

State of California
The Resources Agency
DEPARTMENT OF FISH AND WILDLIFE

ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT:
CHINOOK AND COHO SALMON AND FALL-RUN STEELHEAD RUN-SIZE
ESTIMATES USING MARK-RECAPTURE METHODS
2018-19 SEASON



On the cover: Spring Chinook Salmon in Junction City weir trap, 2018.

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2018-19 SEASON

by

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FOREWORD

This is the California Department of Fish and Wildlife's (CDFW) Trinity River Basin Salmon and Steelhead Monitoring Project's thirtieth annual report to the United States Bureau of Reclamation (Reclamation). Reported activities were funded by CDFW/Reclamation Cooperative Agreement Number R18AC200070.

This report presents work performed on the main stem Trinity River and at Trinity River Hatchery. Necessity for performing our Klamath-Trinity basin monitoring activities are outlined in several Acts of Congress including Public Law 386 (69 Stat. 719), August 12, 1955; Public Law 98-541, October 24, 1984; the "Trinity River Basin Fish and Wildlife Management Reauthorization Act" of 1995; and the Trinity River "Record of Decision", 2000.

ACKNOWLEDGMENTS

We would like to thank the CDFW fisheries technicians on whom we relied heavily for the bulk of the field work in the 2018 season: Michael Bradford, Liv Carter, Chris Hubler, Todd Newhouse, Jane Sartori, Guy Smith, Ron Smith, Steven Strite, Ted Tillinghast, and Nathan Keiki Yamasaki. Hoopa Valley Tribal Fisheries (HVTF) provided valuable assistance during the installation and removal of both weirs, once again. Our thanks to Billy Colegrove, who was our HVTF weir technician throughout the season. We continue to benefit from our relationship with HVTF and appreciate the help we get from everyone who works on our weir installation and pull days.

We value the cooperation of the CDFW Trinity River Hatchery staff during recovery efforts and Doris Chase and Ginger, Tom O'Gorman, Steve Strite, and the U.S. Forest Service for access, off-season in-basin equipment storage, and general project support.

The CDFW monitoring program was approved by the Trinity Management Council and funded by Reclamation through the Trinity River Restoration Program (TRRP) office in Weaverville, CA. We thank (and will miss) Caryn Hunt DeCarlo, and we thank the TRRP for their contract administration and liaising efforts. Additionally, we extol the monumental efforts of Derek Rupert and all the folks at Reclamation to get our funding in place.

Trinity River Basin Salmon and Steelhead Monitoring Project
Chinook and Coho Salmon and Fall-Run Steelhead Run-Size Estimates
2018-19 Season

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ABSTRACT

California Department of Fish and Wildlife's Trinity River Project conducted tagging and recapture operations from June 2018 through March 2019 to produce run-size, angler harvest, and spawner escapement estimates of spring- and fall-run Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), and fall-run steelhead (*O. mykiss*) in the Trinity River basin. Monitoring results inform the Trinity River Restoration Program's (TRRP) adaptive management decision making process and help evaluate progress toward achieving fundamental objectives outlined in the Integrated Assessment Plan (TRRP 2009). Additionally, run-size estimates are used in annual fishery management decisions, feeding into the Pacific Fishery Management Council's Klamath River basin fishery regulation and harvest allocation process.

Using a Petersen mark-recapture methodology, we estimated 8,032 (95% CI 7,250 – 8,858) spring-run Chinook Salmon migrated into Trinity River basin upstream of Junction City weir. The run was comprised of an estimated 927 jacks [346 natural origin (NOR) and 581 hatchery origin (HOR)] and 7,105 adults (2,032 NOR and 5,073 HOR). Using tags returned by anglers we estimate zero jack and 265 adult spring Chinook were harvested, yielding a total escapement of 7,767 fish, including 2,908 spring Chinook that entered Trinity River Hatchery and 4,859 estimated natural area spawners. Escapement of 1,938 NOR adult spring Chinook Salmon is 32.3% of the TRRP goal of 6,000.

An estimated 26,848 (95% CI 24,413 – 29,634) fall-run Chinook Salmon migrated upstream of Willow Creek weir (WCW) in 2018. The run consisted of an estimated 22,402 (8,650 NOR and 13,752 HOR) adult and 4,446 (4,087 NOR and 359 HOR) jack fall Chinook Salmon. Using tags returned by anglers we estimate 961 fall Chinook Salmon were harvested, yielding an escapement of 25,887. Escapement of 8,357 NOR adult fall Chinook Salmon is 13.5% of the 62,000 fish TRRP goal.

Both Coho Salmon run-size and escapement in the Trinity River upstream of WCW were estimated at 1,486 (95% CI 1,084 – 2,100), because no Coho Salmon were reported as harvested. Coho Salmon escapement was comprised of an estimated 42 NOR adults, 18 NOR jacks, 1,017 HOR adults, and 409 HOR jacks. Escapement of 42 NOR Coho Salmon adults was 3.0% of the TRRP goal of 1,400 fish.

Using a Petersen mark-recapture methodology we estimated 5,885 (95% CI 5,007 – 6,835) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 157 adult fall steelhead upstream of the weir, leaving 5,728 (2,326 NOR and 3,402 hatchery-origin) fish as potential spawners. Escapement of 2,326 NOR adult steelhead is 5.8% of the 40,000 fish TRRP goal.

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PROJECT OBJECTIVES

- Determine run-size, age composition, hatchery/natural origin proportions, distribution, and timing of adult Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), and steelhead (*O. mykiss*) in the Trinity River basin [Integrated Assessment Plan (IAP) assessment 13A – “Monitor adult escapement of hatchery and naturally produced spring and fall Chinook, coho, and fall steelhead (TRRP, 2009)”].
- Determine in-river sport angler harvest and spawner escapements of Trinity River Chinook Salmon, Coho Salmon, and steelhead [IAP assessments 16A, 17A, 18A, and 19A – “Monitor harvest (tribal, sport and commercial) of naturally produced spring Chinook, fall Chinook, coho and steelhead”].

1. INTRODUCTION

The California Department of Fish and Wildlife's (CDFW) Trinity River Project (TRP) annually monitors run-size and spawner escapement of spring-run Chinook Salmon (spring Chinook) in the Trinity River basin upstream of a weir near Junction City, California and the run-size and spawner escapement of fall-run Chinook Salmon (fall Chinook), Coho Salmon (Coho), and adult fall-run steelhead (steelhead) in the Trinity River basin upstream of a weir near Willow Creek, California. The project is conducted in cooperation with the Hoopa Valley Tribal Fisheries Department (HVTF). We use a Petersen type mark-recapture methodology to estimate run-size (the number of fish estimated to migrate from the ocean) into the Trinity River basin upstream of the weir sites. Spawner escapement is the number of fish that survive in-river tribal and recreational harvest to spawn in natural areas or enter Trinity River Hatchery (TRH). This is a continuation of studies that began in 1977.

Results from this investigation are provided to the Trinity River Restoration Program (TRRP) to help evaluate program objectives including natural-origin (NOR, progeny of fish that spawned in the river) salmonid escapement goals (13A, 17A, 16A, 18A and 19A) outlined in the IAP (TRRP 2009). Current Trinity River basin adult escapement goals set by the TRRP for NOR adults are 6,000 spring Chinook Salmon, 62,000 fall Chinook Salmon, 1,400 Coho Salmon and 40,000 steelhead. Similar goals for hatchery adult escapement are 3,000 spring Chinook, 9,000 fall Chinook, 2,100 Coho and 10,000 steelhead. Estimates from this project are used to assess progress toward the goals stated in the Record of Decision (ROD) (Interior, 2000), including increasing harvest opportunity for dependent fisheries. Data are also used in the short term to inform adaptive management decisions and stock management through the Pacific Fishery Management Council process, and in the long term for trend analysis in pre- and post-ROD fish populations, cross-functional ecological and physical evaluations, composition

(race and proportion of hatchery-marked¹ or TRP-tagged² fish), spatial distribution, and timing of salmonid runs in the Trinity River basin.

2. METHODS

Our general study design employs a simple Petersen mark-recapture experiment in which fish are marked at a weir (located near either Junction City or Willow Creek), then recaptured at a single recovery location, Trinity River Hatchery. A tag return program is integrated into the study design to estimate angler sport harvest. These methods have been followed essentially unchanged for the 41 years this project has been underway.

2.1. Trapping, Tagging and Marking

2.1.1. Locations and Periods

Trapping and tagging operations were conducted from June 12 through November 19, 2018 by TRP and HVTF personnel at two temporary weir sites located on the main stem Trinity River (Figure 1).

Junction City weir (JCW) was located near the town of Junction City at approximately 136.5 river kilometers (rkm) (~river mile [rm] 84.4) upstream from the Klamath River confluence near Weitchpec (40° 41' 0.24" N, 123° 1' 37.71" W). The JCW was operated June 12 through October 2, 2018, and is primarily operated to capture, bio-sample, and tag spring Chinook Salmon.

Willow Creek weir (WCW), was located near the town of Willow Creek at approximately 36.5 rkm (~rm 22.7) upstream from the Trinity River's confluence with the Klamath River (40° 58' 29.85" N, 123° 38' 8.61" W) and was operated August 29 through November 19, 2018. The WCW is primarily operated to capture, bio-sample and tag fall Chinook Salmon, Coho Salmon, and adult steelhead.

Trinity River Hatchery (TRH) is located at rkm 179.8 (~rm 111.7) just downstream of Lewiston Dam, the current terminus of anadromy on the main stem Trinity River. Pre-release clipping of fish reared at TRH is performed by TRP and HVTF staff to identify fish of hatchery origin. All steelhead and 25% of Chinook produced at TRH are adipose fin-clipped (ad-clipped) before release. Additionally, ad-clipped Chinook have coded-wire tags (CWT) inserted into the snout portion of their heads. All Coho Salmon reared at TRH have their right maxillary (RM) clipped as a hatchery identifier.

¹ Adipose fin-clipped and coded-wire-tagged (ad-clipped and CWT), hatchery-produced Chinook and right-maxillary (RM)-clipped Coho Salmon.

² Serially numbered "spaghetti" tags applied by CDFW personnel to salmonids on their up-river migration (spawning run).

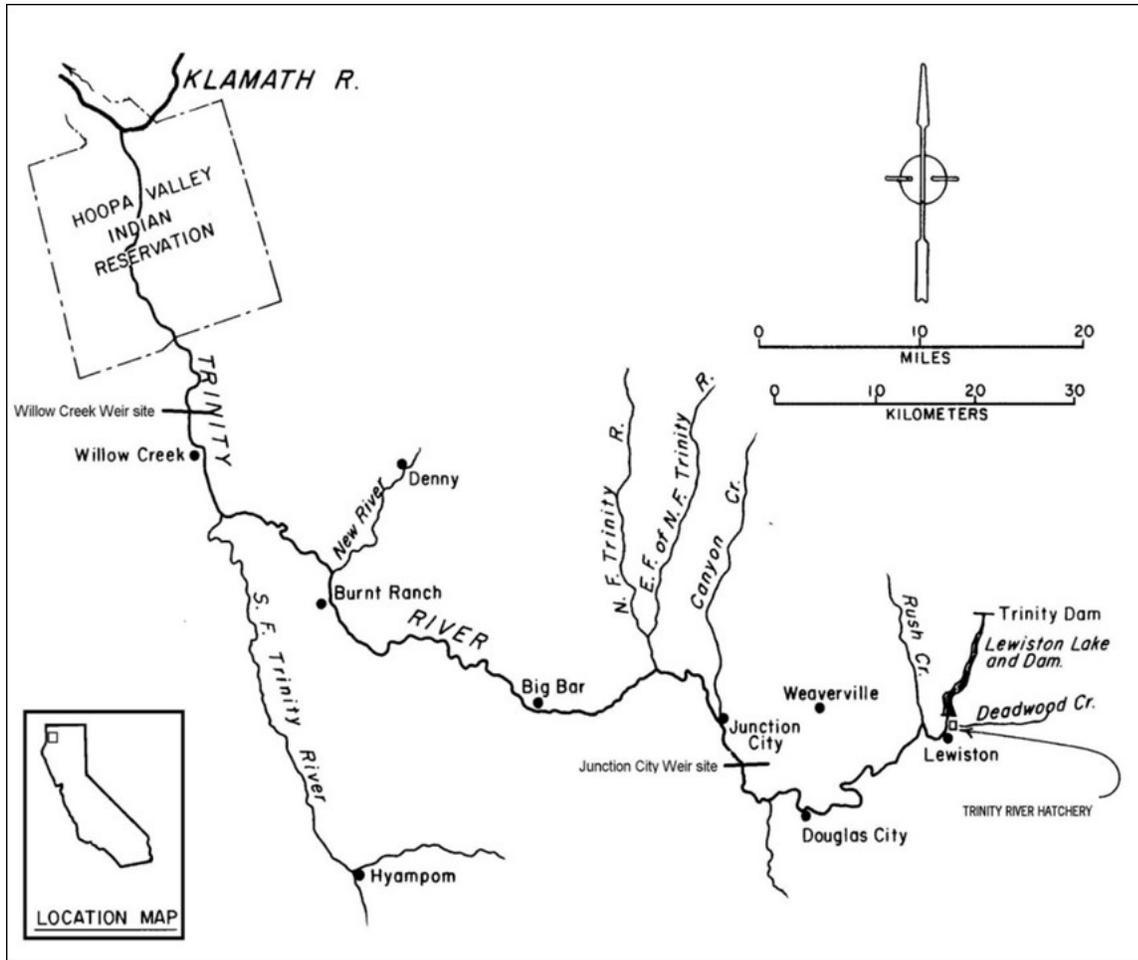


Figure 1. Location of trapping/tagging weirs near Willow Creek and Junction City, and Trinity River Hatchery, in the Trinity River basin, 2018.

2.1.2. Weir and Trap Design

Bertoni (Alaskan-style) weirs operated at both sites consist of fixed picket sections, trap boxes (1-3 per weir) and a boat gate. The weirs are supported by wooden tripods set 2.5 m apart. Weir panels consist of 3.0 m x 1.9 cm (10 ft x ¾ in) electrical conduit spaced less than 5.1 cm apart on center, leaving a gap of 2.5 cm between conduit pieces. Conduit is supported by three sections of aluminum channel arranged 0.92 m apart, which are connected to supporting tripods. The tripods are anchored with cable to 1.8 m – 2.4 (6 -8 ft) T-posts driven into the stream bottom. Weir panels are angled at roughly a 45° angle, with the top of the weir standing 1.8 m above the river bottom (Figure 2 and Figure 3).



Figure 2. Photograph of Alaskan-style weir, tripods, support channels, and conduit (looking upstream).



Figure 3. Junction City weir (JCW) configuration in 2018 after the JW 30 rebuild. This shows the weir in trapping mode. Stream flow is right to left.

The trap boxes are made of 1.9 cm ($\frac{3}{4}$ in) electrical conduit spaced 2.5 cm (1 in) apart and welded into panels. The panels are fastened together at the corners to produce a 2.4 m (8 ft) square box, which is fastened to a plywood floor and covered with a plywood lid. A fyke, also made of conduit panels, is installed on the downstream side of the trap to guide fish into the trap box and hinder their escape. The trap is placed on the upstream side of the weir, directly in front of 24 raised conduit pieces, creating an opening approximately 96 cm (3.1 ft). This opening allows fish to pass through the weir and into the trap. At WCW in 2018 the left trap (looking downstream) was located at the upstream end of a plywood-topped tunnel made with conduit panels (Figure 4). Approximately mid-way on the tunnel an aluminum box housing video monitoring equipment was installed to record fish passage as part of a video monitoring pilot project. Further details regarding the video project will be available in a separate report (Lindke, in progress).



Figure 4. Willow Creek weir in 2018. Note the floating boat gate and tunnel with camera box downstream of trap.

To allow boat passage at JCW, a gate approximately 4.9 m (16 ft) wide is secured between two weir panels. The gate is constructed similarly to trap panels and is set perpendicular to the stream substrate. Weir personnel must remove and replace the gate panels to pass boats. In 2018, due to the addition of the video project, the gate at WCW consisted of six 0.9 m (3 ft) wide by 5.5 m (18 ft) long modified floating resistance board panels. The panels were strung on a cable attached on the upstream end to an iron substrate rail that was pinned to the riverbed. The gate was designed to be passable by boaters (by submerging under the weight of a boat) without aid from crew.

Flexible netting with a mesh size of approximately 1.9 cm (3/4 inch) was secured to the edges of the Bertoni weir panel and resistance board weir panel at each side to prevent fish from passing upstream at the intersections of weir panels (Figure 4).

2.1.3. Trapping Schedule

Trapping at both weirs is scheduled five nights a week, beginning around dusk of each trapping night, and continuing until mid-day the next day. Fish are processed from the previous night's trapping at approximately 0830 hours, and again from the morning's trapping at approximately 1230 hours.

After the afternoon processing, each weir is opened to allow for fish passage for 4 - 8 hours, then closed again at dusk for overnight trapping. At JCW the opening procedure entails pulling up approximately 24 conduit/pickets in every other panel (creating a 96 cm opening), opening the boat gate, and opening any traps. The weir is also opened in the same manner from Friday afternoon to Sunday at dusk. Opening the weir in this configuration was found to reduce migration delays as compared to smaller and fewer openings (Strange, 2008). Video monitoring at WCW in 2018 required that all fish migrating upstream pass through a 70 cm (24 inch) wide opening in front of a video camera 24-7 throughout the season. Consequently, "opening" the weir when we were not trapping was reduced to removing a 1.2 m (4 ft) panel on the upstream side of the river left trap, allowing fish to move through the tunnel (past the video camera) through the trap and to continue upstream. No conduit was lifted, and the boat gate remained closed for the duration of the season.

Occasionally, trapping schedules are modified to allow for holidays or high flows that prevent trapping in a safe manner. The weirs generally operate in flows ranging from 300 to 1,700 cubic feet per second (cfs). When the river is anticipated to rise above this level, conduit is raised (like the above description for afternoons and weekends) to allow unimpeded migration and to protect equipment. The weir can usually be modified to safely remain in the river and withstand flows up to 3,500 cfs and will be removed from the river entirely if flows are anticipated to exceed 5,000 cfs. Trapping and tagging are not conducted if stream temperatures exceed 21° Celsius.

2.1.4. Processing of Fish at Weirs

All salmonids are netted, placed into a submerged cradle, measured to the nearest cm fork length (FL), and examined for hook, predator, or gill-net wounds or scars, fin clips, signs of disease or parasites, and tags. Fish are not anesthetized and are released immediately after tagging to resume their upstream migration unless they appear stressed. Stressed fish are placed in an in-stream recovery tube until they are able to swim away on their own volition.

Each untagged, unspawned salmonid judged to be in good condition is tagged with a serially numbered two mm “spaghetti” tag (Floy Tag and Manufacturing, Inc. FT-4³). Tags are applied with a solid applicator needle through the fish's back approximately two cm below and two cm anterior to the posterior insertion of the dorsal fin. We tag all salmon regardless of length. Steelhead less than 42 cm FL are considered “half-pounders” (immature) and are not tagged.

All salmonid carcasses recovered at the weir (washed back) were measured to the nearest cm FL, examined for wounds, tags, fin clips, and spawning condition. All heads from ad-clipped Chinook Salmon carcasses were removed for later CWT recovery and analysis. After processing, all carcasses were cut in half to prevent recounting and returned to the river downstream of the weir.

In 2018 we collected scales for age determination from every other Chinook Salmon in good condition that we encountered at WCW. Scales were removed from the left side of the fish above the lateral line and posterior to the dorsal fin with a sharp knife. Scale samples were then placed on Rite-in-the-Rain paper, folded, and put in a coin envelope labeled with the date, location, species, length, and tag number. Scales were also taken from every Chinook Salmon at JCW and archived at HVTF for analysis at a later date.

Chinook Salmon tagged at JCW received \$10 and \$20 tags at a 1:1 ratio, and ad-clipped adult steelhead received \$10 tags. Natural-origin steelhead (those with intact adipose fins) were not tagged at JCW. At WCW, fall Chinook were tagged 1:1 with non-reward and \$50 reward tags, and non-reward tags and \$20 rewards tags were applied to adult steelhead at a 1:1 ratio. All Coho Salmon at WCW were tagged with non-reward tags, and no Coho were trapped at JCW. Half-pounder steelhead were not tagged at either weir.

2.2. Recovery of Tagged Fish

Fish tagged at JCW and WCW were recovered from four sources: (1) angler return of tags, (2) tags found during Trinity River spawner surveys, (3) tagging mortalities found on or near the tagging weirs, and (4) fish returning to Trinity River Hatchery.

2.2.1. Angler Tag Returns

Spaghetti tags applied at JCW and WCW are inscribed with a reward amount and the address of the CDFW field office in Arcata, CA. Tags returned to the Arcata office through May 1, 2019 were used to estimate harvest and catch-and-release rates for steelhead and Chinook Salmon in 2018. Tags returned after that date are processed for payment but not used for analysis due to the need for meeting annual reporting deadlines. Public service announcements distributed to press throughout the Northern California region, posted online in social media, and displayed in store-front windows

³ The use of brand or trade names is for identification purposes only and does not imply the endorsement of any product by the CDFW.

throughout the Trinity basin encouraged the timely (same-season) return of tags and announced that after the 2018-19 season out-of-year tags would no longer be accepted for payment. This new policy was enacted to incentivize in-season tag returns in an effort to improve estimation of harvest and catch-and-release rates.

2.2.2. Spawner Surveys

Cooperative spawning ground surveys are conducted annually with the U.S. Fish and Wildlife Service, U.S. Forest Service, Yurok Tribe, Hoopa Valley Tribe, and CDFW in the entire main stem Trinity River, except for a few reaches with limited spawning habitat or that are unsafe to survey. Tagged fish recovered in these surveys were examined for spawning success and project tags and those data are provided to the CDFW Arcata office. Spawner survey methods and results are presented in a separate report.

2.2.3. Weir Recovery

Dead salmonids recovered on the weir are measured to the nearest cm FL, and examined for tags, fin clips, and spawning condition. Heads of ad-clipped Chinook Salmon are collected for later recovery of the CWT. After examination, carcasses were cut in half to prevent recounting and returned to the river downstream of the weir. Weekly surveys were conducted via kayak in the 5.5 km upstream of WCW to look for tag mortalities.

Tagged salmonids recovered dead at the weir, in spawning surveys, or reported dead by anglers were considered tagging mortalities if there was no evidence they had spawned, and they were recovered ≤ 30 days after tagging. Tagged fish recovered dead more than 30 days after tagging, or those that had spawned regardless of the number days after tagging, were not considered tagging mortalities.

2.2.4. Trinity River Hatchery Recovery

Spawning operations began September 4, 2018 for spring Chinook Salmon and ended on March 12, 2019 with the last processing of steelhead. The fish ladder was closed for a "spawning break" October 2 to October 21 (all of Julian weeks 41-42), a practice at TRH designed to temporally segregate spring and fall runs of Chinook Salmon. Spawning operations were generally conducted two days per week during the Chinook spawn, with additional spawn days occurring during the peak of the fall Chinook run in November. Spawning of Coho Salmon and steelhead generally occur on different days than Chinook Salmon.

All fish entering TRH were sexed, measured to the nearest cm FL, and inspected for ad-clips, TRP tags, fin clips, maxillary clips, or other tags or marks. Scales were collected from every 5th fall Chinook Salmon by HVTF personnel beginning in JW 43. Heads from all ad-clipped Chinook were retained during the spawning process for later CWT extraction and analysis.

2.3. Recovery of Coded Wire Tags

All ad-clipped Chinook Salmon recovered dead at weirs, on spawning grounds or at TRH have the snout portion of their heads removed and put into a bag with a serially-numbered head tag card with the unique head tag number, date, recovery location, species, run, sex, and length. Heads are frozen for later CWT extraction and decoding in the laboratory. The CWT code identifies the race, release type (fingerling or yearling), brood year (BY) and the location of release of each fish.

2.3.1. Chinook Salmon CWT Dissection

Heads from Chinook Salmon recovered at TRH, the weirs, or the spawner surveys are processed in our office lab as follows:

- 1) Heads and corresponding head tag numbers are removed from the storage bag one at a time.
- 2) Each head is run through a Northwest Marine Technologies FSD-I field metal detector. A beep from the machine indicates the presence of the tag (or other metal).
- 3) The head is cut into successively smaller pieces and each piece is passed through the detector until a small piece of head that contains the tag is left. The tag is then visually detected and removed using a magnetized pencil.
- 4) The tag is placed into a 2x3 inch sealed baggie which is stapled to the corresponding head tag for decoding. If no tag is detected in the initial and subsequent passes through the metal detector, then it is assumed the fish had shed its tag prior to recovery and a code (100000) is assigned to the head tag. If the tag was initially detected but lost during the dissection process a separate code (200000) is assigned to the head tag to indicate such. If the entire head is somehow lost, a code of 300000 is assigned.

All recovered CWTs are read using a stereozoom microscope equipped with a 10X wide-field eyepiece. The microscope has a continuous magnification zoom range of 7X to 30X. The CWT code is identified and transferred to the head tag. If the CWT code is unreadable the head tag will be assigned a 400000 code.

All head tags and corresponding CWT codes are entered into a database and merged into the TRH recovery database based on the common "head tag" field. Thus, each CWT code, along with the corresponding release information becomes associated with all TRH recovery information for that individual fish.

2.4. Post-season Data Analysis

Methods used for estimating run-size, escapement, harvest, and hatchery-origin vs. natural-origin composition are similar for each of the three species and two runs, with slight variations.

2.4.1. Size Discrimination between Jack and Adult Chinook Salmon and Coho Salmon

The methods for separating jacks (2-years old) from adults (3-years old and older) differs for spring vs. fall Chinook Salmon; age composition of spring Chinook is determined from fork length-frequency analysis, and scale aging is used for fall Chinook. Combined length data of spring Chinook collected at JCW and TRH, excluding fish tagged at JCW and subsequently recovered at TRH, were analyzed to identify the nadir separating jacks and adults. Data were smoothed with a moving average of five, 1-cm increments to determine the nadir if it was not otherwise readily identifiable. The resulting jack/adult size division or “cutoff” is used for all spring Chinook Salmon in all sectors. For fall Chinook Salmon, scales are collected from fish trapped at WCW and TRH to determine ages of individual fish. Age proportions are calculated directly from HVTF scale-read ages, separately for WCW and TRH. Age proportions at WCW are used for the entire fall run upstream of the weir, whereas age proportions at TRH are used only for TRH. Fall Chinook Salmon are also assigned a nadir-based jack /adult cutoff which is used only during harvest and catch-and-release fishery estimation.

Coho Salmon do not receive CWTs and we do not collect or age their scales, so exact ages are unknown. The separation of jack and adult Coho was based entirely on FL frequency distribution analysis.

2.4.2. Size Discrimination between Adult and Immature Steelhead

All steelhead >41 cm FL were considered adults, steelhead <42 cm FL were assumed to be half-pounders (immature fish assumed to have migrated to the ocean). Half-pounders captured at weirs are measured but not tagged, but half-pounders that entered TRH were not measured or counted since we did not know whether they had migrated to the ocean or were residual fish.

2.4.3. Separation of Spring and Fall Chinook Salmon Runs at the Hatchery and Weirs

Trinity River spring Chinook Salmon immigrate mainly between April and September, whereas fall Chinook Salmon immigrate August through December. Although there is temporal overlap of runs, for analysis we separate spring and fall runs based on a hard cut-off date determined independently each year, and we group data by Julian Week (JW) to allow inter-annual comparisons of identical weekly periods (Appendix 1. **List of Julian weeks and their calendar date equivalents.**).

To determine the cut-off date at TRH, proportions of spring and fall Chinook Salmon arriving at TRH are estimated for each JW from expanded CWT recoveries, and the week in which the proportion of fall Chinook exceeds the proportion of spring Chinook is designated as the first week of the fall run. The “spawning break” closure of the fish ladder usually, but not always, coincides with the post-season identified break.

To determine the cut-off date at the weirs we estimate the proportion of each run for each JW based on CWT and TRP-tag recoveries of spring and fall Chinook Salmon

separately for each weir. Coded wire tag recoveries are of known run, and run is assigned to TRP-tagged fish subsequently recovered at TRH depending on whether the fish arrives before or after the cut-off date determined for TRH. At each weir, the JW in which the proportion of fall Chinook exceeds spring Chinook is designated as the first week of the fall run at that location. If there are two consecutive weeks with nearly identical proportions then the first week is designated spring-run and the second as fall-run.

2.4.4. Estimating Numbers of Spring and Fall Chinook Salmon at Trinity River Hatchery

A constant fractional marking program was instituted for Chinook Salmon in brood year 2000, attempting to mark 25% of each release group. We can count the numbers of Chinook with ad-clips and CWT, but to estimate the respective numbers of spring and fall Chinook Salmon without CWTs entering TRH, we expanded the numbers of tags recovered from each returning CWT group by the ratio of tagged to total Chinook (production multiplier) when they were originally released (same strain, BY, release site, release group and date). For example, 87,269 spring Chinook of CWT group 06-09-54 plus 283,043 unmarked spring Chinook were released directly from TRH in June of 2017. The expanded estimate for each returned CWT fish of this group is 4.24334 $(87,269+283,043)/87,269$. Thus, each CWT fish that returned to TRH was expanded by its production multiplier to estimate the total number of hatchery-origin (HOR) spring or fall Chinook Salmon that entered the hatchery. If more Chinook Salmon entered the hatchery than could be accounted for by the expansion of all CWT groups, we assumed the additional fish were of natural-origin (NOR). Conversely, if the expanded number of HOR fish exceeds the number of fish entering TRH, we assume all fish entering TRH are HOR. We designated these fish as spring- or fall-run in the same proportions that were determined by the expansion of the CWT groups by their week of entry.

2.4.5. Effectively Tagged Fish

The total number of fish tagged at each weir is greater than the number of fish that effectively remain in the marked population due to various types of tag loss. The number of “effectively” tagged fish was determined by subtracting from the total those fish that were classified as tagging mortalities (fish having died within 30 days of tagging without spawning), tagged fish recovered downstream of the tagging site, and those fish whose tags were removed by catch-and-release anglers.

2.4.6. Run-size Estimates

Run-size estimates in 2018 for spring and fall Chinook Salmon, Coho Salmon and adult steelhead were calculated using Chapman's version of the Petersen Single Census Method [as modified by Ricker (1975)]:

$$N = \frac{(M + 1)(C + 1)}{(R + 1)}$$

where

N = estimated run size
M = the number of effectively tagged fish
C = the number of fish examined for tags at TRH
R = the number of TRP – tagged fish recovered at TRH

Assumptions of the mark-recapture estimator include 1) fish tagged at the weir are a random sample representative of the population; 2) tagged and untagged fish are equally vulnerable to recapture at TRH; 3) all Project tags are recognized upon recovery; 4) tagged and untagged fish are randomly mixed throughout the population and among the fish recovered at TRH; and 5) we account for all tagging mortalities.

Each year we attempt to tag and recover enough fish to obtain 95% confidence limits within $\pm 10\%$ of the run-size estimate. We use criteria established by Chapman (1948) to select confidence interval estimator.

2.4.7. Harvest Estimates and Catch-and-Release Rates

Generally, in the steelhead fishery, which is mostly catch-and-release, anglers return reward and non-reward tags at approximately the same rate, but in the Chinook Salmon fishery reward tags are returned at a higher rate than non-reward tags. When reward tags are returned at a higher rate than non-reward tags, we use only reward tag returns to determine harvest rates. If non-reward tags are returned at the same or higher rates than reward tags, we combine the two to determine harvest rates. Harvest rates for each species, run, and age class (jacks or adults) are calculated by dividing the number of tags returned by anglers from fish reported as harvested by the number of fish that were effectively tagged.

The number of fish of each species, run, and age class harvested upstream of the respective weir was estimated by multiplying the respective harvest rate by the relevant run-size.

We estimated catch-and-release rates for each species, run and age class by dividing the number of tags returned by anglers from fish reported as caught-and-released by the number of fish effectively tagged plus the number of fish reported as released.

2.4.8. Hatchery- and Naturally-Produced Composition of Run-size Estimates

Estimating the total return of individual CWT groups depends first and foremost on a basin run-size estimate. Total run-size and CWT return estimates for spring and fall Chinook Salmon are calculated for the Trinity River basin upstream of the JCW and WCW, respectively. Escapement and harvest and corresponding CWT estimates for natural escapement areas below the respective weirs and harvest in the ocean are not included in the estimates presented in this report.

We estimated contribution rates of TRH-produced (HOR) Chinook Salmon to total

spring and fall Chinook Salmon run-sizes by expanding each of the individual CWT estimated run-sizes by its corresponding hatchery expansion factor (total releases represented by each CWT release group/CWT fish released). In doing this, we assume that marked fish are representative of their unmarked counterparts.

The information needed to estimate the numbers of salmon of a specific CWT group that returned to the Trinity River basin and contributed to the fisheries and spawner escapement are: 1) Jack and adult total run-size, 2) Angler harvest rate of jack and adults, 3) Proportion of the run comprised of ad-clipped fish, 4) Proportion of CWT groups recovered at TRH, and, 5) Independent estimates of spring and fall Chinook Salmon run-size and angler harvest rates for each race of Chinook.

Any single digit disagreement in numbers throughout this report is due solely to rounding discrepancies.

3. RESULTS

3.1. Run-size, Escapement and Harvest Estimates

Using a Petersen mark-recapture methodology, we estimated 8,032 (95% CI 7,250 – 8,858) spring-run Chinook Salmon (927 jack and 7,105 adults) migrated into Trinity River basin upstream of JCW in 2018 (Table 1, Appendix 2, Appendix 3). The run was comprised of an estimated 346 NOR jacks, 2,032 NOR adults, 581 HOR jacks and 5,073 HOR adults (Appendix 4, Appendix 5). Based on expansions of the tags returned by anglers, we estimate zero jack and 265 adult spring Chinook Salmon were harvested, yielding an escapement of 7,767 fish, including the 2,908 spring Chinook that entered TRH and 4,859 estimated natural area spawners (Table 2). Spawning escapement of 1,938 NOR adult spring Chinook is 32.3% of the TRRP goal of 6,000 (Table 3). This year's run-size estimate of 8,032 is approximately 51% of the 39-year average of 15,882 since 1978. Estimated spring Chinook Salmon run-size has ranged from 2,381 fish in 1991 to 62,692 fish in 1988.

An estimated 26,848 (95% CI 24,413 – 29,634) fall-run Chinook Salmon (4,449 jack and 22,402 adults) migrated into the Trinity River basin upstream of WCW in 2018 (Table 1, Appendix 6, Appendix 7). The run consisted of an estimated 4,087 NOR jack, 8,650 NOR adult, 359 HOR jack and 13,752 HOR adult fall Chinook Salmon (Appendix 8, Appendix 9). Using tags returned by anglers we estimate 961 (200 jack and 761 adult) fall Chinook Salmon were harvested, yielding an escapement of 25,887, including the 7,313 fall Chinook that entered TRH and the 18,574 estimated natural area spawners (Table 2). Spawning escapement of 8,357 NOR adult fall Chinook Salmon is 13.5% of the 62,000 fish TRRP (Table 3). This year's run-size estimate of 26,848 is approximately 66% of the 42-year average of 40,854 since 1977. Estimated fall Chinook Salmon run-size has ranged from 6,196 fish in 2016 to 147,888 fish in 1986.

Both Coho Salmon run-size and escapement in the Trinity River upstream of WCW were estimated at 1,486 (95% CI 1,084 – 2,100) because no Coho Salmon were reported as harvested (Table 1, Appendix 10, Appendix 11). The run consisted of an estimated 18 NOR jacks, 42 NOR adults, 409 HOR jacks and 1,017 HOR adults (Appendix 12, Appendix 13), with 742 of those fish entering TRH and an estimated 744 escaping to spawn in natural areas. The estimated escapement of 42 NOR Coho Salmon adults was 3.0% of the TRRP goal of 1,400 fish (Table 3). This year's run-size estimate of 1,486 is approximately 9.5% of the 42-year average of 15,633 since 1977. Estimated Coho Salmon run-size has ranged from 655 in 2017 to 59,079 in 1987.

An estimated 5,885 (95% CI 5,007 – 6,835) adult fall steelhead returned to the Trinity River basin upstream of WCW (Table 1, Appendix 14). Anglers harvested an estimated 157 adult fall steelhead upstream of the weir, leaving 5,728 (2,326 NOR and 3,402 HOR) fish as potential spawners (Table 2, Appendix 15). Escapement of 2,326 NOR adult steelhead is 5.8% of the 40,000 fish TRRP goal (Table 3). This year's run-size is 41.4% of the average of 14,225 since 1980, with a range from 2,972 in 1998 to 53,885 in 2007.

Table 1. Run-size estimates and 95% confidence limits for Trinity River basin spring and fall Chinook Salmon, Coho Salmon, and adult fall steelhead during the 2018-19 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum ^a	Number effectively tagged ^b	Trinity River Hatchery recoveries		Run-size estimate ^d	Confidence limits 1-p= 0.95	Confidence limit estimator
				Number examined for tags ^c	Number of tags in sample			
Spring Chinook Salmon	Upstream of Junction City weir	Jacks	24	420	7	927	7,250 - 8,858	Normal Approximation
		Adults	911	2,488	331	7,105		
		Total	935	2,908	338	8,032		
Fall Chinook Salmon	Upstream of Willow Creek weir (WCW)	Jacks	231	224	8	4,446	24,413 - 29,634	Normal Approximation
		Adults	1,273	7,089	401	22,402		
		Total	1,504	7,313	409	26,848		
Coho Salmon	Upstream of Willow Creek weir	Jacks	46	186	20	427	1,084 - 2,100	Poisson Approximation
		Adults	25	556	15	1,059		
		Total	71	742	35	1,486		
Fall-run steelhead	Upstream of WCW	Adults	455	1,896	146	5,885	5,007 - 6,835	Normal Approx

a/ Stratum: Jacks = two-year-old salmon; Adults = three years or older; Steelhead adults = fish greater than 41 cm FL.

b/ The number of effectively tagged fish was corrected for fish not tagged, tagging mortalities, and fish which had their tags removed (caught and released).

c/ Numbers of spring and fall run Chinook Salmon were estimated from expansion of coded wire tag recoveries at Trinity River Hatchery; Coho Salmon and steelhead numbers were actual recoveries.

d/ For jack and adult estimate of total run size: spring Chinook Salmon was based on the proportion of jacks to adults observed at JCW and TRH combined, and the Coho Salmon jack/adult assignment was based on the WCW/TRH combined proportions (both using FL frequency analysis to split age classes). We applied the scale-aged proportions at WCW to reach jack/adult assignment of the fall Chinook Salmon run.

Table 2. Estimates of Trinity River basin spring and fall Chinook Salmon, Coho Salmon, and adult fall-run steelhead run-size, angler harvest, and spawner escapement during the 2018-19 season.

Species/ race	Area of Trinity River basin for run- size estimate	Stratum ^a	Run-size estimate	Angler Harvest		Spawner Escapement		
				Harvest rate ^b	Number of fish ^c	Natural area spawners ^d	Trinity River Hatchery	Total
Spring Chinook	Upstream of Junction City weir	Jacks	927	0.0%	0	507	420	927
		Adults	7,105	3.7%	265	4,352	2,488	6,840
		Total	8,032		265	4,859	2,908	7,767
Fall Chinook	Upstream of Willow Creek weir	Jacks	4,446	4.5%	200	4,075	171	4,246
		Adults	22,402	3.4%	761	14,499	7,142	21,641
		Total	26,848		961	18,574	7,313	25,887
Coho	Upstream of Willow Creek weir	Jacks	427	0.0%	0	241	186	427
		Adults	1,059	0.0%	0	503	556	1,059
		Total	1,486		0	744	742	1,486
Fall-run adult steelhead	Upstream of Willow Creek weir	Natural	2,354	1.2%	28	2,289	37	2,326
		Hatchery	3,531	3.7%	129	1,543	1,859	3,402
		Total	5,885		157	3,832	1,896	5,728

a/ Stratum: Jacks = two-year-old salmon, Adults = three years old or older; Steelhead adults were fish greater than 41 cm FL.

b/ Harvest rates were based on the return of reward tags for spring and fall Chinook Salmon and steelhead.

There was no legal Coho Salmon harvest allowed, nor any reported.

c/ Calculated as the run-size times the harvest rate.

d/ Calculated as run-size minus angler harvest minus hatchery escapement. Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery. Any difference between these numbers and others throughout this report are due to rounding.

Table 3. Estimates of contribution of naturally-produced and hatchery-produced adult spring and fall Chinook Salmon, Coho Salmon, and adult fall-run steelhead to the Trinity River basin spawner escapement during the 2018-19 season.

Species/ race	Area of Trinity River	Produced	Total Spawner Escapement			Natural-origin contribution to escapement	
			Natural area spawners ^a	Trinity River Hatchery	Total	TRRP Goal	% of Goal
Spring Chinook	Upstream of Junction City weir	Naturally	1,650	288	1,938	6,000	32.3%
		Hatchery	2,702	2,200	4,902		
		Total	4,352	2,488	6,840		
Fall Chinook	Upstream of Willow Creek weir	Naturally	7,538	819	8,357	62,000	13.5%
		Hatchery	6,961	6,323	13,284		
		Total	14,499	7,142	21,641		
Coho	Upstream of Willow Creek weir	Naturally	1	41	42	1,400	3.0%
		Hatchery	502	515	1,017		
		Total	503	556	1,059		
Fall-run steelhead	Upstream of Willow Creek weir	Naturally	2,289	37	2,326	40,000	5.8%
		Hatchery	1,543	1,859	3,402		
		Total	3,832	1,896	5,728		

a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery. Any difference between these numbers and others throughout this report are due to rounding.

3.2. Spring Chinook Salmon

3.2.1. Spring Chinook Salmon Trapping and Tagging

The CDFW and HVTF installed JCW on June 11, 2018 (JW 24) and trapped the first night. The weir was disabled by high flow releases from Lewiston Dam on July 27 (JW 30) which resulted from a mechanical failure associated with the Carr Fire. The weir was rebuilt and resumed trapping on August 6 (JW 32). The weir was removed for the season on October 2, 2018 (JW 40).

A total of 1,079 Chinook Salmon were trapped at JCW over 72 nights in 2018 (Table 4, Figure 5), of which 948 were determined to be spring Chinook Salmon (see Section 2.4.3.). The number of spring Chinook trapped peaked at 92.4 fish per night during JW 26. All Chinook trapped through JW 38 at JCW in 2018 were designated as spring Chinook Salmon, while Chinook trapped in JWs 39 and 40 were not included in our spring Chinook analysis. All Chinook trapped at JCW in 2018 were tagged.

Table 4. Weekly summary of Chinook Salmon trapped at Junction City weir on the Trinity River during 2018 ^a

Julian week	Inclusive dates	Nights trapped	Number trapped							
			Jacks ^b	Ad-clip Jacks ^c	Adults	Ad-clip Adults	Total trapped	Ad-clips total	Fish/night	Ad-clips /night
24	11-Jun - 17-Jun	4	0	0	48	7	48	7	12.0	1.8
25	18-Jun - 24-Jun	5	0	0	202	41	202	41	40.4	8.2
26	25-Jun - 1-Jul	5	1	0	461	84	462	84	92.4	16.8
27	2-Jul - 8-Jul	4	4	0	68	18	72	18	18.0	4.5
28	9-Jul - 15-Jul	5	1	0	27	7	28	7	5.6	1.4
29	16-Jul - 22-Jul	5	1	0	18	1	19	1	3.8	0.2
30	23-Jul - 29-Jul	4	0	0	1	0	1	0	0.3	0.0
31	30-Jul - 5-Aug	0					--	--	--	--
32	6-Aug - 12-Aug	4	0	0	6	0	6	0	1.5	0.0
33	13-Aug - 19-Aug	5	3	1	5	1	8	2	1.6	0.4
34	20-Aug - 26-Aug	5	2	1	7	0	9	1	1.8	0.2
35	27-Aug - 2-Sep	5	5	1	16	3	21	4	4.2	0.8
36	3-Sep - 9-Sep	4	3	0	7	1	10	1	2.5	0.3
37	10-Sep - 16-Sep	5	1	0	18	2	19	2	3.8	0.4
38	17-Sep - 23-Sep	5	4	1	39	4	43	5	8.6	1.0
39 ^d	24-Sep - 30-Sep	5	8	0	89	13	97	13	19.4	2.6
40 ^d	1-Oct - 7-Oct	2	4	0	30	3	34	3	17.0	1.5
Total Chinook trapped:		72	37	4	1,042	185	1,079	189		
Mean of all Chinook:									15.0	2.6
Total spring Chinook trapped:		65	25	4	923	169	948	173		
Mean of spring Chinook:									14.6	2.7

a/ Trapping at Junction City weir took place June 12 - October 2, 2018 (Julian weeks 24-40).

b/ Spring Chinook <51 cm FL were considered jacks in 2018.

c/ Adipose fin-clipped Chinook. Number shown is a subset of weekly jack and adult Chinook totals.

d/ We determined Chinook Salmon trapped after JW 38 were fall Chinook, so are not included in Spring Chinook totals.

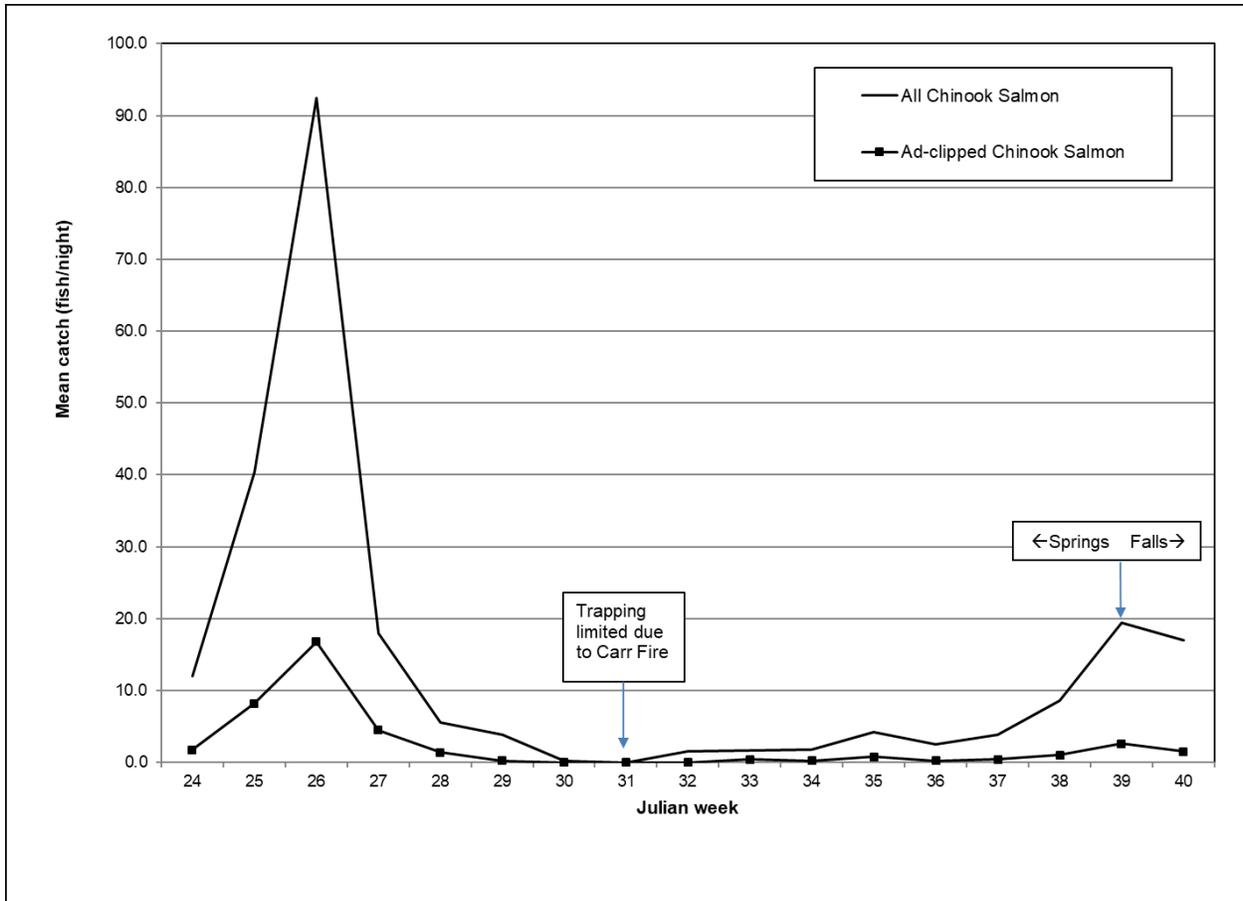


Figure 5. Mean catch of Chinook Salmon at Junction City weir on the Trinity River, 2018.

Spring Chinook Salmon trapped at JCW averaged 63.5 cm FL (Figure 6), and ranged from 37 cm to 86 cm FL (Appendix 16). Fork length distribution analysis, including all unique spring Chinook either trapped at JCW or recovered at TRH, showed the nadir separating jack from adult spring Chinook was between 51 and 52 cm FL. Fish ≤ 51 cm FL were designated as jacks and fish >51 cm FL were designated as adults. Jacks averaged 45.0 cm FL and adults averaged 63.8 cm FL. Using 52 cm FL as the minimum adult size, only 2.6% of the 948 spring Chinook that were trapped at JCW were considered jacks. Ad-clipped fish comprised 18.2% (173 of 948) of the spring Chinook Salmon trapped at JCW.

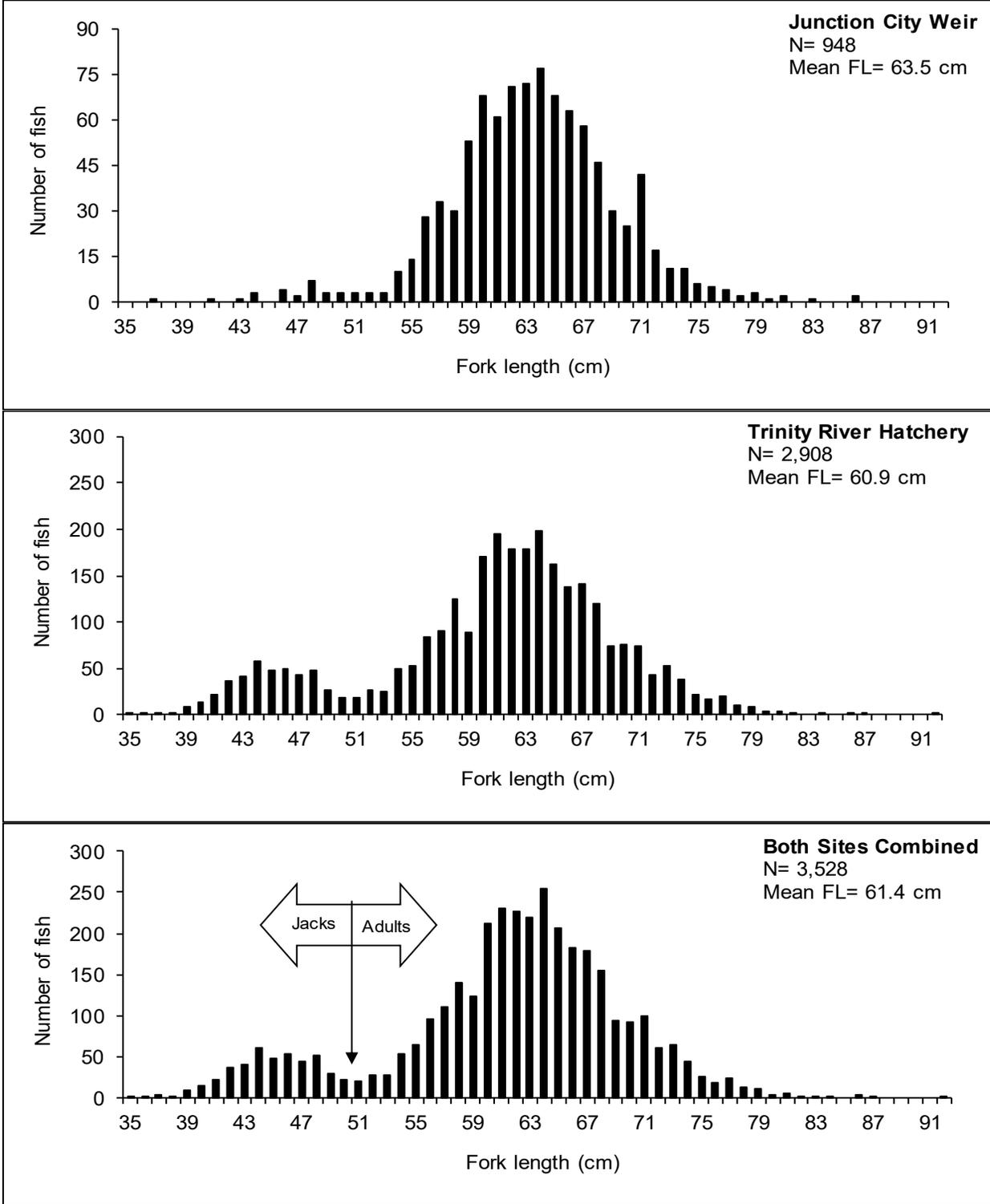


Figure 6. Spring Chinook Salmon fork lengths (cm) observed at Junction City weir, Trinity River Hatchery, and both sites combined during the 2018-19 season. Note: Fish trapped at JCW then recovered at TRH are only included once in the “combined” (bottom) graph. Also, the arrow denotes the size used to separate jacks and adults for analysis.

3.2.2. Spring/Fall Run Chinook Salmon Separation and Run Timing

We recovered 10,221 Chinook Salmon at TRH in 2018, of which 2,260 (22.1%) had ad-clips (Appendix 17). We recovered CWTs from 615 known (ad-clipped with a readable CWT) spring Chinook Salmon and we recovered CWTs from 1,553 known fall Chinook Salmon; the remaining 92 ad-clipped fish had either shed their CWT (68 fish) or the CWT was lost or unreadable (24 fish). Those 92 Chinook were classified as spring-run (41 fish) or fall-run (51 fish) based on their date of entry into TRH, resulting in a total of 656 spring CWT Chinook Salmon (Appendix 18) and 1,604 fall CWT Chinook Salmon (Appendix 19).

Three hundred sixty-five Chinook Salmon tagged at JCW were subsequently recovered at TRH between JW 36 and 46. Of those, 338 (including 71 spring CWT) entered TRH before JW 41, and the remaining 27 (including eight fall CWT) entered after the ladder was reopened in JW 43. Based on timing of passage through JCW, the arrival dates of JCW-tagged fish at TRH, and CWT analysis, we designated Chinook Salmon that passed through JCW from JW 24 through JW 38 to be spring-run, and those that passed after JW 38 to be fall-run (Figure 7).

One TRH-origin spring CWT Chinook Salmon was tagged at WCW during JW 38 and subsequently recovered at TRH in JW 44, and no Chinook Salmon tagged at WCW arrived at TRH prior to JW 43. Consequently, all Chinook tagged at WCW in 2018 were designated as fall Chinook.

3.2.3. Spring Chinook Salmon Recovery

3.2.3.1. Angler Tag Recovery

Anglers reported harvesting zero jack and 34 adult TRP-tagged spring Chinook Salmon, resulting in an estimated harvest of 265 adult spring Chinook Salmon and harvest rates for spring Chinook Salmon upstream of JCW of 0.0% for jacks and 3.73% for adults. There was one tag returned from a jack and 11 tags returned from adult spring Chinook in the catch-and-release fishery, resulting in catch-and-release rates of 4.0% for jacks and 1.2% for adults. Additionally, seven tags found loose or on dead fish were returned by anglers or other river users.

3.2.3.2. Spawner Survey Recovery

Mainstem Trinity River Chinook Salmon spawner surveys were conducted from August 28 to December 14, 2018. There was one jack and 42 adult TRP-tagged spring Chinook recovered during spawner surveys in 2018. None of those tags were recovered from unspawned dead fish less than 30 days after tagging, so none were identified as tagging mortalities.

3.2.3.3. Tagging Mortalities

There was one adult spring Chinook Salmon identified as a tagging mortality at JCW in 2018. This tag was omitted from the number of tagged fish used to estimate run size.

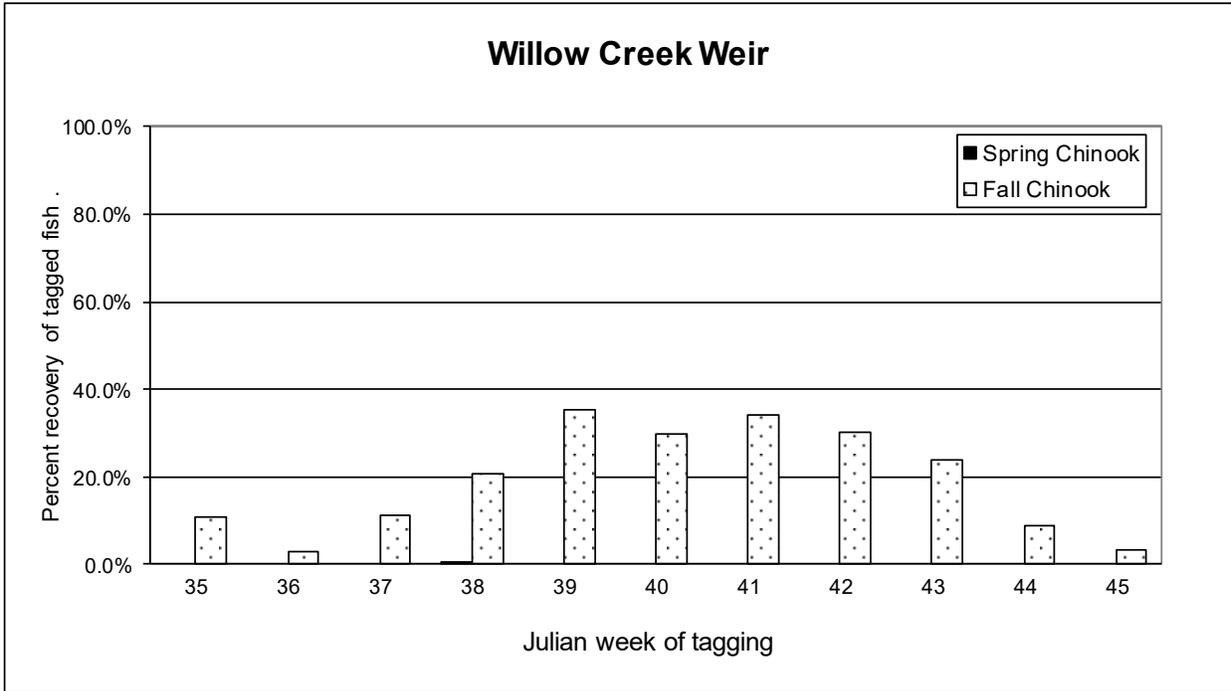
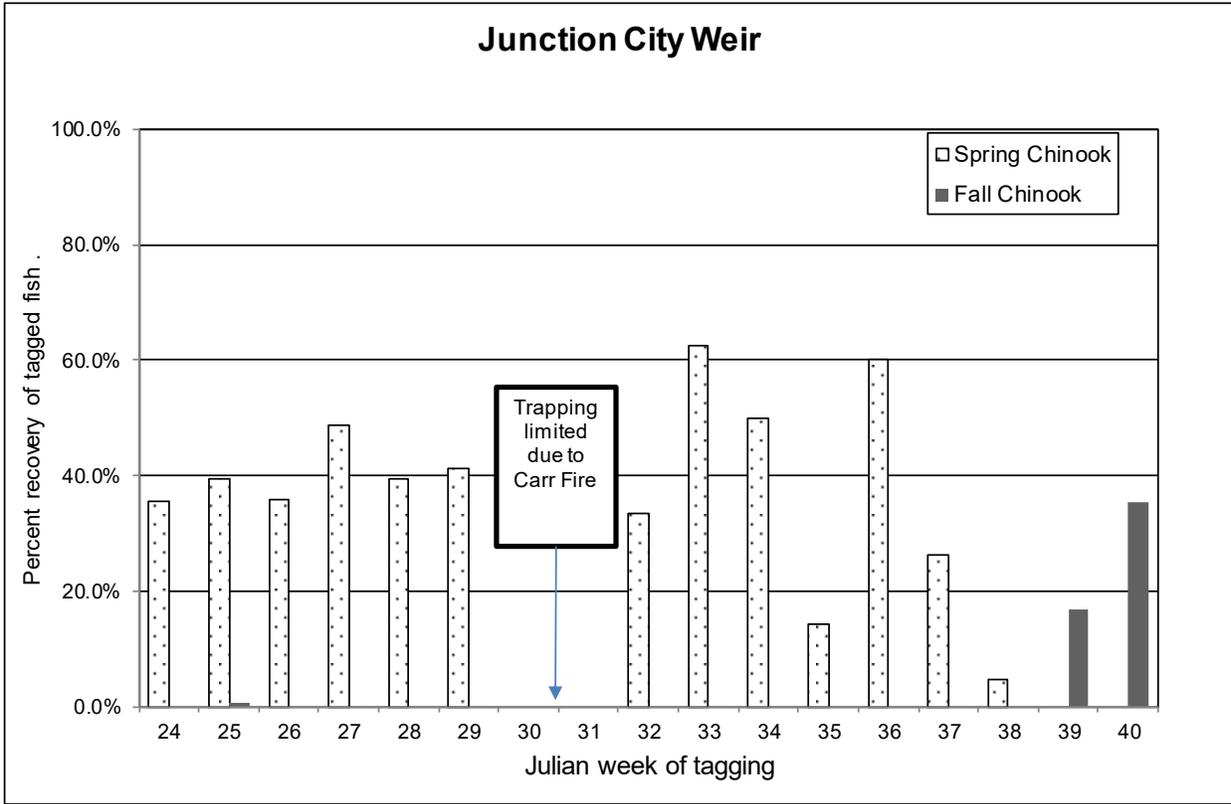


Figure 7. Percent recovery of Junction City weir and Willow Creek weir marked Chinook Salmon at Trinity River Hatchery during the 2018-19 season.

3.2.3.4. Trinity River Hatchery Recovery

Spring Chinook Salmon began entering TRH on September 4, 2018 (JW 36). Most of the spring-run arrived before the spawning break in JW 41, although a few continued entering through JW 44 (Appendix 17). Recovery of spring Chinook peaked in JW 40 with 1,241 fish, which coincided with the peak of spring CWT Chinook recovery (Appendix 18). Of the 935 spring Chinook effectively tagged at JCW, 338 (36.1%) were recovered at TRH. Based on run-timing determined from CWT recoveries, an estimated 2,908 (420 jack and 2,488 adult) spring Chinook Salmon returned to TRH in 2018.

3.2.3.5. Size and Age of Trapped Fish

Spring Chinook Salmon trapped at TRH averaged 60.9 cm FL (Figure 6). Fork length distribution analysis shows the nadir separating jack from adult spring Chinook was between 50 and 51 cm FL. Data from known age, hatchery-marked spring Chinook that entered TRH supported the minimum adult fork length of 51 cm (Appendix 20). There was some overlap in the size distributions of known age-2 and age-3 fish, but the mean lengths were markedly different. Known age-2 fish averaged 45.5 cm FL and known age-3 fish averaged 63.0 cm FL. Applying the minimum adult size of 51 cm FL, an estimated 2.6% and 14.4% of observed spring Chinook Salmon were jacks at JCW and TRH, respectively.

3.2.4. Spring Chinook Salmon Coded-Wire Tag Recovery and Hatchery Origin Contribution to Runs

The 615 CWTs recovered from spring Chinook Salmon at TRH represented 14 CWT release groups from BYs 2013 – 2016 (ages 2-5). It is rare to recover a known age-6 Chinook Salmon in the Trinity River, so we consider the age-5 fish returning in 2018 to represent the last returns for the complete BY 2013 cohort. Of the 362,633 (258,761 fingerling and 103,872 yearling) spring Chinook Salmon released from TRH with CWTs for BY 2013, 424 (0.12%) returned to the Trinity River between 2015 – 2018, far below the mean of 0.64% (Figure 8, Appendix 21). For the full breakdown of run-size, percent return, harvest and spawner escapement estimates for TRH CWT spring Chinook Salmon by release group see Appendix 22.

Based on the total estimated spring Chinook Salmon run-size upstream of JCW (927 jacks and 7,105 adults), the estimated angler harvest rate (0.0% jacks, 3.7% adults), and the percentage of ad-clipped spring Chinook at JCW also containing CWTs (94.6%), we estimate the contribution of spring-run CWT Chinook Salmon to the total run of spring Chinook upstream of JCW to be 1,371 in 2018, including 140 jacks and 1,231 adults (Appendix 23). The run is estimated to include 46 CWT spring Chinook Salmon harvested by anglers, 623 recovered at TRH and 702 available to spawn in natural areas. The age composition of 2018 CWT spring Chinook Salmon returns was 140 (10.2%) age 2, 1,177 (85.8%) age 3, 52 (3.8%) age 4, and 2 (0.2%) age 5 fish.

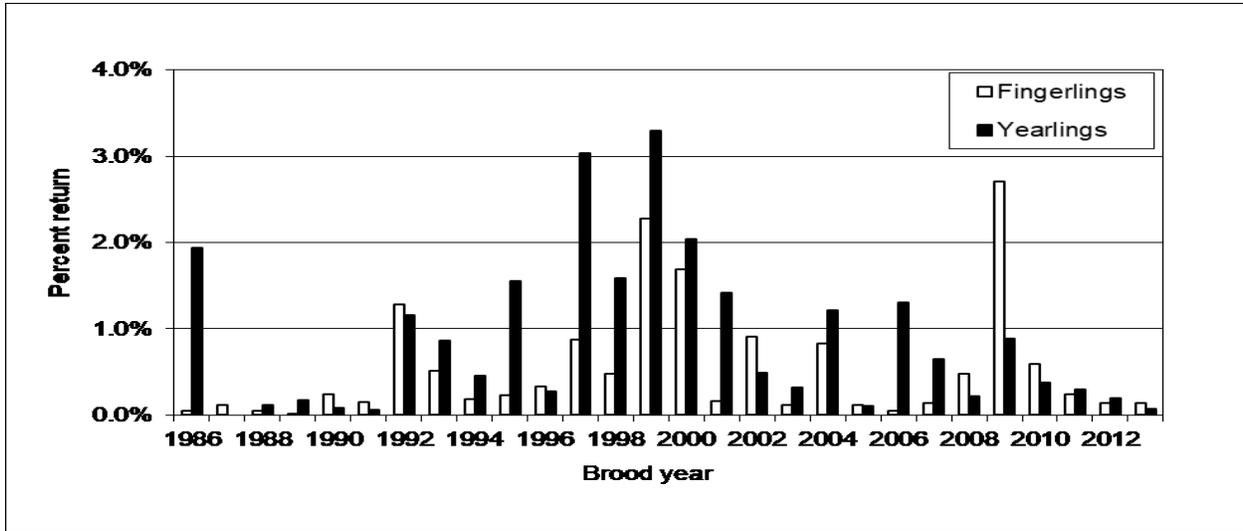


Figure 8. Percent return of Trinity River Hatchery produced, coded-wire tagged spring Chinook Salmon, brood years 1986 - 2013, based on estimated returns upstream of Junction City weir.

Applying production multipliers to CWT recoveries allows for the estimation of HOR spring Chinook Salmon contributions to the total Trinity River spring Chinook Salmon run-size upstream of JCW. In 2018, an estimated 5,654 (581 jack, 5,073 adult) HOR spring Chinook Salmon returned to the Trinity River upstream of JCW, which represents 70.4% of the combined HOR and NOR run and is above the 27 year mean of 59.5% (Figure 9, Appendix 24).

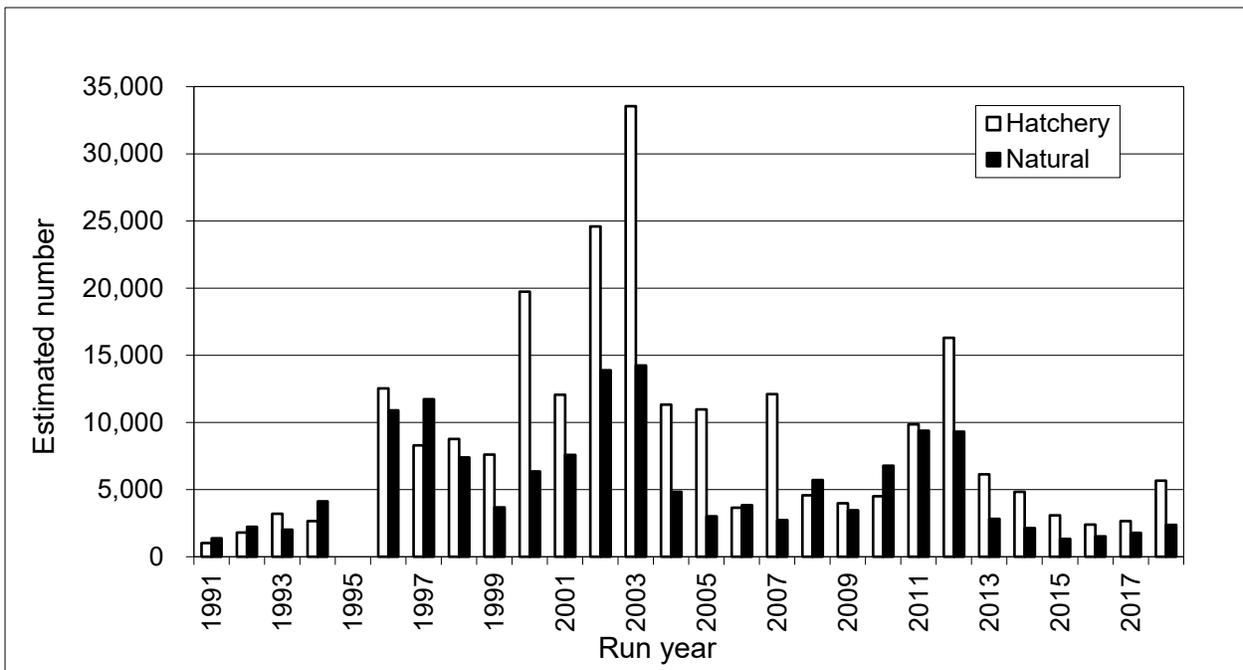


Figure 9. Estimated contribution of Trinity River Hatchery-origin and natural-origin spring Chinook Salmon to total run-size upstream of Junction City weir, 1991 - 2018.

3.3. Fall Chinook Salmon

3.3.1. Fall Chinook Salmon Trapping and Tagging

Willow Creek weir started trapping the night of August 28, 2018 (JW 35). Trapping continued until November 19 (JW 47) when the weir was removed for the season in anticipation of an impending storm-related high flow event.

A total of 1,592 Chinook Salmon were trapped at WCW over 58 nights in 2018 (Table 5), all of which were determined to be fall Chinook Salmon (see Section 2.4.3). Tags were applied to 1,565 of those fish; 27 were not tagged due to poor condition, and one died from tagging stress. The number of fall Chinook trapped at WCW peaked at 104.0 fish per night during JW 39 (Figure 10), with a mean of 27.4 fish per night across the trapping period.

Table 5. Weekly summary of Chinook Salmon trapped at Willow Creek weir on the Trinity River during 2018.^a

Julian week	Inclusive dates	Nights trapped	Number trapped					Ad-clip total	Fish/night
			Jacks ^b	Ad-clip ^c Jacks	Adults	Ad-clip Adults	Total		
35	27-Aug - 2-Sep	3	5		43	2	48	2	16.0
36	3-Sep - 9-Sep	4	19		50	2	69	2	17.3
37	10-Sep - 16-Sep	5	12		42	14	54	14	10.8
38	17-Sep - 23-Sep	5	25		146	64	171	64	34.2
39	24-Sep - 30-Sep	5	113	3	407	32	520	35	104.0
40	1-Oct - 7-Oct	5	31		188	31	219	31	43.8
41	8-Oct - 14-Oct	5	12	1	173	29	185	30	37.0
42	15-Oct - 21-Oct	5	6		133	15	139	15	27.8
43	22-Oct - 28-Oct	5	6	1	97	5	103	6	20.6
44	29-Oct - 4-Nov	5	8		29	8	37	8	7.4
45	5-Nov - 11-Nov	5	11		23	1	34	1	6.8
46	12-Nov - 18-Nov	5	2		7	1	9	1	1.8
47	19-Nov - 25-Nov	1	1		3		4	0	4.0
Total:		58	251	5	1,341	204	1,592	209	
Mean:									27.4

a/ Trapping at Willow Creek weir took place August 29 - November 19, 2018 (Julian weeks 35-47).

All Chinook trapped at Willow Creek weir in 2018 were considered Fall run.

b/ Chinook <51 cm FL were considered jacks in 2018 for this graphic, though scale-age proportions were used elsewhere in this report.

c/ Adipose fin-clipped Chinook. Number shown is a subset of weekly jack and adult Chinook totals.

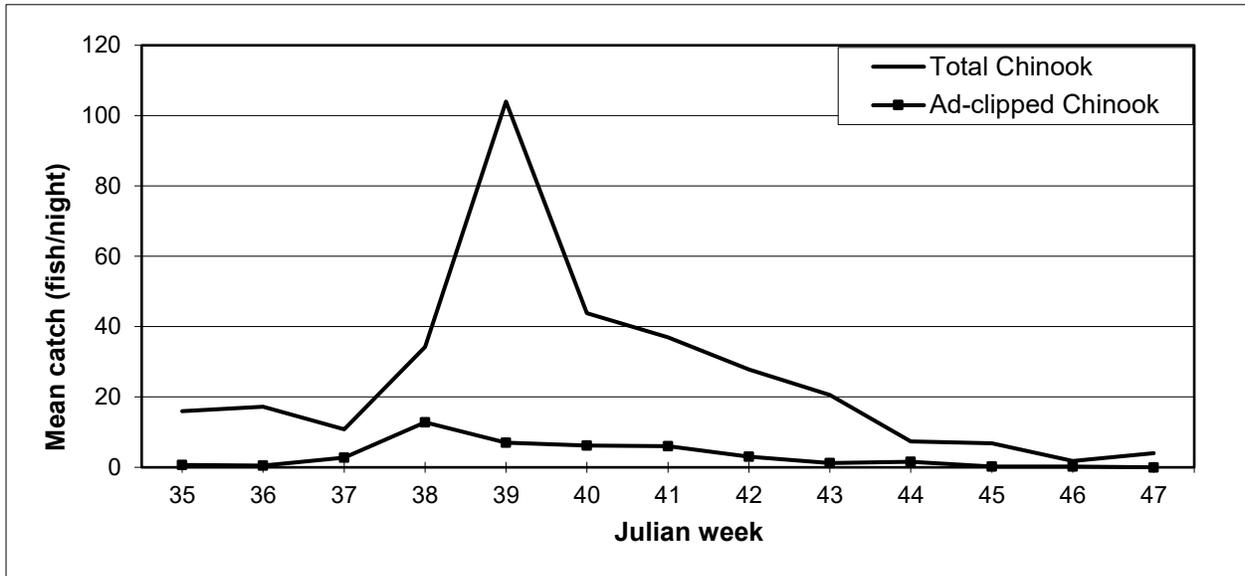


Figure 10. Mean catch of fall run Chinook Salmon at Willow Creek weir on the Trinity River, 2018.

Fall Chinook Salmon trapped at WCW averaged 60.5 cm FL (Figure 11), and ranged from 36 cm to 87 cm FL (Appendix 25). Fork length distribution analysis determined the nadir separating jacks from adults to be between 50 and 51 cm FL, although for assigning age classes to the entire run we used HVTFs scale age proportions (see Section 2.4.1). Jacks averaged 45.1 cm and adults averaged 63.2 cm FL. Using 51 cm FL as the minimum adult size, 15.8% of the 1,592 fall Chinook that were trapped at WCW were considered jacks. Ad-clipped fish comprised 13.1% (209 of 1,592) of the fall Chinook Salmon trapped at WCW.

3.3.2. Fall Chinook Salmon Recovery

3.3.2.1. Angler Tag Recovery

Anglers reported harvesting 35 (6 jack and 29 adult) TRP-tagged fall Chinook Salmon (Appendix 25) resulting in an estimated harvest of 961 fall Chinook Salmon. The estimated harvest rate of fall Chinook upstream of WCW was 4.5% for jacks and 3.4% for adults. There were 60 tags (15 jacks and 25 adults) returned from the catch-and-release fishery, and there were 38 tags (1 jack and 27 adults) found loose (no live fish attached) that were returned by anglers or other river users.

3.3.2.2. Spawner Survey Recovery

There were 52 adult TRP-tagged fall Chinook Salmon recovered (Appendix 25) during spawner surveys in 2018. No TRP-tagged jacks were recovered. No tags were recovered from unspawned dead fish less than 30 days after tagging, so none were identified as tagging mortalities.

3.3.2.3. Tagging Mortalities

There was one observed fall Chinook Salmon tagging mortality at WCW in 2018.

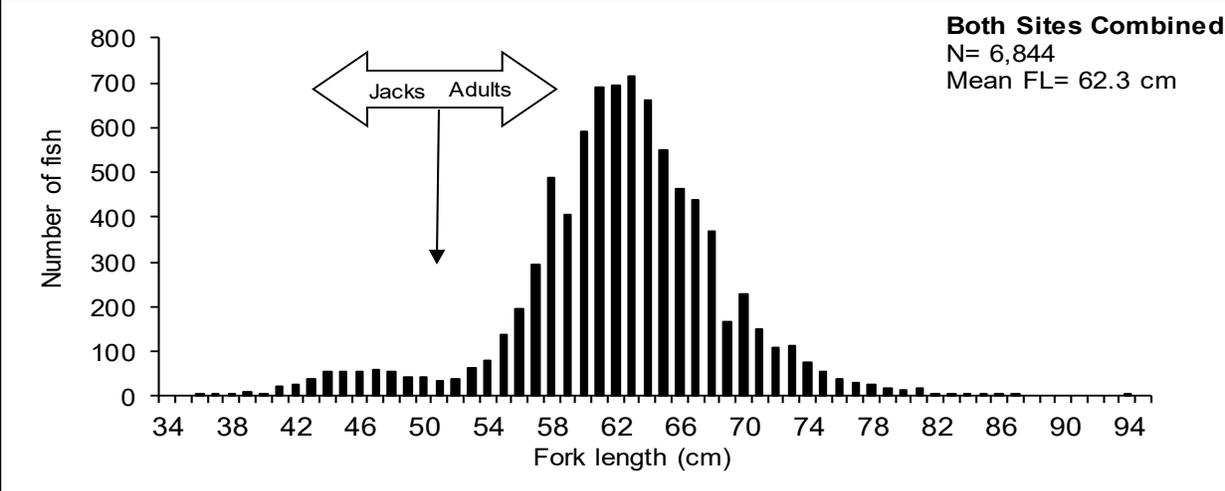
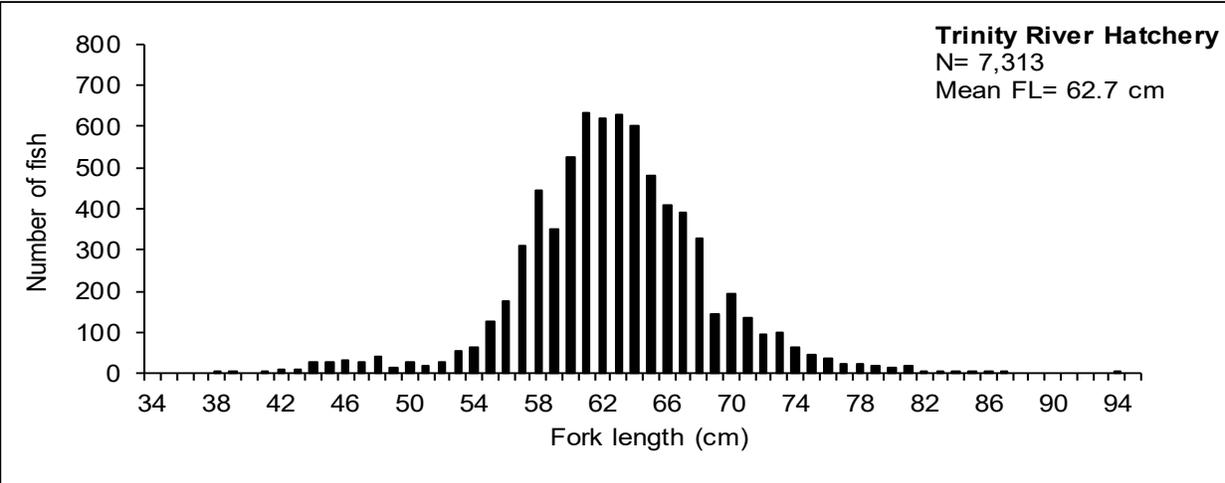
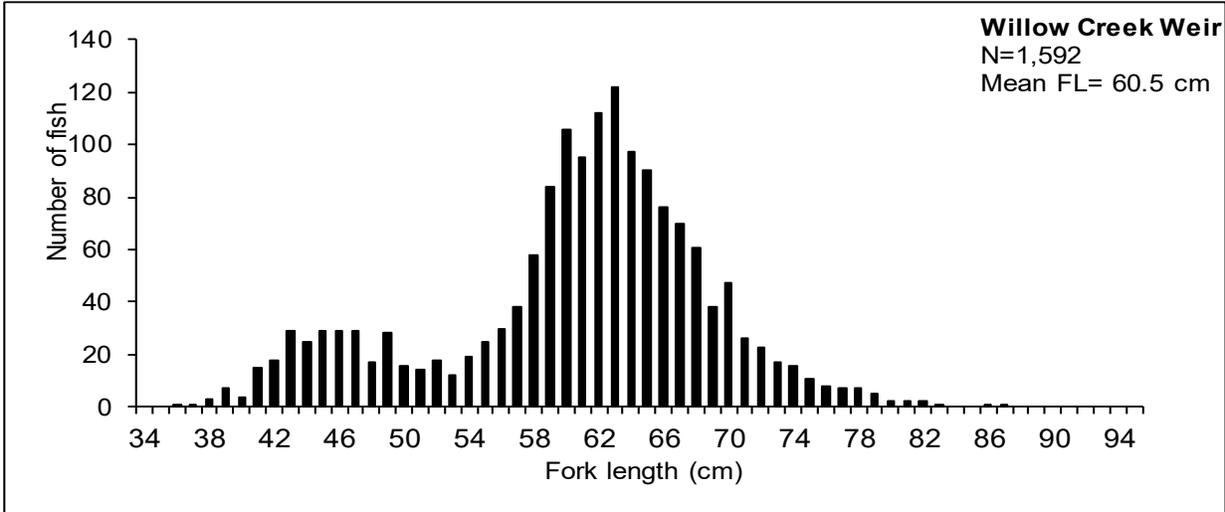


Figure 11. Fall Chinook Salmon fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery, and both sites combined during the 2018-19 season. Note: Fish trapped at WCW then recovered at TRH are only included once in the “combined” (bottom) graph. Also, the arrow denotes the size used to separate jack and adults for harvest and catch and release fishery estimates.

3.3.2.4. Trinity River Hatchery Recovery

Fall Chinook Salmon began entering TRH on October 22, 2018 (JW 43) and continued entering through JW 4 (Appendix 17). Recovery of fall Chinook peaked in JW 46 with 1,584 fish, whereas peak week for fall CWT Chinook recovery was JW 44 (Appendix 19). Of the 1,504 fall Chinook effectively tagged at WCW, 409 (27.2%) were recovered at TRH. Based on run-timing determined from CWT recoveries, an estimated 7,313 (171 jack and 7,142 adult) fall Chinook Salmon returned to TRH in 2018.

3.3.2.5. Size and Age of Trapped Fish

Fall Chinook Salmon trapped at TRH averaged 62.7 cm FL (Figure 11). Data from known age, hatchery-marked fall Chinook that entered TRH indicated a minimum adult fork length of 51 cm (Appendix 26). There was little overlap between sizes of age-2 and age-3 fish, and the mean lengths were markedly different. Known age-2 fish averaged 46.5 cm FL and known age-3 fish averaged 63.4 cm FL. Applying the proportions determined from HVT scale analysis, jacks comprised 2.35% and adults 97.66% of fall Chinook entering TRH. There were a few age-4 fish (1.2%) and zero age-5 at TRH in 2018.

3.3.3. Fall Chinook Salmon Coded-Wire Tag Recovery and Hatchery Origin Contribution to Runs

The 1,553 CWTs recovered from fall Chinook Salmon at TRH represented eight CWT release groups from BYs 2014 – 2016 (ages 2-4). There were no known-age 5 fall Chinook recovered in 2018. We considered the 2013 BY to have completed their life-cycle this year. Of the 766,646 (526,760 fingerling and 239,886 yearling) fall Chinook Salmon released from TRH with CWTs for BY 2013, just 416 (0.05%) returned between 2015 – 2018, well below the mean of 0.75% (Figure 12, Appendix 27). For the full breakdown of run-size, percent return, and harvest and spawner escapement estimates for TRH CWT fall Chinook Salmon by release group see Appendix 28.

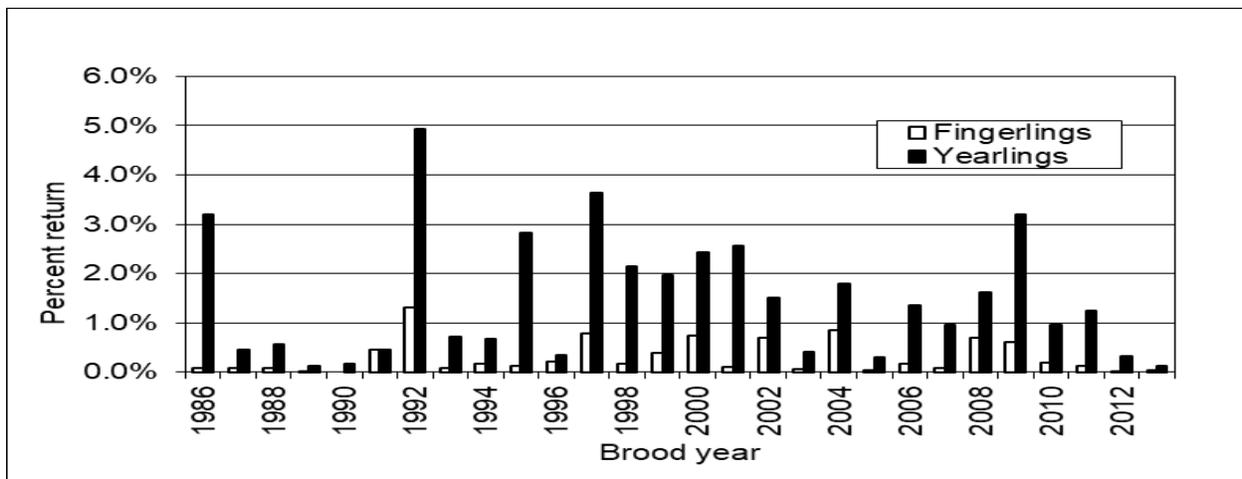


Figure 12. Percent return of Trinity River Hatchery produced, coded-wire tagged fall Chinook Salmon, brood years 1986 - 2013, based on estimated returns upstream of Willow Creek weir.

Based on the total estimated fall Chinook Salmon run-size upstream of WCW (4,446 jacks and 22,402 adults), the estimated angler harvest rate (4.5% jacks, 3.4% adults), and the percentage of ad-clipped fall Chinook at WCW also containing CWTs (97.8%), we estimate the contribution of fall-run CWT Chinook Salmon to the total run of fall Chinook upstream of WCW to be 3,417 in 2018, including 86 jacks and 3,331 adults (Appendix 29). The run is estimated to include 117 CWT fall Chinook Salmon harvested by anglers, 1,568 recovered at TRH and 1,732 available to spawn in natural areas. The age composition of 2018 CWT fall Chinook Salmon returns was 359 (2.5%) age 2, 13,614 (96.5%) age 3, 138 (1.0%) age 4, and 0 (0.0%) age 5 fish.

Applying production multipliers to CWT recoveries allows for the estimation of HOR fall Chinook Salmon contributions to the total Trinity River fall Chinook Salmon run-size upstream of WCW. In 2018, an estimated 14,111 (359 jack, 13,752 adult) HOR fall Chinook Salmon returned to the Trinity River upstream of WCW, which represents 52.6% of the combined HOR and NOR run and is slightly above the 28-year mean of 49.9% (Figure 13, Appendix 30).

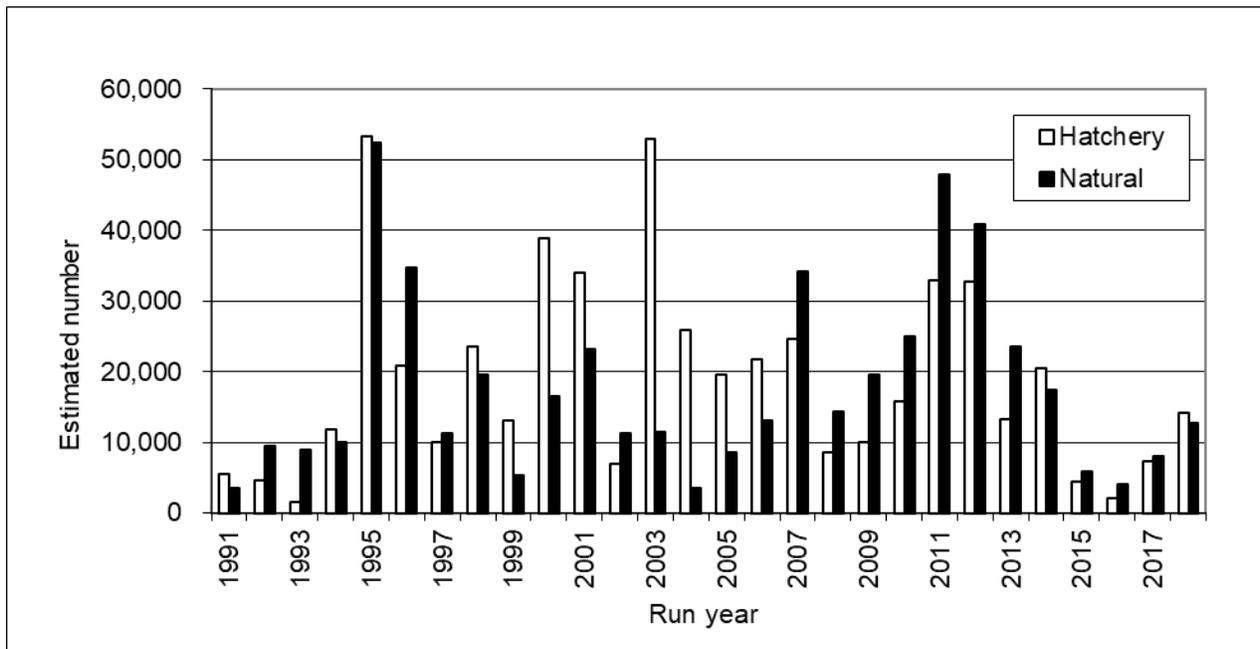


Figure 13. Hatchery- and natural-origin contributions to total fall Chinook Salmon run-size, upstream of Willow Creek weir, 1991 – 2018.

3.4. Coho Salmon

3.4.1. Coho Salmon Trapping and Tagging

A total of 73 Coho Salmon (48 jacks and 25 adults) were trapped at WCW between JWs 39-45 in 2018, all of which were tagged (Table 6, Appendix 31). Trapping averaged 1.3 Coho Salmon per night and peaked in JW 41 at 5.6 per night (Figure 14). Right

maxillary clipped fish comprised 95.9% (70 of 73) of Coho Salmon trapped at WCW, indicating TRH origin.

Table 6. Weekly summary of Coho Salmon trapped in the Trinity River at Willow Creek weir during 2018.^a

Julian week	Inclusive dates	Nights trapped	Number trapped						
			Jacks ^b	RMclip ^c Jacks	Adults	RMclip Adults	Total trapped	Total RM clips	Total Coho
35	27-Aug - 2-Sep	3					0	0	0.0
36	3-Sep - 9-Sep	4					0	0	0.0
37	10-Sep - 16-Sep	5					0	0	0.0
38	17-Sep - 23-Sep	5					0	0	0.0
39	24-Sep - 30-Sep	5	2	2			2	2	0.4
40	1-Oct - 7-Oct	5	2	2	5	5	7	7	1.4
41	8-Oct - 14-Oct	5	15	14	13	13	28	27	5.6
42	15-Oct - 21-Oct	5	11	10	4	4	15	14	3.0
43	22-Oct - 28-Oct	5	9	9	1	1	10	10	2.0
44	29-Oct - 4-Nov	5	6	6	2	1	8	7	1.6
45	5-Nov - 11-Nov	5	3	3			3	3	0.6
46	12-Nov - 18-Nov	5					0	0	0.0
47	19-Nov - 25-Nov	1					0	0	0.0
Total:		58	48	46	25	24	73	70	
Mean:									1.3

a/ Trapping at Willow Creek weir took place August 29 - November 19, 2018 (Julian weeks 39 - 47).

b/ Coho <49cm FL were considered jacks in 2017.

c/ Right maxillary clipped Coho. Number shown is a subset of weekly jack and adult Coho totals.

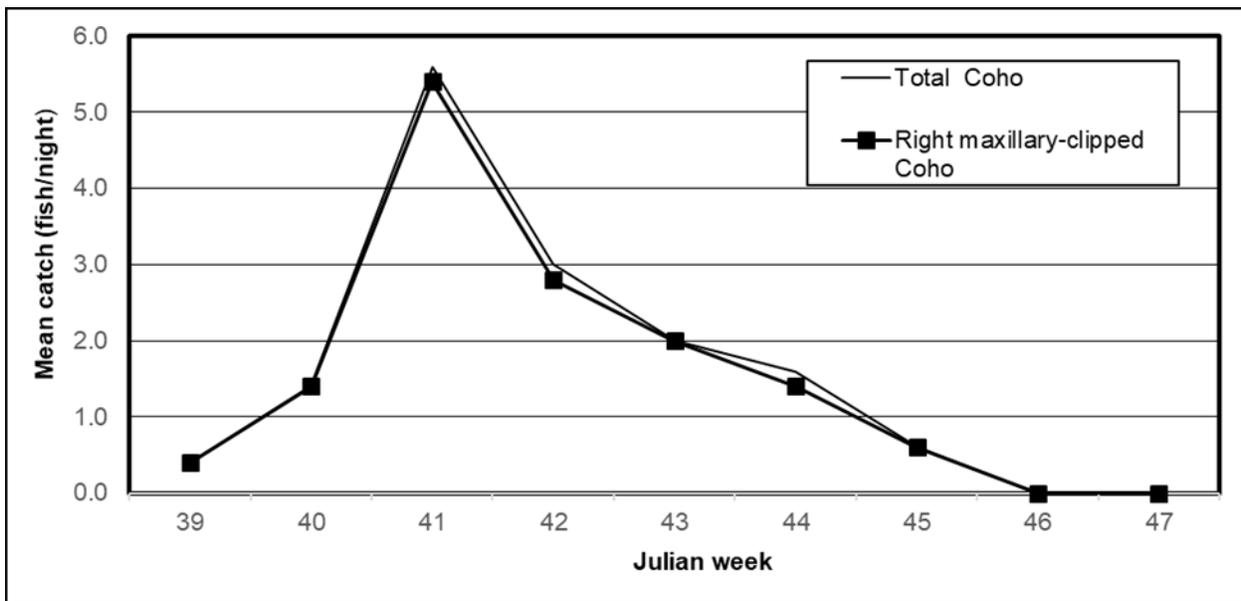


Figure 14. Mean catch of Coho Salmon trapped in the Trinity River at Willow Creek weir, 2018.

Coho Salmon trapped at WCW and TRH averaged 46.6 cm FL and 56.9 cm FL, respectively, with a combined average of 56.3 cm FL (Figure 15). Using length distribution analysis of Coho trapped at WCW and TRH, the nadir separating jack from adult Coho Salmon was between 48 and 49 cm FL. Based on the nadir, jacks comprised 65.8% of the run at WCW, and 25.1% at TRH.

3.4.2. Coho Salmon Recovery

3.4.2.1. Angler Tag Recovery

There was no reported harvest of TRP-tagged Coho Salmon in 2018. However, there were two tags (from jacks) returned from the catch-and-release fishery, leaving 71 effectively tagged fish. There was one tag found loose (no live fish attached) and returned by an angler or other river user.

3.4.2.2. Spawner Survey Recovery

There were no TRP-tagged Coho Salmon recovered during spawner surveys in 2018.

3.4.2.3. Tagging Mortalities

We observed zero Coho Salmon mortalities at WCW in 2018.

3.4.2.4. Trinity River Hatchery Recovery

The first Coho Salmon entered TRH during JW 43 and they continued returning through JW 52 of 2018 (Appendix 17). The run peaked in JW 48 when 267 Coho entered TRH. A total of 742 Coho (186 jacks and 556 adults) were recovered at TRH during the season. Of the 71 Coho Salmon effectively tagged at WCW, 35 were recaptured at TRH (Appendix 31).

Of the 742 Coho Salmon that entered TRH in 2018, we observed 700 (94.3%) with RM clips; 42 (5.7%) had no clip. Unclipped fish are assumed to be NOR Coho Salmon.

Based on length frequency analysis, TRH-origin RM-clipped Coho Salmon were assigned into two brood years. The 185 Coho measuring less than 49 cm FL were considered jacks (age 2, from the 2016 BY), and the 515 greater than 48 cm FL were considered adults (age 3, from the 2015 BY). The 42 Coho without RM clips that entered the hatchery were also considered jacks or adults based on those lengths.

For information about the juvenile Coho Salmon marking at TRH in 2019, or brood year performance, refer to Appendix 32.

3.4.3. Coho Salmon Hatchery-Origin Contributions to Run

Trinity River Hatchery reared Coho Salmon receive RM clips before release to the Trinity River. We estimate the contribution of hatchery-origin fish to the total Trinity River run by applying the RM percentage at WCW to the run-size estimate. In 2018 95.8% of the jacks and 96.0% of the adult Coho encountered at WCW were RM-clipped,

therefore we estimate 1,426 (409 jacks and 1,017 adults) of the 1,486 Coho Salmon run-size estimate to be of hatchery-origin.

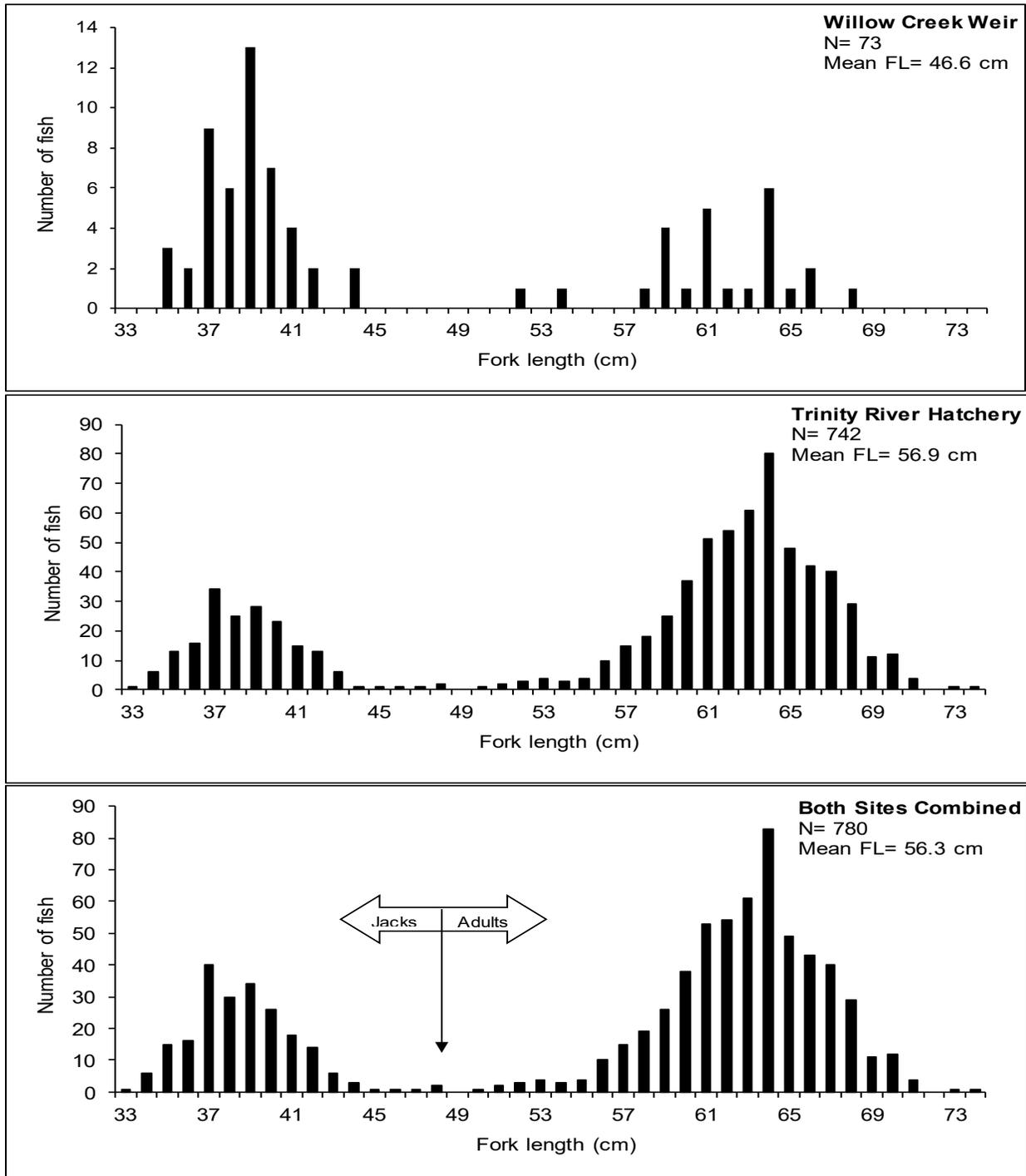


Figure 15. Coho Salmon fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery, and both sites combined during the 2018-19 season. Note: Fish trapped at WCW then recovered at TRH are only included once in the “combined” (bottom) graph. Also, the arrow denotes the size used to separate jack and adults for analysis.

3.5. Adult Fall Steelhead

3.5.1. Adult Fall Steelhead Trapping and Tagging

A total of 532 steelhead (22 half-pounders and 510 adults) were trapped at WCW between JWs 35-47 in 2018 (Table 7, Figure 16), and 509 of the 510 adults were tagged (Appendix 33). Steelhead trapping peaked in JW 40 when we averaged 34.8 steelhead per night, and ad-clipped steelhead peaked the same week with 22.0 steelhead per night. Hatchery-origin fish comprised 60.0% (306 of 510) of the adult steelhead trapped at WCW.

Table 7. Weekly summary of fall-run steelhead trapped in the Trinity River at Willow Creek weir during 2018.

Julian week	Inclusive dates	Nights trapped	Number trapped ^a						Fish/night
			1/2 lbers	Ad-clipped 1/2 lbers ^c	Ad-clipped Adults	Adults	Total	Ad-clip total	
35	27-Aug - 2-Sep	3	0	0	37	19	37	19	12.3
36	3-Sep - 9-Sep	4	0	0	49	26	49	26	12.3
37	10-Sep - 16-Sep	5	0	0	15	10	15	10	3.0
38	17-Sep - 23-Sep	5	1	1	26	16	27	17	5.4
39	24-Sep - 30-Sep	5	1	1	85	47	86	48	17.2
40	1-Oct - 7-Oct	5	11	3	163	107	174	110	34.8
41	8-Oct - 14-Oct	5	3	1	65	34	68	35	13.6
42	15-Oct - 21-Oct	5	0	0	5	4	5	4	1.0
43	22-Oct - 28-Oct	5	0	0	6	5	6	5	1.2
44	29-Oct - 4-Nov	5	4	1	54	35	58	36	11.6
45	5-Nov - 11-Nov	5	0	0	5	3	5	3	1.0
46	12-Nov - 18-Nov	5	2	1	0	0	2	1	0.4
47	19-Nov - 25-Nov	1	0	0	0	0	0	0	0.0
Total:		58	22	8	510	306	532	314	
Mean:									9.2

a/ Trapping at Willow Creek weir took place August 29 - November 19, 2018 (Julian weeks 35-47).

b/ Steelhead <42 cm FL were considered 1/2 lbers (half-pounders).

c/ Adipose fin-clipped steelhead. Number shown is a subset of weekly half-pounder and adult steelhead totals.

Steelhead trapped at WCW and TRH averaged 55.2 and 57.5 cm FL, respectively, with a combined average of 56.8 cm FL (Figure 17).

Escapement estimates of steelhead upstream of JCW are not an objective of this project, but steelhead are trapped there, and ad-clipped steelhead are tagged for qualitative studies not reported here. Steelhead were trapped nearly every week from JW 24 to 40; 66 total fish, peaking in JW 40 with 11 fish. Two half-pounders (<42 cm FL) and 64 adult steelhead were trapped, including 26 adult ad-clipped fish that were tagged. Fifteen of the JCW tagged steelhead were subsequently recovered at TRH.

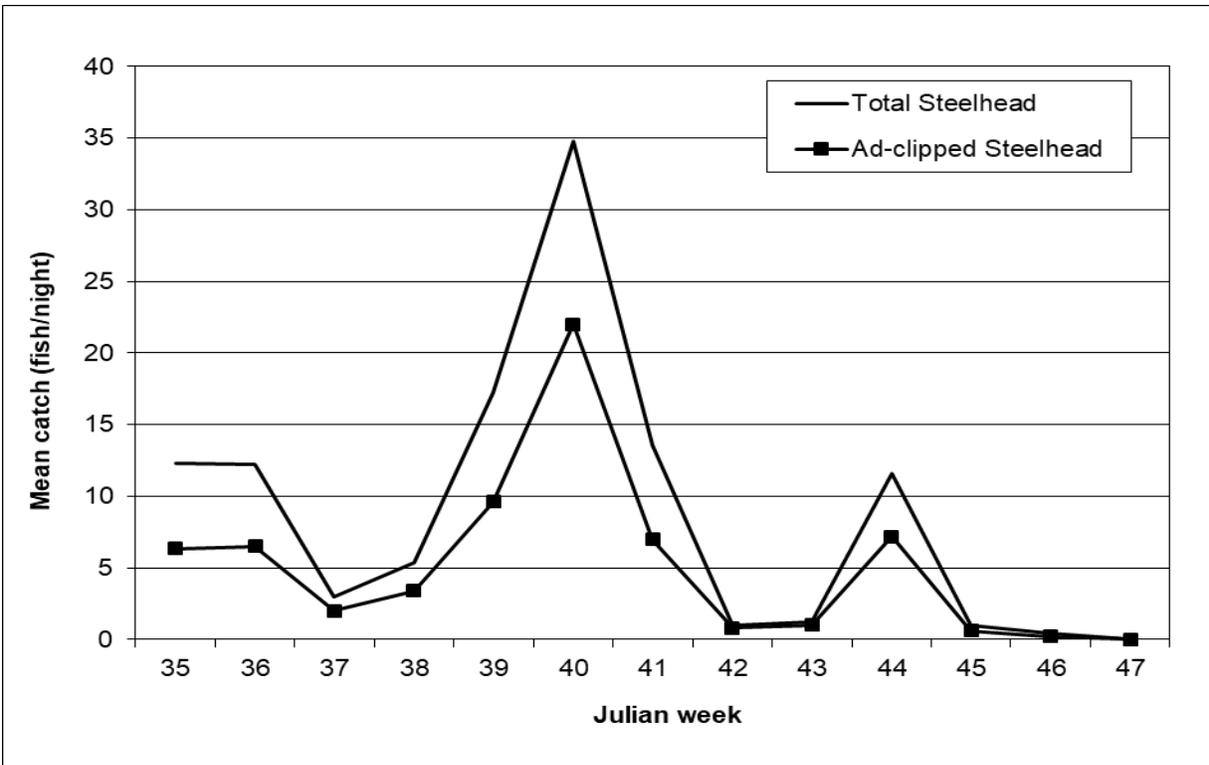


Figure 16. Mean catch of fall-run steelhead in the Trinity River at Willow Creek weir, 2018.

3.5.2. Adult Fall Steelhead Recovery

3.5.2.1. Angler Tag Recovery

There were 11 TRP-tagged steelhead reported as harvested in 2018 (Appendix 33), and 16 tags were found loose on the riverbank and returned by anglers or other river users. There were 54 tags returned from the catch-and-release fishery, leaving 455 effective tags.

3.5.2.2. Spawner Survey Recovery

There were no Project-tagged steelhead recovered during spawner surveys in 2018.

3.5.2.3. Tagging Mortalities

There were zero steelhead identified as tagging mortalities at WCW in 2018.

3.5.2.4. Trinity River Hatchery Recovery

Steelhead entered TRH during every week the fish ladder was open, except for JW 37 (Appendix 17). Recovery of steelhead peaked in JW 4 of 2019 when 278 steelhead entered TRH. A total of 1,896 adult steelhead (plus 14 half pounders) were recovered at TRH during the season. Of the 455 steelhead effectively tagged at WCW, 146 (32.1%) were recaptured at TRH. Hatchery-origin fish comprised 98.0% (1,859 of 1,896) of the adult steelhead recovered at TRH in the 2018-2019 season.

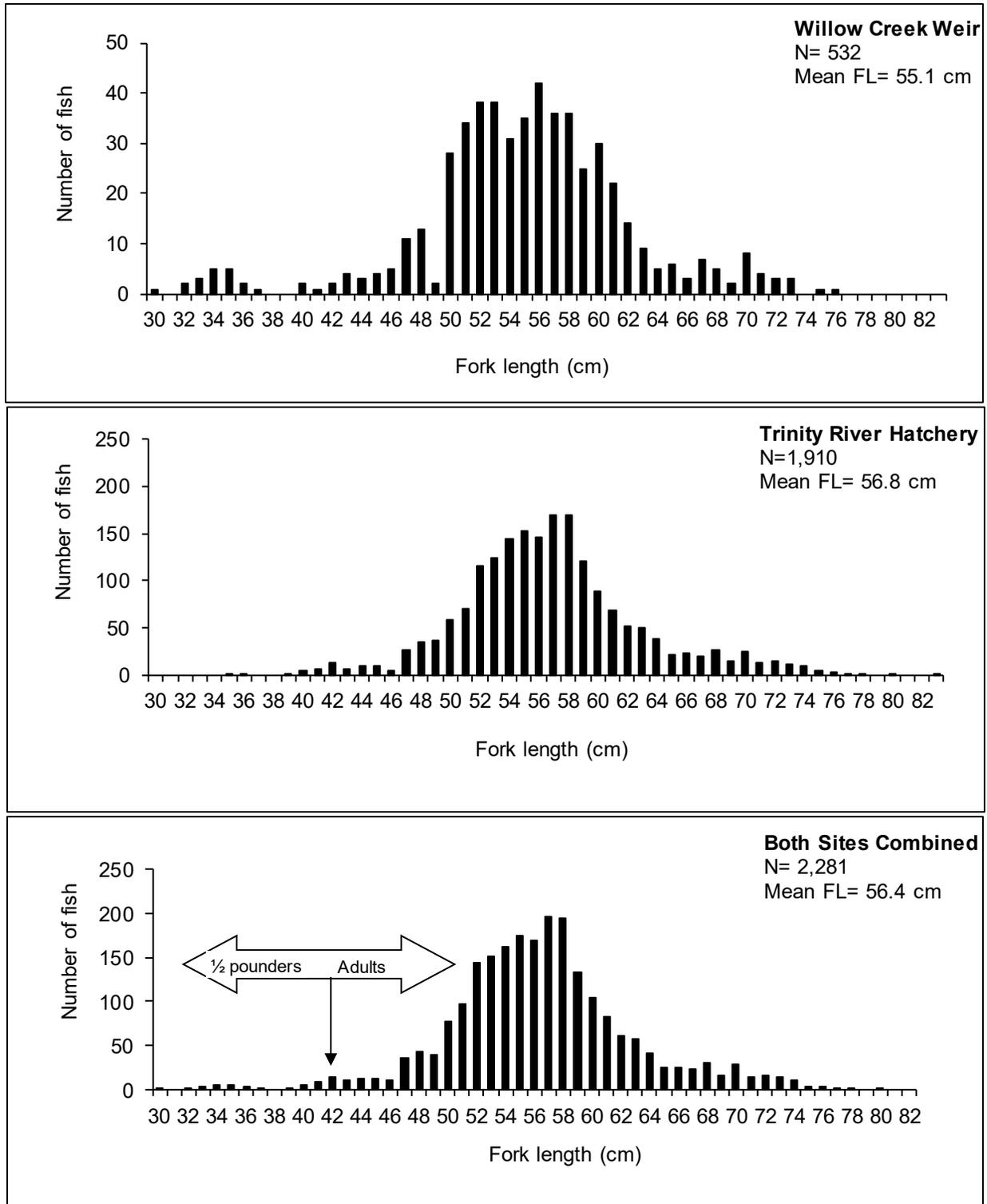


Figure 17. Steelhead fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery and both sites combined during the 2018-19 season. Note: Fish trapped at WCW then recovered at TRH are only included once in the “combined” (bottom) graph. Arrow denotes the size used to separate ½ pounders (sub-adults) and adults for analysis.

3.5.3. Adult Fall Steelhead Hatchery-Origin Contribution to Run

All TRH reared steelhead receive an adipose clip before release to the Trinity River. We estimate the contribution of hatchery-origin fish to the total Trinity River run by applying the ad-clip percentage of steelhead at WCW to the total run-size estimate. In 2018 60% of steelhead encountered at WCW were ad-clipped, therefore we estimate 60%, or 3,531, of the 5,885 adult fall steelhead run estimate to be of hatchery-origin.

4. DISCUSSION

4.1. Factors Influencing Run-Size, Harvest and Escapement Estimates

Attaining adult NOR salmonid production goals while providing dependent tribal and non-tribal harvest are fundamental objectives of the TRRP. Factors that directly affect salmonid run-size and, therefore, progress toward TRRP goals, include availability and quality of habitat for all life stages, natural mortality, and the amount of ocean and in-river harvest. Environmental conditions are also contributing factors and include ocean-atmospheric climate variability over the North Pacific Ocean that result in inter-annual and inter-decadal changes in Pacific salmon survival (Beamish, et. al 2009). In addition, assessing progress toward meeting TRRP objectives depends on the accurate estimation of run sizes and escapements for adult salmonids.

Accuracy and precision of mark-recapture field studies and data analyses directly influence escapement estimates. Accuracy of the modified Petersen mark-recapture estimator relies on a set of assumptions, and estimator bias can occur if assumptions are violated. For example, unaccounted tagging mortality creates a positive bias in mark-recapture studies (Hankin, 2001). Hankin makes evident the magnitude of potential bias in the following scenario: “If 90% of untagged fish that pass the WCW survive to arrive at TRH”...”but only 75% of WCW-tagged fish survive to arrive at TRH, then the approximate proportional bias of the total run-size estimator would be $(0.90/0.75) - 1 = 1.29 - 1 = 0.29$, so that the estimator would have a positive proportional bias of almost 30%”. We take steps to minimize tagging-associated mortality through our operational protocol at the weirs. In the past we observed most tagging mortalities when water temperatures were high (near 22° C), therefore trapping is suspended if water temperatures exceed 21°C. In addition, fish are not tagged if deemed in poor condition or if they have already spawned. We account for tagging mortalities through recovery of tagged fish found dead during surveys conducted upstream of the weir sites throughout the trapping season, in the main stem Trinity spawning surveys (any unspawned fish within 30 days of tagging), and by checking any TRP-tagged carcasses washed back on the weir for signs of spawning. Tagged fish that are judged to have died due to the stress of handling and/or tagging are removed from the tagged population for purposes of estimating total escapement. Reliance on

experienced crew and adherence to protocol contributes to a relatively small number of tagging mortalities.

Interruption in trapping, or missing part of the run, may violate the assumption that fish trapped and tagged at the weir are a random sample representative of the population. Most often interruption of trapping during the season or missing part of the run before or after the trapping season is due to high river flow. Flow variability results from storm events and releases from Lewiston Dam, both of which affect the timing and duration of high-flow events. This affects JCW more than WCW because of its proximity to the dam and the narrower channel in which JCW sits. The water year designation for the Trinity River in 2018 was “Critically Dry,” which corresponds to an allocation of 369,000 acre-feet of water for release to the Trinity River (Interior, 2000). The spring recession of flow releases from Lewiston Dam allowed JCW to be installed by mid-June (Appendix 34), allowing sufficient trapping of the spring Chinook Salmon run. By the time complications from the Carr fire required emergency increases in flow releases from Lewiston Dam in late July the spring Chinook Salmon run was largely past JCW. We were able to begin installation of WCW on August 23, but due to the increased complexity of boat gate installation, video monitoring installation, and high water temperatures, trapping did not begin until August 28 when the downstream USGS (Hoopa Valley) gage measured ~850 cfs (Appendix 35). There were no fall augmentation flows or Hoopa tribal ceremonial flows in 2018, so we were able to fish throughout the season at WCW despite elevated flows related to the Carr fire and a few minor to moderate rain events.

Estimates of total run size is not affected by potential bias of estimated age proportions when a pooled (vs. stratified) Peterson estimator is used, but biased age proportions will result in biased adult estimates. We know splitting the run into jack and adults based on a hard length cutoff (i.e., using the nadir of fork length distributions) will assign some fish to the wrong age class. However, when we have compared jack vs. adult proportions based on mixture distribution analyses vs. our fork length distribution analysis, bias associated with using the nadir appeared to be insignificant (Kier and Hileman, 2016). We plan to rely solely on scale-age proportions for fall Chinook Salmon going forward, but we have not yet identified an appropriate replacement for other species. Further work should be done to compare the accuracy of nadir-based vs. mixture distribution-based estimates of age-2 proportions as they compare to scale-based estimates. We assume scale-based aging is the least biased method for fish without CWTs, but it is up to managers to allocate funding for scale-based aging of other species.

Estimates of hatchery contributions to total run-size are based, in part, on the overall run-size estimates for each race of Chinook Salmon and corresponding expansion of CWT recoveries. Consequently, they are subject to the precision and potential biases associated with the mark-recapture estimates, as well as the accuracy of reported CWT expansion factors. The effect of this potential bias is most relevant to estimates of NOR and HOR fish spawning in natural areas because hatchery recoveries are actual counts, whereas NOR and HOR proportions in natural spawning grounds are estimated by subtracting angler harvest and expanded CWT recoveries from the natural-area run size

estimate. Estimation of HOR vs. NOR proportions also rely on accurate estimates of expansion factors. If the reported expansion factor is greater or less than the true proportion of HOR fish with CWTs, total hatchery returns would be over- or under-estimated, respectively. In addition, we assume the CWT fish that enter the hatchery are representative of the entire CWT population, but if an age or release type of HOR Chinook is more likely to stray than others, then the estimated proportions of HOR fish, based on fish recovered at TRH, will be biased. Data on the TRH-origin Chinook recovered during the 2018 carcass surveys is not yet available due to the 2018-19 federal government shutdown, but we anticipate they will represent tag groups across the range of those that entered TRH, as occurs in most years.

Run-size estimates have the potential for bias (which are positive under most scenarios) in many cases due to violations of underlying assumptions of the estimator. However, biases that may affect estimates of total may not affect hatchery contribution rates since hatchery contribution rates are based on ad-clip rates observed at either JCW or WCW. Even if total run-size were biased, the ad-clip rate would remain the same and result in the same hatchery contribution rates. If, however, HOR fish are more or less vulnerable to capture at the weirs than their natural counterparts, the estimated contribution of hatchery fish could be biased. This could occur, for example, if the run timing of hatchery fish coincided with weir operations more so than natural fish, or vice versa. It could also occur if the weirs were size selective and there is a systematic difference in size distributions of NOR vs. HOR fish. In 2018 we believe trapping at WCW and JCW spanned the majority of fall- and spring-runs, respectively, thus reducing potential bias due to vulnerability of capture based on timing, but we currently do not have a method to evaluate potential size selection at weirs.

The amount of sport and commercial ocean harvest, in-river sport harvest, and tribal harvest affect salmon and steelhead run-size and escapement. Ocean harvest rates and in-river harvest quotas are determined by the Pacific Fisheries Management Council only for the combined Klamath-Trinity fall Chinook Salmon stock and can range from no harvest up to two-thirds of the projected run-size to the basin. Thus, dependent fisheries may have a large impact on fall Chinook Salmon escapement to the basin and to the Trinity River. In 2018 the adult (> 22" total length) quota for the entire Klamath-Trinity Basin fall Chinook Salmon run was 3,490, with the Trinity recreational harvest share (33.0%) of just 1,151 fish. The preliminary estimated recreational harvest of 1,010 (CDFW 2019) has been adjusted to a final estimate closer to 1,045 (761 upstream of WCW, and 284 below WCW). The basin-wide estimated harvest of spring Chinook was unknown in 2018, though an estimated 3.7% of Trinity River spring Chinook Salmon were estimated to have been taken in the recreational fishery upstream of JCW. Coho salmon are protected from sport harvest entirely, and only hatchery marked steelhead are allowed for sport harvest.

Our harvest estimates are based on TRP tags returned by anglers and other river users. Unreported angler harvest of tagged fish results in an under-estimate of harvest rate and a corresponding over-estimate in escapement, even if the total run size is unbiased. Although the number of TRP tags returned is usually sufficient to generate a harvest

estimate, we are trying to increase the rate of tag return, especially from Chinook Salmon anglers. Even when we tag similar numbers of Chinook Salmon and steelhead, tags are returned from the steelhead fishery at a greater rate than from the salmon fishery. Likely explanations for this difference include the longer steelhead season, the fact that emigrating steelhead tend to be more active feeders than Chinook, and potential negative bias in tag return rates for Chinook.

We have attempted for the past number of years to run a side-study, similar to Heubach et al (1992) to determine the reward level at which 100% of the tags are returned (one of our harvest estimate assumptions) per Bradford and Hankin's (2012) recommendation. Early analysis seemed to show that anglers tend to return tags with greater rewards at higher rates than tags with lessor or no value, as expected. However, small sample sizes continue to complicate drawing robust conclusions from the study overall. One thing we have observed as we have increased the proportion of higher value tags is an increase in the number of people seeking those tags while engaged in activities other than fishing. Numerous tags were returned by people who intentionally searched for them by diving pools below heavily spawned areas of the river, and many tags were returned from salmon carcasses found lying on the riverbanks. While these tags are still "effective," they do not inform the harvest estimate. The 2018 season is the last year we will honor reward tags returned to CDFW after the season is over (i.e., the following year or later), and we were pleased to see an abrupt end to returns shortly before the expiration date now printed on the tags.

Our goal is to trap and tag 5 – 10% of the target run(s) at each weir. In 2018, we sampled an estimated 11.6% of the spring Chinook Salmon run at JCW but only 5.9% of the fall Chinook Salmon run at WCW, meeting or exceeding our goal at both traps. In 2017 at WCW, we built a tunnel connecting the weir to the trap box for the first time, and we trapped more than 12% of the estimated run. Fish presumably came upon the barrier of the weir structure and, after exploring for upstream passage, either found the tunnel more easily and/or swam into it more readily than they would have with a trap situated directly upstream of the weir line. One hypothesis of crew members is that the disturbance in flow occurring immediately downstream of the trap box was no longer felt at the weir line. In 2018 we built a tunnel again, but we caught only about 6% of the run. However, because we also added a video monitoring system (with a light and a camera) and changed the degree to which we opened the weir during the afternoons and weekends, it is not appropriate to compare the effect of the tunnel on trap efficiency between the two years. Hoping to increase our catch at JCW in 2018, we installed a similar tunnel at the beginning of the season, but the weir failure due to the Carr fire damaged some weir panels and forced us to cannibalize the tunnel panels to reconfigure the weir. We hope to install tunnels at both weirs again in 2019.

The video monitoring aspect, a side-study, of the overall monitoring at WCW in 2018 will be reported separately (Lindke, in progress), but likely had some effect on trap efficiency. A light was used from dusk to dawn to illuminate the chute in front of the camera, which seemed to be a barrier for some fish. We observed more holding behavior in the tunnel and below the weir than we had noticed the previous year, and

some fish can be seen on video acting erratically, presumably in response to the light. The weir configuration in 2019 will be very similar to 2017 with a straight line (no “dog leg”), tunnel(s), and no video monitoring. We may test a sonar unit at WCW in 2019, but there will be no lighting and daily and weekend openings will be much more generous than in 2018.

4.2 Spring Chinook Salmon

Results from the 2018 mark-recapture study indicate the total run-size of 8,032 (95% CI 7,250-8,858), was nearly twice (180%) last year’s run, with the majority of those “additional” fish HOR adults. The estimated contribution of NOR adults showed a slight increase from last year, but it remains below the TRRP annual escapement goal of 6,000 NOR adult spring Chinook (Figure 18).

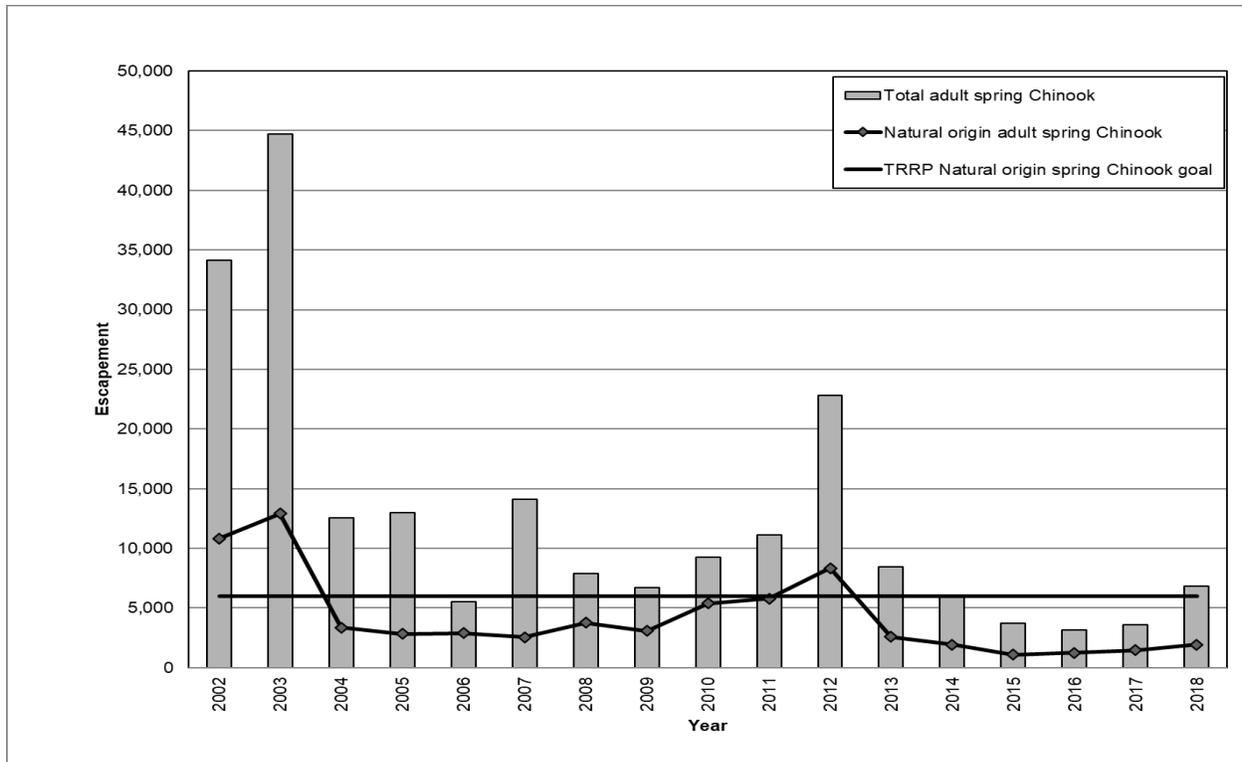


Figure 18. Total adult escapement, and escapement of natural origin spring Chinook Salmon to the Trinity River upstream of Junction City weir, 2002-2018.

Shortly after Prince, et al (2017) published a study which found spring-run Chinook Salmon are genetically distinct from their fall-run counterparts, the Karuk Tribe and the Salmon River Restoration Council petitioned NOAA Fisheries to list under the Endangered Species Act (ESA) the Upper Klamath-Trinity (UKTR) basin Chinook Salmon Evolutionarily Significant Unit (ESU) or, alternatively, to create a new, separate ESU to describe Klamath spring-run Chinook salmon and list that new ESU under the ESA. NOAA Fisheries is currently engaged in a status review to consider whether to

designate a new, separate ESU to describe spring-run Chinook in the UKTR basin, or to evaluate the status of the existing UKTR Chinook Salmon ESU and determine if it warrants listing.

4.3. Fall Chinook Salmon

Fall Chinook Salmon run-size of 26,848 (95% CI 24,413 – 29,634) was ranked 27th of the 42-year period of record and is 65.7% of the average run-size of 40,854 across those years. The 2018 escapement of 8,357 natural-origin adult fall Chinook returning to the Trinity basin is well below the 62,000 TRRP goal but made for the third uptick in three years, suggesting the effects of the worst of California’s nearly seven year drought may be easing (Figure 19).

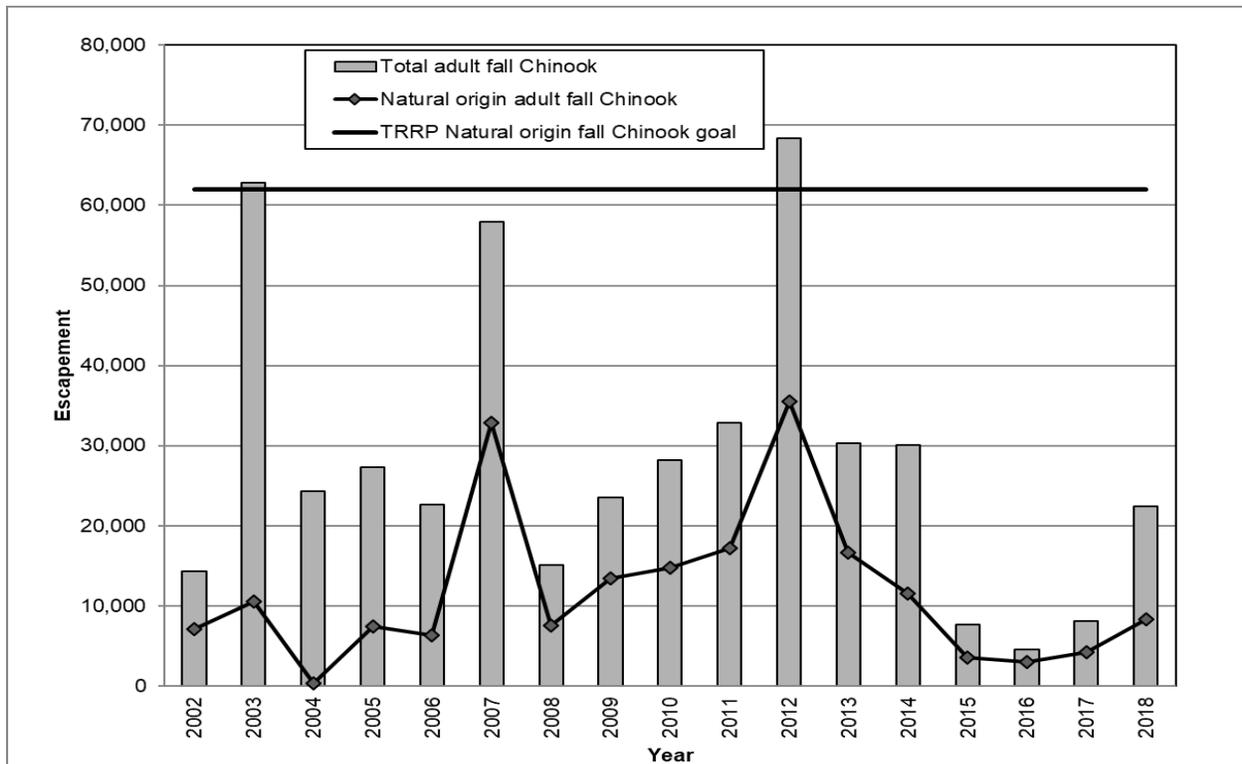


Figure 19. Total adult escapement, and escapement of natural origin fall Chinook Salmon to the Trinity River upstream of Willow Creek weir, 2002-2018.

The surprisingly large percentage of jacks in the 2017 run made for an astoundingly large proportion of three-year-old fall Chinook Salmon in 2018; virtually the entire run (82.6%) were age three. The pre-season forecast for Klamath River basin fall Chinook Salmon adult returns to the mouth of the Klamath River was 91,900 (PFMC, 2018), and the post-season estimate was a close 92,300 (KRTT, 2019).

4.4. Coho Salmon

The 2018 estimated run-size of 1,486 Coho Salmon (95% CI 1,084 – 2,100) is the 39th lowest in 42 years (Figure 20). Coho jacks comprised 28.7%, and the adults 71.3% of the estimated run, which is the average split across the years on record. We saw a far smaller proportion of adults at WCW than entered TRH (34% v. 75%). Natural origin adult contribution (2.9%) to the total Coho Salmon run was nearly non-existent, and only 3.0% of the TRRP goal of 1,400.

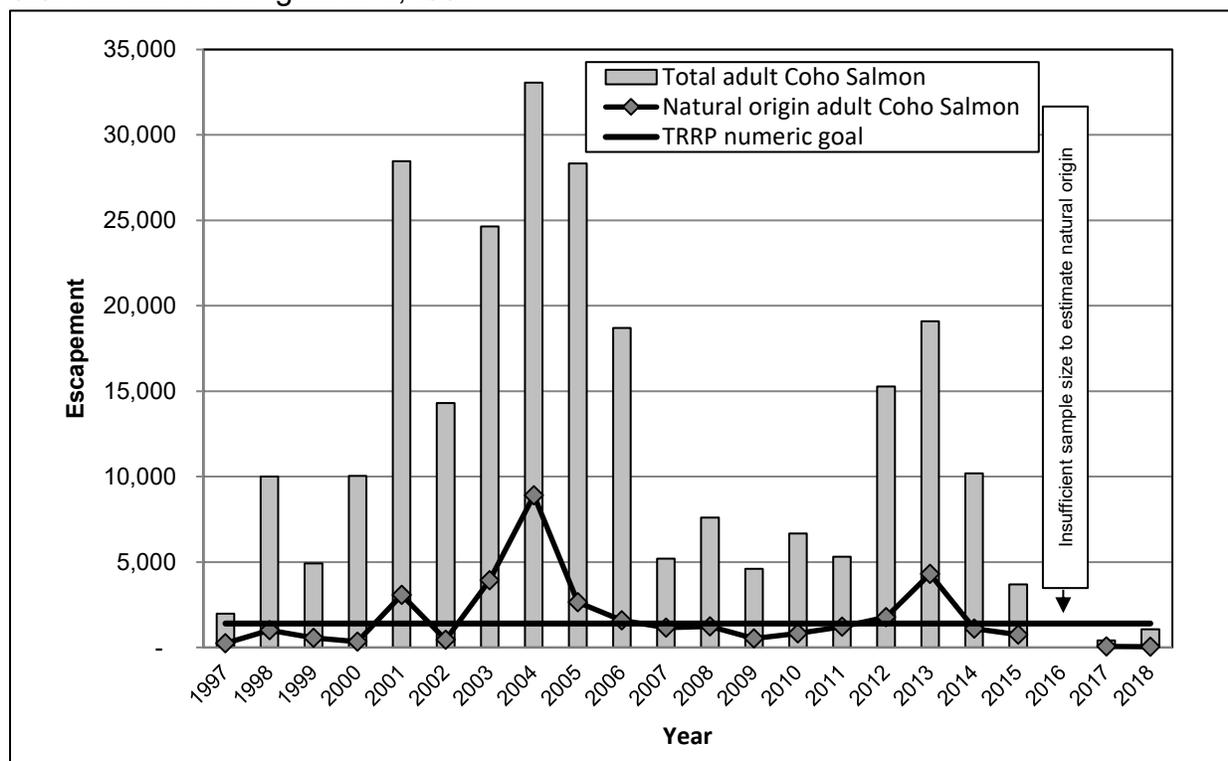


Figure 20. Total adult escapement, and escapement of natural origin Coho Salmon to the Trinity River upstream of Willow Creek weir, 2002-2018.

In 2015, under EPIC v. Lehr, et al (2014), production of Coho Salmon at TRH was reduced from 500,000 to 300,000 until a hatchery genetics management plan can be adopted. Consequently, the fairly severe reduction in escapement observed from 2016-2018 cannot not be attributed solely to the severe California drought of 2012-2015. The hatchery genetics management plan was submitted in December 2017, and an Environmental Assessment has been written and is currently going through the NOAA Fisheries review/approval process.

The Hoopa Valley Tribe installed a harvest weir spanning the Trinity River downstream of WCW near the southern boundary of the Hoopa Valley Reservation (near Tish Tang Creek confluence) for the third consecutive year in 2018. No details on weir operations, including trapping schedules, or estimate of harvest for Coho Salmon are publicly available. We suspect that an additional weir six miles downstream of WCW could

increase weir wariness and stress, but effects on Coho Salmon have not been quantified or investigated.

4.5 Adult Fall Steelhead

The 2018 run-size estimate for adult fall steelhead of 5,885 (95% CI 5,007 – 6,835) is ranked 26 (and is 41% of the average run-size of 14,225) over the 35-year period of record. The 2018 total escapement of 5,728 adult steelhead was comprised of only 40% NOR fish (Figure 21) overall, up 5% over 2017 and quite close to the average 43% for the 24 years we have all the information needed to make the comparison.

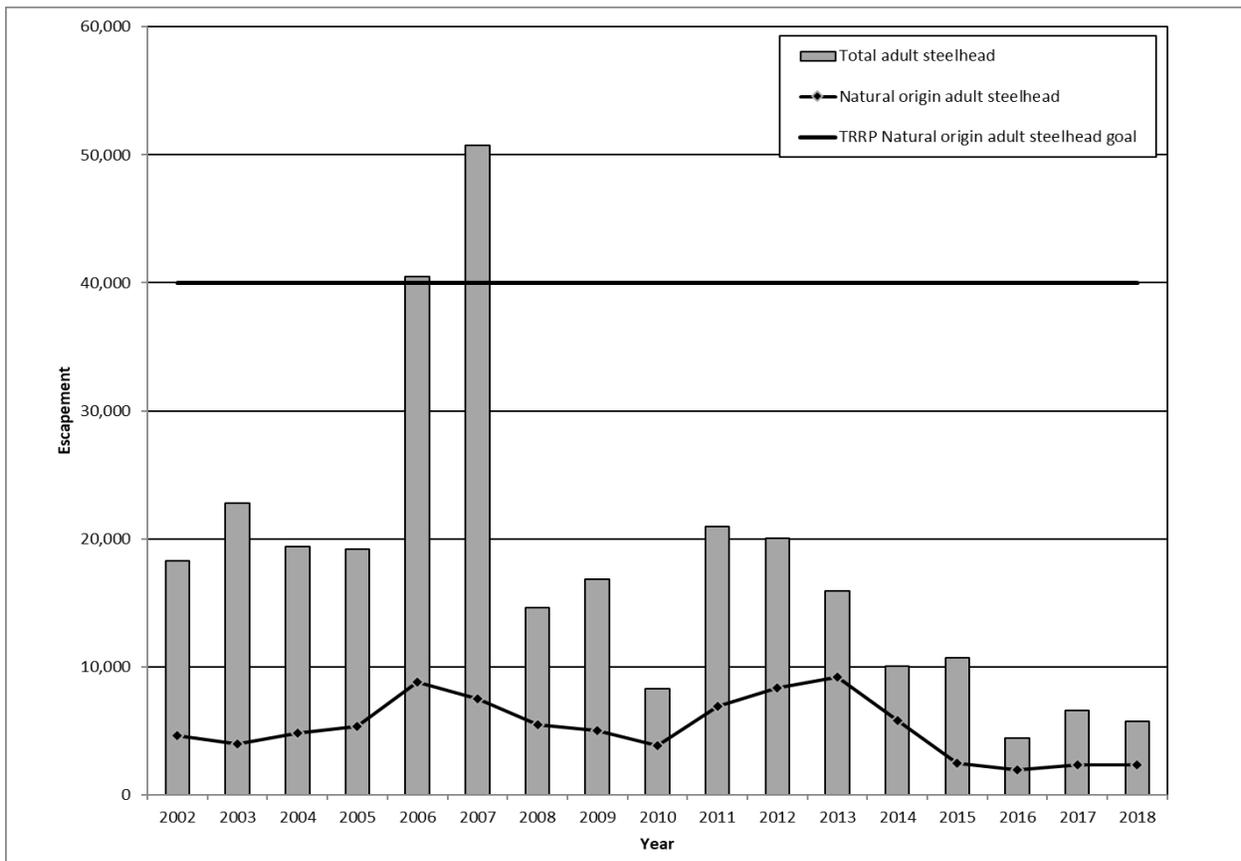


Figure 21. Total adult escapement, and escapement of natural origin steelhead to the Trinity River upstream of Willow Creek weir, 2002-2018.

The lawsuit and consent decree that curtailed production of Coho Salmon at TRH also affected production of steelhead at TRH. In 2014 production was decreased from 800,000 to no more than 448,000 steelhead, and limitations were placed on time of release. Hatchery-origin fish make up a much larger proportion of populations of steelhead and Coho Salmon in the Trinity River as compared to Chinook Salmon. Consequently, reductions in hatchery production are expected to have a larger effect on total returns for these species, which makes it more difficult to associate the recent

decline in population sizes to recent changes in environmental conditions such as the 2012-2014 California drought and poor ocean conditions.

Harvest has been limited to hatchery-origin steelhead since 1998. Pre-1998 harvest rates on steelhead averaged 13.4% but has since dropped to 3.1%. The catch-and-release fishery continues to be more popular than harvest among steelhead anglers.

5. RECOMMENDATIONS

- Run-size and escapement estimates of NOR and HOR spring and fall Chinook Salmon, Coho Salmon, and adult fall steelhead in the Trinity River basin should be continued on an annual basis to maintain short and long term baselines which help assess objectives stated in the IAP and ROD and inform adaptive management decision making.
- Management and operations of the TRRP and TRH should be coordinated to ensure that objectives for natural fish production and hatchery management goals are synchronized across restoration and mitigation programs.

6. REFERENCES

- Beamish, R.J., B.E. Riddell, K.L. Lange, E. Farley Jr., S. Kang, T. Nagasawa, V. Radchenko, O. Temnykh, and S. Urawa. 2009. The effects of climate change on Pacific salmon – A summary of published literature. North Pacific Anadromous Fish Commission. www.npafc.org. 11 pp.
- Bradford, M. and D. Hankin. 2012. Trinity River Restoration Program (TRRP) adult salmonid monitoring evaluation. TRRP. Weaverville, CA. 47 pp.
- Bureau of Reclamation (Reclamation). 2018. Reclamation announces 2018 schedule for release into Trinity River as part of Restoration program, News release archive. <https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=61990>
- CA Department of Fish and Wildlife (CDFW). 2019. Klamath River basin fall Chinook Salmon spawner escapement, in-river harvest and run-size estimates, 1978 – 2018 (aka Fall Chinook mega-table). Klamath/Trinity Program. CA Dept. Fish and Wildlife. Arcata, CA
- CA Department of Fish and Wildlife (CDFW). 2014a. Final annual report. Trinity River Basin Salmon and Steelhead Monitoring Project, 2013 - 14 season. Klamath/Trinity Program. CA Dept. Fish and Wildlife. Redding, CA. 94 pp.
- CA Department of Fish and Wildlife (CDFW). 2014b. Final annual report. Trinity River Basin Salmon and Steelhead Monitoring Project, 2012 – 13 season. Klamath/Trinity Program. CA Dept. Fish and Wildlife. Redding, CA. 163 pp.
- Chapman, D. G. 1948. A mathematical study of confidence of salmon populations calculated from sample tag ratios. *Int. Pac. Sal. Fish. Comm. Bull.* 2:69-85.
- Environmental Protection Information Center (EPIC) v. Lehr, et al. 2014. 13-02293-MMC. US District Court, Northern District. San Francisco Division.
- Hankin, D. 2001. A preliminary evaluation of the performance of methods used to estimate spawning escapement of Chinook Salmon in the Trinity River. Contract Agreement #000203 between the Hoopa Valley Tribal Fisheries Department and the Humboldt State University Foundation.
- Heubach, B., M. Lau, and E. Miller. 1992. Annual run-size, angler harvest, and spawner escapement of Chinook and Coho Salmon in the Trinity River basin. Job IV. Pages 93-104 *in* K. Urquhart and R. Carpenter, editors. Annual report of the Trinity River Basin Salmon and Steelhead Monitoring Project, 1990 – 91 season.

- Kier, MC, J. Hileman, and K. Lindke. 2017. Chinook and Coho Salmon and fall-run steelhead run-size estimates using mark-recapture methods; 2016-17 season. Final annual report of the CA Dept. Fish and Wildlife, Trinity River Basin Salmon and Steelhead Monitoring Project. 97 pp.
- Kier, MC, J. Hileman, and K. Lindke. 2018. Chinook and Coho Salmon and fall-run steelhead run-size estimates using mark-recapture methods; 2017-18 season. Final annual report of the CA Dept. Fish and Wildlife, Trinity River Basin Salmon and Steelhead Monitoring Project. 97 pp.
- Klamath River Technical Team (KRTT). 2019. Klamath River fall Chinook Salmon age-specific escapement, river harvest and run-size estimate, 2018 run. 21 pp.
- Lindke, K. In progress. Video monitoring of fish passage at Willow Creek weir: Feasibility of validating capture-recapture run size estimates.
- Pacific Fishery Management Council (PFMC). 2018. Preseason Report I: Stock abundance analysis and environmental assessment Part I for 2018 Ocean Salmon Fishery Regulations. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 101, Portland, Oregon 97220-1384.
- Prince, D.J, S. M. O'Rourke, T. Q. Thompson, O. A. Ali, H. S. Lyman, I. K. Saglam, T. J. Hotaling, A. P. Spidle, and M. R. Miller. 2017. The evolutionary basis of premature migration in Pacific salmon highlights the utility of genomics for informing conservation. *Sci. Adv.* 3, e1603198.
- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Bd. Can.* No. 191.
- Strange, J. 2008. Adult Chinook Salmon migration in the Klamath River Basin: 2007 Biotelemetry Monitoring Study, Final Report. Yurok Tribal Fisheries Program.
- Trinity River Restoration Program (TRRP), ESSA Technologies Ltd. 2009. Integrated Assessment Plan, Version 1.0 – September 2009. Draft report prepared for the Trinity River Restoration Program. Weaverville, CA. 285 pp.
- United States Fish and Wildlife Service (USFWS). 2018. URL: Trinity River mainstem redd survey update, 12/14/2018. https://www.fws.gov/arcata/fisheries/projectUpdates/TRSpawningSurvey/2018/TrinityReddUpdate_2018_12_14.pdf
- United States Department of the Interior (Interior). 2000. Record of Decision. Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement/ Environmental Impact Report. December 2000. 43 pp.

7. APPENDICES

Appendix 1. List of Julian weeks and their calendar date equivalents.

Julian Week Number	Inclusive Dates	Julian Week Number	Inclusive Dates
1	Jan-01 - Jan-07	27	Jul-02 - Jul-08
2	Jan-08 - Jan-14	28	Jul-09 - Jul-15
3	Jan-15 - Jan-21	29	Jul-16 - Jul-22
4	Jan-22 - Jan-28	30	Jul-23 - Jul-29
5	Jan-29 - Feb-04	31	Jul-30 - Aug-05
6	Feb-05 - Feb-11	32	Aug-06 - Aug-12
7	Feb-12 - Feb-18	33	Aug-13 - Aug-19
8	Feb-19 - Feb-25	34	Aug-20 - Aug-26
9	Feb-26 - Mar-04	35	Aug-27 - Sep-02
10	Mar-05 - Mar-11	36	Sep-03 - Sep-09
11	Mar-12 - Mar-18	37	Sep-10 - Sep-16
12	Mar-19 - Mar-25	38	Sep-17 - Sep-23
13	Mar-26 - Apr-01	39	Sep-24 - Sep-30
14	Apr-02 - Apr-08	40	Oct-01 - Oct-07
15	Apr-09 - Apr-15	41	Oct-08 - Oct-14
16	Apr-16 - Apr-22	42	Oct-15 - Oct-21
17	Apr-23 - Apr-29	43	Oct-22 - Oct-28
18	Apr-30 - May-06	44	Oct-29 - Nov-04
19	May-07 - May-13	45	Nov-05 - Nov-11
20	May-14 - May-20	46	Nov-12 - Nov-18
21	May-21 - May-27	47	Nov-19 - Nov-25
22	May-28 - Jun-03	48	Nov-26 - Dec-02
23	Jun-04 - Jun-10	49	Dec-03 - Dec-09
24	Jun-11 - Jun-17	50	Dec-10 - Dec-16
25	Jun-18 - Jun-24	51	Dec-17 - Dec-23
26	Jun-25 - Jul-01	52	Dec-24 - Dec-31

* Eight-day Julian week only during leap years

**Eight-day Julian week every year

Appendix 2. Spring Chinook Salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Junction City weir, 1978 – 2018.

Year	Run-size estimate			Spawner escapements						Angler harvest					
	Jacks ^b		Adults	Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total		
	Number	%			Jacks	Adults	Total	Jacks	Adults	Total					
1977	no estimates			no estimates			385	1,124	1,509	no estimates					
1978	190	1.0	18,816	99.0	19,006	29	14,384	14,413	153	3,680	3,833	8	752	760	c/
1979	113	1.4	7,964	98.6	8,077	0	5,008	5,008	113	1,658	1,771	0	1,298	1,298	
1980	1,949	45.9	2,301	54.1	4,250	1,312	1,614	2,926	353	547	900	284	140	424	
1981	347	4.2	7,913	95.8	8,260	242	3,362	3,604	95	2,405	2,500	10	2,146	2,156	
1982	656	10.3	5,731	89.7	6,387	387	3,868	4,255	150	1,226	1,376	119	637	756	
1983	no estimates			no estimates			385	930	1,315	no estimates					
1984	255	9.4	2,465	90.6	2,720	140	1,354	1,494	76	736	812	39	375	414	
1985	1,434	14.8	8,278	85.2	9,712	799	4,897	5,696	508	2,645	3,153	127	736	863	d/
1986	7,018	23.1	23,403	76.9	30,421	4,335	13,371	17,706	1,461	7,083	8,544	1,222	2,949	4,171	
1987	4,858	9.5	46,016	90.5	50,874	2,577	29,083	31,660	1,387	8,466	9,853	894	8,467	9,361	
1988	720	1.1	61,972	98.9	62,692	241	39,329	39,570	377	13,905	14,282	102	8,738	8,840	
1989	502	1.9	25,804	98.1	26,306	435	18,241	18,676	17	4,983	5,000	50	2,580	2,630	
1990	265	4.1	6,123	95.9	6,388	126	2,880	3,006	104	2,433	2,537	35	810	845	
1991	190	8.0	2,191	92.0	2,381	92	1,268	1,360	71	614	685	27	309	336	
1992	1,671	41.5	2,359	58.5	4,030	944	942	1,886	533	1,313	1,846	194	104	298	d/
1993	68	1.3	5,164	98.7	5,232	37	2,111	2,148	31	2,630	2,661	0	423	423	d/
1994	1,793	26.4	4,995	73.6	6,788	550	2,897	3,447	944	1,943	2,887	299	155	454	d/
1995	no estimates			no estimates			385	8,722	9,107	no estimates					
1996	489	2.1	22,927	97.9	23,416	370	16,283	16,653	119	5,131	5,250	0	1,513	1,513	d/
1997	768	3.8	19,271	96.2	20,039	543	13,049	13,592	225	4,892	5,117	0	1,330	1,330	d/
1998	802	5.0	15,365	95.0	16,167	567	9,057	9,624	184	4,679	4,863	51	1,629	1,680	d/
1999	1,028	9.1	10,265	90.9	11,293	440	5,968	6,408	547	3,671	4,218	41	626	667	d/
2000	2,159	8.3	23,923	91.7	26,082	1,264	10,846	12,110	571	11,594	12,165	324	1,483	1,807	d/
2001	2,065	10.5	17,556	89.5	19,621	1,178	10,284	11,462	629	6,366	6,995	258	906	1,164	d/
2002	2,575	6.7	35,910	93.3	38,485	1,883	23,674	25,557	617	10,440	11,057	75	1,796	1,871	d/
2003	1,039	2.2	46,756	97.8	47,795	909	30,211	31,120	130	14,512	14,642	0	2,033	2,033	d/
2004	2,929	18.1	13,218	81.9	16,147	1,708	7,314	9,022	985	5,251	6,236	236	653	889	d/
2005	55	0.4	13,929	99.6	13,984	30	6,003	6,033	25	6,966	6,991	0	961	961	d/
2006	1,963	26.2	5,520	73.8	7,483	1,127	2,955	4,082	819	2,565	3,384	17	0	17	d/
2007	135	0.9	14,700	99.1	14,835	80	8,154	8,234	55	5,981	6,036	0	565	565	d/
2008	2,218	21.6	8,065	78.4	10,283	1,741	4,470	6,211	329	3,437	3,766	148	158	306	d/
2009	260	3.5	7,166	96.5	7,426	191	3,724	3,915	69	3,000	3,069	0	442	442	d/
2010	1,554	13.8	9,731	86.2	11,285	1,309	6,810	8,119	245	2,457	2,702	0	463	463	d/
2011	8,087	42.1	11,132	57.9	19,219	5,217	7,309	12,526	2,758	3,823	6,581	112	0	112	d/
2012	813	3.2	24,804	96.8	25,617	542	16,117	16,659	109	6,712	6,821	163	1,976	2,139	d/
2013	281	3.1	8,680	96.9	8,961	185	5,956	6,141	96	2,482	2,578	0	243	243	d/
2014	660	9.5	6,298	90.5	6,958	282	2,833	3,115	362	3,255	3,617	16	210	226	d/
2015	490	11.1	3,918	88.9	4,408	250	1,980	2,230	240	1,748	1,988	0	190	190	d/
2016	545	14.0	3,359	86.0	3,904	250	1,331	1,581	277	1,830	2,107	18	198	216	d/
2017	802	18.1	3,623	81.9	4,425	481	2,459	2,940	246	1,134	1,380	75	29	104	d/
2018	927	11.5	7,105	88.5	8,032	507	4,352	4,859	420	2,488	2,908	0	265	265	d/

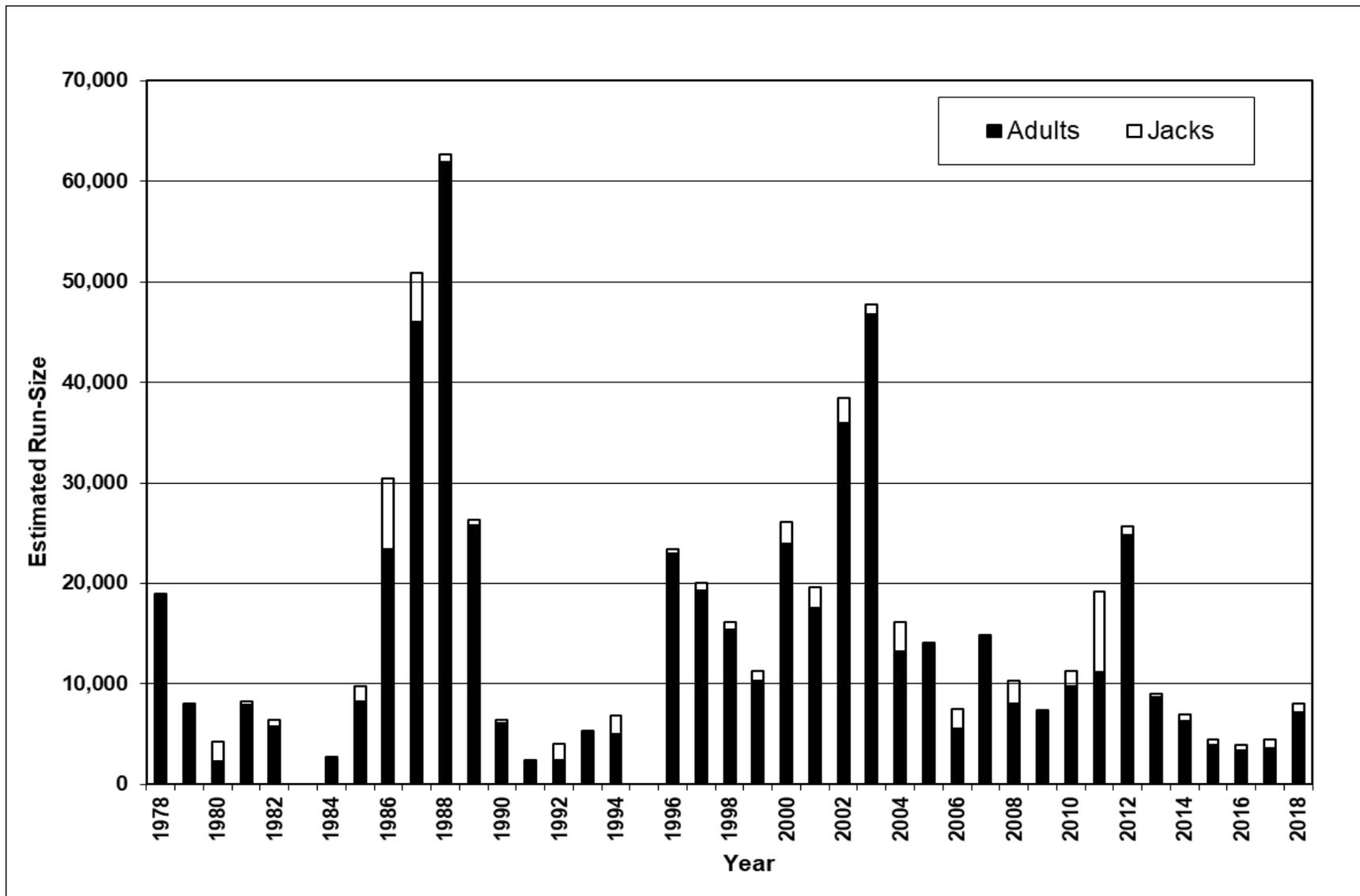
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

b/ Jacks are two year old salmon, adults are three years old or older.

c/ The 1978 sport harvest of spring Chinook Salmon was limited by a salmon fishing closure beginning August 25, 1978.

d/ The sport harvest of adult spring Chinook Salmon was subject to seasonal and size limit restrictions.

Appendix 3. Spring Chinook Salmon estimated run-size for the Trinity River upstream of Junction City weir, 1978 – 2018. ^a



^a No estimate in 1983 or 1995 due to lack of funding.

Appendix 4. Spring Chinook Salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Junction City weir, 2002 – 2018, showing natural- and Trinity River Hatchery-origin composition.

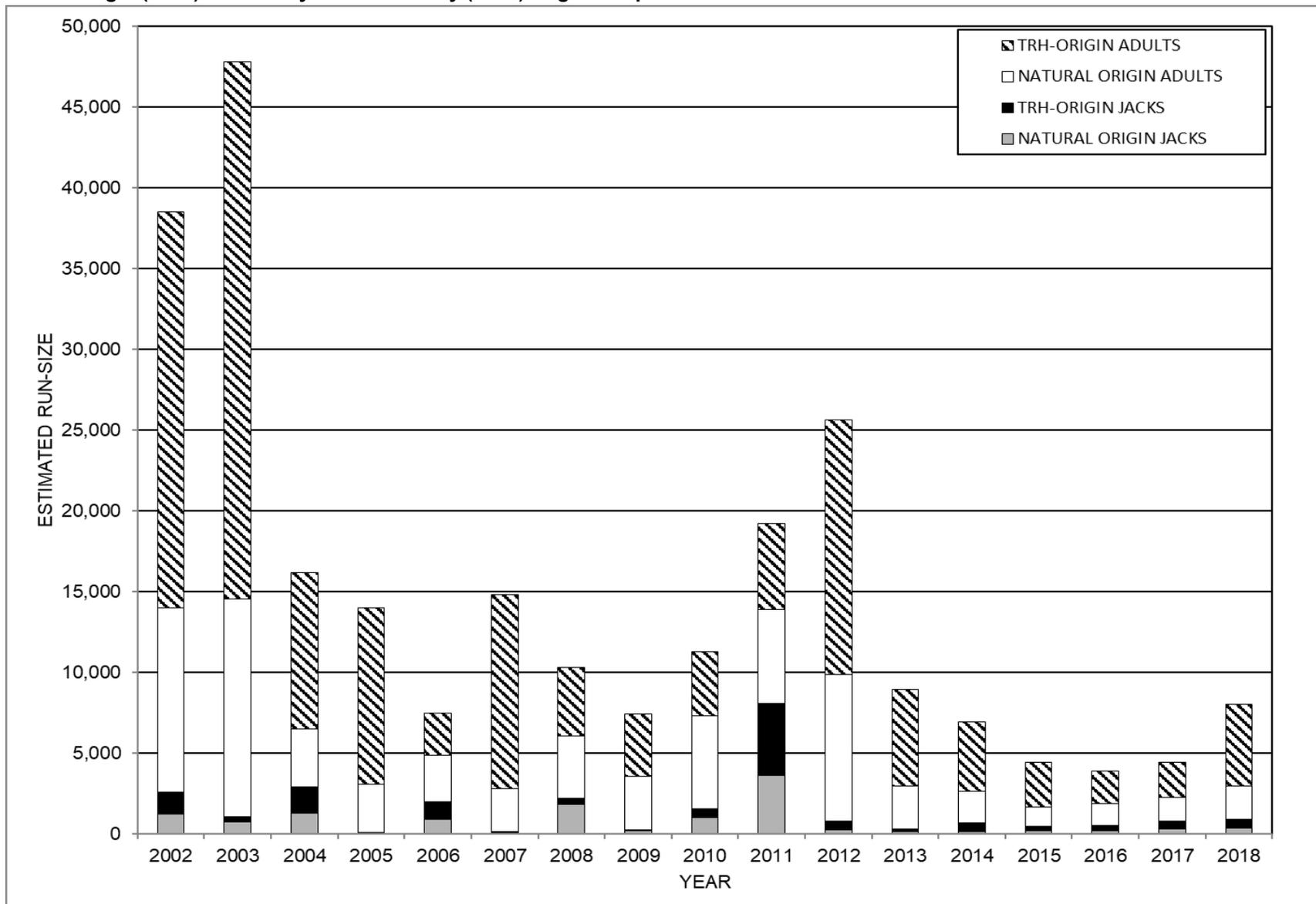
Year	Run-size estimate					Spawner escapements						Angler harvest ^c		
	Jacks ^a		Adults		Total	Natural Area Spawners ^b			Trinity River Hatchery			Jacks	Adults	Total
	Number	Percent	Number	Percent		Jacks	Adults	Total	Jacks	Adults	Total			
2002 NATURAL	1,238	10%	11,398	90%	12,636	1,109	10,097	11,206	87	722	809	41	579	620
2002 TRH	1,337	5%	24,512	95%	25,849	774	13,577	14,351	530	9,718	10,248	34	1,217	1,251
2002 TOTAL	2,575	7%	35,910	93%	38,485	1,883	23,674	25,557	617	10,440	11,057	75	1,796	1,871
2003 NATURAL	740	5%	13,509	95%	14,249	729	11,490	12,219	11	1,432	1,443	0	587	587
2003 TRH	299	1%	33,247	99%	33,546	180	18,721	18,901	119	13,080	13,199	0	1,446	1,446
2003 TOTAL	1,039	2%	46,756	98%	47,795	909	30,211	31,120	130	14,512	14,642	0	2,033	2,033
2004 NATURAL	1,266	26%	3,556	74%	4,822	1,009	2,966	3,975	154	410	564	103	180	283
2004 TRH	1,663	15%	9,662	85%	11,325	699	4,348	5,047	831	4,841	5,672	133	473	606
2004 TOTAL	2,929	18%	13,218	82%	16,147	1,708	7,314	9,022	985	5,251	6,236	236	653	889
2005 NATURAL	-14	0%	3,032	100%	3,018	-2	2,028	2,026	-11	799	788	0	206	206
2005 TRH	69	1%	10,897	99%	10,966	32	3,975	4,007	36	6,167	6,203	0	755	755
2005 TOTAL	55	0%	13,929	100%	13,984	30	6,003	6,033	25	6,966	6,991	0	961	961
2006 NATURAL	914	24%	2,911	76%	3,825	792	2,418	3,210	114	494	608	8	0	8
2006 TRH	1,049	29%	2,609	71%	3,658	335	537	872	705	2,071	2,776	9	0	9
2006 TOTAL	1,963	26%	5,520	74%	7,483	1,127	2,955	4,082	819	2,565	3,384	17	0	17
2007 NATURAL	56	2%	2,680	98%	2,736	67	1,705	1,772	-11	862	851	0	113	113
2007 TRH	79	1%	12,020	99%	12,099	13	6,449	6,462	66	5,119	5,185	0	452	452
2007 TOTAL	135	1%	14,700	99%	14,835	80	8,154	8,234	55	5,981	6,036	0	565	565
2008 NATURAL	1,846	32%	3,860	68%	5,706	1,614	3,210	4,824	108	571	679	123	79	202
2008 TRH	372	8%	4,205	92%	4,577	127	1,260	1,387	221	2,866	3,087	25	79	104
2008 TOTAL	2,218	22%	8,065	78%	10,283	1,741	4,470	6,211	329	3,437	3,766	148	158	306
2009 NATURAL	175	5%	3,278	95%	3,453	155	2,672	2,827	20	404	424	0	202	202
2009 TRH	85	2%	3,888	98%	3,973	36	1,052	1,088	49	2,596	2,645	0	240	240
2009 TOTAL	260	4%	7,166	96%	7,426	191	3,724	3,915	69	3,000	3,069	0	442	442
2010 NATURAL	1,020	15%	5,756	85%	6,776	959	5,066	6,025	61	321	382	0	368	368
2010 TRH	534	12%	3,975	88%	4,509	350	1,744	2,094	184	2,136	2,320	0	95	95
2010 TOTAL	1,554	14%	9,731	86%	11,285	1,309	6,810	8,119	245	2,457	2,702	0	463	463
2011 NATURAL	3,592	38%	5,781	62%	9,373	3,350	5,577	8,927	193	204	397	50	0	50
2011 TRH	4,495	46%	5,351	54%	9,846	1,867	1,732	3,599	2,565	3,619	6,184	62	0	62
2011 TOTAL	8,087	42%	11,132	58%	19,219	5,217	7,309	12,526	2,758	3,823	6,581	112	0	112
2012 NATURAL	251	3%	9,060	97%	9,311	116	7,569	7,685	31	788	819	105	703	808
2012 TRH	562	3%	15,744	97%	16,306	426	8,548	8,974	78	5,924	6,002	58	1,273	1,331
2012 TOTAL	813	3%	24,804	97%	25,617	542	16,117	16,659	109	6,712	6,821	163	1,976	2,139
2013 NATURAL	146	5%	2,669	95%	2,815	127	2,487	2,614	19	116	135	0	67	67
2013 TRH	135	2%	6,011	98%	6,146	58	3,469	3,527	77	2,366	2,443	0	176	176
2013 TOTAL	281	3%	8,680	97%	8,961	185	5,956	6,141	96	2,482	2,578	0	243	243
2014 NATURAL	132	6%	1,998	94%	2,130	49	1,559	1,608	80	372	452	3	66	211
2014 TRH	528	11%	4,300	89%	4,828	233	1,274	1,507	282	2,883	3,165	13	144	15
2014 TOTAL	660	9%	6,298	91%	6,958	282	2,833	3,115	362	3,255	3,617	16	210	226
2015 NATURAL	177	13%	1,146	87%	1,323	123	817	940	55	273	327	0	56	56
2015 TRH	313	10%	2,772	90%	3,085	127	1,163	1,290	185	1,475	1,661	0	134	134
2015 TOTAL	490	11%	3,918	89%	4,408	250	1,980	2,230	240	1,748	1,988	0	190	190
2016 NATURAL	178	12%	1,337	88%	1,515	155	1,168	1,323	17	90	107	6	79	85
2016 TRH	367	15%	2,022	85%	2,389	95	163	258	260	1,740	2,000	12	119	131
2016 TOTAL	545	14%	3,359	86%	3,904	250	1,331	1,581	277	1,830	2,107	18	198	216
2017 NATURAL	309	17%	1,466	83%	1,775	322	1,429	1,751	-42	25	-17	29	12	41
2017 TRH	493	19%	2,157	81%	2,650	159	1,030	1,189	288	1,109	1,397	46	17	63
2017 TOTAL	802	18%	3,623	82%	4,425	481	2,459	2,940	246	1,134	1,380	75	29	104
2018 NATURAL	346	15%	2,032	85%	2,378	295	1,650	1,945	51	288	339	0	75	75
2018 TRH	581	10%	5,073	90%	5,654	212	2,702	2,914	369	2,200	2,569	0	190	190
2018 TOTAL	927	12%	7,105	88%	8,032	507	4,352	4,859	420	2,488	2,908	0	265	265

a/ Jacks are two year old salmon, adults are three years old or older.

b/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

c/ The sport harvest of spring Chinook Salmon was subject to seasonal and size limit restrictions.

Appendix 5. Spring Chinook Salmon estimated run-size for the Trinity River upstream of Junction City weir, 2002 – 2018, showing natural origin (NOR) and Trinity River Hatchery (HOR) origin composition.



Appendix 6. Fall Chinook Salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2018.

Year	Run-size estimate					Spawner escapements						Angler harvest		
	Jacks ^e		Adults		Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total
	Number	Percent	Number	Percent		Jacks	Adults	Total	Jacks	Adults	Total			
1977	14,318	43.5	18,596	56.5	32,914	9,737	13,501	23,238	2,177	2,035	4,212	2,404	3,060	5,464
1978	6,037	14.0	37,086	86.0	43,123	4,712	31,052	35,764	1,325	6,034	7,359	Fishing closure	0	b/
1979	5,665	35.0	10,520	65.0	16,185	3,936	8,028	11,964	964	1,335	2,299	765	1,157	1,922
1980	21,549	62.7	12,797	37.3	34,346	16,837	7,700	24,537	2,256	4,099	6,355	2,456	998	3,454
1981	8,366	28.6	20,884	71.4	29,250	5,906	15,340	21,246	1,004	2,370	3,374	1,456	3,174	4,630
1982	14,938	52.2	13,653	47.8	28,591	8,149	9,274	17,423	4,235	2,058	6,293	2,554	2,321	4,875
1983	1,240	4.7	25,138	95.3	26,378	853	17,284	18,137	271	5,494	5,765	116	2,360	2,476
1984	4,575	34.8	8,556	65.2	13,131	3,416	5,654	9,070	766	2,166	2,932	393	736	1,129
1985	53,062	81.6	11,954	18.4	65,016	29,454	9,217	38,671	18,166	2,583	20,749	5,442	154	5,596 c/
1986	27,506	18.6	120,382	81.4	147,888	20,459	92,548	113,007	3,609	15,795	19,404	3,438	12,039	15,477
1987	9,325	8.9	95,287	91.1	104,612	5,949	71,920	77,869	2,453	13,934	16,387	923	9,433	10,356
1988	18,113	20.3	71,309	79.7	89,422	10,626	44,616	55,242	4,752	17,352	22,104	2,735	9,341	12,076
1989	2,991	6.4	43,631	93.6	46,622	2,543	29,445	31,988	239	11,132	11,371	209	3,054	3,263
1990	634	6.3	9,358	93.7	9,992	241	7,682	7,923	371	1,348	1,719	22	328	350
1991	681	7.4	8,526	92.6	9,207	382	4,867	5,249	205	2,482	2,687	94	1,177	1,271
1992	2,932	20.7	11,232	79.3	14,164	2,563	7,139	9,702	211	3,779	3,990	158	314	472 c/
1993	3,381	32.2	7,104	67.8	10,485	2,473	5,898	8,371	736	815	1,551	172	391	563 c/
1994	7,494	34.2	14,430	65.8	21,924	2,505	10,906	13,411	4,442	3,264	7,706	547	260	807 c/
1995	9,892	9.4	95,833	90.6	105,725	9,262	77,876	87,138	76	15,178	15,254	554	2,779	3,333 c/
1996	5,072	9.1	50,574	90.9	55,646	4,478	42,646	47,124	249	6,411	6,660	345	1,517	1,862 c/
1997	3,767	17.6	17,580	82.4	21,347	2,845	11,507	14,352	820	5,387	6,207	102	686	788 c/
1998	2,307	5.3	40,882	94.7	43,189	1,974	24,460	26,434	192	14,296	14,488	141	2,126	2,267 c/
1999	6,583	35.6	11,933	64.4	18,516	4,154	6,753	10,907	2,027	5,037	7,064	402	143	545 d/
2000	3,163	5.7	52,310	94.3	55,473	1,964	24,880	26,844	1,028	26,018	27,046	171	1,412	1,583 d/
2001	1,214	2.1	55,895	97.9	57,109	914	36,152	37,066	204	17,971	18,175	96	1,772	1,868 d/
2002	3,812	21.0	14,344	79.0	18,156	2,566	10,310	12,876	1,078	3,475	4,553	168	559	727 d/
2003	1,547	2.4	62,815	97.6	64,362	758	31,195	31,953	634	29,752	30,386	155	1,867	2,022 d/
2004	5,224	17.7	24,310	82.3	29,534	3,839	11,545	15,384	1,059	12,384	13,443	327	381	708 d/
2005	899	3.2	27,332	96.8	28,231	751	12,717	13,468	48	13,758	13,806	100	856	956 d/
2006	12,290	35.2	22,622	64.8	34,912	8,228	14,566	22,794	3,938	8,056	11,994	124	0	124 d/
2007	886	1.5	57,987	98.5	58,873	765	38,967	39,732	33	18,081	18,114	89	939	1,028 d/
2008	7,856	34.2	15,141	65.8	22,997	6,861	10,408	17,269	801	4,451	5,252	194	281	475 d/
2009	6,018	20.3	23,575	79.7	29,593	5,732	15,663	21,395	141	7,353	7,494	145	559	704 d/
2010	12,554	30.8	28,238	69.2	40,792	10,969	20,301	31,270	1,458	7,749	9,207	127	188	315 d/
2011	35,277	43.6	45,542	56.4	80,819	32,527	30,810	63,337	1,840	13,882	15,722	910	851	1,761 d/
2012	5,243	7.1	68,423	92.9	73,666	5,120	49,317	54,437	92	17,461	17,553	31	1,644	1,675 d/
2013	6,717	18.2	30,272	81.8	36,989	6,582	25,675	32,257	135	3,717	3,852	0	880	880 d/
2014	6,938	18.3	30,892	81.7	37,830	6,603	23,105	29,708	221	6,975	7,196	114	812	926 d/
2015	2,750	26.5	7,615	73.5	10,365	2,505	4,451	6,956	224	3,129	3,353	21	35	56 d/
2016	1,661	26.8	4,535	73.2	6,196	1,260	3,353	4,613	401	1,142	1,543	0	40	40 d/
2017	7,355	47.6	8,100	52.4	15,455	5,492	4,330	9,822	1,863	3,770	5,633	0	0	0 d/
2018	4,446	16.6	22,402	83.4	26,848	4,075	14,499	18,574	171	7,142	7,313	200	761	961 d/

a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

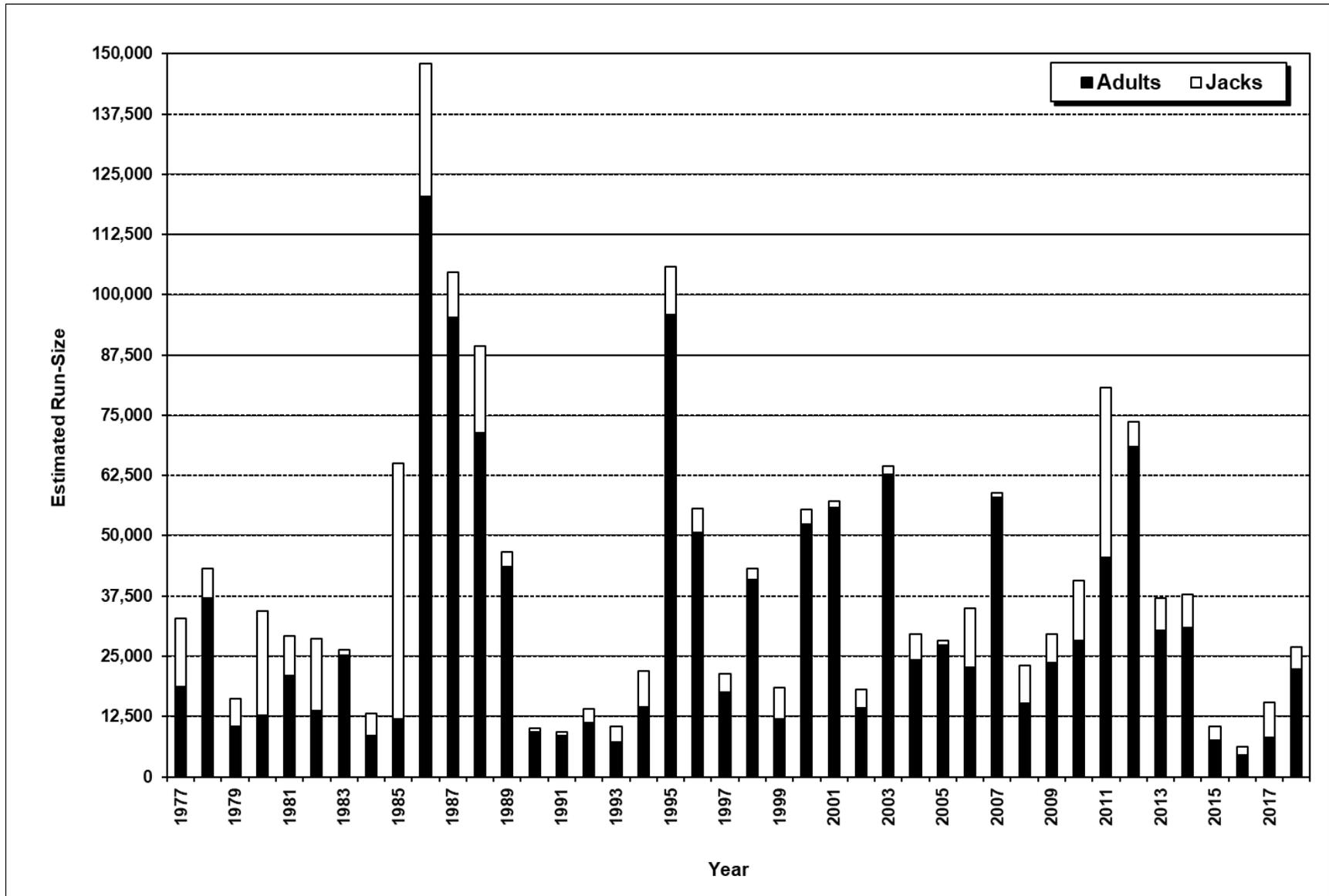
b/ The 1978 sport harvest of fall Chinook was restricted by a salmon fishing closure beginning August 25, 1978.

c/ The sport harvest of adult fall Chinook was subject to seasonal and size limit restrictions.

d/ The 1999-2018 sport harvest of Klamath Basin fall Chinook was managed with a quota system. The quota for adult fall Chinook was 957 in 1999; 693 in 2000; 9,834 in 2001; 6,926 in 2002; 10,800 in 2003; 4,700 in 2004; 1,262 in 2005, zero in 2006, 10,600 in 2007, 20,500 in 2008, 30,800 in 2009, 12,000 in 2010, 7,900 in 2011, 67,600 in 2012, 40,006 in 2013, 4,128 in 2014, 14,133 in 2015, 1,110 in 2016, zero (no allowable harvest) in 2017, and 3,490 in 2018.

e/ Jacks are two year old fish, adults are a minimum of three years old.

Appendix 7. Fall Chinook Salmon estimated run-size for the Trinity River upstream of Willow Creek weir, 1977 - 2018.



Appendix 8. Fall Chinook Salmon estimated run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 – 2018, showing natural- and Trinity River Hatchery-origin composition.

Year	Run-size estimate					Spawner escapements						Angler harvest		
	Jacks ^b		Adults		Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total
	Number	Percent	Number	Percent		Jacks	Adults	Total	Jacks	Adults	Total			
2002 NATURAL	1,314	15.1	7,367	84.9	8,681	1,231	6,549	9,019	26	523	549	57	295	352
2002 TRH	2,498	26.4	6,977	73.6	9,475	1,335	3,761	3,857	1,052	2,952	4,004	111	264	375
2002 TOTAL	3,812	21.0	14,344	79.0	18,156	2,566	10,310	12,876	1,078	3,475	4,553	168	559	727 d/
2003 NATURAL	579	5.1	10,839	94.9	11,418	415	9,273	9,688	105	1,243	1,349	58	322	380
2003 TRH	968	1.8	51,976	98.2	52,944	343	21,922	22,265	529	28,509	29,037	97	1,545	1,642
2003 TOTAL	1,547	2.4	62,815	97.6	64,362	758	31,195	31,953	634	29,752	30,386	155	1,867	2,022 d/
2004 NATURAL	3,210	90	369	10	3,578	2,941	-223	2,718	70	595	664	c/ 200	-3	197
2004 TRH	2,014	8	23,941	92	25,956	898	11,768	12,666	989	11,789	12,779	127	384	511
2004 TOTAL	5,224	17.7	24,310	82.3	29,534	3,839	11,545	15,384	1,059	12,384	13,443	327	381	708 d/
2005 NATURAL	879	10.3	7,678	89.7	8,557	743	6,364	7,107	36	1,065	1,101	100	247	347
2005 TRH	20	0.1	19,654	99.9	19,674	8	6,353	6,361	12	12,693	12,705	0	609	609
2005 TOTAL	899	3.2	27,332	96.8	28,231	751	12,717	13,468	48	13,758	13,806	100	856	956 d/
2006 NATURAL	6,845	52	6,299	48	13,144	6,358	5,114	11,472	421	1,185	1,606	66	0	66
2006 TRH	5,445	25	16,323	75	21,768	1,870	9,452	11,322	3,517	6,871	10,388	58	0	58
2006 TOTAL	12,290	35.2	22,622	64.8	34,912	8,228	14,566	22,794	3,938	8,056	11,994	124	0	124 d/
2007 NATURAL	819	2.4	33,421	97.6	34,240	723	31,412	32,135	16	1,457	1,473	81	552	633
2007 TRH	67	0.3	24,566	99.7	24,633	42	7,555	7,597	17	16,624	16,641	8	387	395
2007 TOTAL	886	1.5	57,987	98.5	58,873	765	38,967	39,732	33	18,081	18,114	89	939	1,028 d/
2008 NATURAL	6,723	46.6	7,689	53.4	14,412	6,373	6,951	13,324	185	599	784	165	138	303
2008 TRH	1,133	13.2	7,452	86.8	8,585	488	3,457	3,945	616	3,852	4,468	29	143	172
2008 TOTAL	7,856	34.2	15,141	65.8	22,997	6,861	10,408	17,269	801	4,451	5,252	194	281	475 d/
2009 NATURAL	5,733	29.4	13,788	70.6	19,521	5,602	12,537	18,139	-9	921	912	c/ 141	330	471
2009 TRH	285	2.8	9,787	97.2	10,072	130	3,126	3,256	150	6,432	6,582	4	229	233
2009 TOTAL	6,018	20.3	23,575	79.7	29,593	5,732	15,663	21,395	141	7,353	7,494	145	559	704 d/
2010 NATURAL	10,125	40.6	14,814	59.4	24,939	9,782	14,104	23,886	241	611	852	102	99	201
2010 TRH	2,429	15.3	13,424	84.7	15,853	1,187	6,197	7,384	1,217	7,138	8,355	25	89	114
2010 TOTAL	12,554	30.8	28,238	69.2	40,792	10,969	20,301	31,270	1,458	7,749	9,207	127	188	315 d/
2011 NATURAL	30,462	63.5	17,482	36.5	47,944	29,530	15,470	45,000	146	1,688	1,834	786	327	1,113
2011 TRH	4,815	14.6	28,060	85.4	32,875	2,997	15,340	18,337	1,694	12,194	13,888	124	524	648
2011 TOTAL	35,277	43.6	45,542	56.4	80,819	32,527	30,810	63,337	1,840	13,882	15,722	910	851	1,761 d/
2012 NATURAL	4,514	11.0	36,416	89.0	40,931	4,530	34,702	39,232	-42	838	796	c/ 31	1,644	1,675
2012 TRH	729	2.2	32,007	97.8	32,735	590	14,615	15,205	134	16,623	16,757	4	769	773
2012 TOTAL	5,243	7.1	68,423	92.9	73,666	5,120	49,317	54,437	92	17,461	17,553	31	1,644	2,448 d/
2013 NATURAL	6,514	27.6	17,104	72.4	23,618	6,515	16,689	23,204	-1	-82	-83	c/ 0	498	498
2013 TRH	203	1.5	13,168	98.5	13,371	67	8,986	9,053	136	3,799	3,935	0	382	382
2013 TOTAL	6,717	18.2	30,272	81.8	36,989	6,582	25,675	32,257	135	3,717	3,852	0	880	880 d/
2014 NATURAL	5,553	32.0	11,814	68.0	17,367	5,492	11,528	17,020	-19	10	-9	c/ 80	276	356
2014 TRH	1,385	6.8	19,078	93.2	20,463	1,111	11,577	12,688	240	6,965	7,205	34	536	570
2014 TOTAL	6,938	18.3	30,892	81.7	37,830	6,603	23,105	29,708	221	6,975	7,196	114	812	926 d/
2015 NATURAL	2,226	38.1	3,609	61.9	5,834	2,167	3,576	5,744	41	16	57	17	17	34
2015 TRH	524	11.6	4,006	88.4	4,531	338	875	1,212	183	3,113	3,296	4	18	22
2015 TOTAL	2,750	26.5	7,615	73.5	10,365	2,505	4,451	6,956	224	3,129	3,353	21	35	56 d/
2016 NATURAL	1,022	25.5	2,987	74.5	4,008	979	2,853	3,831	43	108	151	0	26	26
2016 TRH	639	29.2	1,548	70.8	2,188	281	500	782	358	1,034	1,392	0	14	14
2016 TOTAL	1,661	26.8	4,535	73.2	6,196	1,260	3,353	4,613	401	1,142	1,543	0	40	40 d/
2017 NATURAL	3,901	48.3	4,180	51.7	8,081	3,639	3,785	7,424	262	395	657	0	0	0
2017 TRH	3,454	46.8	3,920	53.2	7,374	1,853	545	2,398	1,601	3,375	4,976	0	0	0
2017 TOTAL	7,355	47.6	8,100	52.4	15,455	5,492	4,330	9,822	1,863	3,770	5,633	0	0	0 d/
2018 NATURAL	4,087	32.1	8,650	67.9	12,737	3,883	7,538	11,421	20	819	839	184	293	477
2018 TRH	359	2.5	13,752	97.5	14,111	192	6,961	7,153	151	6,323	6,475	16	468	484
2018 TOTAL	4,446	16.6	22,402	83.4	26,848	4,075	14,499	18,574	171	7,142	7,313	200	761	961 d/

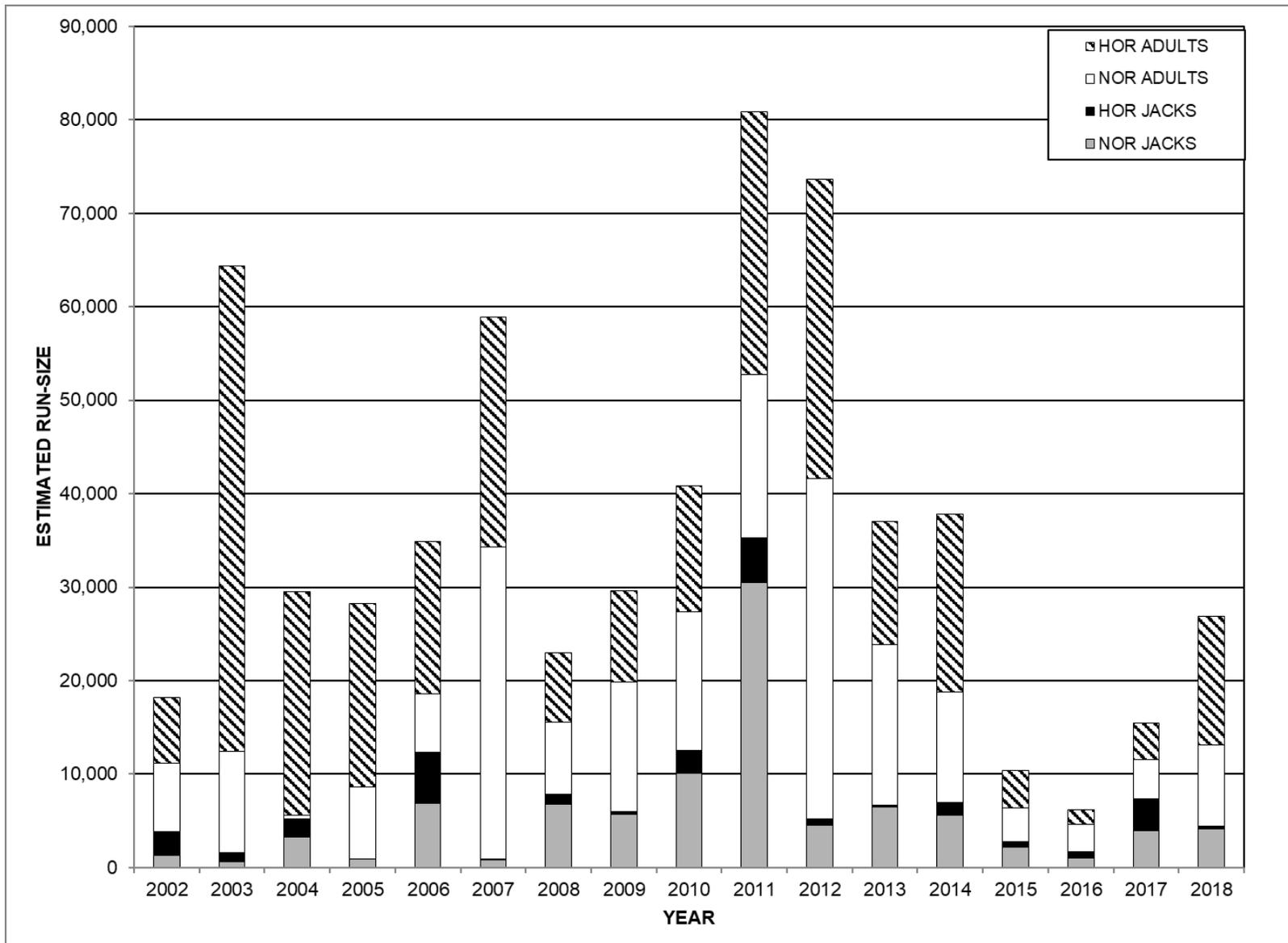
a/ Natural area spawners include both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

b/ Jacks are two year old fish, adults are a minimum of three years old.

c/ Negative numbers occur when the estimated number of hatchery fish, based on expansion of coded-wire tag recoveries for sampling and production, exceeds the estimated total number of fish.

d/ The 1999-2018 sport harvest of Klamath Basin fall Chinook was managed with a quota system. The quota for adult fall Chinook was 957 in 1999; 693 in 2000; 9,834 in 2001; 6,926 in 2002; 10,800 in 2003; 4,700 in 2004; 1,262 in 2005, zero in 2006, 10,600 in 2007, 20,500 in 2008, 30,800 in 2009, 12,000 in 2010, 7,900 in 2011, 67,600 in 2012, 40,006 in 2013, 4,128 in 2014, 14,133 in 2015, 1,110 in 2016, zero (no allowable harvest) in 2017, and 3,490 in 2018.

Appendix 9. Fall Chinook Salmon estimated run-size for the Trinity River upstream of Willow Creek weir, 2002 - 2018, showing natural origin (NOR) and Trinity River Hatchery (HOR) origin composition.



Appendix 10. Coho Salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2018.

YEAR	Run-size estimate				Spawner escapements						Angler harvest			
	Number		Percent		Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total
	Jacks ^b	Adults	Jacks	Adults		Total	Jacks	Adults	Total					
1977	3,106	80.5	752	19.5	3,858	1,756	25	1,781	1,230	698	1,928	120	29	149
1978	6,685	73.2	2,447	26.8	9,132	4,309	1,168	5,477	2,376	1,279	3,655	Fishing closure ^c		
1979	9,067	78.0	2,557	22.0	11,624	5,567	1,695	7,262	2,793	742	3,535	707	120	827
1980	2,499	41.0	3,595	59.0	6,094	954	1,817	2,771	1,545	1,778	3,323			0
1981	6,144	56.0	4,826	44.0	10,970	3,486	1,995	5,481	1,994	2,529	4,523	664	302	966
1982	2,021	17.5	9,508	82.5	11,529	1,158	5,097	6,255	823	3,975	4,798	40	436	476
1983	536	27.2	1,435	72.8	1,971	295	788	1,083	192	514	706	49	133	182
1984	15,208	77.2	4,486	22.8	19,694	6,188	2,971	9,159	7,727	1,134	8,861	1,293	381	1,674
1985	9,216	23.7	29,717	76.3	38,933	4,798	21,586	26,384	4,237	7,549	11,786	181	582	763 ^c
1986	18,909	67.6	9,063	32.4	27,972	13,034	6,247	19,281	5,402	2,589	7,991	473	227	700
1987	7,253	12.3	51,826	87.7	59,079	3,975	28,398	32,373	2,865	20,473	23,338	413	2,955	3,368
1988	2,731	7.0	36,173	93.0	38,904	1,850	22,277	24,127	743	12,073	12,816	138	1,823	1,961
1989	290	1.5	18,462	98.5	18,752	208	13,274	13,482	77	4,893	4,970	5	295	300
1990	412	10.6	3,485	89.4	3,897	234	1,981	2,215	173	1,462	1,635	5	42	47
1991	265	2.9	8,859	97.1	9,124	164	6,163	6,327	98	2,590	2,688	3	106	109
1992	2,378	23.0	7,961	77.0	10,339	1,168	5,565	6,733	1,210	2,372	3,582	0	24	24
1993	573	10.2	5,048	89.8	5,621	416	3,024	3,440	93	2,024	2,117	64	0	64
1994	613	71.9	239	28.1	852	453	105	558	160	134	294	0	0	0
1995	634	3.9	15,477	96.1	16,111	370	10,680	11,050	264	4,503	4,767	0	294	294
1996	1,269	3.5	35,391	96.5	36,660	1,149	25,308	26,457	120	9,835	9,955	0	248	248 ^d
1997	5,951	75.0	1,984	25.0	7,935	5,038	1,097	6,135	871	887	1,758	42	0	42 ^d
1998	2,471	19.8	10,009	80.2	12,480	1,494	5,995	7,489	977	4,014	4,991	0	0	0 ^d
1999	623	11.3	4,912	88.7	5,535	234	1,696	1,930	389	3,118	3,507	0	98	98 ^d
2000	5,486	35.3	10,046	64.7	15,532	4,560	6,585	11,145	926	3,461	4,387	0	0	0 ^d
2001	3,670	11.4	28,470	88.6	32,140	2,644	18,715	21,359	1,026	9,755	10,781	0	0	0 ^d
2002	1,709	10.7	14,307	89.3	16,016	1,006	7,812	8,818	703	6,495	7,198	0	0	0 ^d
2003	3,501	12.4	24,651	87.6	28,152	2,038	14,255	16,293	1,463	10,396	11,859	0	0	0 ^d
2004	5,819	15.0	33,063	85.0	38,882	4,742	23,117	27,859	1,077	9,906	10,983	0	40	40 ^d
2005	3,093	9.8	28,326	90.2	31,419	1,341	11,702	13,043	1,731	16,624	18,355	21	0	21 ^d
2006	1,369	6.8	18,709	93.2	20,078	708	8,870	9,578	661	9,839	10,500	0	0	0 ^d
2007	545	9.5	5,205	90.5	5,750	270	2,552	2,822	275	2,653	2,928	0	0	0 ^d
2008	2,379	23.8	7,603	76.2	9,982	1,730	3,064	4,794	649	4,539	5,188	0	0	0 ^d
2009	1,762	27.5	4,634	72.5	6,396	888	2,157	3,045	874	2,477	3,351	0	0	0 ^d
2010	1,278	16.1	6,669	83.9	7,947	752	2,770	3,522	526	3,899	4,425	0	0	0 ^d
2011	9,722	64.6	5,318	35.4	15,040	6,792	3,394	10,186	2,886	1,924	4,810	44	0	44 ^d
2012	3,389	18.2	15,268	81.8	18,657	2,510	7,912	10,422	879	7,357	8,236	0	0	0 ^d
2013	2,819	12.9	19,087	87.1	21,906	2,392	12,883	15,275	427	6,204	6,631	0	0	0 ^d
2014	3,338	24.7	10,199	75.3	13,537	2,401	7,228	9,629	937	2,971	3,908	0	0	0 ^d
2015	935	20.2	3,684	79.8	4,619	657	625	1,282	278	3,059	3,337	0	0	0 ^{de}
2016	208	15.7	1,117	84.3	1,325	163	635	798	45	482	527	0	0	0 ^d
2017	244	37.3	411	62.7	655	94	141	235	150	270	420	0	0	0 ^d
2018	427	28.7	1,059	71.3	1,486	241	503	744	186	556	742	0	0	0 ^d

a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

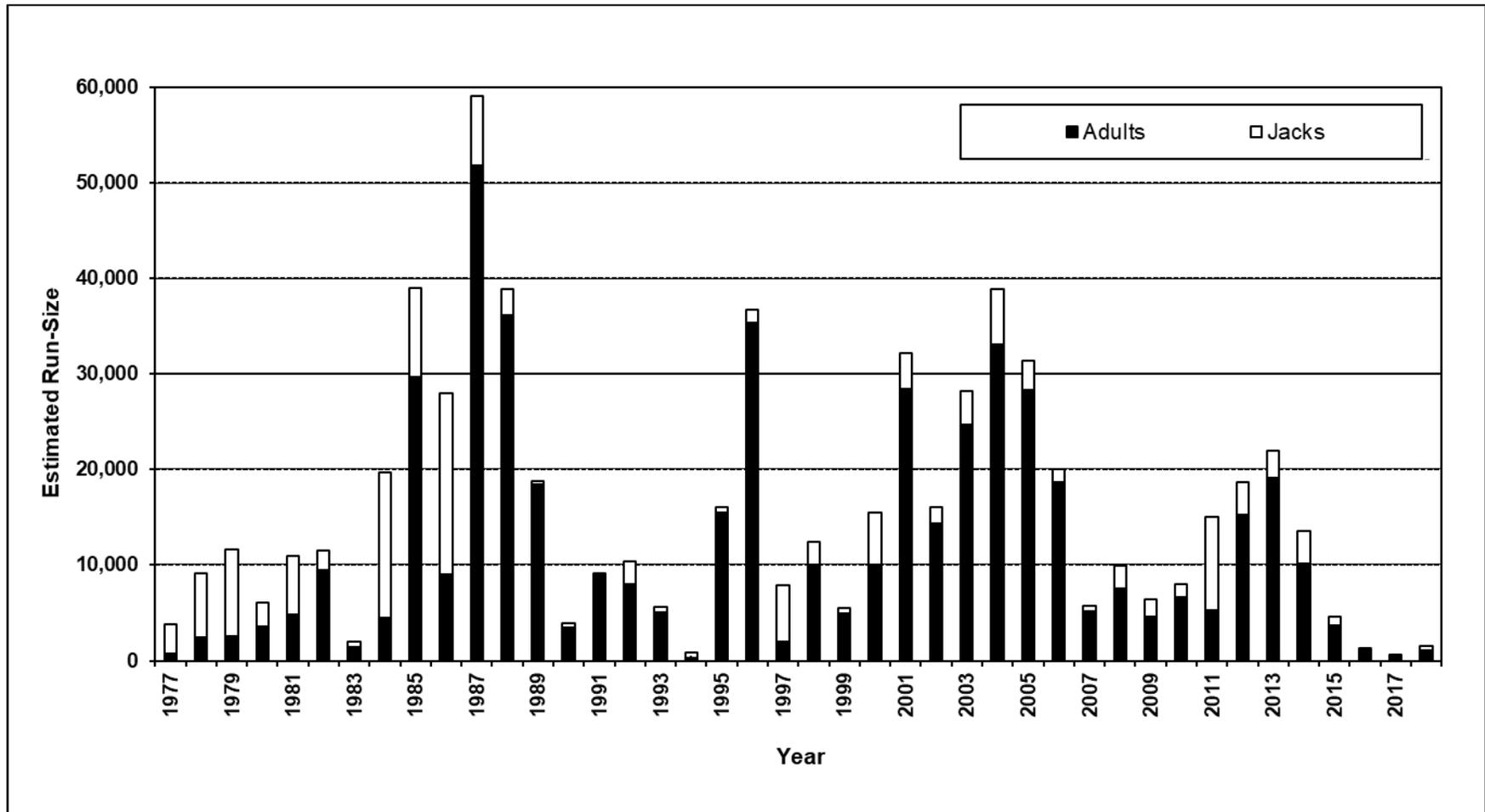
b/ Jacks are two year old fish, adults are three years.

c/ The 1978 sport harvest of Coho Salmon was essentially eliminated by a salmon fishing closure beginning August 25, 1978, and the 1985 sport harvest of adult Coho Salmon was limited by a closure for the taking of salmon > 55 cm total length beginning September 22, 1985.

d/ The 1996-2018 sport fishery was closed to the take of Coho Salmon.

e/ The methods used to estimate run-size and escapement of Coho in 2016 differs from other years due to insufficient sample marked at Willow Creek weir.

Appendix 11. Coho Salmon estimated run-size for the Trinity River upstream of Willow Creek weir, 1977 - 2018.



Appendix 12. Coho Salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1997 - 2018, showing natural- and Trinity River Hatchery (TRH)-origin composition.

YEAR	Strata Component	Run-size estimate			Spawner escapement						Angler harvest		
		Jacks ^b	Adults	Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total
1997	Natural	277	481	758	224	461	685	13	20	33	40	0	40
	TRH	3,879	3,298	7,177	3,021	2,431	5,452	858	867	1,725	0	0	0
	TOTAL	4,156	3,779	7,935	3,245	2,892	6,137	871	887	1,758	40	0	40
1998	Natural	131	1,001	1,132	123	886	1,009	8	115	123	0	0	0
	TRH	2,340	9,008	11,348	1,371	5,109	6,480	969	3,899	4,868	0	0	0
	TOTAL	2,471	10,009	12,480	1,494	5,995	7,489	977	4,014	4,991	0	0	0
1999	Natural	31	556	586	23	453	477	8	103	111	0	0	0
	TRH	592	4,356	4,949	217	1,239	1,455	375	3,021	3,396	0	96	96
	TOTAL	623	4,912	5,535	240	1,692	1,932	383	3,124	3,507	0	96	96
2000	Natural	197	342	539	187	288	475	10	54	64	0	0	0
	TRH	5,289	9,704	14,993	4,373	6,297	10,670	916	3,407	4,323	0	0	0
	TOTAL	5,486	10,046	15,532	4,560	6,585	11,145	926	3,461	4,387	0	0	0
2001	Natural	297	3,075	3,372	295	2,945	3,240	2	130	132	0	0	0
	TRH	3,373	25,395	28,768	2,349	15,770	18,119	1,024	9,625	10,649	0	0	0
	TOTAL	3,670	28,470	32,140	2,644	18,715	21,359	1,026	9,755	10,781	0	0	0
2002	Natural	138	458	596	123	372	495	15	86	101	0	0	0
	TRH	1,571	13,849	15,420	883	7,440	8,323	688	6,409	7,097	0	0	0
	TOTAL	1,709	14,307	16,016	1,006	7,812	8,818	703	6,495	7,198	0	0	0
2003	Natural	163	3,930	4,093	149	3,264	3,414	14	666	680	0	0	0
	TRH	3,338	20,721	24,059	1,889	10,991	12,880	1,449	9,730	11,179	0	0	0
	TOTAL	3,501	24,651	28,152	2,038	14,255	16,294	1,463	10,396	11,859	0	0	0
2004	Natural	154	8,901	9,055	145	7,830	7,975	9	1,071	1,080	0	0	0
	TRH	5,665	24,162	29,827	4,597	15,287	19,884	1,068	8,835	9,903	0	40	40
	TOTAL	5,819	33,063	38,882	4,742	23,117	27,859	1,077	9,906	10,983	0	40	40
2005	Natural	81	2,648	2,729	71	1,728	1,799	10	920	930	0	0	0
	TRH	3,012	25,678	28,690	1,270	9,974	11,244	1,721	15,704	17,425	21	0	21
	TOTAL	3,093	28,326	31,419	1,341	11,702	13,043	1,731	16,624	18,355	21	0	21
2006	Natural	38	1,586	1,624	34	1,416	1,450	4	170	174	0	0	0
	TRH	1,331	17,123	18,454	674	7,454	8,128	657	9,669	10,326	0	0	0
	TOTAL	1,369	18,709	20,078	708	8,870	9,578	661	9,839	10,500	0	0	0
2007	Natural	42	1,157	1,199	37	940	977	5	217	222	0	0	0
	TRH	503	4,048	4,551	233	1,612	1,845	270	2,436	2,706	0	0	0
	TOTAL	545	5,205	5,750	270	2,552	2,822	275	2,653	2,928	0	0	0
2008	Natural	89	1,223	1,312	83	861	944	6	362	368	0	0	0
	TRH	2,290	6,381	8,671	1,647	2,204	3,851	643	4,177	4,820	0	0	0
	TOTAL	2,379	7,604	9,983	1,730	3,065	4,795	649	4,539	5,188	0	0	0
2009	Natural	117	525	643	114	438	552	3	87	94	0	0	0
	TRH	1,645	4,108	5,753	774	1,718	2,492	871	2,390	3,258	0	0	0
	TOTAL	1,762	4,633	6,396	888	2,156	3,044	874	2,477	3,352	0	0	0
2010	Natural	44	817	861	34	624	658	10	193	203	0	0	0
	TRH	1,233	5,852	7,085	717	2,146	2,863	516	3,706	4,222	0	0	0
	TOTAL	1,277	6,669	7,946	751	2,770	3,521	526	3,899	4,425	0	0	0
2011	Natural	208	1,205	1,413	187	991	1,178	21	214	235	0	0	0
	TRH	9,514	4,113	13,627	6,606	2,403	9,009	2,865	1,710	4,575	44	0	44
	TOTAL	9,722	5,318	15,040	6,793	3,394	10,187	2,886	1,924	4,810	44	0	44
2012	Natural	192	1,774	1,966	184	1,577	1,761	8	197	205	0	0	0
	TRH	3,198	13,494	16,692	2,327	6,335	8,662	871	7,159	8,030	0	0	0
	TOTAL	3,390	15,268	18,658	2,511	7,912	10,423	879	7,356	8,235	0	0	0
2013	Natural	152	4,305	4,457	149	3,948	4,097	3	357	360	0	0	0
	TRH	2,667	14,782	17,448	2,243	8,935	11,177	424	5,847	6,271	0	0	0
	TOTAL	2,819	19,087	21,905	2,392	12,883	15,274	427	6,204	6,631	0	0	0
2014	Natural	99	902	1,001	94	823	917	5	79	84	0	0	0
	TRH	3,239	9,297	12,536	2,307	6,405	8,712	932	2,892	3,824	0	0	0
	TOTAL	3,338	10,199	13,537	2,401	7,228	9,629	937	2,971	3,908	0	0	0
2015	Natural	65	748	814	57	459	517	8	289	297	0	0	0
	TRH	870	2,936	3,805	600	166	765	270	2,770	3,040	0	0	0
	TOTAL	935	3,684	4,619	657	625	1,282	278	3,059	3,337	0	0	0
2016	Natural	163	635	798	insufficient sample to make estimation of			0	74	74	0	0	0
	TRH	45	482	527				45	408	453	0	0	0
	TOTAL	208	1,117	1,325	163	635	798	45	482	527	0	0	0
2017	Natural	9	57	65	8	34	41	1	23	24	0	0	0
	TRH	236	354	590	87	107	194	149	247	396	0	0	0
	TOTAL	244	411	655	94	141	235	150	270	420	0	0	0
2018	Natural	18	42	60	17	1	18	1	41	42	0	0	0
	TRH	409	1,017	1,426	224	502	726	185	515	700	0	0	0
	TOTAL	427	1,059	1,486	241	503	744	186	556	742	0	0	0

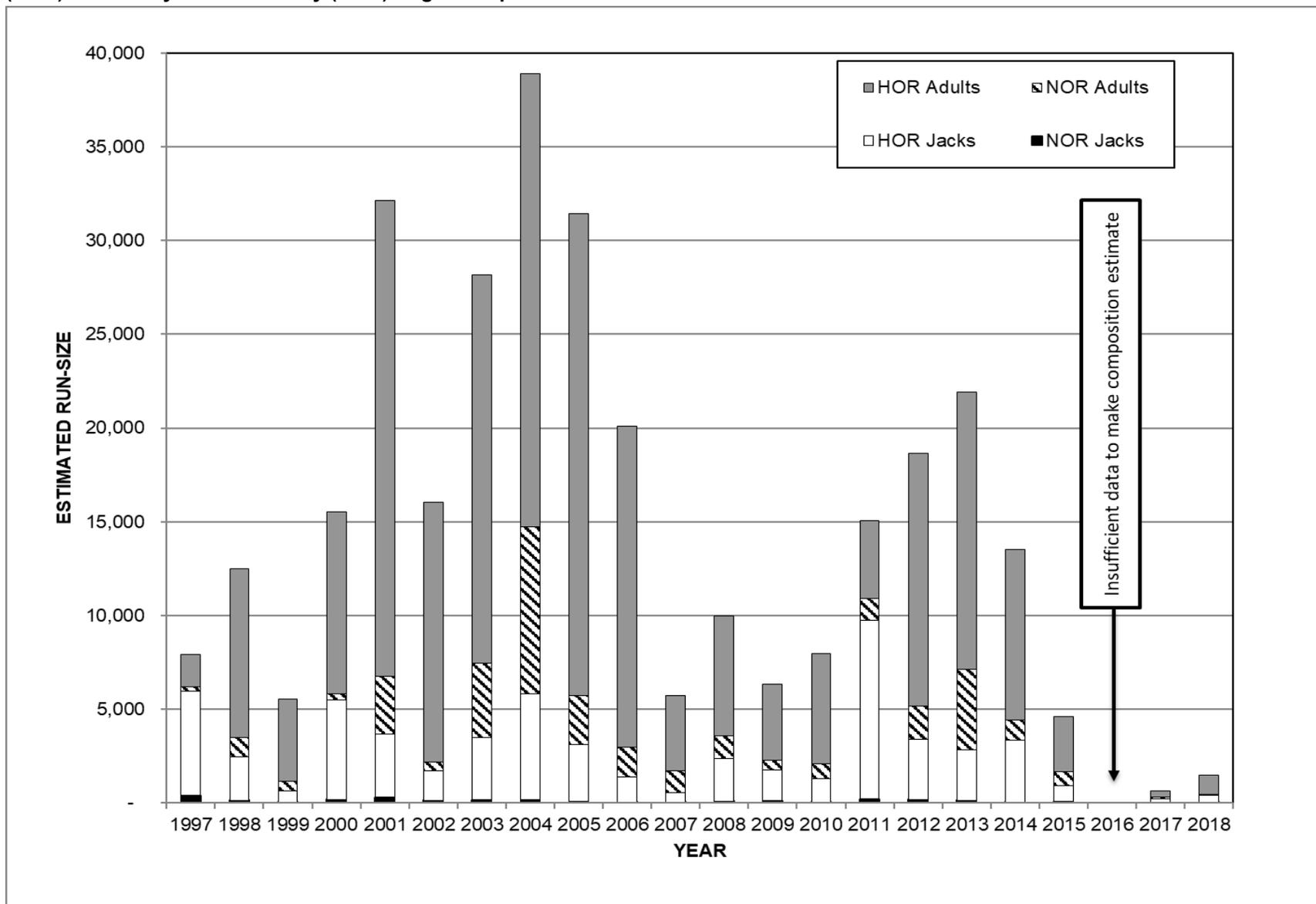
a/ Natural area spawners include both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

b/ Jacks are two year old fish, adults are three years.

c/ The 1996-2018 sport fishery was closed to the take of Coho Salmon

d/ The methods used to estimate run-size and escapement of Coho Salmon in 2016 differs from other years due to insufficient sample size.

Appendix 13. Coho Salmon estimated run-size for the Trinity River upstream of Willow Creek weir, 1997 - 2018, showing natural-origin (NOR) and Trinity River Hatchery (HOR) origin composition.



Appendix 14. Fall-run adult steelhead (>41 cm FL) run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2018.

Year	Run-size estimate				Spawner escapement						Angler harvest			
	Hatchery ^b		Wild ^c		Total	Natural Area Spawners ^a			Trinity River Hatchery			Hatchery	Wild	Total
	Number	Percent	Number	Percent		Hatchery	Wild	Total	Hatchery	Wild	Total			
1977	No estimates					No estimates			269	16	285	No estimates		
1978	"					"			628	55	683	"		
1979	"					"			329	53	382	"		
1980	8,449	33.7	16,645	66.3	25,094	5,101	14,462	19,563	1,903	102	2,005	1,445	2,081	3,526
1981	No estimates					No estimates			892	112	1,004	No estimates		
1982	2,106	20.0	8,426	80.0	10,532	971	6,889	7,860	634	79	713	501	1,458	1,959
1983	No estimates for hatchery/wild component				8,605									
1984	"				7,833									
1985	No estimates					No estimates						No estimates		
1986	"					"						"		
1987	"					"						"		
1988	No estimates for hatchery/wild component				12,743				11,926 ^d			817		
1989	"				37,276				28,933			4,765		
1990	"				5,348				3,188			930		
1991	"				11,417				8,631			446		
1992	1,315	43.2	1,731	56.8	3,046	759	1,540	2,299	430	25	455	126	166	292
1993	1,894	58.4	1,349	41.6	3,243	801	1,176	1,977	875	10	885	218	163	381
1994	1,477	34.8	2,767	65.2	4,244	878	2,410	3,288	403	8	411	196	349	545
1995	1,595	37.2	2,693	62.8	4,288	1,424	1,867	3,291	681	24	705	147	145	292
1996	8,598	82.4	1,837	17.6	10,435	4,127	1,703	5,830	3,964	48	4,012	507	86	593
1997	No estimates for hatchery/wild component				5,212	No estimates			4,267			No estimates		
1998	"				2,972	"			2,463			441		
1999	"				5,470	"			3,817			1,571		
2000	"				8,042	"			7,097			768		
2001	"				12,638	"			9,938			2,333		
2002	14,408	75.6	4,650	24.4	19,058	7,715	4,551	12,266	5,996	42	6,038	697	57	754 ^e
2003	19,245	83.0	3,947	17.0	23,192	8,717	3,837	12,554	10,182	42	10,224	346	68	414 ^e
2004	15,038	75.7	4,817	24.3	19,855	8,937	4,732	13,669	5,688	37	5,725	413	48	461 ^e
2005	14,049	72.4	5,363	27.6	19,412	5,782	5,280	11,062	8,080	63	8,143	187	20	207 ^e
2006	32,609	78.8	8,781	21.2	41,390	20,272	8,660	28,932	11,509	38	11,547	828	83	911 ^e
2007	46,379	86	7,506	14	53,885	31,923	7,405	39,328	11,366	31	11,397	3,090	70	3,160 ^e
2008	9,538	64	5,477	36	15,015	6,680	5,415	12,095	2,471	24	2,495	386	38	424 ^e
2009	13,314	73	5,047	27	18,361	7,704	4,877	12,581	4,234	17	4,251	1,376	154	1,530 ^e
2010	4,640	55	3,811	45	8,451	2,468	3,749	6,217	2,000	37	2,037	172	25	197 ^e
2011	14,969	68	6,932	32	21,901	8,344	6,850	15,194	5,700	50	5,750	925	32	957 ^e
2012	12,253	59	8,359	41	20,612	6,060	8,215	14,275	5,685	52	5,737	507	92	599 ^e
2013	7,389	45	9,205	55	16,594	4,521	9,039	13,560	2,295	80	2,375	573	86	659 ^e
2014	4,460	43	5,822	57	10,282	1,822	5,691	7,513	2,499	62	2,561	139	69	208 ^e
2015	8,713	78	2,454	22	11,167	5,043	2,417	7,460	3,235	37	3,272	436	0	436 ^e
2016	2,568	57	1,972	43	4,540	943	1,927	2,870	1,557	17	1,574	68	28	96 ^e
2017	4,498	66	2,348	34	6,846	2,249	2,295	4,544	1,996	53	2,049	253	0	253 ^e
2018	3,531	60	2,354	40	5,885	1,543	2,289	3,832	1,859	37	1,896	129	28	157 ^e

a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

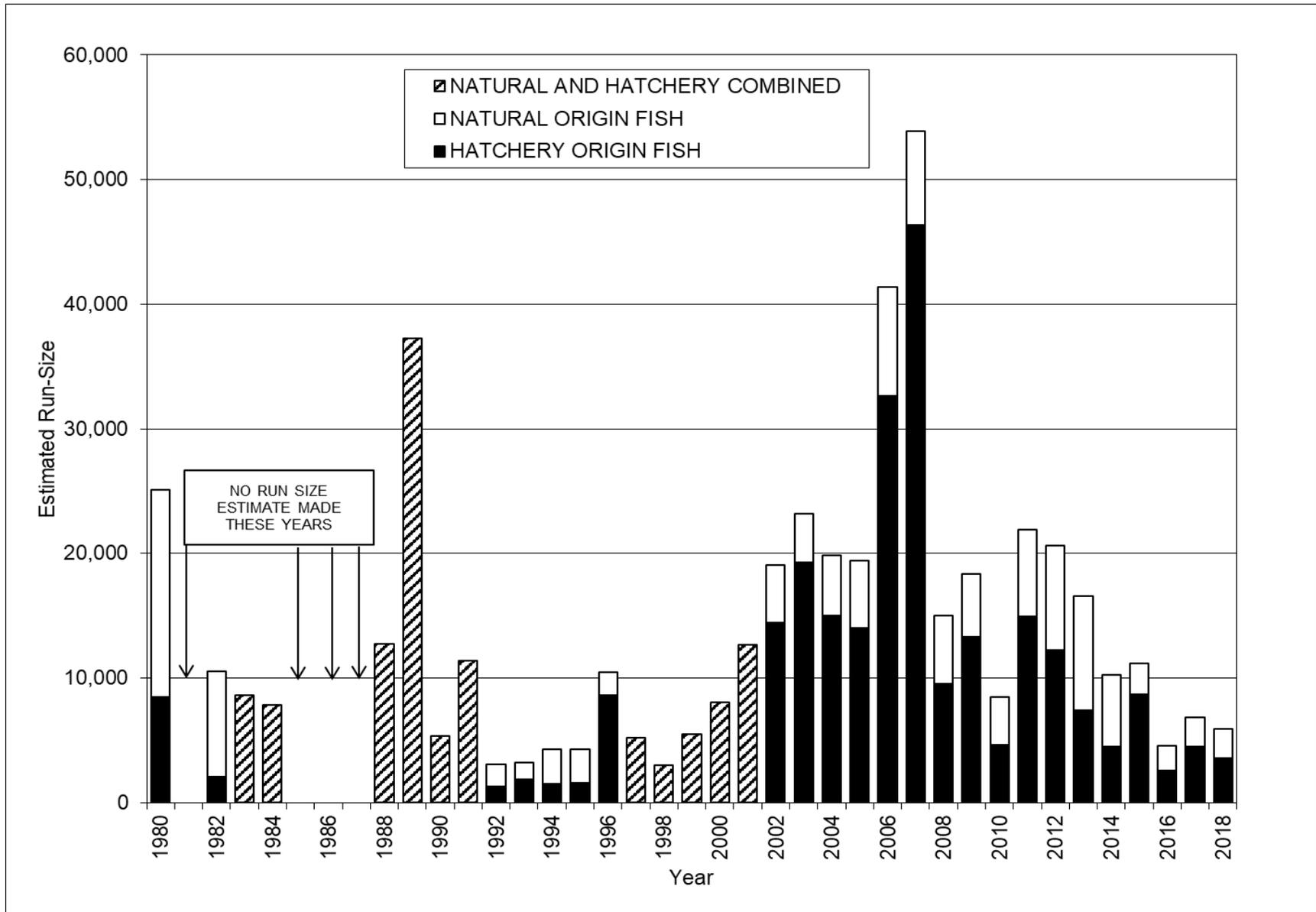
b/ Trinity River Hatchery-produced steelhead.

c/ Naturally produced steelhead.

d/ The natural spawner escapement reflects an overestimate due to the unknown number of fish harvested by anglers upstream of Willow Creek Weir.

e/ Harvest was limited to hatchery-produced fish only. Hatchery fish are those with an adipose fin-clip.

Appendix 15. Fall-run adult steelhead (>41 cm FL) estimated in the Trinity River upstream of Willow Creek weir, 1980 - 2018.



Appendix 16. Fork length (FL) distribution of spring Chinook Salmon trapped and tagged at Junction City weir (JCW), and subsequently recovered during the 2018-19 season.

FL (cm)	JCW ^a		RECOVERIES							Total Recoveries	% Recoveries
	Total Trapped and Tagged ^b	Ad-clips ^c	Tag Morts ^d	Angler Harvest ^e	TRH ^f Recoveries	Carcass ^g Recoveries	Found Tags ^h	Angler Released ⁱ			
37	1								0	0.0	
38									0	--	
39									0	--	
40									0	--	
41	1				1				1	100.0	
42									0	--	
43	1				1				1	100.0	
44	3				1				1	33.3	
45									0	--	
46	4								0	0.0	
47	2				1				1	50.0	
48	7	3			3				3	42.9	
49	3	1						1	2	66.7	
50	3								0	0.0	
51	3				1			1	2	66.7	
52	3	1			1				1	33.3	
53	3	2			1				1	33.3	
54	10	5		1	5			1	7	70.0	
55	14	1		1	3				4	28.6	
56	28	5		1	16			2	20	71.4	
57	33	9		2	14	1		2	19	57.6	
58	30	4		2	17	2			21	70.0	
59	53	11		3	19	2		1	25	47.2	
60	68	13			26	2		1	29	42.6	
61	61	11		2	26	4		1	33	54.1	
62	71	20	1	3	25	4		3	36	50.7	
63	72	9			31	4			35	48.6	
64	77	13		4	24	6			34	44.2	
65	68	11		3	24	3	1	2	33	48.5	
66	63	15		3	21	3			27	42.9	
67	58	6		2	20	2			24	41.4	
68	46	7		3	13	4	1		21	45.7	
69	30	5			9	1			10	33.3	
70	25	3			8	2			10	40.0	
71	42	8		3	16	1		1	21	50.0	
72	17	4		1	1				2	11.8	
73	11	2							0	0.0	
74	11				5				5	45.5	
75	6				2				2	33.3	
76	5	2			3				3	60.0	
77	4	1				1			1	25.0	
78	2								0	0.0	
79	3								0	0.0	
80									0	--	
81	1								0	0.0	
82	2								0	0.0	
83									0	--	
84	1	1							0	0.0	
85									0	--	
86	2								0	0.0	
Totals:	948	173	1	34	338	43	7	12	435	45.9%	
Mean FL:	63.5	63.0	62.0	63.3	62.7	63.8	58.6	60.5	62.8		
Total jacks: ^j	25	4	0	0	7	1	0	1	9	36.0%	
Total adults:	923	169	1	34	331	42	7	11	426	46.2%	

a/ Trapping at JCW took place June 12 - October 2, 2018 (Julian weeks 30-40). Chinook trapped after JW38 in 2018 were considered fall Chinook and excluded from this table.

b/ All Chinook trapped at Junction City weir in 2018 were tagged.

c/ Ad-clip = Adipose fin clipped fish.

d/ Tagged fish found dead and unspawed within 30 days of tagging are considered tagging mortalities.

e/ Fish reported as harvested by angle

f/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).

g/ Fish recovered in upper Trinity River spawner surveys.

h/ Fish tags found loose or on dead fish and returned by anglers or other river enthusiasts.

i/ Fish caught and released by anglers, their tag removed.

j/ Spring Chinook <51 cm FL were considered jacks in 2018.

Appendix 17. Total number (by entry week) and numbers of Junction City weir (JCW) and Willow Creek weir (WCW) tagged Chinook Salmon, Coho Salmon and adult steelhead that entered Trinity River Hatchery (TRH) during the 2018 - 19 season.

Julian week	Inclusive dates ^a	Chinook Salmon					Coho Salmon		Steelhead	
		Total entering TRH	Spring run tagging site JCW	WCW	Fall run tagging site JCW	WCW	Total entering TRH	Tagged at WCW	Total entering TRH	Tagged at WCW
36	3-Sep - 9-Sep	83	28						1	
37	10-Sep - 16-Sep	277	71							
38	17-Sep - 23-Sep	564	85						1	
39	24-Sep - 30-Sep	743	69						1	
40	1-Oct - 7-Oct	1,241	84		1				4	
41	8-Oct - 14-Oct									
42	15-Oct - 21-Oct									
43	22-Oct - 28-Oct	531	1	1	20	93	38	1	22	1
44	29-Oct - 4-Nov	1,044		4	5	117	53	5	8	
45	5-Nov - 11-Nov	1,386				48	93	4	9	
46	12-Nov - 18-Nov	1,584			1	47	53	2	4	1
47	19-Nov - 25-Nov	1,494				68	45	2	1	
48	26-Nov - 2-Dec	811				30	267	16	99	8
49	3-Dec - 9-Dec	319				4	133	3	181	13
50	10-Dec - 16-Dec	106				2	39	1	199	22
51	17-Dec - 23-Dec	15					9		54	5
52	24-Dec - 31-Dec	13					12	1	267	22
1	1-Jan - 7-Jan	7							93	11
2	8-Jan - 14-Jan	1							24	2
3	15-Jan - 21-Jan	1							157	7
4	22-Jan - 28-Jan	1							278	25
5	29-Jan - 4-Feb								271	11
6	5-Feb - 11-Feb								147	12
7	12-Feb - 18-Feb								31	3
8	19-Feb - 25-Feb								15	2
9	26-Feb - 4-Mar								2	
10	5-Mar - 11-Mar								22	1
11	12-Mar - 18-Mar								19	
Totals:		10,221	338	5	27	409	742	35	1,910	146

a/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).

Appendix 18. Recoveries at Trinity River Hatchery (TRH), by Julian week, of TRH-origin coded-wire tagged spring Chinook Salmon during the 2018-19 season.

Coded-wire tag number and release type ^b	Brood year	Number of spring Chinook Salmon entering TRH, by Julian week ^a										Totals	
		36	37	38	39	40	41	42	43	44			
060605-f	2013	1											1
060690-f	2014		3	1		1							5
060691-f	2014		2										2
060696-y	2014		4	5	4	1							14
068772-f	2014			1									1
060772-f	2015	3	27	32	21	12			1				96
060773-f	2015	8	19	16	14	30			1				88
060774-f	2015	3	17	18	15	33					4		90
060779-y	2015	20	44	57	49	49			1				220
060781-f	2015	1	1		3	5							10
060954-f	2016	4	12	19	11	8							54
060955-f	2016			2	2	6							10
060956-f	2016	1		2	4	4			1				12
060961-y	2016	1	1	1	2	7							12
Lost CWT ^c			2	5		1							8
No CWT ^d		2	4	4	7	16							33
Weekly totals:		44	136	163	132	173	0	0	4	4			656

a/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed all of JWs 41-42).

b/ Release types are either fingerling (f) or yearling (y).

c/ CWTs were lost or unreadable (CWT codes 200,00 - 400,000). Chinook with lost or unreadable tags recovered before JW 42 were considered spring run.

d/ No CWTs were recovered from these ad-clipped fish. Chinook with shed tags recovered before JW 42 were considered spring run.

Appendix 19. Recoveries at Trinity River Hatchery (TRH), by Julian week, of TRH-origin coded-wire tagged fall Chinook Salmon during the 2018-19 season.

CWT number and release type ^b	Brood year	Number of fall Chinook Salmon entering TRH, by Julian week ^a											Totals		
		40	43	44	45	46	47	48	49	50	51	52			
060697-y	2014		3	6	1		3	2							15
															0
060775-f	2015		31	48	25	25	14	14	4						161
060776-f	2015		21	46	19	21	24	12	3						146
060777-f	2015		3	10	10	10	13	11	4				1		62
060778-f	2015		3	10	3	9	13	19	3		2				62
060780-y	2015	3	188	268	107	142	179	128	28	15			1		1,059
060782-f	2015		3	3	1	2	2	1							12
060962-y	2016		10	13	5	4	1	2	1						36
Lost CWT ^c			3	6	0	2	1	4							16
No CWT ^d			4	8	2	3	8	7	1	2					35
Weekly totals:		3	269	418	173	218	258	200	44	17	2	2			1,604

a/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed all of JWs 41-42).

b/ Release types are either fingerling (f) or yearling (y).

c/ CWTs were lost or unreadable (CWT code 200,00 - 400,000). Chinook with lost or unreadable tags recovered after JW 40 were considered fall Chinook.

d/ No CWTs were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after Julian week 40 were considered fall Chinook.

Appendix 20. Fork length distribution of coded-wire tagged, Trinity River Hatchery origin spring Chinook Salmon recovered at TRH during the 2018-19 season. ^a

FL (cm)	Brood Year													Total	
	2013	2014				2015				2016					
	060605-f	060690-f	060691-f	060696-y	068772-f	060772-f	060773-f	060774-f	060779-y	060781-f	060954-f	060955-f	060956-f		060961-y
36													1	1	
37														0	
38													1	1	
39												1		1	
40											2	1	1	4	
41											1	1		2	
42											3	1	1	5	
43											2		2	4	
44											8	1	1	13	
45									1		8	3	2	15	
46											6	1	1	9	
47											7	1	1	9	
48									1		8	1	2	12	
49											5	2	1	8	
50									2			1		3	
51											2	1		3	
52						1			2		1			4	
53								1	4		1			6	
54						1	1	1	13					16	
55						2	1	2	7					12	
56						3	3	1	12	1				20	
57						4	3	3	17					27	
58						5	3	3	10					21	
59						4	6		13					23	
60						9	6	2	16	1				34	
61						9	5	7	25	2				48	
62						9	4	6	13	1				33	
63						3	7	5	10					25	
64				3		6	3	5	19	3				39	
65			1	2		8	3	10	16	1				41	
66		1				2	9	9	12	1				34	
67				1		9	6	7	6					29	
68		1				4	5	7	3					20	
69						3	3	4	2					12	
70				1		3	4	2	5					15	
71		1		1		3	4	4	4					17	
72				1			5	3	4					13	
73				1		3	1	5	2					12	
74		1		1			2	1	1					6	
75					1	3	1							5	
76			1	1			1	2						5	
77				2		1	1							4	
78						1								1	
79							1							1	
80		1												1	
81	1													1	
Totals:	1	5	2	14	1	96	88	90	220	10	54	10	12	615	
Mean	81.0	71.8	70.5	69.9	75.0	63.7	64.9	65.2	61.1	62.3	46.0	47.3	44.5	42.6	60.8

a/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).

b/ Age at release: f = fingerlings, y = yearlings.

Appendix 21. Percent return of Trinity River Hatchery origin, coded-wire tagged spring Chinook Salmon, brood years 1986-2013.

Brood year	Fingerlings-f			Yearlings-Y			f+Y Combined		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	197,113	103	0.05%	101,030	1,960	1.94%	298,143	2,063	0.69%
1987	185,718	208	0.11%	0	0	---	185,718	208	0.11%
1988	181,698	84	0.05%	98,820	112	0.11%	280,518	196	0.07%
1989	186,413	7	0.00%	102,555	176	0.17%	288,968	183	0.06%
1990	196,908	479	0.24%	94,639	82	0.09%	291,547	561	0.19%
1991	198,277	297	0.15%	110,797	68	0.06%	309,074	365	0.12%
1992	215,038	2,766	1.29%	109,856	1,272	1.16%	324,894	4,038	1.24%
1993	222,056	1,125	0.51%	111,525	958	0.86%	333,581	2,083	0.62%
1994	113,236	202	0.18%	113,491	513	0.45%	226,727	715	0.32%
1995 ^a	196,211	450	0.23%	101,934	1,581	1.55%	298,145	2,031	0.68%
1996	222,950	743	0.33%	112,464	312	0.28%	335,414	1,055	0.31%
1997	209,155	1,834	0.88%	147,507	4,471	3.03%	356,662	6,305	1.77%
1998	176,968	845	0.48%	137,602	2,186	1.59%	314,570	3,031	0.96%
1999	148,380	3,372	2.27%	129,919	4,288	3.30%	278,299	7,660	2.75%
2000	261,193	4,422	1.69%	99,304	2,029	2.04%	360,497	6,451	1.79%
2001	253,248	412	0.16%	104,627	1,480	1.41%	357,875	1,892	0.53%
2002	244,754	2,217	0.91%	106,139	514	0.48%	350,893	2,731	0.78%
2003	265,556	310	0.12%	104,974	339	0.32%	370,530	649	0.18%
2004	253,830	2,095	0.83%	104,478	1,269	1.21%	358,308	3,364	0.94%
2005	263,108	317	0.12%	107,607	111	0.10%	370,715	428	0.12%
2006	486,833	229	0.05%	104,019	1,354	1.30%	590,852	1,583	0.27%
2007	180,083	252	0.14%	96,803	626	0.65%	276,886	878	0.32%
2008	229,956	1,107	0.48%	104,078	231	0.22%	334,034	1,338	0.40%
2009	161,053	4,364	2.71%	108,824	959	0.88%	269,877	5,323	1.97%
2010	168,702	994	0.59%	97,128	361	0.37%	265,830	1,355	0.51%
2011	167,205	406	0.24%	97,771	292	0.30%	264,976	698	0.26%
2012	260,105	349	0.13%	101,471	192	0.19%	361,576	541	0.15%
2013	258,761	349	0.13%	103,872	75	0.07%	362,633	424	0.12%
Means:	218,018	1,084	0.54%	104,044	993	0.89%	322,062	2,077	0.64%

a/ Based on estimated returns upstream of Junction City weir. No estimate was produced in 1995, therefore returns of age 2 through 5 Chinook from that year are hatchery returns only. Does not include ocean harvest, in-river harvest, and escapement below Junction City weir.

Appendix 22. Brood year release and return data for Trinity River Hatchery (TRH)-origin, CWT spring Chinook Salmon returning to the Trinity River basin upstream of Junction City weir, 2015 - 2018.

Release data					Estimated returns						
CWT a/ code	Brood year	Date b/ Date	Number	Site	Age	Run- size	% of release	Angler harvest	Spawning escapement		
									TRH c/ TRH	Natural	Total ^f
060605	2013	06/01-04/14	80,615	TRH	2	36	0.04	0.0	21	15	36
060605	2013				3	123	0.15	7.2	105	10	115
060605	2013				4	10	0.01	0.1	5	5	10
060605	2013				5	2	0.00	0.1	1	1	2
					Totals: d/	171	0	7	133	30	163
					Total adults: e/	135	0	7	112	16	127
060606	2013	06/01-04/14	69,846	TRH	2	22	0.03	0.0	13	9	22
060606	2013				3	63	0.09	3.7	54	5	59
060606	2013				4	14	0.02	0.1	7	7	14
060606	2013				5	0	0.00	0.0	0	0	0
					Totals:	99	0	4	74	21	95
					Total adults:	77	0	4	61	12	73
060607	2013	06/01-04/14	89,761	TRH	2	14	0.02	0.0	8	6	14
060607	2013				3	46	0.05	2.7	39	4	43
060607	2013				4	16	0.02	0.1	8	7	15
060607	2013				5	0	0.00	0.0	0	0	0
					Totals:	75	0	3	55	17	72
					Total adults:	61	0	3	47	11	58
060612	2013	10/01-22/14	103,872	TRH	2	2	0.00	0.0	1	1	2
060612	2013				3	51	0.05	3.0	44	4	48
060612	2013				4	22	0.02	0.2	11	10	22
060612	2013				5	0	0.00	0.0	0	0	0
					Totals:	75	0.07	3	56	15	72
					Total adults:	73	0.07	3	55	15	70
068848	2013	03/14-6/26/14	10,065	TRH	2	2	0.02	0.0	1	1	2
068848	2013				3	2	0.02	0.1	2	0	2
068848	2013				4	0	0.00	0.0	0	0	0
068848	2013				5	0	0.00	0.0	0	0	0
					Totals:	4	0.04	0	3	1	4
					Total adults:	2	0.02	0	2	0	2
068849	2013	03/14-6/26/14	8,474	RIVER	2	0	0.00	0.0	0	0	0
068849	2013				3	1	0.01	0.1	1	0	1
068849	2013				4	0	0.00	0.0	0	0	0
068849	2013				5	0	0.00	0.0	0	0	0
					Totals:	1	0.01	0	1	0	1
					Total adults:	1	0.01	0	1	0	1
060690	2014	06/01-15/15	85,278	TRH	2	31	0.04	1.0	22	8	30
060690	2014				3	214	0.25	1.7	110	102	212
060690	2014				4	12	0.01	0.4	5	6	11
060691	2014	06/01-15/15	88,724	TRH	2	16	0.02	0.5	11	4	15
060691	2014				3	57	0.06	0.5	29	27	56
060691	2014				4	5	0.01	0.2	2	2	5
060696	2014	10/01-15/15	102,032	TRH	2	7	0.01	0.2	5	2	7
060696	2014				3	81	0.08	0.7	41	38	80
060696	2014				4	33	0.03	1.2	14	17	32
068772	2014	03/11-06/15/15	17,668	RIVER	2	3	0.02	0.1	2	1	3
068772	2014				3	14	0.08	0.1	7	7	14
068772	2014				4	2	0.01	0.1	1	1	2
060772	2015	06/01-15/16	89,636	TRH	2	31	0.03	2.9	18	10	28
060772	2015				3	226	0.25	8.4	98	120	217
060773	2015	06/01-15/16	68,126	TRH	2	16	0.02	1.5	9	5	14
060773	2015				3	206	0.30	7.7	89	109	198
060774	2015	06/01-15/16	89,986	TRH	2	35	0.04	3.2	20	11	31
060774	2015				3	211	0.23	7.9	91	112	203
060779	2015	06/01-15/16	107,160	TRH	2	33	0.03	3.1	19	11	30
060779	2015				3	516	0.48	19.2	223	274	497
060781	2015	03/29-7/11/16	12,943	RIVER	2	5	0.04	0.5	3	2	5
060781	2015				3	23	0.18	0.9	10	12	22
060954	2016	06/16-23/17	87,269	TRH	2	86	0.10	0.0	55	32	86
060955	2016	06/16-23/17	73,142	TRH	2	16	0.02	0.0	10	6	16
060956	2016	06/16-23/17	101,275	TRH	2	19	0.02	0.0	12	7	19
060961	2016	10/21-26/17	105,153	TRH	2	19	0.02	0.0	12	7	19

a/ CWT = coded-wire tag.

b/ Chinook Salmon released during June were fingerlings, those released in October were yearlings.

c/ TRH = Trinity River Hatchery.

d/ Totals are presented only for brood year 2013. These fish have reached five years of age and are considered to have completed their life cycle.

e/ The term "adults" includes Chinook Salmon aged three through five.

f/ Rounding sometimes makes for seeming addition errors in this column.

Appendix 23. Run-size, angler harvest and spawning escapement estimates, and associated expanded estimates, by tag code, of Trinity River Hatchery (TRH) origin spring Chinook Salmon returning to the Trinity River basin during the 2018-19 season.^a

CWT code ^b	BY ^c	Age	TRH expansion factor ^d	TRH Total CWTs ^e	Percent of total CWTs	Run-size	Expanded run-size ^f	Angler harvest	Expanded angler harvest ^f	Spawning escapement					
										TRH	Expanded TRH ^f	River	Expanded River ^{fg}	Total ^h	Expanded Total
Adults															
060605-f	13	5	4.22	1.00	0.19%	2.3	9.74	0.09	0	1.00	4	1.22	5	2.22	9
060690-f	14	4	4.27	5.08	0.95%	11.7	50.01	0.44	2	5.08	22	6.20	26	11.29	48
060691-f	14	4	4.14	2.03	0.38%	4.7	19.37	0.17	1	2.03	8	2.48	10	4.51	19
060696-y	14	4	4.27	14.23	2.67%	32.8	140.23	1.22	5	14.23	61	17.36	74	31.59	135
068772-f	14	4	4.23	1.03	0.19%	2.4	10.06	0.09	0	1.03	4	1.26	5	2.29	10
060772-f	15	3	4.15	97.54	18.27%	224.9	934.30	8.39	35	97.54	405	118.96	494	216.51	899
060773-f	15	3	4.12	89.01	16.67%	205.2	844.75	7.66	32	89.01	366	108.56	447	197.57	813
060774-f	15	3	4.13	91.11	17.06%	210.1	866.73	7.84	32	91.11	376	111.12	458	202.24	834
060779-y	15	3	4.08	222.85	41.74%	513.8	2,097.22	19.16	78	222.85	910	271.79	1109	494.64	2019
060781-f	15	3	4.36	10.05	1.88%	23.2	101.09	0.86	4	10.05	44	12.25	53	22.30	97
Adult totals:				533.94	100.00%	1,231.1	5,073	45.92	189	533.94	2,200	651.21	2,684	1185.15	4,884
Jacks															
060954	16	2	4.24	54.85	61.53%	86.4	358.77	0.00	0	54.85	228	31.51	131	86.36	359
060955	16	2	4.16	10.10	11.33%	15.9	65.47	0.00	0	10.10	42	5.80	24	15.91	65
060956	16	2	4.08	12.10	13.57%	19.1	78.61	0.00	0	12.10	50	6.95	29	19.05	79
060961	16	2	4.36	12.09	13.56%	19.0	77.71	0.00	0	12.09	49	6.95	28	19.04	78
Jack totals:				89.15	100.00%	140	581	0	0	89	369	51	212	140	581
Spring Totals:				623.09		1,371	5,654	46	189	623	2,569	702	2,896	1,326	5,465

a/ Estimate is for upstream of Junction City weir.

b/ CWT=coded-wire tag code. Fish are of the same race and release type (f=fingerling and y=yearling).

c/ BY=brood year.

d/ Expansion factors used to account for untagged releases of the same BY and release type for each CWT group.

e/ Number of ad-clipped fish observed at Trinity River Hatchery, expanded by the number of ad-clipped fish with lost or unreadable tags.

f/ Expanded run-size, angler harvest, TRH escapement and river (natural area) escapement estimates are the product of each of those respective estimates multiplied by the TRH expansion factors.

g/ River (natural area) escapement estimates equal the total escapement minus the TRH escapement.

h/ Run-size estimate minus harvest estimate equals escapement estimate.

Appendix 24. Estimated contribution of Trinity River Hatchery (TRH) origin spring Chinook Salmon to the total estimated run-size upstream of Junction City weir, 1991-2018 seasons.

Year	Run-size	TRH component	Natural component	% TRH composition
1991	2,381	1,016	1,365	42.7%
1992	4,030	1,794	2,236	44.5%
1993	5,232	3,206	2,026	61.3%
1994	6,788	2,659	4,129	39.2%
1995	No estimate	No estimate	No estimate	No estimate
1996	23,416	12,524	10,892	53.5%
1997	20,039	8,303	11,736	41.4%
1998	16,167	8,774	7,393	54.3%
1999	11,293	7,616	3,677	67.4%
2000	26,083	19,730	6,353	75.6%
2001	19,622	12,051	7,571	61.4%
2002	38,485	24,599	13,886	63.9%
2003	47,795	33,546	14,249	70.2%
2004	16,147	11,324	4,823	70.1%
2005	13,984	10,966	3,018	78.4%
2006	7,483	3,649	3,834	48.8%
2007	14,835	12,099	2,736	81.6%
2008	10,283	4,577	5,706	44.5%
2009	7,426	3,973	3,453	53.5%
2010	11,285	4,505	6,780	39.9%
2011	19,219	9,846	9,373	51.2%
2012	25,617	16,306	9,311	63.7%
2013	8,961	6,146	2,815	68.6%
2014	6,959	4,828	2,131	69.4%
2015	4,408	3,085	1,323	70.0%
2016	3,904	2,389	1,515	61.2%
2017	4,425	2,650	1,775	59.9%
2018	8,032	5,654	2,378	70.4%
Mean:	14,233	8,808	5,425	59.5%

Appendix 25. Fork length (FL) distribution of fall Chinook Salmon trapped and tagged at Willow Creek weir (WCW), and subsequently recovered during the 2018-19 season.^a

FL (cm)	WCW			RECOVERIES							
	Total Trapped	Total Tagged ^b	Ad-clips ^c	Tag Morts ^d	Angler Harvest ^e	TRH ^f Recoveries	Carcass ^g Recoveries	Found Tags ^h	Angler Released ⁱ	Total Recoveries	% Recoveries
36	1	1								0	0.0
37	1	1								0	0.0
38	3	3								0	0.0
39	7	7	1		1					1	14.3
40	4	4								0	0.0
41	15	15								0	0.0
42	18	18			1	1				2	11.1
43	29	28	2			1			1	2	7.1
44	25	25							1	1	4.0
45	29	28			1	2			3	6	21.4
46	29	29	1			2			1	3	10.3
47	29	28			1			1	3	5	17.9
48	17	17			1				2	3	17.6
49	28	26	1		1	1			2	4	15.4
50	16	16				1			2	3	18.8
51	14	13				1				1	7.7
52	18	18	2		1	2			1	4	22.2
53	12	12				2		1	1	4	33.3
54	19	17	6		1	2		1		4	23.5
55	25	25	4			10			2	12	48.0
56	30	29	3			10	2		1	13	44.8
57	38	38	11			19	3		1	23	60.5
58	58	57	11		1	17	4		2	24	42.1
59	84	82	13		2	28	1		4	35	42.7
60	106	105	19			38	3	6	6	53	50.5
61	95	92	23		4	32	7	3	4	50	54.3
62	112	110	17		2	36	4	7	5	54	49.1
63	122	121	19		4	35	7	7	2	55	45.5
64	97	96	15		3	30	5	2	2	42	43.8
65	90	89	15		2	23	1	2	4	32	36.0
66	76	76	10		2	23	4	1		30	39.5
67	70	69	16		2	25	3	2	3	35	50.7
68	61	59	5		3	19	3	2	1	28	47.5
69	38	37				11	1	1	2	15	40.5
70	47	47	5		1	11	1	1		14	29.8
71	26	26	4		1	8	1			10	38.5
72	23	23	2	1		8			3	12	52.2
73	17	17				1			1	2	11.8
74	16	16				4	1			5	31.3
75	11	11					1			1	9.1
76	8	8	1			3				3	37.5
77	7	6						1		1	16.7
78	7	7	2							0	0.0
79	5	5				1				1	20.0
80	2	2				1				1	50.0
81	2	2	1			1				1	50.0
82	2	1								0	0.0
83	1	1								0	0.0
84										--	--
85										--	--
86	1	1								0	0.0
87	1	1								0	0.0
Totals:	1,592	1,565	209	1	35	409	52	38	60	595	38.0
Mean FL:	60.5	60.5	62.0	72.0	60.1	62.7	63.1	62.7	58.5	62.2	
Total jacks: ^j	251	246	5	0	6	8	0	1	15	30	12.2
Total adults:	1,341	1,319	204	1	29	401	52	37	45	565	42.8

a/ Trapping at Willow Creek weir took place August 29 - November 11, 2018 (Julian weeks 35-47). All Chinook trapped at WCW in 2018 were considered fall Chinook.

b/ Twenty-seven (5 jack and 22 adult) fall Chinook were not tagged due to poor condition.

c/ Ad-clip = Adipose fin clipped fish.

d/ Tagged fish found dead and unspawned within 30 days of tagging are considered tagging mortalities.

e/ Fish reported as harvested by anglers.

f/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).

g/ Fish recovered in upper Trinity River spawner surveys.

h/ Fish tags found loose or on dead fish and returned by anglers or other river enthusiasts.

i/ Fish caught and released by anglers, their tag removed.

j/ Fall Chinook <51 cm FL were considered jacks in 2018 (for this analysis).

Appendix 26. Fork length distribution of coded-wire tagged, Trinity River Hatchery origin fall Chinook Salmon recovered at TRH during the 2018-19 season.

FL (cm)	Brood Year							TOTALS	
	2014	2015					2016		
	060697-y	060775-f	060776-f	060777-f	060778-f	060780-y	060782-f		060962-y
38								0	
39								0	
40								0	
41								0	
42								0	
43								5	
44								2	
45								9	
46								3	
47								5	
48						1		5	
49						1		2	
50						3		3	
51								0	
52						2		1	
53		2	1			4		1	
54						12		12	
55		4	1		1	19		25	
56		3	2	1		32		38	
57		7	4	2	5	54		72	
58		6	7		5	62	2	82	
59		6	12	5	2	54	1	80	
60		10	10	4	4	86	1	115	
61		14	15	3	5	106		143	
62	1	16	7	9	1	98	1	133	
63	1	17	14	6	4	87	2	131	
64	1	16	14	4	4	91	1	131	
65		8	16	1	8	71		104	
66		14	6	5	4	52		81	
67	1	8	8	2	6	63	2	90	
68		6	7	4	5	51	1	74	
69		5	7	4	3	21		40	
70	2	8	5		2	30		47	
71	2	4	3	2	1	20		32	
72		3		1		9		13	
73	2		2	5	1	9		19	
74			2	1		6		9	
75		2	2		1	5		10	
76				1		4		5	
77	1					1		2	
78		1	1			2	1	5	
79						1		1	
80	2			1		1		4	
81		1		1				2	
82	1					1		2	
83								0	
84								0	
85	1							1	
86								0	
87								0	
88								0	
89								0	
90								0	
Totals:	15	161	146	62	62	1,059	12	36	1,517
Mean	72.5	63.6	63.7	65.3	63.8	62.8	63.9	46.5	

a/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).
b/ Age at release: f = fingerlings, y = yearlings.

Appendix 27. Percent return of Trinity River Hatchery origin, coded -wire tagged fall Chinook Salmon, brood years 1986-2013.

Brood year	Fingerlings -f			Yearlings-Y			f + Y combined		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	393,955	292	0.07%	153,700	4,899	3.19%	547,655	5,191	0.95%
1987	172,980	129	0.07%	92,300	418	0.45%	265,280	547	0.21%
1988	194,197	138	0.07%	143,934	796	0.55%	338,131	934	0.28%
1989	201,622	21	0.01%	143,978	174	0.12%	345,600	195	0.06%
1990	0	0	---	103,040	166	0.16%	103,040	166	0.16%
1991	206,416	937	0.45%	115,300	517	0.45%	321,716	1,454	0.45%
1992	192,032	2,503	1.30%	108,894	5,369	4.93%	300,926	7,872	2.62%
1993	201,032	158	0.08%	110,336	798	0.72%	311,368	956	0.31%
1994	216,563	374	0.17%	113,124	756	0.67%	329,687	1,130	0.34%
1995	216,051	285	0.13%	110,327	3,106	2.82%	326,378	3,391	1.04%
1996	217,981	445	0.20%	112,746	394	0.35%	330,727	839	0.25%
1997	216,772	1,707	0.79%	313,080	11,396	3.64%	529,852	13,103	2.47%
1998	184,781	292	0.16%	334,726	7,173	2.14%	519,507	7,465	1.44%
1999	181,301	693	0.38%	296,892	5,833	1.96%	478,193	6,526	1.36%
2000	522,316	3,909	0.75%	216,593	5,245	2.42%	738,909	9,154	1.24%
2001	499,919	476	0.10%	230,055	5,894	2.56%	729,974	6,370	0.87%
2002	508,963	3,563	0.70%	236,319	3,561	1.51%	745,282	7,124	0.96%
2003	534,219	289	0.05%	225,798	944	0.42%	760,017	1,233	0.16%
2004	486,369	4,125	0.85%	218,386	3,909	1.79%	704,755	8,034	1.14%
2005	488,466	157	0.03%	227,903	675	0.30%	716,369	832	0.12%
2006	486,833	849	0.17%	238,156	3,240	1.36%	724,989	4,089	0.56%
2007	446,316	324	0.07%	244,661	2,330	0.95%	690,977	2,654	0.38%
2008	518,269	3,576	0.69%	259,330	4,211	1.62%	777,599	7,787	1.00%
2009	496,761	2,988	0.60%	230,461	7,361	3.19%	727,222	10,349	1.42%
2010	475,062	856	0.18%	231,430	2,221	0.96%	706,492	3,077	0.44%
2011	406,418	461	0.11%	200,337	2,489	1.24%	606,755	2,950	0.49%
2012	393,038	84	0.02%	221,247	714	0.32%	614,285	798	0.13%
2013	526,760	136	0.03%	239,886	280	0.12%	766,646	416	0.05%
Means:	342,335	1,063	0.31%	195,462	3,031	1.46%	537,798	4,094	0.75%

a/ Based on estimated returns upstream of Willow Creek weir. Does not include ocean harvest, in-river harvest, and escapement below Willow Creek weir.

Appendix 28. Run-size, percent return, in-river sport harvest, and spawner escapement estimates for Trinity River Hatchery (TRH)-origin, CWT fall Chinook Salmon returning to the Trinity River basin upstream of Willow Creek weir during the period 2015-2018.

Release data					Estimated returns						
CWT ^a	Brood					Run-	% of	River	Spawning escapement		
code	year	Date ^b	Number	Site	Age	size	release	harvest	TRH ^c	Natural	Total ^g
060608	2013	06/01-04/14	128,061	TRH	2	26	0.02	0.2	9	17	26
060608	2013				3	21	0.02	0.2	14	7	21
060608	2013				4	4	0.00	0.0	3	0	4
060608	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	51	0.04	0.4	26	24	50
					Total adults: ^e	25	0.02	0.2	17	7	24
060609	2013	06/01-04/14	124,107	TRH	2	17	0.01	0.1	6	11	17
060609	2013				3	20	0.02	0.2	13	6	19
060609	2013				4	4	0.00	0.0	3	0	4
060609	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	41	0.03	0.3	22	18	40
					Total adults: ^e	23	0.02	0.2	16	7	23
060610	2013	06/01-04/14	127,893	TRH	2	9	0.01	0.1	3	6	9
060610	2013				3	6	0.00	0.1	4	2	6
060610	2013				4	4	0.00	0.0	3	0	4
060610	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	18	0.01	0.1	10	8	18
					Total adults: ^e	10	0.01	0.1	7	2	10
060611	2013	06/01-04/14	128,022	TRH	2	9	0.01	0.1	3	6	9
060611	2013				3	9	0.01	0.1	6	3	9
060611	2013				4	2	0.00	0.0	2	0	2
060611	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	20	0.02	0.2	11	9	20
					Total adults: ^e	11	0.01	0.1	8	3	11
060613	2013	10/01-22/14	239,886	TRH	2	64	0.03	0.5	22	41	63
060613	2013				3	160	0.07	1.4	107	52	158
060613	2013				4	56	0.02	0.0	48	8	56
060613	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	280	0.12	1.9	177	100	278
					Total adults: ^e	216	0.09	1.4	155	59	214
060614	2013	06/01-04/14	9,305	TRH	2	0	0.00	0.0	0	0	0
060614	2013				3	2	0.02	0.0	1	0	2
060614	2013				4	0	0.00	0.0	0	0	0
060614	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	2	0.02	0.0	1	0	2
					Total adults: ^e	2	0.02	0.0	1	0	2
068850 ^f	2013	5/16-8/28/14	9,372	River	2	3	0.03	0.0	1	2	3
068850 ^f	2013				3	2	0.02	0.0	1	0	1
068850 ^f	2013				4	0	0.00	0.0	0	0	0
068850 ^f	2013				5	0	0.00	0.0	0	0	0
					Totals: ^d	4	0.05	0.0	2	2	4
					Total adults: ^e	2	0.02	0.0	1	0	1
060697	2014	10/01-15/15	236,204	TRH	2	20	0.01	0.0	11	9	20
060697					3	733	0.31	0.0	532	201	733
060697					4	35	0.01	1.2	15	18	34
060775	2015	06/01-15/16	116,945	TRH	2	102	0.09	0.0	60	42	102
060775					3	372	0.32	12.7	163	197	360
060776	2015	06/01-15/16	115,416	TRH	2	116	0.10	0.0	68	48	116
060776					3	338	0.29	11.5	148	179	326
060777	2015	06/01-15/16	111,222	TRH	2	62	0.06	0.0	36	26	62
060777					3	143	0.13	4.9	63	76	138
060778	2015	06/01-15/16	111,020	TRH	2	41	0.04	0.0	24	17	41
060778					3	144	0.13	4.9	63	76	139
060780	2015	10/01-15/16	239,139	TRH	2	7	0.00	0.0	4	3	7
060780					3	2,447	1.02	83.2	1,069	1,295	2,364
060782 ^f	2015	06/19-8/30/16	6,444	River	2	337	5.22	0.0	197	140	337
060782 ^f					3	28	0.43	0.9	12	15	27
060962	2016	10/21-26/2017	247,474	TRH	2	91	0.04	4.1	36	51	87

a/ CWT = coded-wire tag.

b/ Chinook Salmon released during June were smolts, those released in October were yearlings.

c/ TRH = Trinity River Hatchery.

d/ Totals are presented only for brood year 2013. These fish have reached five years of age and are considered to have completed their life cycle.

e/ The term "adults" includes Chinook aged three through five.

f/ Experimental release group. Fish used in screw trap efficiency studies; released near North Fork Trinity River or Willow Creek.

g/ Rounding sometimes makes for seeming addition errors in this column.

Appendix 29. Run-size, angler harvest and spawning escapement estimates, and associated expanded estimates, by tag code, of Trinity River Hatchery (TRH) origin fall Chinook Salmon returning to the Trinity River during the 2018-19 season.^a

CWT code ^b	BY ^c	Age	TRH expansion factor ^d	TRH Total CWTs ^e	Percent of total CWTs	Run-size	Expanded run-size ^f	Angler harvest	Expanded angler harvest ^f	Spawning escapement						
										TRH	Expanded TRH ^f	River	Expanded River ^{fg}	Escapement Total ^h	Expanded Total	
Adults																
060697-y	14	4	4.18	15.18	0.99%	33.0	137.9	1.1	4.7	15.2	63.4	16.7	69.8	31.9	133.2	
060775-f	15	3	4.10	162.64	10.62%	353.7	1,451.6	12.0	49.4	162.6	667.5	179.0	734.8	341.7	1,402.2	
060776-f	15	3	4.09	147.46	9.63%	320.7	1,310.7	10.9	44.6	147.5	602.7	162.3	663.5	309.8	1,266.2	
060777-f	15	3	4.12	62.56	4.08%	136.1	560.9	4.6	19.1	62.6	257.9	68.9	283.9	131.4	541.9	
060778-f	15	3	4.13	62.72	4.10%	136.4	563.4	4.6	19.2	62.7	259.1	69.0	285.2	131.8	544.2	
060780-y	15	3	4.14	1068.84	69.79%	2,324.5	9,613.9	79.0	326.9	1,068.8	4,420.7	1,176.6	4,866.3	2,245.4	9,287.1	
060782-f	15	3	4.28	12.13	0.79%	26.4	112.9	0.9	3.8	12.1	51.9	13.3	57.2	25.5	109.1	
Adult totals:				1531.53	100.00%	3,330.7	13,751.5	113.2	467.5	1,531.5	6,323.3	1,685.9	6,960.7	3,217.4	13,283.9	
Jacks																
060962	16	2	4.15	36.39	100.00%	86.5	359.3	3.9	16.2	36.4	151.2	46.2	191.9	82.6	343.1	
Jack totals:				36.39	100.00%	86.5	359.3	3.9	16.2	36.4	151.2	46.2	191.9	82.6	343.1	
Fall Chinook CWT Totals:				1567.92		3,417.2	14,110.7	117.1	483.7	1,567.9	6,474.4	1,732.1	7,152.6	3,300.0	13,627.0	

a/ Estimate is for upstream of Willow Creek weir (WCW).

b/ CWT=coded-wire tag code. Fish are of the same race and release type (f=fingerling and y=yearling).

c/ BY=brood year.

d/ Expansion factors used to account for untagged releases of the same BY and release type for each CWT group.

e/ Number of ad-clipped fish observed at Trinity River Hatchery, expanded by the number of ad-clipped fish with lost or unreadable tags.

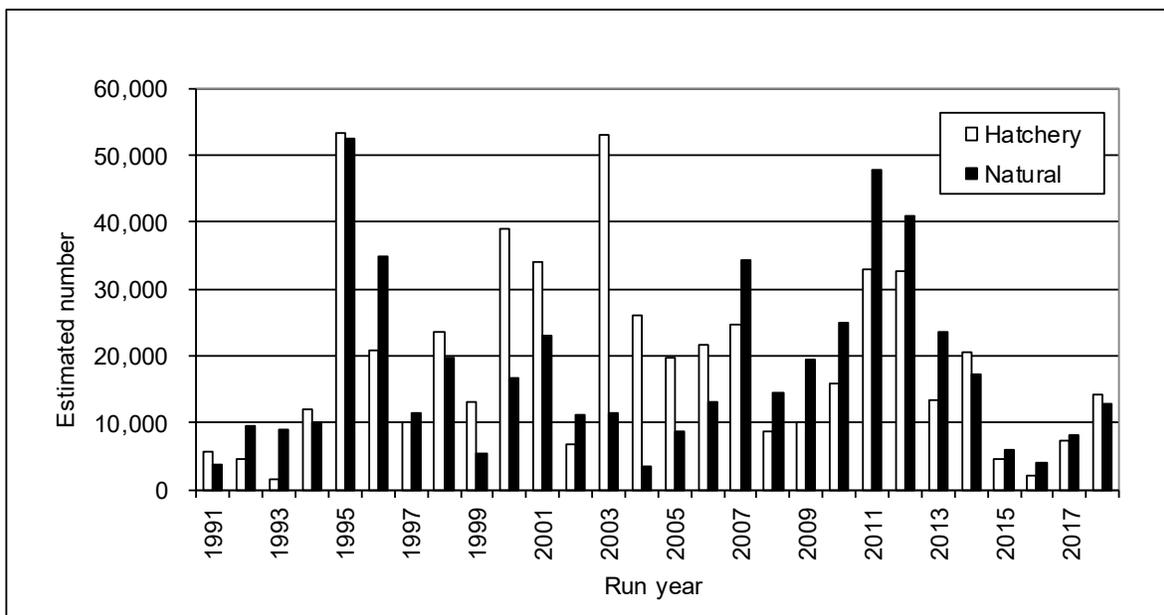
f/ Expanded run-size, angler harvest, TRH escapement and river (natural area) escapement estimates are the product of each of those respective estimates multiplied by the TRH expansion factors.

g/ River (natural area) escapement estimates equal the total escapement minus the TRH escapement.

h/ Run-size estimate minus harvest estimate equals escapement estimate.

Appendix 30. Estimated contribution of Trinity River Hatchery (TRH) origin fall Chinook Salmon to the total estimated run-size upstream of Willow Creek weir, 1991-2018 seasons.

Year	Run-size	TRH component	Natural component	% TRH composition
1991	9,207	5,597	3,610	60.8%
1992	14,164	4,651	9,513	32.8%
1993	10,485	1,499	8,986	14.3%
1994	21,924	11,880	10,044	54.2%
1995	105,725	53,263	52,462	50.4%
1996	55,646	20,824	34,822	37.4%
1997	21,347	9,977	11,370	46.7%
1998	43,189	23,536	19,653	54.5%
1999	18,516	13,081	5,435	70.6%
2000	55,473	38,881	16,592	70.1%
2001	57,109	33,984	23,125	59.5%
2002	18,156	6,884	11,272	37.9%
2003	64,362	52,944	11,418	82.3%
2004	29,534	25,956	3,578	87.9%
2005	28,231	19,674	8,557	69.7%
2006	34,912	21,768	13,144	62.4%
2007	58,873	24,633	34,240	41.8%
2008	22,997	8,585	14,412	37.3%
2009	29,593	10,072	19,521	34.0%
2010	40,792	15,853	24,939	38.9%
2011	80,818	32,875	47,943	40.7%
2012	73,666	32,735	40,931	44.4%
2013	36,989	13,371	23,618	36.1%
2014	37,829	20,463	17,366	54.1%
2015	10,365	4,531	5,834	43.7%
2016	6,196	2,188	4,008	35.3%
2017	15,450	7,393	8,057	47.9%
2018	26,848	14,111	12,737	52.6%
Mean:	36,728	18,972	17,757	49.9%



Appendix 31. Fork length (FL) distribution of Coho Salmon trapped and tagged at Willow Creek weir and subsequently recovered during the 2018-19 season.

FL (cm)	Willow Creek Weir			RECOVERIES							Total Recovered	% Recovered
	Total Trapped	Total Tagged ^b	RM-clips ^c	Tag Morts ^d	Angler Harvest ^e	TRH ^f Recoveries	Carcass ^g Recoveries	Found Tags ^h	Angler Released ⁱ			
35	3	3	2			1				1	33.3	
36	2	2	2			2				2	100.0	
37	9	9	9			3			1	4	44.4	
38	6	6	6			1			1	2	33.3	
39	13	13	13			7				7	53.8	
40	7	7	7			4				4	57.1	
41	4	4	3			1				1	25.0	
42	2	2	2			1				1	50.0	
43										0	--	
44	2	2	2							0	0.0	
45										0	--	
46										0	--	
47										0	--	
48										0	--	
49										0	--	
50										0	--	
51										0	--	
52	1	1	1			1				1	100.0	
53										0	--	
54	1	1	1			1				1	100.0	
55										0	--	
56										0	--	
57										0	--	
58	1	1	1					1		1	100.0	
59	4	4	3			3				3	75.0	
60	1	1	1							0	0.0	
61	5	5	5			3				3	60.0	
62	1	1	1			1				1	100.0	
63	1	1	1			1				1	100.0	
64	6	6	6			3				3	50.0	
65	1	1	1							0	0.0	
66	2	2	2			1				1	50.0	
67										0	--	
68	1	1	1			1				1	100.0	
Totals:	73	73	70	0	0	35	0	1	2	38	52.1	
Mean FL:	46.6	46.6	46.6	--	--	48.3	--	--	--	47.9		
Total jacks: ^j	48	48	46	0	0	20	0	0	2	22	45.8	
Total adults:	25	25	24	0	0	15	0	1	0	16	64.0	

a/ Trapping at Willow Creek weir took place August 29 - November 19, 2018 (Julian weeks 35-47).

b/ No trapped Coho went untagged in 2018 due to poor condition.

c/ RM-clips = Right maxillary clipped fish of Trinity River Hatchery origin.

d/ There were no tagged fish found dead and unspawned within 30 days of tagging (considered tagging mortalities) in 2018.

e/ Fish reported as harvested by anglers. There were zero reported as harvested by anglers in 2018.

f/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).

g/ There were no WCW tagged Coho recovered in upper Trinity River spawner surveys.

h/ There was one tag found loose or on dead fish and returned by anglers or other river enthusiasts in 2018.

i/ There were two Coho reported as caught and released by anglers, their tag removed, in 2018.

j/ Coho <49 cm FL were considered jacks in 2018.

Appendix 32. Juvenile Coho Salmon Marking at Trinity River Hatchery, 2019.

In order to distinguish natural origin (NOR) from hatchery-origin (HOR) Coho Salmon in the Trinity River, CA Department of Fish and Wildlife crew excised the right maxillaries (RM) of the Trinity River Hatchery (TRH) BY 2017 yearling Coho Salmon from February 15 – March 18, 2019. Marking of TRH Coho Salmon has been performed since 1994.

Approximately 2% (3,041) of the BY 2017 fish were sampled for RM clip quality and FL prior to the start of their volitional release in April 2019. We estimate 149,659 of the 149,807 yearling Coho released from TRH were effectively marked with a RM clip (Table CA1). Based on the quality control sampling, an estimated 99.90% of the BY 2017 production was effectively RM clipped. Although there was a court-mandated decrease in production from the approximately 500,000 to no more than 300,000 beginning with the 2013 BY, the release number of BY 2017 Coho was particularly small due to a lack of eggs.

Table CA1. Production, marking totals, and quality control data for BY 2017 TRH Coho Salmon volitionally released in April 2019.

Raceway	Net marked	QC # checked	Estimated % unmarked	Effectively marked ^a	Estimated unmarked releases	Marked releases	Total released
O3-O4	73,023	1,501	0.07	73,024	48	72,976	73,024
O1-O2	76,697	1,540	0.13	76,699	100	76,683	76,783
Total	149,720	3,041	0.20	149,723	148	149,659	149,807

a/ Effectively marked = Net marked + QC re-clipped

Coho Salmon Returns

Coho Salmon of the Trinity River typically have a three-year life-cycle with juveniles rearing in freshwater during their first year, then migrating to the ocean. After approximately one year at sea, some return to the river as two-year-old jacks (mostly males) and a year later as three-year-old adults (Table). Coho adults (age 3) returning to the Trinity River in 2018 were of BY 2015 brood stock, Coho Salmon jacks (age 2) returning during 2018 were of BY 2016 brood stock.

Table CA2. Release and recovery data for right maxillary-clipped Coho Salmon recovered at Trinity River Hatchery (TRH) during the 2018-19 season.

Release data						TRH Recovery data					Number recovered	
Mark	source	Egg year	Brood Date	Number	Site	Males		Females		Total No.	Tagging site	
						No.	FL ^a	No.	FL ^a		WCW	JCW
RM ^b	TRH	2015	3/16-24/17	248,102	TRH	308	63.5	207	62.0	515	15	--
RM ^b	TRH	2016	3/15-25/18	258,243	TRH	185	38.6	0	--	185	20	--
Total Coho:						493		207		700	35	--

a/ FL = Mean fork length in cm.

b/ Since 1996, all Coho Salmon produced at TRH have received a right maxillary clip (RM). Coho Salmon <49 cm FL were classified as brood year 2016 and Coho Salmon >48 cm FL were classified as brood year 2015. Age cutoff based on fork length distribution.

Total percent return for RM-clipped TRH-origin Coho from BY 2015 was 0.51%. Since 1994 the BY total return rate has ranged from 0.17 to 6.60 %. (Figure CA1, Table CA3).

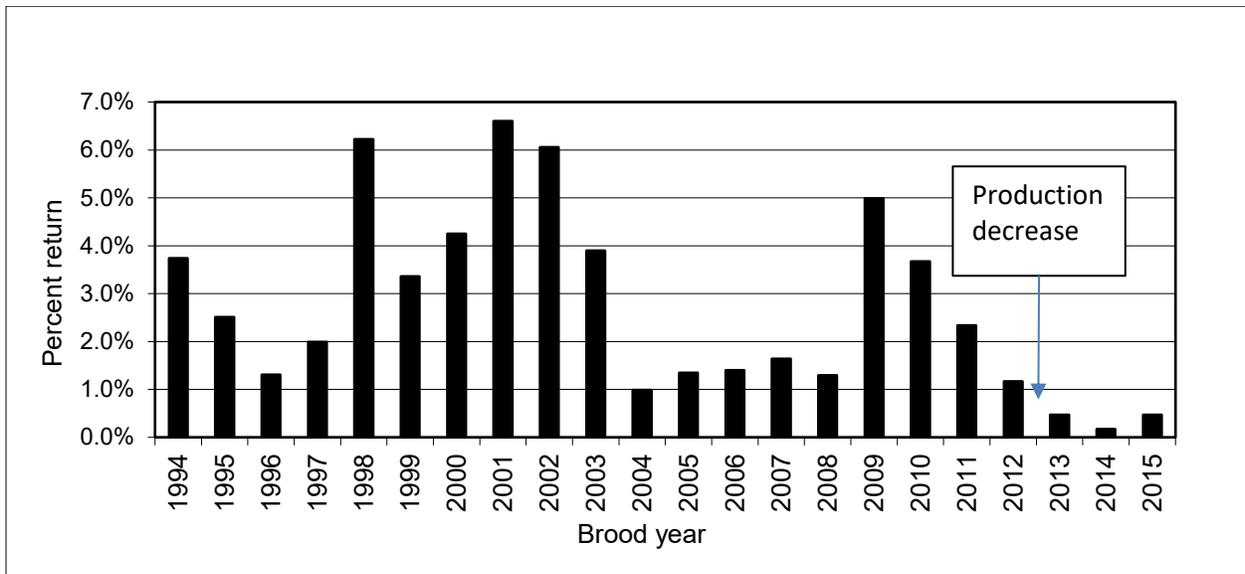


Figure CA1. Percent return of Trinity River Hatchery origin Coho Salmon to Trinity River Hatchery, 1994 – 2018.

The 2018 estimated escapement of Coho Salmon to the Trinity River (upstream of Willow Creek weir) was an estimated 1,486 fish. This consisted of 427 jacks (18 NOR, 409 HOR) and 1,059 adults (42 NOR and 1,017 HOR) for a total of 95.9% HOR fish.

Table CA3. Run-size, harvest and spawner escapement estimates for right maxillary clipped, Trinity River Hatchery-produced Coho Salmon returning to the Trinity River upstream of Willow Creek weir, brood years, 1994 – 2015.

Release data				Return data						
Brood year	Date	Effective Number	Site	Age	Run-size	% of release	In-river harvest	Spawner Escapement		
								TRH	Natural	Total
1994	3/17-21/96	72,311	TRH	2	970	1.34%	0	105	865	970
				3	1,732	2.40%	0	867	865	1,732
				Totals:	2,702	3.74%	0	972	1,730	2,702
1995	3/17-21/97	580,880	TRH	2	5,552	0.96%	39	858	4,655	5,513
				3	9,008	1.55%	0	3,899	5,109	9,008
				Totals:	14,560	2.51%	39	4,757	9,764	14,521
1996	3/16-20/98	513,663	TRH	2	2,340	0.46%	0	969	1,371	2,340
				3	4,357	0.85%	86	3,015	1,256	4,271
				Totals:	6,697	1.30%	86	3,984	2,627	6,611
1997	3/15-22/99	517,196	TRH	2	592	0.11%	0	381	211	592
				3	9,704	1.88%	0	3,407	6,297	9,704
				Totals:	10,296	1.99%	0	3,788	6,508	10,296
1998	3/15-20/00	493,233	TRH	2	5,289	1.07%	0	916	4,373	5,289
				3	25,395	5.15%	0	9,625	15,770	25,395
				Totals:	30,684	6.22%	0	10,541	20,143	30,684
1999	3/15-22/01	512,986	TRH	2	3,373	0.66%	0	1,024	2,349	3,373
				3	13,849	2.70%	0	6,409	7,440	13,849
				Totals:	17,222	3.36%	0	7,433	9,789	17,222
2000	3/17-19/02	524,238	TRH	2	1,571	0.30%	0	688	883	1,571
				3	20,721	3.95%	0	9,730	10,991	20,721
				Totals:	22,292	4.25%	0	10,418	11,874	22,292
2001	3/17-19/03	416,201	TRH	2	3,338	0.80%	0	1,449	1,889	3,338
				3	24,162	5.81%	40	8,835	15,287	24,122
				Totals:	27,500	6.60%	40	10,284	17,176	27,460

Table CA3 (continued). Run-size, harvest and spawner escapement estimates for right maxillary clipped, Trinity River Hatchery-produced Coho Salmon returning to the Trinity River upstream of Willow Creek weir, brood years, 1994 – 2015.

Release Data				Return data						
Brood year	Date	Effective Number	Site	Age	Run-size	% of release				
2002	3/15-18/04	516,906	TRH	2	5,665	1.10%	0	1,068	4,597	5,665
				3	25,678	4.97%	0	15,704	9,974	25,678
				Totals:	31,343	6.06%	0	16,772	14,571	31,343
2003	3/14-18/05	520,847	TRH	2	3,012	0.58%	21	1,269	1,721	2,990
				3	17,123	3.29%	0	7,454	9,669	17,123
				Totals:	20,135	3.90%	21	8,723	11,390	20,113
2004	3/15-20/06	545,199	TRH	2	1,331	0.24%	0	657	674	1,331
				3	4,048	0.74%	0	2,436	1,612	4,048
				Totals:	5,379	0.99%	0	3,093	2,286	5,379
2005	3/15-20/07	511,961	TRH	2	503	0.10%	0	270	233	503
				3	6,381	1.25%	0	4,177	2,204	6381
				Totals:	6,884	1.34%	0	4,447	2,437	6,884
2006	3/15-20/08	455,482	TRH	2	2,290	0.50%	0	643	1,647	2,290
				3	4,067	0.89%	0	2,386	1,681	4,067
				Totals:	6,357	1.40%	0	3,029	3,328	6,357
2007	3/16-20/09	457,478	TRH	2	1,645	0.36%	0	871	774	1,645
				3	5,852	1.28%	0	3,706	2,146	5,852
				Totals:	7,497	1.64%	0	4,577	2,920	7,497
2008	4/6-8/10	413,178	TRH	2	1,233	0.30%	0	516	707	1,233
				3	4,113	1.00%	0	1,710	2,403	4,113
				Totals:	5,346	1.29%	0	2,226	3,110	5,336
2009	3/15-28/11	490,998	TRH	2	10,982	2.24%	0	2,862	8,120	10,982
				3	13,494	2.75%	0	7,159	6,335	13,494
				Totals:	24,476	4.98%	0	10,021	14,455	24,476

Table CA3 (continued). Run-size, harvest and spawner escapement estimates for right maxillary clipped, Trinity River Hatchery-produced Coho Salmon returning to the Trinity River upstream of Willow Creek weir, brood years, 1994 – 2015.

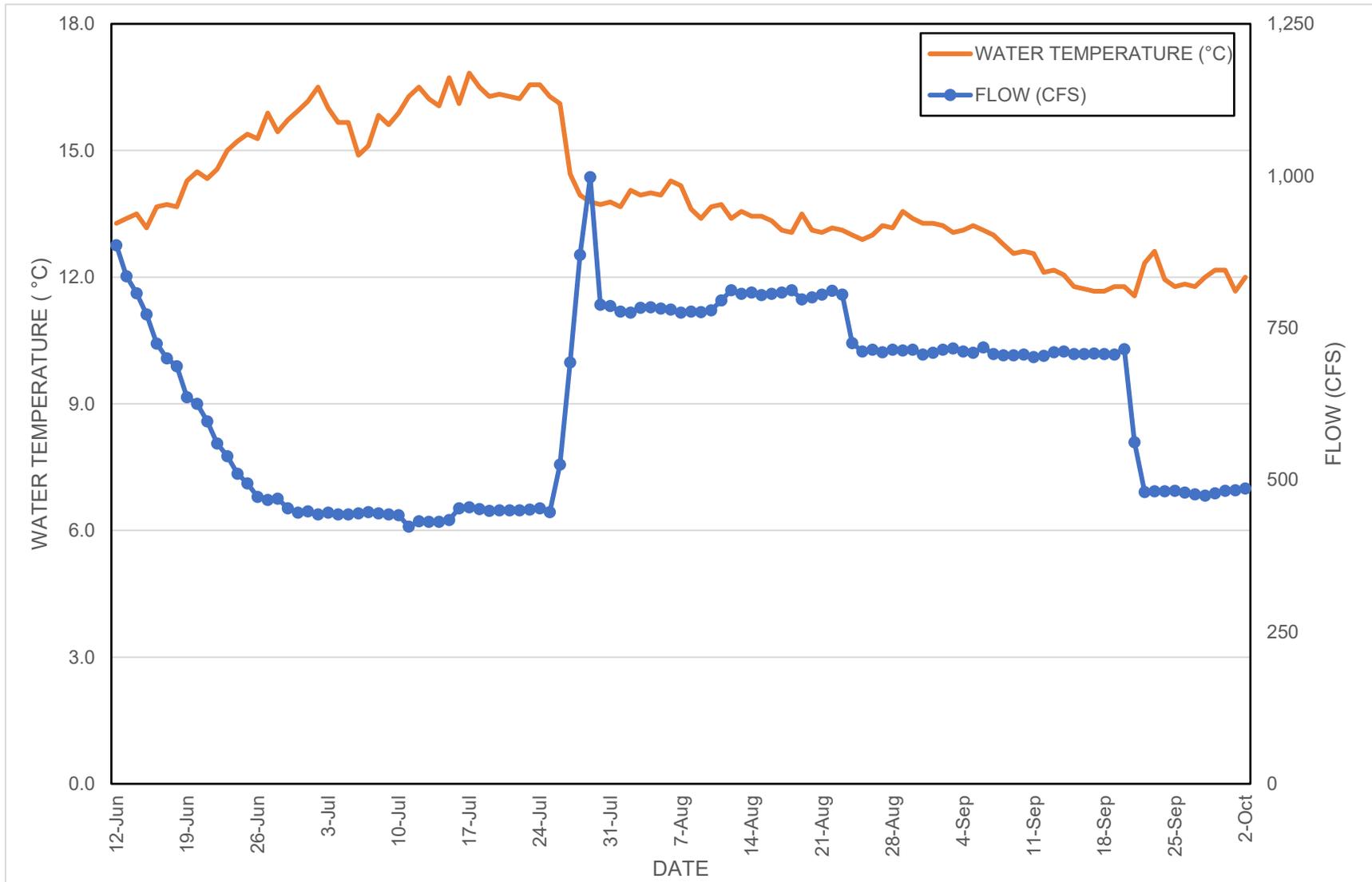
Release Data				Return data						
Brood year	Date	Effective Number	Site	Age	Run-size	% of release	In-river harvest	Spawner Escapement		
								TRH	Natural	Total
2010	3/15-26/12	489,429	TRH	2	3,198	0.65%	0	871	2,327	3,198
				3	14,782	3.02%	0	5,847	8,935	14,782
				Totals	17,980	3.67%	0	6,718	11,262	17,980
2011	3/15-20/13	511,618	TRH	2	2,667	0.52%	0	424	2,243	2,667
				3	9,297	1.82%	0	2,892	6,405	9,297
				Totals	11,964	2.34%	0	3,316	8,648	11,964
2012	3/15-18/14	528,016	TRH	2	3,239	0.61%	0	932	2,307	3,239
				3	2,936	0.56%	0	2,770	166	2,936
				Totals	6,175	1.17%	0	3,702	2,473	6,175
2013	3/15-23/15	287,720	TRH	2	870	0.30%	0	270	600	870
				3	482	0.17%	0	408	74	482
				Totals	1,352	0.47%	0	678	674	1,352
2014	3/15-21/16	230,821	TRH	2	45	0.02%	0	45	0	45
				3	354	0.15%	0	247	107	354
				Totals	399	0.17%	0	292	107	399
2015	03/16-24/17	248,102	TRH	2	236	0.10%	0	149	87	236
				3	515	0.21%	0	515	502	1,017
				Totals	751	0.30%	0	664	589	1,253

Appendix 33. Fork length (FL) distribution of fall steelhead trapped and tagged at Willow Creek weir and subsequently recovered during the 2018-19 season.

FL (cm)	WCW			RECOVERIES							
	Total Trapped	Total Tagged ^b	Ad-clips ^c	Tag Morts ^d	Angler Harvest ^e	TRH ^f Recoveries	Carcass ^g Recoveries	Found Tags ^h	Angler Released ⁱ	Total Recoveries	% Recoveries
30	1		1							0	--
31										--	--
32	2									0	--
33	3		2							0	--
34	5		2							0	--
35	5		2							0	--
36	2		1							0	--
37	1									0	--
38										--	--
39										--	--
40	2									0	--
41	1									0	--
42	2	2	1							0	0.0
43	4	4	2							0	0.0
44	3	3								0	0.0
45	4	4								0	0.0
46	5	5	1						1	1	20.0
47	11	11	1			1			1	3	27.3
48	13	12	6			2			1	3	25.0
49	2	2	1							0	--
50	28	28	17			7			4	11	39.3
51	34	34	21			6			5	11	32.4
52	38	38	21			10			9	19	50.0
53	38	38	27		1	9		1	6	17	44.7
54	31	31	22		4	12		1	2	19	61.3
55	35	35	25		2	11			3	16	45.7
56	42	42	30		2	17			3	22	52.4
57	36	36	25			8			7	15	41.7
58	36	36	20		1	11			1	13	36.1
59	25	25	16			10			3	13	52.0
60	30	30	16		1	14		2	2	19	63.3
61	22	22	10			7		1	1	9	40.9
62	14	14	7			4		5	1	10	71.4
63	9	9	5			1		4	1	6	66.7
64	5	5	3			2				2	40.0
65	6	6	2			2			1	3	50.0
66	3	3	1			1				1	33.3
67	7	7	4			2				2	28.6
68	5	5	4							0	0.0
69	2	2	1					1		1	50.0
70	8	8	7			4			1	5	62.5
71	4	4	3			1			1	2	50.0
72	3	3	2			2				2	66.7
73	3	3	3							0	--
74										--	--
75	1	1	1			1				1	100.0
76	1	1	1			1				1	100.0
Totals:	532	509	314	0	11	146	0	16	54	227	44.6
Mean FL:	55.2	56.1	56.0	--	55.4	57.3	--	60.4	55.0	56.9	
Total 1/2lb ^{ers}	22	0	8	0	0	0	0	0	0	0	
Total adults ^j :	510	509	306	0	11	146	0	16	54	227	44.6

a/ Trapping at Willow Creek weir took place August 29 - November 19, 2018 (Julian weeks 35-47).
b/ Twenty four steelhead were trapped but not tagged at WCW in 2018; 22 were half-pounders (too small), and 2 adults were in poor condition.
c/ Ad-clip = Adipose fin clipped fish.
d/ Tagged fish found dead and unspawned within 30 days of tagging are considered tagging mortalities.
e/ Fish reported as harvested by anglers.
f/ Trapping occurred at Trinity River Hatchery September 4, 2018 - March 12, 2019 (JWs 36-11; closed parts or all of JWs 41-43).
g/ Fish recovered in upper Trinity River spawner surveys; of which we found none in 2018.
h/ Fish tags found loose or on dead fish and returned by anglers or other river enthusiasts.
i/ Fish caught and released by anglers, their tag removed.
j/ Adult steelhead are all those > 41 cm FL.

Appendix 34. Daily mean flow (CFS) recorded at USGS gauge (11526250) and water (°C) temperature for Trinity River upstream of Junction City, 2018.



Appendix 35. Daily mean flow (CFS) recorded at USGS gauge (11530000) and water (°C) temperature for Trinity River near Willow Creek weir, 2018.

