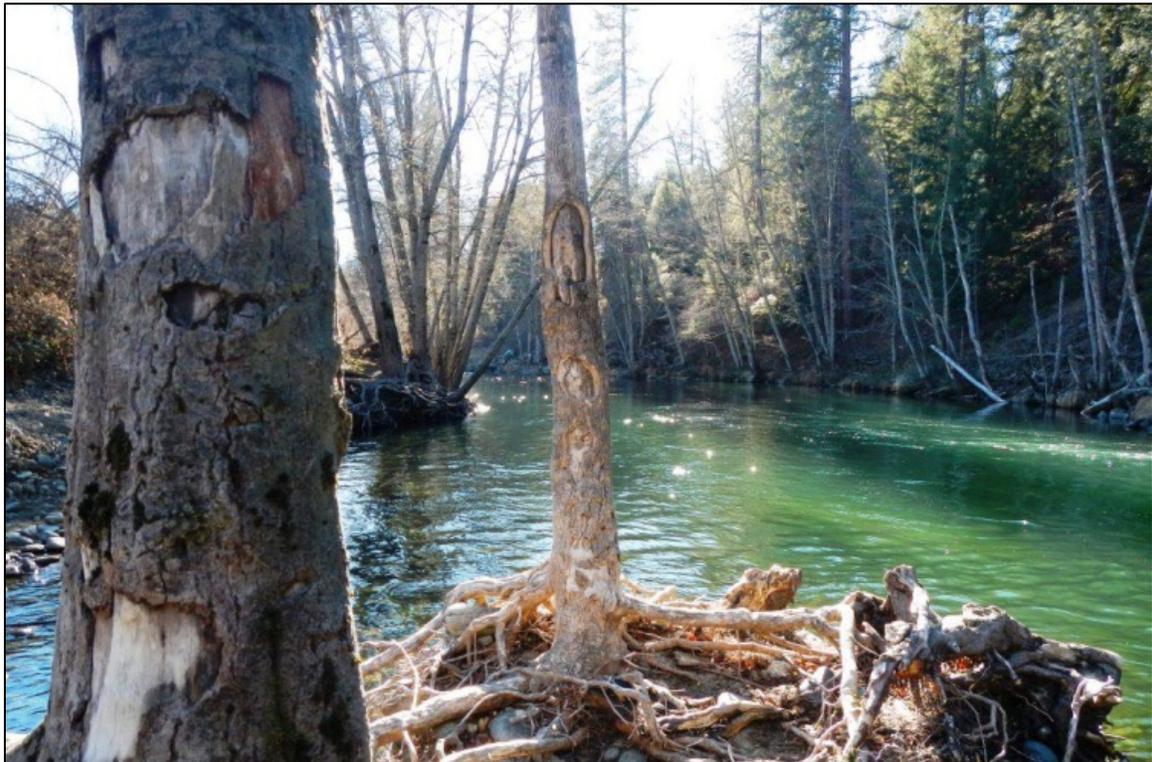


State of California
The Resources Agency
DEPARTMENT OF FISH AND WILDLIFE

ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD
MONITORING PROJECT
2012-13 SEASON



On the cover: Upper mainstem Trinity River, 2012.

State of California
The Resources Agency
DEPARTMENT OF FISH AND WILDLIFE

ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD
MONITORING PROJECT
2012-13 SEASON

by

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Northern Region
Klamath and Trinity River Projects

601 Locust Street
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APRIL 2014

FOREWORD

This is the California Department of Fish and Wildlife's¹ (CDFW) Trinity River Basin Salmon and Steelhead Monitoring Project's twenty-fourth annual report to the United States Bureau of Reclamation (Reclamation). The activities reported on occurred between April 2012 and March 2013, and were funded by CDFW/Reclamation Cooperative Agreement Number R12AC20520. The field work was conducted by personnel of the CDFW Klamath-Trinity Program working in conjunction with Hoopa Valley Tribal Fisheries (HVTF), Yurok Tribal Fisheries Program (YTFP), U.S. Fish and Wildlife Service (USWFS), and the U.S. Forest Service (USFS).

This report presents work on five separate but inter-related projects (Tasks) performed on the lower Klamath river, the main stem Trinity River and at Trinity River Hatchery. The 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. This is the final report for the above referenced cooperative agreement.

ACKNOWLEDGMENTS

The CDFW fisheries technicians on whom we relied during the 2012 field season include: Michael Bradford, Nick Campise, Jason Coburn, Becky Dutra, Melissa Gordon, Chris Hubler, Mark Kerr, Stephen Marten, Carl Meredith, Lauren Romero nee Meissner, Angela Moran, Todd Newhouse, Eric Ojerholm, Laurel Osborne, Nancy Overton, Roddy Park, Melissa Reneski, Jane Sartori, Garth Savage, Tony Scheiff, Guy Smith, Ron Smith, Sam Stehr, Steven Strite, Ted Tillinghast, Cindy Walker, Paula Whitten, and Eileen Williams. We are very fortunate to have much of our excellent field staff return year after year, including veteran HVTF technicians Eric Matilton and Loren Aubrey. We especially appreciate the cooperative nature of the help we get from HVTF on our weir installation/pull days and the hard-working crew who come out to help makes those enormous jobs less daunting. Thanks too to Brenda Tuel for always keeping our administrative wheels spinning true.

We appreciate the cooperation of the CDFW Trinity River Hatchery staff during salmonid recovery, and landowners Linda Allan, Doris Chase, Tom O'Gorman, Pierre LeFuel, the Bureau of Land Management and the U.S. Forest Service for access, off-season in-basin equipment storage and general project support.

¹ California Department of Fish and Game's name changed to California Department of Fish and Wildlife on January 1, 2013. The time span of this report was under both names, however we will be using the new name throughout this report.

The CDFW monitoring program was approved by the Trinity Management Council (TMC) and funded by the United States Bureau of Reclamation through the Trinity River Restoration Program (TRRP) office in Weaverville, CA. We thank Robin Schrock and the TRRP for their contract administration efforts.

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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2012-13 SEASON**

**TASK 1
CHINOOK AND COHO SALMON AND FALL-RUN STEELHEAD RUN-SIZE
ESTIMATES USING MARK-RECAPTURE METHODS**

by

Mary Claire Kier

ABSTRACT

The California Department of Fish and Wildlife's Trinity River Project conducted tagging and recapture operations from July 2012 through March 2013 to obtain adult spring-run (spring Chinook) and fall-run (fall Chinook) Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and fall steelhead (*O. mykiss*) run-size, angler harvest, and spawner escapement estimates for the Trinity River basin. The information from Task 1 is used by the Trinity River Restoration Program (TRRP) to evaluate program objectives outlined in the Integrated Assessment Plan (TRRP, 2009)

Two weirs installed in the main stem Trinity River near the towns of Junction City and Willow Creek trapped 2,798 Chinook salmon, 589 coho salmon, 3,620 fall steelhead and 75 brown trout (*Salmo trutta*). Utilizing a Petersen mark-recapture methodology, and fish tagged at the weirs and recaptured at Trinity River Hatchery (TRH), we estimate 25,617 spring Chinook migrated into the Trinity River basin upstream of Junction City weir. Using tags returned by anglers we estimate 2,138 spring Chinook were harvested, yielding an escapement of 23,479 fish. An estimated 73,666 fall Chinook migrated past Willow Creek weir (WCW), of which an estimated 1,675 were harvested by anglers, yielding and escapement of 71,991 fish.

The coho salmon (coho) run-size in the Trinity above Willow Creek was estimated at 18,657 fish, with no coho estimated to have been harvested, leaving an escapement estimate of all 18,657 fish for potential spawning. An estimated 20,611 (8,379 naturally produced and 12,233 hatchery produced) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 599 adult fall steelhead above the WCW, leaving 20,012 fish as potential spawners.

TASK OBJECTIVES

- To determine the size, composition, distribution, and timing of adult Chinook salmon, coho salmon, and steelhead runs 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)].
- To determine the in-river angler harvest and spawner escapements of Trinity River Chinook salmon and coho salmon, and steelhead (IAP assessments 16A, 17A, 18A, 19A – Monitor harvest (tribal, sport and commercial) of naturally produced spring Chinook, fall Chinook, coho salmon and steelhead).

INTRODUCTION

The California Department of Fish and Wildlife's (CDFW) Trinity River Project (TRP or Project) personnel annually estimate the run-size and spawner escapement of spring-run Chinook salmon (*Oncorhynchus tshawytscha*) 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, coho salmon (*O. kisutch*), and fall-run steelhead (*O. mykiss*) 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). Run size is the number of fish estimated to migrate from the ocean into the Trinity River basin, while spawner escapement is the number of fish that survive in-river harvest to spawn in natural areas or enter Trinity River Hatchery (TRH). A Peterson type mark-recapture analysis is used to make the estimations. This is a continuation of studies that began in 1977 with the trapping, tagging, and recapture of fall-run Chinook salmon (fall Chinook), coho salmon (coho), and fall-run steelhead (steelhead).

The information from this investigation (Task) is used by the Trinity River Restoration Program (TRRP) to help evaluate program objectives [13A, 17A, 16A, 18A and 19A] outlined in the Integrated Assessment Plan (IAP)(TRRP 2009). The current escapement goals in the Trinity River basin for naturally-produced adults are 62,000 fall Chinook; 6,000 spring Chinook; 1,400 coho; and 40,000 steelhead. Similar goals for hatchery adult escapement are 9,000 fall Chinook; 3,000 spring Chinook; 2,100 coho; and 10,000 steelhead. Task 1 data are used to assess progress toward the goal of increasing harvest opportunity for dependent fisheries found in the Record of Decision (ROD) (Interior, 2000). Task 1 data are used in the short term to assess management decisions and add to long term trend analysis in pre- and post-ROD fish populations. The data also serve as baseline for current and future cross-functional ecological and physical evaluations, the composition (race and proportion of hatchery-marked^{1/} or Project-tagged^{2/} fish), distribution, and timing of salmonid runs in the Trinity River basin.

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

² Spaghetti tags applied by CDFW personnel to salmonids on their up-river migration (spawning run).

METHODS

Trapping and Tagging

Trapping Locations and Periods

Trapping and tagging operations were conducted from July 24, 2012 through November 16, 2012 by TRP and HVTF personnel at two temporary weir sites located on the main stem Trinity River (Figure 1). The Junction City weir (JCW) is located 132.7 river kilometers (rkm) (~river mile (rm) 81.7) upstream from the Klamath River confluence (40° 41' 5.51" N, 123° 01' 35.55" W) near the town of Junction City. The JCW was operated July 24 through August 13, 2012, and is primarily operated to capture, measure, and tag spring-run Chinook salmon (spring Chinook). The Willow Creek weir (WCW), is located 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 21 through November 16, 2012. The WCW is primarily operated to capture, measure, and tag fall Chinook, coho, and steelhead.

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. Each trapping day the weir is opened for at least five hours to allow fish to pass unimpeded through the weir, and it is generally opened over the weekend as well. Occasionally, trapping schedules are modified to allow for holidays or high flows which prevent trapping in a safe manner. Trapping and tagging are not conducted if stream temperatures exceed 21° Celsius.

Weir and Trap Design

Since 1989, a Bertoni (Alaskan) weir design has been used at both sites (Figures 2-4). The weir is supported by wooden tripods set 2.5 m apart. Weir panels consisted of 3.0 m x 1.9 cm (10 ft x $\frac{3}{4}$ in) electrical conduit spaced 5.1 cm apart on center, leaving a gap of 3.2 cm between conduits. Conduit pieces are supported by three sections of aluminum channel arranged 0.92 m apart, which are connected to the supporting tripods. The tripods are anchored with cable to 1.8 m stakes driven into the stream bottom. The weir panels are angled at roughly a 45° angle, with the top of the weir standing 1.8 m above the river bottom.

The traps are made of 1.9 cm electrical conduit spaced 2.5 cm apart and welded into panels. The panels are wired together at the corners to produce a 2.4 m square box which is bolted to a plywood floor and covered with a plywood lid to prevent fish from jumping out. A fyke, also made of conduit panels, is installed between the weir panels and the downstream side of the trap to guide fish into the trap box and prevent their escape. The trap is placed on the upstream side of the weir, directly in front of 12 raised conduit pieces creating an opening approximately 60 cm. This opening allows fish to pass through the weir, through the fyke (which closes down to a minimum of 12.5 cm), then into the trap. To allow boat passage, gates approximately 5.3 m wide were inserted between two weir panels. The gate at Junction City weir was constructed of welded conduit panels with 2.5 cm spacing between pieces of conduit and was perpendicular to the stream substrate.

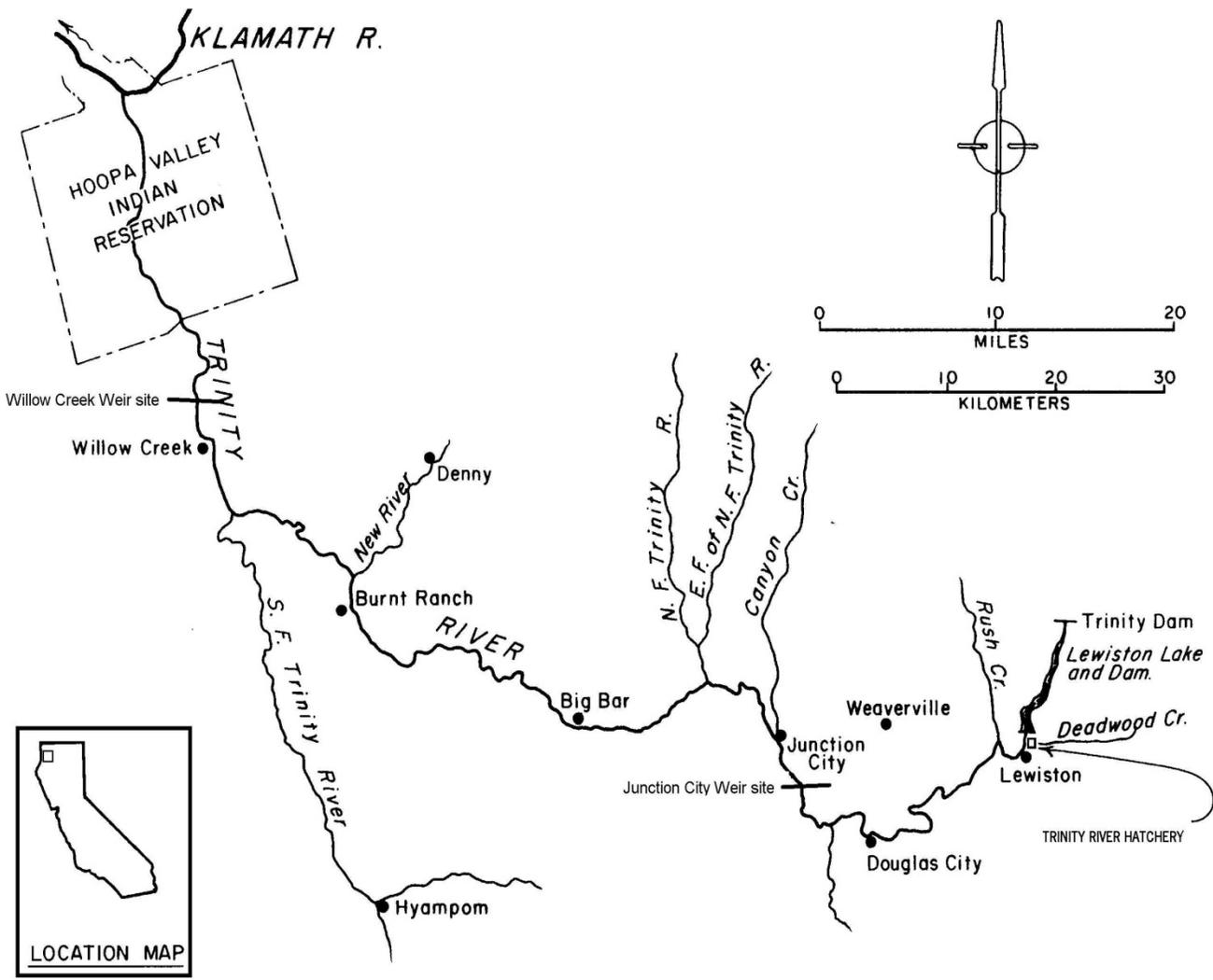


Figure 1. Location of trapping/tagging weirs near Willow Creek and Junction City, and Trinity River Hatchery, in the Trinity River basin, 2012 season.



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



Figure 3. Set up of Willow Creek weir, 2012. Note the boat gate and three trap boxes.



Figure 4. Typical Junction City weir configuration (looking downstream). Note the single trap box (on left) and boat gate (on right).

The gate at WCW was constructed of 4.0 cm mesh chain-link fencing supported by two livestock gates and was sloped downstream, even with the weir.

Processing of Fish

At both weirs, all trapped salmonids are identified to species, measured to the nearest cm fork length (FL), and examined for hook, predator, or gill-net wounds or scars, fin clips, and tags. Each untagged, un-spawned salmonid judged in good condition is tagged with a serially numbered Floy Tag and Manufacturing, Inc. FT-4³ spaghetti tag (Project-tag). Tags are inserted using an applicator needle through the fish's back approximately two cm below the base of the dorsal fin and $\frac{1}{4}$ the length of the dorsal fin, anterior of the posterior edge of the dorsal fin. At WCW, tags with no reward value, \$10 reward, and \$20 reward were applied to the Chinook and steelhead at a 1:1:1 ratio. At JCW the same 1:1:1 ratio of \$0:\$10:\$20 tags were applied to the Chinook. Adult steelhead tagged at JCW are tagged with non-reward tags. Juvenile, or "half-pounder", steelhead are not tagged at either weir. Coho at both weirs are tagged with non-reward tags only. At JCW, brown trout are tagged with serially numbered (Floy) FD-94 anchor tags; while the brown trout trapped at WCW are tagged with non-reward FT-4s.

In addition to the tagging, scales are collected from one of every two Chinook captured in good condition at the weirs. Post-season, these scale samples are mounted and read by HVTF staff to determine an age composition of the run and to inform the

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.

Klamath River Technical Team's Klamath River age composition analysis (KRTT, 2011).

Separation of Spring and Fall Chinook Runs at the Weirs and at Trinity River Hatchery

Each year there is temporal overlap of the spring and fall Chinook runs in the Trinity River, but the run timing varies year to year so, for analytical purposes, dates must be ascertained to separate the two races at each of the weirs and TRH. The separation dates are derived utilizing coded-wire-tag information from fish recovered at TRH.

Approximately 25% of TRH-reared Chinook have coded-wire tags (CWTs) implanted in their snouts before their release from TRH. These fish are identifiable by the absence of their adipose fin, which is clipped off (ad-clipped) during the CWT tagging process. When these salmon are recovered at the hatchery their heads are removed and stored for later CWT extraction and de-coding. Each code identifies it as either a spring- or fall-run fish, among other information of origin (for CWT-related methods see Task 2 of this report). Each ad-clipped Project-tagged fish recovered at TRH is identified (after having their CWTs extracted and read) as a spring or fall run fish in the same manner. The Julian week (JW) in which the proportion of fall Chinook exceeds spring Chinook at each weir is then designated as the first week of the fall Chinook run at each weir. If there are two consecutive weeks with nearly identical proportions, then the first week is designated as spring run and the following as fall run.

Project-tagged (and non-Project tagged) fish without CWTs are classified as either spring or fall fish based on the date they enter the hatchery. If they enter the hatchery during the period associated with the spring run (based on CWT recoveries at the hatchery) they are considered spring Chinook. The Chinook entering the hatchery during the period associated with the fall run (based on CWT recoveries) are considered fall Chinook.

To help isolate and minimize spawning of spring-run with fall-run Chinook at Trinity River Hatchery, CDFW personnel take a spawning break, and annually close the TRH fish ladder for a ten-day period which in 2012 was between October 12 and October 25 (JW 42 plus days on each side of JW 42). Hatchery personnel did empty the ladder on October 17, 2012, not spawning any of the fish. The timing of the annual ladder closure is the period historically associated with the arrival of the fall Chinook to TRH. If after CWTs are analyzed the separation of the two Chinook races should have been other than JW 42 any mixed race eggs are destroyed.

Estimation of Numbers of Spring and Fall Chinook at Trinity River Hatchery

To estimate the respective numbers of spring and fall Chinook without CWTs that enter TRH, the numbers of tags recovered from each returning CWT group are expanded by the CWT production multiplier (the ratio of tagged to total Chinook released by same strain, brood year (BY) release site, release group and date). For example, 231,430 marked fall yearling Chinook of CWT group 06-87-81 plus 713,665 unmarked fall yearling Chinook were released from TRH in October of 2011. The expanded estimate for each return from this group is $4.0837186 \left(\frac{231,430 + 713,665}{231,430} \right)$. Each CWT

return is expanded by its production multiplier to estimate the total number of spring or fall Chinook that entered the hatchery. If more Chinook entered the hatchery on a particular sorting day than could be accounted for by the expansion of all CWT groups, the additional fish are considered naturally produced. Conversely, if fewer Chinook entered the hatchery on a particular sorting day than could be accounted for by expansion of all CWT groups that lack of fish would be recorded as a negative number of naturally produced fish in the daily CWT expansion...but this has not occurred to date (Sinnen, DFG, pers. com). Fish are designated as either spring run or fall run in the same proportions that were determined by the expansion of the CWT groups on that day.

Determining the Separation between Summer, Fall, and Winter Steelhead Runs at the Weirs

Throughout this report we refer to fall-run adult steelhead, when actually we are reporting on a mix of runs. Most of the steelhead we encounter at the WCW are fall-run steelhead, but there is temporal overlap in the run-timing of the summer, fall, and winter runs, as evidenced by a higher proportion of fish caught without ad-clips early in our sampling season (ie mid-August), and again toward the end of the season (November). The TRH endeavors to produce fall-run steelhead (100% of which are marked with an ad-clip). Until such time as we can distinguish the runs from each other we will continue to refer to all the steelhead we catch at Willow Creek weir as fall-run steelhead.

Size Discrimination Between Adult and Jack Chinook and Coho Salmon

For any preliminary or in-season needs we use 55 cm FL as the minimum size of an adult salmon. When doing post-season analyses we utilized length frequency data obtained at the two trapping sites and TRH to determine the nadir separating jacks and adults. Fork length data from TRH Chinook was only used from weeks in which ≥ 90 percent of the Chinook could be designated as either spring run or fall run as explained by the expansion of CWTs. For fall Chinook we also utilized the scale-based ageing analysis provided by HVTF during the Klamath River Technical Team's collaborative age composition meeting in February 2013.

Coho salmon do not receive CWTs, nor are scales retained for age analysis; therefore exact ages of coho are unknown. The separation of jack and adult coho is based entirely on length-frequency analysis.

Size Discrimination Between Adult and Immature Steelhead

All steelhead >41 cm FL are considered adults, and steelhead <41 cm FL captured at the weirs are considered sub-adults or "half-pounders". These "half-pounders", which spend only 2 to 4 months in the ocean before returning to the river in late summer and early fall are sexually immature fish which feed extensively in freshwater and are highly prized by sport anglers. Half-pounders over-winter in the river without spawning before returning to the ocean and return as mature adults during subsequent migrations. Half-pounders have a very limited geographic distribution and are known to exist only in the Rogue, Klamath-Trinity, Mad, and Eel River systems. Half-pounders that enter TRH are tallied and returned to the river.

Recovery of Tagged Fish

Weir Recovery

Throughout the weir season all manner of flora and fauna are found washed against the weir, most of which we allow to continue downstream intact. All salmonid carcasses recovered at the weir, however, are examined for wounds, tags, fin clips, and spawning condition and are measured to the nearest cm FL. All heads from ad-clipped fish are removed for the potential recovery and decoding of the CWT. After processing, all carcasses are cut in half to prevent recounting and returned to the river downstream of the weir.

Tagging 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 dead less than 30 days after tagging. Tagged fish recovered dead more than 30 days after tagging, or those that had spawned, regardless of the number of days after tagging, were not considered tagging mortalities.

Angler Tag Returns

All the tags placed on fish at the weirs were inscribed with the TRP Arcata field office address and the word RETURN. The information from returned Project-tags by anglers and river enthusiasts allowed for estimation of angler harvest and catch and release rates for all species marked. Anglers who returned tags without including the necessary information were sent questionnaires asking the date and location of their catch and whether they harvested (kept) or released their catch. The questionnaire informed them of the fish's tagging date and tagging location.

Tags returned to the TRP Arcata field office through December 31, 2013 were included in assessing harvest and catch and release rates. Earlier sampling-year tags returned after that date were processed for payment but not used for analysis.

Trinity River Hatchery Returns

The TRH fish ladder was opened September 3, 2012, closed October 12-22 to separate spring and fall Chinook and closed for the season March 12, 2013. The first spring Chinook spawning date was September 4. Hatchery personnel typically conduct fish spawning operations two days per week during the Chinook and coho spawn, with additional spawn days during the peak of the runs in November. Steelhead spawning operations occurred typically one day per week from January 1 to March 12, 2013.

All salmon and steelhead entering TRH are identified to species, sexed, examined for tags and clips, and measured to the nearest cm FL. Coho and adult steelhead that enter the hatchery prior to the start of spawning of those species receive upper caudal fin clips prior to live release to the river. Each salmon and steelhead that enters the TRH spawning house is measured to the nearest cm FL only once at the time of first TRH entry. Both coho and steelhead are known to make multiple returns to the

hatchery within the same spawning season. We refer to these marked returns as “re-runs”. The purpose of the upper caudal clip is to prevent double counting of fish that have been released live to the river but return on subsequent days.

For spawning purposes, TRH staff initially sort fish as either sexually ripe or unripe. Ripe salmon are either spawned or killed, and ripe steelhead either spawned or returned to the river. Unripe Chinook salmon are either moved to holding tanks (becoming "hold-overs") for further ripening (up to 14 days) or are killed, and unripe steelhead are either held for further ripening or returned to the river. Prior to transferring to the holding tanks, unripe fish with ad-clips or Project tags are given a week-specific fin clip to indicate which week they entered TRH. Unripe fish without an ad-clip or a Project tag are tallied prior to being transferred to the holding pond. Held fish are then processed on a later spawning day, after the “fresh” fish are sorted and processed. Entry week fin clips are recorded from all holdover fish when processed.

The "hold-overs" TRH keeps at the beginning of the spawning of each of the races of Chinook, coho and steelhead are to ensure that during the course of the spawning of each of those species enough eggs will be available to meet the hatchery's egg need to produce the number of fish intended. Once the TRH egg-take quota is reached they cease to hold fish over.

For analytical purposes, Project-tagged salmon and steelhead recovered at TRH are generally assigned the FL recorded for them at the weir. The heads of all ad-clipped salmon are removed and placed individually in plastic bags with serially-numbered head tags noting the date, location of recovery, species, sex, and FL. Project personnel later perform extraction and decoding of CWTs.

Spawner Surveys

With crews from U.S. Fish and Wildlife Service, U.S. Forest Service, the Yurok Tribe, and Hoopa Valley Tribal Fisheries Program, TRP staff conducted spawner surveys in the upper Trinity River from Cedar Flat (rkm 78) upstream to Lewiston Dam (rkm 180) and from Hawkins Bar (rkm 64) to Weitchpec (rkm 0). Fish recovered in these surveys were examined for spawning success and Project tags.

Run-size, Angler Harvest and Spawner Escapement Estimates

Effectively Tagged Fish

The number of effectively tagged fish is estimated by subtracting from the total number of tagged fish the number of fish classified as tagging mortalities, tagged fish recovered downstream of the tagging site, and tagged fish that an angler caught and removed the tag before releasing the fish.

Run-size Estimates

Run-size estimates were calculated using Chapman's version^{4/} of the Petersen Single Census Method (as modified by Ricker (1975), wherein subtracting one from the fraction is dropped as it is viewed as having negligible effect):

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

N = estimated run-size

M = the number of effectively tagged fish

C = the number of fish examined at TRH

R = the number of Project-marked fish recovered in the hatchery sample.

Assumptions of the Peterson run size estimates are:

- Fish trapped and released from the weirs are a random sample representative of the population;
- Tagged and untagged fish are equally vulnerable to recapture at TRH;
- All Project tags are recognized upon recovery;
- Tagged and untagged fish are randomly mixed throughout the population and among the fish recovered at TRH;
- All tag loss is taken into account, and,
- The population is closed (that population being made up of individuals upstream of each respective weir in the Trinity River basin)

Annually, TRP staff attempt to tag and recover enough fish to obtain 95% confidence within $\pm 10\%$ of the run-size estimate. The confidence interval estimator is selected using criteria established by Chapman (1948), and written into a program in dBase, that indicates, after the trapping and tagging data are input, which of the approximations, Normal or Poisson is appropriate to use. In the 2012-13 spawning season there were not enough spring Chinook, fall Chinook, or coho salmon caught to stratify jack and adult salmon and obtain the 95% confidence interval on each of the stratified portions of the run, therefore the estimate we used in each case was for the (un-stratified) run size as a whole. We then used the proportion of jacks/adults observed at each of the weirs (or in the case of the spring Chinook the JCW/TRH combined ratio) for each species and applied those proportions to the run-size estimates to break them into jack/adult numbers.

All steelhead run-size estimates are for adults only. All TRH-produced steelhead since the 1997 brood year have received ad-clips. The proportion of the run that was hatchery-produced is based upon the percentage of ad-clipped steelhead observed at WCW.

Rounding differences may cause single digit differences between the tables presented.

⁴ Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to zoological census. Univ. CA Publ. Stat. 1:131-160, As cited in Ricker (1975).

Angler Harvest and Catch and Release Rates and Harvest Estimates

When reward tags are returned by anglers at a higher rate than non-reward tags, only returns from reward tags are used to determine harvest rates. When non-reward tags are returned at higher rates than reward tags, harvest rates are determined by combining the returns of both reward and non-reward tags. In 2012 we used reward tag returns to estimate harvest for spring Chinook adults and jacks, and fall Chinook adults, but were forced to use non-reward tags only for fall Chinook jacks as no reward tags from fall Chinook jacks were returned.

Harvest rates are calculated for each species (and run of Chinook) by dividing the number of angler-returned tags from harvested fish by the number of effectively tagged fish. Independent harvest rates are calculated for jack and adult salmon. Catch and release rate for each species (and run of Chinook) are calculated by dividing the number of angler-returned tags from caught and released fish by the number of fish effectively tagged plus the number of fish reported as released.

The number of fish harvested upstream of each weir is estimated by multiplying the harvest rates (for each species/race) by their respective run-sizes upstream of each weir.

Use of Standard Julian Week

Weekly sampling data collected by Project personnel at the weirs and TRH are presented in Julian week (JW) format. Each JW is defined as one of a consecutive set of 52 weekly periods, beginning January 1, regardless of the day of the week on which January 1 falls (Appendix 1). The extra day in leap years is included in the ninth week. This procedure allows inter-annual comparisons of identical weekly periods.

RESULTS

Trapping and Tagging

Chinook Salmon

Spring/Fall Chinook Separation and Run Timing

Trinity River spring Chinook immigrate mainly between April and September while fall Chinook immigrate August through December. For purpose of analysis, we designate the spring/fall separation point as a hard date; although in reality the timing of the two runs overlaps (Figure 5). Because no TRH-origin fall Chinook identified by CWT were observed at JCW, and the only JCW-tagged Chinook that was trapped during the fall spawning period at TRH was tagged in JW30, we determined all Chinook trapped at JCW in 2012 were spring Chinook. Using CWTs we determined the first week of the fall run Chinook at WCW was JW 35, and only those Chinook tagged after JW 34 were used in our mark-recapture analysis for fall Chinook estimates.

We installed the JCW July 24, 2012 (JW 30). The number of spring Chinook trapped was highest the first week at 19.5 fish per night (Table 1, Figure 6). The weir was removed from the river August 13, 2012 due to scheduled high releases from Lewiston Dam. The releases were designed to improve water quality of the lower Klamath and reduce the potential for crowding during an unusually large expected run of fall Chinook.

We began operating WCW on August 21, 2012 (JW 34). We had our highest catch of fall Chinook during JW 40, with 88.2 fish per night (Table 2, Figure 7). Though we had a varied flow regime throughout the season (due to releases from Lewiston Dam) we had three traps at different depths and were able to trap consistently throughout season.

Size of Trapped Fish

Spring Chinook trapped at JCW and TRH averaged 67.0 and 67.5 cm FL, respectively, with a combined average 67.5 cm FL (Figure 8, Appendix 4). By fork length distribution analysis alone the nadir separating jack from adult spring Chinook was between 53 and 54 cm FL. Data from known age, hatchery-marked spring Chinook that entered TRH supported the minimum adult fork length of 54 cm. While there was some overlap between sizes of age 2 and age 3 fish (Appendix 2), the mean FL of those CWTs were distinctly different. Applying the minimum adult size of 54 cm FL to the observed population, an estimated 3.2% of the spring Chinook observed were jacks at JCW, and 1.6% at TRH.

Fall Chinook trapped at WCW and TRH averaged 68.0 and 67.9 cm FL, respectively, with a combined mean FL of 67.9 cm. (Figure 9). The nadir on the fork length distribution between jacks and adult fall Chinook indicated a maximum jack size of 49 cm FL. Data from known age, hatchery marked fall Chinook entering TRH supported this separation between jacks and adults (Appendix 3), overlapped as in the spring Chinook, but with markedly different mean FLs between brood years.

Using the maximum jack size of 50 cm, fall Chinook jacks comprised 7.1 and 0.5% of the run observed at WCW and TRH respectively.

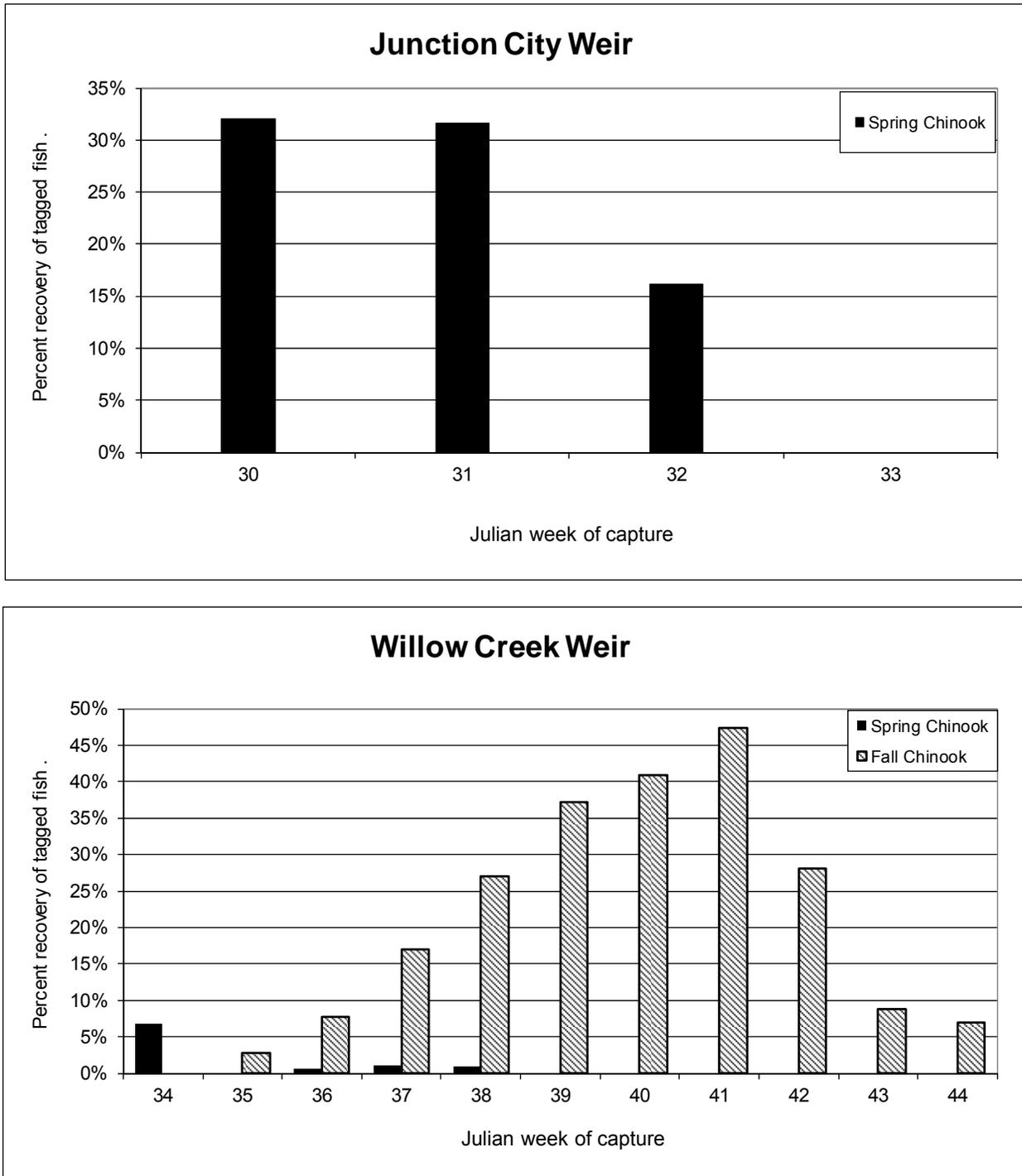


Figure 5. Percent recovery of Junction City weir and Willow Creek weir marked Chinook at Trinity River Hatchery during the 2012-13 season.

Table 1. Weekly summary of Chinook trapped in the Trinity River at Junction City weir during 2012.^a

Julian week	Inclusive dates	Nights Trapped	Number trapped						Fish/night
			Jacks ^b	Ad-clip Jacks	Ad-clip Adults	Ad-clip Adults	Total	Ad-clip total	
Spring Chinook									
30	23-Jul - 29-Jul	4	1	1	77	13	78	14	19.5
31	30-Jul - 5-Aug	5	1	0	37	8	38	8	7.6
32	6-Aug - 12-Aug	5	4	0	67	8	71	8	14.2
33	13-Aug - 19-Aug	1	0	0	2	0	2	0	2.0
Total:		15	6	1	183	29	189	30	12.6
Mean:									11.2

a/ Trapping at Junction City weir took place July 24 - August 13, 2012 (Julian weeks 30-33).

b/ Spring Chinook <54 cm FL were considered jacks in 2012.

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

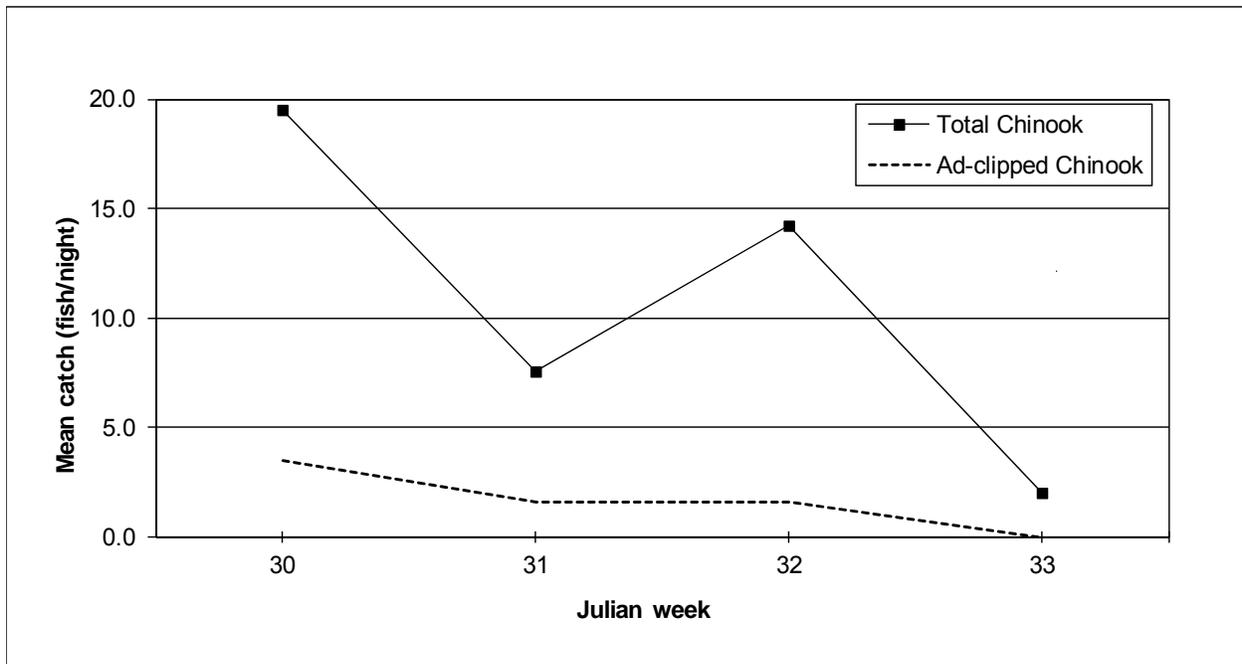


Figure 6. Mean catch of Chinook in the Trinity River at Junction City weir, during 2012. All salmon trapped at JCW in 2012 were spring Chinook.

Table 2. Weekly summary of Chinook trapped in the Trinity River at Willow Creek weir during 2012.

Julian week	Inclusive dates	Nights trapped	Number trapped					Fish/night	
			Jacks ^b	Ad-clip ^c Jacks	Ad-clip Adults	Ad-clip Total	Ad-clip total		
Spring Chinook									
34	20-Aug - 26-Aug	4	6		102	2	108	2	27.0
Fall Chinook									
35	27-Aug - 2-Sep	5	22		247	4	269	4	53.8
36	3-Sep - 9-Sep	5	29		275	13	304	13	60.8
37	10-Sep - 16-Sep	5	22		260	18	282	18	56.4
38	17-Sep - 23-Sep	5	14		337	33	351	33	70.2
39	24-Sep - 30-Sep	5	34	1	367	71	401	72	80.2
40	1-Oct - 7-Oct	5	25	1	416	79	441	80	88.2
41	8-Oct - 14-Oct	5	7	1	96	17	103	18	20.6
42	15-Oct - 21-Oct	5	2		90	16	92	16	18.4
43	22-Oct - 28-Oct	5	7	2	102	12	109	14	21.8
44	29-Oct - 4-Nov	5	8		85	8	93	8	18.6
45	5-Nov - 11-Nov	5	3	1	25	1	28	2	5.6
46	12-Nov - 18-Nov	5	5		23		28	0	5.6
Total:		64	184	6	2,425	274	2,609	280	40.8
Mean:									41.6

a/ Trapping at Willow Creek weir took place August 21 - November 16, 2012 (Julian weeks 34-46).

b/ Fall Chinook <50 cm FL were considered jacks in 2012.

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

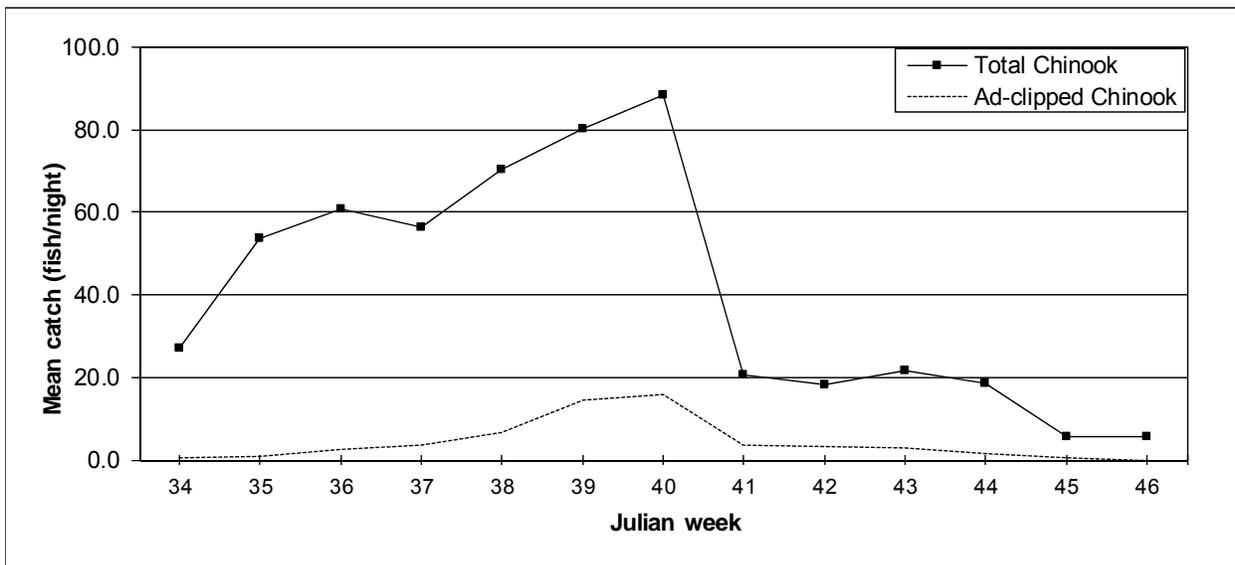


Figure 7. Mean catch of Chinook in the Trinity River at Willow Creek weir, during 2012. Spring Chinook comprised the majority of the run in JW 34, yielding to fall Chinook beginning in JW 35.

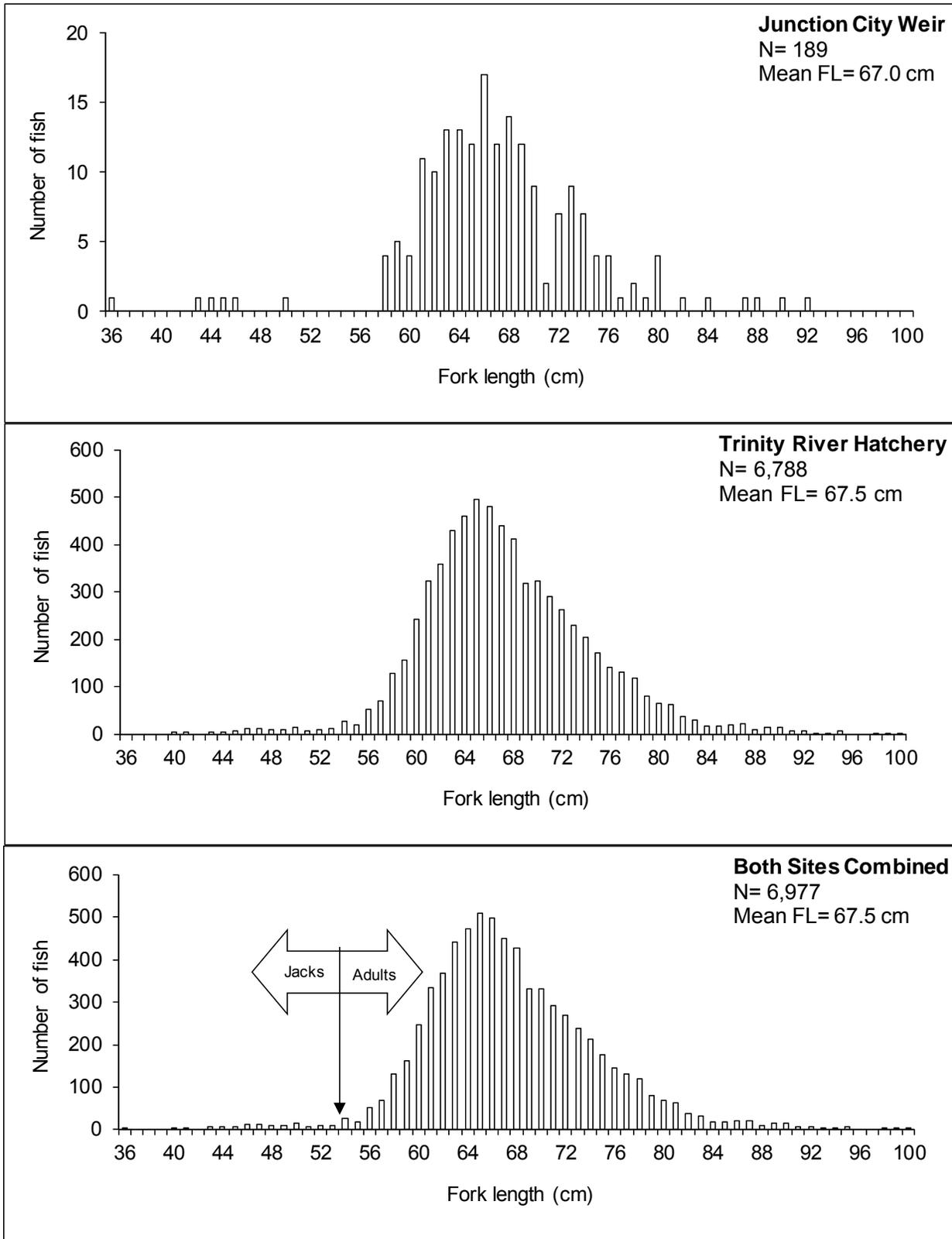


Figure 8. Spring Chinook fork lengths (cm) observed at Junction City weir, Trinity River Hatchery, and both sites combined during the 2012-13 season. The arrow denotes the size used to separate jacks and adults for analysis.

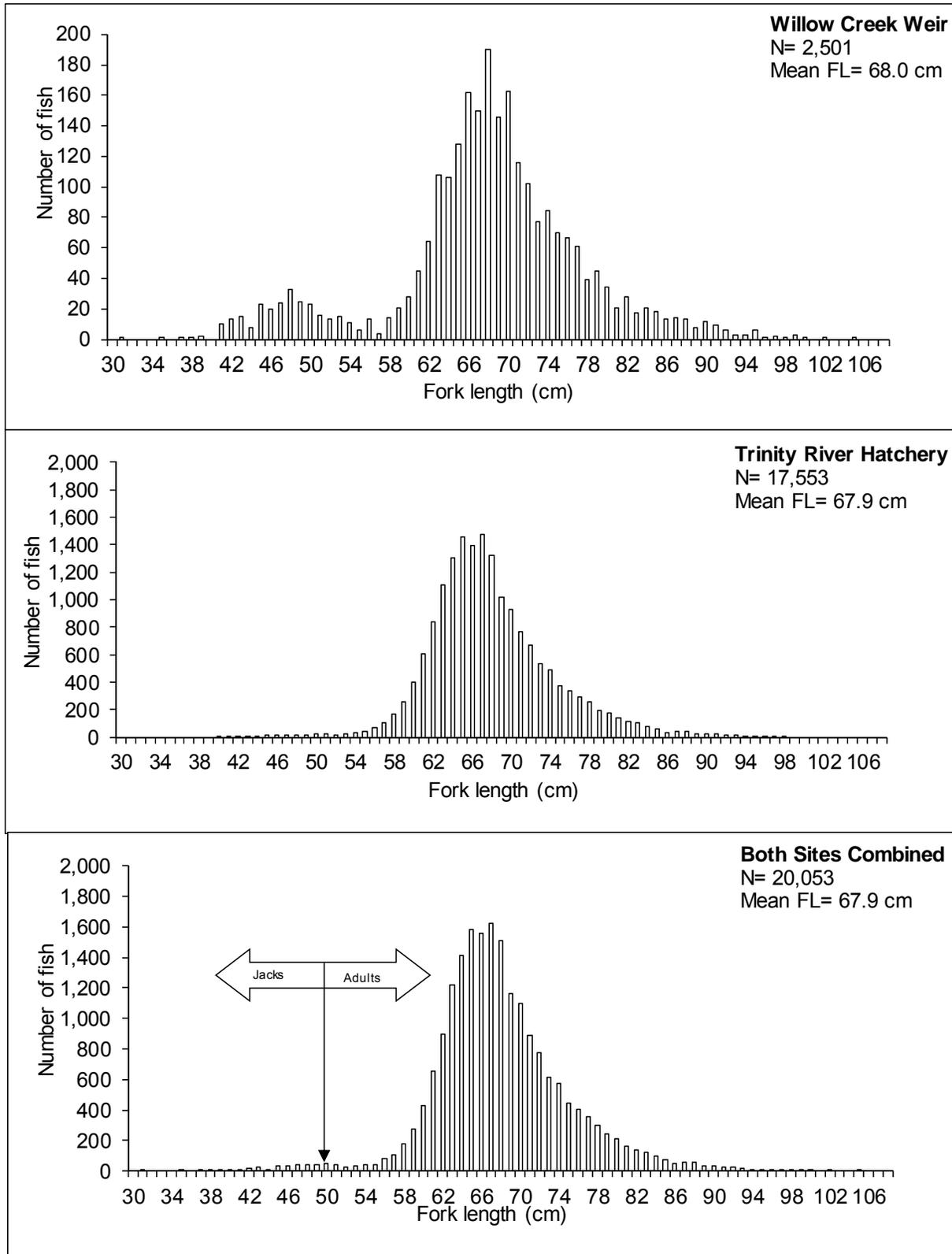


Figure 9. Fall Chinook fork lengths (cm) observed at Willow Creek weir and Trinity River Hatchery and both sites combined during the 2012-13 season. The arrow denotes the size used to separate jacks and adults for analysis.

Effectively Tagged Fish

The term “effectively tagged” in this study refers to the number of fish trapped and tagged, but excludes those fish determined to have suffered tagging mortality, and fish that were caught and released and had their tags removed by anglers. A total of 189 spring Chinook were trapped at JCW, of which 183 (6 jacks and 177 adults) were effectively tagged (Appendix 4). There were two tagging mortalities detected and four caught and released spring Chinook from which anglers reported removing tags (Appendix 4). There were no fall Chinook trapped at JCW in 2012.

The 108 Chinook trapped at WCW in JW 34 were determined, after post-season analysis, to be spring Chinook, but none of them were considered effectively tagged for purposes of the spring Chinook estimate as it is done upstream of JCW. A total of 2,501 fall Chinook were trapped, of which 2,450 were tagged (Appendix 5). Of those 2,450 tagged fish, 2,412 of them (171 jack and 2,241 adult) were effectively tagged. There were five tagging mortalities detected, and 33 (all adult) fall Chinook from which anglers reported removing tags.

Incidence of Fin Clips

Ad-clipped fish comprised 15.9% of the spring Chinook captured (30 of 189) at JCW (Table 1, Appendix 4). Sixteen of the ad-clipped spring Chinook tagged at JCW were recovered at TRH (Table 3).

Of the 2,501 fall Chinook trapped at WCW, 278 (11.1%) were ad-clipped (Table 2, Appendix 5), of which 140 (49.3%) were recovered at TRH (Table 3).

Coho Salmon

Run timing

There were no coho salmon trapped at JCW in 2012. At WCW we trapped our first coho of the season during JW 36. The largest component of the coho run passed through the weir during JWs 39, decreasing through the rest of the season with a sampling season mean of ~9.2 fish trapped per night (Table 4, Figure 10). A total of 589 coho salmon were trapped (107 jacks and 482 adults) at WCW during the 2012 season.

Size of Trapped Fish

The mean FL of coho trapped at WCW and TRH was 60 and 63 cm, respectively (Figure 11). The size separating jacks from adult was based fork length frequency analysis of the data from coho salmon trapped at WCW and those that entered TRH. This year all coho salmon <51 cm FL were considered jacks. Jacks comprised 18.2% and 10.7% of the coho salmon trapped at WCW and TRH respectively.

Table 3. Release data and recoveries of coded-wire tagged (CWT) and maxillary-clipped salmon trapped in the Trinity River at Willow Creek weir (WCW) and Junction City weir (JCW), and subsequently recovered at Trinity River Hatchery (TRH) during the 2012-13 season.

CWT and release type ^a	Species	Race	Brood year	Date	Number of CWT fish	Origination Site	Number recovered / Tagging site		
							WCW	JCW	
SPRING CHINOOK									
068802-f	Chinook	spring	2007	06/ 02-12 /2008	73,822	TRH			
068803-f	Chinook	spring	2007	06/ 02-12 /2008	50,488	TRH			
068810-y	Chinook	spring	2007	10/ 01-14 /2008	96,803	TRH			
068811-f	Chinook	spring	2008	06/01-15/2009	75,847	TRH			
068812-f	Chinook	spring	2008	06/01-15/2009	89,934	TRH			
068813-f	Chinook	spring	2008	06/01-15/2009	64,175	TRH			
068819-y	Chinook	spring	2008	10/01 - 15/2009	104,078	TRH		1	
068821-f	Chinook	spring	2009	06/01-08/2010	63,456	TRH		1	
068822-f	Chinook	spring	2009	06/01-08/2010	82,259	TRH	1	11	
068831-f	Chinook	spring	2009	06/01-08/2010	7,234	TRH			
068832-f	Chinook	spring	2009	06/01-08/2010	8,104	TRH			
068836-y	Chinook	spring	2009	10/01 - 09/2010	108,824	TRH		3	
068773-f	Chinook	spring	2010	06/01-17/2011	33,636	TRH			
068774-f	Chinook	spring	2010	06/01-17/2011	63,224	TRH			
068775-f	Chinook	spring	2010	06/01-17/2011	71,842	TRH			
068776-y	Chinook	spring	2010	10/03-12/2011	97,128	TRH			
shed tag ^b	Chinook	spring							
Total spring Chinook:								1	16
FALL CHINOOK									
068809-y	Chinook	fall	2007	10/ 01-14 /2008	244,661	TRH			
065356-f	Chinook	fall	2008	06/01-15/2009	11,403	TRH			
065357-f	Chinook	fall	2008	06/01-15/2009	9,676	TRH			
065358-f	Chinook	fall	2008	06/01-15/2009	9,882	TRH			
065359-y	Chinook	fall	2008	10/01-15/2009	6,257	TRH			
068814-f	Chinook	fall	2008	06/01-15/2009	93,228	TRH	3		
068815-f	Chinook	fall	2008	06/01-15/2009	94,165	TRH			
068816-f	Chinook	fall	2008	06/01-15/2009	96,264	TRH	1		
068817-f	Chinook	fall	2008	06/01-15/2009	92,360	TRH	2		
068818-f	Chinook	fall	2008	06/01-15/2009	90,758	TRH	2		
068820-y	Chinook	fall	2008	10/01-15/2009	253,073	TRH	10		
608080000-f ^c	Chinook	fall	2008	04/29-08/20/09	17,618	TRH			
068823-f	Chinook	fall	2009	06/01-08/10	85,136	TRH	4		
068824-f	Chinook	fall	2009	06/01-08/10	89,959	TRH	9		
068825-f	Chinook	fall	2009	06/01-08/10	91,310	TRH	8		
068826-f	Chinook	fall	2009	06/01-08/10	88,851	TRH	5		
068827-f	Chinook	fall	2009	06/01-08/10	90,929	TRH	5		
068828-f	Chinook	fall	2009	06/01-08/10	39,642	TRH	5		
068833-f ^c	Chinook	fall	2009	03/02-07/10/10	5,664	TRH			
068834-f ^c	Chinook	fall	2009	03/02-07/10/10	5,270	TRH			
068837-y	Chinook	fall	2009	10/01-09/10	230,461	TRH	80		
068777-f	Chinook	fall	2010	06/01-17/11	114,941	TRH			
068778-f	Chinook	fall	2010	06/01-17/11	119,394	TRH	1		
068779-f	Chinook	fall	2010	06/01-17/11	119,945	TRH	1		
068780-f	Chinook	fall	2010	06/01-17/11	112,828	TRH			
068781-y	Chinook	fall	2010	10/03-12/11	231,430	TRH	1		
068835-f ^c	Chinook	fall	2010	06/01-17/11	7,954	TRH			
shed tag ^b	Chinook	fall					2		
Total fall Chinook:							139	0	
COHO									
RM ^d	coho		2009	03/15-25/2011	490,998	TRH	210		
RM ^d	coho		2010	03/15-26/2012	489,429	TRH	38		
Total coho:							248	0	

a/ f = fingerling; y = yearling

b/ Fish with shed CWTs were designated as either spring or fall Chinook based on the date they were trapped at the weirs.

c/ These fish were raised at TRH but were used as screw trap quality control and released off-site within the Trinity River basin.

d/ Since 1996, all coho produced at TRH have received a right maxillary clip (RM). Coho <51 cm FL were classified as brood year 2010 and coho >50 cm FL were classified as brood year 2009. Age cutoff based on fork length distribution.

Table 4. Weekly summary of coho trapped in the Trinity River at Willow Creek during 2012.^a

Julian week	Inclusive dates	Nights trapped	Number trapped				Total trapped	Total RM clips	Fish / night	
			Jacks ^b	RM clip ^c Jacks	Adults	RM clip Adults				
34	20-Aug - 26-Aug	4					0	0	0.0	
35	27-Aug - 2-Sep	5					0	0	0.0	
36	3-Sep - 9-Sep	5			1	1	1	1	0.2	
37	10-Sep - 16-Sep	5			11	10	11	10	2.2	
38	17-Sep - 23-Sep	5			124	110	124	110	24.8	
39	24-Sep - 30-Sep	5	32	30	188	159	220	189	44.0	
40	1-Oct - 7-Oct	5	43	41	58	51	101	92	20.2	
41	8-Oct - 14-Oct	5	20	18	65	60	85	78	17.0	
42	15-Oct - 21-Oct	5	10	10	8	8	18	18	3.6	
43	22-Oct - 28-Oct	5	2	1	18	18	20	19	4.0	
44	29-Oct - 4-Nov	5			7	7	7	7	1.4	
45	5-Nov - 11-Nov	5			2	2	2	2	0.4	
46	12-Nov - 18-Nov	5					0	0	0.0	
Total		Total:	64	107	100	482	426	589	526	
Mean:		Mean:								9.2

a/ Trapping at Willow Creek weir took place August 21 - November 16, 2012 (Julian weeks 34-46).

b/ Coho <51cm FL were considered jacks in 2012.

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

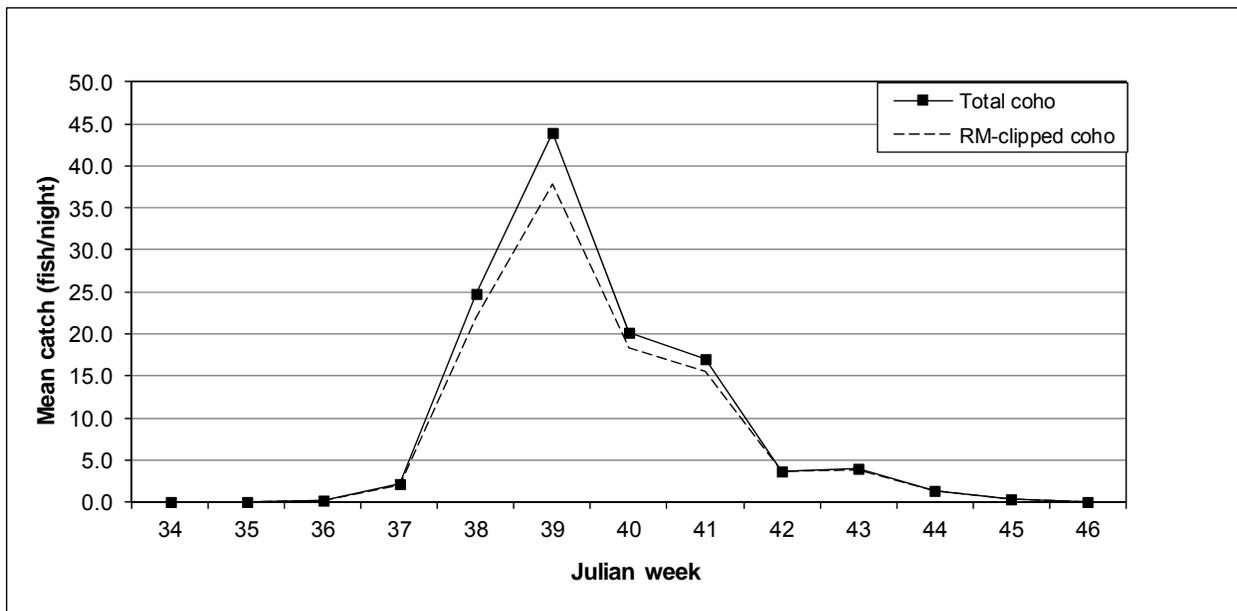


Figure 10. Mean catch of coho trapped in the Trinity River at Willow Creek weir during 2012.

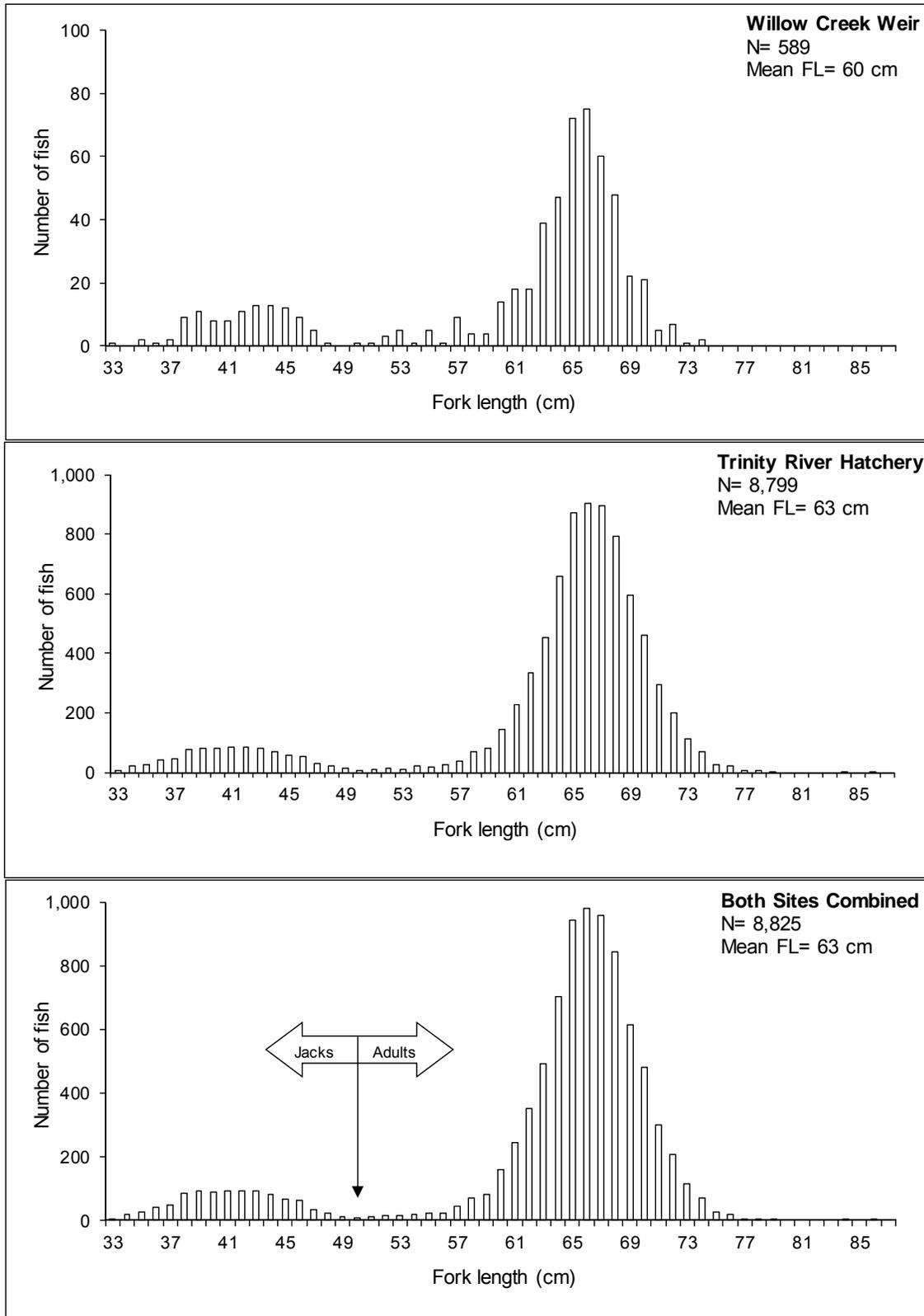


Figure 11. Coho salmon fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery and both sites combined during the 2012-13 season. The arrow denotes the size used to separate jacks and adults for analysis.

Effectively Tagged Fish

There were no coho trapped at JCW in 2012. Of the 589 coho trapped at WCW, 346 (99 jack and 464 adult) were effectively tagged. Due to poor condition (wounds or other stressors) 18 coho trapped at WCW were not tagged. There is no legal recreational coho fishery, so no coho were harvested and seven were caught and released (Appendix 6). To discourage anglers from targeting coho, all coho were tagged with non-reward tags.

Incidence of Fin Clips

Five hundred twenty six (89.3%) of the coho trapped at WCW bore right maxillary (RM) clips (Table 4). Of the 248 coho tagged at WCW and recovered at TRH, 243 had RM clips.

Fall Steelhead

Run Timing

Ten steelhead, all adult, six of them ad-clipped, were trapped at JCW in 2012 (Table 5, Figure 12). Six of the fish were tagged, but because the run-size estimate for steelhead is above WCW, the results of this particular tagging are purely qualitative in nature and not included in run-size estimates.

We trapped 3,610 fall-run steelhead at WCW in 2012 (Table 6, Figure 13); 21 half-pounders (<42 cm FL) and 3,589 adults. The peak of the run was during JW 40 with an average of 152.0 fish trapped per night.

Size of Fish Trapped

Steelhead caught at WCW and TRH averaged 60 and 63 cm FL, respectively (Figure 14), with a mean combined FL for the three sites combined of 62 cm. Adult steelhead (> 41 cm FL) made up 99.4% and 99.5% of the steelhead trapped at WCW and TRH respectively.

Effectively Tagged Fish

Of the 3,610 adult steelhead trapped at WCW in 2012, 3,572 were tagged (only adult fish were tagged, and 47 adults were not tagged due to poor condition). We identified one tagging mortality and anglers reported removing tags from 460 caught and released fish, leaving 3,081 effectively tagged adult steelhead (Appendix 7).

Incidence of Fin Clips

Ad-clips were found on 12 of the 21 half-pounders and 2,130 of the 3,589 adult steelhead for an overall ad-clip rate of 59.3%. Adipose clips were found on 5,685 (99.1%) of the 5,737 adult steelhead trapped at TRH in 2012. All steelhead released from TRH have been ad-clipped prior to release since brood year 1997.

Table 5. Weekly summary of fall-run steelhead trapped in the Trinity River at the Junction City weir during 2012. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped						Fish / night
			Ad-clipped		Ad-clipped		Ad-clipped		
			1/2 lbers ^b	1/2 lbers	Adults	adults ^c	Total	total	
30	23-Jul - 29-Jul	4	0	0	1	1	1	1	0.3
31	30-Jul - 5-Aug	5	0	0	1	1	1	1	0.2
32	6-Aug - 12-Aug	5	0	0	8	4	8	4	1.6
33	13-Aug - 19-Aug	1	0	0	0	2	0	2	0.0
Total:		15	0	0	10	8	10	8	
Mean:									0.7

a/ Trapping at Junction City weir took place July 24 - August 13, 2012 (Julian weeks 30-33).

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.

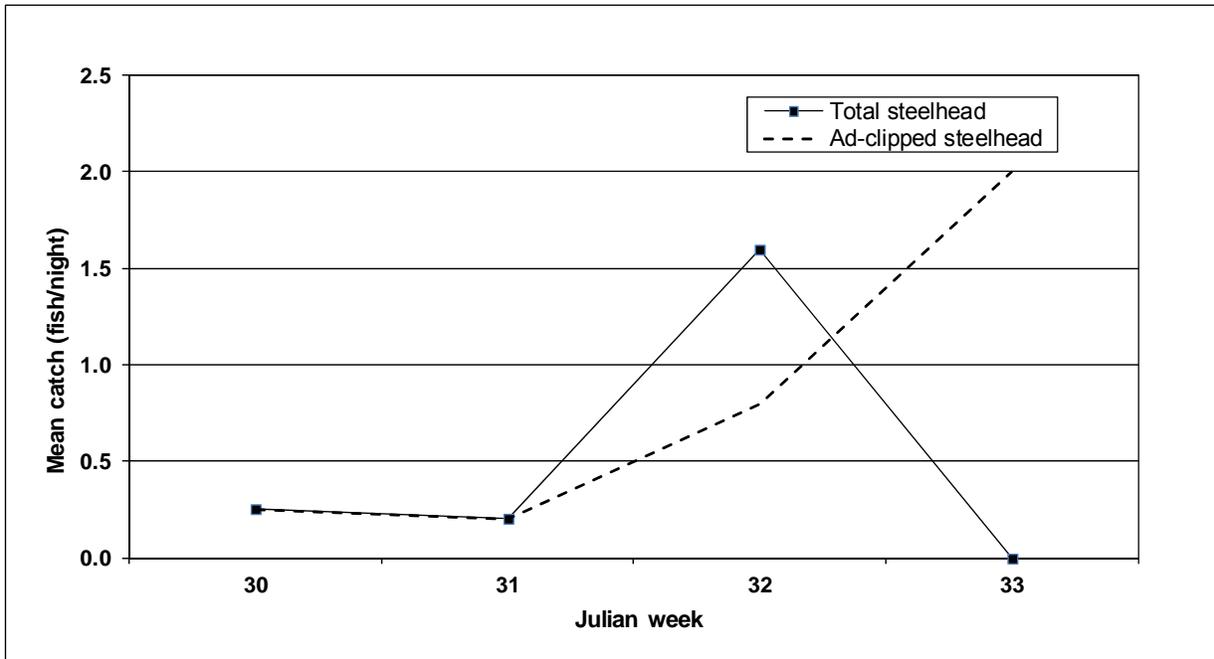


Figure 12. Mean catch of fall-run steelhead in the Trinity River at Junction City weir during 2012.

Table 6. Weekly summary of fall-run steelhead trapped in the Trinity River at Willow Creek weir during 2012.^a

Julian week	Inclusive dates	Nights trapped	Number trapped						Fish/night
			1/2 lbers	Ad-clipped 1/2 lbers ^c	Ad-clipped Adults	Ad-clipped Total	Ad-clip total		
34	27-Aug - 2-Sep	4			110	52	110	52	27.5
35	3-Sep - 9-Sep	5			112	50	112	50	22.4
36	10-Sep - 16-Sep	5	1	0	68	37	69	37	13.8
37	17-Sep - 23-Sep	5			156	89	156	89	31.2
38	24-Sep - 30-Sep	5	3	3	265	153	268	156	53.6
39	1-Oct - 7-Oct	5	4	3	593	377	597	380	119.4
40	8-Oct - 14-Oct	5	1	0	759	492	760	492	152.0
41	15-Oct - 21-Oct	5			212	149	212	149	42.4
42	22-Oct - 28-Oct	5	4	2	599	341	603	343	120.6
43	29-Oct - 4-Nov	5	3	1	300	164	303	165	60.6
44	5-Nov - 11-Nov	5	1	1	361	198	362	199	72.4
45	12-Nov - 18-Nov	5	4	2	48	25	52	27	10.4
46	19-Nov - 25-Nov	5			6	3	6	3	1.2
Total:		64	21	12	3,589	2,130	3,610	2,142	
Mean:									56.4

a/ Trapping at Willow Creek weir took place August 21 - November 16, 2012 (Julian weeks 34-46).

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.

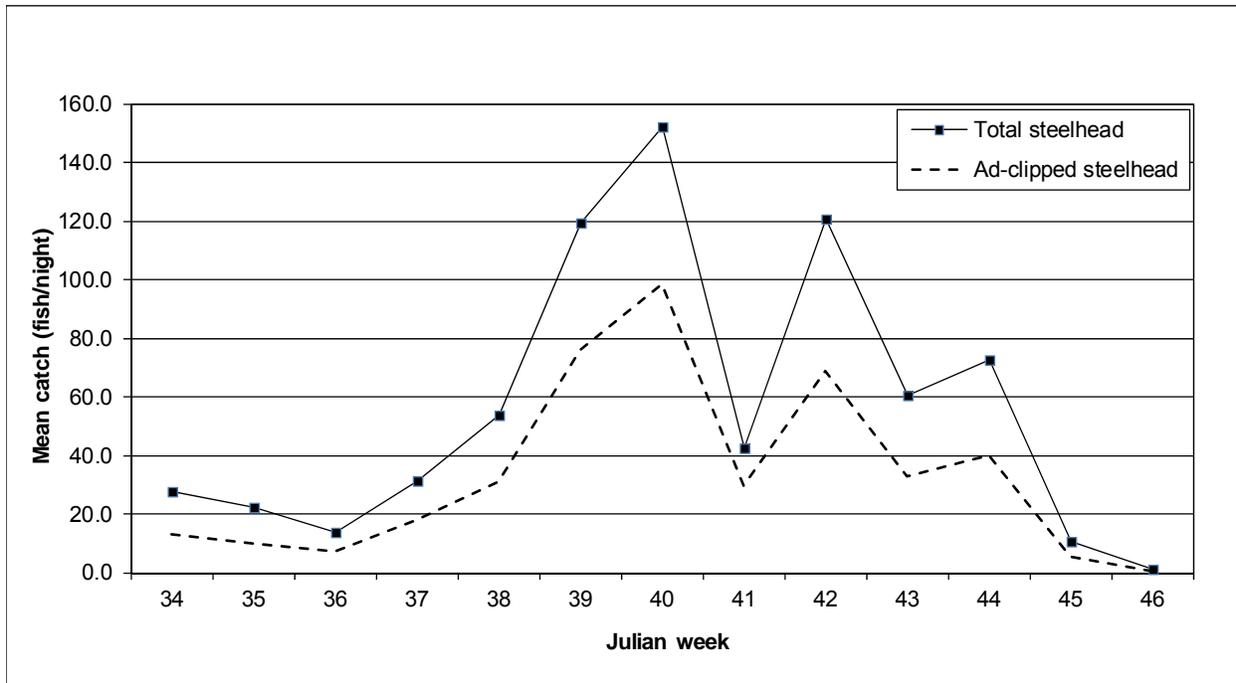


Figure 13. Mean catch of fall-run steelhead in the Trinity River at Willow Creek weir during 2012.

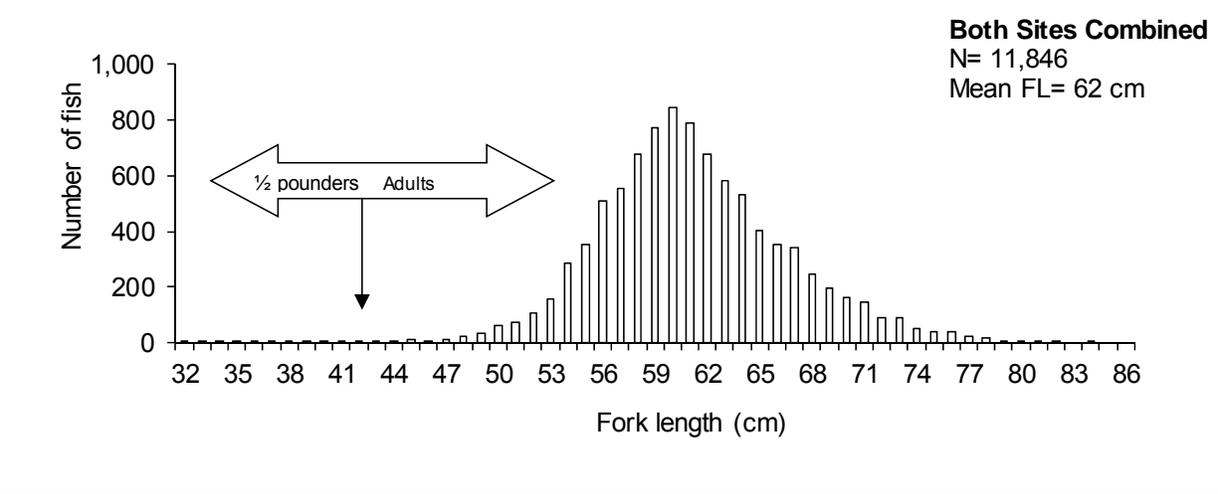
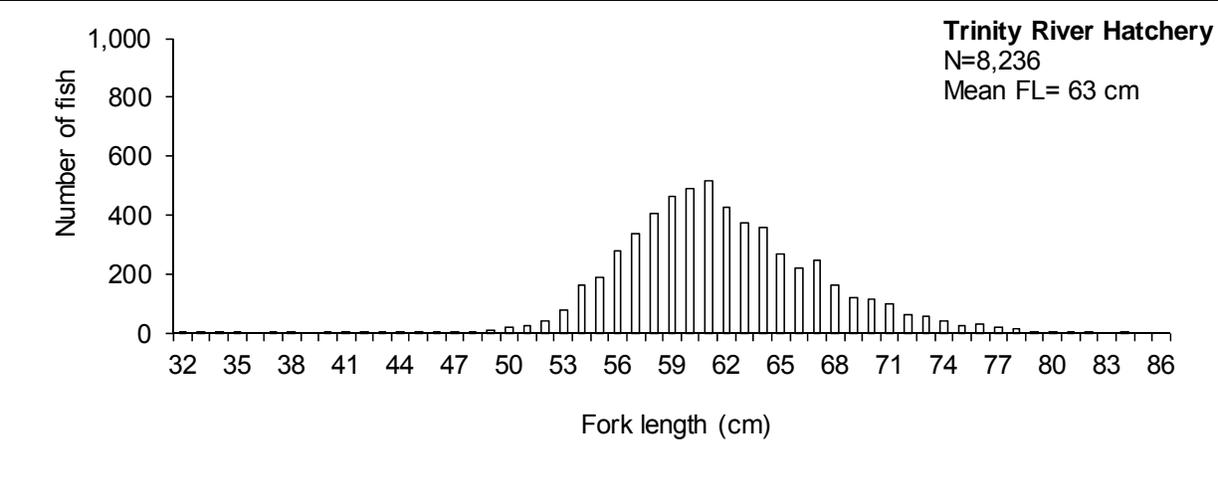
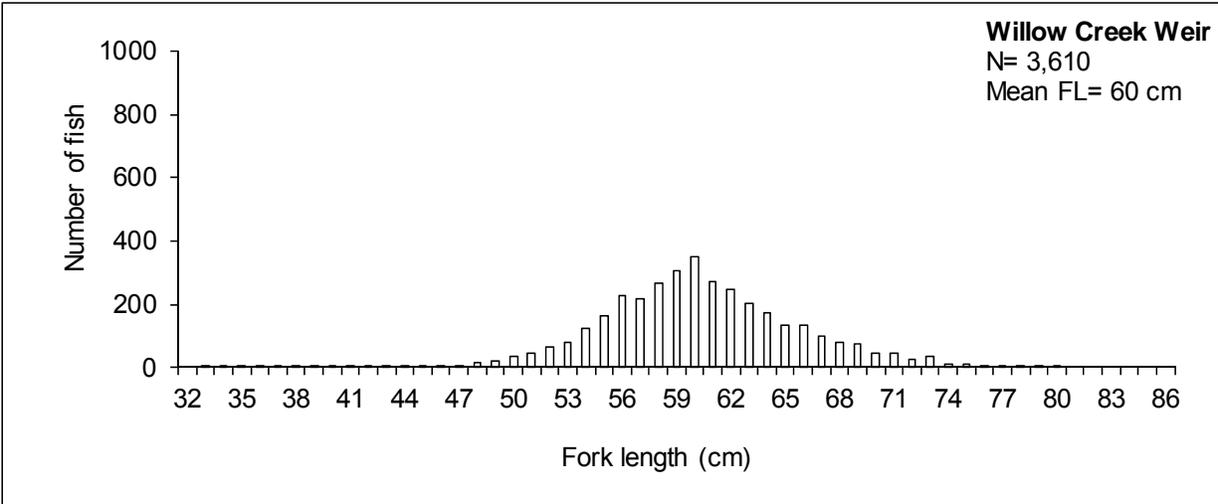


Figure 14. Steelhead fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery and both sites combined during the 2012-13 season. The arrow denotes the size used to separate 1/2 pounders (sub-adults) and adults for analysis.

Brown Trout

Capture Timing

Brown trout capture coincides with the salmonid trapping at JCW, and we tag them for qualitative purposes only. During the 2012 sampling season, 75 brown trout were captured during 15 nights of trapping at JCW (Table 7, Figure 15). The highest catch occurred during JW 40 with a mean fish/night rate of 8.0. There were no brown trout trapped at WCW during 2012.

Size of Fish Trapped

The 75 brown trout caught at JCW had a mean length of 45.2 cm (Figure 16). Brown trout recoveries can be seen in Appendix 8.

Table 7. Weekly summary of brown trout trapped in the Trinity River at Junction City weir during 2012.^a

Julian week	Inclusive dates	Nights trapped	Number trapped	
			Total	Fish/night
30	23-Jul - 29-Jul	4	15	3.8
31	30-Jul - 5-Aug	5	18	3.6
32	6-Aug - 12-Aug	5	40	8.0
33	13-Aug - 19-Aug	1	2	2.0
Total:		15	75	
Mean:				5.0

a/ Trapping at Junction City weir took place July 24 - August 13, 2012 (Julian weeks 30 - 33).

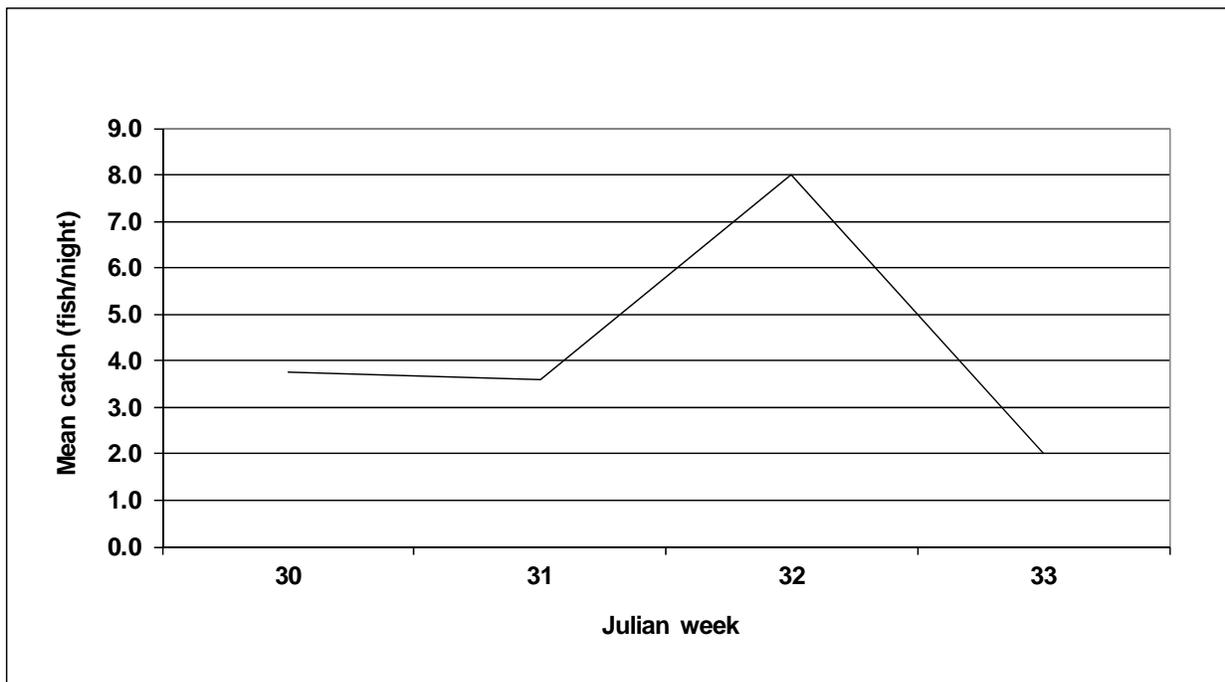


Figure 15. Mean catch of brown trout in the Trinity River at Junction City weir during 2012.

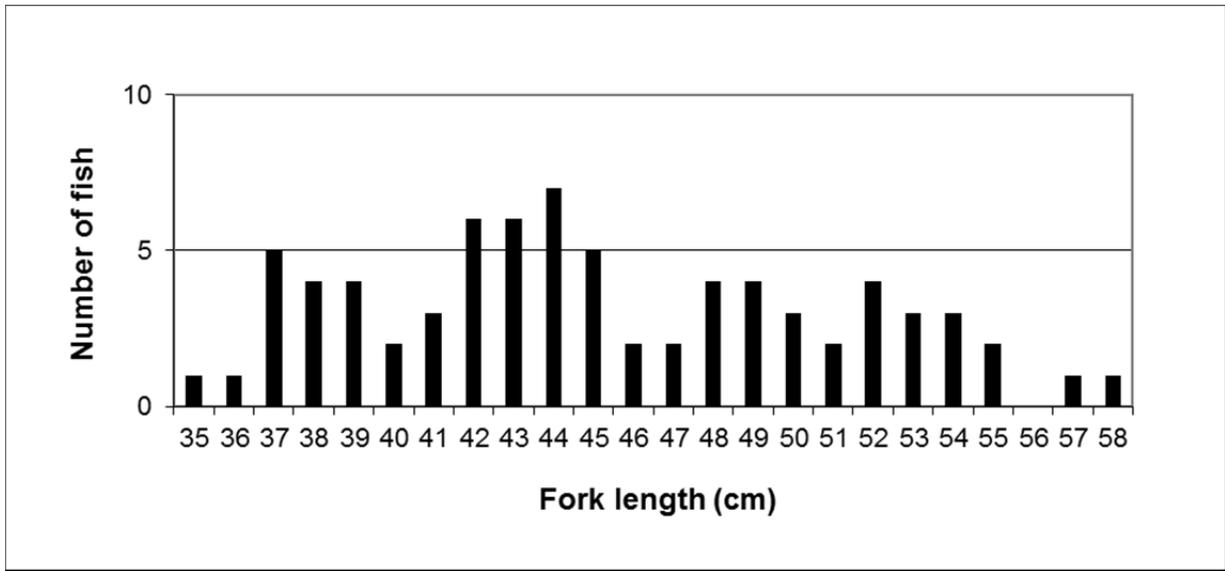


Figure 16. Fork length distribution of brown trout (N=75) trapped in the Trinity River at Junction City weir during 2012.

Recovery of Tagged Fish

Total Recoveries

Fish tagged at JCW and WCW were recovered from four different sources: Angler returns; upper Trinity River spawner surveys, Trinity River Hatchery, and tagging mortalities found on or near the tagging weirs. Length frequencies of spring and fall Chinook, coho, and steelhead tagged at the weirs and subsequently recovered are presented in Appendices 4-7.

Of the 189 tagged spring Chinook at JCW 38.1% were recovered, whereas only 30.2% of the 2,450 fall Chinook tagged at WCW were recovered. Of the 571 coho tagged at WCW, 46.6% were recovered, as was 39.9% of the 3,542 adult fall steelhead tagged at WCW. Most of the recoveries, for all species, occurred at TRH.

Tag Returns by Anglers

Spring Chinook

The reported harvest of one Project-tagged spring Chinook jack is estimated to represent a total harvest of 163 jacks for the season. A reported harvest of nine Project-tagged adult spring Chinook represents an estimated harvest of 1,976 adults. The total harvest rate of Project-tagged spring Chinook upstream of JCW was 20.0% for jacks, 7.96% for adults. There were four adult tags reported from the catch and release fishery (Appendix 4).

Fall Chinook

The reported harvest of one Project-tagged fall Chinook jack represents an estimated harvest of 31 jacks for the season. A reported harvest of 50 Project-tagged adults equates to an estimated harvest of 1,644 adults for the season. The estimated harvest rate of Project-tagged fall Chinook upstream of WCW was 0.6% for jacks and 2.4% for adults. Anglers also reported the catch and release of 33 Project-tagged adults in the catch and release fishery.

Coho Salmon

To discourage the harvest of threatened coho salmon, all coho salmon tagged at WCW received non-reward tags. There was no reported harvest of Project-tagged coho in 2012, though one tag was returned from a jack and six from adults in the catch and release fishery.

Fall Steelhead

Anglers returned 84 tags from Project-tagged adult fall steelhead reported harvested, representing an estimated harvest of 599 fish. An additional 460 Project-tags were returned from the catch and release fishery (Appendix 7). The estimated harvest rate of Project tagged adults was 2.7% overall (0.9% of non-ad clipped fish (which are not legal to keep) and 3.9% of the ad-clipped) Project tagged steelhead.

Spawner Surveys

Main stem Trinity spawner surveys were conducted by Project personnel in cooperation with YTFP, HVTF, USFS and the USFWS from September 05 to December 18, 2012 from TRH to Weitchpec. During the spawner surveys the numbers of Project-tagged recoveries were as follows: Seven spring Chinook (Appendix 4), 69 fall Chinook (Appendix 5), nine coho (Appendix 6) and one fall steelhead (Appendix 7). For additional information on the 2012 spawner survey refer to Task 4 of this report.

Trinity River Hatchery

Operation Dates

Recovery and fish spawning operations occurred from September 04, 2012 (JW 36) through March 12, 2013 (JW 11). The ladder and trap were closed during parts or all of Julian weeks 41-43 to separate the spring and fall runs of Chinook, though during JW 42 it was cleared of 33 fish (none of which were spawned, though heads were removed from ad-clipped fish for their CWTs. The ladder may have been also occasionally closed at the discretion of the hatchery manager for fish health concerns or labor constraints.

Spring Chinook

Spring Chinook began entering TRH as soon as it was opened to them (during JW 36) and continued through JW 42 (Table 10). Recovery of spring Chinook peaked in JW 40 when 1,715 Chinook entered, 376 of which were CWTed (Table 8). Based on run-

timing (ascertained by CWT analysis), an estimated 6,821 (109 jack and 6,712 adult) spring Chinook were recovered at TRH, from which 1,424 readable CWTs were recovered. Using CWT expansion (see Task 2), an estimated 6,002 (hatchery-origin) spring Chinook entered TRH. Of the 183 spring Chinook effectively tagged at JCW, 48 (26.2%) were recovered at TRH.

Fall Chinook

In-season CWT analysis revealed JW 42 (coincident to the scheduled TRH spawning break) as the separation week between the majority of the spring and fall Chinook runs in 2012, though 62 CWTed fall Chinook entered TRH prior to that time (Table 9). The fall run peaked during JW 44 when an estimated 4,793 Chinook entered the facility. An estimated 17,553 fall Chinook (92 jack and 17,461 adult) were recovered at TRH. Using CWT expansion, an estimated 16,757 (hatchery-origin) fall Chinook entered TRH. Of the 2,412 fall Chinook effectively tagged at WCW, 574 (23.8%) were recovered at TRH (Table 10).

Coho Salmon

The first coho entered TRH during JW 40 of 2012. The coho run peaked during JW 47 and the last coho entered TRH during JW 1 of 2013 (Table 10). A total of 8,236 coho (879 jack and 7,357 adults) were recovered at TRH during the season. Two hundred forty eight (44.0%) of the 563 coho effectively tagged at WCW were recovered at TRH.

Of the 8,236 coho entering TRH, 8,030 (97.50%) were observed to have right maxillary (RM) clips, indicating they were of TRH origin, 205 (2.49%) had no clip, and one (0.01%) had a left maxillary clip. The unclipped fish are believed to be either naturally produced coho salmon which entered the hatchery or TRH-produced fish which received no or poor clips prior to release from the hatchery.

Based on length frequency analysis, TRH-produced, RM-clipped coho salmon were apportioned into two brood years. The 871 coho less than 51 cm FL were considered jacks (age 2, from the 2010 brood year) while the 7,159 coho greater than 50 cm FL were considered adults (age 3, from the 2009 brood year). The 206 coho without RM clips which entered the hatchery were also considered jacks or adults based on those lengths.

Table 8. Recoveries at Trinity River Hatchery (TRH) of TRH-origin spring Chinook by coded-wire tag group during the 2012-13 season.

Coded-wire tag number and release type ^c	Brood year	Number of spring Chinook entering TRH, by Julian week ^{a b}											Totals	
		36	37	38	39	40	41	42 ^d	43	44	45	46		
068802-f	2007			1										1
068803-f	2007			1										1
068810-y	2007		1	1			1							3
068811-f	2008	9	5	8	5	1								28
068812-f	2008	4	2	6	12	26	19							69
068813-f	2008	5	2	3	7	7	4	1						29
068819-y	2008	9	4	10	13	11	7							54
068821-f	2009	48	70	132	121	66	12							449
068822-f	2009	15	15	55	122	179	105	4	4					499
068831-f	2009	1	3	15	11	13	4							47
068832-f	2009	5	3	11	13	17	5							54
068836-y	2009	28	22	40	28	34	20							172
068773-f	2010						1							1
068774-f	2010	1	2	1	3	1	2							10
068775-f	2010				1	2	3							6
068776-y	2010						1							1
No CWT ^e		9	3	13	15	19	9							68
Weekly totals:		134	132	297	351	376	193	5	4	0	0	0		
														1,492

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

b/ Entry week was the week that fish were initially sorted; they may have actually entered the hatchery during the previous sorting week.

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

d/ The hatchery was closed to fish entry this week, though the ladder was cleared of stragglers.

e/ No CWT's were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after Julian week 42 were considered fall run.

Table 9. Recoveries at Trinity River Hatchery (TRH) of TRH-origin fall Chinook by coded-wire tag group during the 2012-13 season.

CWT number and release type ^c	Brood year	Number of fall Chinook entering TRH, by Julian week ^{ab}															Totals
		39	40	41	42 ^d	43	44	45	46	47	48	49	50	51	52		
068809-y	2007						2										2
065356-f	2008							1									1
065357-f	2008									1			2				3
065358-f	2008									1	1	2		1			5
065359-y	2008						2			1	3	1	1				8
068814-f	2008				1		5	17	8	6		1					38
068815-f	2008						5	15	10	5	2	1					38
068816-f	2008				1		5	3	8	6	3	3					29
068817-f	2008						4	7	10	5	8	8					42
068818-f	2008							1	2	5	10	4	1				23
068820-y	2008	1	3	7			69	103	94	57	48	28	1	1			412
608080000-f	2008							3		1							4
068823-f	2009				1		50	90	58	21	13	3	1				237
068824-f	2009						37	75	47	22	13	4					198
068825-f	2009				1		5	24	40	19	36	18	2				145
068826-f	2009				1		6	10	21	18	22	15					93
068827-f	2009						5		11	24	25	22	18		1		106
068828-f	2009				1		9	26	33	21	10	8	1				109
068833-f	2009								1	2	2	1					6
068834-f	2009							1	1	2							4
068837-y	2009		11	33			328	708	627	401	311	124	13	1	2		2,559
068777-f	2010							2	2	1			1				6
068778-f	2010		1					2	2	1		1					7
068779-f	2010							1	2		1						4
068780-f	2010							1	1	1		2					5
068781-y	2010						2	3	3								8
068835-f	2010										1		1				2
No CWT ^e							13	31	28	12	9	2	2	1			98
Weekly totals:		1	15	46	0		545	1,126	1012	635	516	249	41	3	3	0	4,192

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

b/ Entry week was the week that fish were initially sorted, although they may have actually entered the hatchery during the previous sorting week.

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

d/ The hatchery was closed to fish entry this week, though the ladder was cleared of stragglers.

e/ No CWTs were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after Julian week 42 were considered fall Chinook.

Table 10. Total number and numbers of Willow Creek weir (WCW) and Junction City weir (JCW) tagged Chinook and coho that entered Trinity River Hatchery (TRH) during the 2012-13 season.^a

Julian week ^b	Inclusive dates	Chinook					Coho		
		Total entering TRH	Spring run tagging site		Fall run tagging site		Total entering TRH	Tagging site	
			JCW	WCW	JCW	WCW		JCW	WCW
36	3-Sep - 9-Sep	564	1						
37	10-Sep - 16-Sep	619	5						
38	17-Sep - 23-Sep	1,281	8						
39	24-Sep - 30-Sep	1,579	11						
40	1-Oct - 7-Oct	1,715	19	2			3		
41	8-Oct - 14-Oct	1,047	3	5			21		
42	15-Oct - 21-Oct	33	1				0		
43	22-Oct - 28-Oct	2,346				93	568	21	
44	29-Oct - 4-Nov	4,793				153	326	10	
45	5-Nov - 11-Nov	4,492				163	1,820	53	
46	12-Nov - 18-Nov	2,610				85	1,942	72	
47	19-Nov - 25-Nov	2,133				56	2,227	57	
48	26-Nov - 2-Dec	1,033				21	805	18	
49	3-Dec - 9-Dec	128				3	426	15	
50	10-Dec - 16-Dec	14					61		
51	17-Dec - 23-Dec	4					27	2	
52	24-Dec - 31-Dec	0					8		
1	1-Jan - 7-Jan	1					2		
2	8-Jan - 14-Jan	0							
3	15-Jan - 21-Jan	0							
4	22-Jan - 28-Jan								
5	29-Jan - 4-Feb								
6	5-Feb - 11-Feb								
7	12-Feb - 18-Feb								
8	19-Feb - 25-Feb								
9	26-Feb - 4-Mar								
10	5-Mar - 11-Mar								
Totals:		24,391	48	7	0	574	8,236	0	248

a/ Trapping at TRH occurred September 4, 2012 - March 12, 2013 (Julian weeks 36-11; closed parts or all of JWs 41-43).

b/ Julian week of spawning or death; the fish may have actually entered the hatchery during a previous week.

Fall Steelhead

Adult steelhead entered TRH in all but one week the fish ladder and trap were open, though they did not arrive in sizeable numbers until the last week of October (JW 43) (Table 11). A total of 5,737 steelhead >41 cm, FL entered TRH during the season. Of the 3,081 adult fall steelhead effectively tagged at WCW, 857 were recovered at TRH. One adult steelhead tagged at JCW was also recovered at TRH.

Ad-clipped steelhead adults composed 59.3 % of the steelhead trapped at WCW (2,130 of the 3,589) and 99.1% (5,685/5,737) of the steelhead that entered TRH this season. Beginning with the 1997 brood year, all steelhead released from TRH have been ad-clipped prior to their release.

Run-size, Angler Harvest, and Spawner Escapement Estimates

Spring Chinook Salmon

An estimated 25,617 (24,804 adult and 813 jack) spring Chinook migrated into the Trinity River basin upstream of JCW. Based on the Poisson Approximation, the 95% confidence interval for the spring Chinook run-size estimate was 19,640 – 34,551 (Table 12). Spawning escapement above JCW was an estimated 23,479, including the 6,821 spring Chinook that entered TRH and 16,658 natural area spawners (Table 13). This year's run-size estimate is approximately 45.1% above the 33 year average spring Chinook run-size of 17,658. Estimated spring Chinook run-size has ranged from 2,381 fish in 1991 to 62,692 fish in 1988 (Appendix 9). We estimate anglers harvested 163 jacks, and 1,976 adult spring Chinook during the 2012 season.

Fall Chinook Salmon

An estimated run-size of 73,666 (68,423 adults and 5,243 jack) fall Chinook migrated into the Trinity River basin upstream of WCW. Based on the Poisson Approximation, the 95% confidence interval for the fall Chinook run-size estimate upstream of WCW was 67,976 – 80,057 (Table 12). Trinity River fall Chinook spawner escapement, upstream of WCW, was estimated at 71,991 (5,212 jack, 66,779 adult) fish, including 17,533 fall Chinook that entered TRH and 54,438 natural area spawners (Table 13). Harvest rates generated from tags applied at WCW were used to estimate 31 jack and 1,644 adult fall Chinook harvested by anglers. The estimated total fall Chinook run-size, upstream of WCW, has ranged from 9,207 fish in 1991 to 147,888 fish in 1986 (Appendix 10). This year's fall Chinook estimated run-size of 73,666 is approximately 67.6% above the 43,950 mean run-size for the years since 1977.

Table 11. Total number of adult steelhead^a (>41 cm FL) entering Trinity River Hatchery (TRH) and number recovered that were tagged at Willow Creek or Junction City weir (WCW) during the 2012-13 season.^b

Julian Week of Entry ^c	Inclusive Dates		Number Entering TRH	Recoveries from	
				WCW	JCW
36	3-Sep	9-Sep	4		
37	10-Sep	16-Sep	1		
38	17-Sep	- 23-Sep	0		
39	24-Sep	- 30-Sep	5		
40	1-Oct	- 7-Oct	6		
41	8-Oct	- 14-Oct	5		
42	15-Oct	- 21-Oct	--		
43	22-Oct	- 28-Oct	149	10	
44	29-Oct	- 4-Nov	79	5	
45	5-Nov	- 11-Nov	228	32	
46	12-Nov	- 18-Nov	29	2	
47	19-Nov	- 25-Nov	144	33	
48	26-Nov	- 2-Dec	477	64	1
49	3-Dec	- 9-Dec	1,461	208	
50	10-Dec	- 16-Dec	350	62	
51	17-Dec	- 23-Dec	83	14	
52	24-Dec	- 31-Dec	14	3	
1	1-Jan	- 7-Jan	229	45	
2	8-Jan	- 14-Jan	308	57	
3	15-Jan	- 21-Jan	241	47	
4	22-Jan	- 28-Jan	159	23	
5	29-Jan	- 4-Feb	435	59	
6	5-Feb	- 11-Feb	370	63	
7	12-Feb	- 18-Feb	439	57	
8	19-Feb	- 25-Feb	50	8	
9	26-Feb	- 4-Mar	145	21	
10	5-Mar	- 11-Mar	173	24	
11	12-Mar	- 18-Mar	179	20	
Totals:			5,763	857	1

a/ Steelhead <42 cm FL are considered sub-adults and were not counted at TRH.

b/ The fish ladder was open August 31, 2012 - March 12, 2013 (Julian weeks 35 -11; closed all or parts of JWs 41-43).

c/ Entry week was the week the fish were initially sorted, although they may have actually entered the hatchery during a previous sorting week.

Coho Salmon

An estimated 18,657 (15,268 adult and 3,389 jack) coho migrated into the Trinity River basin upstream of the WCW in 2012. Based on the Poisson Approximation, the 95% confidence interval for the coho run-size estimate upstream of WCW was 16,515 – 21,181 fish (Table 12). Of the estimated 18,657 fish, 8,236 are estimated to have entered TRH (Table 13), and 10,422 were natural area spawners. There were no tags returned from harvested coho; therefore harvest rates generated from tags applied at WCW were estimated to be zero for both jack and adult. Estimated coho run-size, upstream of WCW, has ranged from 852 fish in 1994 to 59,079 fish in 1987 (Appendix 12). This year's run-size of 18,657 is ranked 13th of the 36 years on record, and is 9.6% above the 17,029 average.

Adult Fall Steelhead

An estimated 20,612 adult fall steelhead migrated upstream of WCW this season. The 95% confidence interval for the estimate, based on the Normal Approximation, was 19,361 – 21,906 adult steelhead (Table 12). The adult steelhead spawning escapement was estimated at 20,012, of which 5,737 entered TRH, leaving 14,275 as natural area spawners. An estimated 92 naturally-produced and 507 TRH produced steelhead were harvested by anglers above WCW (Table 13). In the 28 years for which we have data since 1980, run-size estimates have ranged from 2,972 in 1998 to 53,885 in 2007 (Appendix 13). The mean estimated run-size for fall adult steelhead in the Trinity River above WCW across the period of record is 15,260 fish. This year's run was 35.1% above the average.

Table 12. Run-size estimates and 95% confidence limits for Trinity River basin spring and fall Chinook and coho salmon, and adult fall steelhead during the 2012-13 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	Upstream of Junction City weir	Jacks	6	109	0	813	19,640 - 34,551	Poisson Approximation
		Adults	177	6,712	48	24,804		
		Total	183	6,821	48	25,617		
Fall Chinook	Upstream of Willow Creek weir	Jacks	171	92	2	5,243	67,976 - 80,057	Poisson Approximation
		Adults	2,241	17,461	572	68,423		
		Total	2,412	17,553	574	73,666		
Coho	Upstream of Willow Creek weir	Jacks	99	879	38	3,389	16,515 - 21,181	Poisson Approximation
		Adults	464	7,357	210	15,268		
		Total	563	8,236	248	18,657		
Fall-run steelhead	Upstream of Willow Creek weir	Adults	3,081	5,737	857	20,611	19,361 - 21,906	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 tagging mortalities, fish not tagged and fish which had their tags removed (caught and released).

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

d/ Run-size estimates for coho and fall Chinook were based on the proportion of jacks to adults observed at Willow Creek weir only; while the spring Chinook was based on the Junction City weir and Trinity River Hatchery combined jack/adult ratio.

Table 13. Estimates of Trinity River basin spring and fall Chinook and coho salmon, and adult fall-run steelhead run-size, angler harvest, and spawner escapement during the 2012-13 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	813	20.0%	163	542	109	651
		Adults	24,804	8.0%	1,976	16,117	6,712	22,829
		Total	25,617		2,139	16,657	6,821	23,480
Fall Chinook	Upstream of Willow Creek weir	Jacks	5,243	0.6%	31	5,120	92	5,212
		Adults	68,423	2.4%	1,644	49,318	17,461	66,779
		Total	73,666		1,675	54,438	17,553	71,991
Coho	Upstream of Willow Creek weir	Jacks	3,389	0.0%	0	2,510	879	3,389
		Adults	15,268	0.0%	0	7,911	7,357	15,268
		Total	18,657		0	10,421	8,236	18,657
Fall-run adult steelhead	Upstream of Willow Creek weir	Natural	8,359	1.1%	92	8,215	52	8,267
		Hatchery	12,253	4.1%	507	6,061	5,685	11,746
		Total	20,612		599	14,276	5,737	20,013

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 fall and spring Chinook and steelhead. There was no coho harvest.

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.

DISCUSSION

Before the 2000 Record of Decision (ROD), spring flow releases from Lewiston Dam were much lower than the currently-mandated flows. Historically JCW was installed in the beginning of May, trapping peak numbers of spring Chinook in late May to mid-June. The post-ROD flows in the Trinity River main stem rarely recede to a level low enough to install the JCW in its current location earlier than mid-June, and sometimes not until much later. In 2012 with the water year designation of “Normal” (flow and schedule) adopted by the Bureau of Reclamation, and some late spring rains, the river remained fairly high and JCW could not be installed until 23 July. Confounding the flow issue in 2012 was a series of special releases; flows designed specifically to keep another fish die off like that which occurred in 2002 from repeating itself in the lower Klamath River with the very large run of fall Chinook (381,000) predicted. With the late put-in the JCW sampling amounted to only 15 days before removal was necessitated by the first-in-a-series of increased flow releases from Lewiston dam.

The Willow Creek weir has a greater range of flow it can withstand than JCW. We installed it prior to the scheduled preventative releases, and were able to keep it in, fishing consistently with no rain-event loss of trapping, throughout our season. We pulled WCW in mid-November prior to a major flow event, after the target fish runs had largely ended. We installed three traps at WCW in 2012 so that we would have sufficient trap capacity if we were to get huge amounts of fish, and put the three traps at various depths to make certain that no matter what the flow regime was doing, short of needing a high flow removal, we would have sufficient trap capacity for whatever salmonids came our way. It was a strategy that proved successful. We were able to trap a standard five nights/week schedule and caught 6,808 fish when we average 3,316.

Our escapement estimates are generated by subtracting from the run size estimates the harvest estimates, which are based on Project tags returned by anglers. In 2012, 51 of the 2,412 (2.1%) fall Chinook tags were returned from harvested fish, while 33 (1.4%) were returned from the catch and release fishery. We received 84 tags from harvested steelhead and 460 tags returned from that catch and release fishery. We generally receive tag returns from the steelhead fishery at a much greater rate than the salmon fishery, for reasons which include a much longer steelhead season and what seems to be a higher level of curiosity in the history of the fish expressed by steelhead anglers (who tend to be recreational anglers) than the meat anglers who mainly comprise the Chinook fishery. While the numbers returned are sufficient to generate our harvest estimates we would like to increase the number of tags returned, especially from Chinook anglers.

In 2012 we began to retest some of the assumptions on which our harvest estimate is based. Prodded by the suggestions of Hankin and Bradford (2012) during the TRRP adult review, we used some higher dollar amount tags than is our standard protocol. Repeating a study reported in Heubach, Lau, and Miller, (1992) (see “Table 10” excerpted from that study, below) we used non-reward, \$10 and \$20 tags on both

Chinook and steelhead, though we maintained our standard protocol of applying only non-reward tags to coho.

Table 10. Angler-return rates of non-reward and reward tags applied to fall-run chinook and coho salmon, and fall-run steelhead in the Trinity River at Willow Creek Weir during the 1990 - 91 season.

Species	Effective number of tags applied and returned by anglers ^a									Chi square value	P
	Non-reward tag			\$10 Reward tag			\$20 Reward tag				
	Applied	Returned	(%)	Applied	Returned	(%)	Applied	Returned	(%)		
Fall Chinook	215	4	(1.9)	180	7	(3.9)	79	2	(2.5)	1.5	<.50
Coho	90	1	(1.1)	83	1	(1.2)	83	1	(1.2)	<0.1	<.99
Steelhead	94	11	(11.7)	94	19	(20.2)	80	21	(26.2)	6.1	<.05

a. Corrected for tagging mortalities and tag shedding.

Our tagging results from 2012 (see below) indicate that though there was no statistically significant difference in return between the non-reward tags and the \$10 tags for either species (with chi-squares of 1.748 (steelhead) and 0.264 (Chinook)), nor a significant difference between the \$10 tags and the \$20 tags for either species (with chi-squares of 1.044 (steelhead) and 2.259 (Chinook)) there did appear to be significance between the return rate of the non-reward tags and the \$20 tags (with chi-squares of 5.487 (steelhead) and 4.012 (Chinook)).

Species	Non-reward tag			\$10 Reward tag			\$20 Reward tag		
	Applied	Returned	%	Applied	Returned	%	Applied	Returned	%
Steelhead	1182	147	12.44%	1178	170	14.43%	1182	190	16.07%
Chinook	852	25	2.93%	859	29	3.38%	845	41	4.85%

We plan on continuing this study in 2013, and hope to identify additional incentives to anglers to increase tag return program participation.

Hankin and Bradford (2012) recommended we use the MIXDIST procedure to derive age distributions for our target species thereby eliminating the bias associated with the visual estimates of the nadir. However, the scale-based estimate derived for the fall Chinook age composition process (KRTT, 2013) provides an alternative way to split the jacks and adults (see differences below) for that race. For 2012 we used the fork length distribution for reporting purposes. We will work towards utilizing scale based and MIXDIST in the future.

Strata	FL – Based Run-size Estimate (Nadir)				KRTT – Scale-based Age Comp Run-size			
	TRH	Natural	Harvest	Run size	TRH	Natural	Harvest	Run size
Jack	92	5,120	3	5,243	92	7,164	31	7,287
Adult	17,461	49,317	1,644	68,423	17,461	47,274	1,644	66,379
Total	17,553	54,438	1,675	73,666	17,553	54,438	1,675	73,666

Too few spring or fall Chinook or coho salmon jacks were tagged to generate independent estimates for adults and jacks, therefore we used numbers of adults and jacks combined to generate the total tagged, total recaptured and total recovered fish

when calculating spawning escapement and run-size estimates for each species or race. We then applied JCW only proportion of jacks/adults proportion and the WCW only of jacks/adults proportion for the fall Chinook to come up with the proportion of jacks/adults in each of those respective runs. For coho the division between jacks and adult was made purely by length frequency as no scale data are available. The steelhead estimates above WCW are for adults only.

Unaccounted tagging mortality creates a positive bias in all mark-recapture studies (Hankin 2001). We attempt to account for tagging mortalities through recovery of tagged fish found dead at the weirs and in carcass surveys, although we are not sure all tagging mortalities are found. Most of our tagging mortalities from WCW are observed during the early part of the season when water temperatures are high (near 22° C). We believe that tagging mortality is not a constant rate and is a function of water temperature. This postulation leads to difficulty in applying a potential tagging mortality rate for the season. Hankin (2001) concluded that tagging mortality could substantially positively bias our estimates. Using Hankin's example: If 90% of untagged fish passing WCW survive to arrive at TRH (assuming that they are otherwise programmed to arrive at that destination), but only 75% of WCW tagged fish survive to arrive at TRH, then the approximate positive proportional bias would be almost 30%. We have addressed this concern through our tagging protocol at the weirs. Fish are not tagged if deemed in poor condition or if they have already spawned, and all trapping is suspended if water temperatures exceed 21°C. Even with the extremely large number of fish handled this season, and with increased numbers and lengths of surveys for tagging mortality above the weirs, we found only 11 (0.15%) mortalities of more than 7,082 fish handled at the two weirs.

RECOMMENDATIONS

1. In light of the continued need by the TRRP for the information used to evaluate the objectives outlined in the IAP and the numeric goals stated in the ROD, tagging and recapture operations for adult spring and fall Chinook and coho salmon, and adult fall steelhead in the Trinity River basin should be continued during the migration season, using the capture sites near Willow Creek and somewhere above the North Fork Trinity or Junction City.
2. Continue educating the angling public and try to increase buy-in by the river guides to the angler tag return program. Continue to test assumption that higher tag rewards (incentives) will increase returns.

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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. Fork length (FL) distribution of coded-wire tagged, Trinity River Hatchery (TRH)-produced spring Chinook recovered at TRH during the 2012-13 season. ^a

FL (cm)	Brood Years						
	2007 ^b			2008			
	068802-f	068803-f	068810-y	068811-f	068812-f	068813-f	068819-y
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60						1	1
61							
62							2
63							
64							2
65				1	2		3
66				1		2	1
67				1	1		2
68							2
69					6	2	4
70				1	2		3
71				1	2		1
72				2	3	3	4
73				1	4	2	1
74					1	1	2
75				1	2		5
76				3	4	1	3
77		1		1	4	2	1
78					5	2	2
79				3	2	3	1
80				2	4	1	1
81					4	3	3
82				1	2	2	1
83					4		2
84				1	2		
85					1		
86				3	1	1	3
87				1	3		2
88					2		1
89				1	1		
90						2	1
91			1			2	
92				3	1		
93						1	
94					1		
95			1		1		
96							
97							
98							
99		1					
100			1				
Totals:	1	1	3	28	69	29	54
Mean	99.0	77.0	95.3	78.9	78.7	77.1	74.2

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

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

Appendix 2 (continued). Fork length distribution of coded-wire tagged, Trinity River Hatchery (TRH)-produced spring Chinook recovered at TRH during the 2012-13 season. ^a

Brood Years										Total
2009 ^b					2010					
068821-f	068822-f	068831-f	068832-f	068836-y	068773-f	068774-f	068775-f	068776-y		
						1				1
						1	1			2
										0
						1	2			3
						1		1		2
						1				1
							1			1
				1		4	2			7
1				3						4
				3		1				4
				1	1					2
1				2						3
			1	3						5
		1		8						9
4				6						10
4	3			14						21
6	6		1	17						30
16	14	1	3	15						51
21	19	1	1	14						56
22	22	2	2	5						55
32	30	3		24						89
33	26	4	8	11						84
35	52	6	8	9						116
35	42	6	4	4						95
42	42	4	3	7						102
37	31	1	7	8						86
20	21	4	5	6						68
28	44	1	2	4						85
19	23	4	2	2						54
20	30	1		1						64
18	21	1	1							49
16	13	3	1	2						39
7	14	2	2	1						34
8	8		1							28
7	11	2	1	1						31
4	11		1							25
2	5	1								17
2	3									13
6	2									18
	1									7
1										7
	1									4
2	2									5
										8
										6
										3
										2
										5
										3
										4
										1
										1
										2
										0
										0
										0
										1
										1
449	499	47	54	172	1	10	6	1		1,424
67.3	68.0	67.9	66.8	61.9	53.0	48.0	47.5	47.0		

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

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

Appendix 3. Fork length (FL) distribution of coded-wire tagged, Trinity River Hatchery (TRH)-produced, fall Chinook recovered at TRH during the 2012-13 season.^a

FL (cm)	Brood Year											
	2007	2008										
	068809-y ^b	065356-f	065357-f	065358-f	065359-y	068814-f	068815-f	068816-f	068817-f	068818-f	068820-y	0608080000-f
43												
44												
45												
46												
47												
48												
49												
50												
51												
52												
53												
54												
55												1
56												
57												1
58												
59												1
60												
61												1
62												1
63				1								3
64										1		2
65							1					10
66										1		6
67							1			1		14
68				1		1			2			11
69					1				2			13
70						1			1	1		16
71					1	2	3	1	1			19
72			1		2	2	1		4	1		27
73				1		1		3	3			20
74		1		1	1	3	5	2	5	1		26
75				1		1	2	2	1	2		35
76			1			6	1	1	5			26
77						2	3	3	6	3		24
78					1	5	3	3	2			32
79							1	4	2	1		19
80					1	2	3	3		3		19
81						3	3	1	1			8
82							4		2	1		17
83							3	1	2	1		18
84						1	2	1				9
85						1		1				6
86						2		1				6
87						1				2	2	4
88					1			1				3
89								1		1		3
90									1	1		3
91			1							1		6
92												1
93						2				1		
94												1
95												
96	1					2	2					
97	1											
Totals:	2	1	3	5	8	38	38	29	42	23	412	4
Mean	96.5	74.0	79.7	70.6	75.5	79.0	78.3	78.7	76.1	78.9	75.7	86.5

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

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

Appendix 3 (continued). Fork length (FL) distribution of coded-wire tagged, Trinity River Hatchery (TRH)-produced, fall Chinook recovered at TRH during the 2012-13 season.^a

FL (cm)	Brood Year								
	2009								
	068823-f ^b	068824-f	068825-f	068826-f	068827-f	068828-f	068833-f	068834-f	068837-y
43									1
44									1
45									
46									1
47									2
48									1
49									3
50									
51					1				1
52									3
53									1
54									5
55					1				7
56					1				13
57		1							18
58	3	1							37
59	3	1	1	1	2				55
60	3	2		1					80
61	4	2	3	2	4	3			118
62	6	5	4	1	1	6			161
63	19	16	8	1	10	4			211
64	10	7	7	3	7	3	1		264
65	15	17	11	5	7	11			267
66	19	17	9	9	7	5			230
67	22	20	19	10	12	16	1	1	257
68	18	16	12	8	14	16	1		198
69	15	16	14	12	4	8		1	155
70	21	14	11	11	8	9		1	128
71	13	9	9	7	7	8	1		97
72	15	11	7	9	4	6	1		80
73	17	12	5	1	4	2			49
74	9	5	4	2	3	3	1		43
75	3	4	5	2	5	2			20
76	5	2	1	2	1				18
77	3	7	4	1		3		1	11
78	3	1	4	1	1				9
79	2	5	4		2	2			5
80	3	1	1	1		1			5
81		1	1	1					2
82	1			2		1			1
83	2	2	1						
84	2	1							
85		2							1
86	1								
87									
88									
89									
90									
91									
92									
93									
94									
95									
96									
97									
Totals:	237	198	145	93	106	109	6	4	2,559
Mean	68.8	68.9	69.0	69.2	67.5	68.4	69.3	70.8	65.8

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).
b/ Age at release: f = fingerlings, y = yearlings.

Appendix 3 (continued). Fork length (FL) distribution of coded-wire tagged, Trinity River Hatchery (TRH)-produced, fall Chinook recovered at TRH during the 2012-13 season.^a

FL (cm)	Brood Year					TOTALS	
	2010						
	068777-f ^b	068778-f	068779-f	068780-f	068781-y	068835-f	
43		1			1	46	
44						45	
45	1				3	49	
46	1				2	50	
47					1	50	
48					1	50	
49						52	
50	1			2		53	
51			1			54	
52	1		1	1		58	
53	1	1		1		58	
54		2		1		62	
55		1				65	
56	1					71	
57			2			79	
58						99	
59						124	
60						146	
61		1				199	
62		1				248	
63						336	
64						369	
65						409	
66						369	
67						441	
68						366	
69						310	
70						292	
71						249	
72						243	
73						191	
74						189	
75						160	
76						145	
77						148	
78						143	
79						126	
80						123	
81						103	
82						111	
83						113	
84						100	
85						96	
86						96	
87						96	
88						95	
89						95	
90						95	
91						99	
92						93	
93						96	
94						95	
95						95	
96						101	
97						98	
Totals:	6	7	4	5	8	2	7,944
Mean	50.3	54.6	54.3	51.8	45.6	56.0	

a/ Trapping occurred at TRH September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

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

Appendix 4. Fork length (FL) distribution of spring Chinook trapped and tagged at Junction City (JCW) weir and subsequently recovered during the 2012-13 season. ^a

FL (cm)	JCW		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		
36	1								0	0.0
37	0									--
38										--
39										--
40										--
41										--
42										--
43	1								0	0.0
44	1	1							0	0.0
45	1								0	0.0
46	1								0	0.0
47										--
48										--
49										--
50	1			1					1	100.0
51										--
52										--
53										--
54										--
55										--
56										--
57										--
58	4							1	1	25.0
59	5	1			3				3	60.0
60	4	1			2			1	3	75.0
61	11	2		1	4	1			6	54.5
62	10	1			3				3	30.0
63	13	3		2	5	1			8	61.5
64	13	2		1	6	1			8	61.5
65	12	3			5	1			6	50.0
66	17	2			3	1		1	5	29.4
67	12	1		2	2				4	33.3
68	14	1					1		1	7.1
69	12	3			3	1			4	33.3
70	9	2		2	4	1			7	77.8
71	2	1			1				1	50.0
72	7	3			1				1	14.3
73	9	1			1			1	2	22.2
74	7		1		1				2	28.6
75	4				1				1	25.0
76	4	2			1				1	25.0
77	1								0	0.0
78	2		1		1				2	100.0
79	1				1				1	100.0
80	4								0	0.0
81										--
82	1								0	0.0
83										--
84	1			1					1	100.0
85										--
86										--
87	1								0	0.0
88	1								0	0.0
89										--
90	1								0	0.0
91										--
92	1								0	0.0
Totals:	189	30	2	10	48	7	1	4	72	38.1
Mean FL:	67.0	66.2	76.0	65.9	66.0	65.4	68.0	64.3	66.1	
Total jacks: ^j	6	1	0	1	0	0	0	0	1	16.7
Total adults:	183	29	2	9	48	7	1	4	71	38.8

a/ Trapping at Junction City weir took place July 24 - August 13, 2012 (Julian weeks 30-33). All Chinook trapped at JCW in 2012 were considered spring Chinook.
b/ All spring Chinook trapped at Junction City weir in 2012 were tagged.
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, 2012 - March 12, 2013 (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 <54 cm FL were considered jacks in 2012.

Appendix 5. Fork length (FL) distribution of fall Chinook trapped and tagged at Willow Creek weir (WCW) and subsequently recovered during the 2012-13 season. ^a

FL (cm)	WCW			RECOVERIES							Total Recoveries	% 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			
29	1									0	--	
30										0	--	
31	1	1	1							0	0.0	
32										0	--	
33										0	--	
34										0	--	
35	1									0	--	
36										0	--	
37	1									0	--	
38	1	1								0	0.0	
39	2	2								0	0.0	
40										0	--	
41	10	9								0	0.0	
42	13	13					2			2	15.4	
43	15	14					1			1	7.1	
44	8	8								0	0.0	
45	23	23	1			1				1	4.3	
46	20	20					1			1	5.0	
47	24	23	1							0	0.0	
48	33	32						1		1	3.1	
49	25	25	1		1	1	1			3	12.0	
50	23	22				1				1	4.5	
51	16	16	1			3				3	18.8	
52	13	13	1		1	1				2	15.4	
53	15	15	2		1	2				3	20.0	
54	11	11	2		1	3	1			5	45.5	
55	6	6				1				1	16.7	
56	13	12	1			4				4	33.3	
57	4	4	1			1				1	25.0	
58	14	13	2			5				5	38.5	
59	21	21	4			9				9	42.9	
60	28	27	4			11				11	40.7	
61	45	44	10			17	1		1	19	43.2	
62	64	64	14		1	24			1	26	40.6	
63	108	108	12	1	2	39	3			45	41.7	
64	106	106	13		2	23	4		1	30	28.3	
65	128	127	21	1	3	44	2		1	51	40.2	
66	162	159	22		5	57	4	1	1	68	42.8	
67	150	145	18		4	38	10		2	54	37.2	
68	190	188	24		6	51	6	1	4	68	36.2	
69	146	145	17	1	6	39	7		5	58	40.0	
70	163	161	23	1	6	46	5		4	62	38.5	
71	116	114	11		3	31	4		1	39	34.2	
72	102	101	8		1	24	1			26	25.7	
73	77	73	5			15	6		1	22	30.1	
74	84	83	14			16				16	19.3	
75	70	68	8		1	14	1	1	2	19	27.9	
76	67	65	4			11	1		1	13	20.0	
77	61	58	6			8	1	1	1	11	19.0	
78	39	37	4		2	7	1			10	27.0	
79	45	45	5		1	2	1	1		5	11.1	
80	34	34	1		1	3	1		2	7	20.6	
81	21	19	1			5				5	26.3	
82	28	25				4				4	16.0	
83	17	16	2			3	2			5	31.3	
84	21	21				2				2	9.5	
85	18	18				1				1	5.6	
86	13	13		1			1			3	23.1	
87	14	13	2		1	4				5	38.5	
88	13	13				1	1			2	15.4	
89	8	8	1						1	1	12.5	
90	12	12								0	0.0	
91	9	9	1			2			1	3	33.3	
92	6	6	1					1	1	2	33.3	
93	3	3								0	0.0	
94	3	3							1	1	33.3	
95	6	5							1	1	20.0	
96	1	1								0	0.0	
97	2	2								0	0.0	
98	1	1								0	0.0	
99	3	3			1					1	33.3	
100	1	1								0	0.0	
101	0	0								0	--	
102	1	1	1							0	0.0	
103	0	0								0	--	
104	0	0								0	--	
105	1	1								0	0.0	
Totals:	2,501	2,450	271	5	51	574	69	7	33	739	30.2	
Mean FL:	68.0	68.0	67.9	70.6	68.7	67.8	67.9	72.1	73.2	68.2		
Total jacks: ^j	178	171	4	0	1	2	5	1	0	9	5.3	
Total adults:	2,323	2,279	267	5	50	572	64	6	33	730	32.0	

a/ Trapping at Willow Creek weir took place August 21 - November 16, 2012 (Julian weeks 34-46). All Chinook trapped after JWeek 34 were considered fall Chinook.
b/ Fifty-one (7 jack and 44 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, 2012 - March 12, 2013 (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 <50 cm FL were considered jacks in 2012.

Appendix 6. Fork length (FL) distribution of coho trapped and tagged at Willow Creek weir (WCW), and subsequently recovered during the 2012-13 season.^a

FL (cm)	WCW			RECOVERIES							Total Recoveries	% Recoveries
	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			
33	1									0	--	
34										0	--	
35	2	1	1			1				1	100.0	
36	1		1							0	--	
37	2	1	2							0	0.0	
38	9	7	7			3				3	42.9	
39	11	10	10			3				3	30.0	
40	8	8	8			3				3	--	
41	8	8	8			3				3	37.5	
42	11	11	11			7				7	63.6	
43	13	13	13			5				5	38.5	
44	13	13	12			5				5	38.5	
45	12	12	12			5				5	41.7	
46	9	9	9			2			1	3	33.3	
47	5	5	4			1				1	20.0	
48	1	1	1							0	0.0	
49										0	--	
50	1	1	1							0	0.0	
51	1	1	1							0	0.0	
52	3	3	3			1				1	33.3	
53	5	4	4						1	1	25.0	
54	1	1	1							0	0.0	
55	5	5	5	1						1	20.0	
56	1	1	1							0	0.0	
57	9	8	9			3			1	4	50.0	
58	4	4	4			3				3	75.0	
59	4	4	4							0	0.0	
60	14	14	13			6				6	42.9	
61	18	17	17			9				9	52.9	
62	18	17	17			10				10	58.8	
63	39	39	35			18	1		1	20	51.3	
64	47	46	43			20	3			23	50.0	
65	72	72	64			34	1		1	36	50.0	
66	75	74	69			36	1	1		38	51.4	
67	60	60	53			29				29	48.3	
68	48	44	40			21	1			22	50.0	
69	22	22	18			7				7	31.8	
70	21	20	15			8	1		1	10	50.0	
71	5	5	4			2			1	3	60.0	
72	7	7	5			3	1			4	57.1	
73	1	1	1							0	0.0	
74	2	2								0	0.0	
Totals:	589	571	526	1	0	248	9	1	7	266	46.6	
Mean FL:	60.8	61.1	60.5	55.0	--	61.7	66.2	66.0	60.7	61.8		
Total jacks: ^j	106	100	100	0	0	38	0	0	1	39	39.0	
Total adults:	482	471	426	1	0	210	9	1	6	227	48.2	

a/ Trapping at Willow Creek weir took place August 21 - November 16, 2012 (Julian weeks 34-46).

b/ Eighteen (7 jack and 11 adult) coho were not tagged due to poor condition.

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

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

e/ Fish reported as harvested by angler

f/ Trapping occurred at Trinity River Hatchery September 4, 2012 - March 12, 2013 (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/ Coho <51 cm FL were considered jacks in 2012.

Appendix 7. Fork length (FL) distribution of fall run steelhead trapped and tagged at Willow Creek weir (WCW) and subsequently recovered during the 2012-13 season. ^a

FL (cm)	WCW			RECOVERIES							Total Recoveries	% 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			
33	2		2							0	--	
34	1		1							0	--	
35	5		3							0	--	
36	3		2							0	--	
37	2		1							0	--	
38	3		2							0	--	
39	1									0	--	
40	1									0	--	
41	3		1							0	--	
42	2	1	1							0	0.0	
43	3	2								0	0.0	
44	5	5	1			1				1	20.0	
45	6	5							1	1	20.0	
46	8	8							2	2	25.0	
47	9	9	1						1	1	11.1	
48	16	16	1			1			4	5	31.3	
49	24	24	3		1	1			3	5	20.8	
50	37	37	12			4			13	17	45.9	
51	46	46	12			2			8	10	21.7	
52	66	66	26		2	7			15	24	36.4	
53	79	77	37		2	9			9	20	26.0	
54	124	120	54		3	12			22	37	30.8	
55	163	160	73		1	24			25	50	31.3	
56	229	224	127		5	40			43	88	39.3	
57	218	213	124		5	45			28	78	36.6	
58	270	268	152		12	62		1	43	118	44.0	
59	307	306	184	1	8	81		1	32	123	40.2	
60	352	348	245		15	104			43	162	46.6	
61	274	272	185		3	85			38	126	46.3	
62	249	246	151		5	76		1	26	108	43.9	
63	205	203	142		2	74			15	91	44.8	
64	173	171	117		2	52			24	78	45.6	
65	134	133	87		3	32			17	52	39.1	
66	135	133	91		7	40			13	60	45.1	
67	98	96	63		1	25			13	39	40.6	
68	81	80	49			11	1		7	19	23.8	
69	75	73	50		2	18			7	27	37.0	
70	44	44	28		1	12		1	3	17	38.6	
71	47	46	34		3	11		1	4	19	41.3	
72	28	28	22		1	8				9	32.1	
73	35	35	23			8			2	10	28.6	
74	13	13	11			3			1	4	30.8	
75	11	11	10			2				2	18.2	
76	9	9	5			4			1	5	55.6	
77	6	6	4			2				2	33.3	
78	4	4	2						1	1	25.0	
79	3	3	2			1				1	33.3	
80	1	1	1							0	0.0	
Totals:	3,610	3,542	2,142	1	84	857	1	5	464	1,412	39.9	
Mean FL:	60.2	60.4	61.1	59.0	60.4	61.4	68.0	64.0	59.1	60.6		
Total 1/2lbbers	21	0	12	0	0	0	0	0	0	0		
Total adults ^j :	3,589	3,542	2,130	1	84	857	1	5	464	1,412	39.9	

a/ Trapping at Willow Creek weir took place August 21 - November 16, 2012 (Julian weeks 34-46).

b/ Sixty eight steelhead were trapped but not tagged at WCW in 2012, 21 half-pounders (too small) and 47 adult (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 angler.

f/ Trapping occurred at Trinity River Hatchery September 4, 2012 - March 12, 2013 (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/ Adult steelhead are all those > 41 cm FL.

Appendix 8. Fork length (FL) distribution of brown trout trapped and tagged at Junction City weir (JCW) and subsequently recovered during the 2012-13 season.^a

FL (cm)	JCW	RECOVERIES							
	Total Trapped/ Tagged ^b	Tag Morts ^c	Angler Harvest ^d	TRH ^e Recoveries	Carcass ^f Recoveries	Found Tags ^g	Angler Released ^h	Total Recoveries	% Recoveries
35	1							0	0.0
36	1							0	0.0
37	5							0	0.0
38	4							0	0.0
39	4							0	0.0
40	2						1	1	50.0
41	3							0	0.0
42	6						1	1	16.7
43	6					1		1	16.7
44	7							0	0.0
45	5							0	0.0
46	2							0	0.0
47	2		1					1	50.0
48	4							0	0.0
49	4							0	0.0
50	3							0	0.0
51	2							0	0.0
52	4							0	0.0
53	3							0	0.0
54	3							0	0.0
55	2							0	0.0
56								0	--
57	1							0	0.0
58	1							0	0.0
Totals:	75	0	1	0	0	1	2	4	5.3
Mean FL:	45.2	--	47.0	--	--	43.0	41.0	43.0	

a/ Trapping at Junction City weir took place July 24 - August 13, 2012 (Julian weeks 30-33).

b/ All the brown trout trapped were tagged at JCW in 2012.

c/ Fish found dead / unspawned within 30 days of tagging are considered tagging mortalities, of which there were no BT in 2012.

d/ Fish reported as harvested by anglers.

e/ Trapping occurred at Trinity River Hatchery September 4, 2012 - March 12, 2013 (JWs 36-11; closed parts or all of JWs 41-43).

f/ Fish recovered in upper Trinity River spawner surveys.

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

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

Appendix 9. Spring Chinook run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Junction City weir, 1977 – 2012.

Year	Run-size estimate					Spawner escapements						Angler harvest			
	Jacks ^d		Adults		Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total	
	Number	Percent	Number	Percent		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	b/	760
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	c/	863
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	c/	298
1993	68	1.3	5,164	98.7	5,232	37	2,111	2,148	31	2,630	2,661	0	423	c/	423
1994	1,793	26.4	4,995	73.6	6,788	550	2,897	3,447	944	1,943	2,887	299	155	c/	454
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	c/	1,513
1997	768	3.8	19,271	96.2	20,039	543	13,049	13,592	225	4,892	5,117	0	1,330	c/	1,330
1998	802	5.0	15,365	95.0	16,167	567	9,057	9,624	184	4,679	4,863	51	1,629	c/	1,680
1999	1,028	9.1	10,265	90.9	11,293	440	5,968	6,408	547	3,671	4,218	41	626	c/	667
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	c/	1,807
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
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
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
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
2005	55	0.4	13,929	99.6	13,984	30	6,003	6,033	25	6,966	6,991	0	961		961
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
2007	135	0.9	14,700	99.1	14,835	80	8,154	8,234	55	5,981	6,036	0	565		565
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
2009	260	3.5	7,166	96.5	7,426	191	3,724	3,915	69	3,000	3,069	0	442		442
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
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
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

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

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

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

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

Appendix 10. Fall Chinook run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 – 2012.

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	b/	0
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	c/ 5,596
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	c/ 472
1993	3,381	32.2	7,104	67.8	10,485	2,473	5,898	8,371	736	815	1,551	172	391	c/ 563
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	c/ 807
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	c/ 3,333
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	c/ 1,862
1997	3,767	17.6	17,580	82.4	21,347	2,845	11,507	14,352	820	5,387	6,207	102	686	c/ 788
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	c/ 2,267
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	d/ 545
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	d/ 1,583
2001	1,214	2.1	55,895	97.9	57,109	914	36,152	37,066	204	17,971	18,175	96	1,772	d/ 1,868

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 1999-2012 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 and 67,600 in 2012.

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

Appendix 10 (continued). Fall Chinook run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 – 2012.

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			
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	d/ 727
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	d/ 2,022
2004 NATURAL	3,210	90	369	10	3,578	2,941	-223	2,718	70	595	664	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	d/ 708
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	d/ 956
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	d/ 124
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	d/ 1,028
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	d/ 475
2009 NATURAL	5,733	29.4	13,788	70.6	19,521	5,602	12,537	18,139	-9	921	912	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	d/ 704
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	d/ 315
2011 NATURAL	14,028	29.3	17,482	36.5	47,944	29,530	15,470	45,000	146	1,688	1,834	786	327	1,113
2011 TRH	1,694	5.2	12,194	37.1	32,875	2,997	15,340	18,337	1,694	12,194	13,888	124	524	648
2011 TOTAL	15,722	19.5	63,337	78.4	80,819	32,527	30,810	63,337	1,840	13,882	15,722	910	851	d/ 1,761
2012 NATURAL	4,514	11.0	36,416	89.0	40,931	4,530	34,702	39,232	-42	838	796	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	d/ 2,448

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 1999-2012 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 and 67,600 in 2012.

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

Appendix 11. Coho salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2012.

YEAR	Run-size estimate					Spawner escapements						Angler harvest		
	Number		Percent		Total	Natural Area Spawners ^a			Trinity River Hatchery			Jacks	Adults	Total
	Jacks ^e		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 ^b		0
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

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

b/ The 1978 sport harvest of coho was essentially eliminated by a salmon fishing closure beginning August 25, 1978.

c/ The 1985 sport harvest of adult coho was limited by a closure for the taking of salmon greater 55 cm total length beginning September 22, 1985.

d/ The 1996-2012 sport fishery was closed to the take of coho salmon.

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

Appendix 12. Fall-run adult steelhead run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2012.

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				6,661				599	1,345	
1984			"		7,833				6,430				142	1,261	
1985			No estimates			No estimates						461	No estimates		
1986			"			"						3,780	"		
1987			"			"						3,007	"		
1988	No estimates for hatchery/wild component				12,743	11,926 ^d						817	"		
1989			"		37,276	28,933						4,765	3,578		
1990			"		5,348	3,188						930	1,230		
1991			"		11,417	8,631						446	2,340		
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			429	No estimates	
1998			"		2,972	"			2,463	"			441	68 ^e	
1999			"		5,470	"			3,817	"			1,571	82 ^e	
2000			"		8,042	"			7,097	"			768	177 ^e	
2001			"		12,638	"			9,938	"			2,333	367 ^e	
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	

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

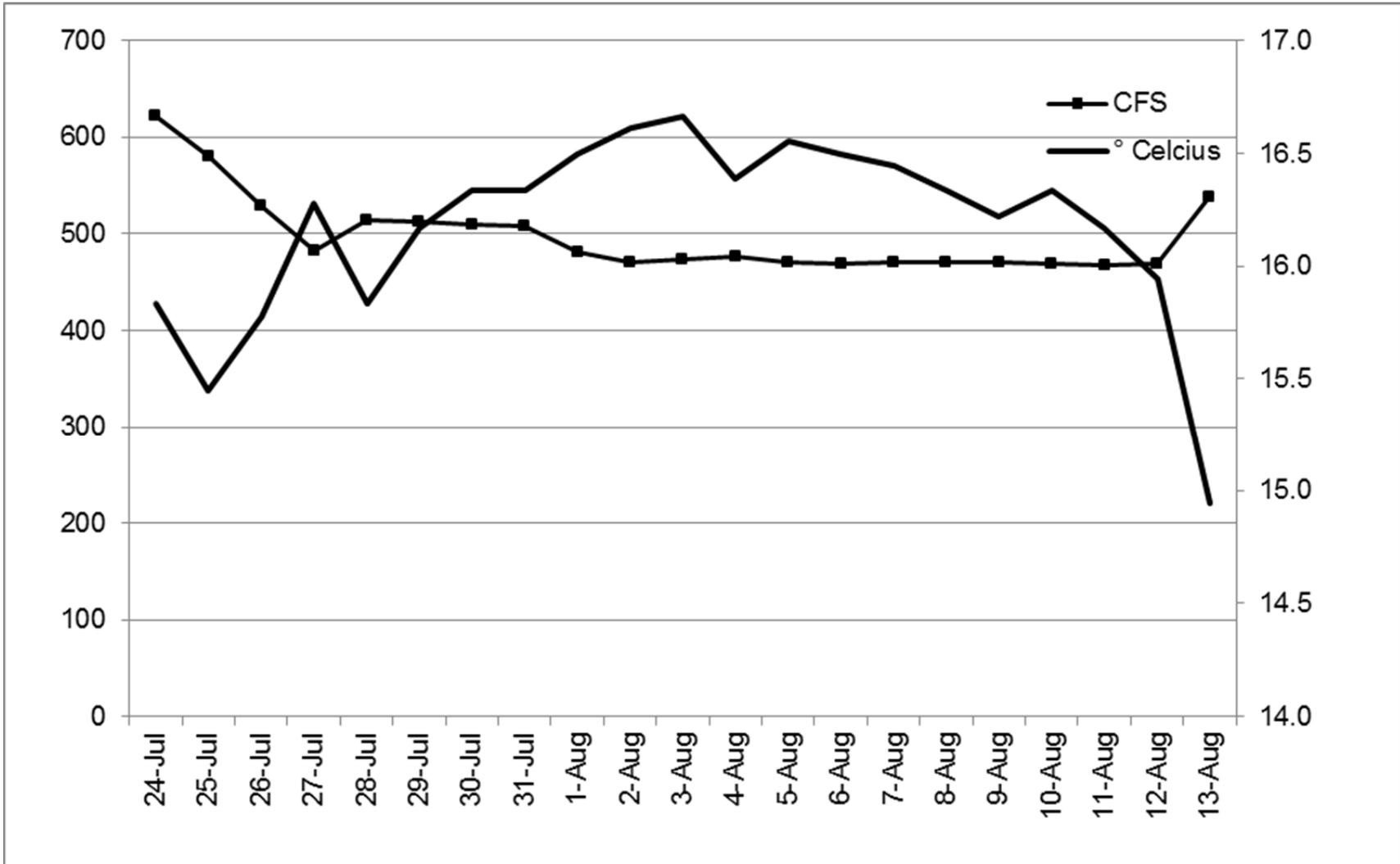
b/ Trinity River Hatchery-produced steelhead.

c/ Naturally produced steelhead.

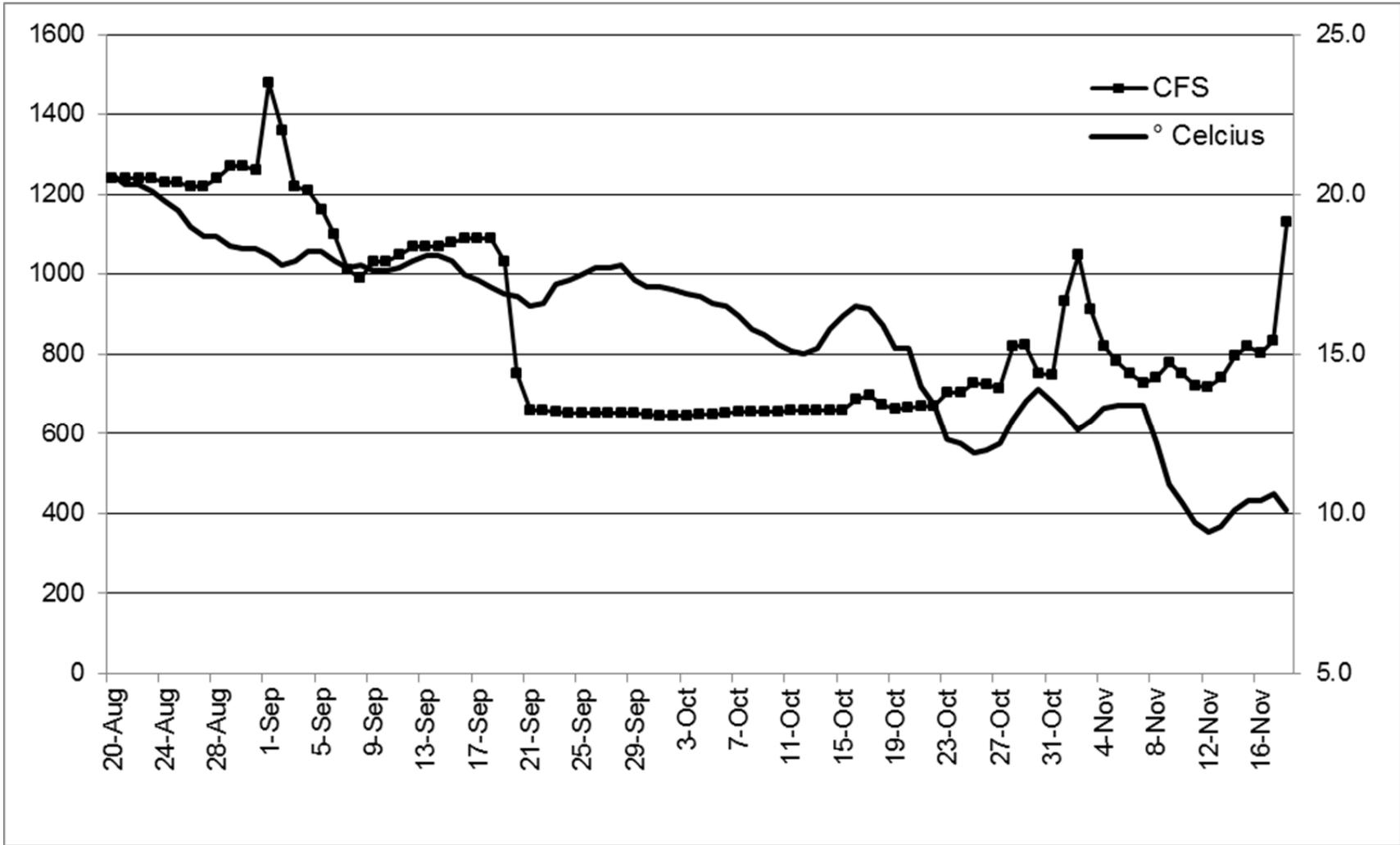
d/ The natural spawner escapement reflects an overestimate due to the unknown number of fish harvested by anglers upstream of Willow Creek Weir.

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

Appendix 13. Daily mean flow (CFS) recorded at USGS gauge (11526250) and water (°C) temperature for Trinity River near Junction City, 2012.



Appendix 14. Daily mean flow (CFS) recorded at USGS gauge (11530000) and water (°C) temperature for Trinity River near Willow Creek weir.



**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2012-13 SEASON**

**TASK 2
RUN-SIZE ESTIMATES OF NATURALLY- AND HATCHERY-PRODUCED TRINITY
RIVER CHINOOK SALMON**

by

Mary Claire Kier and John Hileman

ABSTRACT

An estimated run-size of 9,310 naturally-produced (9,059 adult) and 16,307 hatchery-produced (15,745 adult) spring-run Chinook (*Oncorhynchus tshawytscha*) returned upstream of Junction City weir and a run-size of 40,931 naturally-produced (36,416 adult) and 32,735 (32,007 adult) hatchery-produced fall-run Chinook salmon returned to the Trinity River above the Willow Creek weir during the 2012-13 season. The annual adult escapement goals set by the TRRP for Trinity River are 6,000 naturally-produced and 3,000 hatchery-produced adult spring-run (spring) Chinook and 62,000 naturally-produced and 9,000 hatchery-produced adult fall-run (fall) Chinook. For the 2012 season, the escapement of naturally-produced spring Chinook met approximately 139.3% of the TRRP production goal and the escapement of natural fall Chinook was approximately 57.3% of the goal.

Coded wire tag release group return rates (expressed as a percentage of release numbers) for the completed 2007 BY ranged from 0.09 to 0.65% for spring Chinook CWT groups, and from 0.07 to 0.95% for fall Chinook groups.

TASK OBJECTIVES

- To determine relative return rates and the contribution to spawning escapement and in-river sport fisheries made by naturally- and hatchery-produced Chinook salmon, and to evaluate hatchery management practices aimed at increasing adult returns, while reducing competition between hatchery- and naturally-produced salmon.
- Develop in-river cohort reconstructions for hatchery Chinook and evaluate cohort performance or year class strength, and population growth rate.

INTRODUCTION

A key objective of Task 2 is to estimate adult (age ≥ 3) escapement of naturally- and hatchery-produced stocks of spring-run (spring) and fall-run (fall) Chinook salmon (*Oncorhynchus tshawytscha*). Total in-river run estimates are derived from methods and data provided in Task 1 of this annual report. The escapement data provide short-term feedback to management actions and adds to long term trend analysis needed to help the Trinity River Restoration Program (TRRP) assess natural salmonid escapement objectives. Task 2 also provides return rate estimates from coded-wire-tagged groups of hatchery produced fingerling and yearling Chinook. These data provided a basis for Chinook salmon cohort reconstructions and are used to evaluate annual cohort performance.

California Department of Fish and Wildlife's (CDFW) Trinity River Hatchery (TRH) personnel annually propagate and release approximately 4.3 million juvenile Chinook salmon (Chinook). These include approximately 1.4 million spring and 2.9 million fall Chinook. The Chinook produced at TRH are mitigation for the loss of salmon and their habitat in the Trinity River upstream of Lewiston Dam. About two-thirds of the Chinook are released into the river from TRH in early June as "fingerlings" and the remaining fish are released in early October as "yearlings". Before they are released, approximately 25% receive coded-wire-tag (CWT) implants and adipose fin clips (ad-clips) to identify them. The Hoopa Valley Tribal Fisheries Department (HVTF) conducts CWT implanting operations at TRH and CDFW's efforts are directed at recovery and analysis of the information collected from CWTs.

Run-size estimates for spring and fall Chinook are produced utilizing a Peterson type mark and recapture methodology. "Chinook escapement" is the number of Chinook that survive sport harvest (or associated mortality) to return to the Trinity River basin to either spawn in the river or return to TRH. The escapement and harvest data provide information to help evaluate TRH and Trinity River Restoration Project (TRRP) management goals, and provide baseline data describing the current status and trends in TRH- and naturally-produced Chinook in the Trinity River basin. The annual escapement goals for Trinity River fall Chinook are 62,000 naturally produced and 9,000 hatchery produced fish. Escapement goals for spring Chinook are 6,000 naturally produced and 3,000 hatchery fish. These goals are mandated in the United States Department of Interior Record of Decision (2000) and have been incorporated into the TRRP's Integrated Assessment Plan (TRRP 2009).

This study is a continuation of previous studies conducted by the CDFW and is reliant on data presented in previous years of this annual report.

METHODS

Marking of Chinook Salmon at Trinity River Hatchery

Hoopa Valley Tribal Fisheries implant CWTs in the snouts of approximately 25% of all Chinook produced at TRH. Each fish implanted with a CWT is also marked with an ad-clip which identifies them as tagged. Before their release into the river HVTF conducts quality control to ascertain the true number of marked individuals after subtracting for fish with shed tags, poor ad-clips and mortalities. The estimated number of effectively tagged and ad-clipped fish is recorded on standard release forms and sent to the CDFW tagging coordinator for dissemination. The release forms detail the number of fish marked, the corresponding CWT tag code used for individual lots of fish and the estimated number of un-marked fish that are part of the lot. The number of marked fish plus the number of un-marked fish are summed and then divided by the number of marked fish to produce an expansion multiplier. The multiplier is used to estimate the number of hatchery produced fish for each CWT recovery (i.e. approximately four for every recovery). TRP staff maintain a file of all CWT codes, the corresponding biological information (species, brood year, race, size at release, date of release) and the expansion for each code. This information is then used to develop total hatchery contribution rates for escapement and harvest above weir sites in the Trinity River basin.

Chinook Processing at Main Stem Weirs

We examine all salmon captured at two main stem Trinity River weirs (near the towns of Junction City and Willow Creek). The upper site, Junction City weir (JCW), is located approximately 47 rkm downstream of Lewiston Dam, the uppermost point of anadromy. The lower site, Willow Creek weir (WCW), is located 143 rkm downstream of Lewiston dam and approximately 36.5 rkm upstream of the Trinity River and Klamath River confluence near Weitchpec.

Both weirs are operated to capture a sample of migrating salmon and steelhead using mark-recapture methods (See Task 1 of this report for complete methods and results). The JCW is operated to estimate spring Chinook runs, while WCW is utilized to estimate fall Chinook runs as well as coho and adult fall-run steelhead runs. At both weir sites all Chinook captured are examined for the presence or absence of adipose fins, as well as other biological information such as length, scarring, predator wounds, disease presence etc. A missing adipose fin indicates the fish is of hatchery origin and should contain a CWT. Each Chinook deemed in good condition is tagged with a serially numbered Floy Tag and Manufacturing, Inc. FT-4¹ spaghetti tag (Project-tagged) and immediately released. After the weirs are removed for the season the number and ratio of ad-clipped to non-ad-clipped Chinook is used to estimate the proportion of each run that is of hatchery origin.

¹ The use of brand or trade names is for identification purposes only, and does not imply the endorsement of any product by the CDFW.

Coded-Wire Tag Recovery

Trinity River Hatchery

All Chinook salmon which enter TRH are examined for adipose fin clips (ad-clips) and Project tags, as well as other biological information. All Chinook salmon with ad-clips are given a unique head tag number and the head of that salmon is removed, placed into a bag with the head tag, and stored in a freezer for later CWT extraction and decoding in the laboratory. The CWT code identifies the race, release type (fingerling or yearling) and brood year (BY) of each fish.

Chinook Salmon CWT Dissection

Heads from Chinook salmon recovered at TRH are processed in our office lab. The process for dissection is the following:

- 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 any other metal.
- 3) The head is cut into smaller pieces and passed through the detector until a small piece of head is left that contains the tag. The tag can then be visually detected and removed using a magnetized pencil.
- 4) The tag is placed into a 2X3 inch sealed baggie and is stapled to the corresponding head tag. 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 at TRH. In this case, a code (100000) is assigned to the head tag. If the tag was initially detected but lost during the dissection process a separate code (300000) is assigned to the head tag to indicate such.

All recovered CWTs are read using a Leica Stereozoom 5 microscope equipped with a 10X wide-field eyepiece. The microscope has a continuous magnification zoom range of 7X to 30X. The code is identified and transferred to the head tag. 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 and TRH recovery information is a single record in our database ready for analysis.

Quality control of the Trinity River Hatchery adult recovery data set consists of generating a length frequency distribution for each of the respective brood years from the CWT recovery data set. Summary statistics are derived from the data for each brood year. Using the mean and the standard deviation (SD), and ANOVA statistical methods, data points >2 SDs from the mean and data points < 2 SDs from the mean for each brood year are considered to be "outliers" and are subjected to scrutiny.

Estimation Techniques

Estimating the total return of individual CWT groups depends on a basin run-size estimate. In evaluating the return of CWT hatchery Chinook, we report on the individual year's return along with a summary of each CWT group throughout their five-year life cycle.

Total run-size and CWT return estimates for spring and fall Chinook are calculated for the Trinity River basin upstream of the JCW and the 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 Chinook salmon to total spring and fall Chinook 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/CWTed 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) Jacks and adult total run-size,
- 2) Angler harvest rate of jacks and adults,
- 3) Proportion of the run comprised of marked fish,
- 4) Proportion of CWT groups recovered at TRH, and,
- 5) Independent estimates of spring and fall Chinook run-size and angler harvest rates for each race of Chinook are required.

Methods to determine total run-size and angler harvest rate estimates were presented in Task 1 of this report.

To estimate the number of jacks and adult salmon above a specific weir site with a CWT, we used the equation:

$$N_{cwt} = \frac{NW_{adclip}}{NW} \times \frac{NH_{adwct}}{NH_{adclip}} \times N_{runsizeestimate}$$

where:

N_{cwt} = estimated number of Chinook salmon above the weir with a CWT;
 NW_{adclip} = number of salmon observed at the weir with an ad-clip;
 NW = total number of salmon observed at the respective weir;
 NH_{adwct} = number of salmon observed at TRH with an ad-clip and a CWT;
 NH_{adclip} = total number of ad-clipped salmon observed at TRH; and
 $N_{runsizeestimate}$ = run-size estimate.

Independent estimates were generated for jack (2-year-old) and adult (ages 3- 5) salmon.

Using the various CWT groups recovered at TRH, we estimated the fraction of the population upstream of the weir with a specific CWT with the equation:

$$F_{cwtgroup} = \frac{NH_{cwtgroup}}{NH_{adcwt}}$$

where:

$F_{cwtgroup}$ = fraction of the salmon population with a specific CWT code;

$NH_{cwtgroup}$ = number of salmon observed at TRH with a specific CWT code; and

NH_{adcwt} = number of salmon observed at TRH with an ad-clip and a CWT.

We estimated the total number of jacks and adult Chinook salmon upstream of the weir with a specific CWT code with the equation:

$$N_{cwtgroup} = N_{cwt} \times F_{cwtgroup}$$

where:

$N_{cwtgroup}$ = estimated total number of salmon of a specific CWT group.

The estimated number of fish from each CWT group caught in the Trinity River sport fishery upstream of the weir was then estimated by the equation:

$$SF_{cwtgroup} = N_{cwtgroup} \times N_{harvestrateestimate}$$

where:

$SF_{cwtgroup}$ = number of salmon of a specific CWT group caught in the Trinity River sport fishery; and

$N_{harvestrateestimate}$ = harvest rate estimate.

We estimated the total number of fish of a specific CWT code group available to the spawner escapement by the equation:

$$N_{cwtescapement} = N_{cwtgroup} - SF_{cwtgroup}$$

where:

$N_{cwtescapement}$ = the total number of salmon of a specific CWT group available to the spawner escapement.

The estimated number of salmon of specific CWT code group available to natural spawner escapement was:

$$N_{cwtnaturalescapement} = N_{cwtescapement} - NH_{cwtgroup}$$

where:

$N_{cwtnaturalescapement}$ = the estimated number of a specific CWT group contributing to natural spawning escapement.

RESULTS

Coded-Wire Tag Recovery

We recovered 24,374 Chinook salmon at TRH in 2012, of which 5,685 (23.3%) had ad-clips. We recovered CWTs from 1,424 known spring Chinook and 4,094 known fall Chinook (Table 1). The remaining 166 ad-clipped fish had either shed their CWT (97) or the CWT was lost or unreadable (69). Chinook with shed, lost, or unreadable CWTs were classified as either spring- or fall-run based on their date of entry into TRH. Spring Chinook CWTs were represented by 16 release groups from the 2007 through 2010 BYs. Fall Chinook CWTs were composed of 27 release groups representing the 2007 through 2010 BYs (Table 1).

Run-size, Angler Harvest, and Escapement of Coded-wire Tagged Salmon

Spring Chinook

Based on estimated total Chinook run-size above JCW, the ad-clip rate of spring Chinook at JCW, the estimated angler harvest rate, and recovery of spring-run CWT fish at TRH, we estimate 3,927 (131 jack and 3,795 adult) CWT spring Chinook returned to the Trinity River above JCW during the 2012 season (Table 2) and 26 jack and 302 adult CWT fish were harvested by anglers during the season. Escapement of CWT spring Chinook was divided between 1,446 fish recovered at TRH and 2,152 estimated to spawn in natural areas (Table 2). Based on CWTs, the known age composition of the 2012 hatchery produced spring Chinook run was composed of 131 (3.35%) age 2; 3,295 (83.92%) age 3; 486 (12.39%) age 4; and 13 (0.34%) age 5 fish (Table 2).

2007 Brood Year

The 2012 spawning season was the last year for returns of the 2007 BY. The age five component of the run is historically very small for Trinity River Hatchery Chinook stocks, but this BY has performed below average throughout. The total contribution of the four (three fingerling and one yearling) 2007 BY tag code release groups that returned to the Trinity River ranged from 0.09 (a fingerling group) to 0.65% (the yearling group) (Table 3). The final total return rate for all 2007 BY spring Chinook release groups was approximately 0.317% (Appendix 1), less than half the mean return rate of 0.684% since 1986.

2008 Brood Year

Spring Chinook from the 2008 BY have returned at age two, three and four. The yearling group continues to return a smaller rate than each of the three of the fingerling groups. Fingerling group (068812) with 0.61% return is the highest performer of this BY (Table 3). These fish are expected to continue to contribute to the spring Chinook returns for one additional year.

Table 1. Release and recovery data for adipose fin-clipped Chinook recovered at Trinity River Hatchery (TRH) during the 2012-13 season.

CWT ^a code	Egg source	Brood year	Release data				Recovery data				
			Date	Number	Size (# / lb)	Site	Males		Females		Total No.
							No.	FL ^b	No.	FL ^b	
Spring Chinook											
068802	TRH	2007	06/02-12/2008	73,822	96.0	TRH	1	99.0	0	--	1
068803	TRH	2007	06/02-12/2008	50,488	112.0	TRH	0	--	1	77.0	1
068810	TRH	2007	10/01-14/2008	96,803	11.4	TRH	3	95.3	0	--	3
068811	TRH	2008	06/01-15/2009	75,847	37.9	TRH	12	85.3	16	74.1	28
068812	TRH	2008	06/01-15/2009	89,934	54.5	TRH	28	84.5	41	74.8	69
068813	TRH	2008	06/01-15/2009	64,175	47.0	TRH	10	82.9	19	74.1	29
068819	TRH	2008	10/01-15/2009	104,078	8.1	TRH	20	80.8	34	70.3	54
068821	TRH	2009	06/01-08/2010	63,456	44.0	TRH	163	70.7	286	65.4	449
068822	TRH	2009	06/01-08/2010	82,259	55.0	TRH	201	71.0	298	66.0	499
068831	TRH	2009	06/01-08/2010	7,234	55.0	TRH	21	70.5	26	65.8	47
068832	TRH	2009	06/01-08/2010	8,104	55.0	TRH	18	70.3	36	65.0	54
068836	TRH	2009	10/01-09/2010	108,824	8.6	TRH	95	63.0	77	60.4	172
068773	TRH	2010	06/01-17/2011	33,636	65.8	TRH	1	53.0	0	--	1
068774	TRH	2010	06/01-17/2011	63,224	75.5	TRH	10	48.0	0	--	10
068775	TRH	2010	06/01-17/2011	71,842	90.0	TRH	6	47.5	0	--	6
068776	TRH	2010	10/03-12/2012	97,128	13.0	TRH	1	47.0	0	--	1
Lost CWT ^{c,e}							10		13		23
No CWT ^{d,e}							22	70.5	23	65.0	45
Spring Chinook totals:							622		870		1,492
Fall Chinook											
068809	TRH	2007	10/01-14/2008	244,661	16.7	TRH	2	96.5	0	--	2
065356	TRH	2008	06/01-15/2009	11,403	85.8	TRH	0	--	1	74.0	1
065357	TRH	2008	06/01-15/2009	9,676	85.8	TRH	1	91.0	2	74.0	3
065358	TRH	2008	06/01-15/2009	9,882	85.8	TRH	1	73.0	4	70.0	5
065359	TRH	2008	10/01-15/2009	6,257	13.3	TRH	3	78.3	5	73.8	8
068814	TRH	2008	06/01-15/2009	93,228	80.5	TRH	13	82.7	25	77.1	38
068815	TRH	2008	06/01-15/2009	94,165	81.5	TRH	17	79.9	21	77.1	38
068816	TRH	2008	06/01-15/2009	96,264	98.5	TRH	6	82.5	23	77.7	29
068817	TRH	2008	06/01-15/2009	92,360	94.0	TRH	10	79.8	32	75.0	42
068818	TRH	2008	10/01-15/2009	90,758	103.5	TRH	14	81.4	9	75.1	23
068820	TRH	2008	10/01-15/2009	253,073	11.5	TRH	178	78.3	234	73.8	412
0608080000 ^f	TRH	2008	04/29 -08/20/09	17,618	various	River	3	86.0	1	88.0	4
068823	TRH	2009	06/01-08/2010	85,136	91.0	TRH	133	70.1	104	67.1	237
068824	TRH	2009	06/01-08/2010	89,959	113.0	TRH	108	70.2	90	67.4	198
068825	TRH	2009	06/01-08/2010	91,310	133.0	TRH	94	70.2	51	66.9	145
068826	TRH	2009	06/01-08/2010	88,851	134.0	TRH	57	70.3	36	67.6	93
068827	TRH	2009	06/01-08/2010	90,929	186.0	TRH	51	69.2	55	66.0	106
068828	TRH	2009	06/01-08/2010	39,642	114.0	TRH	57	69.6	52	67.1	109
068833 ^f	TRH	2009	03/02-07/10/10	5,664	316.0	River	5	69.6	1	68.0	6
068834 ^f	TRH	2009	03/02-07/10/10	5,270	316.0	River	3	71.3	1	69.0	4
068837	TRH	2009	10/01-09/2010	230,461	11.6	TRH	1,593	66.5	966	64.7	2,559
068777	TRH	2010	06/01-17/2011	114,941	122.5	TRH	6	50.3	0	--	6
068778	TRH	2010	06/01-17/2011	119,394	124.0	TRH	6	53.3	1	62.0	7
068779	TRH	2010	06/01-17/2011	119,945	124.5	TRH	4	54.3	0	--	4
068780	TRH	2010	06/01-17/2011	112,828	158.5	TRH	5	51.8	0	--	5
068835 ^f	TRH	2010	06/02-08/13/11	7,945	124.0	River	2	56.0	0	--	2
068781	TRH	2010	10/03-12/2012	231,430	15.3	TRH	8	45.6	0	--	8
Lost CWT ^{c,e}							24		21		45
No CWT ^{d,e}							26		26		52
Fall Chinook totals:							2,430		1,761		4,191

a/ CWT = Coded-wire tag.

b/ FL = Mean fork length in cm.

c/ CWT lost or un-readable during recovery (CWT CODES 200,000 - 400,000).

d/ No CWT was detected (CWT CODE = 100,000).

e/ Assigned as either spring or fall Chinook based on entry date into Trinity River Hatchery.

f/ Experimental release groups; fish used in screw trap efficiency studies on main stem Trinity River.

Table 2. Run-size, angler harvest, and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, spring and fall Chinook salmon returning to the Trinity River during the 2012-13 season.

Run-size estimates	Run-size estimate		Harvest rates		TRH	Percentage of		Ad+CWT		
	Jacks	Adults	Jacks	Adults	Ad-clips with CWTs	Jacks	Adults	Jacks	Adults	Total
Spring Chinook (JCW)	813	24,804	20.0%	8.0%	96.84%	16.7%	15.8%	131	3,795	3,927
Fall Chinook (WCW)	5,243	68,423	0.6%	2.4%	98.73%	3.4%	11.7%	176	7,911	8,087

CWT code	BY	Age	TRH	% of total	Run-size	Angler harvest	Spawning escapement		
			Total No.				TRH	Natural	Total
Spring Chinook salmon									
Adults									
068802	07	5	1.01	0.1%	2.68	0.21	1.01	1.46	2.47
068803	07	5	1.01	0.1%	2.68	0.21	1.01	1.46	2.47
068810	07	5	3.03	0.2%	8.05	0.64	3.03	4.38	7.41
068811	08	4	28.51	2.0%	75.78	6.03	28.51	41.23	69.74
068812	08	4	70.09	4.9%	186.29	14.83	70.09	101.37	171.46
068813	08	4	29.49	2.1%	78.38	6.24	29.49	42.65	72.14
068819	08	4	54.93	3.8%	146.00	11.62	54.93	79.44	134.37
068821	09	3	455.77	31.9%	1,211.37	96.43	455.77	659.18	1,114.95
068822	09	3	506.71	35.5%	1,346.76	107.20	506.71	732.85	1,239.56
068831	09	3	47.70	3.3%	126.78	10.09	47.70	68.99	116.69
068832	09	3	54.89	3.8%	145.89	11.61	54.89	79.39	134.28
068836	09	3	174.77	12.2%	464.51	36.98	174.77	252.77	427.54
Totals:			1,427.91	100.0%	3,795.19	302.10	1,427.91	2,065.17	3,493.08
Jacks									
0688773	10	2	1.01	5.5%	7.28	1.46	1.01	4.81	5.82
0688774	10	2	10.14	55.6%	73.05	14.61	10.14	48.30	58.44
0688775	10	2	6.09	33.4%	43.87	8.77	6.09	29.01	35.10
0688776	10	2	1.01	5.5%	7.28	1.46	1.01	4.81	5.82
Totals:			18.25	100.0%	131.48	26.30	18.25	86.93	105.18
Spring Totals:			1,446.16		3,926.67	328.39	1,446.16	2,152.10	3,598.26
Fall Chinook salmon									
Adults									
068809	07	5	2.03	0.05%	3.91	0.09	2.03	1.78	3.81
065356	08	4	1.01	0.02%	1.94	0.05	1.01	0.89	1.90
065357	08	4	3.02	0.07%	5.81	0.14	3.02	2.66	5.68
065358	08	4	5.04	0.12%	9.70	0.23	5.04	4.43	9.47
065359	08	4	8.07	0.20%	15.54	0.37	8.07	7.09	15.16
068814	08	4	38.48	0.94%	74.09	1.78	38.48	33.83	72.31
068815	08	4	38.48	0.94%	74.09	1.78	38.48	33.83	72.31
068816	08	4	29.32	0.71%	56.45	1.36	29.32	25.78	55.10
068817	08	4	42.40	1.03%	81.64	1.96	42.40	37.28	79.68
068818	08	4	23.16	0.56%	44.59	1.07	23.16	20.36	43.52
068820	08	4	416.60	10.14%	802.14	19.28	416.60	366.26	782.86
0608080000	08	4	4.05	0.10%	7.80	0.19	4.05	3.56	7.61
068823	09	3	239.89	5.84%	461.89	11.10	239.89	210.90	450.79
068824	09	3	200.40	4.88%	385.86	9.27	200.40	176.18	376.58
068825	09	3	146.50	3.57%	282.08	6.78	146.50	128.80	275.30
068826	09	3	93.90	2.29%	180.80	4.34	93.90	82.55	176.45
068827	09	3	107.02	2.60%	206.06	4.95	107.02	94.09	201.11
068828	09	3	110.30	2.68%	212.38	5.10	110.30	96.97	207.27
068833	09	3	6.05	0.15%	11.65	0.28	6.05	5.32	11.37
068834	09	3	4.05	0.10%	7.80	0.19	4.05	3.56	7.61
068837	09	3	2,588.69	63.01%	4,984.35	119.78	2,588.69	2,275.88	4,864.57
Totals:			4,108.46	100.00%	7,910.56	190.11	4,108.46	3,612.00	7,720.46
Jacks									
068777	10	2	6.07	18.75%	33.00	0.19	6.07	26.74	32.81
068778	10	2	7.09	21.90%	38.55	0.23	7.09	31.23	38.32
068779	10	2	4.05	12.51%	22.02	0.13	4.05	17.84	21.89
068780	10	2	5.04	15.57%	27.40	0.16	5.04	22.20	27.24
068781	10	2	8.11	25.05%	44.09	0.26	8.11	35.73	43.84
068835	10	2	2.01	6.21%	10.93	0.06	2.01	8.85	10.86
Totals:			32.37	100.00%	176.00	1.03	32.37	142.60	174.97
Fall Totals:			4,140.83		8,086.56	191.14	4,140.83	3,754.60	7,895.43

Table 3. Run-size, percent return, in-river sport catch and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, spring Chinook returning to the Trinity River basin upstream of Junction City weir during the period 2008 through 2012.

Release data					Estimated returns						
CWT a/ code	Brood year	Date b/ Date	Number	Site	Age	Run- size	% of release	River harvest	Spawning escapement		
									TRH c/ TRH	Natural	Total
068801	2007	06/2-12/08	55,773	TRH	2	2	0.00	0	1	1	2
068801	2007				3	15	0.03	1	8	6	14
068801	2007				4	33	0.06	0	22	11	33
068801	2007				5	0	0.00	0	0	0	0
					Totals: d/	50	0.09	1	31	18	49
					Total adults: e/	48	0.09	1	30	17	47
068802	2007	06/2-12/08	73,822	TRH	2	7	0.01	0	4	3	7
068802	2007				3	58	0.08	3	32	23	55
068802	2007				4	54	0.07	0	36	17	54
068802	2007				5	3	0.00	0	1	1	2
					Totals: d/	121	0.16	3	73	45	118
					Total adults: e/	114	0.15	3	69	42	111
068803	2007	06/2-12/08	50,488	TRH	2	7	0.01	0	4	3	7
068803	2007				3	29	0.06	1	16	12	28
068803	2007				4	42	0.08	0	28	13	42
068803	2007				5	3	0.01	0	1	1	2
					Totals: d/	80	0.16	1	49	30	79
					Total adults: e/	73	0.15	2	94	56	150
068810	2007	10/01-14/08	96,803	TRH	2	12	0.01	0	7	5	12
068810	2007				3	181	0.19	9	101	72	173
068810	2007				4	424	0.44	0	287	137	424
068810	2007				5	8	0.01	1	3	4	7
					Totals: d/	626	0.65	9	398	219	616
					Total adults: e/	614	0.63	9	391	214	604
068811	2008	06/01-15/09	75,847	TRH	2	35	0.05	0	12	23	35
068811	2008				3	143	0.19	0	97	46	143
068811	2008				4	76	0.10	6	29	41	70
068812	2008	06/01-15/09	89,934	TRH	2	59	0.07	0	20	38	59
068812	2008				3	303	0.34	0	205	98	303
068812	2008				4	186	0.21	15	70	101	171
068813	2008	06/01-15/09	64,175	TRH	2	38	0.06	0	13	25	38
068813	2008				3	189	0.30	0	128	61	189
068813	2008				4	78	0.12	6	29	43	72
068819	2008	10/1-15/09	104,078	TRH	2	0	0.00	0	0	0	0
068819	2008				3	82	0.08	0	55	27	82
068819	2008				4	146	0.14	12	55	79	134
068821	2009	06/01-8/10	63,456	TRH	2	427	0.67	6	243	177	421
068821	2009				3	1,211	1.91	96	456	659	1,115
068822	2009	06/01-8/10	82,259	TRH	2	479	0.58	7	273	199	472
068822	2009				3	1,347	1.64	107	507	733	1,240
068831	2009	06/01-8/10	7,234	TRH	2	65	0.90	1	37	27	64
068831	2009				3	127	1.75	10	48	69	117
068832	2009	06/01-8/10	8,104	TRH	2	71	0.87	1	40	29	70
068832	2009				3	146	1.80	12	55	79	134
068836	2009	10/1-9/10	108,824	TRH	2	37	0.03	1	21	15	36
068836	2009			TRH	3	465	0.43	37	175	253	428
068773	2010	06/01-17/11	33,636	TRH	2	7	0.02	1	1	5	6
068774	2010	06/01-17/11	63,224	TRH	2	73	0.12	15	10	48	58
068875	2010	06/01-17/11	71,842	TRH	2	44	0.06	9	6	29	35
068776	2010	10/3-12/11	97,128	TRH	2	7	0.01	1	1	5	6

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 2007. 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.

2009 Brood Year

Five 2009 BY release groups (four fingerling, one yearling) returned as three year olds this season (Table 3). The fingerling groups continued their strong return, averaging 1.8% for the year, 1.3% across the past two years. Spring Chinook from this BY are expected to return to the Trinity system for two additional years, as four and five-year-olds.

2010 Brood Year

The three fingerling and one yearling group that make up this BY had unremarkable returns ranging from 0.01 to 0.12% in 2012. It is anticipated they will be returning in future years as three, four and five year olds.

Fall Chinook

Based on the estimated total Chinook run-size above WCW, the ad-clip rate of fall Chinook at WCW, the estimated angler harvest rate, and recovery of fall-run CWT fish at TRH, we estimate 8,087 CWT (176 jack and 7,911 adult) fall Chinook salmon returned to the Trinity River above WCW during the 2012-13 season and that anglers harvested one jack and 190 adult CWT fall Chinook. Escapement of CWT fall Chinook was divided between 4,141 fish recovered at TRH and 3,755 estimated to have spawned in natural areas this season (Table 2). Based on CWTs, the known age composition of the 2012 fall Chinook run was: 176 (2.18%) age 2 fish, 6,733 (83.26%) age 3 fish, 1,174 (14.42%) age 4 fish, and four (0.05%) age 5 fish.

2007 Brood Year

The 2012 spawning season was the last year for returns of the 2007 BY, made up of five fingerling and one yearling groups (Table 4). All five of the fingerling groups returned at a total rate of just 0.07% over the 5 year, while the yearling group, 068809, returned at 0.95% overall. The final total contribution for all 2007 BY fall Chinook release groups was approximately 0.384 % (Appendix 2).

2008 Brood Year

Comprised of 12 CWT groups (ten fingerling and two yearling) the 2008 BY has now returned as two-, three- and four-year-olds (Table 4). Two of the fingerling groups were released from sites downriver of the hatchery as part of downstream migrant trap work outside of this report. In 2012 the percent of the 2008 BY ranged from 0.0 - 0.32, with the yearling groups performing better than the fingerling groups. It is anticipated this BY will continue to return as five year olds in 2013.

2009 Brood Year

The 2009 BY was comprised of eight fingerling groups (two of which were released from sites downriver of TRH) and one yearling group. Coded wire tag code 068837 (the yearlings) returned at a remarkable 2.16% rate, whereas the fingerlings of the BY ranged from 0.15 to 0.54%. This year class is expected to return as four and five year old fish over the next two years.

Table 4. Run-size, percent return, in-river sport catch, and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, fall Chinook returning to the Trinity River basin upstream of Willow Creek weir during the period 2008 through 2012.

Release data					Estimated returns						
CWT ^a	Brood					Run-	% of	Angler	Spawning escapement		
code	year	Date ^b	Number	Site	Age	size	release	harvest	TRH ^c	Natural	Total
068804	2007	06/2-12/08	92,759	TRH	2	4	0.00	0	2	2	4
068804	2007				3	32	0.03	0	17	15	32
068804	2007				4	26	0.03	0	11	14	25
068804	2007				5	0	0.00	0	0	0	0
Totals: d/						62	0.07	1	30	31	61
Total adults: e/						58	0.06	1	28	29	57
068805	2007	06/2-12/08	89,972	TRH	2	2	0.00	0	1	1	2
068805	2007				3	40	0.04	0	21	18	40
068805	2007				4	21	0.02	0	9	11	21
068805	2007				5	0	0.00	0	0	0	0
Totals: d/						63	0.07	1	31	31	62
Total adults: e/						61	0.07	1	30	30	60
068806	2007	06/2-12/08	89,348	TRH	2	2	0.00	0	1	1	2
068806	2007				3	32	0.04	0	17	15	32
068806	2007				4	33	0.04	1	14	18	32
068806	2007				5	0	0.00	0	0	0	0
Totals: d/						67	0.07	1	32	34	66
Total adults: e/						65	0.07	1	31	33	64
068807	2007	06/2-12/08	84,063	TRH	2	2	0.00	0	1	1	2
068807	2007				3	30	0.04	0	16	14	30
068807	2007				4	30	0.04	1	13	17	30
068807	2007				5	0	0.00	0	0	0	0
Totals: d/						62	0.07	1	30	32	62
Total adults: e/						60	0.07	1	29	31	60
068808	2007	06/2-12/08	90,174	TRH	2	0	0.00	0	0	0	0
068808	2007				3	42	0.05	0	22	19	41
068808	2007				4	28	0.03	1	12	15	27
068808	2007				5	0	0.00	0	0	0	0
Totals: d/						70	0.08	1	34	35	69
Total adults: e/						70	0.08	1	34	35	69
068809	2007	10/1-14/08	244,661	TRH	2	60	0.02	1	32	27	59
068809	2007				3	1,587	0.65	11	844	733	1,576
068809	2007				4	679	0.28	13	295	371	666
068809	2007				5	4	0.00	0	2	2	4
Totals: d/						2,330	0.95	25	1,173	1,132	2,305
Total adults: e/						2,270	0.93	24	1,141	1,105	2,246

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 2007. 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.

Table 4 (continued). Run-size, percent return, in-river sport catch, and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, fall Chinook returning to the Trinity River basin upstream of Willow Creek weir during the period 2008 through 2012.

Release data					Estimated returns						
CWT ^a code	Brood year	Date ^b	Number	Site	Age	Run- size	% of release	River harvest	Spawning escapement TRH ^c	Natural	Total
065356	2008	06/1-15/09	11,403	TRH	2	10	0.09	0.1	5	5	10
065356	2008				3	60	0.53	1.1	26	33	59
065356	2008				4	2	0.02	0.1	1	1	2
065357	2008	06/1-15/09	9,676	TRH	2	6	0.06	0.1	3	3	6
065357	2008				3	46	0.48	0.9	20	25	46
065357	2008				4	6	0.06	0.1	3	3	6
065358	2008	06/1-15/09	9,882	TRH	2	10	0.10	0.1	5	5	10
065358	2008				3	61	0.61	1.1	26	33	59
065358	2008				4	10	0.10	0.2	5	4	9
065359	2008	10/01-15/09	6,257	TRH	2	6	0.09	0.1	3	3	6
065359	2008				3	79	1.26	1.5	34	43	77
065359	2008				4	16	0.25	0.4	8	7	15
068814	2008	06/1-15/09	93,228	TRH	2	157	0.17	1.6	79	77	156
068814	2008				3	657	0.70	12.3	285	359	644
068814	2008				4	74	0.08	1.8	38	34	72
068815	2008	06/1-15/09	94,165	TRH	2	101	0.11	1.0	50	49	100
068815	2008				3	652	0.69	12.2	283	356	640
068815	2008				4	74	0.08	1.8	38	34	72
068816	2008	06/1-15/09	96,264	TRH	2	74	0.08	0.8	37	36	74
068816	2008				3	507	0.53	9.5	220	277	497
068816	2008				4	56	0.06	1.4	29	26	55
068817	2008	06/1-15/09	92,360	TRH	2	77	0.08	0.8	38	37	76
068817	2008				3	411	0.45	7.7	179	225	403
068817	2008				4	82	0.09	2.0	42	37	80
068818	2008	06/1-15/09	90,758	TRH	2	40	0.04	0.4	20	20	40
068818	2008				3	355	0.39	6.6	154	194	349
068818	2008				4	45	0.05	1.1	23	20	44
068820	2008	10/01-15/09	253,073	TRH	2	99	0.04	1.0	49	48	98
068820	2008				3	3,203	1.27	59.9	1,392	1,751	3,143
068820	2008				4	802	0.32	19.3	417	366	783
0608080000 ^f	2008	04/29 - 08/20/09	17,618	River	2	16	0.09	0.2	8	8	16
0608080000 ^f	2008				3	49	0.28	0.9	21	27	48
0608080000 ^f	2008				4	8	0.04	0.2	4	4	8
0608080001 ^f	2008	04/29 - 08/20/09	2,915	River	2	4	0.13	0.0	2	2	4
0608080001 ^f	2008				3	7	0.24	0.1	3	4	7
0608080001 ^f	2008				4	0	0.00	0.0	0	0	0

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 2007. 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.

Table 4 (continued). Run-size, percent return, in-river sport catch, and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, fall Chinook returning to the Trinity River basin upstream of Willow Creek weir during the period 2008 through 2012.

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
068823	2009	06/1 - 8/10	85,136	TRH	2	331	0.39	9	116	206	322
068823	2009				3	462	0.54	11	240	211	451
068824	2009	06/1 - 8/10	89,959	TRH	2	253	0.28	7	89	157	246
068824	2009				3	386	0.43	9	200	176	377
068825	2009	06/1 - 8/10	91,310	TRH	2	77	0.08	2	27	48	75
068825	2009				3	282	0.31	7	147	129	275
068826	2009	06/1 - 8/10	88,851	TRH	2	35	0.04	1	12	21	34
068826	2009				3	181	0.20	4	94	83	176
068827	2009	06/1 - 8/10	90,929	TRH	2	23	0.03	1	8	14	22
068827	2009				3	206	0.23	5	107	94	201
068828	2009	06/1 - 8/10	39,642	TRH	2	52	0.13	1	18	32	50
068828	2009				3	212	0.54	5	110	97	207
068833 ^f	2009	03/2-7/10/10	5,664	River	2	3	0.05	0	1	2	3
068833 ^f	2009				3	12	0.21	0	6	5	11
068834 ^f	2009	03/2-7/10/10	5,270	River	2	3	0.05	0	1	2	3
068834 ^f	2009				3	8	0.15	0	4	4	8
068837	2009	10/1 - 9/10	230,461	TRH	2	400	0.17	10	141	249	389
068837	2009				3	4,984	2.16	120	2,589	2,276	4,865
068777	2010	06/1-17/11	114,941	TRH	2	33	0.03	0	6	27	33
068778	2010	06/1-17/11	119,394	TRH	2	39	0.03	0	7	31	38
068779	2010	06/1-17/11	119,945	TRH	2	22	0.02	0	4	18	22
068780	2010	06/1-17/11	112,828	TRH	2	27	0.02	0	5	22	27
068781	2010	10/3-12/11	231,430	TRH	2	44	0.02	0	8	36	44
068835 ^f	2010	06/2-8/13/11	7,954	River	2	11	0.14	0	2	9	11

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 2007. 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.

2010 Brood Year

Six CWT groups (five fingerling and one yearling) from the 2010 BY releases returned as two-year-olds during 2012 (Table 4). Interestingly, the one fingerling group that was released down river in the rotary screw trap experiment returned at the highest rate of the groups with 0.14%, the rest of the groups returned at 0.02 - 0.03%. Adult returns from this BY will occur over the next three years.

Contribution of Hatchery Produced Chinook to Total Estimated Run-Size

The estimated contribution of TRH-origin spring Chinook to the Trinity River run-size estimate upstream of JCW was 16,307 fish. This represents 69.1% (562/813) of the jacks, 63.5% (15,745/24,804) of the adult run, and 63.7% (16,307/25,617) overall (Table 5). Of the 15,745 TRH-origin adult spring Chinook in the run-size estimate, 5,924 escaped to TRH, while 8,548 escaped to areas outside of the hatchery and 1,274 are estimated to have been harvested.

The estimated contribution of TRH-origin fall Chinook to the Trinity River run-size estimate upstream of WCW was 32,735 fish. This represents 13.9% (729/5,243) of the jacks, 46.8% (32,007/68,423) of the adults and 44.4% (32,735/73,666) overall. Of the 32,007 TRH-origin adult fall Chinook in the run-size estimate, an estimated 16,623 escaped to the hatchery, an estimated 14,615 escaped in-river, leaving an estimated 769 to have been harvested.

DISCUSSION

Since CWT estimates are based, in part, on the overall run-size estimates for each race of Chinook, they are subject to the precision and potential biases associated with the mark-recapture estimates performed under Task 1 of this report. The impact of this would be most relevant to the number of fish estimated spawned in “natural” areas, due to the fact that hatchery recoveries are actual counts, while CWT fish estimated to spawn naturally are the estimated number of fish remaining after hatchery CWTs and estimated angler harvest are subtracted from the overall CWT estimate. Return rates are also affected by ocean and in-river harvest and escapement below the weir sites, which is not included in our estimates. Harvest and stray rates in these sectors can greatly affect river returns upstream of respective weir sites in any given year.

Run-size estimates have the potential for bias (see Task 1), which under most scenarios would tend to be positive. This bias should not affect hatchery contribution rates, however, since total CWT run-sizes are based on ad-clip rates observed at either JCW or WCW times the estimated runs above these sites. Even if total run-size was adjusted lower, the ad-clip rate would remain the same, resulting in the same hatchery contribution rates. If, however, hatchery-produced fish are more vulnerable to capture, or their run-timing coincides more so than their natural counterparts with dates of weir operations (i.e. spring Chinook at JCW), the estimated contribution of hatchery fish could be biased. So, another source of potential bias is vulnerability of capture.

Table 5. Estimated run-size, angler harvest, and spawner escapement estimates for Trinity River Hatchery-produced, spring and fall Chinook salmon expanded for unmarked releases (hatchery multiplier) returning to the Trinity River during the 2012-13 season. ^a

CWT code b/	BY c/	Age	TRH		Run- size	Expanded run-size e/	Angler harvest	Expanded angler harvest	Spawning escapement						
			expansion factor d/	TRH f/					Expanded TRH	River	Expanded River	Escapement Total	Expanded total		
Spring Chinook															
Adults															
068802	07	5	4.12		2.68	11.04	0.22	0.91	1.01	4.16	1.45	5.97	2.46	10.14	
068803	07	5	4.09		2.68	10.96	0.22	0.90	1.01	4.13	1.45	5.93	2.46	10.06	
068810	07	5	4.02		8.05	32.36	0.65	2.61	3.03	12.18	4.37	17.57	7.40	29.75	
068811	08	4	4.05		75.78	306.91	6.13	24.83	28.51	115.47	41.14	166.62	69.65	282.08	
068812	08	4	4.07		186.29	758.20	15.06	61.29	70.09	285.27	101.14	411.64	171.23	696.91	
068813	08	4	4.13		78.38	323.71	6.34	26.18	29.49	121.79	42.55	175.73	72.04	297.53	
068819	08	4	4.09		146.00	597.14	11.81	48.30	54.93	224.66	79.26	324.17	134.19	548.84	
068821	09	3	4.15		1,211.37	5,027.19	97.95	406.49	455.77	1,891.45	657.65	2,729.25	1,113.42	4,620.69	
068822	09	3	4.18		1,346.76	5,629.46	108.90	455.20	506.71	2,118.05	731.15	3,056.21	1,237.86	5,174.25	
068831	09	3	4.21		126.78	533.74	10.25	43.15	47.70	200.82	68.83	289.77	116.53	490.59	
068832	09	3	4.21		145.89	614.20	11.80	49.68	54.89	231.09	79.20	333.43	134.09	564.52	
068836	09	3	4.09		464.51	1,899.85	37.56	153.62	174.77	714.81	252.18	1,031.42	426.95	1,746.23	
					Total adult	3,795.17	15,744.75	306.89	1,273.17	1,427.91	5,923.87	2,060.37	8,547.71	3,488.28	14,471.58
Jacks															
068773	10	2	4.21		7.28	30.65	0.75	3.16	1.01	4.25	5.52	23.24	6.53	27.49	
068774	10	2	4.16		73.05	303.89	7.55	31.41	10.14	42.18	55.36	230.30	65.50	272.48	
068775	10	2	4.49		43.87	196.98	4.53	20.34	6.09	27.34	33.25	149.29	39.34	176.64	
068776	10	2	4.16		7.28	30.28	0.75	3.12	1.01	4.20	5.52	22.96	6.53	27.16	
					Total jack	131.48	561.80	13.58	58.03	18.25	77.98	99.65	425.79	117.90	503.77
					Total spring Chinook	3,926.65	16,306.55	320.47	1,331.20	1,446.16	6,001.85	2,160.02	8,973.50	3,606.18	14,975.35
Fall Chinook															
Adults															
068809	07	5	4.07		3.91	15.91	0.1	0.37	2.03	8.26	1.79	7.29	3.82	15.55	
065356	08	4	4.03		1.94	7.82	0.1	0.20	1.01	4.07	0.88	3.55	1.89	7.62	
065357	08	4	4.03		5.81	23.41	0.1	0.56	3.02	12.17	2.65	10.68	5.67	22.85	
065358	08	4	4.03		9.70	39.09	0.2	0.93	5.04	20.31	4.43	17.85	9.47	38.16	
065359	08	4	4.00		15.54	62.16	0.4	1.48	8.07	32.28	7.10	28.40	15.17	60.68	
068814	08	4	4.08		74.09	302.29	1.8	7.26	38.48	157.00	33.83	138.03	72.31	295.02	
068815	08	4	4.07		74.09	301.55	1.8	7.24	38.48	156.61	33.83	137.69	72.31	294.30	
068816	08	4	4.02		56.45	226.93	1.4	5.47	29.32	117.87	25.77	103.60	55.09	221.46	
068817	08	4	4.03		81.64	329.01	2.0	7.90	42.40	170.87	37.28	150.24	79.68	321.11	
068818	08	4	4.05		44.59	180.59	1.1	4.33	23.16	93.80	20.36	82.46	43.52	176.26	
068820	08	4	4.02		802.14	3,224.60	19.3	77.51	416.60	1,674.73	366.26	1,472.37	782.86	3,147.10	
06080800	08	4	3.98		7.80	31.04	0.2	0.76	4.05	16.12	3.56	14.17	7.61	30.29	
068823	09	3	4.19		461.89	1,934.75	11.1	46.50	239.89	1,004.84	210.90	883.41	450.79	1,888.25	
068824	09	3	4.09		385.86	1,579.95	9.3	37.96	200.40	820.56	176.19	721.43	376.59	1,542.00	
068825	09	3	4.07		282.08	1,149.33	6.8	27.63	146.50	596.91	128.80	524.80	275.30	1,121.71	
068826	09	3	4.11		180.80	743.65	4.3	17.85	93.90	386.22	82.56	339.58	176.46	725.80	
068827	09	3	4.06		206.06	836.62	5.0	20.10	107.02	434.51	94.09	382.01	201.11	816.52	
068828	09	3	4.03		212.38	856.38	5.1	20.56	110.30	444.76	96.98	391.05	207.28	835.81	
068833	09	3	4.53		11.65	52.81	0.3	1.27	6.05	27.42	5.32	24.11	11.37	51.54	
068834	09	3	4.53		7.80	35.33	0.2	0.86	4.05	18.34	3.56	16.12	7.61	34.47	
068837	09	3	4.03		4,984.35	20,073.62	119.8	482.39	2,588.69	10,425.51	2,275.88	9,165.72	4,864.57	19,591.23	
					Total adult	7,910.57	32,006.84	190.1	769.12	4,108.46	16,623.18	3,612.02	14,614.54	7,720.48	31,237.72
Jacks															
068777	10	2	4.20		33.00	138.73	0.2	0.80	6.07	25.52	26.74	112.41	32.81	137.93	
068778	10	2	4.08		38.55	157.28	0.2	0.94	7.09	28.93	31.23	127.41	38.32	156.34	
068779	10	2	4.07		22.02	89.53	0.1	0.53	4.05	16.47	17.84	72.54	21.89	89.00	
068780	10	2	4.23		27.40	115.99	0.2	0.68	5.04	21.34	22.20	93.98	27.24	115.31	
068781	10	2	4.08		44.09	180.05	0.3	1.06	8.11	33.12	35.72	145.87	43.83	178.99	
068835	10	2	4.29		10.93	46.94	0.1	0.26	2.01	8.63	8.86	38.05	10.87	46.68	
					Total jack	175.99	728.52	1.0	4.26	32.37	134.00	142.59	590.26	174.96	724.26
					Total fall Chinook	8,086.56	32,735.36	191.1	773.38	4,140.83	16,757.17	3,754.61	15,204.80	7,895.44	31,961.97

a/ Estimates are upstream of Junction City and Willow Creek weirs for spring and fall estimates respectively.
b/ CWT=coded-wire tag code. Fish are of the same race and release type (smolt or yearling).
c/ BY=brood year.
d/ Expansion factor used to account for untagged releases of the same BY and release type for each CWT group.
e/ Run-size times TRH expansion factor.
f/ TRH=Trinity River Hatchery.

Assumptions of our CWT estimate include both equal probability of capture for hatchery or natural fish and equal probability of capture of Chinook throughout the entire run.

Run-timing is also a potential source of bias. Trapping constraints at JCW often preclude operating there until late June, or as was the case this year, mid-July, so likely affects our spring Chinook CWT estimates, while early storms (which seem to be increasing in frequency though we did not have any this year) can cause us to miss segments of the fall Chinook run at WCW, potentially affecting our fall CWT estimates. We have finally located a new site for the JCW which should allow us to trap longer, and decrease the potential bias in our spring estimates.

We assume the CWT fish that enter the hatchery are representative of the entire CWT population, but if an age or release type of hatchery-produced Chinook is more likely to stray than others, the proportional CWT run estimate, based on fish recovered at TRH, will over- or under-estimate the true proportions of each CWT group. Recoveries of TRH-produced Chinook during the 2012 carcass surveys (Task 4) appeared generally consistent with TRH recoveries.

Estimated in-river 2007 BY spring Chinook return rates of TRH fingerlings (0.14%) were meager in comparison to the 21 year data set average of 0.49%, while the yearlings (0.65%) were below the 1.05% average as well (Appendix 1). Estimated fall Chinook 2007 BY fingerling in-river returns were very poor at 0.07% (average being 0.32%). Though the fall Chinook yearling releases fared better, returning at a rate of 0.95%, they still fell below the 1.52% average (Appendix 2).

The 2009 BY fingerling release groups of spring Chinook continued to return at an extraordinary rate, ranging from 1.64 to 1.91% (Table 3). It will be interesting to see if this class returns strongly as four year olds too.

The contribution of hatchery-produced spring Chinook to total run-size was estimated at 63.7% of the run upstream of Junction City weir (Appendix 3). The contribution of hatchery-produced fall Chinook to total run-size, upstream of Willow Creek weir, was estimated at 44.4% (Appendix 4).

RECOMMENDATIONS

1. Coded-wire tagging and release of smolt and yearling Chinook salmon, and the monitoring of adult salmon returns at Trinity River Hatchery, should be continued in 2013-14.
2. Monitor the annual TRH-produced Chinook salmon contribution rates to the overall runs to determine the relative status of naturally-produced Chinook salmon in the Trinity basin.

3. Continue spawner carcass surveys (Task 4) in the upper Trinity River to evaluate straying of TRH produced fish.
4. 4. Collect information and report on CWT recoveries from Klamath basin in-river and ocean recreational, and Tribal net fisheries.

LITERATURE CITED

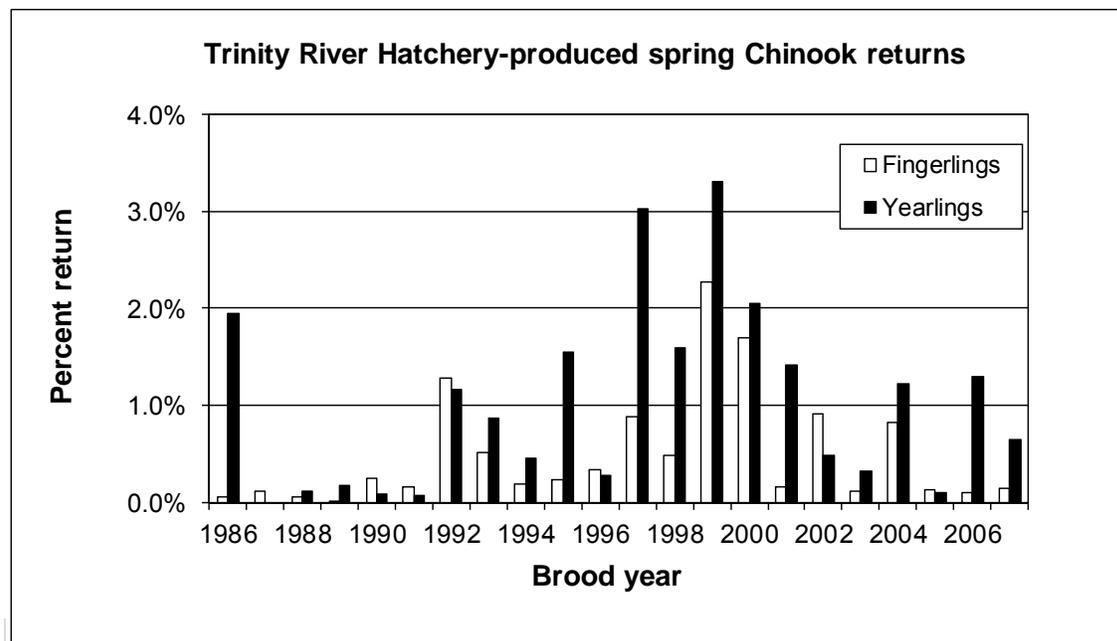
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APPENDICES

Appendix 1. Percent return of Trinity River Hatchery-produced, coded-wire tagged, spring Chinook salmon, brood years 1986-2007. ^a

Brood year	Fingerling releases			Yearling releases		
	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%
1987	185,718	208	0.11%	---	---	---
1988	181,698	84	0.05%	98,820	112	0.11%
1989	186,413	7	0.00%	102,555	176	0.17%
1990	196,908	479	0.24%	94,639	82	0.09%
1991	198,277	297	0.15%	110,797	68	0.06%
1992	215,038	2,766	1.29%	109,856	1,272	1.16%
1993	222,056	1,125	0.51%	111,525	958	0.86%
1994	113,236	202	0.18%	113,491	513	0.45%
1995 ^a	196,211	450	0.23%	101,934	1,581	1.55%
1996	222,950	743	0.33%	112,464	312	0.28%
1997	209,155	1,834	0.88%	147,507	4,471	3.03%
1998	176,968	845	0.48%	137,602	2,186	1.59%
1999	148,380	3,372	2.27%	129,919	4,288	3.30%
2000	261,193	4,422	1.69%	99,304	2,029	2.04%
2001	253,248	412	0.16%	104,627	1,480	1.41%
2002	244,754	2,217	0.91%	106,139	514	0.48%
2003	265,556	310	0.12%	104,974	339	0.32%
2004	253,830	2,095	0.83%	104,478	1,269	1.21%
2005	263,108	317	0.12%	107,607	111	0.10%
2006	226,458	229	0.10%	104,019	1,354	1.30%
2007	180,083	252	0.14%	96,803	626	0.65%
Means:	209,016	1,035	0.49%	109,528	1,224	1.05%

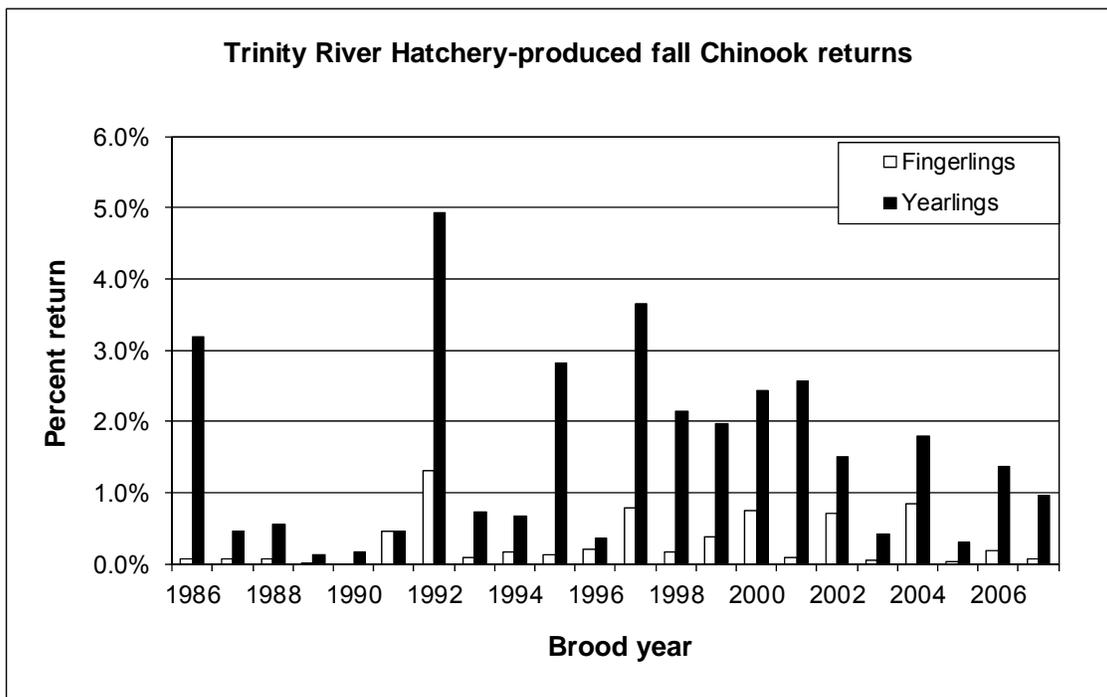
a/ Based on estimated returns upstream of Junction City weir. No estimate was produced in 1995, therefore returns of age 2 through 5 Chinook from that year are hatchery returns only. Does not include ocean harvest, in-river harvest, and escapement below Junction City weir.



Appendix 2. Percent return of Trinity River Hatchery produced, coded wire tagged fall Chinook, brood years 1986 – 2007.^a

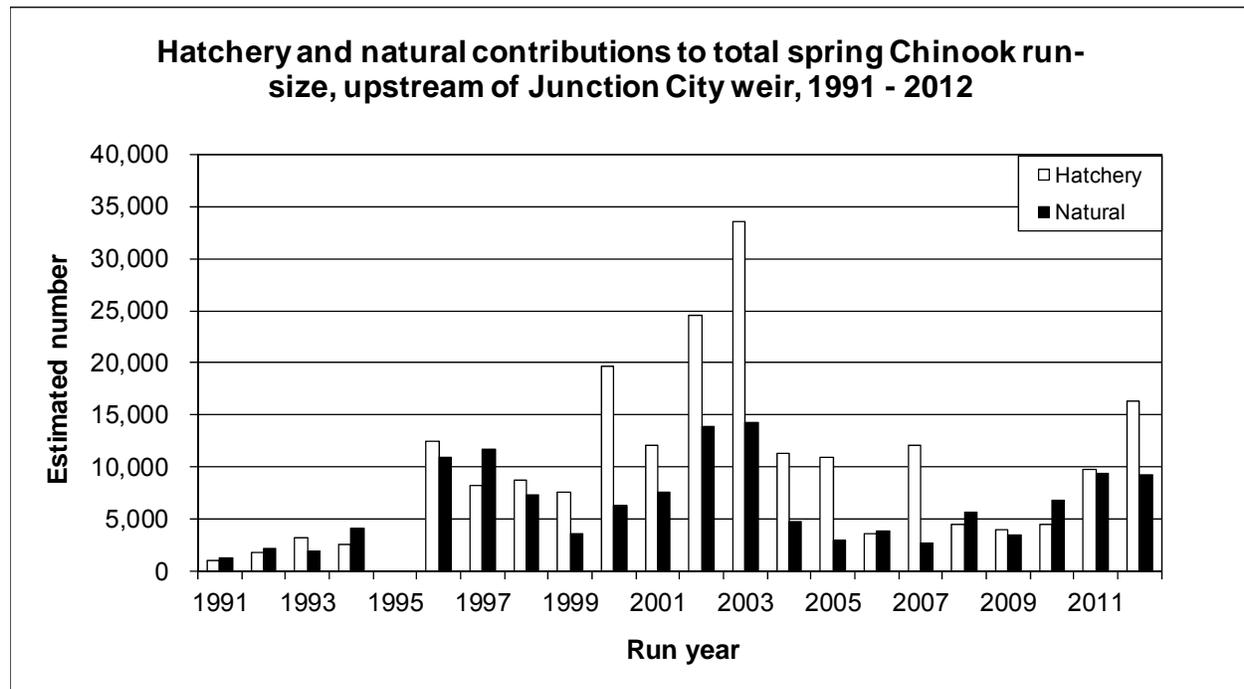
Brood year	Fingerling releases			Yearling releases		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	393,955	292	0.07%	153,700	4,899	3.19%
1987	172,980	129	0.07%	92,300	418	0.45%
1988	194,197	138	0.07%	143,934	796	0.55%
1989	201,622	21	0.01%	143,978	174	0.12%
1990	---	---	---	103,040	166	0.16%
1991	206,416	937	0.45%	115,300	517	0.45%
1992	192,032	2,503	1.30%	108,894	5,369	4.93%
1993	201,032	158	0.08%	110,336	798	0.72%
1994	216,563	374	0.17%	113,124	756	0.67%
1995	216,051	285	0.13%	110,327	3,106	2.82%
1996	217,981	445	0.20%	112,746	394	0.35%
1997	216,772	1,707	0.79%	313,080	11,396	3.64%
1998	184,781	292	0.16%	334,726	7,173	2.14%
1999	181,301	693	0.38%	296,892	5,833	1.96%
2000	522,316	3,909	0.75%	216,593	5,245	2.42%
2001	499,919	476	0.10%	230,055	5,894	2.56%
2002	508,963	3,563	0.70%	236,319	3,561	1.51%
2003	534,219	289	0.05%	225,798	944	0.42%
2004	486,369	4,125	0.85%	218,386	3,909	1.79%
2005	488,466	157	0.03%	227,903	675	0.30%
2006	486,833	849	0.17%	238,156	3,240	1.36%
2007	446,316	324	0.07%	244,661	2,330	0.95%
Means:	322,337	1,032	0.32%	185,920	3,072	1.52%

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



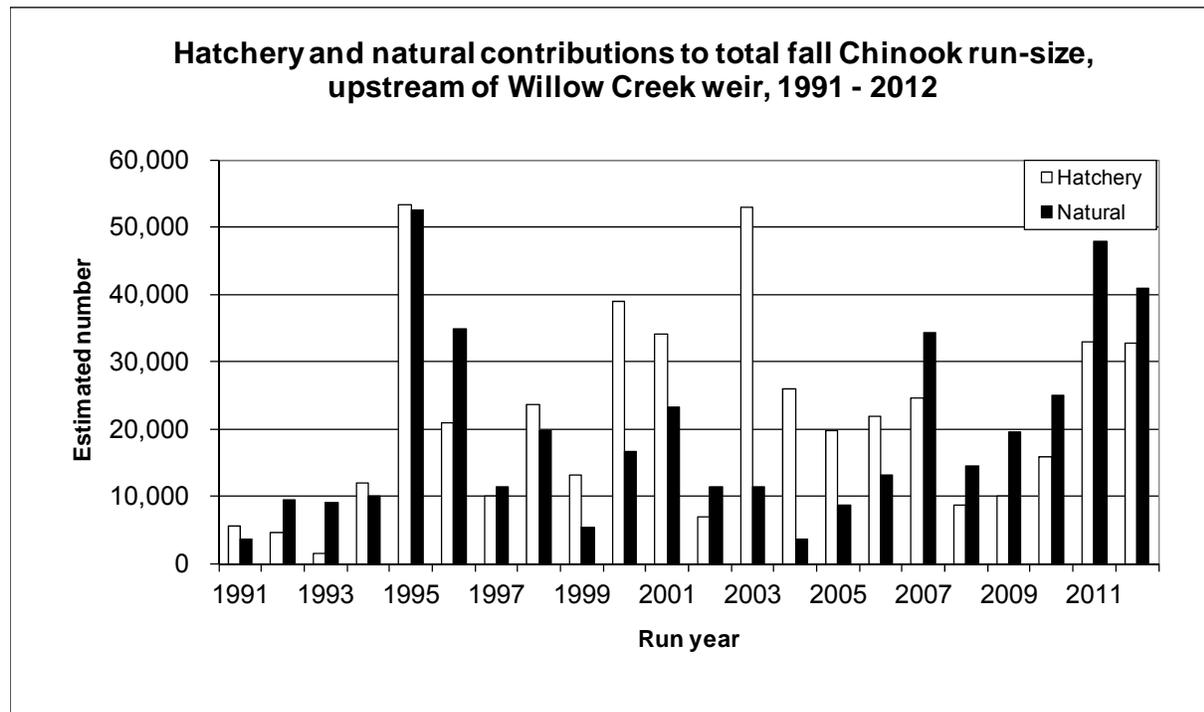
Appendix 3. Estimated contributions of Trinity River Hatchery-produced, spring Chinook salmon to total estimated run-size above Junction City weir, 1991-2012 seasons.

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%
Means:	16,553	10,146	6,407	57.5%



Appendix 4. Estimated contribution of Trinity River Hatchery-produced fall Chinook to total estimated run-size above Willow Creek weir, 1991 – 2012.

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%
Means:	40,669	21,325	19,344	51.3%



**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2012-13 SEASON**

**TASK 3
RUN-SIZE AND CONTRIBUTION TO SPAWNING ESCAPEMENT MADE BY
NATURALLY- AND HATCHERY-PRODUCED COHO SALMON
IN THE TRINITY RIVER**

by

Steve Cannata and John Hileman

ABSTRACT

This report provides the 2012 update for run-size and escapement monitoring of naturally-produced and Trinity River Hatchery (TRH)-produced coho salmon (*Oncorhynchus kisutch*) returning to the Trinity River upstream of Willow Creek, California. Annual coho monitoring contributes short-term and long-term data used to evaluate the Trinity River Restoration Program's (TRRP) fundamental objective of restoring natural salmonid spawning populations and supporting dependent fisheries as stated in the TRRP's Integrated Assessment Plan (IAP). A TRRP goal is to meet or exceed escapement of 1,400 naturally-produced adult coho salmon annually (TRRP 2009). The TRH has an annual escapement goal of 2,100 adult coho salmon. The coho run-size estimates were calculated using a Petersen type mark-recapture model and represent the coho run-size after ocean fishery impacts, in-river tribal fishery harvests and in-river sport fishery impacts downstream of Willow Creek Weir (WCW).

For 2012-13, we estimate a total run-size of 18,657 coho salmon [95 % confidence interval (CI): 16,515 to 21,181] returned to the Trinity River, upstream of WCW. The run was composed of 3,389 jacks (age 2) and 15,268 adults (age 3), of which 89.5% (16,692 individuals) were TRH-produced stock identified by a right maxillary (RM) clip. This total includes 8,030 individuals counted at TRH and an escapement estimate of 8,662 TRH stock to natural spawning areas. The 2012-13 coho salmon escapement to TRH is well above target returns.

The escapement estimate of naturally-produced coho salmon is 1,966 fish. This estimate consists of 192 jacks (age 2) and 1,774 adults (age 3), of which 205 (8 jacks and 197 adults) entered TRH. The estimate for naturally-produced coho salmon to natural areas is 184 jacks and 1,577 adults. The 2012-13 escapement estimate for naturally-produced adult coho salmon is the largest in the last five years. This is the first year since the publication of the IAP that naturally-produced coho salmon escapement exceeded the goal of 1,400 adult coho salmon.

TASK OBJECTIVE

- To determine the return rates and contributions to spawning escapement made by naturally- and hatchery-produced coho in the Trinity River.

INTRODUCTION

Trinity River coho salmon (*Oncorhynchus kisutch*) run-size and escapement have been monitored annually by California Department of Fish and Wildlife (CDFW, formerly CDFG) since 1977. The coho population is composed of both Trinity River Hatchery (TRH) stocks and naturally-produced stocks. Hatchery stocks are needed to mitigate for the loss of coho production on the Trinity River due to construction and operation of Trinity and Lewiston dams. The CDFW and TRRP have an annual escapement goal of 2,100 adult coho salmon returning to TRH. In addition, a CDFW and TRRP project objective is to mark 100% of the TRH-produced juvenile coho with right maxillary (RM) clips prior to their release to the river. Enumerating observations of clipped coho during the monitoring process enables separate run-size estimates for both hatchery- and naturally-produced coho.

Naturally-produced coho stocks are considered offspring from fish that spawn in natural areas within the main-stem and tributary reaches throughout the Trinity River basin above Willow Creek. Based on current CDFW known coho distribution maps, we estimate that above Willow Creek there are 88 miles of main-stem Trinity River habitat utilized as migration corridors or for spawning or juvenile coho rearing, 112 miles of tributary stream habitat; and an additional 70 miles utilized in the South Fork Trinity River and its tributaries.

Annual monitoring of coho salmon run-size and escapement contributes short-term and long-term data used to evaluate the Trinity River Restoration Program's (TRRP) target goals and the fundamental objective of restoring natural salmonid spawning populations and supporting dependent fisheries. The annual escapement target for naturally-produced fish set by the TRRP is 1,400 adult fish. The TRRP objective to support dependent fisheries is not applicable to sport harvest of coho salmon at this time. Coho salmon is listed as "threatened" under the Federal Endangered Species Act and the California Endangered Species Act. Thus the sport angling harvest of coho salmon in the Trinity River is prohibited by State and Federal law.

Coho salmon of the Trinity River typically have a three year brood-cycle. For any spawn-year, the population consists of juveniles rearing in the TRH, the river and tributaries, yet to out-migrate (age 1), and those returning from the ocean as jacks (age 2) and adults (age 3). Coho salmon jacks returning during the 2012-13 season were produced (born) in BY 2010. Jacks are predominately males. Coho salmon adults returning to the Trinity River in 2012-13 were produced in BY 2009.

A means objective of this task was to mark the entire annual TRH production of BY 2011 yearling coho salmon with a right maxillary (RM) clip prior to volitional release. Marking of TRH-produced juvenile coho salmon prior to volitional release enables separate run-size estimates for natural and TRH-produced coho salmon in subsequent years.

METHODS

Run-size and Escapement Estimates

Willow Creek weir (WCW) was in operation from August 21, 2012 to November 16, 2012. Individual fish trapped at WCW were marked with a unique serial numbered spaghetti tag, then inspected for maxillary or fin clips (indicating TRH or other hatchery origin) and measured to the nearest centimeter (cm) fork-length (FL). The unique serial numbered tags (tag number) functioned as a primary key (unique identifier) in the relational database structure for each individual tagged fish. The tag number effectively linked the WCW data with the TRH adult recovery data and any harvest data (sport angler tag returns) for any given tagged fish. The observed marked to unmarked ratio of TRH-produced versus naturally-produced coho salmon at WCW was used in the analysis to estimate the natural escapement.

TRH commenced spawning operations for 2012-13 on September 4, 2012. Coho salmon that entered the TRH spawning facility were identified to sex, inspected for tags, inspected for fin or maxillary clips, and measured to FL.

The observed length frequency distribution of coho salmon FL measurements was stratified into jacks and adult year classes. The minimum adult size was determined by analysis of the WCW and TRH coho salmon length frequencies (see Task 1).

The contribution of TRH-produced coho to run-size, escapement and in-river angler harvest above WCW, required the following information:

1. Marked totals of juvenile coho salmon released from TRH for BY 2009 and BY 2010,
2. Recovery totals of marked and unmarked coho returning to TRH in 2012-13,
3. Total coho salmon run-size above WCW,
4. The percentage of marked coho salmon observed at WCW,
5. In-river angler harvest rates on coho above WCW, and,
6. Specific age class determinations.

To estimate the TRH-produced component of the run above WCW, we use the equation:

$$N_{RM} = \frac{NW_{RM}}{NW} \times N_{cohorun}$$

where:

- N_{RM} = the estimated number of coho above WCW with a RM clip,
- NW_{RM} = the number of coho observed at WCW with a RM clip,
- NW = the total number of coho observed at WCW; and,
- $N_{Cohorun}$ = the total estimated run of coho above WCW.

To estimate the number of naturally-produced (un-marked) coho salmon above the weir we use the equation:

$$N_N = N_{Cohorun} - N_{RM}$$

where:

- N_N = the estimated number of naturally-produced coho salmon above WCW.

The number of RM clipped (marked) coho salmon for each age strata is estimated by multiplying the ratio of marked to unmarked coho salmon observed at WCW with the total age stratified run-size estimate. The remaining coho salmon are considered naturally-produced.

Coho salmon harvest rate estimates are calculated using angler tag return data presented in Task 1. Harvest rates are applied to the age stratified coho salmon run to produce a harvest estimate. The estimate is apportioned to either RM clipped or naturally-produced coho salmon based on tag returns. Coho salmon escapement is determined by the following equation:

$$N_{escapement} = N_{cohorun} - H_{coho}$$

where:

- H_{coho} = the estimated number of coho harvested by anglers upstream of WCW.

Escapement is divided into TRH escapement and natural escapement. TRH escapement is a direct count of RM clipped and unmarked coho salmon that entered TRH, while natural escapement is estimated by the following equation:

$$N_{Naturalescapement} = N_{escapement} - N_{TRHescapement}$$

where:

- $N_{Naturalescapement}$ = the estimated number of coho salmon that spawned above WCW in natural areas; and
- $N_{TRHescapement}$ = the number of coho salmon that entered TRH.

All estimates are stratified by jacks and adults and by RM clipped and unmarked coho individuals.

Additional data compilation and analysis methods are reported in Sinnen and Null, 2002; Sinnen and Moore, 2000; Sinnen, 2004a, 2004b, 2005, 2006, 2008; and Sinnen and Hileman, 2009, 2010a, 2010b, 2011, and 2013.

Juvenile Coho Marking at Trinity River Hatchery

The naturally-produced and TRH-produced coho salmon run-size and escapement estimates involved several steps beginning two years prior with the marking of BY 2009 TRH-produced coho salmon with RM clips prior to volitional release from TRH in March 2010. BY 2010 TRH-produced coho salmon were marked with RM clips prior to volitional release from TRH in March 2011.

In 2012-13, the marking of the age 1 BY 2011 TRH-produced coho salmon was performed. BY 2011 TRH-produced coho salmon were ponded across 4 paired raceway blocks, in 7 separate raceways at TRH. Each raceway was temporarily divided by a removable perforated barrier during the marking process to isolate marked from unmarked individuals. The marking shed was placed on top of each raceway block and moved across the raceway with a forklift upon completion of each block.

During the marking process, individuals from the unmarked side of a raceway were brought by the net-full into a holding tank inside the marking shed. The juvenile coho were anaesthetized with carbon dioxide (CO₂). Upon sedation, the right maxillary (RM) bone of each individual was removed by a technician with a pair of surgical scissors. Marked fish were tallied with a manual counter. Each marked individual was then placed down a flume with running water into the marked side of the raceway. Observed mortalities of marked coho were subtracted from the daily effectively marked total.

Quality control of the marking efforts of the TRH BY 2011 coho salmon consisted of a 2% visual inspection of individuals in each raceway prior to the volitional release in March 2012. The sampled individuals were anaesthetized with CO₂, measured to the nearest millimeter (mm) fork length (FL), and checked for the absence of the right maxillary bone. If more than 3/4 of the bone was excised it was considered a good clip; less than that is considered a poor clip and the individual was re-clipped. Fish with no clips were counted, then clipped and returned to the raceway. After the 2% quality control sample was examined, the total number of non-clips was divided by the total sample x 100 to obtain the percent marking error.

RESULTS

Run-size and Escapement Estimates

A total of 563 coho salmon were trapped and effectively tagged at the WCW for the 2012-13 mark-recapture analysis. The first coho salmon of the season was trapped and

tagged on September 7, 2012. The last coho of the season was trapped and tagged November 15, 2012.

A total of 8,235 coho salmon returned to TRH in 2012-13. The first coho salmon of the season was observed at TRH on October 1, 2012 and the last on January 2, 2013. A total of 248 WCW tagged coho salmon (44.0% of tags applied) were recovered at TRH in 2012-13. Using the Peterson type mark-recapture model, we estimate the total coho salmon run-size and escapement for 2012-13 above WCW was 18,657 fish [95% confidence interval (CI): 16,515 to 21,181]. Based on counts of 8,235 fish returning to TRH we estimate escapement to natural areas was 10,422 fish.

The minimum adult size of 51cm FL for coho salmon returning in 2012-13 was determined from inspection of length-frequency histograms (Task 1). Based on the minimum adult size, we estimate the 2012-13 total run-size was composed of 3,389 (11.2%) jacks and 15,268 (88.8%) adults.

The total escapement to TRH was composed of 879 jacks (99.1% RM-clipped) and 7,356 adults (97.3% RM-clipped). This includes 8 naturally-produced jacks and 197 natural-produced adults recovered at TRH. Based on the percent of jacks (18.1%) and adults (81.2%) observed at WCW the escapement estimate to natural areas consisted of 184 naturally-produced jacks, 2,327 TRH produced jacks, 1,577 naturally-produced adults, and 6,335 TRH produced adults. The total escapement of naturally-produced adult coho for 2012-13 was 1,774 fish (Table 1).

Although the sport harvest of coho salmon is prohibited in the Trinity River, some coho salmon are occasionally harvested by anglers due to mistaken identity or a lack of knowledge of the law. In 2012-13 no coho were reported harvested by sport anglers however, six adults and one jack were reported as caught and released.

Annual run-size estimates for TRH-produced coho jacks and adults 1997-2012 are presented in Figure 2. A recent history of coho population parameters is presented in Tables and Figures A1-A8 in the Appendix.

Table 1. Run-size, in-river sport catch, and spawner escapement estimates for naturally- and Trinity River Hatchery-produced coho, upstream of Willow Creek weir during the 2012-13 season.

Strata	BY a/	Age b/	Run-size	Angler harvest	Spawning escapement	
					TRH c/	Natural area
Naturally-produced	2010	2	192	0	8	184
	2009	3	1,774	0	197	1,577
Subtotal:			1,966	0	205	1,761
TRH-Produced	2010	2	3,198	0	871	2,327
	2009	3	13,494	0	7,159	6,335
Subtotal:			16,692	0	8,030	8,662
Grand total:			18,658	0	8,235	10,423

a/ BY=Brood year

b/ Age classes are determined using fork length frequency analysis.

c/ TRH=Trinity River Hatchery

Brood Year Performance

Coho of BY 2009 completed their typical three-year life-cycle in 2012-13. Based on age three coho run-size estimates and age 2 run-size estimates from 2011-12 of 10,982 jacks and an initial age one volitional release of 490,998 marked juveniles in March 2010, the return rate for BY 2009 TRH produced coho was 5.0% (Table 2). A perspective of brood year performance is presented in Table A-2 and Figure A-8.

The escapement of BY 2009 TRH-produced (marked) coho salmon as adults in 2012-13 consisted of 7,159 marked individuals that entered TRH and an estimated 6,335 marked individuals that spawned in natural areas. The total adult run-size estimate for 2012-13 consisted of 88.4%TRH-produced fish.

The first year for returns of BY 2010 TRH-produced coho salmon was 2012-13. In March 2012, 489,348 BY 2010 TRH-produced coho salmon were volitionally released. The total jack run-size estimate for 2012-13 consisted of 94.0% BY 2010 TRH-produced individuals.

TRH spawned coho salmon from November 6 to December 10, 2012. TRH exceeded the egg take allotment of 1.2 million eggs for the BY 2012 production of 500,000 juveniles. TRH spawned a total of 607 adult female coho salmon in 2012-13 (Larry Glenn (CDFW), personal communication). The annual escapement goal of 2,100 TRH-produced adult coho has been exceeded each year for the last fifteen years.

Table 2. Run-size, percent return, in-river angler harvest and spawner escapement estimates for Trinity River Hatchery-produced coho salmon returning to the Trinity River upstream of the Willow Creek weir during the 2012-13 season.

Release Data				Estimated Returns							
Clip a/	Brood Year	Date	Number b/	Site	Age c/	Run-size	% of release	River harvest	Spawning Escapement		
								TRH d/	Natural	Total	
RM	2009	3/15/2011	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:						24,479	4.98	0	12,883	14,445	24,479
RM	2010	3/15/2011	489,348	TRH	2	3,198	0.65	0	871	2,327	3,198

a/ Identifying clip. Beginning with the 1994 brood year, all coho salmon released from Trinity River Hatchery received right maxillary (RM) clips.

b/ Number of marked (RM) coho estimated released.

c/ Age classes are determined using length frequency analysis.

d/ TRH= Trinity River Hatchery, actual count.

Juvenile Coho Marking at Trinity River Hatchery

The marking of the entire TRH production of BY 2011 coho salmon (age 1) was completed by February 20, 2013. A total of 511,134 individuals were counted during the marking process. Factoring in 70 mortalities, a net total of 511,064 individuals were marked with an RM clip. Approximately 2% of these individuals (10,221) were sampled for RM clip quality and fork length measurement (FL) prior to the start of the volitional release on March 15, 2013.

The pre-release fork length measurements of BY 2011 production ranged from 61mm to 270mm. The pre-release fork length average for the BY 2011 across all raceways was 142.7mm, which is 0.7mm smaller compared to BY 2010.

Based on the quality control sampling, an estimated 99.9% of the BY 2011 production was effectively RM clipped. Factoring in post-marking losses, a total of 511,618 individuals were volitionally released beginning March 15, 2013 (511,022 marked and 596 unmarked). These individuals will compose the population of TRH-produced jacks in 2013-14 and TRH-produced adults in 2014-15.

Table 3. Production, marking totals, and quality control data for BY 2011 TRH coho salmon volitionally released March 15, 2013.

Hatchery raceway								
	G3-4	J3-J4	J1-J2	N3-N4	N1-2	O3-O4	O1-2	Totals
Marking totals								
Number marked	68,074	71,415	73,120	74,367	71,747	81,598	70,813	511,134
Post-mark mortalities	11	5	9	17	14	13	1	70
Total marked	68,063	71,410	73,111	74,350	71,733	81,585	70,812	511,064
Quality control parameters								
Number examined	1,361	1,428	1,462	1,487	1,435	1,632	1,416	10,221
Number un-marked	1	0	1	1	3	2	4	12
Percent un-marked	0.07%	0.00%	0.07%	0.07%	0.21%	0.12%	0.28%	0.12%
Mean fork length (mm)	142.67	141.03	144.78	142.06	148.25	137.95	143.02	142.70
Fork length range (mm)	61 - 266	86 - 250	98 - 270	86 - 257	80 - 245	82 - 262	94 - 265	61 - 270
Release totals								
Marked releases	68,063	71,403	73,108	74,342	71,726	81,578	70,804	511,024
Un-marked releases	50	0	50	50	149	98	201	598
Percentage marked	99.99%	100.00%	99.99%	99.99%	99.79%	99.88%	99.72%	99.88%
Total released	68,113	71,403	73,158	74,392	71,875	81,676	71,005	511,622

DISCUSSION

The 2012-13 coho run-size estimate of 18,658 individuals ranked as the sixth largest in the last sixteen years and is slightly above the sixteen year average of 16,992 fish. The annual run-size estimate of coho salmon has ranged from a low of 5,535 in 1999 to a high of 38,882 in 2004 (Figure A-1). This year's coho run of 16,692 (89%) TRH-produced and 1,966 (11%) naturally-produced coho continues the trend of TRH stock coho returning in much larger numbers than naturally-produced fish.

The 2012-13 naturally-produced run-size of 1,966 coho salmon (192 jacks and 1,774 adults) was the largest in the previous five years (Figure A-2). The naturally-produced escapement estimate of 1,774 adult coho salmon (1,577 to natural areas and 197 recovered at TRH) exceeded the escapement goal of 1,400 set in the IAP. The annual escapement estimate of naturally-produced adult coho salmon returning to natural areas has ranged from a low of 232 in 1997 (first year of record for naturally-produced escapement) to a high of 7,830 in 2004. Although the long term trend in the annual escapement estimates for naturally-produced adult coho salmon has remained relatively flat since 1997 (average of 1,563 natural-produced adults), the short term trend since the implementation of the IAP has steadily increased. The 2012-13 spawning season was the first season since the publication of the IAP that the escapement goal of 1,400 naturally-produced adult coho has been met or exceeded (Figure A-3).

In 2012-13, no sport angler harvested coho salmon were reported. However, this has potential to be an under-estimate as take and possession of coho salmon is illegal under California law and is well documented in the annual sport angler regulations. Since sport harvest of coho salmon is illegal, coho salmon at WCW are only tagged with non-reward tags. Six adults and one jack with non-reward WCW tags were reported by anglers as caught and released.

We estimate 10.85% of the TRH-produced returns were jacks. The percentage of TRH-produced jacks relative to the TRH-produced run size has ranged from a high of 49.74% in 1997 to a low of 6.36% in 2006. Although the percentage has varied from year to year, the long term trend from 1997 to 2012 in the percentage of TRH-produced jacks relative to TRH-produced returns has remained relatively stable (average of 18.4%). It should be noted that TRH generally only spawns adult coho salmon. Jack coho salmon are not included in the spawning matrix within any given spawn-year. This functionally means that jack coho salmon do not make any genetic contribution to the annual TRH production of coho salmon.

An estimate of 192 naturally-produced coho jacks returned in 2011-12 which comprised 1% of the total run and 10% of natural production. The percentage of naturally-produced jacks relative to the naturally-produced run size has varied from a high of 62.28% in 1997 to a low of 1.82% in 2004. The long term trends in the percentage of naturally-produced jacks relative to naturally-produced run size estimates has sharply decreased over the last sixteen years.

Several factors may influence natural coho production and escapement in the Trinity River, including the amount and quality of spawning and juvenile rearing area, TRRP management actions, tribal harvests, interaction with hatchery stocks, and ocean conditions. The recent uptrend in natural coho escapement from the low returns of 2009 corresponds with an increase in TRH stock escapement.

Based on review of WCW trapping data, coho runs returning to the upper Trinity basin are heavily supported by TRH production. Coho run estimates, upstream of WCW, (for years in which all TRH-produced coho have been 100% marked) has consistently shown that the marked percentage of coho has been substantial, 77 to 94% of the total estimated (Appendix 1). While interactions with TRH stocks may be viewed as detrimental to natural coho production for many reasons the hatchery stock also protects the population from catastrophic losses, and could take on a very important role in the protection and recovery of this population (NOAA 2012).

RECOMMENDATIONS

1. Continue the marking of the TRH juvenile coho salmon production prior to volitional release for BY 2013.
2. Continue the mark-recapture efforts at WCW for 2013-14.
3. Offer reward tags for coho salmon spaghetti tags.
4. Study hatchery interactions with natural coho stocks.
5. Perform life-cycle monitoring of natural coho stocks.
6. Review coho salmon management for the Trinity River to ensure consistency with Federal and State strategies and objectives.

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APPENDICES

Table A-1. Natural and Trinity River Hatchery-produced coho salmon run-size, in-river angler harvest and escapement estimates for the Trinity River upstream of Willow Creek weir 1997-2012.

Run year	Strata	Run-size Estimate			Spawner Escapement						Angler harvest		
		Grilse	Adults	Total	Natural			Trinity River Hatchery			Grilse	Adults	Total
					Grilse	Adults	Total	Grilse	Adults	Total			
1997	Natural	399	252	651	383	232	615	13	20	33	3	0	3
	TRH	5,552	1,732	7,284	4,655	865	5,520	858	867	1,725	39	0	39
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
1999	Natural	31	555	586	23	440	463	8	103	111	0	12	12
	TRH	592	4,357	4,949	211	1,256	1,467	381	3,015	3,396	0	86	86
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
2001	Natural	298	3,075	3,373	296	2,945	3,241	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
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
2003	Natural	163	3,930	4,093	149	3,264	3,413	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
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
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
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
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
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
2009	Natural	116	520	636	113	429	542	3	91	94	0	0	0
	TRH	1,630	4,067	5,697	758	1,681	2,439	872	2,386	3,258	0	0	0
2010	Natural	44	817	861	34	654	688	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
2011	Natural	252	1,349	1,601	230	1,139	1,369	22	210	232	0	0	0
	TRH	10,982	4,796	15,778	8,120	3,083	11,203	2,862	1,713	4,575	1	0	1
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

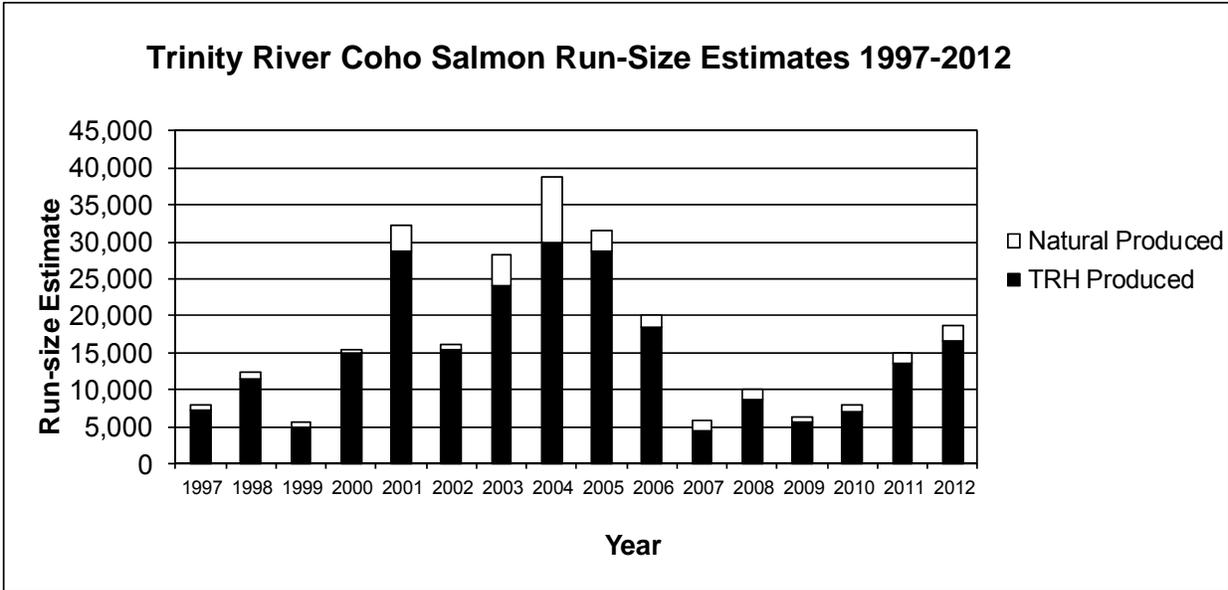


Figure A-1. Annual coho salmon run-size estimates upstream of Willow Creek weir, 1997-2012.

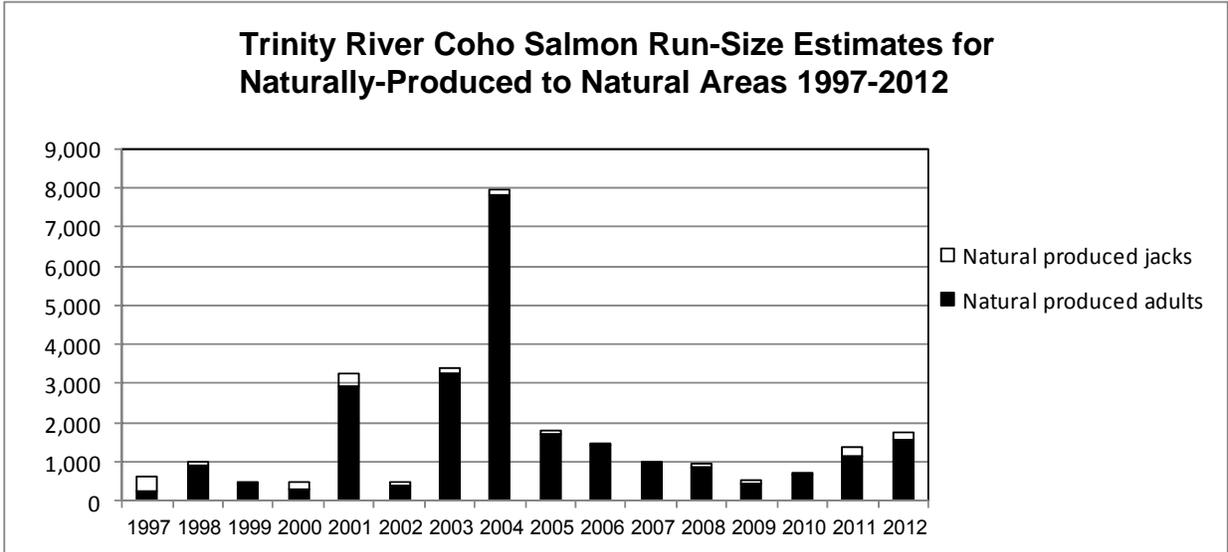


Figure A-2. Annual run-size estimates of naturally-produced coho salmon to natural areas above Willow Creek weir 1997-2012.

Escapement Estimates for Naturally-Produced Adult Coho Salmon Since 2009

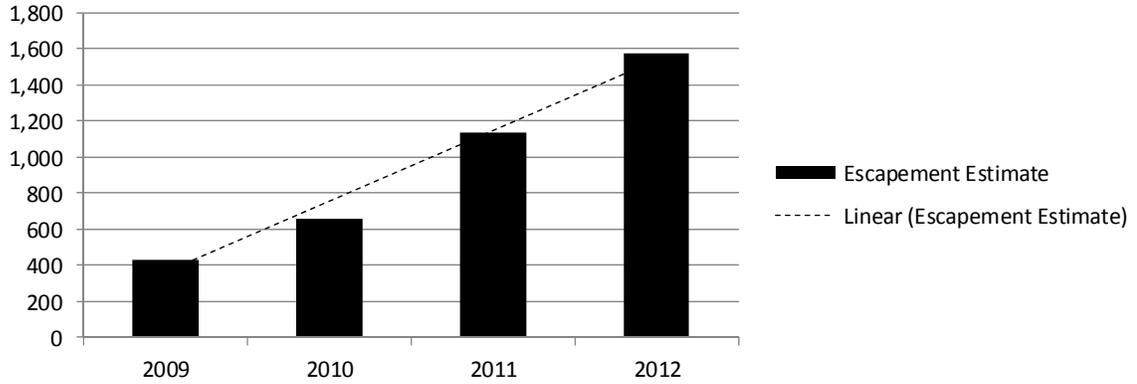


Figure A-3. Adult escapement estimates of naturally-produced coho salmon stocks above Willow Creek weir 2009-2012. A statistically significant ($P=0.0098$; $R^2= 0.98$) short term linear increasing trend is shown.

Trinity River Coho Salmon Run-Size Estimates for Trinity River Hatchery-produced individuals 1997-2012

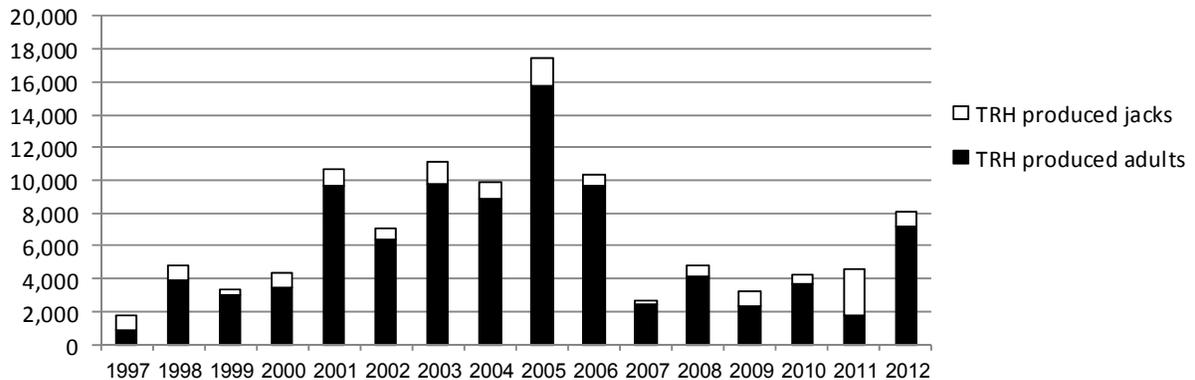


Figure A-4. Annual run-size estimates of Trinity River Hatchery-produced coho salmon to the Trinity River above Willow Creek weir, 1997 – 2012.

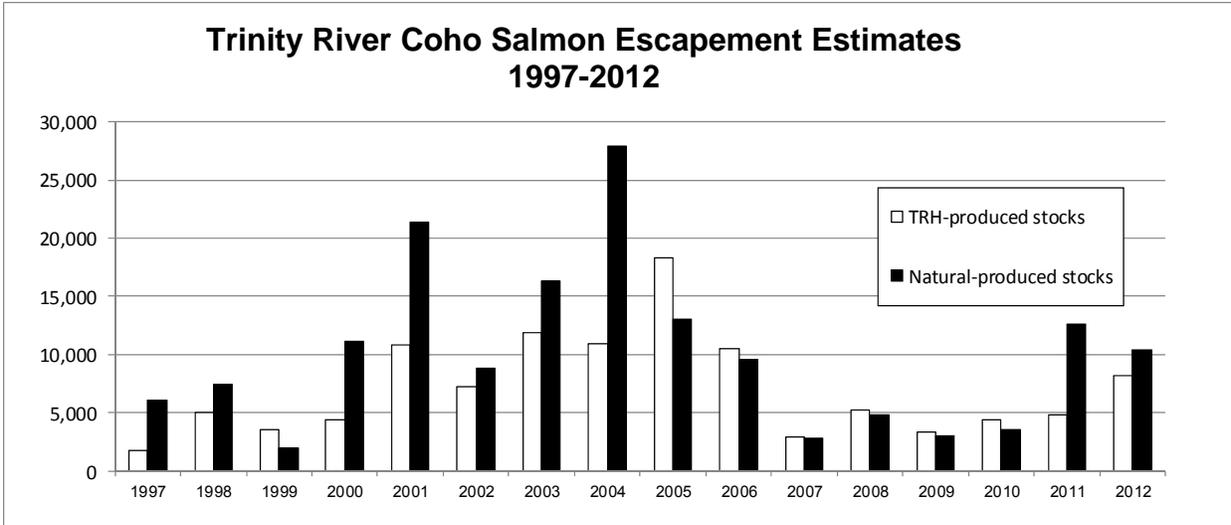


Figure A-5. Annual coho escapement estimates to the Trinity River above Willow Creek weir, 1997-2012.

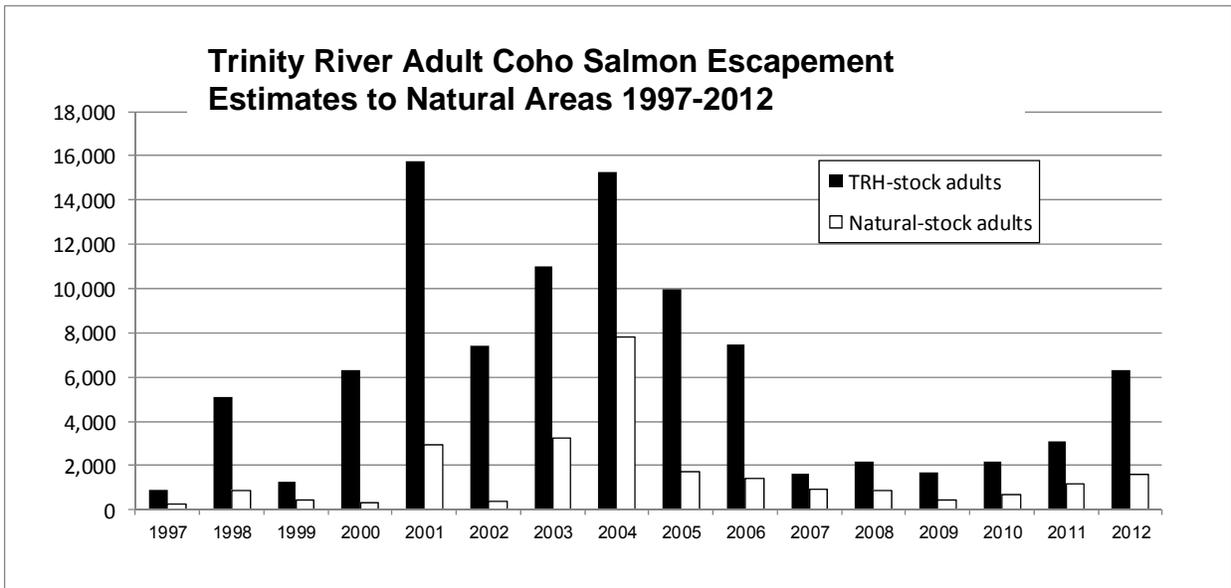


Figure A-6. Escapement estimates of naturally- and hatchery-produced adult coho salmon to natural areas above Willow Creek weir, 1997-2012.

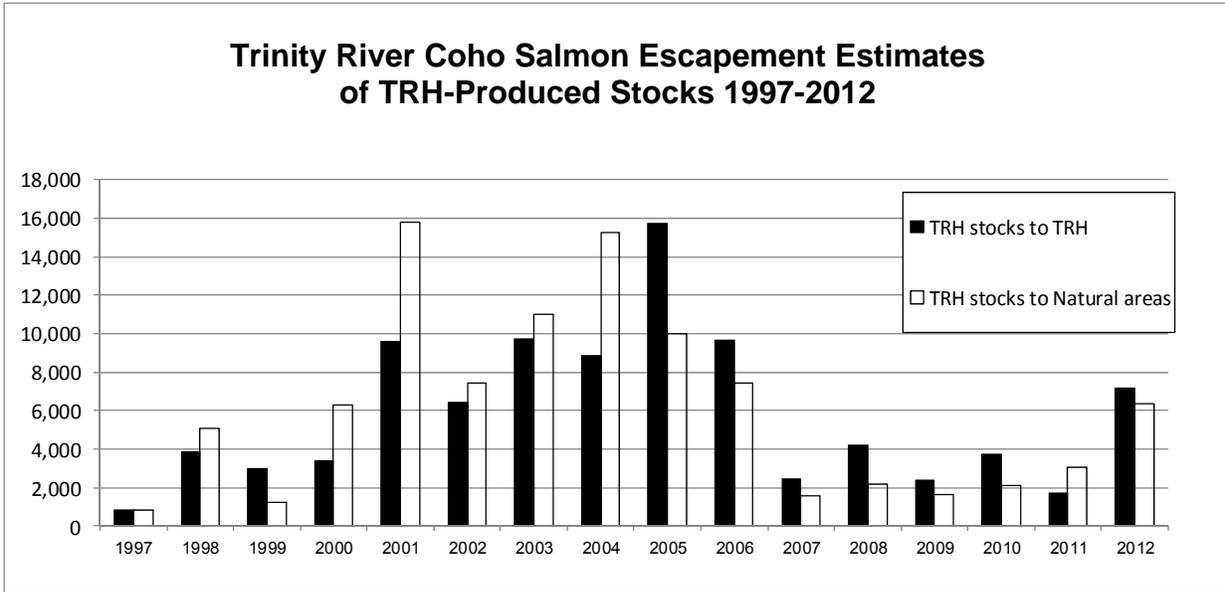


Figure A-7. Adult escapement estimates of Trinity River Hatchery-produced coho salmon stocks above Willow Creek weir, 1997–2012.

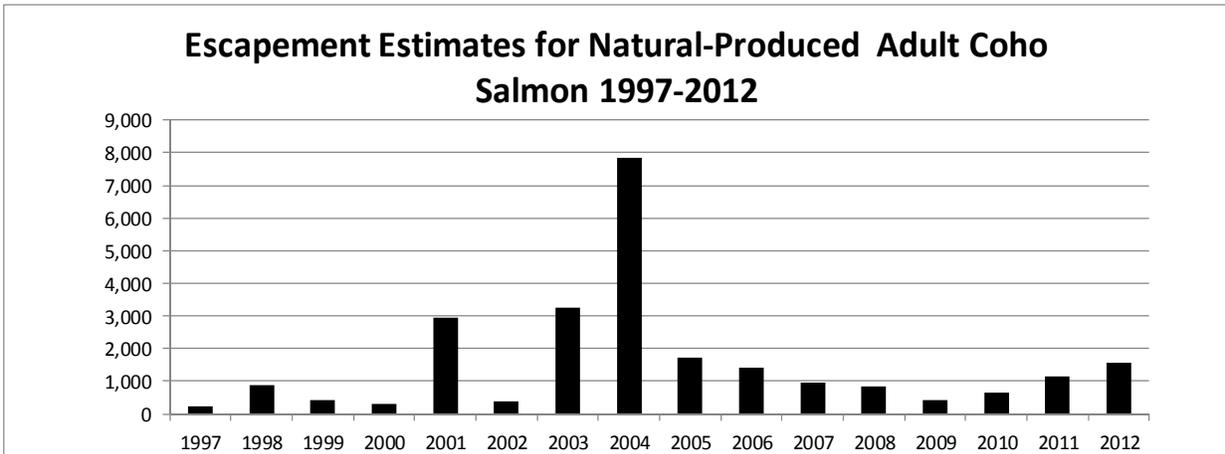


Figure A-8. Adult escapement estimates of naturally-produced coho salmon stocks above Willow Creek weir, 1997 – 2012.

Table A-2. Brood year performance and return data for Trinity River Hatchery coho salmon returning to Trinity River, upstream of Willow Creek weir, 1994 - 2009.

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
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	6,381
				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	0.99%	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

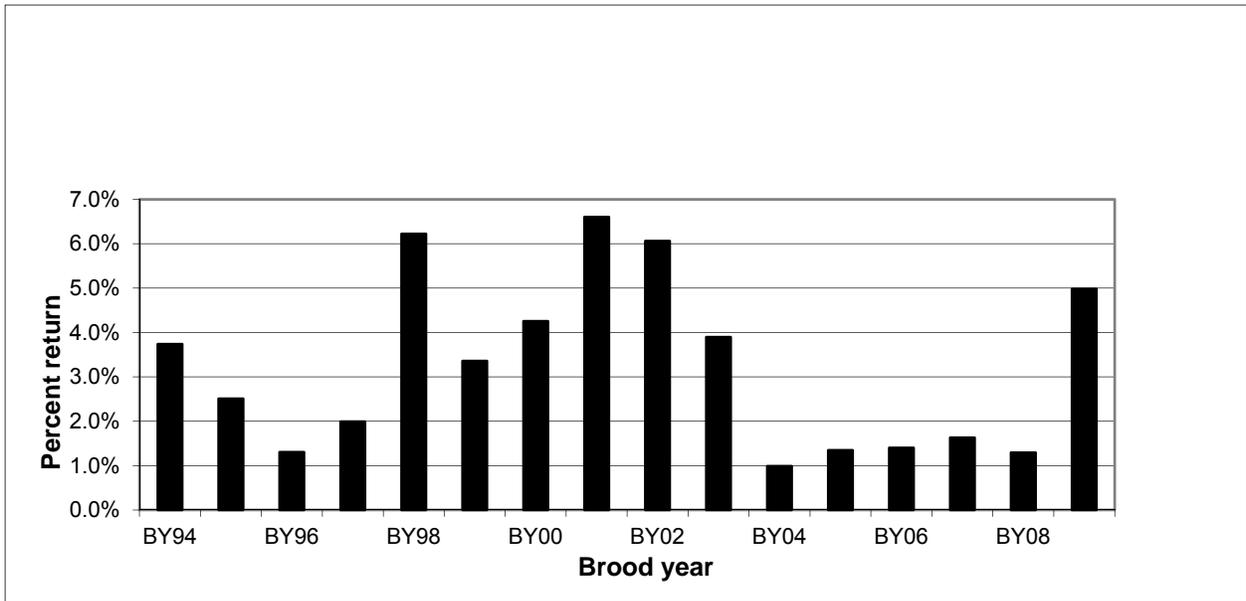


Figure A-9. Return rate for Trinity River Hatchery coho salmon for brood years 1994-2009.

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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2012 SEASON**

**TASK 4
CHINOOK SALMON SPAWNING SURVEYS IN THE UPPER TRINITY RIVER**

by

Andrew Hill

ABSTRACT

The California Department of Fish & Wildlife's Trinity River Project, in cooperation with the Yurok Tribal Fisheries Program, Hoopa Valley Tribal Fisheries, U.S. Forest Service and the U.S. Fish and Wildlife Service, perform annual salmon spawning surveys in the main stem Trinity River. This report summarizes data collected from spawning surveys conducted from September 5, 2012 to December 18, 2012 between Lewiston Dam to Cedar Flat [101.6 river kilometers (rkm)] and from Hawkins Bar to Weitchpec (64.1 rkm) on the Trinity River. Survey data includes carcass identification, sex, fork length, age, spatial distribution, temporal distribution, and pre-spawning mortality of Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*). All estimates and relations between redd and carcass data will be made in the combined report with the United States Fish and Wildlife Service. These data provide short-term and add to long-term trend information to help assess management actions of the Trinity River Restoration Project (TRRP) and to monitor progress of the TRRP goals to restore habitat and increase natural salmonid production in the Trinity River.

TASK OBJECTIVES

- To determine the size, sex composition, and hatchery component of Chinook and coho salmon spawning populations in the main stem Trinity River.
- To determine the incidence of pre-spawning mortality among naturally spawning Chinook and coho salmon in the main stem Trinity River.
- To determine the temporal and spatial distribution of the naturally spawning populations of Chinook and coho salmon within the main stem Trinity River.

INTRODUCTION

The California Department of Fish & Wildlife's (CDFW) Trinity River Project (TRP), in cooperation with the Yurok Tribal Fisheries Program (YTFP), Hoopa Valley Tribal Fisheries (HVTF) and the U.S. Fish and Wildlife Service (USFWS), conducted a Chinook spawning survey in the main stem Trinity River. The survey was funded through the Trinity River Restoration Program (TRRP). The U.S. Forest Service (USFS) also participated in the survey using internal funding. USFS participation was limited to enumerating redds in the uppermost reach from Lewiston Dam to Old Bridge (Reach 1).

In the past, the reporting responsibilities for the project were divided into two parts: 1) CDFW was responsible for reporting on the carcass survey portion of the study, and 2) the USFWS for the redd enumeration part of the study (Chamberlain et al 2012). During the adult review of the Trinity River Restoration Programs in 2012, the decision was made to combine reporting responsibilities for this project. Beginning with the 2012 spawning season, the USFWS will be reporting on combined redd and carcass spawning surveys coauthored by CDFW and other partners. To meet contract obligations, this report will include data from the carcasses encountered and the final estimates and findings will be reported in the combined report.

Spawner surveys have been conducted intermittently on the Trinity River since 1955. Spawning surveys prior to 1964 included river sections located above river mile 111.9 (rkm 180.1), the site of present day Lewiston dam. Results from spawner surveys can be utilized to improve our understanding of the pre- and post- treatment effectiveness of flow and habitat manipulations being implemented by the TRRP to improve salmon spawning conditions. These include assessment of management actions intended to reduce temperature related pre-spawning mortality and protect in-vivo egg viability of anadromous spawners in the main stem Trinity River (IAP Objective 3.1.3), minimize impacts of predation and genetic interactions between and among hatchery and natural anadromous fish (IAP Objective 3.3.3), increase escapement of naturally produced fall Chinook salmon adults to 62,000 (IAP Objective 4.1.1), and increase escapement of naturally produced spring Chinook salmon adults to 6,000 [(IAP Objective 4.2.1) TRRP 2009]. Pertinent metrics to be analyzed over time include spawner density, spawner distribution, hatchery contribution rates, and pre-spawn mortality rates in the upper main-stem Trinity River. Additionally, this survey can be used to validate and refine estimates produced in Task 1 of this report.

METHODS

The study area included the main stem Trinity River from its upstream limit of anadromy at Lewiston Dam downstream to the Cedar Flat Recreational Area and from Hawkins Bar to Weitchpec. The stretch from Cedar Flat to Hawkins Bar is not surveyed due to hazardous conditions. The study area was divided into 14 reaches (Table 1, Figure 1),

and the reaches were surveyed between September 5, 2012 and December 18, 2012. Two rafting teams consisting of CDFW and Yurok Tribal Fisheries crews attempted to survey reaches 1-5 weekly by starting at reaches one and working downstream through reach five. USFWS and HVTF crews also attempted to survey reaches six and seven weekly, while reaches 8-10 and 12-14 were surveyed on a bi-weekly basis. However, logistical constraints caused some reaches to be occasionally excluded (Table 2).

Table 1. Main stem Trinity River spawner survey reach descriptions.

Reach	Start	End
1	Lewiston Dam (rkm 180.1)	Old Lewiston Bridge (rkm 176.9)
2	Old Lewiston Bridge (rkm 176.9)	Bucktail Launch (rkm 169.0)
3	Bucktail Launch (rkm 169.0)	Steel Bridge (rkm 158.8)
4	Steel Bridge (rkm 158.8)	Douglas City Campground (rkm 148.4)
5	Douglas City Campground (rkm 148.4)	Roundhouse Launch (rkm 132.7)
6	Roundhouse Launch (rkm 132.7)	Junction City Campground (rkm 125.5)
7	Junction City Campground (rkm 125.5)	North Fork Trinity Confluence (rkm 116.7)
8	North Fork Trinity Confluence (rkm 116.7)	Big Flat Launch (rkm 107.0)
9	Big Flat Launch (rkm 107.0)	Del Loma Access (rkm 92.2)
10	Del Loma Access (rkm 92.2)	Cedar Flat Recreation Area (rkm 78.5)
11	Cedar Flat Recreation Area (rkm 78.5)	Hawkins Bar (rkm 64.1)
12	Hawkins Bar (rkm 64.1)	Camp Kimtu (Willow Creek, rkm 41.7)
13	Camp Kimtu (Willow Creek, rkm 41.7)	Rolands Bar (rkm 20.3)
14	Rolands Bar (rkm 20.3)	Weitchpec (Trinity mouth rkm 0)

Surveys were conducted using inflatable rafts equipped with rowing frames. Each raft was staffed by two crew members, one rower/recorder and one technician responsible for recovering carcasses and enumerating redds. Each rafting crew covers one side of the river (right bank to middle and left bank to middle) as the crews proceed downstream. Additionally, all side channels are walked by the crew covering the bank of origin. Carcasses were recovered from all accessible areas in the river and along the shoreline. Fish in deeper areas were recovered using telescoping poles with attached gigs.

Carcasses sampled during the survey were given a condition rating in order to describe their stage or degree of decomposition. During the survey, carcasses were separated into one of three categories: 1) condition-1 was a carcass with at least one clear eye, 2) condition-2 was a carcass with both eyes cloudy, and 3) condition-3 was skeletal remains. All condition-1 and condition-2 Chinook carcasses were marked with unique jaw tags and returned to moving water. These carcasses were then available for recapture. Condition 3 carcasses and those with their heads removed for coded wire tag removal were not marked due to reduced probability of being recaptured due to decomposition. If the carcass numbers for a given survey day are predicted to be too great for the survey to be completed, a carcass subsampling method will be initiated to allow surveyors to complete one survey reach during one survey day. No Chinook

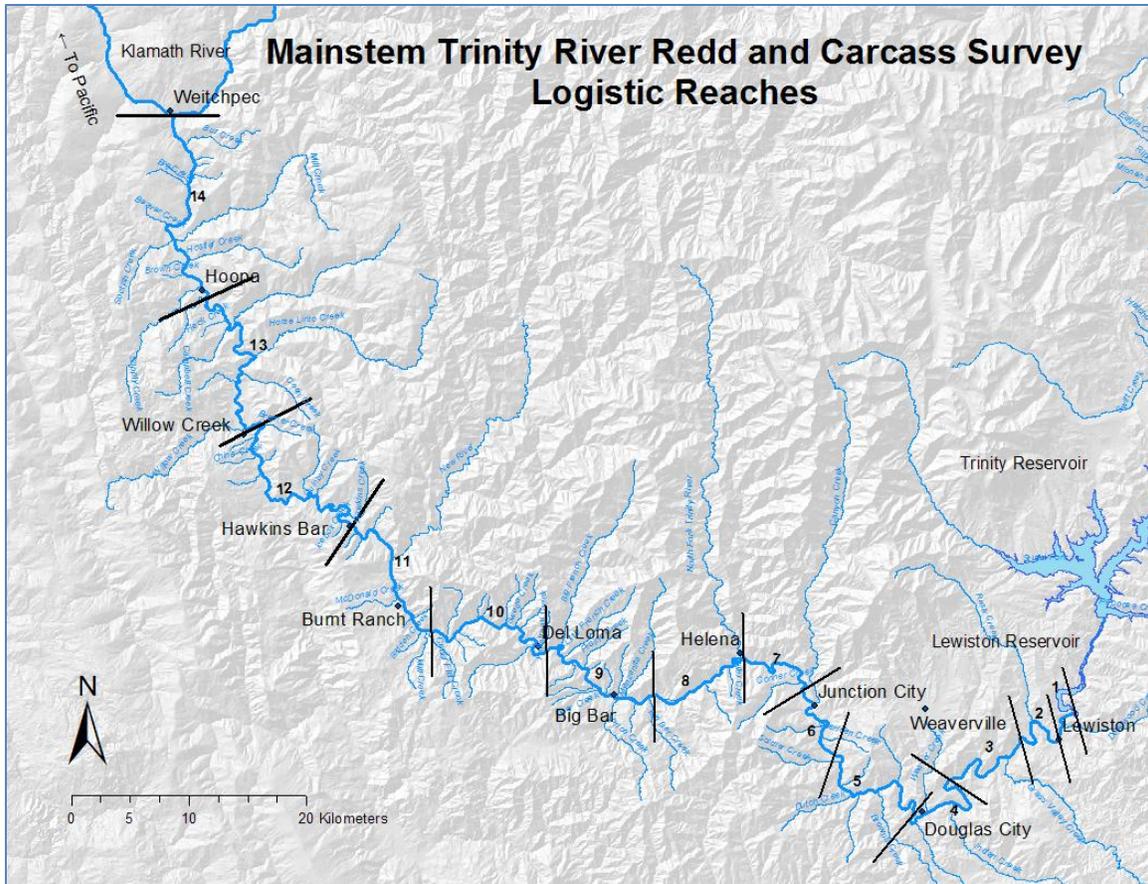


Figure 1. Survey reaches for 2012 Trinity River main stem spawner survey. Map courtesy of USFWS.

carcasses were chopped in half, and all were returned to moving water. All coho salmon, steelhead, and brown trout carcasses encountered during the survey were cut in half with a machete to prevent recounting the same fish on later surveys.

Sampled carcasses were identified to species, gender, spawning condition, examined for hatchery clips, and examined for weir tags. Carcasses were measured to the nearest cm fork length (FL). Trinity River Hatchery (TRH) clips included adipose fin-clips (ad-clips) on Chinook and steelhead and right maxillary clips (RM) on coho salmon. Additionally, all TRH ad-clipped Chinook salmon are implanted with a CWT. At TRH, approximately 25% of all juvenile Chinook and 100% of coho salmon and steelhead are clipped prior to release. Heads of all recovered ad-clipped Chinook were removed and retained for later CWT tag recovery. The CWTs are extracted and read by the Department's Trinity River Project staff. All weir tags, applied at the two main stem weirs, were removed and recorded.

Field crews examined all condition-1 and condition-2 female salmon for spawning condition by visual observation of the carcass and questionable carcasses are sliced

open for determination. Fish were classified as either spawned or un-spawned based upon % egg retention and/ or observation of size of the abdomen condition of the vent. Females with swollen abdomens and non-distended vents and retaining the majority of their eggs were classified as un-spawned; conversely females retaining very few eggs, hollow abdomens, and distended vents were determined to have spawned. Due to the difficulty in accurately determining if a male has successfully spawned, male spawning condition was not assessed.

RESULTS

Temporal Carcass Distribution

A total of 5,776 Chinook, 258 were coho salmon, and 483 unidentified carcasses were sampled during the survey, not including the recaptured and subsampled carcasses (Figure 2). Carcass subsampling began Julian Week 42 and lasted until the end of the survey (Table 2). An important factor in these numbers is the recaptured and subsampled carcasses from table 2 are not included in the figure due to the fact that they were only enumerated and no information was gathered on them. It should also be noted that temporal coverage of the coho run was incomplete because the survey efforts ended prior to the end of spawning activity. To fully enumerate coho salmon spawning activity in the main stem, survey efforts would need to continue at least through January.

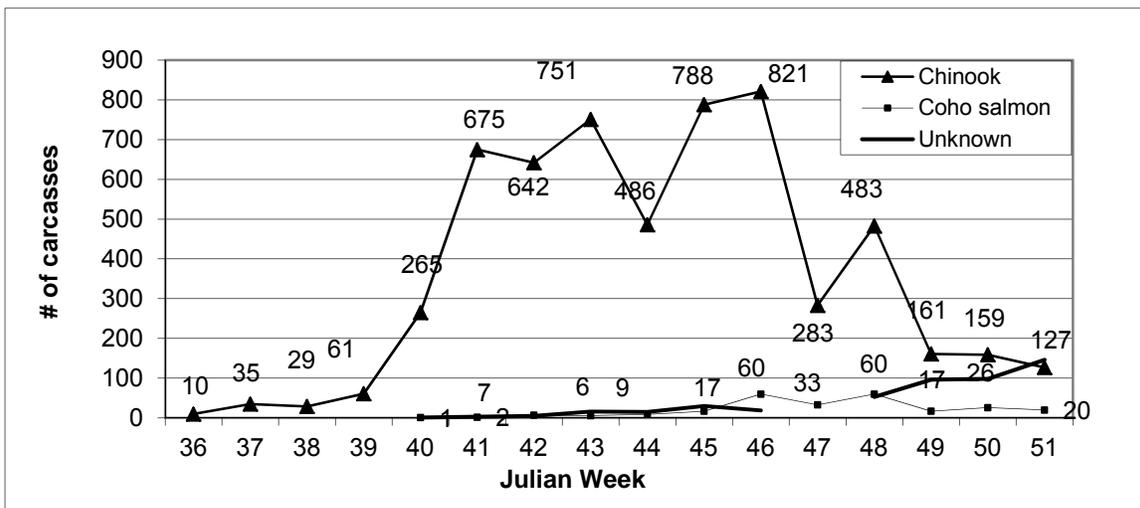


Figure 2. Chinook, coho salmon, and unidentified carcasses collected, by Julian week, during the 2012 Trinity River main stem spawner survey.

Table 2. Subsampling rates and counts for the 2012 main stem Trinity spawner survey.

Julian Week	Reach	Subsample Rate	Subsample Count
42	1	1:2	137
	2	1:2	175
43	1	1:4	167
	2	1:4	361
	3	1:2	87
	4	1:2	104
	5	1:2	67
44	1	1:4	280
	2	1:4	459
	3	1:2	59
	4	1:2	80
	5	1:3	35
45	1	1:3	157
	2	1:4	355
46	1	1:2	317
	2	1:2	286
47	1	1:3	767
48	1	1:5	1,314
	2	1:5	1,142
49	1	1:10	1,849
	2	1:10	834
50	1	1:10	1,648
	2	1:10	898
51	1	1:5	942
	2	1:5	454
Total number of carcasses subsampled			12,974

Chinook Carcass Distribution

In the 14 survey reaches, 5,776 Chinook carcasses were sampled during Julian weeks 36 to 51 (September 5, 2012 to December 18, 2012) (Tables 3). Of the 5,776 Chinook carcasses encountered, 2,741 (47.5%) were recovered in reaches 1 and 2, where 1,524 (26.4%) of the carcasses were recovered in reach 1 alone. Reach 8 had the fewest carcasses (n=4) and 632 (10.9%) of encountered carcasses were downstream of reach 7 (Table 3).

Table 3. Recovery of all sampled Chinook salmon by Julian week and section during 2012 main stem Trinity River spawner survey.

Reach	Julian Week of Recovery																Total
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
1	10	12	10	10	40	122	100	68	65	83	243	283	228	92	81	77	1,524
2	ns	15	4	9	62	176	133	81	100	86	224	ns	187	47	43	50	1,217
3	ns	6	11	22	61	92	98	64	44	43	100	ns	ns	15	21	ns	577
4	ns	0	3	11	64	119	102	81	65	ns	61	ns	ns	7	9	ns	522
5	ns	1	0	5	19	72	64	56	15	44	ns	ns	3	ns	ns	ns	279
6	ns	0	1	2	10	36	68	103	93	98	48	ns	37	ns	3	ns	499
7	ns	0	0	0	9	34	69	166	95	127	ns	ns	28	ns	1	ns	529
8	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	4
9	ns	0	ns	1	ns	19	ns	90	ns	199	ns	ns	ns	ns	1	ns	310
10	ns	1	ns	1	ns	5	ns	42	ns	108	ns	ns	ns	ns	ns	ns	156
12	ns	ns	ns	ns	ns	ns	1	ns	9	ns	83	ns	ns	ns	ns	ns	93
13	ns	ns	ns	ns	ns	ns	3	ns	ns	ns	53	ns	ns	ns	ns	ns	56
14	ns	ns	ns	ns	ns	ns	4	ns	ns	ns	9	ns	ns	ns	ns	ns	13
Total	10	35	29	61	265	675	642	750	486	788	821	283	483	161	159	127	5,776

Of these sampled Chinook, a total 255 carcasses were hatchery clipped (adipose fin clipped), and 4,993 carcasses were not clipped. Hatchery clips were not discernable on 373 carcasses. Sex was discernable on 5,468 of the sampled fish and not on 303 of the carcasses. Male Chinook numbered 2,351 and females 3,117. Of the 3,117 female carcasses, spawning condition was determined on 2,923 of them where 2,821 had spawned and 102 had not spawned indicating a pre-spawning mortality of 3.49% of sampled Chinook carcasses. Final estimates of pre-spawning mortality and hatchery component incorporating the numbers of carcasses not sampled will be available on the combined red and carcass report.

Coho Salmon Carcass Distribution

A total of 258 coho salmon carcasses were sampled during Julian weeks 36 to 51 (September 5, 2012 to December 18, 2012) in the 14 survey sections (Table 4). Of the 258 coho salmon carcasses encountered, 186 (72.1%) were recovered in reaches 1 and 2, where 135 (52.3%) of the carcasses were recovered in reach 1 alone. Reach 10 had the fewest carcasses (n=1) and 16 (6.2%) of encountered carcasses were downstream of reach 7 (Table 4).

Table 4. Recovery of all sampled coho salmon by Julian week and section during 2012 main stem Trinity River spawner survey.

Reach	Julian Week of Recovery																Total
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
1	0	0	0	0	0	1	0	0	2	3	21	33	34	13	14	14	135
2	ns	0	0	0	0	0	0	0	1	1	14	ns	20	2	7	6	51
3	ns	0	0	0	0	1	0	0	1	2	15	ns	ns	1	3	ns	23
4	ns	0	0	0	1	0	0	2	2	ns	3	ns	ns	1	1	ns	10
5	ns	0	0	0	0	0	0	0	0	2	ns	ns	0	ns	ns	ns	2
6	ns	0	0	0	0	0	0	1	3	2	3	ns	4	ns	0	ns	13
7	ns	0	0	0	0	0	1	2	0	2	ns	ns	2	ns	1	ns	8
8	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
9	ns	0	ns	0	ns	0	ns	1	ns	4	ns	ns	ns	ns	0	ns	5
10	ns	0	ns	0	ns	0	ns	0	ns	1	ns	ns	ns	ns	ns	ns	1
12	ns	ns	ns	ns	ns	ns	1	ns	0	ns	3	ns	ns	ns	ns	ns	4
13	ns	ns	ns	ns	ns	ns	1	ns	ns	ns	1	ns	ns	ns	ns	ns	2
14	ns	ns	ns	ns	ns	ns	4	ns	ns	ns	0	ns	ns	ns	ns	ns	4
Total	0	0	0	0	1	2	7	6	9	17	60	33	60	17	26	20	258

Of these sampled coho salmon, a total 226 carcasses were hatchery clipped (225 were right maxillary clipped from one was left maxillary clipped), and 26 carcasses were not clipped. Hatchery clips were not discernable on 6 carcasses. Sex was discernable on 240 of the sampled fish and not on 18 of the carcasses. Male coho salmon numbered 133 and females 107. Of the 107 female carcasses, spawning condition was determined on 103 of them where 80 had spawned and 23 had not spawned indicating a pre-spawning mortality of 22.33% of sampled coho salmon during the survey. Final estimates of pre-spawning mortality and hatchery component incorporating the numbers of carcasses not sampled will be available on the combined red and carcass report.

Coded Wire Tagged Chinook Salmon

During the 2012 spawning season, 181 coded wire tags (CWTs) were recovered from adipose-fin clipped Chinook carcasses. All of these tags originated from the Trinity River Hatchery and all the information is included in table 5. For all Chinook CWTs recovered during the survey, one five year old, 31 four year olds, 116 three year olds, and no two year old coded wire tagged Chinook were recovered.

Table 5. Release and recovery data for coded-wire tagged, Trinity River Hatchery produced Chinook salmon recovered during the 2012 Trinity River spawner survey.

CWT Code	Brood year	Age	Release	Production	Number
			type ₁	multiplier ₂	recovered
Spring Chinook (n=91 spring CWTs)					
68810	2007	5	Sy	4.02374	1
68812	2008	4	Sf	4.06624	2
68813	2008	4	Sf	4.12789	4
68819	2008	4	Sy	4.09357	3
68821	2009	3	Sf	4.14985	33
68822	2009	3	Sf	4.18498	32
68831	2009	3	Sf	4.21136	2
68832	2009	3	Sf	4.21175	8
68836	2009	3	Sy	4.08572	6
Fall Chinook (n=90 fall CWTs)					
68814	2008	4	Ff	4.08246	3
68815	2008	4	Ff	4.07340	3
68816	2008	4	Ff	4.01831	2
68817	2008	4	Ff	4.02600	2
68818	2008	4	Ff	4.05019	1
68820	2008	4	Fy	4.02446	11
68823	2009	3	Ff	4.18876	11
68824	2009	3	Ff	4.09463	9
68825	2009	3	Ff	4.07450	1
68826	2009	3	Ff	4.11311	9
68828	2009	3	Ff	4.03229	1
68833	2009	3	Ff	4.53266	1
68834	2009	3	Ff	4.52903	1
68837	2009	3	Fy	4.02733	35
	Total number of CWT's not recovered ₃				27
	Total number of CWT's recovered				181
1/ Release types; Sf=Spring fingerling, Sy=Spring yearling, Ff=Fall fingerling, Fy=Fall yearling					
2/ Hatchery production multiplier used to account for untagged releases of same brood year, race, and type					
3/ CWT was not present or was lost during recovery					

Size Composition

Only condition-1 and condition-2 fish were measured and included in the size composition analysis. Condition-3 fish were assumed to have decomposed to a point where length measurements were no longer accurate. The size separating grilse and adults for spring-run and fall-run Chinook and coho salmon was determined using length frequency analysis of fish trapped at the Willow Creek weir, Junction City weir, and the Trinity River Hatchery. For additional information regarding grilse and adult fork length separation see Task 1 of this report.

Chinook Salmon

Fork lengths of sampled Chinook ($n = 4,335$) averaged 70.69 cm. and ranged between 29-117 cm. (Figure 3). Grilse lengths for spring Chinook are less than 50 cm and less than 54 cm for fall Chinook based on estimates from Task 1.

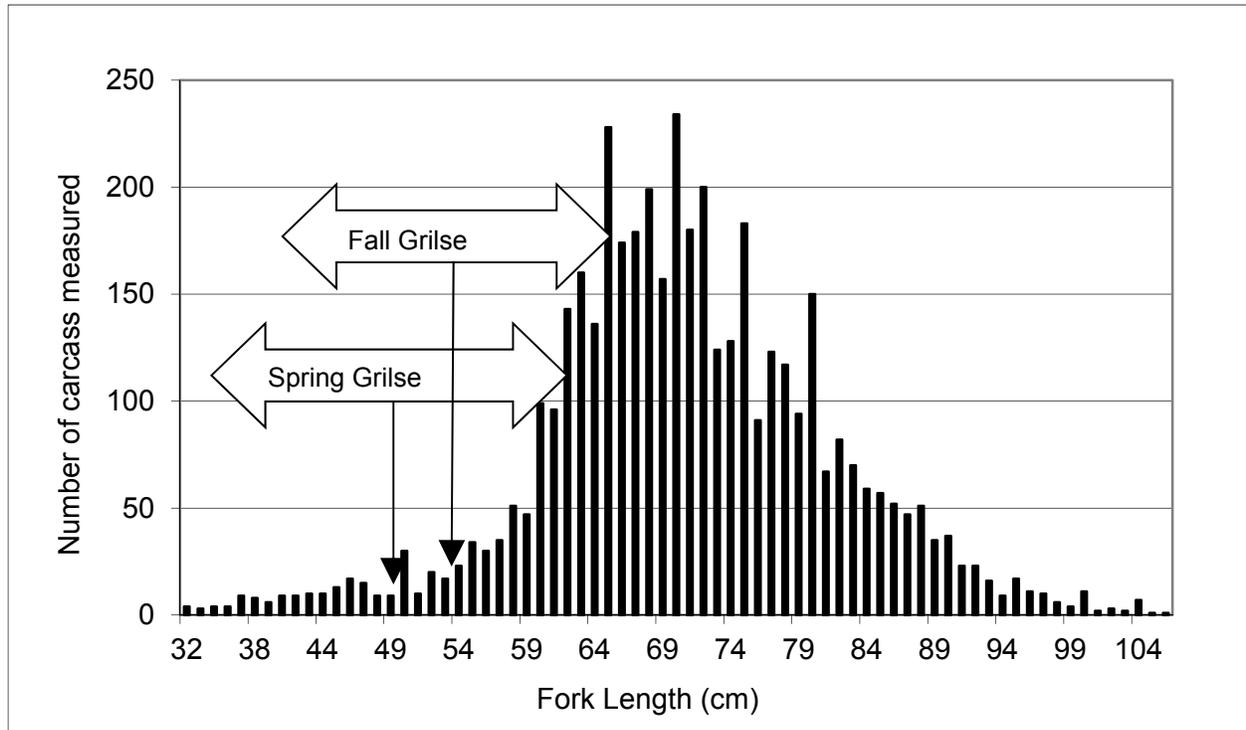


Figure 3. Length frequency for all condition-1 and -2 Chinook measured during the 2012 main stem Trinity River spawner survey.

Coho Salmon

Fork lengths of sampled coho ($n = 207$) averaged 64.95 cm and ranged from 35-80 cm. (Figure 4). Grilse lengths for sampled coho salmon are less than 51cm fork length based on estimates from Task 1.

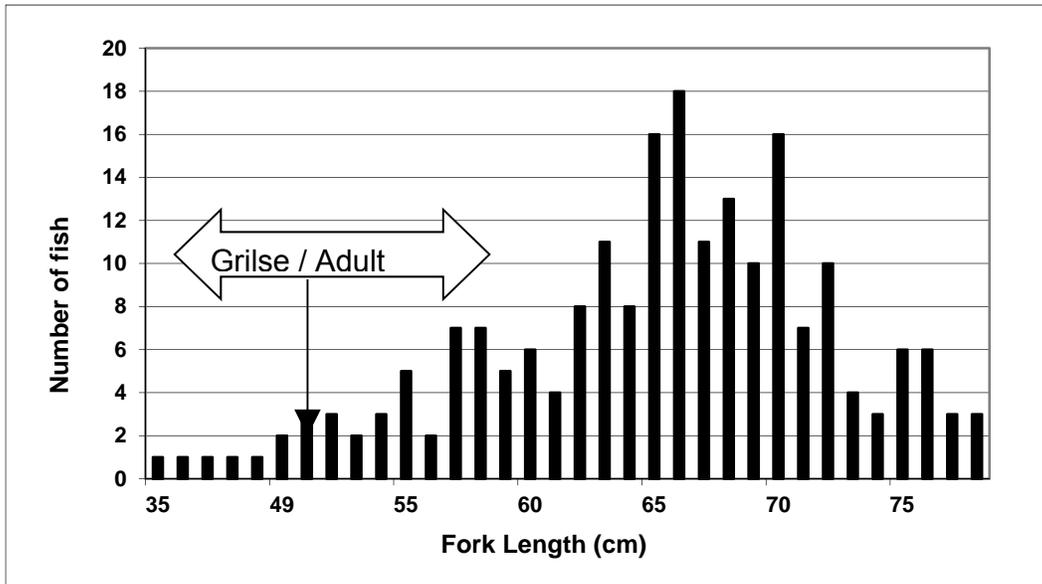


Figure 4. Length frequency for all condition-1 and -2 coho salmon measured during the 2012 main stem Trinity River spawner survey.

Weir Tags Recovered

Spaghetti tags are applied at the Junction City and Willow Creek weir to Chinook, coho salmon, and steelhead. During the 2012 spawning survey, 96 weir tags were recovered on Chinook and coho salmon. Of these, 81 were recovered on Chinook, 12 on coho salmon, and 3 from indiscernible species. Seven weir tags from the Junction City weir and 89 from the Willow Creek weir were recovered during the survey (Table 6).

Table 6. Recovery of weir tags by Julian week and survey reach during the 2012 Trinity River spawner survey.

Reach	Julian Week of Recovery											Total
	41	42	43	44	45	46	47	48	49	50	51	
1	0	0	1 (1-JC)	0	2 (1-JC)	5	4	6	5	5	2	30
2	2 (2-JC)	3 (1-JC)	1	1	3	3	ns	9	1	2	0	25
3	2 (1-JC)	1	0	0	0	0	ns	ns	0	0	ns	3
4	2 (1-JC)	1	1	0	ns	1	ns	ns	0	0	ns	5
5	0	2	1	0	0	ns	ns	0	ns	ns	ns	3
6	0	0	3	5	0	0	ns	3	ns	0	ns	11
7	0	1	2	2	3	ns	ns	2	ns	0	ns	10
9	0	ns	2	ns	4	ns	ns	ns	ns	0	ns	6
10	0	ns	0	ns	0	ns	ns	ns	ns	ns	ns	0
12	ns	0	ns	0	ns	3	ns	ns	ns	ns	ns	3
13	ns	0	ns	ns	ns	0	ns	ns	ns	ns	ns	0
14	ns	0	ns	ns	ns	0	ns	ns	ns	ns	ns	0
Total	6	8	11	8	12	12	4	20	6	7	2	96

(-JC) Indicates number of recovered weir tags applied at the Junction City weir

DISCUSSION

When looking at the Chinook run as a whole, year to year variation in numbers of salmon carcasses recovered on the upper Trinity River is fairly minimal when examined as an order of magnitude (with the exception of the 2003 Chinook season) and normally tracks well with the number of fish recovered at Trinity River Hatchery (see Task 1). When comparing yearly data, it is important to acknowledge differences in survey timing, methodology, and periodicity, as well as climatic events and budgetary constraints that inhibit survey timing and periodicity. In some years, surveys ran into January, therefore covering a greater proportion of the coho salmon run. Additionally, in some years weekly survey periodicity was far from perfect due to extreme weather and high flows.

Carcass Distribution

As in past years, Chinook and coho salmon carcass densities were highest in the uppermost reaches and were negatively associated with increased distance from Lewiston Dam and TRH (Appendices 1 & 2). Salmon imprint upon the waters in which they rear, and subsequently home on those waters when returning to spawn. If more spawners utilize upper reaches and their progeny rear in those reaches, then it is logical to speculate that the majority of returning salmon would then subsequently spawn in those same upper reaches. Other potential factors contributing to the observed high densities in the upper reaches include hatchery fish spawning in-river instead of returning to the hatchery, blockage of further upstream migration by Lewiston Dam, and availability of suitable spawning habitat.

Adult Sex Composition and Female Pre-spawn Mortality

For all races and species of salmon carcasses recovered on the upper Trinity, female adults out-numbered male adults when number of grilse is subtracted from the total number of males recovered. Previous studies on the Trinity River presented in Aguilar (1996), suggest this is common for Chinook salmon. If a portion of males return as grilse (two year olds), then adult females would then make up a higher percentage of adults. Another factor that could possibly skew male to female ratios is unequal capture probability by sex. Zhou (2002) modeled and analyzed 12 years of Salmon River, Oregon fall Chinook carcass data and found that male Chinook were underestimated by 8%, while female Chinook were overestimated by 12%. Assuming similar bias in Trinity River carcass composition results, male to female ratios including grilse have been estimated as follows: 0.75:1 for Chinook and 0.81:1 for coho salmon.

Trinity River Chinook salmon pre-spawn mortalities for years when more than 100 females were examined have ranged from 1.5 to 44.9% for Chinook (Appendix 3). Pre-spawn mortality rates observed this year on sampled carcasses was 3.49% for Chinook. For years in which more than 100 female coho salmon were examined, pre-spawn

mortality rates have ranged from 8.5 to 15.9%. The coho salmon pre-spawn mortality rate observed this season was 22.33%. Final pre-spawn estimates incorporating the subsampled carcasses will likely be less. It is also unclear how this rate is influenced by a truncated survey season, although if pre-spawn mortalities die sooner than successful spawners, this rate would most likely be overestimated. It has also been noted, most recently by Zuspan (1998), that pre-spawn mortality may be density dependent and is positively related to run-size in the Trinity River. As in the past, pre-spawn mortality numbers fluctuate similarly to fluctuating escapement numbers.

Other Possible Sources of Bias

Problems or biases associated with salmon carcass surveys should be identified and subsequently minimized in order to produce more accurate and precise estimates. Some problems are inherent to survey design or human nature, while others are specific to situations or crews working on the Trinity River.

Inter-observer variation is a source of bias affecting all types of fish surveying methods. During this survey, we attempted to minimize this variation by maintaining the same rower/observer teams and rotating sides of the river by week. By rotating banks weekly, bias concerning memory of where marked carcasses were released was minimized. Maintaining the same crew throughout the season is also important to minimize variation in data collection methods and ensure data consistency between weeks and sections.

Weather is an uncontrollable factor, which most likely has a great effect on consistency of survey methods. High flow events reduce carcass capture efficiency due to higher in-stream velocities and increased turbidity. Extreme high flow events may also cause exclusion of weekly surveying efforts on dropped reaches. Capture efficiency can also possibly be reduced by excessive cloud cover or glare associated with the azimuth of the sun.

Sufficient survey periodicity is necessary to ensure proper temporal coverage in recovery of salmon carcasses. Weekly survey periodicity is most convenient when surveying long sections, necessitating the use of four crews. In reaches 8 to 10 and 12 to 14, bi-weekly surveys were conducted due to logistical constraints. Fresh carcasses were available for recapture for four to five weeks following initial capture, thus only fresh carcasses were tagged. An additional problem which may necessitate more frequent surveying is predation and removal of carcasses. High carcass predation rates reduce the efficiency of carcass recovery. If predation rates are found to be inversely proportional to run size (ie predators remove a higher ratio of carcasses when less carcasses exist) then survey periodicity should be increased in lower run-size seasons. Conversely, there could be a density dependent relationship between run-size and attraction of predators, which would also necessitate increased survey periodicity.

Hatchery contribution estimates may be underestimated due to problems associated with identification of hatchery fish. Poor detection of fin clips or errors in recording those fin clips can negatively skew hatchery contribution rates. The right maxillary clip exhibited by TRH released coho salmon is very easy to miss if special attention is not paid to detecting that clip. Advanced decomposition of salmon carcasses may also inhibit the ability to detect hatchery clips. Poor detection or loss of adipose clipped salmon heads or CWTs extracted from those heads also could negatively skew hatchery contribution rates.

RECOMMENDATIONS

1. Annual spawner surveys incorporating a mark-recapture methodology should be continued for future seasons, facilitating future comparisons of mark recapture escapement estimates.
2. In future years, the entire survey area should be surveyed on a consistent temporal basis (e.g. once each week) if possible.
3. If recovery of coho salmon becomes a high priority, the temporal coverage of the surveys will need to be extended into January. If surveys are extended into January, a mark-recapture methodology should be initiated for coho salmon.

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APPENDICES

Appendix 1. Total Chinook carcasses recovered by reach during the main stem Trinity River spawner surveys 2000-2012

Chinook														
	Reach													
Year	1	2	3	4	5	6	7	8	9	10	12	13	14	Total
2000	4,339	1,347	275	102	36	15	5	8	15	8	ns	ns	ns	6,150
2001	3,600	1,203	273	231	31	26	94	15	34	8	ns	ns	ns	5,515
2002	1,520	1,103	400	314	215	311	208	45	78	21	ns	ns	ns	4,215
2003	8,693	3,795	1,437	670	351	330	143	32	93	28	ns	ns	ns	15,572
2004	2,750	1,059	360	274	141	77	84	18	44	18	ns	ns	ns	4,825
2005	1,936	707	223	160	119	56	48	9	40	22	ns	ns	ns	3,320
2006	2,086	952	413	328	177	124	95	5	47	40	ns	ns	ns	4,267
2007	2,661	1,231	330	331	202	167	46	3	29	27	2	1	3	4,733
2008	1,090	685	315	355	224	261	132	17	81	77	150	141	37	3,564
2009	1,062	676	484	342	168	214	167	12	141	58	42	41	12	3,419
2010	1,588	862	415	396	230	189	93	5	26	5	45	8	9	3,871
2011	3,291	2,407	990	864	684	408	311	40	330	194	289	148	122	10,078
2012*	1,524	1,217	577	522	279	499	529	ns	310	157	93	56	13	5,776

* The 2012 survey had a different survey methodology which incorporated subsampling.

Appendix 2 Total coho salmon carcasses recovered by reach during the main stem Trinity River spawner surveys 2000-2012

Coho salmon														
	Reach													
Year	1	2	3	4	5	6	7	8	9	10	12	13	14	Total
2000	291	112	8	1	2	0	0	2	0	1	0	0	0	417
2001	465	211	11	1	2	1	1	0	0	0	0	0	0	692
2002	125	29	8	7	4	1	0	1	1	1	0	0	0	177
2003	304	106	37	8	2	0	1	0	4	6	0	0	0	468
2004	1,162	55	147	58	52	14	19	10	6	6	0	0	0	2,029
2005	572	237	72	28	20	10	6	6	10	0	0	0	0	961
2006	378	127	15	5	3	2	4	0	1	2	0	0	0	537
2007	127	57	16	4	6	0	0	0	2	2	0	0	0	214
2008	154	103	27	8	4	8	4	1	5	0	1	3	0	318
2009	81	52	21	5	2	0	2	0	4	1	0	0	1	169
2010	345	271	40	12	12	8	2	0	0	0	3	0	0	693
2011	110	111	16	6	5	2	2	0	4	1	2	1	1	261
2012*	135	51	23	10	2	13	8	ns	5	1	4	2	4	258

* The 2012 survey had a different survey methodology which incorporated subsampling.

Appendix 3. Salmon female pre-spawn mortality observed during main stem Trinity River spawner surveys 1955-2012

Study	Literature	Total Chinook			Coho salmon		
		Spawned	Not Spawned	% Not spawned	Spawned	Not Spawned	% Not spawned
1955	Gibbs (1956)	2,076	32	1.5			
1956	Weber (1965)	3,438	219	6.0			
1963	LaFaunce (1965)	4,953	328	6.2			
1968	Rogers (1970)	1,494	124	7.7			
1969	Smith (1975)	1,889	23	1.2			
1970	Rogers (1973)	632	34	5.1			
1972	Miller (1972)	791	110	12.2			
1987	Stempel (1988)						
1988	Zuspan (1991)	490	399	44.9			
1989	Zuspan (1992a)	1,740	791	31.3			
1990	Zuspan (1992b)	180	27	13.0			
1991	Zuspan (1994)	184	2	1.1			
1992	Aguilar/Zuspan (1995)	181	4	2.2			
1993	Aguilar (1995)	295	17	5.4			
1994	Aguilar/Davis (1995)	582	14	2.3			
1995	Zuspan (1997)	11,213	3,705	24.8			
1996	Zuspan (1997)	2,301	132	5.4			
1997	Zuspan (1998)	1,754	62	3.4			
2000	Sinnen/Null (2002)	2,499	163	6.1	89	13	12.7
2001	Sinnen (2004)	1,290	120	8.5	236	22	8.5
2002	Sinnen/Currier (2004)	1,742	77	4.2	56	8	12.5
2003	Sinnen/Knechtle (2006)	8,699	950	9.8	210	39	15.7
2004	Sinnen/Currier (2005)	2,510	160	6.0	1,042	187	15.2
2005	Garrison (2006)	1,606	118	6.8	414	78	15.9
2006	Hill(2007)	1,619	48	3.0	288	31	9.7
2007	Hill (2008)	3,073	259	7.8	97	11	10.2
2008	Hill (2009)	1,604	110	6.4	154	22	12.5
2009	Hill (2010)	1,969	100	5.1	95	15	15.8
2010	Hill (2011)	1,859	160	8.6	353	52	14.7
2011	Hill (2013)	4,749	260	5.19	112	16	14.30
2012*	current study	2,821	102	3.49	80	23	22.33

* The 2012 survey had a different survey methodology which incorporated subsampling. Important to note that these are not estimates of pre-spawn mortality, but only those of sampled carcasses.

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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2012-13 SEASON**

**TASK 5
ANGLER CREEL SURVEYS IN THE LOWER KLAMATH RIVER**

by

Sara Borok

ABSTRACT

A creel census was conducted along the lower Klamath River (Pacific Ocean to Hwy 96 Bridge in Weitchpec) August 6, 2012 through November 4, 2012 to estimate the sport fishery harvest of upstream migrating Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*). A goal of the creel census is to determine the contribution of Trinity River salmonids to the annual sport harvest in the lower Klamath River. The information provided by the creel census will help assess the production and harvest goals of the Klamath River Project and Trinity River Restoration Program.

Results from the creel census indicate a total of 11,436 (7,866 adults and 3,570 jacks) Chinook salmon and 226 (213 adults and 13 half-pounders) steelhead were harvested. The 2012 in-river sport quota was 67,600 adult Chinook salmon. The lower Klamath River portion of the quota (33,800 adult Chinook salmon) was not met. One hundred and fifty-six Chinook salmon (33 adults and 123 jacks) caught before August 15, 2012 are considered spring-run fish. Hatchery fish represented an estimated 28.3% of the sport harvest in the lower Klamath River. Trinity River Hatchery (TRH) origin fish represented 13.32% of the estimated harvest and 14.95% were of Iron Gate Hatchery origin. Seasonal summaries and comparisons of angler effort and catch, catch timing, length frequencies, species composition, hatchery fin clips and tag recoveries are presented.

TASK OBJECTIVES

- Quantify total catch, angler effort and catch per effort for salmonids (harvest and catch/release) from the lower Klamath River.
- Determine the contribution to sport harvest from fish produced at Trinity River and Iron Gate hatcheries.

INTRODUCTION

The Klamath River is regarded as one of the most important producers of Chinook salmon to California's commercial and sport fisheries. The lower Klamath fishery resources are composed of both natural and hatchery produced salmonids originating from the Klamath and Trinity river basins. A goal of this creel census is to determine how many Trinity River salmon are harvested from the lower Klamath River by sport anglers. The information provided by the creel census is used to help assess the production and harvest goals of the Klamath River Project and the Trinity River Restoration Program.

Angler harvest of Chinook salmon has been monitored by CDFW to provide data for run-size estimates since 1978 (Boydston 1979, 1980; Lee 1984a, 1984b, 1985, Lau 1992-1997; Pisano 1998; and Borok 2008-2013). This report covers the period from July 1, 2012 through June 30, 2013. It provides sport harvest data and a description of the CDFW fall-run Chinook salmon angler harvest monitoring program conducted in the main stem Klamath River from the mouth of the Klamath River to the Highway 96 Bridge at Weitchpec (rkm 68.8).

For the purposes of this study the Klamath River and Trinity River are divided into sample reach areas. The Klamath River is divided into 3 areas, from the mouth of the river to the Hwy101 Bridge, from the Hwy 101 Bridge to the Hwy 96 Bridge at Weitchpec and from Hwy 96 Bridge at Weitchpec up to Iron Gate Dam. The Trinity River is divided into 2 areas from the confluence with the Klamath River up to Cedar Flat and from that point up to the Old Lewiston Bridge in Lewiston (rkm 245.7). This is to determine angling effort and harvest by section. The CDFW uses this information to determine in real time when sport anglers have reached the in-river sport harvest sub-quota for each section of fall-run adult Chinook salmon. This report covers the lower 2 sections of the Klamath River from the ocean to the Hwy 96 Bridge in Weitchpec.

Quotas and Harvest Management

The Klamath River Chinook quota is implemented in the following manner: Fifty per cent of the total in-river quota is dedicated to the lower Klamath River (rkm 0 to 68.8). The other half is apportioned to the mid Klamath River (17%) (rkm 68.8 to 306) and the Trinity River (33%). CDFW monitors or models each of the areas for the fall-run Chinook harvest and determine when the quota of each portion has been met. Once a sub -quota in any of the sections is met, an adult Chinook salmon harvest closure goes into effect in that section of river. Anglers are still permitted to fish, but must release any adult Chinook salmon caught. Meanwhile, anglers in the other portions of the river are still permitted to harvest adult Chinook. After all sub-quotas are met, fishing for grilse Chinook and other legal species is still permitted but the entire river is closed to the harvest of any adult Chinook. However, once the hatcheries (Iron Gate Hatchery and Trinity River Hatchery) have reached mitigation egg take goals, special exempted fisheries for adult Chinook are permitted from Iron Gate Dam to where Interstate 5

crosses the Klamath River and downstream of Old Lewiston Bridge to the mouth of Indian Creek Bridge on the Trinity.

Starting in 1999 CDFW implemented an “impact quota” for the Klamath and Trinity Rivers. From this impact quota a ten percent hooking mortality factor was accounted for within the quota and this number was used as the quota trigger. This trigger closure was to account for increased hook and release mortalities when the quota was met early in the season. The impact quota was divided among each of the areas in the same manner as the division of the basin quota.

During the 2012 season, fishing regulations allowed anglers to harvest four Chinook salmon per day (up to four adult Chinook) and one hatchery trout or one hatchery steelhead per day. These regulations started on August 15, 2012 in the lower Klamath River and September 1, 2012 in the Trinity River and the Klamath River above the Hwy 96 Bridge in Weitchepc. The limit of hatchery steelhead for the Trinity River only was increased to two per day and four in possession. No harvest of coho salmon was permitted in the entire Klamath Basin. Regulations stated: “hatchery” trout or one “hatchery” steelhead could be harvested, which eliminated the cutthroat trout fishery in the Klamath basin.

METHODS

Description of the Fishery and Creel Sample Area

To estimate angler catch and effort, CDFW divides the main stem Klamath River from the mouth to Iron Gate Dam into three areas. The mouth of the river to the Hwy 96 Bridge in Weitchepc (Areas 1 and 2) are included in this report. Areas upstream of the Hwy 96 Bridge in Weitchepc to Iron Gate Dam (Area 3) were not directly surveyed by CDFW this season. Chinook harvest in this area is estimated using a ratio estimator based on catch in the lower Klamath River.

Area 1: This area consists of 4.5 rkm of river from the mouth of the Klamath to the Highway 101 Bridge and is referred to as the estuary. All shore angling effort in this area took place at the mouth of the river in 2012. River mouth configuration, which changes annually, determines which side (north or south) affords better angling. A creel sample of shore anglers was conducted at the mouth location. During the 2012 season fishing at the mouth was not closed at any time because the Department determined we would not meet the Basin quota. If 15% of the lower river quota had been caught below the Hwy 101 Bridge (5,070 adult fall-run Chinook salmon) and it looked like we would meet the lower basin quota, the spit (100 yards of the channel through the sand spit formed at the Klamath River mouth) would be closed to sport fishing. All boat angling effort in the estuary originated from ten resort boat docks in the estuary area. Three resort docks (Golden Bear RV Park, Riverside RV Park, and Panther Creek RV Park)

and south side Mouth access were sampled this season for angler effort and catch (Figure 1).

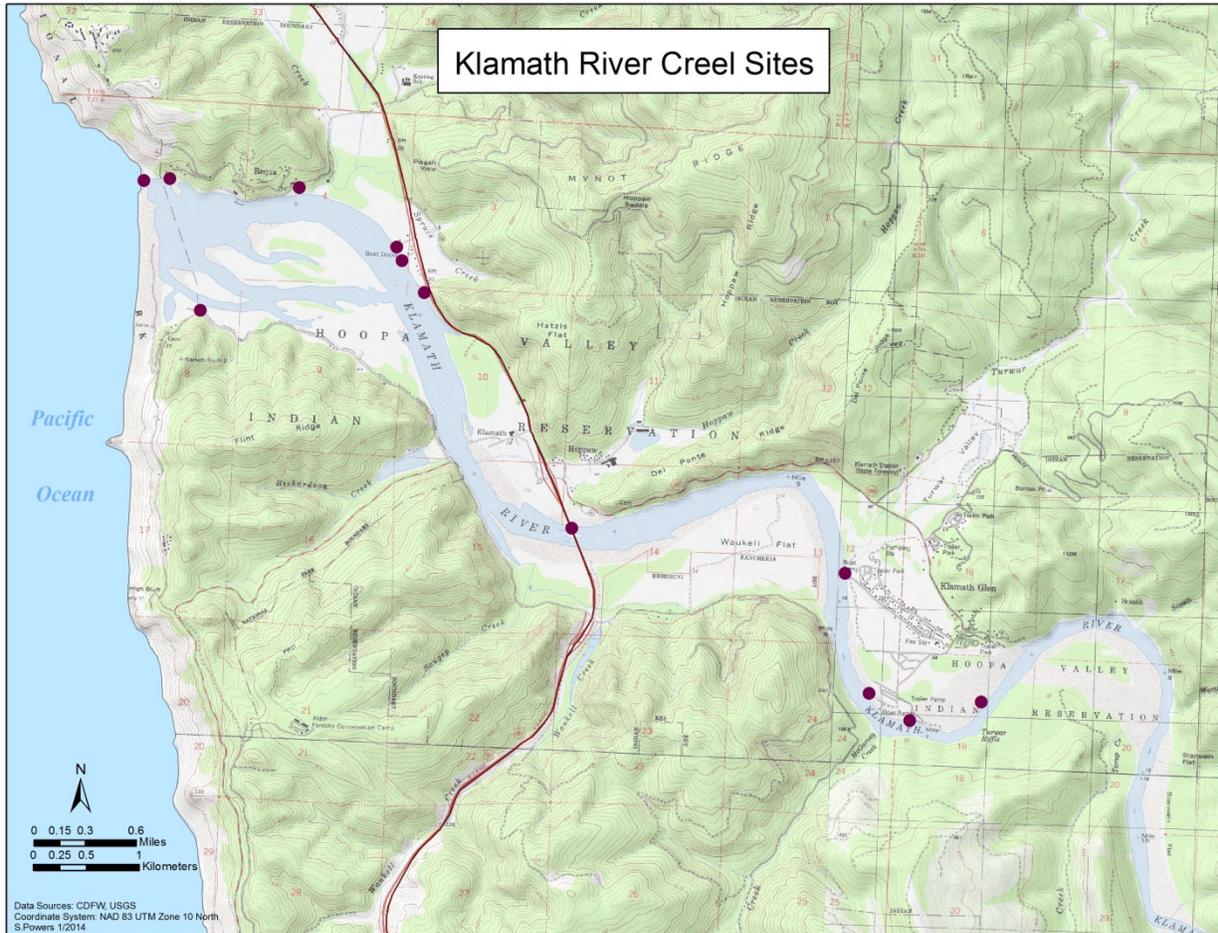


Figure 1. Map of lower Klamath River angler creel survey sites for 2012.

Area 2: This area extends from the Highway 96 Bridge (rkm 68) in Weitchpec downstream to the Highway 101 at Klamath (rkm 5). The division was formerly the falls at Coon Creek (54.4 rkm) near the community of Johnson's riffle (Pecwan Creek), but to make the distinction clearer for anglers it was changed. Shore angling effort is generally confined to two popular easily accessed riffles (Lower Klamath Glen and Blake's) located in the lower 5 rkm of this area and are easily accessible to the shore angler. One former resort boat dock (Klamath Glen) and a public boat launch (Roy Rook), also located in this section 5 rkm, are the principal boat facilities in the area. Creel sampling occurred at these locations (Figure 1).

Angler access routes at Lower Klamath Glen and Blake's riffles are limited to specific routes in and out enabling a complete accounting of angler effort and catch during a sample day at these locations. Boat anglers are also confined to access at the

launching ramp or resort boat dock enabling a complete sample of angler effort and catch for each sample day.

Shore angling access above Blake's Riffle is limited to three access points: the mouth of Blue Creek (rkm 26.3), Ah Pah Creek (rkm 27.5), and Bear Riffle (rkm 29.8). These points are all accessible by vehicle but accounted for an estimated less than one percent of angling effort from data in past surveys (Hopelain 2001). Boat traffic (which is the majority of effort) into this area is accounted for from data collected at the Roy Rook Boat ramp.

Creel Census Methods

Study methods and procedures used in Areas 1 and 2 during the 2012 season were essentially the same as those described for the 1983 -1987 seasons (Hopelain 2001). Data is presented in standard Julian week (JW) format throughout this report (Appendix 1). Catch and release data are expanded in the same manner as harvest and effort data in each area.

Each of the sites identified in the area description on the lower Klamath River were sampled three days per Julian week. The initial start date of Aug 6 is set by the Julian week calendar. In which area the creel census starts is random. Week days are selected systematically based on the day the census starts. Weekend days switch back and forth over the course of the sampling season. For weeks that were sampled other than above, the data are expanded accordingly. Each angling access site is sampled throughout the day to account for total catch and effort for that particular site. California Department of Fish and Wildlife scientific aids interviewed anglers as they departed the fishing site and recorded the following information:

- 1) Was the angler finished fishing for the day at this time?
- 2) Total hours spent fishing (to the nearest half hour).
- 3) The first three numbers of their Zip Code (to find their general area of residence).
- 4) Fish harvested are identified to species, fork length is measured and they are inspected for marks, external tags and unusual conditions. Also a scale sample is collected.
- 5) For Chinook salmon missing an adipose fin (possessed a CWT), the head was removed and retained by staff.
- 6) The number and species of fish caught and released (actually released not lost) by the angler was recorded as juveniles, grilse or adults.
- 7) In Area 1 only, the angler was questioned whether they fished the mouth or from a boat, and if fish were harvested above or below the Hwy 101 Bridge.
- 8) Was this a professionally guided trip?

Harvest and Effort Estimating Procedures

Data is stratified for each creel census location by Julian week (Appendix 1). Angler harvest, releases and effort estimates are calculated for each week. The estimate formula used is:

$$\text{Estimate total} = \sum_{l=1}^n \text{Daily total} (N/n)$$

where: Estimate total = estimates of catch or effort

Daily total = Daily counts of catch or effort

N = Number of fishing days in week

n = number of sample days

l = boat sampling ratio

Area 2: Harvest estimates for the area above Hwy 101 to the Hwy 96 Bridge at Weitchpec was calculated by multiplying the observed harvest and effort by a sampling ratio. This ratio is the weekly expansion value. This value is a simple ratio based on the number of days sampled to the number of legal fishing days within the week (7 days week / 3 days sampled = 2.33). All sites are totaled for the week to obtain the weekly harvest estimate for Area 2. This procedure applies to both boat and shore harvest. No additional expansion for the boat harvest in Area 2 is needed since total boat catch and effort were accounted for in the creel sampling.

Area 1: The procedure for the area below Hwy 101 is identical to Area 2 except for the addition of a boat expansion factor. The boat expansion factor accounts for the harvest by boat anglers not sampled. The boat expansion formula is:

$$\frac{(\text{Boats at the non-sampled docks} + \text{Boats at sampled docks})}{\text{Boats at Sampled docks}}$$

The product of this formula yields a ratio used to expand catch and effort data for non-sampled boats anglers. This ratio is obtained by counting the number of boats at all the docks (both sampled and non-sampled) below Hwy 101. This count occurs usually between 1100 to 1500 hrs. Although not all the boats will be at their docks at this time the assumption that the percentage of boats that do not return to their docks is the same between both the non-sampled and sampled docks. It is also assumed that the effort and catch are equal between the non-sampled boats and sampled boats.

A boat count is made every day Area 1 is sampled. This count excludes all boats used in the Tribal gill-net fishery. An average of these daily values is used to arrive at the average boat expansion value for the week. The closer the expansion value is to one, the greater the total coverage we have in the estuary.

There has been no statistical difference observed between weekdays and weekend days, so there is no separate stratification for these days. Weekly expansions include the weekend days as well as week days.

Daily Real Time Harvest Estimates and Projections

As in previous seasons, the KRP thought it necessary to compute harvest and effort estimates daily (real time) as we neared the quota to help prevent any over-harvesting. In addition, CDFW estimated one, two, and three day harvest projections to allow lead time of any adult Chinook salmon fishery closures.

Size Determination of Fish

Fishing regulations identify the size of adult Chinook at 22 inches (total length) or 56 centimeters. This size is used to make adult - jack determinations during the season. Post season the actual lengths are graphed, scales and coded wire tags are read to determine the actual age composition. For this report only the adult -jack age break is reported.

RESULTS

Rounding numbers to whole numbers may cause some slight addition discrepancies in these results. Spring run Chinook numbers are included in totals. All graphic fork lengths representations are smoothed by a moving average of five centimeters.

The creel census for the lower Klamath River began on August 6 and ran through November 4 (JW 32 through 44) of 2012. Chinook salmon harvested in the lower Klamath fishery ranged in size from 26 to 117 cm in fork length (FL). The adult portion of Chinook harvested ranged from in size 61 to 117 cm FL and averaged 72 cm FL. The jack component of the angler harvest ranged in size from 26 to 60 cm FL and averaged 48 cm FL (Figure 2).

Harvested steelhead ranged in size from 32 to 83 cm FL and averaged 60 cm FL (Figure 3). Any steelhead less than 42 cm FL is considered to be a half-pounder, and those larger are considered adults. Steelhead less than 25 cm FL are considered resident trout and not anadromous. All steelhead harvested this season were considered adult fish.

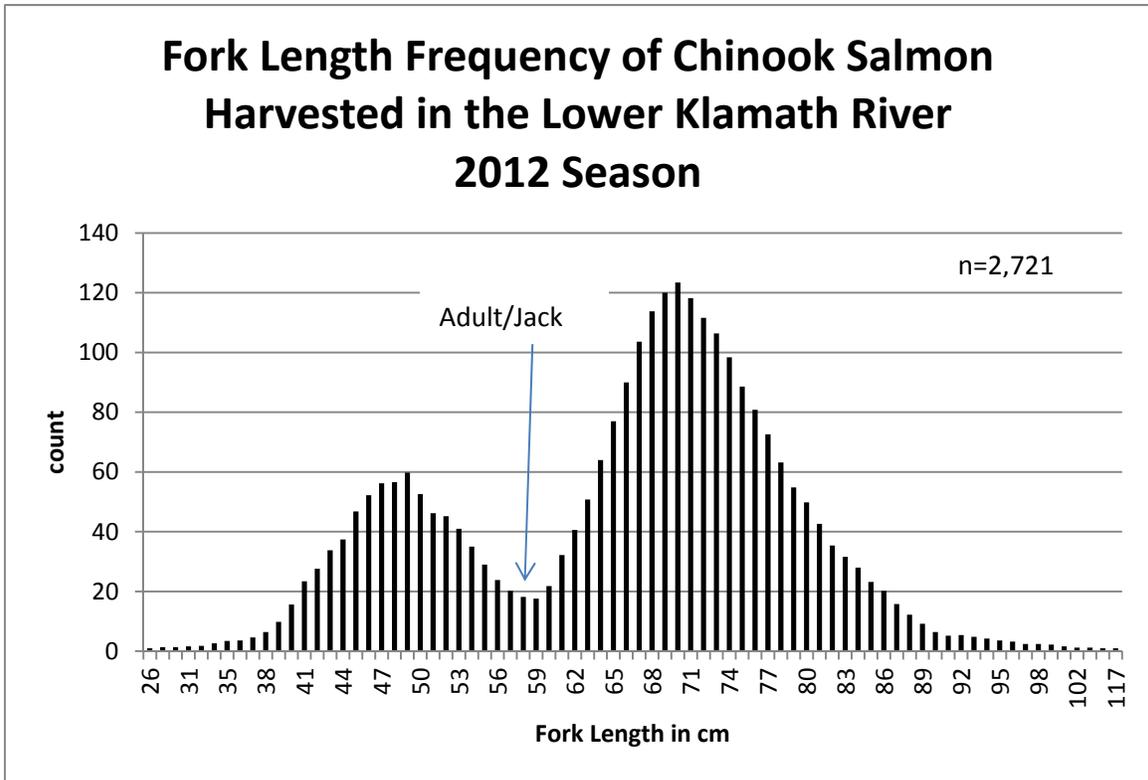


Figure 2. Fork length frequency of Chinook salmon harvested in the lower Klamath River during the 2012 season.

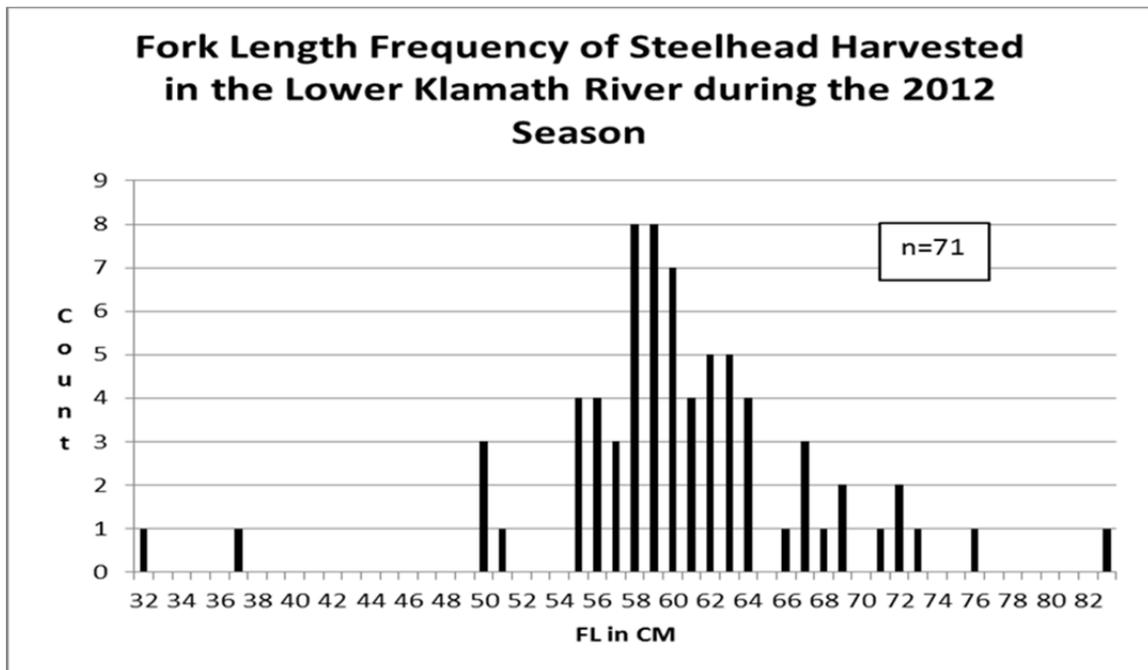


Figure 3. Fork length frequency of steelhead harvested in the lower Klamath River during the 2012 season.

Anglers in the lower river did not meet their quota of 33,800 adult fall run Chinook this season. A total of 11,436 (7,866 adults and 3,570 jacks) Chinook salmon and 226 (213 adults and 13 half-pounders) steelhead were harvested (Table 1). During Julian week 32, 156 (33 adult and 123 jacks) spring-run Chinook salmon were harvested. The total of fall-run Chinook harvested was 11,279 (7,832 adults and 3,447 jacks) fish. Nineteen adult coho were estimated harvested this season.

2012 Harvest and Effort Patterns

The average fishing trip length during the 2012 season was 5.0 hours. This is slightly longer than the 2010 season and longer than the 4.2 hours average trip length over the previous years (Figure 4 and Table 2). Anglers fished longer trips and caught more adult fish and fewer jack Chinook than in the 2011 season.

Table 1. Summary of estimated angler effort and harvest of Chinook salmon and steelhead during the 2012 lower Klamath River creel census.

Site Location	Angler Trips	Angler Hours	Steelhead 1/2 lbers	Steelhead Adults	Chinook Salmon Grilse	Chinook Salmon Adults
Area 1 - Mouth to Highway 101 Bridge						
Shore	3,363	11,601	0	22	124	1,797
Boats	3,399	12,109	0	10	265	893
Total	6,762	23,710	0	32	388	2,690
Area 2 - Highway 101 to HWY 96						
Shore	2,139	6,354	7	16	87	715
Boats	8,740	57,684	6	165	3,095	4,461
Total	10,879	64,038	13	181	3,182	5,176
Grand Total	17,641	87,748	13	213	3,570	7,866
2011	11,833	56,759	20	179	5,891	2,903
2010	11,516	58,842	0	61	1,505	2,057

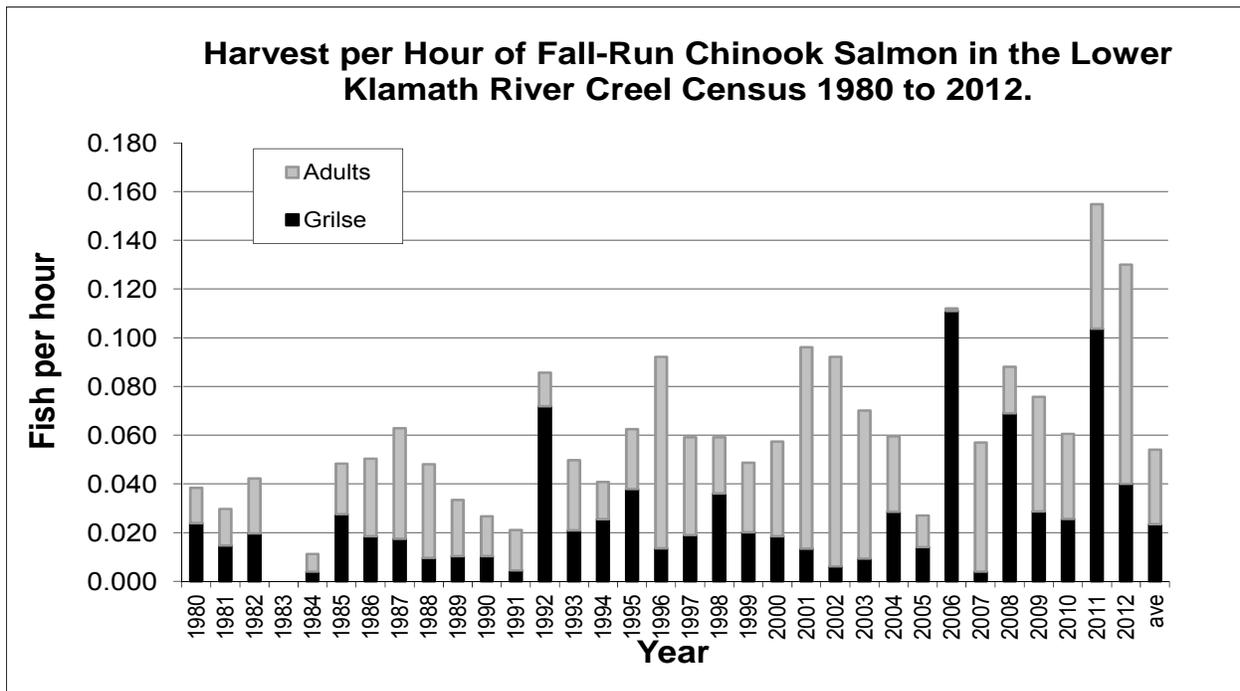


Figure 4. Chinook salmon harvested per hour of angler effort during the lower Klamath River creel survey, 1980-2012.

Table 2. Number of angler trips, hours, and average length of trip in the lower Klamath River sport fishery, 1992 – 2012.

Year	Total Angler		Average Hours/Trip
	Trips	Hours	
1992	11,190	33,080	3.0
1993	16,081	51,889	3.2
1994	15,100	54,748	3.6
1995	19,881	63,369	3.2
1996	27,929	91,019	3.3
1997	18,402	67,154	3.6
1998	17,606	52,145	3.0
1999	11,852	45,109	3.8
2000	14,150	57,184	4.0
2001	20,116	88,053	4.4
2002	18,376	85,925	4.7
2003	16,514	79,228	4.8
2004	15,180	71,397	4.7
2005	12,629	61,000	4.8
2006	8,902	41,792	4.7
2007	13,913	64,101	4.6
2008	10,827	56,005	5.2
2009	14,736	67,160	4.6
2010	11,516	58,842	5.1
2011	11,833	56,759	4.8
2012	17,641	87,748	5.0

Catch and Release

Catch and release data were recorded as part of the creel interview. These data are expanded in the same manner as harvest data. Anglers were specifically asked if fish were released rather than lost. This data should only be used as an estimation of trends as they can be highly subjective. CDFW estimated anglers released 1,635 half-pounders, 1,099 adult steelhead, 657 jack, and 415 adult Chinook salmon (Tables 3 and 4). There were 187 Coho salmon reported released this season. As in all years, if the quota is met early in the season the number of adult Chinook released increases as anglers are still permitted to fish for jacks, but must release adult Chinook salmon.

Table 3. Estimated number of Chinook and coho salmon and steelhead caught and released from the lower Klamath River, 1994-2012.

Year	Chinook		Steelhead		Coho	
	Jack	Adult	1/2 lber	Adult	Jack	Adult
1994	290	2,571	4,044	198	0	0
1995	175	14,408	1,049	259	0	33
1996	521	1,438	1,944	256	7	11
1997	34	1,015	1,479	516	0	0
1998	330	1,317	1,738	460	10	19
1999	1,897	1,164	1,189	346	2	5
2000	757	6,253	8,103	1,129	17	43
2001	464	1,720	11,892	2,997	12	242
2002	405	2,985	4,783	6,036	12	243
2003	303	3,970	3,791	1,553	4	130
2004	509	688	6,223	1,577	29	135
2005	657	1,394	3,678	1,159	11	157
2006	3,758	2,922	1,030	1,129	12	91
2007	162	1,407	1,416	1,050	11	21
2008	1,379	243	624	296	13	58
2009	338	292	924	485	5	34
2010	207	92	1,188	563	7	76
2011	1,287	2,221	1,555	786	0	0
2012	657	415	1,635	1,099	20	167
Ave	744	2,448	3,068	1,152	9	77

Table 4. Summary of estimated angler catch and release effort of Chinook salmon and steelhead during the 2012 lower Klamath River creel census.

Site Location	Angler		Steelhead		Chinook Salmon	
	Trips	Hours	1/2 lbers	Adults	Grilse	Adults
Area 1 - Mouth to Highway 101 Bridge						
Shore	3,363	11,601	25	45	34	96
Boats	3,399	12,109	50	44	83	45
Total	6,762	23,710	75	89	118	141
Area 2 - Highway 101 to HWY 96						
Shore	2,139	6,354	417	114	38	62
Boats	8,740	57,684	1,143	896	501	211
Total	10,879	64,038	1,560	1,009	539	274
Grand Total	17,641	87,748	1,635	1,099	657	415
2011	11,833	56,759	1,555	786	1,287	2,221
2010	11,516	58,842	1,188	536	207	92

Harvest Timing

Angler effort and Chinook harvest peaked in JW 37. This was true for both grilse and adult Chinook salmon (Figure 5 and Table 5).

A few more steelhead were harvested than last season. Harvest of adult steelhead peaked in JW's 32 and 39 (Figure 7). Thirteen half-pounders were reported harvested this season.

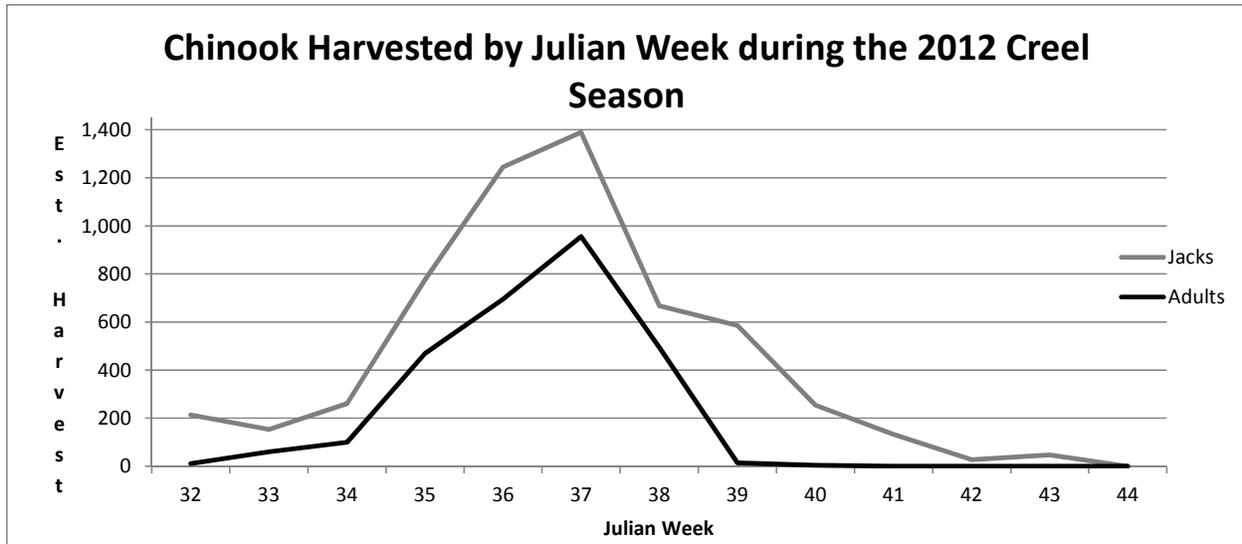


Figure 5. Estimated harvest of Chinook salmon in the lower Klamath River during the 2012 season.

Table 5. Harvest, release and angler effort by Julian week during the 2012 lower Klamath River creel census.

J Week	Angler		Harvested				Released			
			Steelhead		Chinook		Steelhead		Chinook	
			Jacks	Adults	Jacks	Adults	Jacks	Adults	Jacks	Adults
32	975	4,175	0	35	213	11	494	203	39	0
33	1,563	6,210	0	9	153	60	205	64	47	23
34	2,234	10,175	0	24	260	99	175	140	68	23
35	2,773	13,064	0	19	776	470	137	88	137	88
36	2,560	13,040	0	16	1,245	696	54	141	174	102
37	2,938	15,459	2	26	1,389	955	98	96	117	81
38	2,126	12,308	2	29	668	495	75	125	50	75
39	1,256	6,543	0	34	585	14	93	90	12	16
40	699	4,115	5	19	254	5	102	114	14	7
41	323	1,504	4	0	133	0	67	18	0	0
42	149	896	0	2	28	0	51	16	0	0
43	26	120	0	0	47	0	0	0	0	0
44	18	140	0	0	0	0	84	4	0	0
Total	17,641	87,749	13	213	5,752	2,805	1,635	1,099	657	415

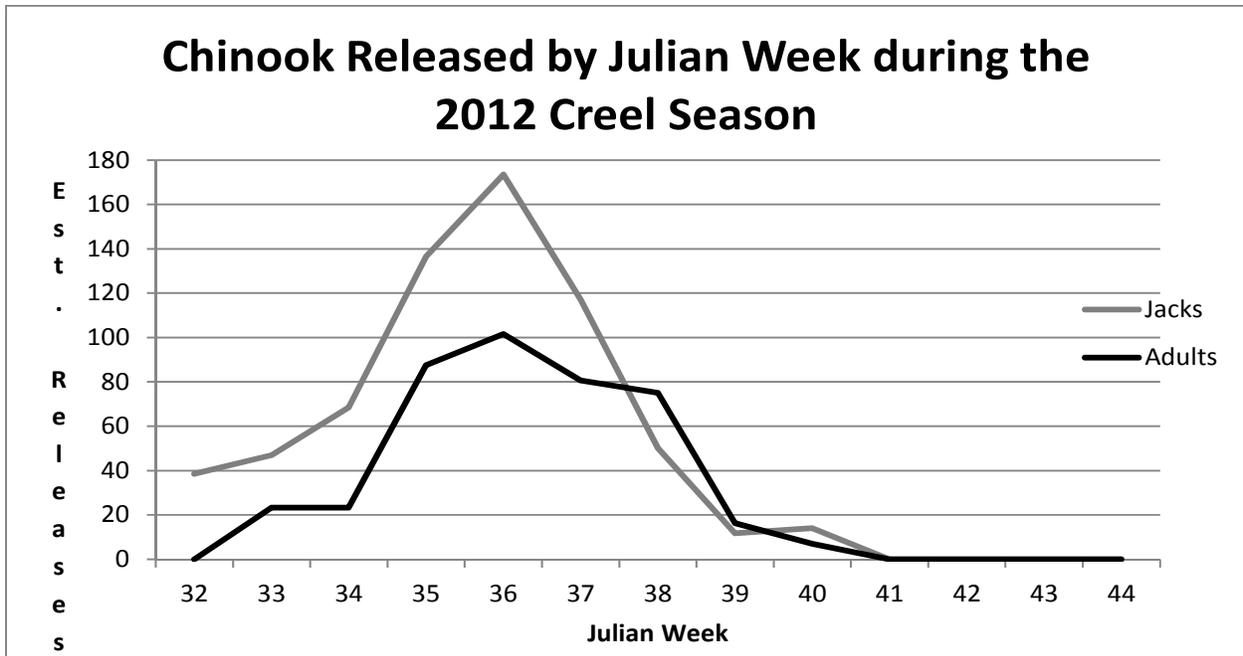


Figure 6. Estimate of Chinook salmon caught and released in the lower Klamath River during the 2012 season.

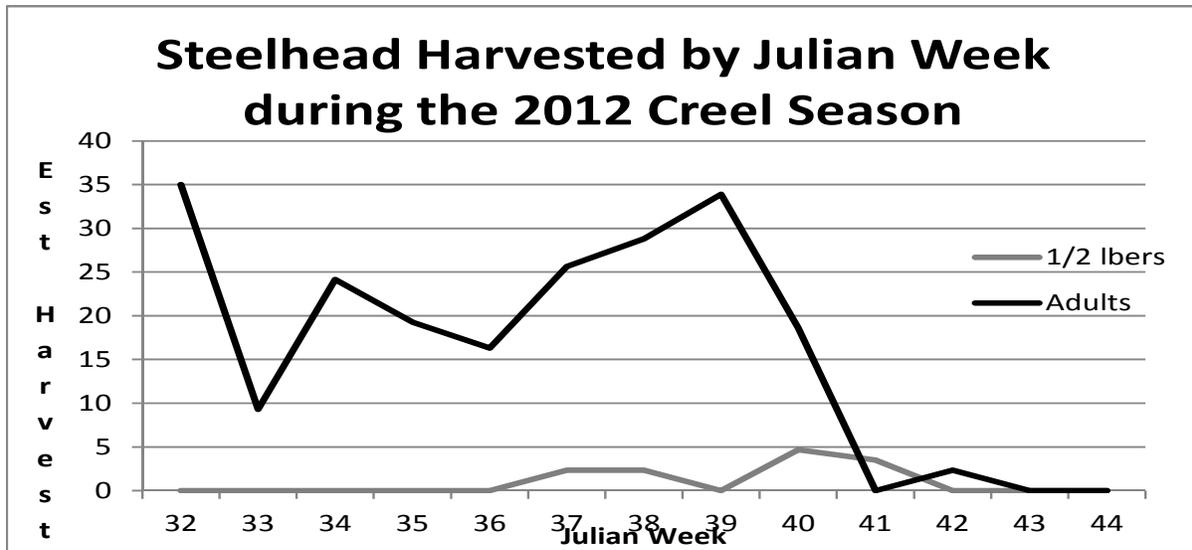


Figure 7. Estimated harvest of steelhead in the lower Klamath River during the 2012 season.

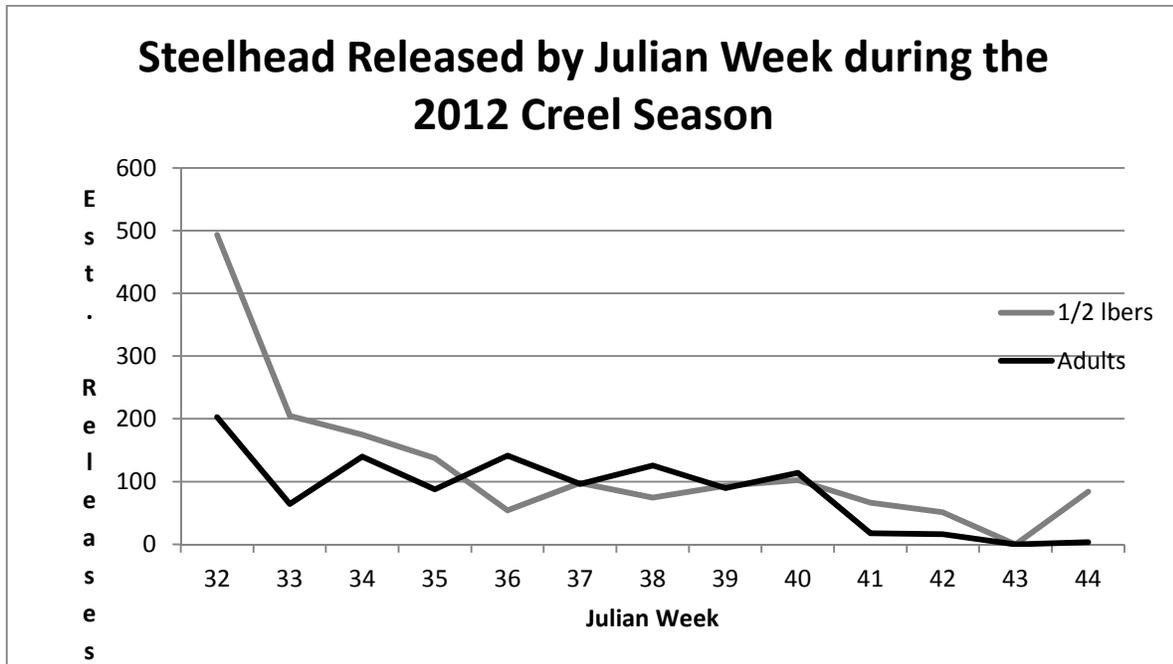


Figure 8. Estimate of steelhead caught and released in the lower Klamath River during the 2012 season.

Coded-Wire Tag Recovery

KRP personnel recovered the heads of 357 adipose fin-clipped and coded-wire-tagged (Ad+CWT) Chinook salmon JW 32 through 42 of the 2012 season. There were thirty-one non-random recoveries (NRR), wherein anglers and or resort owners saved their fish heads for collection by CDFW personnel. These NRRs are not used to estimate the harvest of marked hatchery origin (Ad+CWT) Chinook salmon (Table 6), however, they are used to calculate harvest timing (Figure 9). CWTs were not recovered from four heads and three tags were lost during the recovery process, leaving 319 tags to decode. Of the 319, 318 heads were of Klamath-Trinity basin origin, 298 were from adult salmon while 20 were jack salmon. Three Trinity River Hatchery (TRH) spring Chinook heads were recovered, two adults and one was a jack.

Recoveries of fin-clipped, fall-run Chinook salmon adults ranged in size from 47 to 101 cm and jacks ranged in size from 31 cm to 56 cm. All fin-clipped fish observed in the angler survey were assigned an individual head tag number which allowed tracking of each head through the extraction and decoding process.

Hatchery Contribution

Randomly recovered, marked Chinook salmon composed 7.01% (357/5,091) of the actual Chinook sampled. Expansions were made for creel sampling and hatchery

production multiplier for each tag group. Based on these expansions, CDFW estimated 3,233 hatchery fish were harvested (Table 7). Hatchery fish represented an estimated 28.3% (3,233/11,435) of the entire sport harvest in the lower Klamath River

Iron Gate Hatchery (IGH) Origin Chinook Salmon

CDFW decoded 187 random recovered tags from Klamath River origin Chinook. These Chinook salmon represent 20 different tag codes; 7 from the 2008 Brood Year, 8 from the 2009 Brood Year and five from the 2010 Brood Year at IGH (Table 6). When expanded for creel sampling and hatchery production multipliers for each tag group, IGH origin fish account for 14.95% (1,710/11,435) of the total sport harvest (Table 7). The IGH origin Chinook were harvested between Julian weeks 33 to 40 (Figure 9).

Trinity River Hatchery (TRH) Origin Chinook Salmon

CDFW decoded a total of 160 randomly recovered tags of TRH fall-run Chinook origin. These fall-run Chinook salmon represent 12 different tag codes; three from the 2008 Brood Year, seven from the 2009 Brood Year and two from the 2010 Brood Year at TRH (Table 6). TRH origin fall-run fish represented 13.32% (1,523/11,435) of the total sport harvest (Table 7). There were 3 spring-run TRH origin Chinook representing two different 2009 brood years and one 2010 brood year. TRH fall-run origin Chinook were harvested between Julian weeks 33 to 42 (Figure 9).

During the 2012 season, sport in-river harvest by stock can be presumed to be as follows: the tail end of the TRH spring-run Chinook salmon made up the majority of harvest up to Julian week 33 (based on returns in past years), then IGH fall-run Chinook salmon were present and peaked at JWs 36 through 38. The bulk of the Trinity River fall-run tags were collected during JWs 37 and 39, No more coded-wire tagged Chinook salmon were recovered after JW 42 (Figure 9).

Table 6. Actual coded-wire-tag recoveries by Julian week from Iron Gate Hatchery (IGH) and Trinity River Hatchery (TRH) for Chinook salmon obtained from the lower Klamath River, 2012 season.

CWT Code	Brood year	Julian week										Total
		33	34	35	36	37	38	39	40	42		
Trinity River Hatchery - Spring												
68822	2009	1										1
68832				1								1
68775	2010	1										1
Trinity River Hatchery - Fall												
68814	2008		1									1
68817									1			1
68820				1	4	2	1	1				9
68823	2009			1	5	2	3					11
68824				5	2	1						8
68825					2	3						5
68826					2	1	2					5
68827						1						1
68828							1					1
68837		1		9	20	37	29	8	8	1		113
68777	2010						1					1
68781					1	2	1					4
Iron Gate Hatchery												
68642	2008			1								1
68645				1								1
68646				1								1
68647		1		1		2						4
68648			1	3	1							5
68661			1									1
68662					1							1
68710	2009		1	12	2		1					16
68711			6	12	14	4	1	1				38
68712			2	16	11	6	2		1			38
68713			1	12	4	3						20
68714		1	1	6	9	4	2					23
68715			1	2	3	2	2	1				11
68716				5	4	2						11
68720				1								1
68792	2010				2							2
68793		1	1		2							4
68794				1	2							3
68795				2	2		1					5
68799					1							1
100000		1			3							4
200000				2		1						3
Total		7	16	95	97	73	47	11	10			356

Table 7. Fall Chinook salmon harvest proportioned by hatchery origin of the 2012 lower Klamath River sport harvest, expanded for creel sampling and hatchery production multiplier.

Total Fall-run Chinook Salmon	IGH Expanded	TRH Expanded	Estimated Total Hatchery	Per cent Hatchery
Jacks 3,570	251	32	283	7.9
Adults 7,865	1,459	1,491	2,950	37.5
Total 11,435	1,710	1,523	3,233	28.3

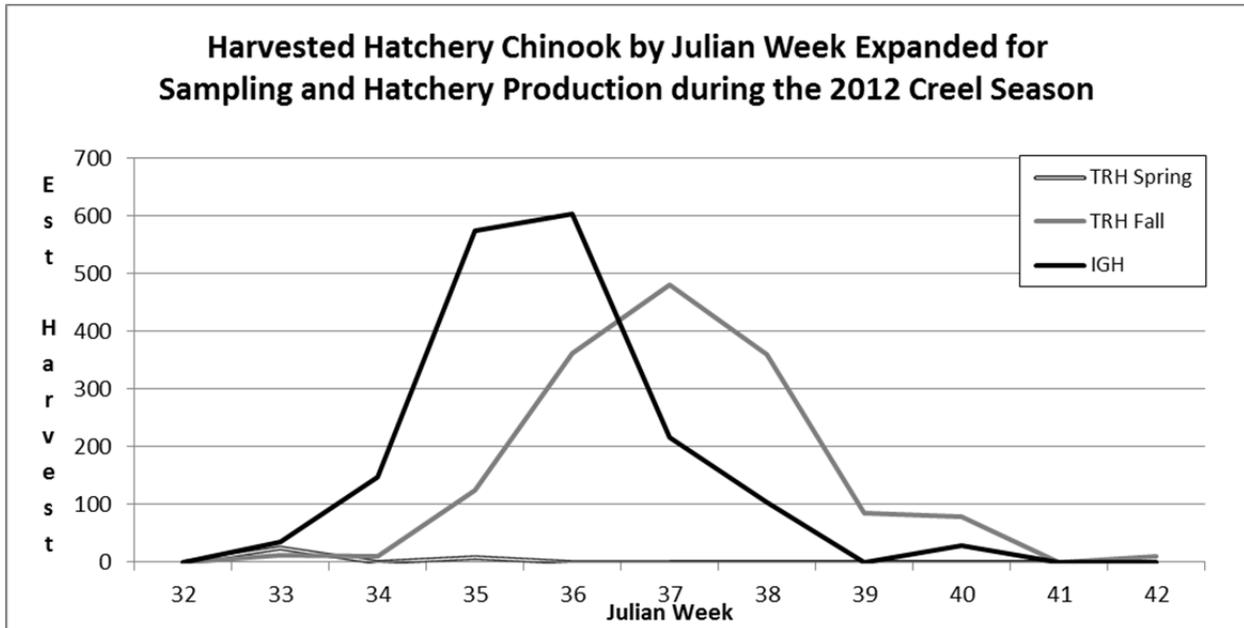


Figure 9. Timing by Julian week of coded wire tags, expanded for sampling and by individual tag code, recovered from Chinook salmon in the lower Klamath River 2012 creel season.

Nine additional hatchery fish heads were turned into CDFW at the end of the season by a fishing guide. There were no dates attached to when these fish were harvested during the season so they were not used in any of the calculations. Seven of these nine were from Trinity River 2009 brood year codes and two were from Iron Gate 2009 brood year codes. We informed the fishing guide to supply us with dates of harvest if they were going to keep them for us in the future.

DISCUSSION

The lower Klamath River sport Chinook fishery is composed of fish produced naturally from the Klamath and Trinity river basins and fish produced at IGH and TRH. Based on creel sampling and hatchery production expansion factors, the estimated 2012 sport harvest was composed of approximately 28.3% hatchery and 71.7 naturally produced Chinook. The hatchery contribution was composed of 14.95% IGH Chinook and 13.32% TRH Chinook. In contrast, the previous 23 years of hatchery contributions to lower Klamath River Chinook harvests have averaged 17% IGH Chinook and 12% TRH. Identifying the contribution of naturally produced Trinity stocks to the sport fishery is beyond the scope of this report. Methods to produce quantitative estimates of natural Chinook contributions from each of the Klamath and Trinity basins to the sport fishery should be investigated. Addressing the contribution to the sport fishery from naturally produced Chinook will add to information to assess TRRP goal and objectives.

An interesting comparison is to look at the known hatchery component of the sport harvest and compare it to the returns to the rest of the basin from the Klamath megatable (Appendix 2), as in Figure 9 and Figure 10. In these figures IGH and TRH origin refer to the known/recovered tags from the sport harvest. The Klamath Basin line (Figure 9) is derived from the numbers that returned to Iron Gate Hatchery, salmon that returned to natural areas on the Klamath and harvest above the confluence with the Trinity River. The Trinity Basin line (Figure 11) is derived from returns to Trinity River hatchery, salmon spawning in natural areas on the Trinity River and harvest on the Trinity above the confluence with the Klamath River. Yurok net harvest data is not included in either figure.

Variance estimates will be addressed in the 2013 report.

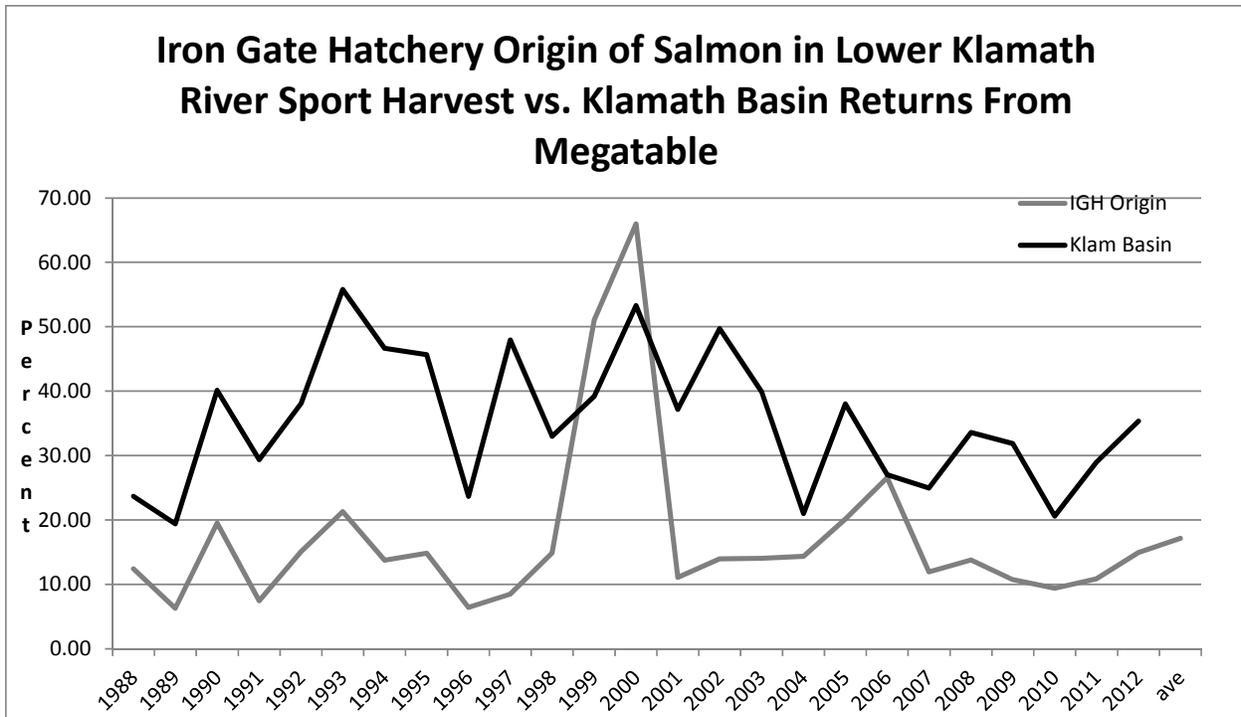


Figure 10. Percent of Iron Gate Hatchery origin salmon from the lower Klamath sport creel as compared to salmon returning to the Klamath portion of the basin from the megatable.

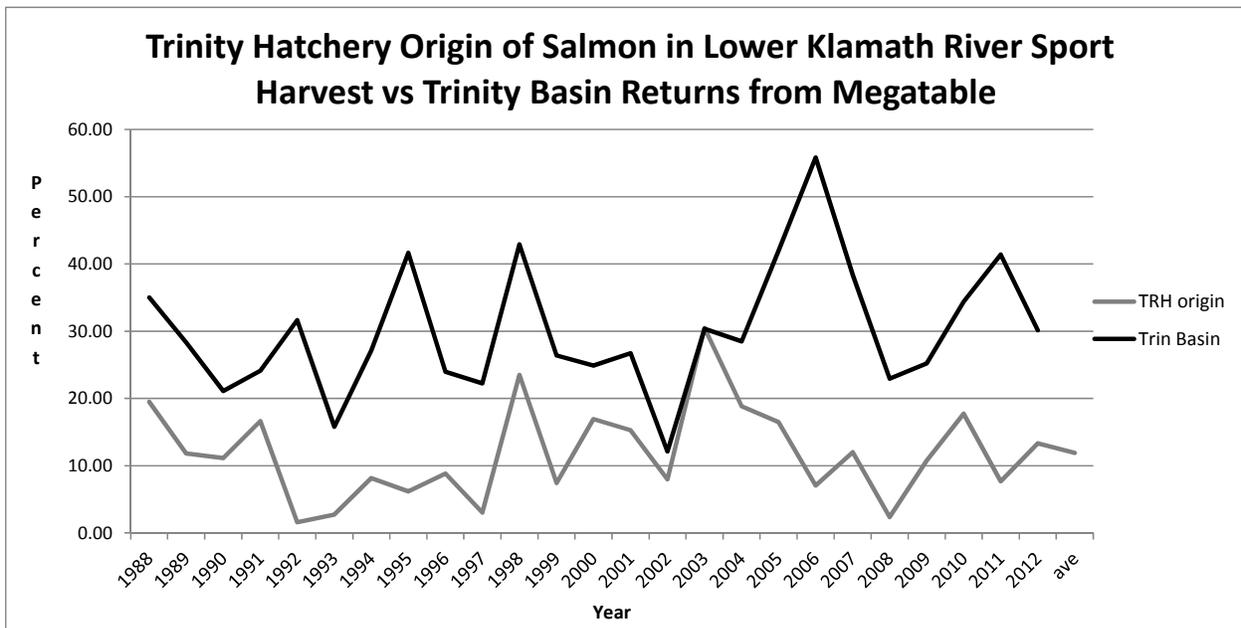


Figure 11. Percent of Trinity River Hatchery origin salmon from the lower Klamath sport creel as compared to salmon returning to the Trinity portion of the basin from the megatable.

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APPENDICES

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

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

a/ Eight-day week in each leap year (years divisible by 4).

b/ Eight-day week every year.

Appendix 2. Page 12 (showing 2011) of “megatable” – excerpt from the Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, 1978-2011

Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-river Harvest and Run-size Estimates, 1978-2011 a/

SPAWNER ESCAPEMENT									
	2011			2012			2013		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Hatchery Spawners									
Iron Gate Hatchery (IGH)	9,549	8,490	18,039						
Trinity River Hatchery (TRH)	1,872	13,849	15,721						
Hatchery Spawner Subtotals:	11,421	22,339	33,760	0	0	0	0	0	0
Natural Spawners									
Main Stem Klamath River n/									
(excluding IGH)	3,306	3,976	7,282						
Salmon River basin	1,819	3,674	5,493						
Scott River basin	2,499	3,016	5,515						
Shasta River basin	11,187	213	11,400						
Bogus Creek basin	2,303	2,919	5,222						
Misc. Klamath tributaries o/									
(above Yurok Reservation)	3,259	3,072	6,331						
Yurok Reservation tribs. (Klamath River) p/	418	1,143	1,561						
Klamath Natural Spawner Subtotals:	24,791	18,013	42,804	0	0	0	0	0	0
Main Stem Trinity River dd/									
(excluding TRH)	37,820	28,668	66,488						
Misc. Trinity tributaries o/									
(above Hoopa Reservation)	96	542	638						
Hoopa Reservation tribs. (Trinity River) p/	94	530	624						
Trinity Natural Spawner Subtotals:	38,010	29,740	67,750	0	0	0	0	0	0
Natural Spawner Subtotals:	62,801	47,753	110,554	0	0	0	0	0	0
Total Spawner Escapement	74,222	70,092	144,314	0	0	0	0	0	0

IN-RIVER HARVEST									
	2011			2012			2013		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Angler Harvest									
Klamath River (below Hwy 101 bridge)	700	624	1,324						
Klamath River (Hwy 101 to Weitchpec)	6,557	912	7,469						
Klamath River (Weitchpec to IGH)	1,480	1,483	2,963						
Trinity River basin	1,260	1,144	2,404						
Angler Harvest Subtotals:	9,997	4,163	14,160	0	0	0	0	0	0
Indian Net Harvest e/									
Klamath River (below Hwy 101 bridge)	429	17,218	17,647						
Klamath River (Hwy 101 to Trinity mouth)	467	4,272	4,739						
Trinity River (Hoopa Reservation)	426	4,863	5,289						
Indian Net Harvest Subtotals:	1,322	26,353	27,675	0	0	0	0	0	0
Total In-river Harvest	11,319	30,516	41,835	0	0	0	0	0	0

IN-RIVER RUN									
	2011			2012			2013		
	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
Totals									
In-river Harvest and Escapement	85,541	100,608	186,149	0	0	0	0	0	0
Angling Mortality (2.04% of harvest) f/	204	85	289	0	0	0	0	0	0
Net Mortality (8.70% of harvest) f/	115	2,292	2,407	0	0	0	0	0	0
Catch and Release Mortality gg/									
Total In-river Run	85,860	102,985	188,845	0	0	0	0	0	0