths for natural age-0, natural age-1, and hatchery coho salmon captured at PTRST and WCRST, 2009. Error bars represent one standard deviation of the mean.

*Steelhead*

Pear Tree

Naturally-produced age-0 steelhead weekly mean FL ranged from 29 mm in April, to 74 mm in late August, and increased steadily as the season progressed. Naturally-produced age-1 steelhead mean weekly FL ranged from 85 mm to 148 mm, and remained fairly consistent from January through mid-May before increasing steadily from June through the remainder of the season. Age-2 steelhead mean weekly FL, in weeks when three or more were measured, ranged from 170 mm to 197 mm, but no clear pattern in FL change

was seen as the season progressed. Hatchery steelhead mean weekly FL, when the sample size was three or more, ranged from 172 mm to 205 mm, with no discernible increase in mean FL as the season progressed (Figure 8, Appendix 11).

Willow Creek

Mean FL of age-0 steelhead generally increased over the 2009 sampling season when catch numbers were three or greater. Natural age-1 steelhead generally increased in size through the season, and the size of natural age-2+ steelhead was mostly constant with a small peak in April. Mean FL of hatchery age-1 steelhead generally decreased from an early average above 200 mm in March and April (Figure 8, Appendix 12).

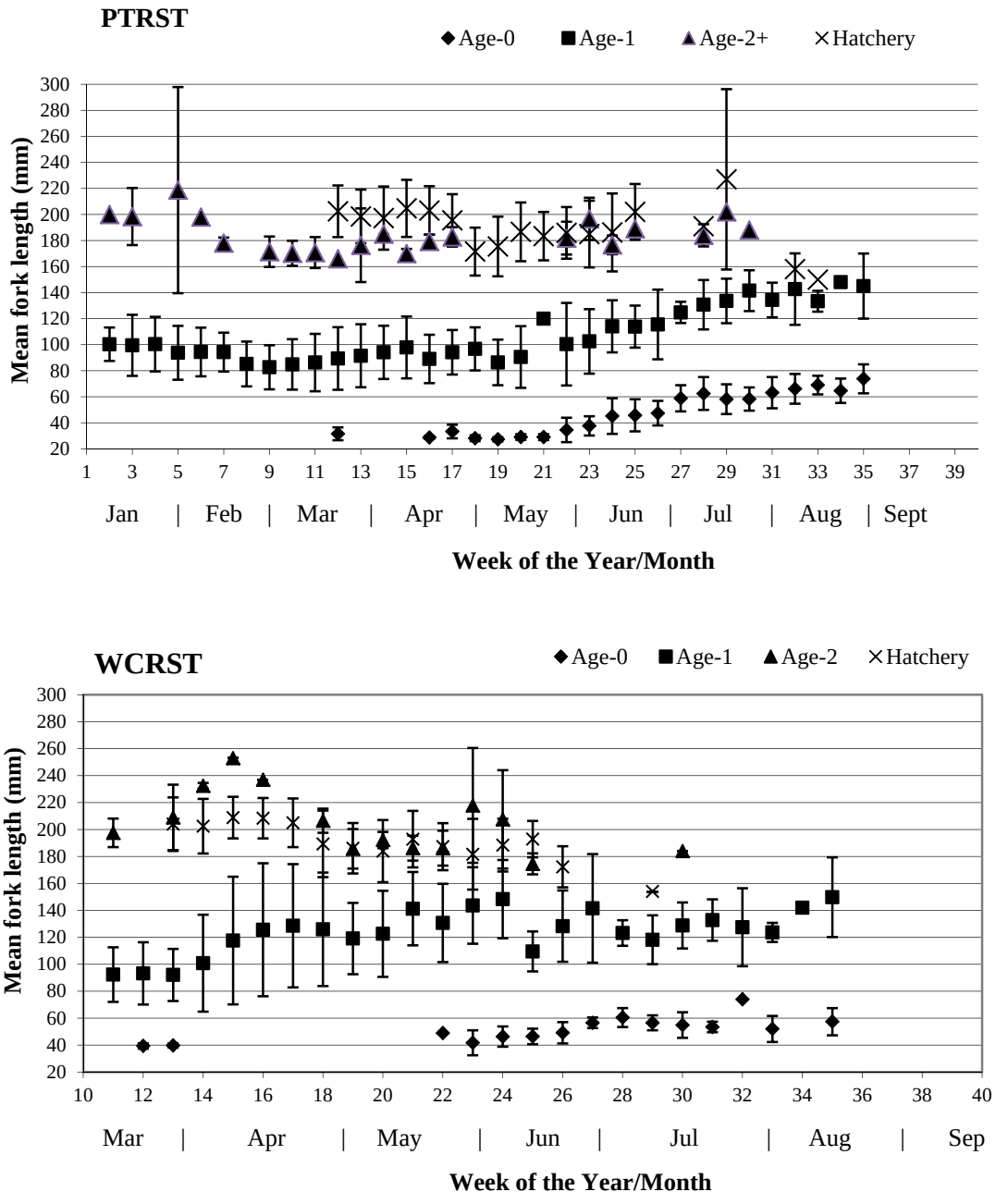


Figure 8. Weekly mean fork lengths for natural age-0, age-1, age-2, and hatchery age-1 steelhead captured at PTRST and WCRST, 2009. Error bars represent one standard deviation of the mean.

## Summary

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 2009 cooperatively by the Arcata Fish and Wildlife Office, Hoopa Valley Tribal Fisheries Department, and Yurok Tribal Fisheries Program. It is intended that this information will provide basic biological information that can be used by managers to evaluate the effectiveness of habitat restoration efforts, especially the new flow regimes recommended in the Record of Decision, in restoring the fishery resources of the Trinity River.

Sampling Efforts

The utilization of multiple traps beginning in 2002 has improved the ability to generate population estimates due to greater capture efficiency and a decreased possibility of losing catch data for a day if one trap has a flawed set, typically due to being clogged with debris. It is recommended that multiple traps continue to be utilized at both Trinity River trapping sites. While trapping operations have been refined to operate the traps at greater flows (>12,000 $ft^3/s$), high and variable flows during the beginning of the trapping seasons create challenges in maintaining effective sampling.

In 2009, trapping at PTRST and WCRST were initiated in the second week of January and March, respectively. 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, is sufficiently sampled, efforts were made to install the traps as early as possible and continue sampling throughout the summer. This allows comparable data, especially similar time periods, to be collected for inter-annual comparisons in emigration timing (duration and peak) and abundance. Additionally, it is important to point out that sampling a portion of the year (i.e. the spring/summer season) samples only a portion of the annual production, and all estimates of production refer only to the sampling period.

Salmonid Biological Information

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. Chinook salmon were captured at PTRST and WCRST throughout the 2009 sampling season with the spring/summer emigration dominated by naturally-produced fish comprising 70% and 79%, respectively, of the total emigration, based on mark-recapture population estimates. The estimate of the week in which 80% of the juvenile Chinook salmon population passed WCRST, as inferred from the flow based abundance index was WOY 26 (June 25-July1), which occurred prior to the Trinity River Restoration Program (TRRP) management target date of July 9.

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 juveniles rearing in the mainstem. Natural age-1 coho salmon emigrated through the Trinity River at PTRST and WCRST beginning prior to trap installation and continued through to late July in 2009, while hatchery age-1 coho salmon emigrated following their release in mid-March through late June. The age-1 coho salmon emigration is composed primarily of hatchery-produced fish at WCRST, comprising 61% of the total index in 2009, and dominated by naturally-produced fish at PTRST, comprising 82% of the total index in 2009 based on abundance indices,. The data suggest that the sampling period did not encompass the entire naturally-produced age-1 coho salmon emigration period at WCRST. It is possible that these naturally-produced age-1 coho salmon spend extended rearing in the Trinity Basin and emigrate in the late fall as larger individuals. The estimate of the week in which 80% of the natural coho salmon smolt population passed the WCRST was WOY 22 (May 28-June 3), which occurred prior to the TRRP management target date of June 4.

The steelhead populations (summer, fall, and winter races) in the Trinity River are composed of both tributary and mainstem spawning and rearing populations that exhibit highly variable juvenile life history patterns, as well as a hatchery-produced component. All age classes of steelhead were generally captured throughout the sampling season at PTRST and WCRST, with peaks in abundance occurring during the early portion of sampling for age-1, and in June for age-0 fish. Age-1 or older natural steelhead were present throughout the sampling period. The majority of hatchery-produced age-1 steelhead emigrated by the end of June. Based on abundance indices at PTRST and WCRST, the age-1+ steelhead emigration is composed of 47% and 35%, respectively, hatchery-produced fish. As with coho salmon smolts, it is likely that naturally-produced age-1 steelhead exhibit extended rearing in the Trinity Basin and emigrate in the fall/winter as larger individuals. The estimate of the week in which 80% of the steelhead smolt population passed the WCRST, as inferred from flow based abundance indices, was WOY 18 (April 30-May 6), which occurred prior to the TRRP management target date of May 22.

Abundance Indices

Since natural age-0 Chinook salmon were captured on the first day of trap operation in 2009, it is possible that a portion of the early spring natural age-0 Chinook salmon emigrated prior to trap installation.

Chinook Salmon Population Estimation

Since 2002, mark-recapture efforts to estimate the size of the emigrating Chinook salmon population, as well as estimate the precision of these estimates, were incorporated into trapping operations. These efforts in previous years were limited due to lack of sufficient funding. Flow based abundance indices calculated by catch numbers and the proportion of flow sampled by the trap(s) have been the quantification method employed for many years (USFWS 1991, 1994, 1998, 1999, and 2001), and are generally thought to be adequate indicators of emigration timing and duration if sampling occurred in all weeks of the sampling period. A shortcoming of the abundance indices is that they do not provide a measure of the precision of the indices, making inter-year comparisons questionable. Mark-recapture efforts employed since 2002 (Pinnix et al. 2007; Pinnix and Quinn 2009, Pinnix et al. 2010) indicate that precise population estimates can be obtained (95% confidence intervals ranging from 9% to 55% of the estimate) depending

on the proportion of the population marked (marking rate), and capture efficiency (recapture rate).

During the 2009 sampling season, marked hatchery Chinook salmon were used to estimate capture efficiency to generate population estimates during the sampling period. The population estimate of naturally-produced age-0 Chinook salmon at PTRST was approximately 1.74 million while the estimate at WCRST was approximately 2.99 million. It is likely that the WCRST estimate is higher due to recruitment of juvenile Chinook salmon from tributaries (i.e. North Fork Trinity River, South Fork Trinity River, and Willow Creek) and mainstem spawning below PTRST. It is interesting to note that the hatchery age-0 Chinook salmon estimates at the two sites were nearly the same, lending evidence to the theory that the higher natural estimate at WCRST is due to additions to the population downstream of PTRST, since there is no hatchery input between the two sites.

## Acknowledgements

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# Appendices

Appendix 1. Trinity River at PTRST weekly Chinook salmon catches, and abundance indices, 2009. NC = no clip, AD = adipose fin clip. Hatchery fish captured before WOY 23 were assumed to be age-1.

| | | | | Weekly Chinook Catch | | | | | Weekly Chinook Index Totals | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Week | Mean | Trap | Hatchery | | Natural | | | Hatchery | | Natural | | |
| Week | of the | Daily | Days | | | | | Catch | | | | | Index |
| Starting | Year | Discharge | Sampled | NC | AD | Age-0 | Age-1 | Total | NC | AD | Age-0 | Age-1 | Total |
| 01/08/09 | 2 | 649 | 4 | 0 | 0 | 15 | 10 | 25 | 0 | 0 | 220 | 147 | 367 |
| 01/15/09 | 3 | 613 | 14 | 3 | 1 | 94 | 87 | 185 | 12 | 4 | 372 | 344 | 732 |
| 01/22/09 | 4 | 536 | 14 | 6 | 2 | 385 | 106 | 499 | 21 | 7 | 1,355 | 373 | 1,756 |
| 01/30/09 | 5 | 475 | 14 | 36 | 12 | 1,162 | 104 | 1,314 | 115 | 38 | 3,677 | 328 | 4,158 |
| 02/05/09 | 6 | 540 | 14 | 30 | 10 | 592 | 73 | 705 | 109 | 36 | 2,105 | 257 | 2,507 |
| 02/12/09 | 7 | 689 | 10 | 12 | 4 | 1,151 | 82 | 1,249 | 75 | 25 | 7,274 | 519 | 7,893 |
| 02/19/09 | 8 | 1,521 | 11 | 21 | 7 | 2,258 | 100 | 2,386 | 269 | 89 | 28,678 | 1,268 | 30,304 |
| 02/26/09 | 9 | 1,936 | 12 | 6 | 2 | 1,123 | 74 | 1,205 | 94 | 31 | 17,559 | 1,157 | 18,841 |
| 03/05/09 | 10 | 1,185 | 14 | 15 | 5 | 2,277 | 42 | 2,339 | 115 | 38 | 17,377 | 320 | 17,850 |
| 03/12/09 | 11 | 941 | 14 | 12 | 4 | 2,492 | 15 | 2,523 | 75 | 25 | 15,264 | 90 | 15,454 |
| 03/19/09 | 12 | 946 | 14 | 42 | 14 | 1,579 | 46 | 1,681 | 263 | 87 | 9,767 | 281 | 10,398 |
| 03/26/09 | 13 | 901 | 14 | 15 | 5 | 1,046 | 30 | 1,096 | 88 | 29 | 6,042 | 172 | 6,331 |
| 04/02/09 | 14 | 773 | 14 | 9 | 3 | 766 | 4 | 782 | 45 | 15 | 3,813 | 20 | 3,893 |
| 04/09/09 | 15 | 741 | 14 | 3 | 1 | 2,702 | 6 | 2,712 | 15 | 5 | 13,067 | 29 | 13,116 |
| 04/16/09 | 16 | 845 | 14 | 6 | 2 | 10,408 | 12 | 10,428 | 33 | 11 | 56,395 | 65 | 56,504 |
| 04/23/09 | 17 | 1,203 | 14 | 9 | 3 | 12,145 | 6 | 12,163 | 72 | 24 | 96,031 | 47 | 96,174 |
| 04/30/09 | 18 | 5,276 | 12 | 0 | 0 | 186 | 1 | 187 | 0 | 0 | 9,256 | 50 | 9,306 |
| 05/07/09 | 19 | 4,397 | 14 | 0 | 0 | 407 | 2 | 409 | 0 | 0 | 13,317 | 65 | 13,382 |
| 05/14/09 | 20 | 3,070 | 14 | 0 | 0 | 862 | 0 | 862 | 0 | 0 | 18,882 | 0 | 18,882 |
| 05/21/09 | 21 | 2,620 | 10 | 0 | 0 | 465 | 0 | 465 | 0 | 0 | 12,808 | 0 | 12,808 |
| 05/28/09 | 22 | 2,166 | 14 | 0 | 0 | 724 | 27 | 751 | 0 | 0 | 11,111 | 414 | 11,525 |
| 06/04/09 | 23 | 1,659 | 14 | 2,588 | 854 | 2,272 | 0 | 5,714 | 29,025 | 9,576 | 25,472 | 0 | 64,073 |
| 06/11/09 | 24 | 1,336 | 14 | 2,405 | 794 | 1,134 | 1 | 4,334 | 21,560 | 7,113 | 10,146 | 9 | 38,828 |
| 06/18/09 | 25 | 942 | 14 | 2,741 | 904 | 1,856 | 0 | 5,501 | 17,877 | 5,898 | 12,113 | 0 | 35,888 |
| 06/25/09 | 26 | 802 | 14 | 2,145 | 708 | 1,674 | 0 | 4,527 | 12,363 | 4,079 | 9,638 | 0 | 26,080 |
| 07/02/09 | 27 | 590 | 10 | 2,311 | 762 | 989 | 0 | 4,062 | 13,527 | 4,463 | 5,800 | 0 | 23,790 |
| 07/09/09 | 28 | 520 | 14 | 4,111 | 1,356 | 1,349 | 0 | 6,816 | 15,046 | 4,964 | 4,940 | 0 | 24,950 |
| 07/16/09 | 29 | 517 | 14 | 1,860 | 614 | 1,058 | 0 | 3,532 | 6,659 | 2,197 | 3,780 | 0 | 12,636 |
| 07/23/09 | 30 | 481 | 14 | 1,272 | 420 | 980 | 0 | 2,672 | 4,265 | 1,407 | 3,280 | 0 | 8,952 |
| 07/30/09 | 31 | 489 | 14 | 875 | 289 | 365 | 0 | 1,529 | 3,037 | 1,002 | 1,261 | 0 | 5,300 |
| 08/06/09 | 32 | 505 | 14 | 262 | 87 | 166 | 0 | 515 | 937 | 309 | 583 | 0 | 1,829 |
| 08/13/09 | 33 | 492 | 8 | 345 | 114 | 119 | 0 | 578 | 2,158 | 712 | 738 | 0 | 3,608 |
| 08/20/09 | 34 | 1,086 | 8 | 159 | 53 | 356 | 0 | 568 | 2,116 | 698 | 4,662 | 0 | 7,476 |
| 08/27/09 | 35 | 564 | 4 | 63 | 21 | 30 | 0 | 114 | 749 | 247 | 343 | 0 | 1,339 |
| Totals | | | 425 | 21,362 | 7,051 | 55,187 | 828 | 84,428 | 130,720 | 43,129 | 427,126 | 5,955 | 606,930 |

Appendix 2. Trinity River at WCRST weekly Chinook salmon catches, and abundance indices, 2009. NC = no clip, AD = adipose fin clip.

| | Week | Mean | | Weekly Chinook Catch | | | | | Weekly Chinook Index Totals | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Week | Of the | Daily | Days | Hatchery | | Natural | | Catch | Hatchery | | Natural | | Index |
| Starting | Year | Discharge | Sampled | NC | AD | Age-0 | Age-1 | Total | NC | AD | Age-0 | Age-1 | Total |
| 03/12/09 | 11 | 8,225 | 12 | 0 | 0 | 134 | 99 | 233 | 0 | 0 | 3,760 | 5,548 | 9,308 |
| 03/19/09 | 12 | 6,735 | 13 | 0 | 0 | 262 | 24 | 287 | 0 | 0 | 7,973 | 865 | 8,902 |
| 03/26/09 | 13 | 5,175 | 21 | 0 | 0 | 591 | 22 | 617 | 0 | 0 | 10,889 | 276 | 11,338 |
| 04/02/09 | 14 | 4,125 | 21 | 0 | 0 | 1,643 | 7 | 1,654 | 0 | 0 | 25,339 | 58 | 25,496 |
| 04/09/09 | 15 | 3,595 | 21 | 0 | 0 | 435 | 8 | 443 | 0 | 0 | 5,559 | 102 | 5,661 |
| 04/16/09 | 16 | 3,610 | 21 | 0 | 0 | 1,126 | 0 | 1,126 | 0 | 0 | 14,370 | 0 | 14,370 |
| 04/23/09 | 17 | 3,450 | 21 | 0 | 0 | 2,859 | 0 | 2,862 | 0 | 0 | 34,693 | 0 | 34,728 |
| 04/30/09 | 18 | 7,085 | 12 | 0 | 0 | 2,028 | 3 | 2,034 | 0 | 0 | 94,130 | 70 | 94,514 |
| 05/07/09 | 19 | 8,635 | 12 | 0 | 0 | 1,140 | 3 | 1,143 | 0 | 0 | 53,425 | 151 | 53,576 |
| 05/14/09 | 20 | 5,645 | 14 | 0 | 0 | 3,101 | 0 | 3,101 | 0 | 0 | 86,381 | 0 | 86,381 |
| 05/21/09 | 21 | 4,455 | 14 | 0 | 0 | 2,375 | 0 | 2,375 | 0 | 0 | 51,976 | 0 | 51,976 |
| 05/28/09 | 22 | 3,675 | 16 | 0 | 0 | 8,106 | 0 | 8,106 | 0 | 0 | 127,256 | 0 | 127,256 |
| 06/04/09 | 23 | 3,145 | 16 | 747 | 249 | 9,494 | 0 | 10,490 | 11,215 | 3,739 | 149,932 | 0 | 164,886 |
| 06/11/09 | 24 | 2,445 | 21 | 2,688 | 896 | 12,183 | 0 | 15,767 | 23,649 | 7,883 | 109,594 | 0 | 141,126 |
| 06/18/09 | 25 | 1,895 | 20 | 6,729 | 2,243 | 17,081 | 0 | 26,053 | 50,342 | 16,781 | 131,320 | 0 | 198,443 |
| 06/25/09 | 26 | 1,550 | 21 | 10,437 | 3,479 | 31,880 | 0 | 45,796 | 64,489 | 21,497 | 191,519 | 0 | 277,505 |
| 07/02/09 | 27 | 1,210 | 15 | 3,372 | 1,124 | 13,618 | 0 | 18,114 | 24,618 | 8,206 | 96,828 | 0 | 129,652 |
| 07/09/09 | 28 | 980 | 21 | 1,845 | 615 | 10,230 | 0 | 12,690 | 8,719 | 2,906 | 49,907 | 0 | 61,532 |
| 07/16/09 | 29 | 869 | 21 | 855 | 285 | 5,693 | 0 | 6,833 | 3,402 | 1,134 | 22,360 | 0 | 26,896 |
| 07/23/09 | 30 | 771 | 21 | 426 | 142 | 1,835 | 0 | 2,403 | 1,439 | 480 | 6,194 | 0 | 8,113 |
| 07/30/09 | 31 | 736 | 18 | 84 | 28 | 738 | 0 | 850 | 289 | 96 | 2,537 | 0 | 2,922 |
| 08/06/09 | 32 | 791 | 16 | 3 | 1 | 127 | 0 | 131 | 16 | 5 | 529 | 0 | 550 |
| 08/13/09 | 33 | 702 | 15 | 12 | 4 | 66 | 0 | 82 | 64 | 21 | 193 | 0 | 278 |
| 08/20/09 | 34 | 791 | 10 | 9 | 3 | 29 | 0 | 41 | 53 | 18 | 119 | 0 | 190 |
| 08/27/09 | 35 | 1,107 | 20 | 6 | 2 | 134 | 0 | 142 | 25 | 8 | 574 | 0 | 607 |
| Total | | | 433 | 27,213 | 9,071 | 126,908 | 166 | 163,373 | 188,320 | 62,774 | 1,277,357 | 7,070 | 1,536,206 |

Appendix 3. Trinity River at PTRST weekly coho salmon catches, and abundance indices, 2009. R-MAX = right maxillary clip.

| Week Starting | Week of the Year | Mean Daily Discharge | Trap Days Sampled | Weekly coho salmon catches | | | | Weekly coho salmon indices | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hatchery | Natural | | Catch | Hatchery | Natural | | Index |
| | | | | R-MAX | Age-0 | Age-1 | Total | R-MAX | Age-0 | Age-1 | Total |
| 01/08/09 | 2 | 649 | 4 | 0 | 0 | 6 | 6 | 0 | 0 | 88 | 88 |
| 01/15/09 | 3 | 613 | 14 | 0 | 0 | 17 | 17 | 0 | 0 | 67 | 67 |
| 01/22/09 | 4 | 536 | 14 | 0 | 0 | 8 | 8 | 0 | 0 | 28 | 28 |
| 01/30/09 | 5 | 475 | 14 | 0 | 0 | 20 | 20 | 0 | 0 | 63 | 63 |
| 02/05/09 | 6 | 540 | 14 | 0 | 0 | 7 | 7 | 0 | 0 | 25 | 25 |
| 02/12/09 | 7 | 689 | 10 | 0 | 0 | 17 | 17 | 0 | 0 | 107 | 107 |
| 02/19/09 | 8 | 1,521 | 11 | 0 | 0 | 115 | 115 | 0 | 0 | 1,461 | 1,461 |
| 02/26/09 | 9 | 1,936 | 12 | 0 | 0 | 142 | 142 | 0 | 0 | 2,220 | 2,220 |
| 03/05/09 | 10 | 1,185 | 14 | 0 | 2 | 171 | 173 | 0 | 15 | 1,305 | 1,320 |
| 03/12/09 | 11 | 941 | 14 | 7 | 0 | 30 | 37 | 43 | 0 | 184 | 227 |
| 03/19/09 | 12 | 946 | 14 | 188 | 0 | 34 | 222 | 1,163 | 0 | 210 | 1,373 |
| 03/26/09 | 13 | 901 | 14 | 9 | 5 | 14 | 28 | 52 | 29 | 81 | 162 |
| 04/02/09 | 14 | 773 | 14 | 4 | 8 | 7 | 19 | 20 | 40 | 35 | 95 |
| 04/09/09 | 15 | 741 | 14 | 4 | 18 | 6 | 28 | 19 | 87 | 29 | 135 |
| 04/16/09 | 16 | 845 | 14 | 4 | 15 | 7 | 26 | 22 | 81 | 38 | 141 |
| 04/23/09 | 17 | 1,203 | 14 | 15 | 8 | 5 | 28 | 119 | 63 | 39 | 221 |
| 04/30/09 | 18 | 5,276 | 12 | 1 | 3 | 1 | 5 | 50 | 149 | 50 | 249 |
| 05/07/09 | 19 | 4,397 | 14 | 3 | 1 | 6 | 10 | 98 | 33 | 196 | 327 |
| 05/14/09 | 20 | 3,070 | 14 | 4 | 0 | 5 | 9 | 88 | 0 | 109 | 197 |
| 05/21/09 | 21 | 2,620 | 10 | 3 | 1 | 4 | 8 | 83 | 28 | 109 | 220 |
| 05/28/09 | 22 | 2,166 | 14 | 2 | 8 | 5 | 15 | 31 | 123 | 76 | 230 |
| 06/04/09 | 23 | 1,659 | 14 | 8 | 3 | 15 | 26 | 90 | 34 | 168 | 292 |
| 06/11/09 | 24 | 1,336 | 14 | 1 | 8 | 5 | 14 | 9 | 72 | 44 | 125 |
| 06/18/09 | 25 | 942 | 14 | 0 | 9 | 0 | 9 | 0 | 59 | 0 | 59 |
| 06/25/09 | 26 | 802 | 14 | 0 | 11 | 1 | 12 | 0 | 63 | 6 | 69 |
| 07/02/09 | 27 | 590 | 10 | 0 | 5 | 0 | 5 | 0 | 29 | 0 | 29 |
| 07/09/09 | 28 | 520 | 14 | 1 | 21 | 0 | 22 | 4 | 77 | 0 | 81 |
| 07/16/09 | 29 | 517 | 14 | 0 | 55 | 1 | 56 | 0 | 197 | 3 | 200 |
| 07/23/09 | 30 | 481 | 14 | 0 | 84 | 4 | 88 | 0 | 281 | 14 | 295 |
| 07/30/09 | 31 | 489 | 14 | 1 | 37 | 0 | 38 | 3 | 128 | 1 | 132 |
| 08/06/09 | 32 | 505 | 14 | 0 | 15 | 1 | 16 | 0 | 53 | 4 | 57 |
| 08/13/09 | 33 | 492 | 8 | 0 | 7 | 4 | 11 | 0 | 44 | 25 | 69 |
| 08/20/09 | 34 | 1,086 | 8 | 0 | 6 | 0 | 6 | 0 | 79 | 0 | 79 |
| 08/27/09 | 35 | 564 | 4 | 0 | 6 | 0 | 6 | 0 | 70 | 0 | 70 |
| Total | | | 425 | 255 | 336 | 658 | 1,249 | 1,894 | 1,834 | 6,785 | 10,513 |

Appendix 4. Trinity River at WCRST weekly coho salmon catches, and abundance indices, 2009. R-MAX = right maxillary clip.

| Week Starting | Week of the Year | Man Daily Discharge | Trap Days Sampled | Weekly coho salmon catches | | | | Weekly coho salmon indices | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hatchery | Natural | | Catch | Hatchery | Natural | | Index |
| | | | | R-MAX | Age-0 | Age-1 | Total | R-MAX | Age-0 | Age-1 | Total |
| 03/12/09 | 11 | 8,225 | 12 | 0 | 0 | 10 | 10 | 0 | 0 | 340 | 340 |
| 03/19/09 | 12 | 6,735 | 13 | 64 | 1 | 16 | 81 | 2255 | 32 | 477 | 2,764 |
| 03/26/09 | 13 | 5,175 | 21 | 10 | 3 | 13 | 26 | 169 | 54 | 241 | 464 |
| 04/02/09 | 14 | 4,125 | 21 | 2 | 2 | 9 | 13 | 28 | 33 | 142 | 203 |
| 04/09/09 | 15 | 3,595 | 21 | 0 | 1 | 47 | 48 | 0 | 13 | 607 | 620 |
| 04/16/09 | 16 | 3,610 | 21 | 0 | 3 | 1 | 4 | 0 | 37 | 13 | 50 |
| 04/23/09 | 17 | 3,450 | 21 | 12 | 3 | 3 | 18 | 154 | 39 | 35 | 228 |
| 04/30/09 | 18 | 7,085 | 12 | 52 | 4 | 11 | 67 | 2750 | 265 | 580 | 3,595 |
| 05/07/09 | 19 | 8,635 | 12 | 22 | 1 | 5 | 28 | 1139 | 36 | 233 | 1,408 |
| 05/14/09 | 20 | 5,645 | 14 | 21 | 1 | 6 | 28 | 559 | 29 | 158 | 746 |
| 05/21/09 | 21 | 4,455 | 14 | 16 | 5 | 9 | 30 | 356 | 109 | 192 | 657 |
| 05/28/09 | 22 | 3,675 | 16 | 25 | 13 | 31 | 69 | 478 | 167 | 583 | 1,228 |
| 06/04/09 | 23 | 3,145 | 16 | 6 | 7 | 20 | 33 | 110 | 105 | 303 | 518 |
| 06/11/09 | 24 | 2,445 | 21 | 13 | 2 | 10 | 25 | 120 | 18 | 90 | 228 |
| 06/18/09 | 25 | 1,895 | 20 | 0 | 2 | 3 | 5 | 0 | 15 | 26 | 41 |
| 06/25/09 | 26 | 1,550 | 21 | 1 | 4 | 2 | 7 | 7 | 26 | 12 | 45 |
| 07/02/09 | 27 | 1,210 | 15 | 0 | 3 | 2 | 5 | 0 | 22 | 15 | 37 |
| 07/09/09 | 28 | 980 | 21 | 0 | 0 | 1 | 1 | 0 | 0 | 4 | 4 |
| 07/16/09 | 29 | 869 | 21 | 1 | 1 | 5 | 7 | 4 | 4 | 23 | 31 |
| 07/23/09 | 30 | 771 | 21 | 1 | 1 | 3 | 5 | 3 | 3 | 18 | 24 |
| 07/30/09 | 31 | 736 | 18 | 0 | 1 | 2 | 3 | 0 | 3 | 6 | 9 |
| 08/06/09 | 32 | 791 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08/13/09 | 33 | 702 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08/20/09 | 34 | 791 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08/27/09 | 35 | 1,107 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | | 433 | 246 | 58 | 209 | 513 | 8,132 | 1,010 | 4,098 | 13,240 |

Appendix 5. Trinity River at PTRST weekly steelhead catches, and abundance indices, 2009. AD = adipose fin clip.

| Week Starting | Week of the Year | Mean Flow | Trap Days Sampled | Weekly Steelhead Catch | | | | | Weekly Steelhead Abundance Indices | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hatchery AD | Natural Age-0 | Natural Age-1+ | Natural Age 2+ | Catch Total | Hatchery AD | Natural Age-0 | Natural Age-1+ | Natural Age 2+ | Index Total |
| 01/08/09 | 2 | 649 | 4 | 0 | 0 | 3 | 1 | 4 | 0 | 0 | 44 | 15 | 59 |
| 01/15/09 | 3 | 613 | 14 | 0 | 0 | 18 | 5 | 23 | 0 | 0 | 71 | 20 | 91 |
| 01/22/09 | 4 | 536 | 14 | 0 | 0 | 27 | 0 | 27 | 0 | 0 | 95 | 0 | 95 |
| 01/30/09 | 5 | 475 | 14 | 0 | 0 | 38 | 3 | 41 | 0 | 0 | 120 | 9 | 129 |
| 02/05/09 | 6 | 540 | 14 | 0 | 0 | 33 | 1 | 34 | 0 | 0 | 117 | 4 | 121 |
| 02/12/09 | 7 | 689 | 10 | 0 | 0 | 75 | 2 | 77 | 0 | 0 | 474 | 13 | 487 |
| 02/19/09 | 8 | 1,521 | 11 | 0 | 0 | 420 | 0 | 420 | 0 | 0 | 5,334 | 0 | 5,334 |
| 02/26/09 | 9 | 1,936 | 12 | 0 | 0 | 1,016 | 5 | 1,021 | 0 | 0 | 15,886 | 78 | 15,964 |
| 03/05/09 | 10 | 1,185 | 14 | 0 | 0 | 445 | 5 | 450 | 0 | 0 | 3,396 | 38 | 3,434 |
| 03/12/09 | 11 | 941 | 14 | 0 | 0 | 146 | 4 | 150 | 0 | 0 | 894 | 25 | 919 |
| 03/19/09 | 12 | 946 | 14 | 378 | 2 | 128 | 1 | 509 | 2,338 | 12 | 792 | 6 | 3,148 |
| 03/26/09 | 13 | 901 | 14 | 1,570 | 0 | 230 | 1 | 1,801 | 9,069 | 0 | 1,329 | 6 | 10,404 |
| 04/02/09 | 14 | 773 | 14 | 481 | 1 | 95 | 2 | 579 | 2,394 | 5 | 473 | 10 | 2,882 |
| 04/09/09 | 15 | 741 | 14 | 653 | 3 | 122 | 4 | 782 | 3,158 | 15 | 590 | 19 | 3,782 |
| 04/16/09 | 16 | 845 | 14 | 568 | 19 | 252 | 6 | 845 | 3,078 | 103 | 1,365 | 33 | 4,579 |
| 04/23/09 | 17 | 1,203 | 14 | 377 | 16 | 156 | 6 | 555 | 2,981 | 127 | 1,233 | 47 | 4,388 |
| 04/30/09 | 18 | 5,276 | 12 | 4 | 21 | 4 | 0 | 29 | 199 | 1,045 | 199 | 0 | 1,443 |
| 05/07/09 | 19 | 4,397 | 14 | 10 | 20 | 24 | 0 | 54 | 327 | 654 | 785 | 0 | 1,766 |
| 05/14/09 | 20 | 3,070 | 14 | 6 | 64 | 26 | 0 | 96 | 131 | 1,402 | 570 | 0 | 2,103 |
| 05/21/09 | 21 | 2,620 | 10 | 12 | 58 | 1 | 0 | 71 | 331 | 1,598 | 28 | 0 | 1,957 |
| 05/28/09 | 22 | 2,166 | 14 | 18 | 29 | 22 | 6 | 75 | 276 | 445 | 338 | 92 | 1,151 |
| 06/04/09 | 23 | 1,659 | 14 | 44 | 30 | 20 | 6 | 100 | 493 | 336 | 224 | 67 | 1,120 |
| 06/11/09 | 24 | 1,336 | 14 | 14 | 50 | 10 | 3 | 77 | 125 | 448 | 90 | 27 | 690 |
| 06/18/09 | 25 | 942 | 14 | 8 | 73 | 8 | 1 | 90 | 52 | 476 | 52 | 7 | 587 |
| 06/25/09 | 26 | 802 | 14 | 0 | 86 | 14 | 0 | 100 | 0 | 495 | 81 | 0 | 576 |
| 07/02/09 | 27 | 590 | 10 | 0 | 35 | 9 | 0 | 44 | 0 | 205 | 53 | 0 | 258 |
| 07/09/09 | 28 | 520 | 14 | 1 | 110 | 20 | 2 | 133 | 4 | 403 | 73 | 7 | 487 |
| 07/16/09 | 29 | 517 | 14 | 2 | 168 | 19 | 1 | 190 | 7 | 601 | 68 | 4 | 680 |
| 07/23/09 | 30 | 481 | 14 | 0 | 214 | 10 | 1 | 225 | 0 | 717 | 34 | 3 | 754 |
| 07/30/09 | 31 | 489 | 14 | 1 | 67 | 9 | 0 | 77 | 3 | 232 | 31 | 0 | 266 |
| 08/06/09 | 32 | 505 | 14 | 1 | 30 | 11 | 0 | 42 | 4 | 107 | 39 | 0 | 150 |
| 08/13/09 | 33 | 492 | 8 | 1 | 17 | 4 | 0 | 22 | 6 | 106 | 25 | 0 | 137 |
| 08/20/09 | 34 | 1,086 | 8 | 0 | 49 | 1 | 0 | 50 | 0 | 645 | 13 | 0 | 658 |
| 08/27/09 | 35 | 564 | 4 | 0 | 131 | 3 | 0 | 134 | 0 | 1,539 | 35 | 0 | 1,574 |
| Total | | | 425 | 4,149 | 1,293 | 3,419 | 66 | 8,927 | 24,976 | 11,716 | 34,951 | 530 | 72,173 |

Appendix 6. Trinity River at WCRST weekly steelhead catches, and abundance indices, 2009. AD = adipose fin clip.

| Week Starting | Week of the Year | Mean Flow | Trap Days Sampled | Weekly Steelhead Catch | | | | | Weekly Steelhead Abundance Indices | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hatchery AD | Natural Age-0 | Natural Age-1 | Natural Age-2+ | Catch Total | Hatchery AD | Natural Age-0 | Natural Age-1 | Natural Age-2+ | Index Total |
| 03/12/09 | 11 | 8,225 | 12 | 0 | 0 | 251 | 2 | 253 | 0 | 0 | 10,622 | 194 | 10,816 |
| 03/19/09 | 12 | 6,735 | 13 | 0 | 23 | 184 | 0 | 207 | 0 | 1,311 | 6,090 | 0 | 7,401 |
| 03/26/09 | 13 | 5,175 | 21 | 173 | 5 | 376 | 4 | 558 | 2,597 | 119 | 6,464 | 593 | 9,773 |
| 04/02/09 | 14 | 4,125 | 21 | 367 | 0 | 980 | 2 | 1,349 | 5,453 | 0 | 14,608 | 203 | 20,264 |
| 04/09/09 | 15 | 3,595 | 21 | 722 | 0 | 473 | 1 | 1,196 | 9,046 | 0 | 6,034 | 392 | 15,472 |
| 04/16/09 | 16 | 3,610 | 21 | 625 | 0 | 463 | 1 | 1,089 | 8,210 | 0 | 6,062 | 384 | 14,656 |
| 04/23/09 | 17 | 3,450 | 21 | 1,146 | 0 | 592 | 0 | 1,738 | 13,885 | 0 | 7,146 | 0 | 21,031 |
| 04/30/09 | 18 | 7,085 | 12 | 655 | 1 | 250 | 9 | 915 | 27,717 | 73 | 12,733 | 1,088 | 40,611 |
| 05/07/09 | 19 | 8,635 | 12 | 135 | 4 | 81 | 16 | 236 | 6,514 | 179 | 3,973 | 1,100 | 11,766 |
| 05/14/09 | 20 | 5,645 | 14 | 76 | 0 | 67 | 8 | 151 | 2,129 | 0 | 1,814 | 518 | 4,461 |
| 05/21/09 | 21 | 4,455 | 14 | 78 | 0 | 60 | 11 | 149 | 1,690 | 0 | 1,309 | 1,188 | 3,917 |
| 05/28/09 | 22 | 3,675 | 16 | 89 | 1 | 145 | 26 | 261 | 1,581 | 12 | 2,449 | 1,371 | 5,413 |
| 06/04/09 | 23 | 3,145 | 16 | 111 | 7 | 123 | 9 | 250 | 1,626 | 149 | 1,934 | 208 | 3,917 |
| 06/11/09 | 24 | 2,445 | 21 | 71 | 13 | 56 | 8 | 148 | 655 | 108 | 526 | 186 | 1,475 |
| 06/18/09 | 25 | 1,895 | 20 | 20 | 26 | 9 | 2 | 57 | 170 | 194 | 78 | 38 | 480 |
| 06/25/09 | 26 | 1,550 | 21 | 12 | 50 | 35 | 0 | 97 | 89 | 301 | 242 | 0 | 632 |
| 07/02/09 | 27 | 1,210 | 15 | 4 | 20 | 24 | 0 | 48 | 31 | 139 | 168 | 0 | 338 |
| 07/09/09 | 28 | 980 | 21 | 0 | 11 | 21 | 0 | 32 | 0 | 65 | 100 | 0 | 165 |
| 07/16/09 | 29 | 869 | 21 | 3 | 23 | 22 | 0 | 48 | 16 | 94 | 92 | 0 | 202 |
| 07/23/09 | 30 | 771 | 21 | 0 | 26 | 32 | 1 | 59 | 0 | 87 | 106 | 8 | 193 |
| 07/30/09 | 31 | 736 | 18 | 0 | 5 | 94 | 0 | 99 | 0 | 17 | 323 | 0 | 340 |
| 08/06/09 | 32 | 791 | 16 | 0 | 6 | 7 | 0 | 13 | 0 | 65 | 33 | 0 | 98 |
| 08/13/09 | 33 | 702 | 15 | 0 | 3 | 4 | 0 | 7 | 0 | 11 | 14 | 0 | 25 |
| 08/20/09 | 34 | 791 | 10 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 8 | 0 | 8 |
| 08/27/09 | 35 | 1,107 | 20 | 0 | 51 | 5 | 0 | 56 | 0 | 256 | 27 | 0 | 283 |
| Total | | | 433 | 4,287 | 275 | 4,356 | 100 | 9,018 | 81,409 | 3,180 | 82,955 | 7,471 | 175,015 |

Appendix 7. PTRST weekly age-0 Chinook salmon population estimate input and results, 2009.

| WOY | Sampling Fraction | Catch NC | Catch AC | Marks Released | Marks Recaptured | Recapture Rate | Estimated Natural | SD Natural | Estimated Hatchery | SD Hatchery |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.29 | 15 | 0 | 0 | 0 | | 2,357 | 1,815 | | |
| 3 | 1 | 94 | 0 | 0 | 0 | | 4,117 | 2,844 | | |
| 4 | 1 | 385 | 0 | 833 | 52 | 0.062 | 6,358 | 903 | | |
| 5 | 1 | 1,162 | 0 | 852 | 67 | 0.079 | 14,933 | 1,786 | | |
| 6 | 1 | 592 | 0 | 1,495 | 77 | 0.052 | 11,734 | 1,362 | | |
| 7 | 0.71 | 1,151 | 0 | 1,356 | 182 | 0.134 | 12,220 | 893 | | |
| 8 | 0.86 | 2,258 | 0 | 1,889 | 145 | 0.077 | 34,433 | 2,859 | | |
| 9 | 1 | 1,123 | 0 | 2,934 | 89 | 0.030 | 36,903 | 3,922 | | |
| 10 | 1 | 2,277 | 0 | 1,546 | 53 | 0.034 | 64,694 | 8,303 | | |
| 11 | 1 | 2,492 | 0 | 4,001 | 232 | 0.058 | 43,128 | 2,860 | | |
| 12 | 1 | 1,579 | 0 | 2,955 | 158 | 0.053 | 29,894 | 2,405 | | |
| 13 | 1 | 1,046 | 0 | 529 | 14 | 0.026 | 43,252 | 11,279 | | |
| 14 | 1 | 766 | 0 | 1,172 | 49 | 0.042 | 19,739 | 2,854 | | |
| 15 | 1 | 2,702 | 0 | 3,204 | 232 | 0.072 | 37,813 | 2,542 | | |
| 16 | 1 | 10,408 | 0 | 1,328 | 57 | 0.043 | 241,567 | 28,764 | | |
| 17 | 1 | 12,145 | 0 | 3,540 | 114 | 0.032 | 372,688 | 32,424 | | |
| 18 | 1 | 186 | 0 | 4,791 | 45 | 0.009 | 21,309 | 3,532 | | |
| 19 | 1 | 407 | 0 | 4,808 | 11 | 0.002 | 138,091 | 34,338 | | |
| 20 | 1 | 862 | 0 | 5,952 | 44 | 0.007 | 112,139 | 16,245 | | |
| 21 | 0.71 | 465 | 0 | 3,852 | 55 | 0.014 | 46,789 | 6,479 | | |
| 22 | 1 | 724 | 0 | 2,621 | 17 | 0.006 | 101,028 | 22,264 | | |
| 23 | 1 | 4,860 | 854 | 2,131 | 37 | 0.017 | 124,394 | 20,683 | 190,445 | 30,380 |
| 24 | 1 | 3,539 | 794 | 5,002 | 152 | 0.030 | 37,562 | 4,450 | 106,260 | 9,217 |
| 25 | 1 | 4,597 | 904 | 3,706 | 120 | 0.032 | 56,619 | 6,281 | 111,551 | 11,085 |
| 26 | 1 | 3,819 | 708 | 1,225 | 44 | 0.036 | 45,699 | 6,636 | 78,360 | 10,444 |
| 27 | 0.71 | 3,300 | 762 | 723 | 45 | 0.062 | 22,834 | 3,879 | 71,153 | 11,093 |
| 28 | 1 | 5,460 | 1,356 | 2,895 | 167 | 0.058 | 23,030 | 2,859 | 94,294 | 7,529 |
| 29 | 1 | 2,918 | 614 | 1,395 | 117 | 0.084 | 12,796 | 1,571 | 30,195 | 2,937 |
| 30 | 1 | 2,252 | 420 | 479 | 77 | 0.161 | 6,457 | 834 | 11,204 | 1,273 |
| 31 | 1 | 1,240 | 289 | 964 | 74 | 0.077 | 4,908 | 956 | 15,732 | 1,984 |
| 32 | 1 | 428 | 87 | 2,803 | 288 | 0.103 | 1,690 | 324 | 3,490 | 397 |
| 33 | 0.57 | 464 | 114 | 952 | 51 | 0.054 | 3,620 | 976 | 14,908 | 2,243 |
| 34 | 0.57 | 515 | 53 | 880 | 126 | 0.143 | 4,327 | 455 | 2,722 | 354 |
| 35 | 0.29 | 93 | 21 | 0 | 0 | 0.000 | 1,315 | 870 | 4,310 | 2,734 |
| | | **76,324** | **6,976** | **72,813** | **2,991** | **0.041** | **1,740,438** | **77,966** | **734,625** | **44,891** |

Appendix 8. Trinity River at WCRST weekly age-0 Chinook salmon population estimate input and results, 2009.

| WOY | Sampling Fraction | Catch NC | Catch AC | Marks Released | Marks Recaptured | Recapture Rate | Estimated Natural | SD Natural | Estimated Hatchery | SD Hatchery |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 0.86 | 233 | 0 | 1,570 | 34 | 0.022 | 11,683 | 1,954 | | |
| 12 | 0.93 | 287 | 0 | 1,381 | 105 | 0.076 | 4,309 | 470 | | |
| 13 | 1 | 617 | 0 | 580 | 29 | 0.050 | 12,059 | 2,171 | | |
| 14 | 1 | 1,654 | 0 | 500 | 82 | 0.164 | 18,976 | 9,407 | | |
| 15 | 1 | 443 | 0 | 500 | 88 | 0.176 | 13,815 | 6,195 | | |
| 16 | 1 | 1,126 | 0 | 1,000 | 121 | 0.121 | 9,972 | 926 | | |
| 17 | 1 | 2,862 | 0 | 1,651 | 99 | 0.060 | 48,240 | 4,728 | | |
| 18 | 0.86 | 2,034 | 0 | 1,188 | 14 | 0.012 | 136,713 | 28,138 | | |
| 19 | 0.86 | 1,143 | 0 | 1,188 | 15 | 0.013 | 89,322 | 18,966 | | |
| 20 | 1 | 3,101 | 0 | 944 | 55 | 0.058 | 101,621 | 29,259 | | |
| 21 | 1 | 2,375 | 0 | 1,659 | 46 | 0.028 | 87,753 | 11,819 | | |
| 22 | 0.76 | 7,984 | 0 | 2,454 | 110 | 0.045 | 234,459 | 22,519 | | |
| 23 | 0.76 | 10,241 | 249 | 1,454 | 76 | 0.052 | 237,114 | 23,792 | 24,919 | 2,853 |
| 24 | 1 | 14,871 | 896 | 911 | 38 | 0.042 | 325,214 | 61,325 | 96,277 | 19,114 |
| 25 | 0.95 | 23,810 | 2,243 | 672 | 26 | 0.039 | 483,343 | 108,367 | 254,105 | 57,339 |
| 26 | 1 | 42,317 | 3,479 | 778 | 40 | 0.051 | 558,657 | 72,493 | 243,859 | 31,351 |
| 27 | 0.71 | 16,990 | 1,124 | 843 | 65 | 0.077 | 266,599 | 24,409 | 88,314 | 8,358 |
| 28 | 1 | 12,075 | 615 | 714 | 50 | 0.070 | 161,131 | 21,265 | 38,868 | 5,367 |
| 29 | 1 | 6,548 | 285 | 855 | 41 | 0.048 | 117,138 | 15,890 | 23,350 | 3,329 |
| 30 | 1 | 2,269 | 140 | 0 | 0 | na | 37,624 | 12,507 | 11,280 | 3,879 |
| 31 | 0.86 | 829 | 23 | 0 | 0 | na | 19,420 | 7,263 | 2,442 | 1,001 |
| 32 | 0.76 | 139 | 1 | 957 | 27 | 0.028 | 6,464 | 1,277 | 539 | 237 |
| 33 | 0.71 | 75 | 2 | 428 | 11 | 0.026 | 3,297 | 868 | 373 | 177 |
| 34 | 0.71 | 38 | 3 | 813 | 55 | 0.068 | 771 | 164 | 167 | 78 |
| 35 | 0.95 | 140 | 1 | 0 | 0 | na | 2,141 | 1,170 | 65 | 65 |
| | **Totals** | **154,201** | **9,061** | **23,040** | **1,227** | **0.053** | **2,987,837** | **212,008** | **784,557** | **88,501** |

Appendix 9. Trinity River at PTRST weekly Chinook salmon and coho salmon fork lengths, 2009.

| Week | Week of the | Chinook salmon | | | | | | | | | | Natural coho salmon | | | | | | | | | | Hatchery coho salmon | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Age-0 | | | | | Age-1 | | | | | Age-0 | | | | | Age-1 | | | | | Age-1 | | | | |
| Starting | Year | 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 |
| 1/8/09 | 2 | 14 | 39.8 | 35 | 44 | 1.9 | 10 | 95.3 | 87 | 106 | 5.8 | 0 | ---- | ---- | ---- | ---- | 6 | 92.0 | 81 | 102 | 9.0 | 0 | ---- | ---- | ---- | ---- |
| 1/15/09 | 3 | 94 | 40.9 | 37 | 56 | 2.3 | 91 | 100.4 | 71 | 184 | 23.2 | 0 | ---- | ---- | ---- | ---- | 17 | 97.8 | 63 | 142 | 17.6 | 0 | ---- | ---- | ---- | ---- |
| 1/22/09 | 4 | 281 | 41.1 | 37 | 69 | 2.5 | 114 | 94.5 | 74 | 178 | 15.4 | 0 | ---- | ---- | ---- | ---- | 8 | 93.9 | 83 | 104 | 8.7 | 0 | ---- | ---- | ---- | ---- |
| 1/29/09 | 5 | 424 | 40.9 | 32 | 61 | 2.2 | 152 | 92.9 | 71 | 185 | 14.7 | 0 | ---- | ---- | ---- | ---- | 20 | 99.8 | 83 | 115 | 10.2 | 0 | ---- | ---- | ---- | ---- |
| 2/5/09 | 6 | 314 | 41.6 | 35 | 50 | 1.9 | 110 | 90.4 | 70 | 200 | 13.9 | 0 | ---- | ---- | ---- | ---- | 7 | 91.4 | 71 | 116 | 15.6 | 0 | ---- | ---- | ---- | ---- |
| 2/12/09 | 7 | 297 | 42.2 | 37 | 65 | 2.9 | 97 | 91.8 | 74 | 190 | 12.5 | 0 | ---- | ---- | ---- | ---- | 17 | 97.6 | 74 | 156 | 19.1 | 0 | ---- | ---- | ---- | ---- |
| 2/19/09 | 8 | 408 | 42.7 | 37 | 58 | 3.5 | 128 | 89.3 | 70 | 124 | 8.6 | 0 | ---- | ---- | ---- | ---- | 83 | 88.2 | 68 | 114 | 10.0 | 0 | ---- | ---- | ---- | ---- |
| 2/26/09 | 9 | 453 | 43.7 | 35 | 75 | 4.8 | 82 | 86.5 | 73 | 107 | 7.1 | 0 | ---- | ---- | ---- | ---- | 129 | 87.5 | 63 | 122 | 9.4 | 0 | ---- | ---- | ---- | ---- |
| 3/5/09 | 10 | 574 | 46.0 | 35 | 75 | 6.2 | 61 | 92.1 | 75 | 170 | 13.5 | 2 | 42.0 | 42 | 42 | ---- | 162 | 89.9 | 65 | 185 | 13.8 | 0 | ---- | ---- | ---- | ---- |
| 3/12/09 | 11 | 554 | 44.0 | 36 | 70 | 6.5 | 29 | 90.7 | 75 | 110 | 10.1 | 0 | ---- | ---- | ---- | ---- | 30 | 91.5 | 65 | 120 | 14.2 | 7 | 149.7 | 128 | 163 | 11.1 |
| 3/19/09 | 12 | 499 | 44.4 | 35 | 75 | 7.7 | 102 | 101.7 | 75 | 164 | 15.2 | 0 | ---- | ---- | ---- | ---- | 34 | 101.4 | 73 | 184 | 25.0 | 158 | 157.5 | 129 | 200 | 14.3 |
| 3/26/09 | 13 | 416 | 49.7 | 36 | 77 | 9.8 | 50 | 101.3 | 80 | 200 | 20.4 | 5 | 35.8 | 34 | 37 | 1.1 | 14 | 91.8 | 75 | 122 | 13.7 | 9 | 152.8 | 126 | 170 | 13.8 |
| 4/2/09 | 14 | 426 | 56.9 | 37 | 84 | 10.5 | 16 | 102.4 | 85 | 120 | 11.5 | 8 | 35.1 | 30 | 37 | 2.2 | 7 | 99.0 | 85 | 114 | 11.6 | 4 | 184.3 | 157 | 235 | 35.2 |
| 4/9/09 | 15 | 416 | 61.7 | 36 | 85 | 9.0 | 10 | 100.8 | 80 | 125 | 11.5 | 18 | 40.7 | 37 | 44 | 1.6 | 6 | 94.7 | 76 | 119 | 15.6 | 4 | 209.5 | 163 | 258 | 44.4 |
| 4/16/09 | 16 | 465 | 61.2 | 35 | 93 | 10.8 | 17 | 106.1 | 92 | 128 | 12.1 | 14 | 37.6 | 29 | 48 | 5.1 | 7 | 99.6 | 86 | 109 | 8.7 | 4 | 201.0 | 186 | 220 | 15.2 |
| 4/23/09 | 17 | 555 | 61.5 | 39 | 88 | 9.6 | 14 | 108.4 | 93 | 130 | 9.0 | 7 | 41.3 | 37 | 47 | 3.5 | 5 | 134.8 | 115 | 175 | 23.6 | 15 | 181.3 | 158 | 212 | 19.0 |
| 4/30/09 | 18 | 136 | 56.3 | 41 | 88 | 10.3 | 1 | 120.0 | 120 | 120 | ---- | 3 | 54.0 | 38 | 74 | 18.3 | 1 | 103.0 | 103 | 103 | ---- | 1 | 158.0 | 158 | 158 | 0.0 |
| 5/7/09 | 19 | 280 | 61.2 | 39 | 88 | 10.0 | 1 | 153.0 | 153 | 153 | ---- | 1 | 56.0 | 56 | 56 | ---- | 6 | 139.0 | 104 | 182 | 34.0 | 3 | 177.7 | 160 | 198 | 19.1 |
| 5/14/09 | 20 | 442 | 63.1 | 41 | 94 | 10.2 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- | 5 | 110.2 | 93 | 125 | 15.3 | 4 | 155.8 | 140 | 165 | 11.4 |
| 5/21/09 | 21 | 263 | 64.3 | 42 | 96 | 11.1 | 0 | ---- | ---- | ---- | ---- | 1 | 59.0 | 59 | 59 | ---- | 4 | 111.3 | 93 | 125 | 13.4 | 3 | 165.0 | 140 | 185 | 22.9 |
| 5/28/09 | 22 | 294 | 66.3 | 43 | 107 | 10.7 | 0 | ---- | ---- | ---- | ---- | 8 | 64.6 | 55 | 77 | 7.0 | 5 | 124.2 | 105 | 150 | 16.9 | 2 | 180.5 | 173 | 188 | 10.6 |
| 6/4/09 | 23 | 709 | 86.4 | 45 | 152 | 17.6 | 0 | ---- | ---- | ---- | ---- | 3 | 69.0 | 56 | 87 | 16.1 | 15 | 135.3 | 108 | 195 | 26.5 | 7 | 156.7 | 121 | 187 | 20.4 |
| 6/11/09 | 24 | 677 | 86.6 | 51 | 172 | 14.4 | 1 | 168.0 | 168 | 168 | ---- | 8 | 71.8 | 56 | 90 | 13.0 | 5 | 117.0 | 104 | 140 | 14.1 | 1 | 153.0 | 153 | 153 | ---- |
| 6/18/09 | 25 | 740 | 86.3 | 45 | 125 | 12.6 | 0 | ---- | ---- | ---- | ---- | 9 | 73.0 | 60 | 107 | 14.2 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 6/25/09 | 26 | 767 | 85.5 | 53 | 120 | 10.0 | 0 | ---- | ---- | ---- | ---- | 7 | 77.3 | 61 | 102 | 14.9 | 1 | 109.0 | 109 | 109 | ---- | 0 | ---- | ---- | ---- | ---- |
| 7/2/09 | 27 | 541 | 86.7 | 55 | 112 | 8.1 | 0 | ---- | ---- | ---- | ---- | 5 | 73.4 | 58 | 96 | 14.9 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 7/9/09 | 28 | 803 | 86.9 | 61 | 118 | 8.0 | 0 | ---- | ---- | ---- | ---- | 20 | 92.7 | 69 | 119 | 16.1 | 0 | ---- | ---- | ---- | ---- | 0 | 150 | 150 | 150 | ---- |
| 7/16/09 | 29 | 748 | 86.9 | 57 | 110 | 7.4 | 0 | ---- | ---- | ---- | ---- | 55 | 103.7 | 77 | 125 | 10.8 | 1 | 145.0 | 145 | 145 | ---- | 0 | ---- | ---- | ---- | ---- |
| 7/23/09 | 30 | 649 | 87.4 | 60 | 119 | 8.0 | 0 | ---- | ---- | ---- | ---- | 62 | 110.3 | 71 | 136 | 13.3 | 4 | 170.0 | 142 | 211 | 32.1 | 0 | ---- | ---- | ---- | ---- |
| 7/30/09 | 31 | 584 | 88.0 | 65 | 122 | 6.9 | 0 | ---- | ---- | ---- | ---- | 35 | 109.7 | 84 | 125 | 9.2 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 8/6/09 | 32 | 266 | 90.2 | 68 | 123 | 7.3 | 0 | ---- | ---- | ---- | ---- | 15 | 108.5 | 76 | 133 | 14.2 | 1 | 142.0 | 142 | 142 | ---- | 0 | ---- | ---- | ---- | ---- |
| 8/13/09 | 33 | 255 | 91.6 | 74 | 131 | 6.5 | 0 | ---- | ---- | ---- | ---- | 7 | 118.4 | 110 | 145 | 12.0 | 4 | 156.0 | 151 | 165 | 6.2 | 0 | ---- | ---- | ---- | ---- |
| 8/20/09 | 34 | 172 | 92.4 | 75 | 137 | 8.8 | 0 | ---- | ---- | ---- | ---- | 5 | 93.8 | 80 | 105 | 12.3 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 8/27/09 | 35 | 98 | 97.0 | 79 | 140 | 12.1 | 0 | ---- | ---- | ---- | ---- | 6 | 84.7 | 75 | 92 | 6.5 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |

Appendix 10. Trinity River at WCRST weekly Chinook salmon and coho salmon fork lengths, 2009.

| Week | Week of the | Chinook salmon | | | | | | | | | | Natural coho salmon | | | | | | | | | | Hatchery coho salmon | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Age-0 | | | | | Age-1 | | | | | Age-0 | | | | | Age-1 | | | | | Age-1 | | | | |
| Starting | Year | 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 |
| 03/12/09 | 11 | 90 | 42 | 34 | 63 | 5.46 | 99 | 99 | 70 | 120 | 10.34 | 0 | ---- | ---- | ---- | ---- | 10 | 101 | 91 | 106 | 5.24 | 0 | ---- | --- | --- | --- |
| 03/19/09 | 12 | 185 | 42 | 34 | 63 | 4.39 | 24 | 101 | 78 | 158 | 18.81 | 1 | 37 | 37 | 37 | ---- | 16 | 117 | 60 | 175 | 40.10 | 61 | 157 | 120 | 213 | 17.39 |
| 03/26/09 | 13 | 257 | 42 | 35 | 71 | 5.52 | 22 | 98 | 75 | 117 | 10.76 | 3 | 33 | 32 | 36 | 2.31 | 13 | 93 | 69 | 120 | 16.20 | 10 | 154 | 137 | 176 | 11.55 |
| 04/02/09 | 14 | 265 | 43 | 34 | 74 | 6.75 | 7 | 89 | 78 | 103 | 7.39 | 2 | 37 | 34 | 40 | 4.24 | 9 | 97 | 71 | 115 | 16.92 | 2 | 169 | 158 | 179 | 14.85 |
| 04/09/09 | 15 | 262 | 44 | 35 | 72 | 7.30 | 8 | 119 | 95 | 150 | 20.94 | 1 | 38 | 38 | 38 | ---- | 47 | 175 | 82 | 228 | 32.29 | 0 | ---- | --- | --- | --- |
| 04/16/09 | 16 | 386 | 48 | 34 | 93 | 12.34 | 0 | ---- | ---- | ---- | ---- | 3 | 46 | 34 | 54 | 10.79 | 1 | 117 | 117 | 117 | ---- | 0 | ---- | --- | --- | --- |
| 04/23/09 | 17 | 428 | 53 | 33 | 83 | 10.84 | 0 | ---- | ---- | ---- | ---- | 3 | 48 | 47 | 49 | 1.00 | 3 | 164 | 152 | 170 | 10.39 | 10 | 181 | 162 | 220 | 21.75 |
| 04/30/09 | 18 | 157 | 56 | 37 | 80 | 10.35 | 3 | 126 | 120 | 134 | 7.09 | 2 | 37 | 32 | 41 | 6.36 | 8 | 156 | 75 | 238 | 50.38 | 35 | 175 | 142 | 248 | 19.39 |
| 05/07/09 | 19 | 308 | 54 | 37 | 84 | 8.56 | 3 | 119 | 113 | 124 | 5.57 | 1 | 67 | 67 | 67 | ---- | 5 | 115 | 105 | 137 | 13.90 | 22 | 180 | 142 | 232 | 19.05 |
| 05/14/09 | 20 | 331 | 56 | 39 | 93 | 9.13 | 0 | ---- | ---- | ---- | ---- | 1 | 68 | 68 | 68 | ---- | 6 | 116 | 91 | 137 | 15.61 | 21 | 168 | 141 | 222 | 16.99 |
| 05/21/09 | 21 | 326 | 62 | 37 | 98 | 13.00 | 0 | ---- | ---- | ---- | ---- | 5 | 50 | 41 | 59 | 6.91 | 9 | 121 | 108 | 135 | 9.57 | 16 | 167 | 143 | 212 | 20.02 |
| 05/28/09 | 22 | 462 | 63 | 37 | 100 | 12.34 | 0 | ---- | ---- | ---- | ---- | 13 | 59 | 52 | 65 | 3.93 | 30 | 118 | 100 | 136 | 10.20 | 23 | 159 | 136 | 199 | 16.82 |
| 06/04/09 | 23 | 471 | 79 | 40 | 130 | 14.23 | 0 | ---- | ---- | ---- | ---- | 3 | 69 | 56 | 88 | 16.65 | 17 | 126 | 112 | 157 | 11.34 | 5 | 163 | 152 | 171 | 7.91 |
| 06/11/09 | 24 | 840 | 86 | 44 | 125 | 15.89 | 0 | ---- | ---- | ---- | ---- | 1 | 65 | 65 | 65 | ---- | 7 | 121 | 107 | 140 | 11.76 | 7 | 158 | 138 | 171 | 12.51 |
| 06/18/09 | 25 | 833 | 86 | 47 | 122 | 14.50 | 0 | ---- | ---- | ---- | ---- | 1 | 80 | 80 | 80 | ---- | 2 | 132 | 130 | 133 | 2.12 | 0 | ---- | --- | --- | --- |
| 06/25/09 | 26 | 718 | 83 | 48 | 178 | 9.64 | 0 | ---- | ---- | ---- | ---- | 2 | 67 | 66 | 68 | 1.41 | 1 | 102 | 102 | 102 | ---- | 1 | 159 | 159 | 159 | --- |
| 07/02/09 | 27 | 583 | 80 | 50 | 120 | 9.93 | 0 | ---- | ---- | ---- | ---- | 3 | 83 | 60 | 101 | 20.95 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | --- | --- | --- |
| 07/09/09 | 28 | 1019 | 82 | 51 | 114 | 8.06 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- | 1 | 125 | 125 | 125 | ---- | 0 | ---- | --- | --- | --- |
| 07/16/09 | 29 | 837 | 81 | 51 | 102 | 7.08 | 0 | ---- | ---- | ---- | ---- | 1 | 99 | 99 | 99 | ---- | 5 | 109 | 95 | 125 | 10.96 | 1 | 102 | 102 | 102 | --- |
| 07/23/09 | 30 | 567 | 80 | 49 | 107 | 8.42 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- | 2 | 104 | 102 | 105 | 2.12 | 1 | 107 | 107 | 107 | --- |
| 07/30/09 | 31 | 290 | 76 | 46 | 112 | 9.09 | 0 | ---- | ---- | ---- | ---- | 1 | 70 | 70 | 70 | ---- | 2 | 111 | 104 | 117 | 9.19 | 0 | ---- | --- | --- | --- |
| 08/06/09 | 32 | 128 | 77 | 55 | 95 | 7.51 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- | 10 | 101 | 91 | 106 | 5.24 | 0 | ---- | --- | --- | --- |
| 08/13/09 | 33 | 78 | 81 | 53 | 122 | 10.12 | 0 | ---- | ---- | ---- | ---- | 1 | 37 | 37 | 37 | ---- | 16 | 117 | 60 | 175 | 40.10 | 61 | 157 | 120 | 213 | 17.39 |
| 08/20/09 | 34 | 36 | 83 | 57 | 124 | 16.67 | 0 | ---- | ---- | ---- | ---- | 3 | 33 | 32 | 36 | 2.31 | 13 | 93 | 69 | 120 | 16.20 | 10 | 154 | 137 | 176 | 11.55 |
| 08/27/09 | 35 | 141 | 89 | 43 | 130 | 13.24 | 0 | ---- | ---- | ---- | ---- | 2 | 37 | 34 | 40 | 4.24 | 9 | 97 | 71 | 115 | 16.92 | 2 | 169 | 158 | 179 | 14.85 |

Appendix 11. Trinity River at PTRST weekly steelhead fork lengths, 2009.

| | Natural steelhead | | | | | | | | | | | | | | | Hatchery steelhead | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Age-0 | | | | | Age-1 | | | | | Age-2+ | | | | | Age-1 | | | | |
| WOY | n | mean | min | max | SD | n | mean | min | max | SD | n | mean | min | max | SD | n | mean | min | max | SD |
| 2 | 0 | ---- | ---- | ---- | ---- | 3 | 100.3 | 91 | 115 | 12.86 | 1 | 200.0 | 200 | 200 | ---- | 0 | ---- | ---- | ---- | ---- |
| 3 | 0 | ---- | ---- | ---- | ---- | 17 | 99.5 | 59 | 140 | 23.46 | 5 | 198.4 | 168 | 230 | 21.9 | 0 | ---- | ---- | ---- | ---- |
| 4 | 0 | ---- | ---- | ---- | ---- | 27 | 100.4 | 56 | 152 | 20.99 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 5 | 0 | ---- | ---- | ---- | ---- | 38 | 93.8 | 56 | 140 | 20.70 | 3 | 218.7 | 170 | 310 | 79.2 | 0 | ---- | ---- | ---- | ---- |
| 6 | 0 | ---- | ---- | ---- | ---- | 33 | 94.4 | 60 | 139 | 18.67 | 1 | 198.0 | 198 | 198 | ---- | 0 | ---- | ---- | ---- | ---- |
| 7 | 0 | ---- | ---- | ---- | ---- | 56 | 94.2 | 74 | 140 | 14.93 | 2 | 178.0 | 175 | 181 | 4.2 | 0 | ---- | ---- | ---- | ---- |
| 8 | 0 | ---- | ---- | ---- | ---- | 200 | 85.2 | 50 | 144 | 17.21 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 9 | 0 | ---- | ---- | ---- | ---- | 240 | 82.6 | 51 | 143 | 16.90 | 5 | 171.4 | 162 | 187 | 11.7 | 0 | ---- | ---- | ---- | ---- |
| 10 | 0 | ---- | ---- | ---- | ---- | 280 | 84.8 | 47 | 158 | 19.35 | 5 | 170.2 | 164 | 187 | 9.6 | 0 | ---- | ---- | ---- | ---- |
| 11 | 0 | ---- | ---- | ---- | ---- | 145 | 86.3 | 52 | 150 | 22.05 | 4 | 170.8 | 162 | 188 | 11.9 | 0 | ---- | ---- | ---- | ---- |
| 12 | 2 | 31.5 | 28 | 35 | 4.95 | 128 | 89.4 | 58 | 153 | 23.98 | 1 | 166.0 | 166 | 166 | ---- | 198 | 202.5 | 108 | 245 | 19.85 |
| 13 | 0 | ---- | ---- | ---- | ---- | 161 | 91.5 | 57 | 173 | 24.19 | 3 | 176.3 | 160 | 209 | 28.3 | 284 | 198.5 | 100 | 252 | 20.59 |
| 14 | 0 | ---- | ---- | ---- | ---- | 95 | 94.1 | 59 | 157 | 20.48 | 2 | 185.0 | 180 | 190 | 0.0 | 283 | 197.2 | 99 | 255 | 24.29 |
| 15 | 0 | ---- | ---- | ---- | ---- | 107 | 97.9 | 65 | 161 | 23.79 | 4 | 170.0 | 165 | 173 | 3.6 | 112 | 204.7 | 140 | 291 | 21.95 |
| 16 | 13 | 28.7 | 27 | 30 | 1.11 | 227 | 89.0 | 51 | 158 | 18.62 | 6 | 179.3 | 170 | 186 | 5.3 | 88 | 203.1 | 150 | 236 | 18.62 |
| 17 | 16 | 33.3 | 28 | 44 | 5.26 | 145 | 94.2 | 60 | 152 | 17.09 | 6 | 182.8 | 175 | 195 | 7.4 | 187 | 195.5 | 118 | 248 | 20.00 |
| 18 | 21 | 28.2 | 25 | 35 | 2.23 | 4 | 96.8 | 84 | 120 | 16.52 | 0 | ---- | ---- | ---- | ---- | 4 | 171.5 | 150 | 195 | 18.45 |
| 19 | 20 | 27.3 | 25 | 30 | 1.59 | 24 | 86.4 | 62 | 117 | 17.45 | 0 | ---- | ---- | ---- | ---- | 10 | 175.4 | 132 | 210 | 22.87 |
| 20 | 61 | 29.1 | 23 | 39 | 2.20 | 26 | 90.5 | 53 | 157 | 23.70 | 0 | ---- | ---- | ---- | ---- | 6 | 186.7 | 160 | 210 | 22.54 |
| 21 | 58 | 29.0 | 24 | 37 | 2.28 | 1 | 120.0 | 120 | 120 | ---- | 0 | ---- | ---- | ---- | ---- | 11 | 183.4 | 160 | 221 | 18.59 |
| 22 | 28 | 34.5 | 26 | 64 | 9.42 | 21 | 100.4 | 64 | 167 | 31.72 | 6 | 181.8 | 170 | 206 | 12.6 | 16 | 185.9 | 153 | 220 | 19.80 |
| 23 | 29 | 37.7 | 27 | 55 | 7.38 | 19 | 102.5 | 73 | 169 | 24.80 | 6 | 196.7 | 173 | 219 | 16.2 | 44 | 185.0 | 114 | 290 | 25.60 |
| 24 | 50 | 45.2 | 29 | 83 | 13.73 | 10 | 114.1 | 82 | 146 | 20.01 | 3 | 176.7 | 172 | 185 | 7.2 | 14 | 186.2 | 106 | 226 | 29.97 |
| 25 | 64 | 45.7 | 26 | 91 | 12.33 | 8 | 113.9 | 89 | 138 | 16.17 | 1 | 189.0 | 189 | 189 | ---- | 7 | 202.0 | 175 | 235 | 21.45 |
| 26 | 80 | 47.4 | 6 | 66 | 9.46 | 13 | 115.5 | 77 | 164 | 26.78 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 27 | 35 | 58.8 | 39 | 84 | 10.04 | 9 | 124.8 | 112 | 134 | 8.15 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 28 | 91 | 62.5 | 39 | 98 | 12.61 | 20 | 130.7 | 104 | 160 | 18.96 | 2 | 184.0 | 178 | 190 | 8.5 | 1 | 191.0 | 191 | 191 | ---- |
| 29 | 165 | 58.1 | 33 | 99 | 11.39 | 19 | 133.6 | 105 | 164 | 17.11 | 1 | 202.0 | 202 | 202 | ---- | 2 | 227.0 | 178 | 276 | 69.30 |
| 30 | 146 | 58.2 | 39 | 83 | 8.94 | 10 | 141.5 | 121 | 172 | 15.67 | 1 | 188.0 | 188 | 188 | ---- | 0 | ---- | ---- | ---- | ---- |
| 31 | 66 | 63.2 | 42 | 108 | 11.99 | 9 | 134.3 | 115 | 160 | 13.28 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 32 | 30 | 66.1 | 49 | 95 | 11.44 | 10 | 142.7 | 107 | 185 | 27.46 | 0 | ---- | ---- | ---- | ---- | 1 | 158.0 | 158 | 158 | ---- |
| 33 | 17 | 69.0 | 55 | 83 | 7.12 | 3 | 133.3 | 125 | 141 | 8.02 | 0 | ---- | ---- | ---- | ---- | 1 | 150.0 | 150 | 150 | ---- |
| 34 | 39 | 64.6 | 45 | 90 | 9.38 | 1 | 148.0 | 148 | 148 | ---- | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |
| 35 | 106 | 73.8 | 44 | 104 | 11.11 | 3 | 145.0 | 120 | 170 | 25.00 | 0 | ---- | ---- | ---- | ---- | 0 | ---- | ---- | ---- | ---- |

Appendix 12. Trinity River at WCRST weekly steelhead fork lengths, 2009.

| | Natural steelhead | | | | | | | | | | | | | | | | | | | | Hatchery steelhead | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Age-0 | | | | | Age-1 | | | | | Age-2 | | | | | Age-3 | | | | | Age-1 | | | | |
| WOY | 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 |
| 11 | 0 | 0 | ---- | ---- | 0 | 229 | 90 | 63 | 150 | 15.79 | 2 | 198 | 190 | 205 | 10.61 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 12 | 23 | 39 | 36 | 42 | 1.97 | 172 | 89 | 63 | 150 | 14.73 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 13 | 5 | 40 | 38 | 42 | 1.48 | 276 | 90 | 60 | 149 | 14.11 | 4 | 209 | 186 | 240 | 24.25 | 0 | 0 | 0 | 0 | ---- | 67 | 204 | 143 | 255 | 19.84 |
| 14 | 0 | 0 | ---- | ---- | 0 | 325 | 89 | 54 | 150 | 13.85 | 2 | 233 | 231 | 234 | 2.12 | 0 | 0 | 0 | 0 | ---- | 243 | 202 | 120 | 250 | 20.24 |
| 15 | 0 | 0 | ---- | ---- | 0 | 205 | 91 | 63 | 141 | 13.14 | 1 | 253 | 253 | 253 | ---- | 0 | 0 | 0 | 0 | ---- | 261 | 209 | 161 | 253 | 15.45 |
| 16 | 0 | 0 | ---- | ---- | 0 | 174 | 91 | 66 | 153 | 14.43 | 1 | 237 | 237 | 237 | ---- | 0 | 0 | 0 | 0 | ---- | 280 | 208 | 158 | 250 | 14.99 |
| 17 | 0 | 0 | ---- | ---- | 0 | 158 | 95 | 65 | 153 | 17.13 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 245 | 205 | 120 | 270 | 18.10 |
| 18 | 0 | 0 | ---- | ---- | 0 | 60 | 96 | 72 | 148 | 17.19 | 9 | 207 | 195 | 222 | 8.93 | 0 | 0 | 0 | 0 | ---- | 186 | 189 | 98 | 239 | 24.70 |
| 19 | 0 | 0 | ---- | ---- | 0 | 37 | 107 | 80 | 145 | 17.58 | 16 | 186 | 167 | 212 | 14.66 | 0 | 0 | 0 | 0 | ---- | 118 | 186 | 128 | 232 | 18.73 |
| 20 | 0 | 0 | ---- | ---- | 0 | 43 | 107 | 72 | 147 | 19.05 | 8 | 192 | 181 | 200 | 6.04 | 0 | 0 | 0 | 0 | ---- | 75 | 184 | 95 | 226 | 23.05 |
| 21 | 0 | 0 | ---- | ---- | 0 | 22 | 117 | 84 | 148 | 19.81 | 11 | 186 | 176 | 205 | 9.22 | 0 | 0 | 0 | 0 | ---- | 74 | 193 | 132 | 250 | 20.97 |
| 22 | 1 | 49 | 49 | 49 | 0 | 71 | 113 | 80 | 154 | 19.81 | 26 | 186 | 172 | 218 | 12.99 | 0 | 0 | 0 | 0 | ---- | 93 | 187 | 151 | 230 | 17.36 |
| 23 | 4 | 42 | 30 | 52 | 9.25 | 41 | 122 | 87 | 154 | 19.80 | 9 | 218 | 186 | 293 | 42.63 | 0 | 0 | 0 | 0 | ---- | 77 | 182 | 93 | 215 | 26.26 |
| 24 | 12 | 46 | 36 | 58 | 7.49 | 16 | 118 | 98 | 154 | 16.94 | 8 | 208 | 185 | 290 | 36.52 | 0 | 0 | 0 | 0 | ---- | 55 | 188 | 96 | 230 | 19.61 |
| 25 | 20 | 46 | 31 | 55 | 5.75 | 2 | 110 | 99 | 120 | 14.85 | 2 | 175 | 169 | 180 | 7.78 | 0 | 0 | 0 | 0 | ---- | 10 | 193 | 175 | 218 | 13.49 |
| 26 | 29 | 49 | 29 | 67 | 7.89 | 5 | 113 | 108 | 125 | 6.80 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 3 | 172 | 163 | 190 | 15.31 |
| 27 | 10 | 57 | 50 | 62 | 3.92 | 1 | 113 | 113 | 113 | 0.00 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 28 | 11 | 60 | 46 | 73 | 7.05 | 4 | 123 | 109 | 128 | 9.50 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 29 | 22 | 57 | 41 | 69 | 5.58 | 5 | 118 | 101 | 148 | 18.10 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 1 | 154 | 154 | 154 | 0 |
| 30 | 24 | 55 | 40 | 77 | 9.48 | 9 | 125 | 106 | 148 | 13.18 | 1 | 184 | 184 | 184 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 31 | 4 | 54 | 49 | 58 | 3.87 | 11 | 126 | 113 | 142 | 9.17 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 32 | 1 | 74 | 74 | 74 | 0 | 3 | 114 | 101 | 130 | 14.64 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 33 | 3 | 52 | 41 | 59 | 9.64 | 3 | 124 | 116 | 130 | 7.09 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 34 | 0 | 0 | ---- | ---- | 0 | 1 | 142 | 142 | 142 | 0.00 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |
| 35 | 12 | 54 | 33 | 70 | 12.35 | 2 | 125 | 121 | 128 | 4.95 | 0 | 0 | 0 | 0 | ---- | 0 | 0 | 0 | 0 | ---- | 0 | 0 | ---- | ---- | 0 |