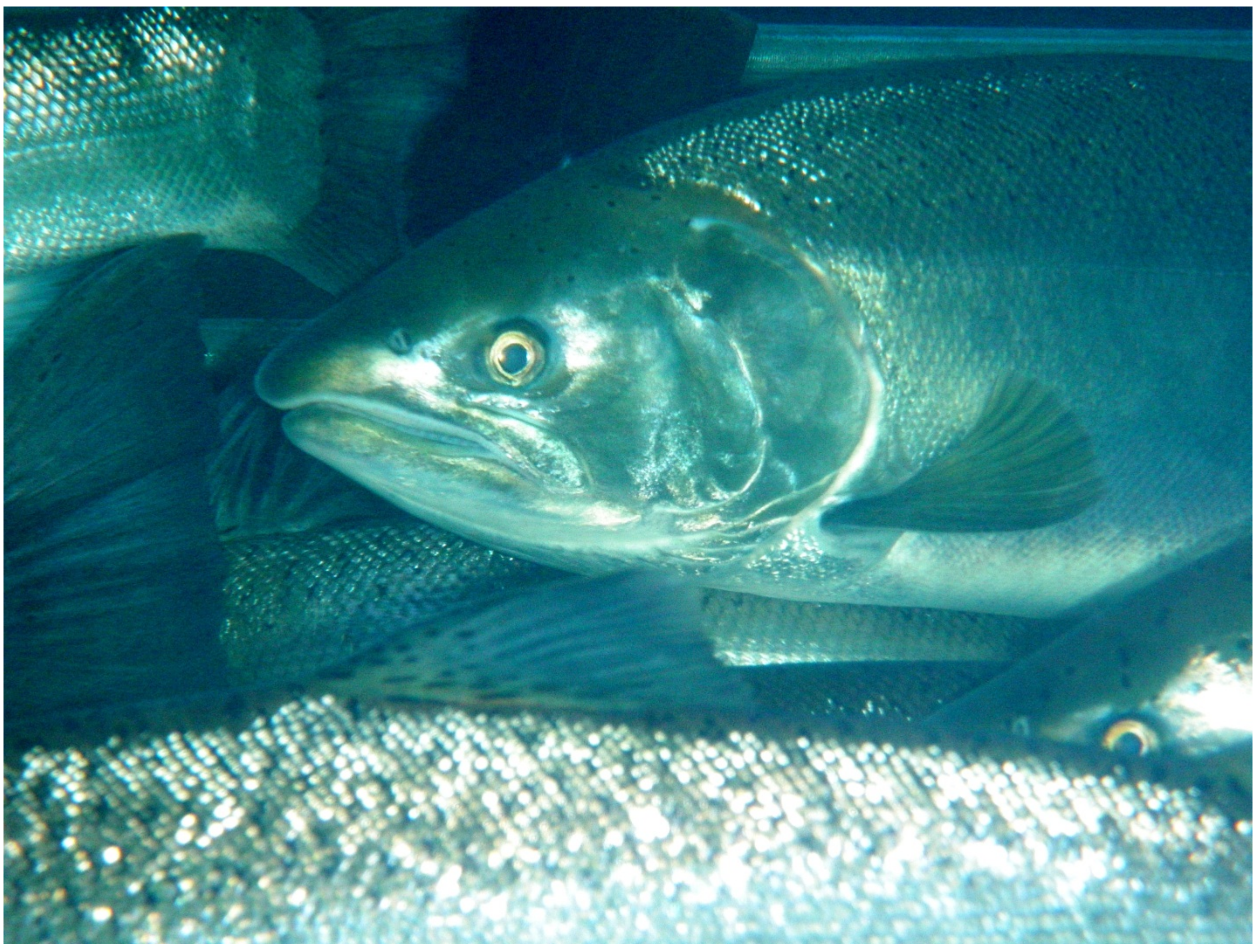
State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

FINAL ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2011-12 SEASON



On the cover: Salmonids trapped at Willow Creek weir, 2011.

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2011-12 SEASON

by

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Northern Region
Klamath and Trinity River Projects

601 Locust Street
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DECEMBER 2013

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FOREWORD

This is the California Department of Fish and Game's (CDFG) Trinity River Basin Salmon and Steelhead Monitoring Project's twenty-third annual report to the United States Bureau of Reclamation (Reclamation). The activities reported on occurred between April 2011 and March 2012, and were funded by Cooperative Agreement Number R11AC20520. The field work was conducted by personnel of the CDFG Klamath-Trinity Program. Cooperators of field studies include the Hoopa Valley Tribal Fisheries (HVTF), Yurok Tribal Fisheries Program (YTFP), U.S. Fish and Wildlife Service (USFWS) and U.S. Forest Service (USFS). The HVTF, YTFP, and USFWS were contracted separately by Reclamation for cooperative and singular work performed during FFY 2011. Please refer to those respective agency/tribal fisheries departments or Reclamation for information regarding other projects/studies.

This year's CDFG work was comprised of five separate 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.

ACKNOWLEDGMENTS

The CDFG fisheries technicians responsible for collecting much of the data during the 2011 field season include: Nancy Barnes, Michael Bradford, Jason Coburn, Dan Dempsey, Becky Dutra, Melissa Gordon, Mark Kerr, Scott LaChance, Stephen Marten, Sherry Mason, Sarah Meese, Carl Meredith, Gaytha Morningstar, Todd Newhouse, Eric Ojerholm, Roddy Park, Jane Sartori, Garth Savage, Guy Smith, Ron Smith, Steven Strite, Cindy Walker, Eileen Williams, Paula Whitten, and Andy Yarusso. We are very fortunate to have much of our talented staff return year after year and rely on them greatly, so thanks to them and thanks, as always, for the administrative support from Brenda Tuel and Mary Kuehner.

We are thankful too for the help of the many biologists, technicians, crew, staff, and volunteers from HVTF, YTFP, USFWS, USFS, and other CDFG projects who worked cooperatively with us on our field projects throughout the year.

We appreciate the cooperation of the CDFG Trinity River Hatchery staff during salmonid recovery, and landowners 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.

The CDFG monitoring program was approved by the Trinity Management Council (TMC) and funded through the Trinity River Restoration Program (TRRP) office in Weaverville, CA. We thank Robin Schrock and the TRRP staff for their input and efforts administering our projects and contracts. We bid adieu to Nina Hemphill from the TRRP office. Her years of contract liaising and support will be missed.

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ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2011-12 SEASON

TASK 1
ANNUAL RUN-SIZE, HARVEST, AND SPAWNER ESCAPEMENT ESTIMATES FOR TRINITY RIVER BASIN CHINOOK AND COHO SALMON AND STEELHEAD

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by

Mary Claire Kier

ABSTRACT

The California Department of Fish and Game's Trinity River Project conducted tagging and recapture operations from July 2011 through March 2012 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 1,923 Chinook salmon, 362 coho salmon, 1,709 fall steelhead and 151 brown trout (*Salmo trutta*). Utilizing a Petersen mark-recapture methodology, and fish tagged at the weirs and recaptured at Trinity River Hatchery (TRH), we estimated a run size of 19,219 spring Chinook migrated into the Trinity River basin upstream of Junction City weir. Using tags returned by anglers we estimated 112 spring Chinook were harvested, yielding an escapement of 19,107 fish. An estimated run-size of 80,818 fall Chinook migrated past Willow Creek weir (WCW), of which an estimated 1,760 were harvested by anglers, yielding and escapement of 79,059 fish.

The coho salmon (coho) run-size to the Trinity above Willow Creek was estimated at 15,040 fish, with 44 fish estimated as harvested, leaving an estimated escapement of 14,996. An estimated 21,901 (6,932 naturally produced and 14,969 hatchery produced) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 957 adult fall steelhead above the WCW, leaving 20,944 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 Game's (CDFG) Trinity River Project (TRP or Project) personnel estimate the run-size and spawner escapement of fall-run Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and fall-run steelhead (*O. mykiss)* in the Trinity River basin upstream of a weir near Willow Creek, California, and estimate the run-size and spawner escapement of spring-run Chinook salmon upstream of a weir near Junction City, 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 Task 1 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, to estimate angler harvest numbers, 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.

METHODS

Trapping and Tagging

Trapping Locations and Periods

Trapping and tagging operations were conducted from August 2, 2011 through November 21, 2011 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 (40º 41' 5.51" N, 123º 01' 35.55" W) near the town of Junction City. The JCW was operated August 2 through September 30, 2011, 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 (40º 58' 29.85" N, 123º 38' 8.61" W) and was operated September 8 through November 21, 2011. The WCW is primarily operated to capture, measure, and tag fall-run Chinook salmon (fall Chinook), coho, and fall-run 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 21º 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 ¾ 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 45º angle, with the top of the weir standing 1.8 m above the river bottom.

[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 CDFG personnel to returning spawning-run fish.

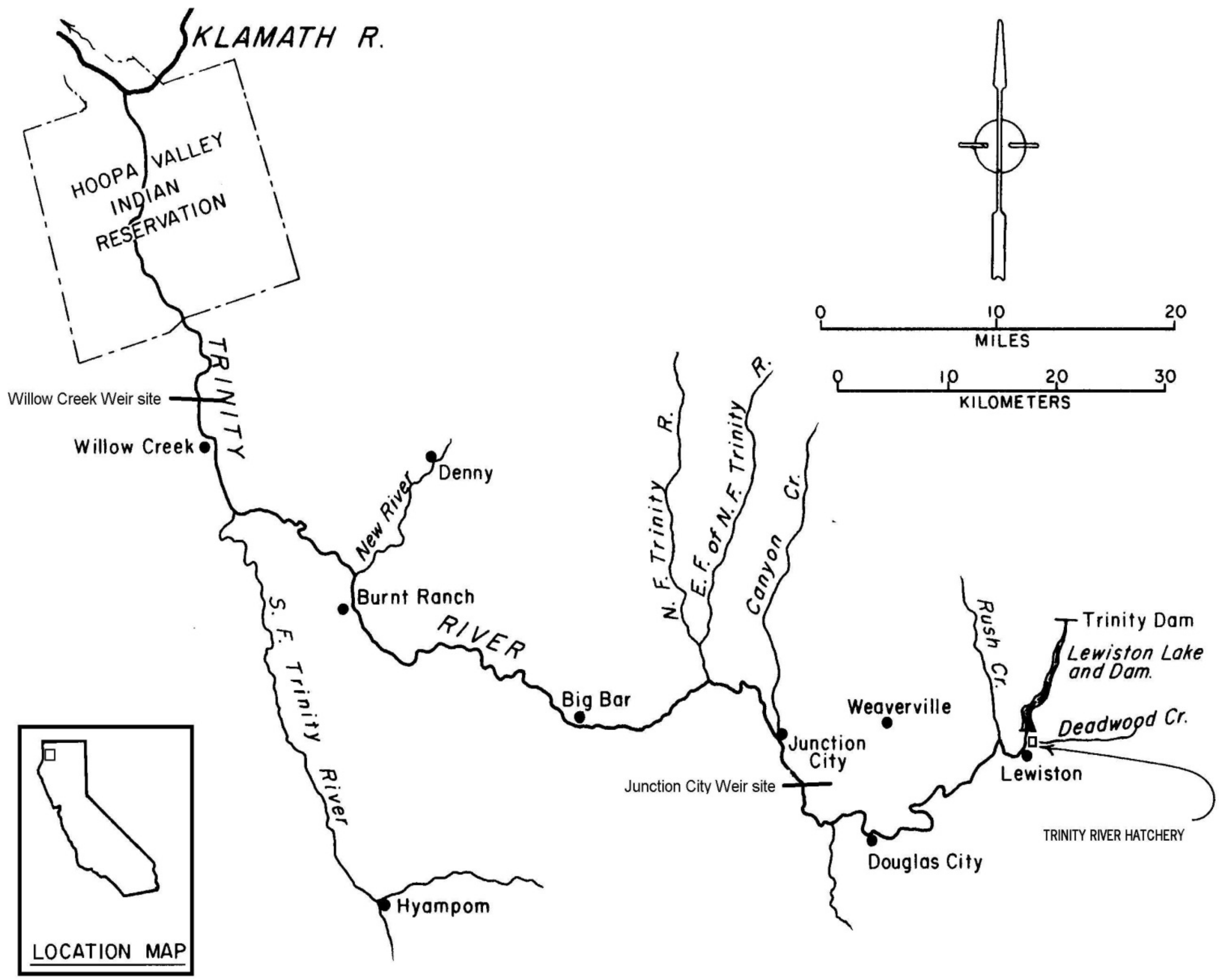


Figure 1. Location of trapping/tagging weirs near Willow Creek and Junction City, and Trinity River Hatchery, in the Trinity River basin, 2011 season.

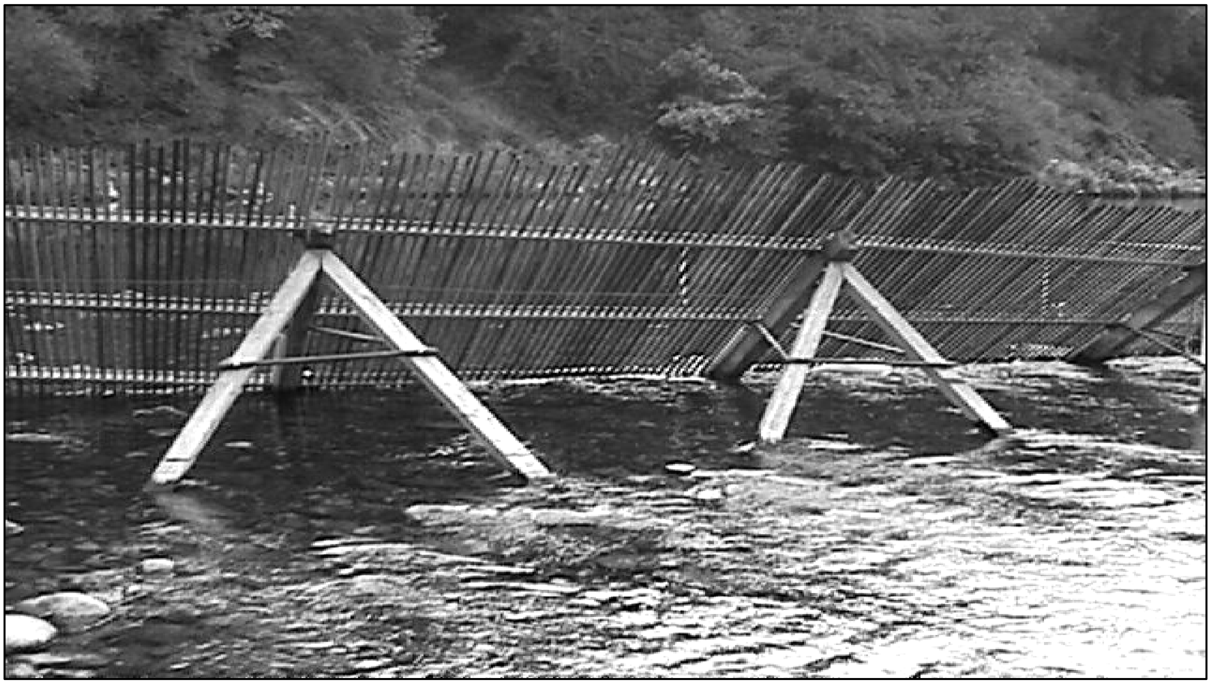


Figure 2. Photograph of Alaskan-style weir tripods, support channels and conduit (looking upstream).

Figure 3. Typical set up of Willow Creek weir. Note the boat gate and two trap boxes.

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

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 on 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, then into the trap. To allow boat passage, gates approximately 5.3 m wide were inserted between two weir panels. The gate at JCW was constructed of welded conduit panels with 2.5 cm spacing between pieces of conduit and was perpendicular to the stream substrate. 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-4[3/] spaghetti tag (Project-tagged). Tags are inserted using an applicator needle through the fish's back approximately two cm below the base of the dorsal fin and ¼ the length of the dorsal fin, anterior of the posterior edge of the dorsal fin. At WCW one-half of the Chinook and

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

one-half of the adult steelhead received $10-reward tags, while the remaining half received non-reward tags. At JCW one third of the Chinook received $10-reward tags, the rest non-reward. 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. 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 inform the Klamath River Technical Team’s Klamath River age composition analysis (KRTT, 2011).

<u>Separation of Spring and Fall Chinook Runs at the Weirs and at Trinity River Hatchery</u>
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 percent 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, CDFG personnel annually close the TRH fish ladder for a ten-day period which in 2011 was between October 15 and October 25 (JW 42 plus days on each side of JW 42). 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 ((231,430+713,665)/231,430). 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 a 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

The size separating adult and jack spring and fall Chinook is based on two criteria; length frequency data obtained at the two trapping sites and TRH, and length data obtained from groups of CWTed fish that enter TRH whose exact age are known. Chinook and coho salmon length-frequency data collected at the weirs and TRH are smoothed with a moving average of five 1-cm increments to determine the nadir separating jacks and adults. Fork length data from TRH Chinook was only used from weeks in which ≥ 90% of the Chinook could be designated as either spring run or fall run as explained by the expansion of CWTs.

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. All anglers that returned tags 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 May 31, 2012 were included in assessing harvest and catch and release rates. The 2011-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 6, 2011, closed October 14-24 to separate spring and fall Chinook and closed for the season March 13, 2012. The first spring Chinook spawning date was September 6. 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 13, 2012.

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.

<u>Spawner Surveys</u>

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 2011-12 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.

[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).

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.

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.

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). Using CWT analysis we designated JW 36 as the last week of spring Chinook at JCW. No TRH-origin spring run Chinook identified by CWT were observed at the WCW, nor were any WCW-tagged Chinook captured during the spring spawning period at TRH. Therefore, all Chinook trapped at WCW in 2011 were designated fall Chinook.

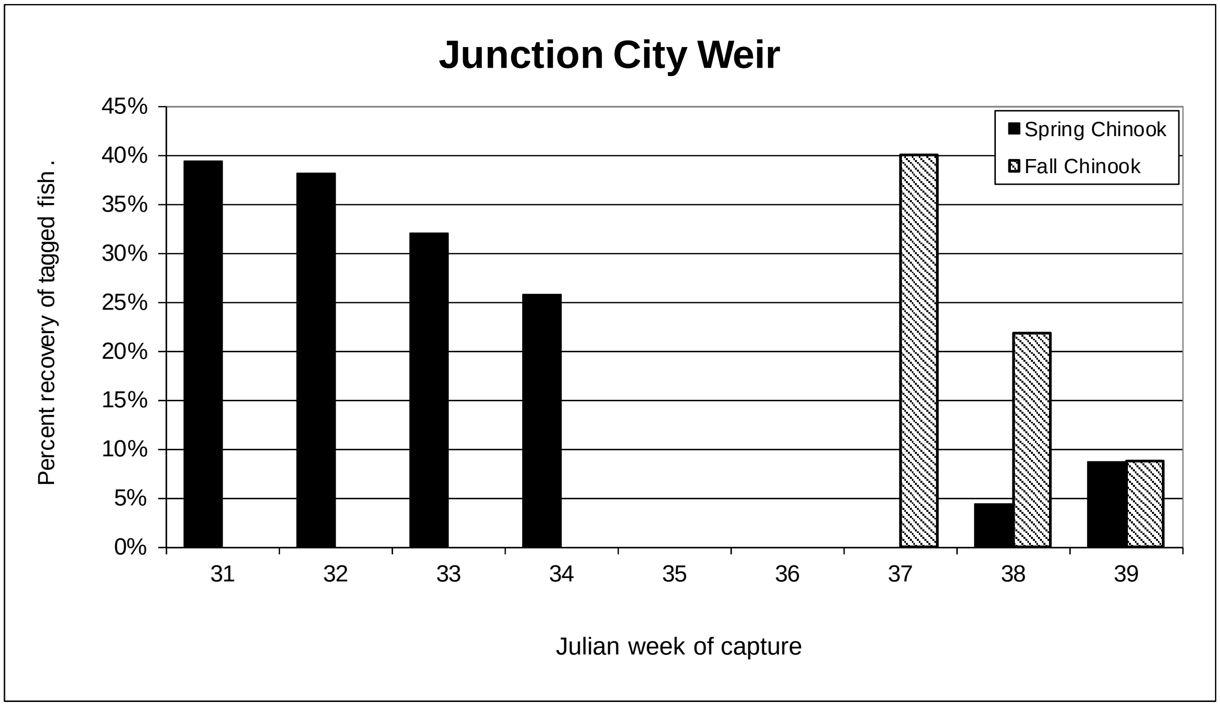
We installed the JCW August 1, 2011 (JW 31). The numbers of spring Chinook trapped was highest the first week at 15.5 fish per night. The fall Chinook comprised the majority of the run (as determined by CWT analysis) by JW 37 (Table 1, Figure 6). The weir was removed from the river September 30, 2011, on schedule.

We installed WCW on September 8, 2011 (JW 36) and determined (utilizing post-season CWT) for purposes of analysis all Chinook tagged at WCW in 2011 to be fall run. We had our highest catch of fall Chinook during JW 37, with 102.4 fish per night (Table 2, Figure 7). We had some storm/flow events that precluded consistent trapping in early October (note the number of nights trapped in Table 2).

Size of Trapped Fish
Spring Chinook trapped at JCW and TRH averaged 62.3 and 64.6 cm FL, respectively, with a combined average 64.5 cm FL (Figure 8, Appendix 4). By fork length distribution analysis alone the nadir separating jack from adult spring Chinook was between 59 and 60 cm FL. Data from known age, hatchery-marked spring Chinook that entered TRH supported the minimum adult fork length of 60 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 60 cm FL to the observed population, an estimated 49.7% of the spring Chinook observed were jacks at JCW, and 41.9% at TRH. We graphically present the fork length data as moving averages of five 1-cm increments to smooth the appearance, especially of those lengths we encountered less frequently, allowing the reader to more readily identify the nadir between jacks and adult. Non-averaged data are presented in the appendices.

Fall Chinook trapped at JCW, WCW and TRH averaged 65.0, 62.8 and 68.7 cm FL, respectively, with a combined mean FL of 68.1 cm. (Figure 9). The nadir on the fork length distribution between jacks and adult fall Chinook indicated a maximum jack size of 57 cm FL. Data from known age, hatchery marked fall Chinook entering TRH supported this separation between jacks and adults (Appendix 3).

Using the maximum jack size of 57 cm, fall Chinook jacks comprised 43.7% and 11.7% of the run observed at WCW and TRH respectively.



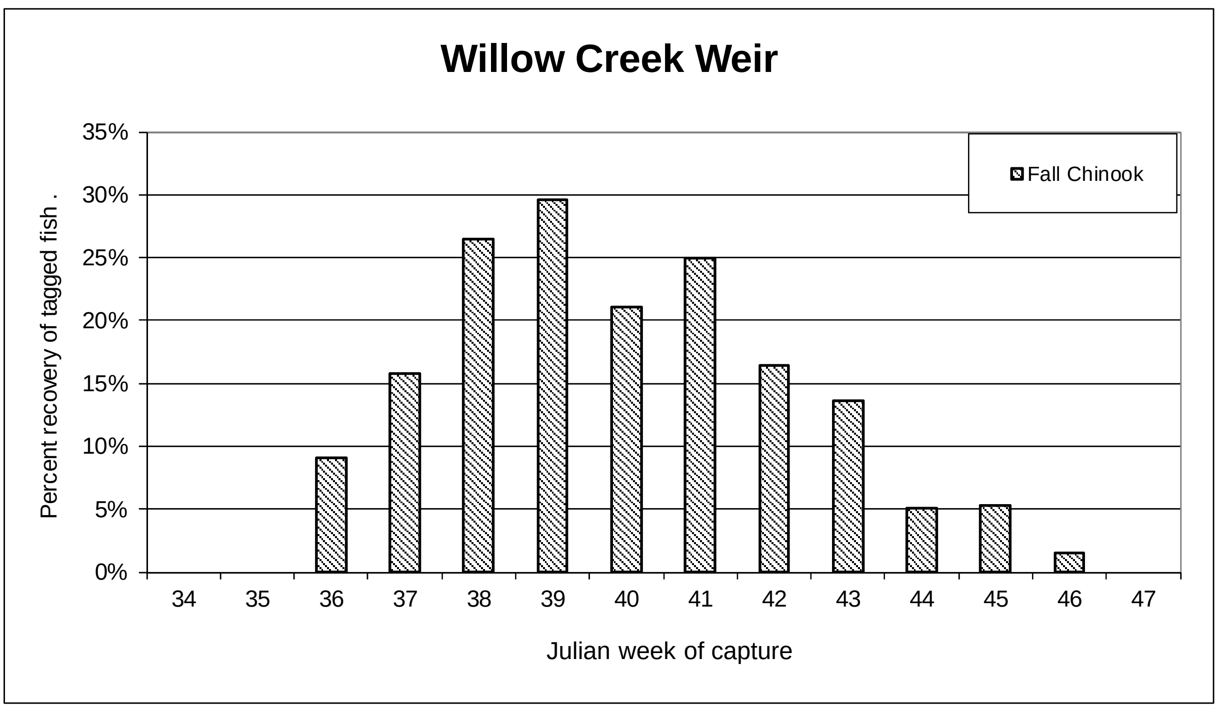


Figure 5. Percent recovery of Junction City weir and Willow Creek weir marked Chinook at Trinity River Hatchery during the 2011-12 season.

Table 1. Weekly summary of Chinook trapped in the Trinity River at Junction City weir during 2011. [a]

			Number trapped							
Julian week	Inclusive dates	Nights Trapped	Jacks [b]	Ad-clip Jacks	Adults	Ad-clip Adults	Total	Ad-clip total	Fish/ night
Spring Chinook									
31	30-Jul - 5-Aug	4	21	0	41	4	62	4	15.5
32	6-Aug - 12-Aug	5	13	4	8	2	21	6	4.2
33	13-Aug - 19-Aug	5	14	2	11	3	25	5	5.0
34	20-Aug - 26-Aug	5	24	4	12	0	36	4	7.2
35	27-Aug - 2-Sep	0	0	0	0	0	0	0	0.0
36	3-Sep - 9-Sep	4	1	0	2	0	3	0	0.8
	Sub-total:	23	73	10	74	9	147	19	
	Mean:								6.4
Fall Chinook									
37	10-Sep - 16-Sep	5	2	0	3	0	5	0	1.0
38	17-Sep - 23-Sep	5	18	1	29	3	47	4	9.4
39	24-Sep - 30-Sep	5	20	0	28	3	48	3	9.6
	Sub-total:	15	40	1	60	6	100	7	
	Mean:								6.7
	Grand total:	38	113	11	134	15	247	26	

a/ Trapping at Junction City weir took place August 2 - September 30, 2011 (Julian weeks 31-39).
b/ Spring Chinook <60 cm FL were considered jacks in 2011. Fall Chinook <58 cm FL were considered jacks
c/ Adipose fin-clipped Chinook. Number shown is a subset of weekly jack and adult Chinook totals.

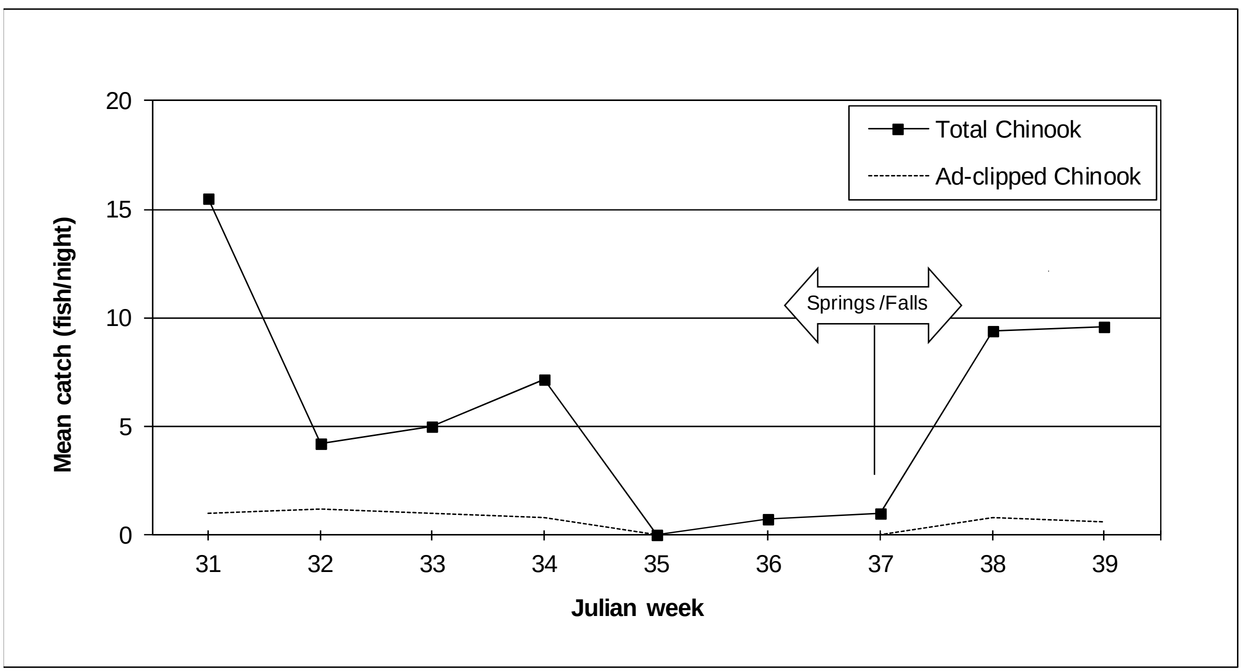


Figure 6. Mean catch of Chinook in the Trinity River at Junction City weir, 2011. Note the delineation between the spring and fall runs at Julian week 37.

Table 2. Weekly summary of Chinook trapped in the Trinity River at Willow Creek weir during 2011.

Julian week	Inclusive dates	Nights trapped	Number trapped: Jacks [b]	Ad-clip [c] Jacks	Adults	Ad-clip Adults	Total	Ad-clip total	Fish/ night
Fall Chinook									
36	3-Sep - 9-Sep	2	82		52	3	134	3	67.0
37	10-Sep - 16-Sep	5	270	3	242	36	512	39	102.4
38	17-Sep - 23-Sep	5	199	9	264	47	463	56	92.6
39	24-Sep - 30-Sep	5	98	9	132	23	230	32	46.0
40	1-Oct - 7-Oct	3	14		44	6	58	6	19.3
41	8-Oct - 14-Oct	2	2		6	2	8	2	4.0
42	15-Oct - 21-Oct	7	11	2	68	10	79	12	11.3
43	22-Oct - 28-Oct	5	11	1	39	9	50	10	10.0
44	29-Oct - 4-Nov	5	14		31	7	45	7	9.0
45	5-Nov - 11-Nov	5	11		10		21	0	4.2
46	12-Nov - 18-Nov	5	19	1	56	5	75	6	15.0
47	19-Nov - 25-Nov	1	1		1		2	0	2.0
	Total:	50	732	25	945	148	1,677	173	
	Mean:								33.5

a/ Trapping at Willow Creek weir took place September 8 - November 21, 2011 (Julian weeks 36-47).
b/ Fall Chinook <58 cm FL were considered jacks in 2011. All Chinook trapped at WCW were fall Chinook in 2011.
c/ Adipose fin-clipped Chinook. Number shown is a subset of weekly jack and adult Chinook totals.

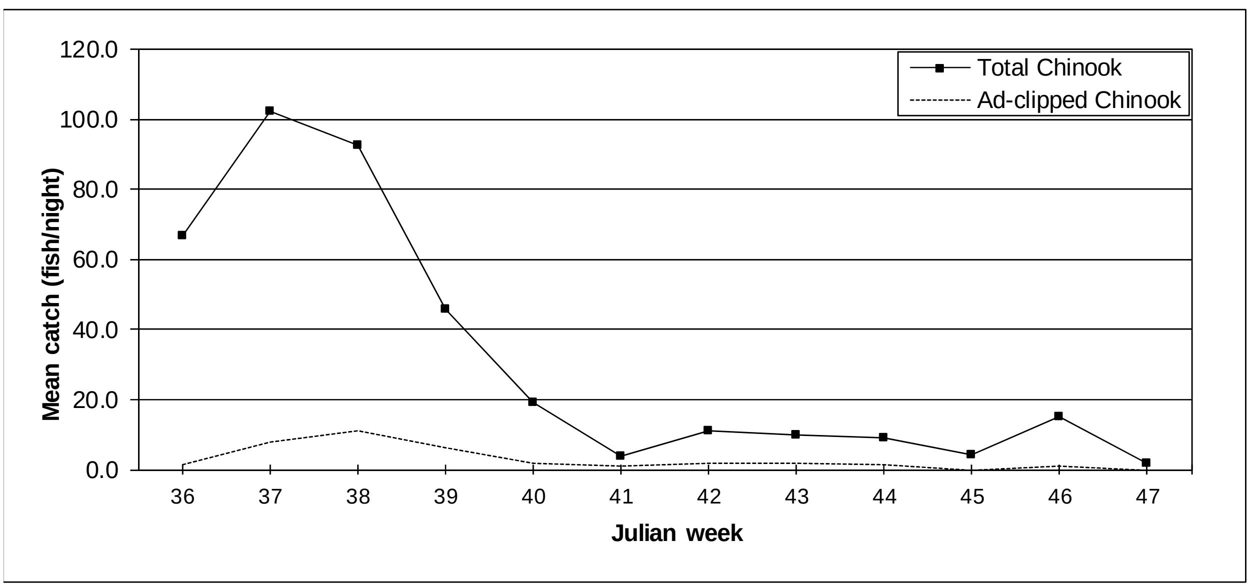


Figure 7. Mean catch of fall Chinook in the Trinity River at Willow Creek weir, 2011.

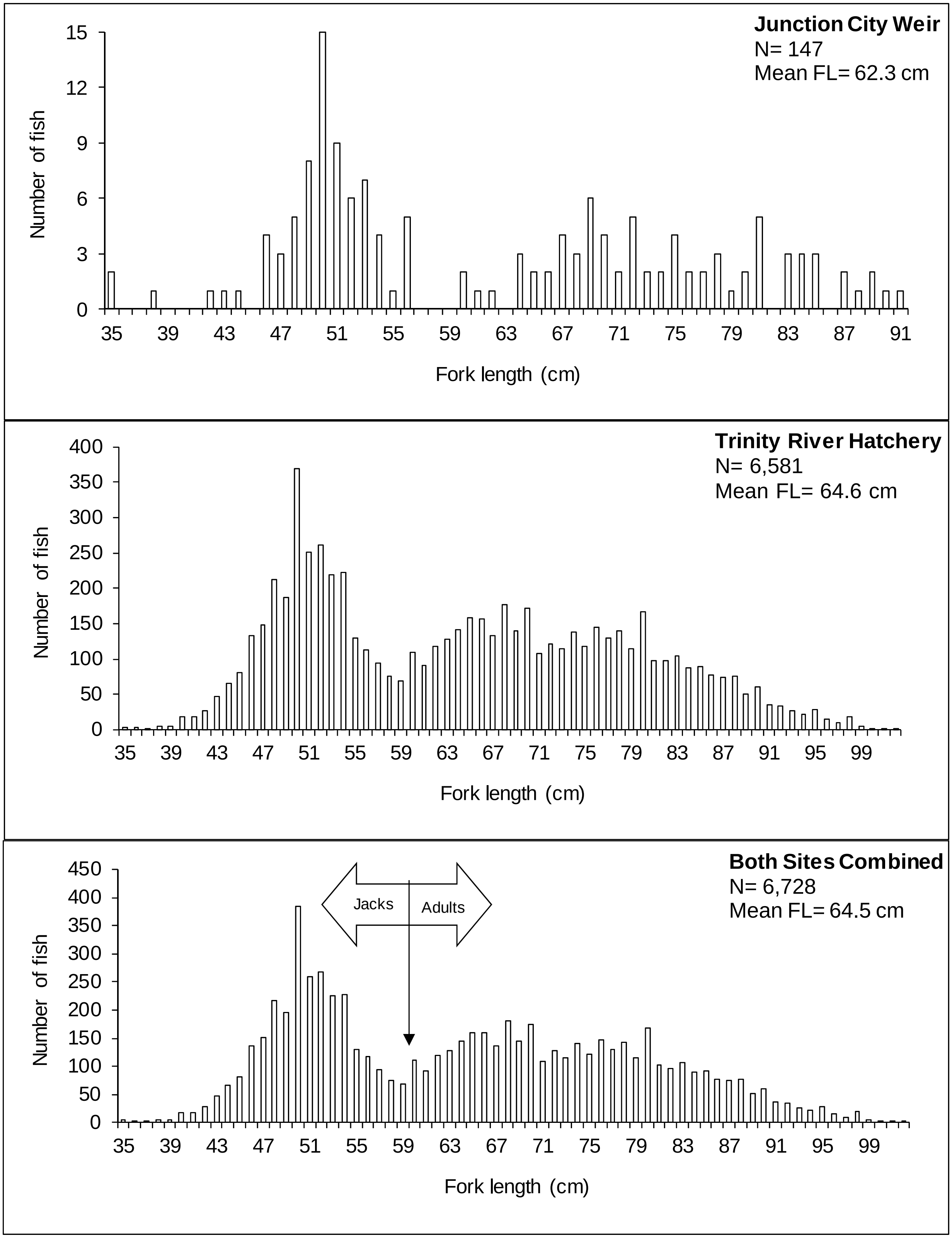


Figure 8. Spring Chinook fork lengths (cm) observed at Junction City weir, Trinity River Hatchery, and both sites combined during the 2011-12 season. The arrow denotes the size used to separate jacks and adults for analysis.

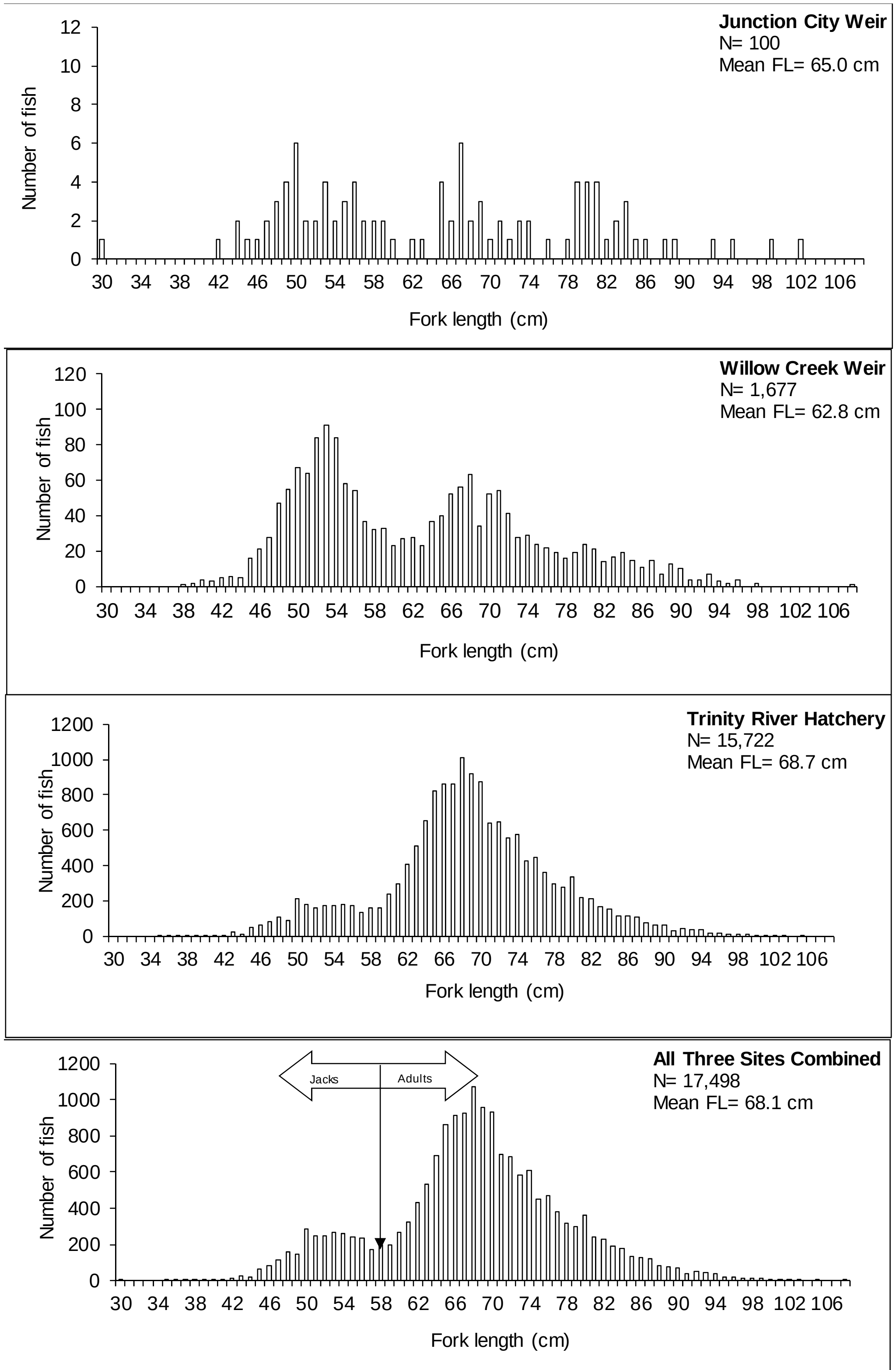


Figure 9. Fall Chinook fork lengths (cm) observed at Junction City weir, Willow Creek weir and Trinity River Hatchery and all sites combined during the 2011-12 season. The arrow denotes the size used to separate jacks and adults for analysis.

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 147 spring Chinook were trapped at JCW, of which 145 (72 jacks and 73 adults) were effectively tagged (Appendix 4). There were two tagging mortalities detected and zero caught and released spring Chinook from which anglers reported removing tags (Appendix 6). There were 100 (40 jack and 60 adult) fall Chinook trapped at JCW in 2011, 97 of which were effectively tagged (Appendix 5).

There were no spring Chinook trapped at WCW in 2011. A total of 1,677 fall Chinook were trapped, of which 1,629 were tagged. Of those 1,629 tagged fish (713 jacks and 916 adults), 1,613 of them (704 jacks and 909 adults) were effectively tagged (Appendix 7). There were no tagging mortalities detected, and 14 (eight jacks, six adults) fall Chinook from which anglers reported removing tags.

Incidence of Fin Clips

Ad-clipped fish comprised 12.9% of the spring Chinook captured (19 of 147) at JCW (Table 1, Appendix 4), and seven of the 100 fall Chinook trapped there. Nine of the ad-clipped spring Chinook tagged at JCW were recovered at TRH.

Of the 1,677 fall Chinook trapped at WCW, 172 (10.7%) were ad-clipped. Seventy five of the ad-clipped fall Chinook tagged at WCW (45.5%), and three of the ad-clipped fall Chinook tagged at JCW were recovered at TRH (Table 3).

Coho Salmon

Run timing

There were no coho salmon trapped at JCW in 2011. 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 40 and 41, decreasing through the rest of the season with a sampling season mean of ~7.2 fish trapped per night (Table 4, Figure 10). A total of 362 coho salmon were trapped (234 jacks and 128 adults) at WCW during the 2011 season.

Size of Trapped Fish

The mean FL of coho trapped at WCW and TRH was 53.3 and 54.4 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 <58 cm FL were considered jacks. Jacks comprised 64.6% and 60.0% 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 2011-12 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								
065347-f	Chinook	spring	2006	06/ 01-08 /2007	65,914	TRH		
065348-f	Chinook	spring	2006	06/ 01-08 /2007	86,088	TRH		
065349-f	Chinook	spring	2006	06/ 01-08 /2007	74,456	TRH		
065360-y	Chinook	spring	2006	10/ 01-10 /2007	104,019	TRH		
068801-f	Chinook	spring	2007	06/ 02-12 /2008	55,773	TRH		
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		2
068813-f	Chinook	spring	2008	06/01-15/2009	64,175	TRH		2
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		3
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		
shed tag[b]	Chinook	spring						
						Total spring Chinook:	0	9
FALL CHINOOK								
065350-f	Chinook	fall	2006	06 /01-08 /2007	118,575	TRH		
065351-f	Chinook	fall	2006	06 /01-08 /2007	119,712	TRH		
065361-y	Chinook	fall	2006	10 /01-10 /2007	238,156	TRH		
068804-f	Chinook	fall	2007	06/ 02-12 2008	92,759	TRH		
068805-f	Chinook	fall	2007	06/ 02-12 2008	89,972	TRH		
068806-f	Chinook	fall	2007	06/ 02-12 2008	89,348	TRH		
068807-f	Chinook	fall	2007	06/ 02-12 2008	84,063	TRH		
068808-f	Chinook	fall	2007	06/ 02-12 2008	90,174	TRH	1	
068809-y	Chinook	fall	2007	10/ 01-14 /2008	244,661	TRH	1	
065356-f	Chinook	fall	2008	06/01-15/2009	11,403	TRH	2	
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	2	
068814-f	Chinook	fall	2008	06/01-15/2009	93,228	TRH	8	
068815-f	Chinook	fall	2008	06/01-15/2009	94,165	TRH	7	1
068816-f	Chinook	fall	2008	06/01-15/2009	96,264	TRH	7	
068817-f	Chinook	fall	2008	06/01-15/2009	92,360	TRH	3	
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	30	
608080000-f[c]	Chinook	fall	2008	04/29-08/20/09	17,618	TRH		1
608080001-f[c]	Chinook	fall	2008	04/29-08/20/09	2,915	TRH		
068823-f	Chinook	fall	2009	06/01-08/10	85,136	TRH	3	1
068824-f	Chinook	fall	2009	06/01-08/10	89,959	TRH	4	
068825-f	Chinook	fall	2009	06/01-08/10	91,310	TRH		
068826-f	Chinook	fall	2009	06/01-08/10	88,851	TRH		
068827-f	Chinook	fall	2009	06/01-08/10	90,929	TRH		
068828-f	Chinook	fall	2009	06/01-08/10	39,642	TRH	1	
068671-f	Chinook	fall	2009			FRH		
068710-f	Chinook	fall	2009			IGH		
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	3	
shed tag[b]	Chinook	fall					1	
						Total fall Chinook:	75	3
COHO								
RM [d]	coho		2008	04/06-08/2010	414,326	TRH	24	
RM [d]	coho		2009	03/15-25/2011	490,998	TRH	70	
						Total coho:	94	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 <58 cm FL were classified as brood year 2009 and coho >57 cm FL were classified as brood year 2008. Age cutoff based on fork length distribution.

Table 4. Weekly summary of coho trapped in the Trinity River at Willow Creek during 2011.[a]

Julian week	Inclusive dates	Nights trapped	Number trapped: Jacks[b]	RM clip[c] Jacks	Adults	RM clip Adults	Total trapped	Total RM clips	Fish / night
36	3-Sep - 9-Sep	2	2	2	0	0	2	2	1.0
37	10-Sep - 16-Sep	5	3	3	0	0	3	3	0.6
38	17-Sep - 23-Sep	5	18	18	0	0	18	18	3.6
39	24-Sep - 30-Sep	5	57	57	8	5	65	62	13.0
40	1-Oct - 7-Oct	3	55	53	0	0	55	53	18.3
41	8-Oct - 14-Oct	2	37	36	2	2	39	38	19.5
42	15-Oct - 21-Oct	7	45	44	52	46	97	90	13.9
43	22-Oct - 28-Oct	5	14	13	31	24	45	37	9.0
44	29-Oct - 4-Nov	5	3	3	20	14	23	17	4.6
45	5-Nov - 11-Nov	5	0	0	11	6	11	6	2.2
46	12-Nov - 18-Nov	5	0	0	4	2	4	2	0.8
47	19-Nov - 25-Nov	1	0	0	0	0	0	0	0.0
Total	Total:	50	234	229	128	99	362	328	
Mean:	Mean:								7.2

a/ Trapping at Willow Creek weir took place September 8 - November 21, 2011 (Julian weeks 36-47).
b/ Coho <58cm FL were considered jacks in 2011.
c/ Right maxillary clipped coho. Number shown is a subset of weekly jack and adult coho totals.

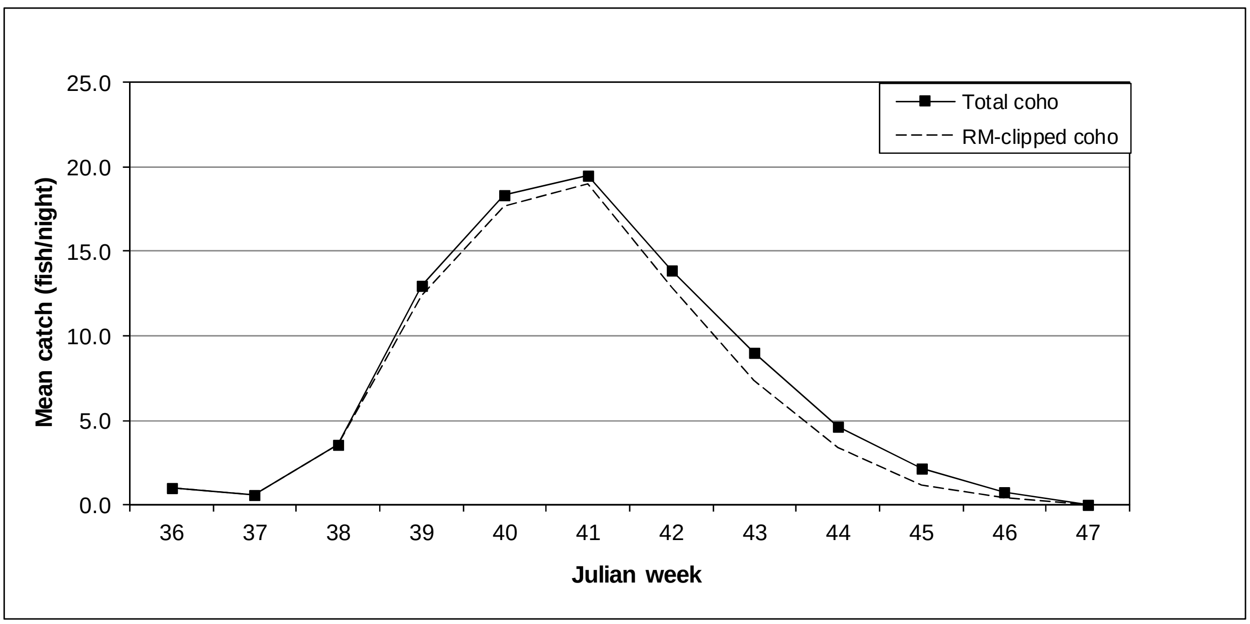


Figure 10. Mean catch of coho trapped in the Trinity River at Willow Creek weir, 2011.

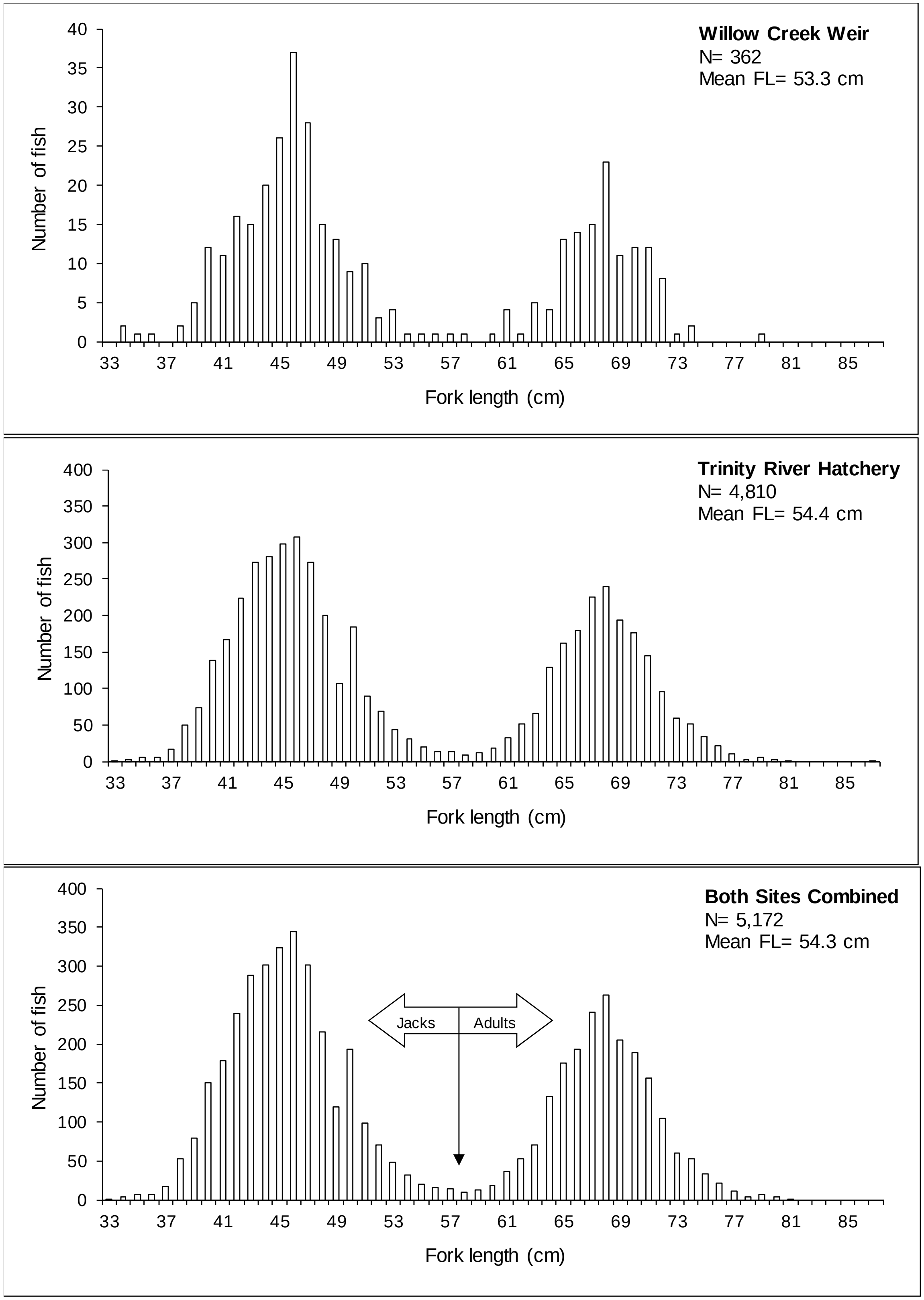


Figure 11. Coho salmon fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery and both sites combined during the 2011-12 season. The arrow denotes the size used to separate jacks and adults for analysis.

Effectively Tagged Fish

There were no coho trapped at JCW in 2011. Of the 362 coho trapped at WCW, 346 (223 jacks and 123 adults) were effectively tagged (Appendix 8). Due to poor condition (wounds or other stressors) 15 coho trapped at WCW were not tagged. There is no legal recreational coho fishery, though one coho was harvested and another was caught and released by an angler who misidentified it. To discourage anglers from targeting coho, all coho were tagged with non-reward tags.

Incidence of Fin Clips

Three hundred twenty eight (90.6%) of the coho trapped at WCW (229 jacks and 99 adults) bore right maxillary (RM) clips (Table 4). Of the 96 coho tagged at WCW and recovered at TRH, 94 had RM clips (Table 3).

Fall Steelhead

Run Timing

At JCW, 55 (48 adult and seven half-pounder) steelhead were trapped all season. Adipose clips were observed on 37 adults and four half-pounders. The highest catch per unit effort occurred in JW 39 when 7.2 fish per night were captured (Table 5, Figure 12). Of the 55 steelhead trapped, 45 were tagged at the weir. Two JCW tagged steelhead were later recovered at TRH. The results of this particular tagging are purely qualitative in nature and not included in run-size estimates.

We trapped 1,653 fall-run steelhead at WCW in 2011 (Table 6, Figure 13); 146 half-pounders (<42 cm FL) and 1,507 adults. The peak of the run was during JW 40 with an average of 150.3 adults trapped per night. The biggest week for half-pounders was JW 41, when 41 were trapped in two nights.

Size of Fish Trapped

Steelhead caught at JCW, WCW, and TRH averaged 54.4, 58.1 and 59.5 cm FL, respectively (Figure 14), with a mean combined FL for the three sites combined of 59.2 cm. Adult steelhead (> 41 cm FL) made up 87.3% and 91.2% of the steelhead trapped at JCW, and WCW, respectively.

Effectively Tagged Fish

Of the 1,507 adult steelhead trapped at WCW in 2011, 1,474 were tagged (only adult fish were tagged). We identified no tagging mortalities, and anglers reported removing tags from 165 caught and released fish, leaving 1,309 effectively tagged adult steelhead.

Table 5. Weekly summary of fall-run steelhead trapped in the Trinity River at the Junction City weir during 2011. [a]

Julian week	Inclusive dates	Nights trapped	Number trapped: 1/2 lbers [b]	Ad-clipped 1/2 lbers	Adults	Ad-clipped adults [c]	Total	Ad-clipped total	Fish / night
31	30-Jul - 5-Aug	4	0	0	7	5	7	5	1.8
32	6-Aug - 12-Aug	5	0	0	1	1	1	1	0.2
33	13-Aug - 19-Aug	5	0	0	0	0	0	0	0.0
34	20-Aug - 26-Aug	5	0	0	0	0	0	0	0.0
35	27-Aug - 2-Sep	0	0	0	0	0	0	0	0.0
36	3-Sep - 9-Sep	4	0	0	1	1	1	1	0.3
37	10-Sep - 16-Sep	5	1	1	3	1	4	2	0.8
38	17-Sep - 23-Sep	5	1	0	5	4	6	4	1.2
39	24-Sep - 30-Sep	5	5	3	31	25	36	28	7.2
	Total:	38	7	4	48	37	55	41	
	Mean:								1.4

a/ Trapping at Junction City weir took place August 2 - September 30, 2011 (Julian weeks 31 - 39).
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.

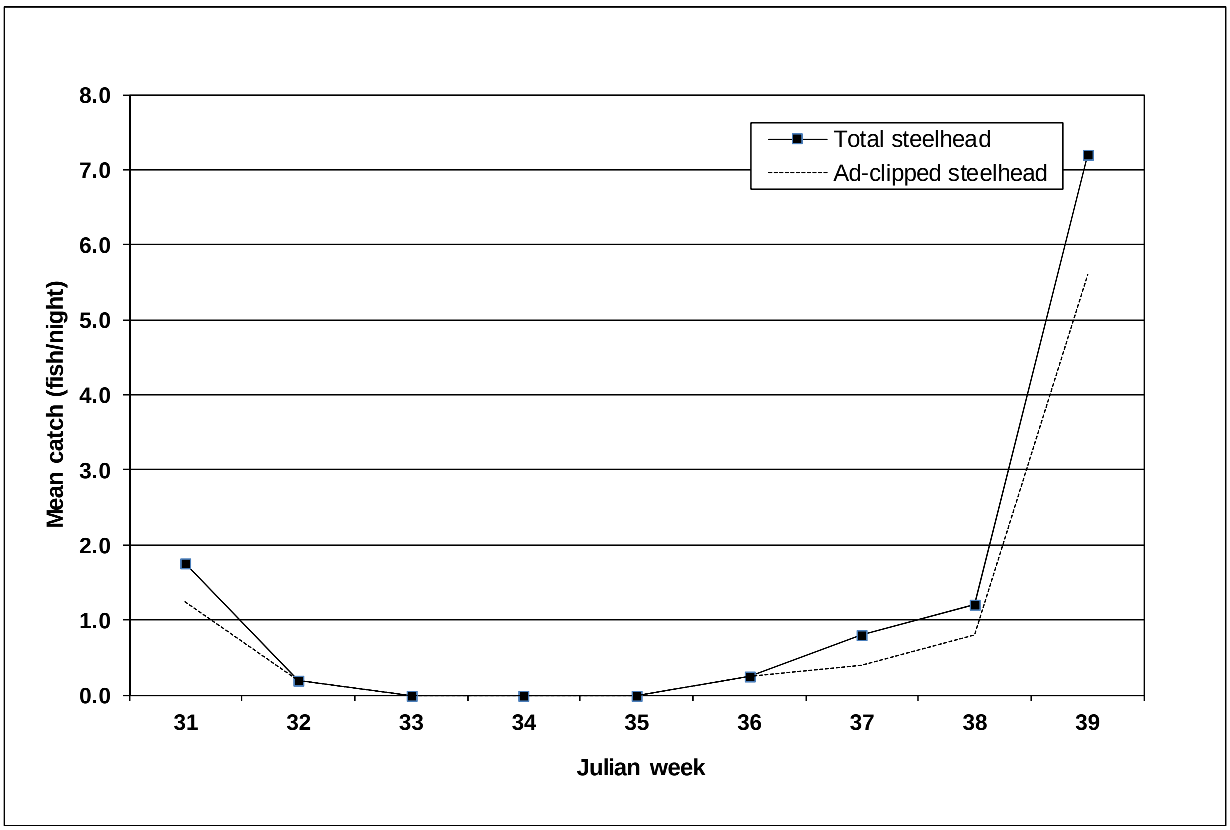


Figure 12. Mean catch of fall-run steelhead in the Trinity River at Junction City weir, 2011.

Table 6. Weekly summary of fall-run steelhead trapped in the Trinity River at Willow Creek weir during 2011. a

Julian week	Inclusive dates	Nights trapped	Number trapped 1/2 lbers	Ad-clipped 1/2 lbers c	Adults	Ad-clipped Adults	Total	Ad-clip total	Fish/ night
36	3-Sep - 9-Sep	2	8	6	94	60	102	66	51.0
37	10-Sep - 16-Sep	5	14	11	217	154	231	165	46.2
38	17-Sep - 23-Sep	5	10	9	135	90	145	99	29.0
39	24-Sep - 30-Sep	5	27	23	265	188	292	211	58.4
40	1-Oct - 7-Oct	3	28	18	451	294	479	312	159.7
41	8-Oct - 14-Oct	2	41	32	108	79	149	111	74.5
42	15-Oct - 21-Oct	7	14	10	104	79	118	89	16.9
43	22-Oct - 28-Oct	5	1	1	13	8	14	9	2.8
44	29-Oct - 4-Nov	5	2	2	25	18	27	20	5.4
45	5-Nov - 11-Nov	5	0	0	56	37	56	37	11.2
46	12-Nov - 18-Nov	5	1	1	38	22	39	23	7.8
47	19-Nov - 25-Nov	1	0	0	1	0	1	0	1.0
	Total:	50	146	113	1,507	1,029	1,653	1,142	
	Mean:								33.1

a/ Trapping at Willow Creek weir took place September 8 - November 21, 2011 (Julian weeks 36-47).
b/ Steelhead <42 cm FL were considered 1/2 lbers (half-pounders).
c/ Adipose fin-clipped steelhead. Number shown is a subset of weekly half-pounder and adult steelhead totals.

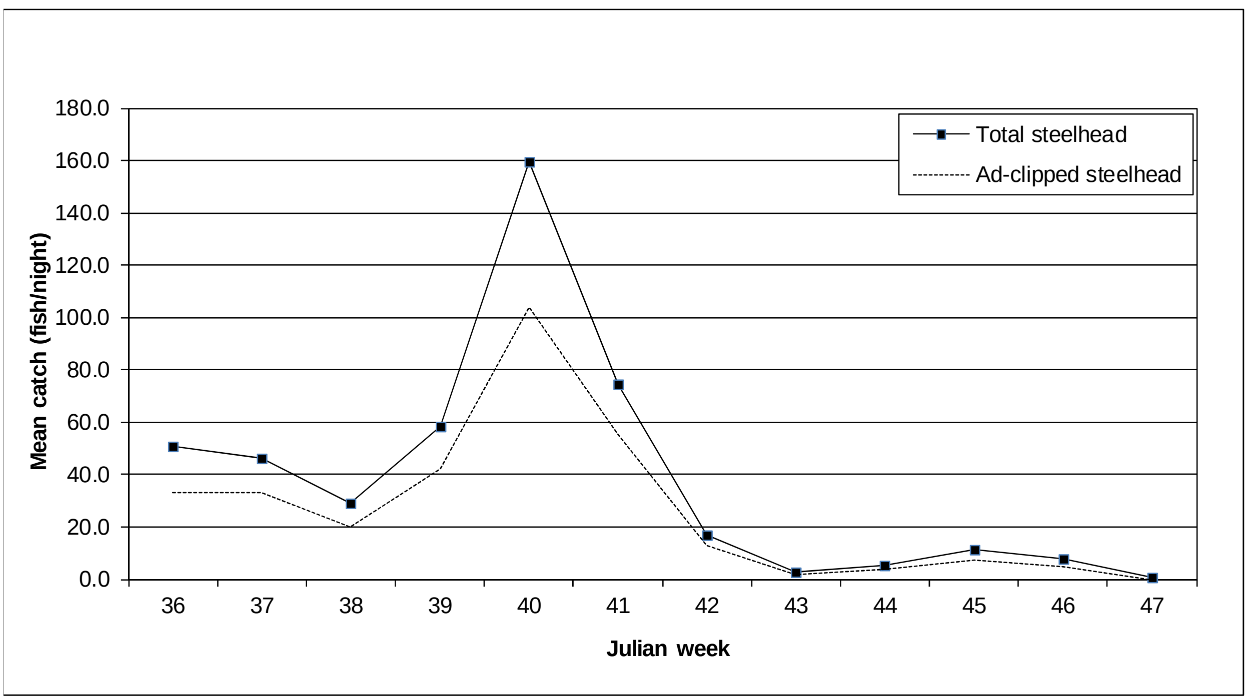


Figure 13. Mean catch of fall-run steelhead in the Trinity River at Willow Creek weir, 2011.

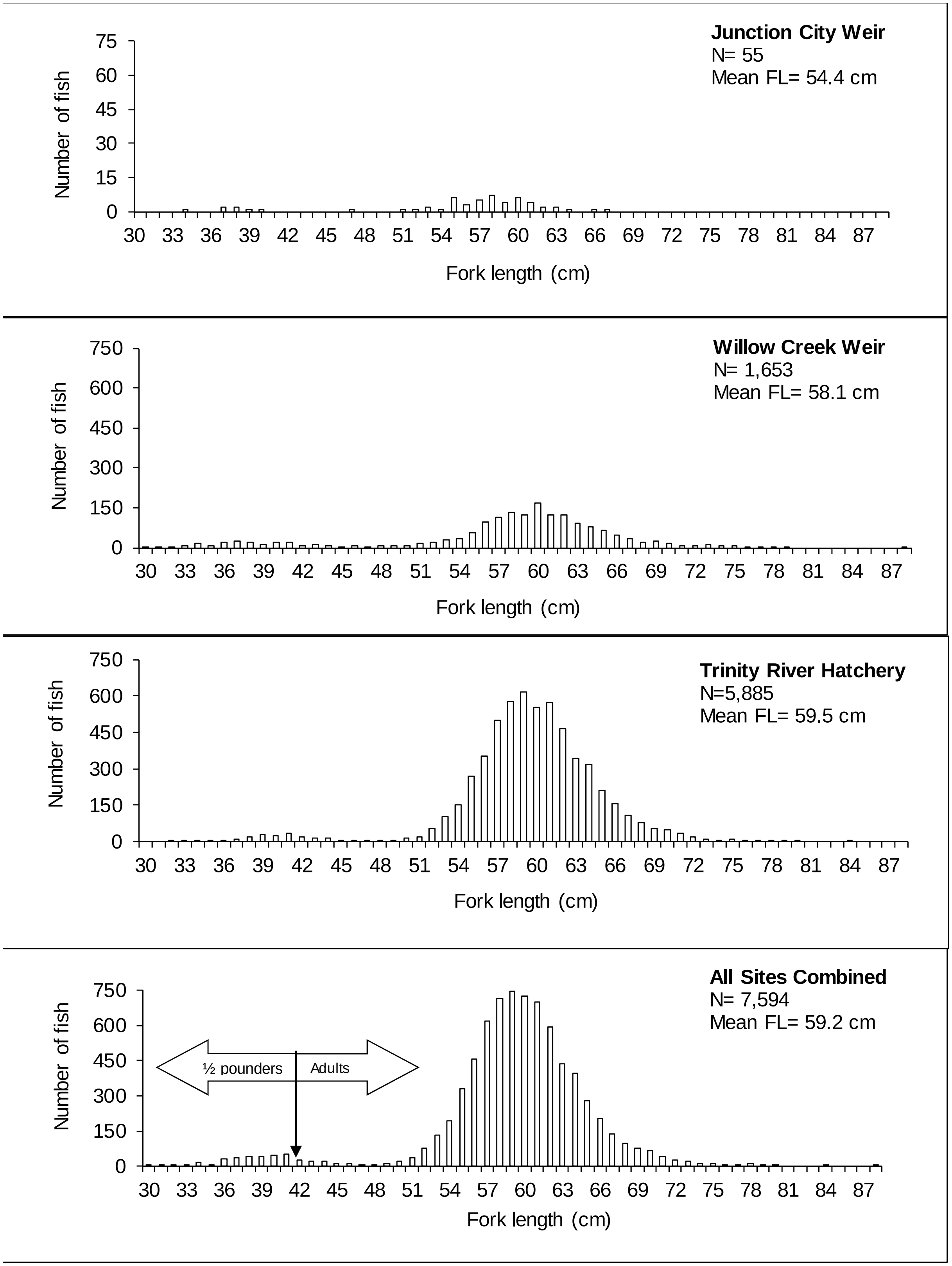


Figure 14. Steelhead fork lengths (cm) observed at Junction City weir, Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2011-12 season. The arrow denotes the size used to separate ½ pounders (sub-adults) and adults for analysis.

Incidence of Fin Clips

Ad-clips were found on four of the seven half-pounders and 37 of the 48 adult steelhead for an overall ad-clip rate of 74.5% for the 55 steelhead trapped at JCW. Of the 1,653 steelhead trapped at WCW, 113 (77.4%) of the 146 half pounders were ad-clipped, as were 1,030 (68.3%) of the 1,507 adults for an overall ad-clip rate of 69.1%. Adipose clips were found on 5,700 (99.1%) of the 5,750 adult steelhead and 5,834 (99.1%) of the 5,885 total steelhead trapped at TRH in 2011. All steelhead released from TRH have been ad-clipped prior to release since brood year 1997.

Brown Trout

Capture Timing

During the 2011 sampling season, 147 brown trout were captured during 38 nights of trapping at JCW (Table 7, Figure 15). The highest catch occurred during Julian week 32 with a mean fish/night rate of 11.4. There were four brown trout trapped at WCW during 2011.

Size of Trapped Fish

Brown trout captured this season ranged in size from 30 to 63 cm FL (Figure 16).

Table 7. Weekly summary of brown trout trapped in the Trinity River at Junction City weir during 2011.[a]

Julian week	Inclusive dates			Nights trapped	Number trapped	
					Total	Fish/night
31	30-Jul	-	5-Aug	4	33	8.3
32	6-Aug	-	12-Aug	5	57	11.4
33	13-Aug	-	19-Aug	5	25	5.0
34	20-Aug	-	26-Aug	5	17	3.4
35	27-Aug	-	2-Sep	0	0	0.0
36	3-Sep	-	9-Sep	4	2	0.5
37	10-Sep	-	16-Sep	5	3	0.6
38	17-Sep	-	23-Sep	5	5	1.0
39	24-Sep	-	30-Sep	5	5	1.0
			Total:	38	147	
			Mean:			3.9

a/ Trapping at Junction City weir took place August 2 - September 30, 2011 (Julian weeks 31 - 39).

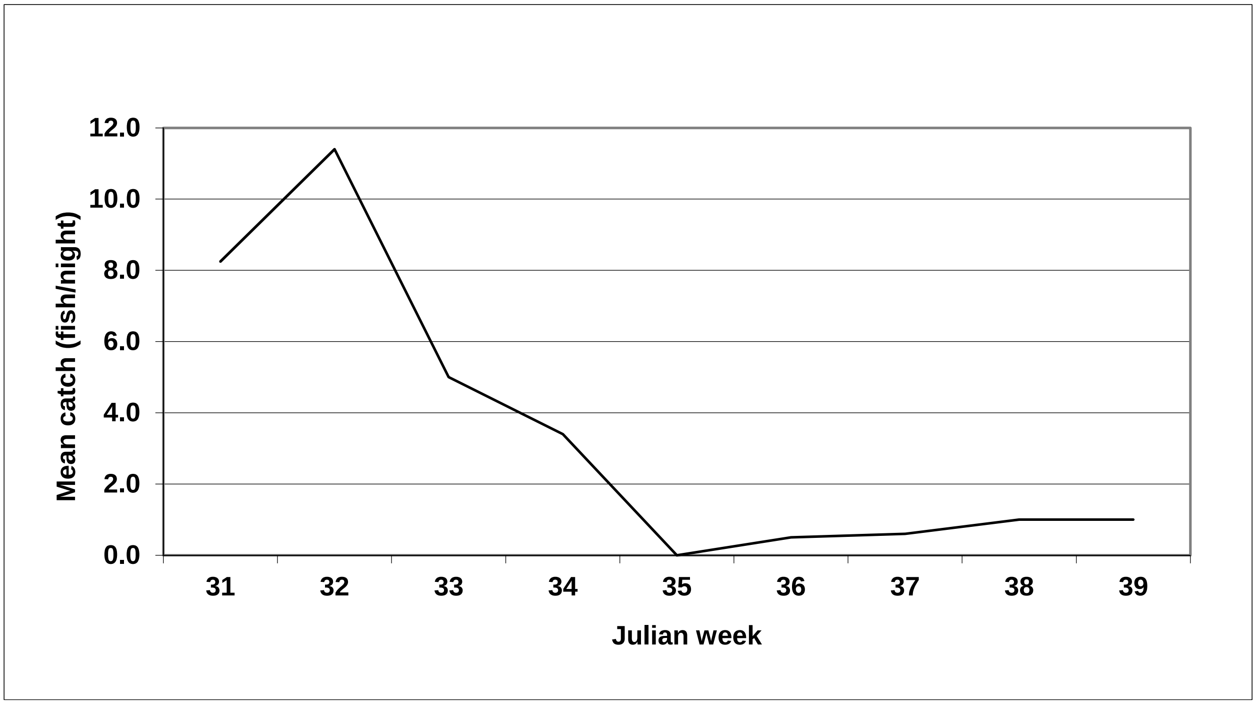


Figure 15. Mean catch of brown trout in the Trinity River at Junction City weir, 2011.

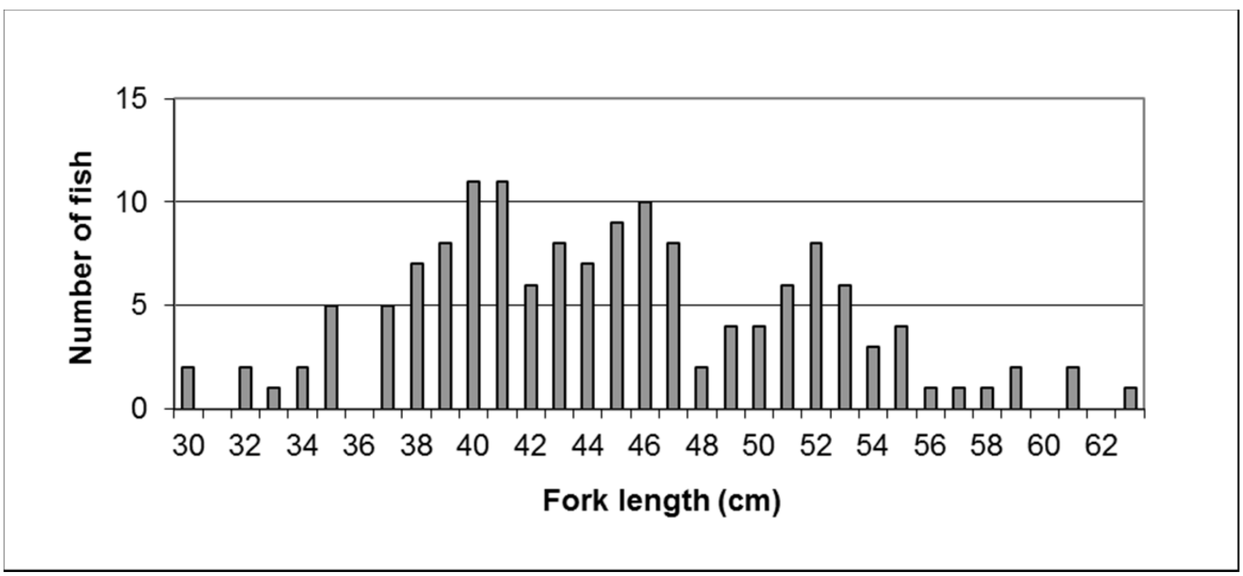


Figure 16. Fork length distribution of brown trout trapped in the Trinity River at Junction City weir during 2011.

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 6-9.

Of the 147 tagged spring Chinook at JCW 40.1% were recovered, whereas only 27.7% of the 1,727 fall Chinook tagged at JCW and WCW were recovered. Of the 362 coho tagged at WCW, 36.9% were recovered, as was 36.9% of the 1,516 adult fall steelhead tagged at JCW and WCW. Most of the recoveries, for all species, occurred at TRH.

Tag Returns by Anglers

Spring Chinook
Anglers returned one tag from a harvested jack spring Chinook tagged at JCW. Based on that single tag return, the estimated total harvest rate of Project-tagged spring Chinook upstream of JCW was 1.39% for jacks, 0% for adults. There were no tags reported from the catch and release fishery (Appendix 6).

Fall Chinook
Anglers returned 33 tags from harvested fall Chinook tagged at JCW and WCW (Appendix 7). Based on the 31 tags returned by anglers from fall Chinook tagged at WCW only, the estimated harvest rate of Project-tagged fall Chinook upstream of WCW was 2.58% for jacks and 1.87% for adults. Anglers also reported the catch and release of eight jacks and six adult tagged fall Chinook from WCW.

Coho Salmon
To discourage the harvest of threatened coho salmon, all coho salmon tagged at WCW received non-reward tags. One tag was returned from a harvested jack coho salmon tagged at WCW, and one tag from a caught and released jack coho (Appendix 8).

Fall Steelhead
Anglers returned 211 tags from adult steelhead tagged at WCW. Of those, 165 tags were from steelhead reported as caught/released, 41 from harvested fish, and five were tags found loose (not attached to a steelhead when found). Based on tag returns from WCW tagged fish only, an estimated 11.2% of the steelhead migrating upstream of WCW were caught and released, and an estimated 4.3% (6.2% of ad-clipped, 0.5% non-ad-clipped) of the (reward-tagged) steelhead were harvested.

Brown Trout
All brown trout tagged at JCW received non-reward tags during 2011. Anglers returned four tags from caught and released tagged brown trout, two from harvested fish and one

tag that was found loose (no fish attached). Three tags were recovered in the upper main stem spawner surveys.

Spawner Surveys

Main stem Trinity spawner surveys were conducted by Project personnel in cooperation with YTFP, HVTF, USFS and the USFWS from September 07, 2011 to December 20, 2011 from TRH to Weitchpec. During the spawner surveys seven spring (Appendix 6) and four fall Chinook tagged at JCW, and 85 fall Chinook (Appendix 7) and eight coho (Appendix 8) tagged at WCW were recovered. There were no Project-tagged steelhead (Appendix 9), and three Project-tagged brown trout recovered in the spawner survey in 2011. For additional information on the 2011 spawner survey refer to Task 4 of this report.

Trinity River Hatchery

Operation Dates

The fish ladder at TRH was opened to fish September 02; while recovery and fish spawning operations occurred from September 06, 2011 (JW 36) through March 13, 2012 (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. 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 when the ladder opened (during JW 36) and continued through JW 46. Recovery of spring Chinook peaked in JW 39 when 2,074 Chinook entered, 417 of which were CWTed (Table 8). Fifty two CWTed spring fish were recovered at TRH after JW 41. Based on run-timing (ascertained by CWT analysis), an estimated 6,581 (2,758 jack and 3,823 adult) spring Chinook were recovered at TRH, from which 1,494 readable CWTs were recovered. Using CWT expansion, an estimated 6,185 (hatchery-origin) spring Chinook entered TRH. Of the 145 spring Chinook tagged at JCW, 49 (33.8%) were recovered at TRH (Table 10).

Fall Chinook

In-season CWT analysis (coincident to the scheduled TRH spawning break) revealed Julian week 42 as the separation week between the majority of the spring and fall Chinook runs in 2011. One CWTed fall Chinook entered TRH in JW 36 (Table 9), no others arrived until JW 40. The fall run peaked during JW 45 when an estimated 5,178 Chinook entered the facility, from which 1,020 readable CWTs were recovered. An estimated 15,722 fall Chinook (1,840 jack and 13,881 adult) were recovered at TRH. Using CWT expansion, an estimated 13,889 (hatchery-origin) fall Chinook entered TRH. Of the 1,613 fall Chinook tagged at WCW, 313 (19.5%) were recovered at TRH (Table 10).

Table 8. Recoveries at Trinity River Hatchery (TRH) of TRH-origin spring Chinook by coded-wire tag group during the 2011-12 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	
065347-f	2006			1									1
065348-f	2006				1	1							2
065349-f	2006					1							1
065360-y	2006	9	6	9	3	1							28
068801-f	2007	3	5	10	3	1							22
068802-f	2007	6	7	10	8	2	2		1				36
068803-f	2007	2	1	8	14	3							28
068810-y	2007	38	44	86	60	41	11		3	1		1	285
068811-f	2008	15	11	33	30	6	1						96
068812-f	2008	8	9	18	46	69	39		14				203
068813-f	2008	11	3	26	34	34	14		5				127
068819-y	2008	4	2	15	12	16	6						55
068821-f	2009	6	29	68	88	42	7		2				242
068822-f	2009	3	5	16	67	90	65		23	1			270
068831-f	2009			4	10	18	4		1				37
068832-f	2009		2	7	17	6	8						40
068836-y	2009		1		10	10							21
No CWT [e]		3	3	7	14	12	13						52
	Weekly totals:	108	128	318	417	353	170	--	49	2	0	1	
													1,546

a/ The fish ladder was open September 6, 2011 through March 13, 2012 (JWs 36-11; closed parts or all of JWs 41-43).
b/ Entry week was the week that fish were initally 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.
e/ No CWTs 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 2011-12 season.

CWT number and release type [c]	Brood year	Number of fall Chinook entering TRH, by Julian week [ab]														
		36	40	41	42 [d]	43	44	45	46	47	48	49	50	51	52	Totals
065350-f	2006						2									2
065351-f	2006			1												1
065361-y	2006					3	4	5	3	0	2					17
068804-f	2007					2	3	4	1	1						11
068805-f	2007					2	4	2	1							9
068806-f	2007			1		4	4	5								14
068807-f	2007						1	6	5	0	0	1				13
068808-f	2007					2	3	5	2							12
068809-y	2007					24	53	79	60	31	34	5	5	2		293
065356-f	2008						2	3	10	5	5	1				26
065357-f	2008					2	2	8	4	1	3					20
065358-f	2008						1	8	5	4	3	4	1			26
065359-y	2008						4	7	10	9	4					34
068814-f	2008		1	0		56	56	112	34	14	2	5	2			282
068815-f	2008			3		50	58	93	53	13	8	2				280
068816-f	2008					13	28	54	58	33	26	5	1			218
068817-f	2008					11	9	46	52	18	33	6	2			177
068818-f	2008	1					8	28	37	23	33	10	11	1	1	153
068820-y	2008			10		194	275	412	273	108	77	21	5	1		1,376
608080000-f	2008		1	0		3	6	6	3	0	2					21
608080001-f	2008						2	1								3
68823-f	2009					24	31	38	15	5	2					115
68824-f	2009					8	21	26	26	5	2					88
68825-f	2009							13	6	4	2	1	1			27
68826-f	2009							3	6	1	1	1				12
68827-f	2009							2	2	1	2	0	1			8
68828-f	2009					2	4	7	4	0	1					18
68833-f	2009								1							1
68834-f	2009							1								1
68837-y	2009		1	0		23	20	46	36	7	5	1				139
No CWT [e]						10	23	24	19	6	4	1				87
Weekly totals:		1	3	15	0	433	624	1,044	726	289	251	64	29	4	1	3,484

a/ The fish ladder was open September 6, 2011 through March 13, 2012 (JWs 36-11; closed parts or all of JWs 41-43).

b/ Entry week was the week that fish were initally 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.

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 (by spawn day) and numbers of Willow Creek weir (WCW) and Junction City weir (JCW) tagged Chinook and coho that entered Trinity River Hatchery (TRH) during the 2011-12 season.[a]

		Chinook					Coho		
		Total entering	Spring run tagging site		Fall run tagging site		Total entering	Tagging site	
Julian week [b]	Inclusive dates	TRH	JCW	WCW	JCW	WCW	TRH	JCW	WCW
36	3-Sep - 9-Sep	504	1						
37	10-Sep - 16-Sep	550							
38	17-Sep - 23-Sep	1363	2						
39	24-Sep - 30-Sep	1687	23		1				
40	1-Oct - 7-Oct	1694	17		2	1	1		
41	8-Oct - 14-Oct	804	4		3		9		
42	15-Oct - 21-Oct						0		
43	22-Oct - 28-Oct	2231	2		10	61	389		8
44	29-Oct - 4-Nov	2642			4	64	728		9
45	5-Nov - 11-Nov	4618			1	97	687		11
46	12-Nov - 18-Nov	3320				54	726		25
47	19-Nov - 25-Nov	1307			1	18	924		27
48	26-Nov - 2-Dec	1119				12	824		19
49	3-Dec - 9-Dec	337				4	285		6
50	10-Dec - 16-Dec	104				2	130		2
51	17-Dec - 23-Dec	22					86		3
52	24-Dec - 31-Dec	1					9		
1	1-Jan - 7-Jan						12		
2	8-Jan - 14-Jan								
3	15-Jan - 21-Jan								
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:	22,303	49	0	22	313	4,810	0	110

a/ The fish ladder was open September 6, 2011 through March 13, 2012 (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.

Coho Salmon

The first coho entered TRH during JW 40 of 2011. The coho run peaked during JW 44 and the last coho entered TRH during JW 1 of 2012 (Table 10). A total of 4,810 coho (2,886 jacks and 1,924 adults) were recovered at TRH during the season. One hundred ten of the 362 coho trapped at WCW were recovered at TRH (31.8 % of the effectively tagged fish).

Of the 4,810 coho entering TRH, 4,575 (95.1%) were observed to have right maxillary (RM) clips, indicating they were of TRH origin, while 235 (4.9%) had no clips. These 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 (Table 11).

Based on length frequency analysis, TRH-produced, RM-clipped coho salmon were apportioned into two brood years. Coho less than 58 cm FL were considered jacks (age 2, from the 2009 brood year) while those greater than 57 cm FL were considered adults (age 3, from the 2008 brood year). The 235 coho without clips which entered the hatchery were also considered jacks or adults based on their length.

Fall Steelhead

Adult steelhead were recovered every week that the fish ladder and trap at TRH were open, though they did not arrive in sizeable numbers until the last week of October (JW 43) (Table 12). A total of 5,750 steelhead >41 cm, FL entered TRH during the season. Of the 1,310 adult fall steelhead tagged at WCW, 343 were recovered at TRH. Two adult steelhead tagged at JCW also were recovered at TRH.

Ad-clipped adults composed 68.3% of the steelhead trapped at WCW (1,030 of the 1,507) and 99.1% (5,700/5,750) 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 19,219 (11,132 adult and 8,087 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 14,750 – 25,799 (Table 12). Spawning escapement above JCW was an estimated 19,107, including the 6,581 spring Chinook that entered TRH and 12,526 natural area spawners (Table 13). This year’s run-size estimate is approximately 10 percent above the 32 year average spring Chinook run-size of 17,409. Estimated spring Chinook run-size has ranged from 2,381 fish in 1991 to 62,692 fish in 1988 (Appendix 10). We estimate anglers harvested 112 jacks, but did not harvest any adult spring Chinook during the 2011 season.

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 2011-12 season.[b]

Julian Week of Entry [c]	Inclusive Dates			Number Entering TRH	Recoveries from WCW	Recoveries from JCW
36	3-Sep		9-Sep	1		
37	10-Sep		16-Sep	1		
38	17-Sep	-	23-Sep	1		
39	24-Sep	-	30-Sep	4		
40	1-Oct	-	7-Oct	13		
41	8-Oct	-	14-Oct	10		
42	15-Oct	-	21-Oct	--		
43	22-Oct	-	28-Oct	242	6	
44	29-Oct	-	4-Nov	56	2	
45	5-Nov	-	11-Nov	26	4	
46	12-Nov	-	18-Nov	47		
47	19-Nov	-	25-Nov	89	5	
48	26-Nov	-	2-Dec	455	32	
49	3-Dec	-	9-Dec	191	15	
50	10-Dec	-	16-Dec	145	8	
51	17-Dec	-	23-Dec	222	16	
52	24-Dec	-	31-Dec	63	5	
1	1-Jan	-	7-Jan	336	17	
2	8-Jan	-	14-Jan	668	31	
3	15-Jan	-	21-Jan	399	15	1
4	22-Jan	-	28-Jan	328	18	
5	29-Jan	-	4-Feb	672	46	
6	5-Feb	-	11-Feb	752	49	
7	12-Feb	-	18-Feb	510	35	1
8	19-Feb	-	25-Feb	161	4	
9	26-Feb	-	4-Mar	142	10	
10	5-Mar	-	11-Mar	123	14	
11	12-Mar	-	18-Mar	93	11	
			Totals:	5,750	343	2

a/ Steelhead <42 cm FL are considered sub-adults and were not counted at TRH.
b/ The fish ladder was open September 6, 2011 - March 13, 2012 (Julian weeks 36 -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.

Fall Chinook Salmon
An estimated run-size of 80,819 (45,542 adults and 35,277 jacks) 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 72,545 – 90,534 (Table 12). Trinity River fall Chinook spawner escapement, upstream of WCW, was estimated at 70,059 (34,367 jacks, 44,692 adult) fish, including 15,722 fall Chinook that entered TRH and 63,337 natural area spawners (Table 13). Harvest rates generated from tags applied at WCW were used to estimate 910 jacks and 851 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 11). This year's fall Chinook estimated run-size of 80,819 is approximately 87.5% above the 43,101 mean run-size for the years since 1977.

Coho Salmon
An estimated 15,040 (5,318 adults and 9,722 jacks) coho migrated into the Trinity River basin upstream of the WCW in 2011. Based on the Poisson Approximation, the 95% confidence interval for the coho run-size estimate upstream of WCW was 12,562 – 18,249 fish (Table 12). Of the estimated 15,040 fish, 4,810 are estimated to have entered TRH (Table 13), and 10,186 were natural area spawners. One tag was returned from a harvested coho; therefore harvest rates generated from tags applied at WCW were estimated to be 0.4% for jacks and zero 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 15,040 is ranked 16th of the 35 years on record, and is 88.6% of the 16,983 average.

Adult Fall Steelhead
An estimated 21,901 adult fall steelhead migrated upstream of WCW this season. The 95% confidence interval for the estimate, based on the Normal Approximation, was 19,715 – 24,204 adult steelhead (Table 12). The adult steelhead spawning escapement was estimated at 20,944, of which 5,750 entered TRH, leaving 15,194 as natural area spawners. An estimated 32 naturally-produced and 925 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 14,963 fish. This year's run was 146.4% of 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 2011-12 season

Species/ race	Area of Trinity River basin for run-size estimate	Stratum [a]	Number effectively tagged [b]	Trinity River Hatchery recoveries: Number examined for tags [c]	Trinity River Hatchery recoveries: Number of tags in sample	Run-size estimate [d]	Confidence limits 1-p= 0.95	Confidence limit estimator
Spring Chinook	Upstream of Junction City weir	Jacks	72	2,758	25	8,087		
		Adults	73	3,823	24	11,132		Poisson
		Total	145	6,581	49	19,219	14,750 - 25,799	Approximation
Fall Chinook	Upstream of Willow Creek weir	Jacks	704	1,840	41	35,277		
		Adults	909	13,882	272	45,542		Poisson
		Total	1,613	15,722	313	80,819	72,545 - 90,534	Approximation
Coho	Upstream of Willow Creek weir	Jacks	223	2,886	85	9,722		
		Adults	123	1,924	25	5,318		Poisson
		Total	346	4,810	110	15,040	12,562 - 18,249	Approximation
Fall-run steelhead	Upstream of Willow Creek weir	Adults	1,309	5,750	343	21,901	19,715 - 24,204	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.

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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 2011-12 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum [a]	Run-size estimate	Angler Harvest: Harvest rate [b]	Angler Harvest: Number of fish [c]	Spawner Escapement: Natural area spawners [d]	Spawner Escapement: Trinity River Hatchery	Spawner Escapement: Total
Spring Chinook	Upstream of Junction City weir	Jacks	8,087	1.4%	112	5,217	2,758	7,975
		Adults	11,132	0.0%	0	7,309	3,823	11,132
		Total	19,219		112	12,526	6,581	19,107
Fall Chinook	Upstream of Willow Creek weir	Jacks	35,277	2.6%	910	32,527	1,840	34,367
		Adults	45,542	1.9%	850	30,810	13,882	44,692
		Total	80,819		1,760	63,337	15,722	79,059
Coho	Upstream of Willow Creek weir	Jacks	9,722	0.4%	44	6,792	2,886	9,678
		Adults	5,318	0.0%	0	3,394	1,924	5,318
		Total	15,040		44	10,186	4,810	14,996
Fall-run adult steelhead	Upstream of Willow Creek weir	Natural	6,932	0.5%	32	6,850	50	6,900
		Hatchery	14,969	6.2%	925	8,344	5,700	14,044
		Total	21,901		957	15,194	5,750	20,944

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.

DISCUSSION

Before the 2000 Record of Decision (ROD), spring flow releases from Lewiston Dam were much lower than the currently-mandated flows. Historically JWC 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 2011 the water year designation of “Wet” (flow and schedule) adopted by the Bureau of Reclamation, after input from the Trinity Management Council, had the river at a level precluding installation of JCW until the beginning of August, allowing us to sample only a fraction of the spring Chinook. In 2011 there was also a late-August Hoopa Tribe Ceremonial Boat Dance (an odd-numbered year event only) with a 2,650 cfs infusion of water which required a complete removal of JCW, forcing us to lose an additional week of trapping (Appendices 14 and 15). The JCW sampling amounted to only 38 days across the season, which once again impacted our ability to get a robust sample of spring Chinook. We have since identified a new site for the Junction City weir that will allow for a longer sampling window and more robust data upon which to estimate that population.

The large flow increase for the Boat Dance also affected the installation timing of the WCW; which we put off until September 7. Because the primary goal at WCW is trapping fall Chinook, coho and fall steelhead, and they rarely occur in large numbers before mid-September, putting off installation was not particularly deleterious to our overall efforts.

We had some rain events the first half of October that kept WCW from a standard five nights a week schedule, but we did some over-the-weekend trapping to partially mitigate for those missed nights.

We pulled the JCW for the season on schedule at the end of September, and pulled WCW before a high flow event pre-Thanksgiving, when the majority of the target species had passed upstream.

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 the combined proportion of jacks/adults caught at JCW and TRH to the total estimate of spring Chinook and the WCW only proportion for the fall Chinook to come up with the proportion of jacks/adults in the run. For coho the division between jacks and adult was made purely by length frequency. The steelhead estimates above WCW are for adults only.

The escapement estimates are generated by subtracting from the run size estimates the harvest estimates, which are based on Project tags returned by anglers. In 2011 we received 31 returned tags from 1,627 fall Chinook tags, which, while better than the nine of 1,265 tags we got in 2010 is still not optimal. In 2012 we will be increasing the reward incentive in hopes to have better angler compliance with the tag return program.

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 attempted to address 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. Perhaps due to the late installation (and resulting cooler water temperatures) or perhaps because of the veteran (well-seasoned) crew, we identified only two total tagging mortalities (0.04%) out of more than 4,150 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. 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 equivilents

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 dayJulian week only during leap years
**Eight day Julian week every year

Appendix 2. Fork length distribution of coded-wire tagged, Trinity River Hatchery-produced spring Chinook recovered at Trinity River Hatchery during the 2011-12 season. [a]

FL	Brood Years 2006				2007				2008				2009					
(cm)	065347-f	065348-f	065349-f	065360-y	068801-f	068802-f	068803-f	068810-y	068811-f	068812-f	068813-f	068819-y	068821-f	068822-f	068831-f	068832-f	068836-y	Total
35																	1	1
36														1				1
37																		0
38																	1	1
39																	1	1
40															1		4	5
41													1	1			3	5
42													3	1	1		2	7
43													2	3	1		4	10
44													4	3	1			8
45													9	5	2		2	18
46													15	6	1	2	1	25
47								1					14	14	4	2		35
48										1			31	20	3			55
49													11	30	2	3	1	47
50										1			32	48	5	10		96
51									1				24	34	1	5		65
52										1		1	28	28	4	1		63
53					1						1		18	21	2	6		49
54										1			22	21	1	4		49
55						1		1		1		1	10	6	2	1		23
56									1	2		2	6	9	1	1		22
57									1	1	4		5	10	4	1		26
58									1	1	2	2	1	3		1		11
59									4	1	2	4		2				13
60							1		4	3	5	8	1				1	23
61								1	6	12	1	4						24
62									2	7	8	6	1					24
63								1	4	8	10	4			1			28
64								1	8	9	7	6	1					32
65									6	10	10	5						31
66								2	11	14	10	2		1				40
67								2	11	14	10	1						38
68						1	1	2	9	18	10	4	1					46
69								4	5	16	5							30
70					1		1	9	4	14	7	2						38
71					1	1		6	3	6	6							23
72					1		2	6	5	14	3					1		32
73					1	2		7	2	7	6	1						26
74							1	9	3	11	4	1	1			1		31
75					3	2		9	2	4	3							23
76					2			17		4	5	1						29
77				1		4	2	16		1	1					1		26
78					1	1	1	17	2	5	1							28
79				2	2	2	2	14	1	4	2			1				30
80	1				1	3	2	22		5	3							37
81				1	2	3	1	7		2								16
82				2			4	14										20
83			1		2	3	2	12		1								21
84				2	1	4	1	19										27
85				3	1		1	16										21
86				2		1	1	13		2	1							20
87		1			1		1	5		1				1				10
88								13		1				1				15
89								7										7
90				2	1	2	1	9										15
91				1		2		4										7
92				1		1		7										9
93				2				2										4
94				1		1	1	5										8
95				1		1	1	2					1					6
96				2			1	1										4
97				1				1										2
98		1		4		1												6
99																		0
100																		0
101																		0
102								1										1
Totals:	1	2	1	28	22	36	28	285	96	203	127	55	242	270	37	40	21	1,494
Mean	80.0	92.5	83.0	89.1	77.5	81.4	80.6	80.6	66.3	68.6	67.4	62.9	50.8	51.2	50.3	53.1	42.7	

a/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43).

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

Appendix 3. Fork length distribution of coded-wire tagged, Trinity River-produced, fall Chinook recovered at Trinity River Hatchery during the 2011-12 season. [a]

	Brood Year								
	2006			2007					
FL (cm)	065350-f	065351-f	065361-y	068804-f	068805-f	068806-f	068807-f	068808-f	068809-y
38									
39									
40									
41									
42									
43									
44									
45				1					
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									1
58									
59									
60									1
61									
62									
63									
64									
65									1
66						1			1
67									1
68						1		1	4
69					1				3
70						1			3
71							1		2
72				1	1		1		3
73						1			2
74							1		5
75								1	8
76				1			1		11
77								1	9
78					1		1	1	13
79				1	1			2	13
80			1		1		1		23
81			1			2		1	16
82				2	2		2	1	18
83				2	1		2		23
84			2			1		2	15
85					1		1	1	20
86				2		2	1		12
87		1	1	1		2			16
88	1		1				1		9
89						2		1	10
90			3						12
91			1			1			3
92	1		2						5
93			1						10
94									7
95									5
96									3
97									
98			2						
99									2
100									2
101									
102			2						
Totals:	2	1	17	11	9	14	13	12	292
Mean	90.0	87.0	90.7	78.3	78.9	81.3	80.0	80.1	82.9

a/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43)
b/ Age at release: f = fingerlings, y = yearlings.

Appendix 3 (continued). Fork length distribution of coded-wire tagged, Trinity River-produced, fall Chinook recovered at TRH during the 2011-12 season.

	Brood Year											
	2008											
FL (cm)	065356-f	065357-f	065358-f	065359-y	068814-f	068815-f	068816-f	068817-f	068818-f	068820-y	0608080000-f	0608080001-f
38												
39												
40												
41												
42												
43												
44												
45												
46										1		
47										1		
48												
49										2		
50												
51												
52										2		
53												
54								1		5		
55										4		
56					1					6		
57										7		
58				1		1	1			15		
59				2		3		1		16		
60						2				32		
61				1	1	5	4	3	4	43		
62				1	3	2	4		2	65		
63	2			3	4	4	3	2	4	95	1	
64		2	1	3	4	12	9	11	6	101		
65	1		3	3	17	7	8	10	6	136	2	
66	1	3	2	2	18	10	7	9	8	111	2	
67	4	2	1	4	14	16	16	11	8	108		
68	1	1	4	1	16	23	15	15	14	123	3	
69		2	1	3	22	28	20	19	9	100	5	1
70	1	1	4	1	25	30	22	9	12	72	1	
71	2	1	3	3	28	16	10	12	12	54	1	1
72	1	1		1	21	18	15	7	11	64	1	
73	2	1	1	1	17	15	12	15	8	39		1
74	1	1	1	1	14	13	18	6	8	47		
75	2			1	10	19	10	5	7	26		
76	2		2		13	12	10	8	9	27	1	
77	1				12	9	7	2	4	24		
78	2	3		1	5	7	8	3	2	10		
79	1		1		4	3	5	7	4	16		
80			1		5	4	5	7	4	11	1	
81		1			5	5	1	2	2	3	1	
82		1		1	9	4	3	3	2	1		
83	1				4	2		3	2	3		
84			1		7	3	1	2		2	1	
85					2	2	1	3	3	1	1	
86	1				1	2	1	1		2		
87						1	2			1		
88									1			
89						2			1			
90												
91												
92												
93												
94												
95												
96												
97												
98												
99												
100												
101												
102												
Totals:	26	20	26	34	282	280	218	177	153	1,376	21	3
Mean	72.3	71.2	70.5	67.3	71.9	71.3	71.2	71.3	71.4	67.4	71.1	71.0

a/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43).
b/ Age at release: f = fingerlings, y = yearlings.

Appendix 3 (continued). Fork length distribution of coded-wire tagged, Trinity River-produced, fall Chinook recovered at TRH during the 2011-12 season.

	Brood Year									
	2009									
FL (cm)	068823-f	068824-f	068825-f	068826-f	068827-f	068828-f	068833-f	068834-f	068837-y	TOTALS
38									1	1
39			1							1
40										0
41										0
42		1							1	2
43			1			1			2	4
44		1			1				2	4
45	1	2	1						11	16
46		1			1				11	14
47			2						15	18
48	3	3				1			11	18
49	4	1	1	1					13	22
50	6	1		3	2	4			25	41
51	4	1	2	3	1	2			16	29
52	7	9	5	1	1			1	5	31
53	18	13	2			1			11	45
54	13	8	4		1	1			5	38
55	7	9	3	2		1	1		8	35
56	10	11	2			2			1	33
57	8	7	3	1	1	2				30
58	7	5				1				31
59	6	4								32
60	5	3				1				44
61	4	3								68
62	4	2								83
63	2	2		1						123
64	2									151
65										194
66										175
67	3									188
68		1							1	224
69										214
70	1									183
71										146
72										146
73						1				116
74										116
75										89
76										97
77										69
78										57
79										58
80										64
81										40
82										49
83										43
84										37
85										36
86										25
87										25
88										13
89										16
90										15
91										5
92										8
93										11
94										7
95										5
96										3
97										0
98										2
99										2
100										2
101										0
102										2
Totals:	115	88	27	12	8	18	1	1	139	3,396
Mean	55.5	54.8	51.9	52.8	50.5	54.0	55.0	52.0	49.4	

a/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 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 during the 2011-12 season. [a]

	JCW		
FL (cm)	Total Trapped	Ad-clips[b]	Effective Tags[c]
35	2		2
36			
37			
38	1		1
39			
40			
41			
42	1		1
43	1		1
44	1		1
45			
46	4		4
47	3		3
48	5		5
49	8	2	8
50	15	1	14
51	9	3	9
52	6	1	6
53	7	2	7
54	4	1	4
55	1		1
56	5		5
57			
58			
59			
60	2		2
61	1	1	1
62	1		1
63			
64	3		3
65	2	1	2
66	2		2
67	4		3
68	3	1	3
69	6	1	6
70	4	2	4
71	2		2
72	5	1	5
73	2	2	2
74	2		2
75	4		4
76	2		2
77	2		2
78	3		3
79	1		1
80	2		2
81	5		5
82			
83	3		3
84	3		3
85	3		3
86			
87	2		2
88	1		1
89	2		2
90	1		1
91	1		1
Totals:	147	19	145
Mean FL:	62.3	59.7	62.3
Total jacks:[d]	73	10	72
Total adults:	74	9	73

a/ Trapping at JCW took place August 2 - September 30, 2011 (Julian weeks 31 - 39). All Chinook trapped before Julian week 37 at JCW were considered spring Chinook. There were no spring Chinook trapped at Willow Creek weir in 2011.

b/ Ad-clip = Adipose fin clipped fish.

c/ Number of effectively tagged fish excludes fish not tagged, tagging mortalities, and fish that had their tags removed (caught/released).

d/ Spring Chinook less than 60cm FL were considered jacks.

Appendix 5. Fork length (FL) distribution of fall Chinook trapped and tagged at Junction City (JCW) weir and Willow Creek weir (WCW) during the 2011-12 season. [a]

	JCW			WCW		
FL (cm)	Total Trapped	Ad-clips[b]	Effective Tags[c]	Total Trapped	Ad-clips[b]	Effective Tags[c]
30	1					
31						
32						
33						
34						
35						
36						
37						
38				1		
39				2		2
40				4		4
41				3		3
42	1			5		5
43				6	1	6
44	2		2	5		5
45	1		1	16		16
46	1		1	21		20
47	2		2	28		27
48	3		3	47	1	45
49	4		4	55	1	52
50	6		6	67	2	65
51	2	1	2	64	3	59
52	2		2	84	3	81
53	4		4	91	4	87
54	2		2	84	5	83
55	3		3	58	1	56
56	4		4	54	3	52
57	2		2	37	1	36
58	2	1	2	32	1	30
59	2	1	2	33	2	31
60	1		1	23		22
61				27	5	26
62	1		1	28	5	28
63	1		1	23	5	23
64				37	13	34
65	4	1	4	40	10	40
66	2		2	52	9	51
67	6		6	56	9	55
68	2	1	2	63	8	63
69	3	1	3	34	7	33
70	1		1	52	7	48
71	2		2	54	10	51
72	1		1	41	13	40
73	2		2	28	5	27
74	2		1	29	5	29
75				24	2	22
76	1		1	22	1	22
77				19	4	17
78	1		1	16	3	16
79	4		4	19	2	19
80	4		4	24	4	21
81	4		4	21	4	17
82	1		1	14	5	13
83	2		2	17	2	16
84	3		3	19	3	19
85	1	1	1	15	1	15
86	1		1	11		11
87				15		14
88	1		1	7		7
89	1		1	13		13
90				10	2	10
91				4		4
92				4		4
93	1		1	7		7
94				3	1	3
95	1		1	2		2
96				4		4
97						0
98				2		2
99	1		1			
100						
101						
102	1		1			
103						
104						
105						
106						
107						
108				1		
Totals:	100	7	97	1,677	173	1,613
Mean FL:	65.0	65.0	65.5	62.8	67.9	62.8
Total jacks:[d]	40	1	38	732	25	704
Total adults:	60	6	59	945	148	909

a/ Trapping at JCW took place August 2 - September 30, 2011; Chinook trapped >JW 36 at JCW were considered fall Chinook. Trapping at WCW took place September 8 - November 21, 2011; all Chinook trapped at WCW in 2011 were considered fall Chinook.

b/ Ad-clip = Adipose fin clipped fish.

c/ Number of effectively tagged fish excludes fish that were not tagged, tagging mortalities, and fish that had their tags removed (caught/released).

d/ Fall Chinook less than 58cm FL were considered jacks.

Appendix 6. Fork length distribution of spring Chinook tagged at Junction City weir and subsequently recovered during the 2011-12 season. [a]

		Recoveries							
FL (cm)	Total Tagged	Tag Morts [b]	Carcass [c] Recoveries	TRH [d] Recoveries	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
35	2							0	0.0
36	0							0	--
37	0							0	--
38	1			1				1	100.0
39	0							0	--
40	0							0	--
41	0							0	--
42	1							0	0.0
43	1							0	0.0
44	1							0	0.0
45	0							0	--
46	4			1				1	25.0
47	3							0	0.0
48	5			2				2	40.0
49	8			4		1		5	62.5
50	15	1		9				10	66.7
51	9			3				3	33.3
52	6		1	2				3	50.0
53	7			1				1	14.3
54	4			1				1	25.0
55	1			1				1	100.0
56	5							0	0.0
57	0							0	--
58	0							0	--
59	0							0	--
60	2			1				1	50.0
61	1			1				1	100.0
62	1							0	0.0
63	0							0	--
64	3			3				3	100.0
65	2			2				2	100.0
66	2			2				2	100.0
67	4	1		1				2	50.0
68	3			3				3	100.0
69	6		1	1				2	33.3
70	4							0	0.0
71	2			2				2	100.0
72	5		2	1				3	60.0
73	2		1	1				2	100.0
74	2			1				1	50.0
75	4			1				1	25.0
76	2							0	0.0
77	2							0	0.0
78	3			1				1	33.3
79	1							0	0.0
80	2		1					1	50.0
81	5			1				1	20.0
82	0							0	--
83	3			1				1	33.3
84	3		4					4	133.3
85	3							0	0.0
86	0							0	--
87	2							0	0.0
88	1							0	0.0
89	2			1				1	50.0
90	1							0	0.0
91	1							0	0.0
Jacks: [h]	73	1	1	25	0	1	0	28	38.4%
Adults:	74	1	9	24	0	0	0	34	45.9%
Total:	147	2	10	49	0	1	0	62	42.2%

a/ Trapping at Junction City took place August 2 - September 30, 2011 (Julian weeks 31-39). Chinook caught prior to Julian week 37 were considered spring Chinook.
b/ Tagged fish found dead and unspawned within 30 days of tagging.
c/ Fish recovered in upper Trinity River spawner surveys.
d/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43).
e/ There were no spring Chinook tagged at JCW and reported as caught and released by anglers in 2011.
f/ Fish reported as harvested by anglers.
g/ There were no 2011 spring Chinook tags reported as found loose or on dead fish.
h/ Spring Chinook <60 cm FL were considered jacks.

Appendix 7. Fork length distribution of fall Chinook tagged at Junction City weir or Willow Creek weir and subsequently recovered during the 2011-12 season. [a]

	WCW + JCW	Recoveries							
FL (cm)	Total Tagged	Tag Morts [b]	Carcass Recoveries [c]	TRH Recoveries [d]	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
39	2							0	0.0
40	4							0	0.0
41	3							0	0.0
42	6				1			1	16.7
43	6			1				1	16.7
44	7							0	0.0
45	17			2				2	11.8
46	22		1		1			2	9.1
47	29			2				2	6.9
48	50		2	2	2	1		7	14.0
49	57			3	1	1		5	8.8
50	72			6		2		8	11.1
51	63		2	4	2	1		9	14.3
52	83		2	5		2		9	10.8
53	92		1	8	1	1	1	12	13.0
54	85		1	4		4		9	10.6
55	60			2	1	2		5	8.3
56	56		1	9		1		11	19.6
57	38		1	2		1		4	10.5
58	32		1	5		2		8	25.0
59	33			7				7	21.2
60	23			9				9	39.1
61	26		2	10			1	13	50.0
62	29		1	11				12	41.4
63	24		1	15		1		17	70.8
64	35		3	12	1	2		18	51.4
65	44		3	19		1		23	52.3
66	53		7	33			1	41	77.4
67	62		7	20	1			28	45.2
68	65		9	14		3		26	40.0
69	36		4	16		1		21	58.3
70	50		6	18	1	3		28	56.0
71	55		6	20	1	1	1	29	52.7
72	42		6	12	1	2		21	50.0
73	29			6				6	20.7
74	31		2	8			1	11	35.5
75	22		2	5				7	31.8
76	23		1	9				10	43.5
77	17			4				4	23.5
78	16			6				6	37.5
79	23		3	6		1		10	43.5
80	26		2	4	1	1		8	30.8
81	21		5	6				11	52.4
82	14		1	2		1		4	28.6
83	18			3				3	16.7
84	22		3	2				5	22.7
85	16			3			1	4	25.0
86	12			1			1	2	16.7
87	14		1	1				2	14.3
88	8							0	0.0
89	14			2				2	14.3
90	10		1					1	10.0
91	4			1				1	25.0
92	4							0	0.0
93	8			1				1	12.5
94	3							0	0.0
95	3							0	0.0
96	4			1				1	25.0
97	0							0	--
98	2							0	0.0
99	1							0	0.0
100	0							0	--
101	0							0	--
102	1							0	0.0
Jacks: [h]	752	0	11	50	9	16	1	87	11.6%
Adults:	975	0	77	292	6	19	6	400	41.0%
Total:	1,727	0	88	342	15	35	7	487	28.2%

a/ Trapping at Junction City weir took place August 2 - September 30, 2011; Chinook caught there after Julian week 36 were considered fall Chinook. Willow Creek trapping took place September 8 - November 21, 2011. All Chinook trapped at WCW in 2011 were considered fall Chinook.

b/ Tagged fish found dead and unspawned within 30 days of tagging.

c/ Fish recovered in upper Trinity River spawner surveys.

d/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43).

e/ Fish reported as caught and released by anglers.

f/ Fish reported as harvested by anglers. Two of these fish were harvested downstream of WCW in the Hoopa net fishery.

g/ Tags found on dead fish or found unattached.

h/ Fall Chinook <58 cm FL were considered jacks in 2011.

Appendix 8. Fork length distribution of coho trapped or tagged at Willow Creek weir and subsequently recovered during the 2011-12 season. [a]

				Recoveries						
FL (cm)	Total Trapped	RM clipped [b]	Total Tagged	Carcass Recoveries[c]	TRH Recoveries[d]	Angler Released[e]	Angler Harvest [f]	Angler Found Tags[g]	Total Recovered	% Recovered
34	2	1	2						0	0.0
35	1	0	0						0	--
36	1	1	0						0	--
37	0	0	0						0	--
38	2	2	2						0	0.0
39	5	5	5		1				1	20.0
40	12	12	11	1	2				3	27.3
41	11	11	11		6				6	54.5
42	16	16	16		2		1		3	18.8
43	15	14	15		6				6	40.0
44	20	19	20	2	7				9	45.0
45	26	26	25		6				6	24.0
46	37	37	36		13	1		1	15	41.7
47	28	28	27		13				13	48.1
48	15	15	14	1	8				9	64.3
49	13	13	13		6				6	46.2
50	9	8	9		4				4	44.4
51	10	10	8		4			2	6	75.0
52	3	3	3		4				4	133.3
53	4	4	4		1				1	25.0
54	1	1	1		1				1	100.0
55	1	1	0		1				1	--
56	1	1	1		0				0	0.0
57	1	1	1		0				0	0.0
58	1	1	1		0				0	0.0
59	0	0	0		0				0	--
60	1	1	1		0				0	0.0
61	4	4	4	1	0				1	25.0
62	1	1	1		1				1	100.0
63	5	5	5		0				0	0.0
64	4	3	4		0				0	0.0
65	13	11	13	1	2				3	23.1
66	14	12	13		3				3	23.1
67	15	11	14		3				3	21.4
68	23	15	22		3				3	13.6
69	11	10	11		5				5	45.5
70	12	8	12	2	2				4	33.3
71	12	8	12		1				1	8.3
72	8	6	7		1				1	14.3
73	1	1	1		3				3	300.0
74	2	2	2		0				0	0.0
75	0				1				--	--
76	0								--	--
77	0								--	--
78	0								--	--
79	1		-						0	--
Jacks: [h]	234	229	224	4	85	1	1	3	94	42.0%
Adults:	128	99	123	4	25	0	0	0	28	22.8%
Total:	362	328	347	8	110	1	1	3	122	35.2%

a/ Trapping at Willow Creek weir took place from September 8 - November 21, 2011.
b/ All coho produced at Trinity River Hatchery are RM (right maxillary) clipped before release into the river.
c/ Fish recovered in upper Trinity River spawner surveys.
d/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43).
e/ Fish reported as caught and released by anglers.
f/ Fish reported as harvested by anglers (Regulations stipulate no harvest of coho).
g/ Tags found on dead fish or found unattached.
h/ Coho <58 cm FL were considered jacks in 2011; the separation point between jacks and adults was derived by fork length distribution analysis.

Appendix 9. Fork length (FL) distribution of adult fall-run steelhead tagged at Willow Creek weir or Junction City weir[h] and subsequently recovered during the 2011-12 season. [a]

		Recoveries							
FL (cm)	Total Tagged	Tag Morts [b]	Carcass Recoveries [c]	TRH Recoveries [d]	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
42	3							0	0.0
43	9				1			1	11.1
44	7							0	0.0
45	4							0	0.0
46	5							0	0.0
47	3							0	0.0
48	4							0	0.0
49	5							0	0.0
50	6			1	1			2	33.3
51	14			1	4			5	35.7
52	22			2	2	4		8	36.4
53	28			3	3	1		7	25.0
54	38			3	5			8	21.1
55	57			10	6	1		17	29.8
56	96			13	16	2		31	32.3
57	118			20	21	2		43	36.4
58	137			26	14	4		44	32.1
59	125			19	21	6	2	48	38.4
60	168			49	13	5		67	39.9
61	120			33	8	2	1	44	36.7
62	124			35	14	3		52	41.9
63	93			32	11	4		47	50.5
64	78			22	5	4	1	32	41.0
65	65			27	12	2		41	63.1
66	48			15	1			16	33.3
67	32			6	1			7	21.9
68	20			5	3	1		9	45.0
69	23			5	3	1		9	39.1
70	15			4				4	26.7
71	6			1		1		2	33.3
72	8			1	1			2	25.0
73	11			1			1	2	18.2
74	7			2				2	28.6
75	5			3				3	60.0
76	2			1				1	50.0
77	3			2				2	66.7
78	4			2				2	50.0
79	2			1				1	50.0
80	--							0	--
81	--							0	--
82	--							0	--
83	--							0	--
84	--							0	--
85	--							0	--
86	--							0	--
87	--							0	--
88	1							0	0.0
Totals:	1,516	0	0	345	166	43	5	559	36.9%

a/ Trapping at Willow Creek took place September 8 - November 21, 2011; trapping at JCW took place August 2 - September 30, 2011.
b/ Tagged fish found dead and unspawned within 30 days of tagging.
c/ Fish recovered in upper Trinity River carcass surveys. There were no steelhead recovered in the 2011 survey.
d/ The fish ladder was open September 6, 2011 - March 13, 2012 (closed all or parts of Julian weeks 41-43).
e/ Fish reported as caught and released by anglers.
f/ Fish reported as harvested by anglers.
g/ Tags found on dead fish or found unattached.
h/ While Junction City tagging and recovery numbers are reported here they are not included in run size estimates.

Appendix 10. Spring Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Junction City weir, 1977 - 2011.

	Run-size estimate					Spawner escapements						Angler harvest			
						Natural Area Spawers [a]			Trinity River Hatchery						
	Jacks[d]		Adults		Total	Jacks	Adults	Total	Jacks	Adults	Total	Jacks	Adults		Total
Year	Number	Percent	Number	Percent											
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	1,757	15.6	9,528	84.4	11,285	1,512	6,617	8,129	245	2,457	2,702	0	454		454
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

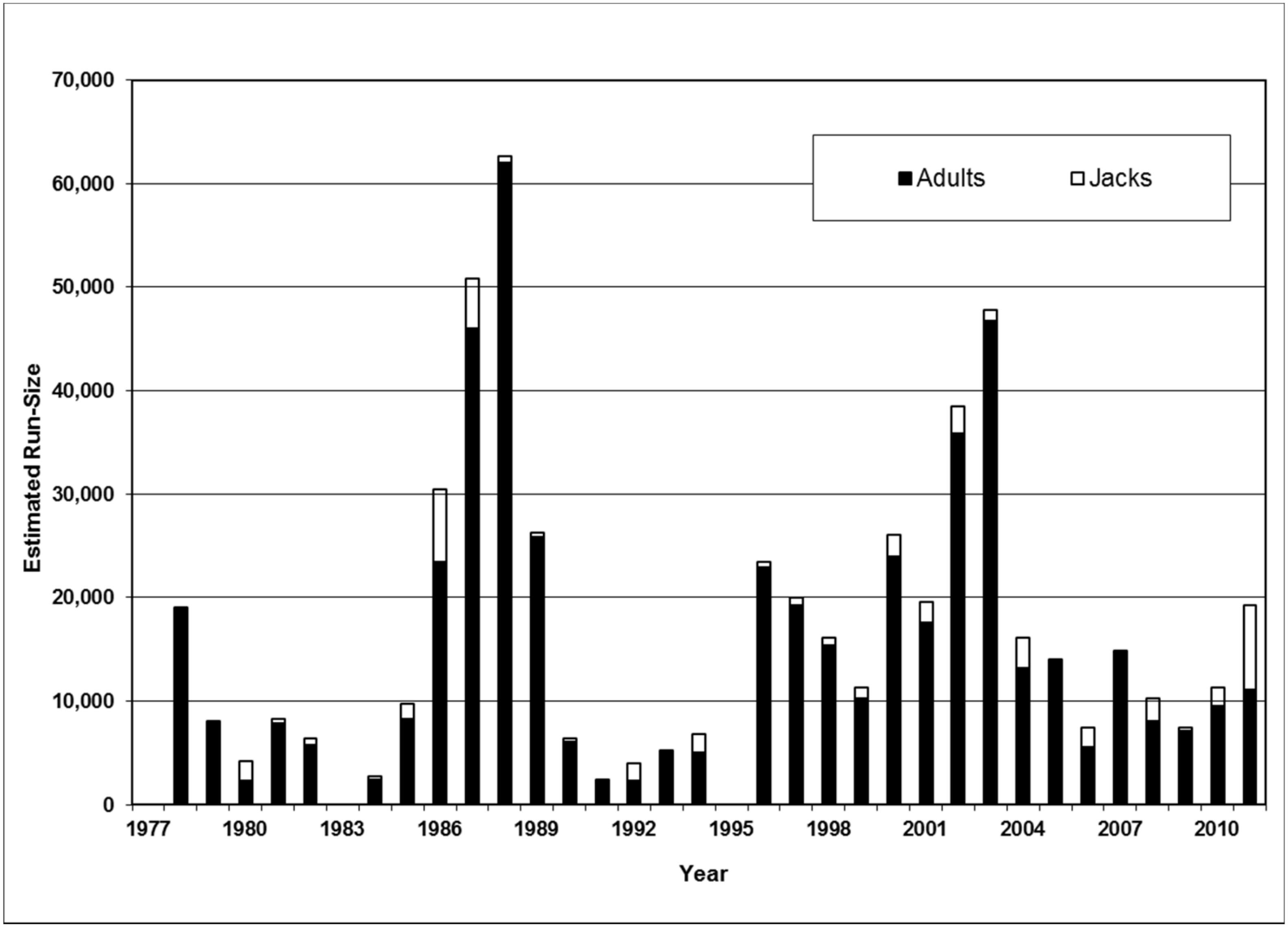
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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 (continued). Spring Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Junction City weir, 1977 - 2011.

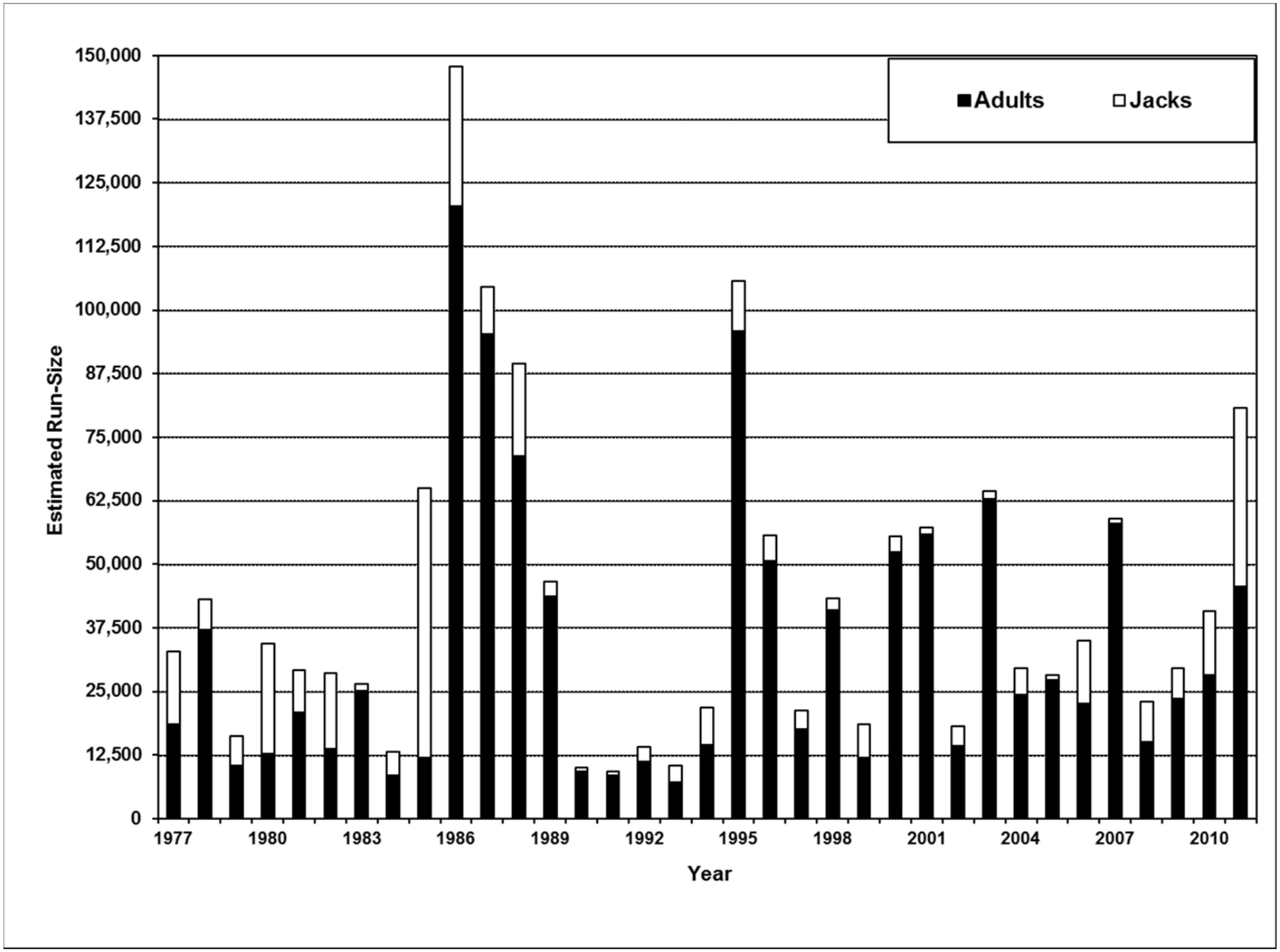


Appendix 11. Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2011.

	Run-size estimate					Spawner escapements						Angler harvest			
						Natural Area Spawners [a]			Trinity River Hatchery						
	Jacks[e]		Adults		Total	Jacks	Adults	Total	Jacks	Adults	Total	Jacks	Adults		Total
Year	Number	Percent	Number	Percent											
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
2002	3,812	21.0	14,344	79.0	18,156	2,566	10,310	12,876	1,078	3,475	4,553	168	559	d/	727
2003	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	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	899	3.2	27,332	96.8	28,231	751	12,717	13,468	48	13,758	13,806	100	856	d/	956
2006	12,290	35.2	22,622	64.8	34,912	8,228	14,566	22,794	3,938	8,056	11,994	124	0	d/	124
2007	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	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	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	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	35,277	43.6	45,542	56.4	80,819	32,527	30,810	63,337	1,840	13,882	15,722	910	850	d/	1,760

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 1999-2011 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, and 7,900 in 2011.
e/ Jacks are two year old fish, adults are a minimum of three years old.

Appendix 11 (continued). Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2011

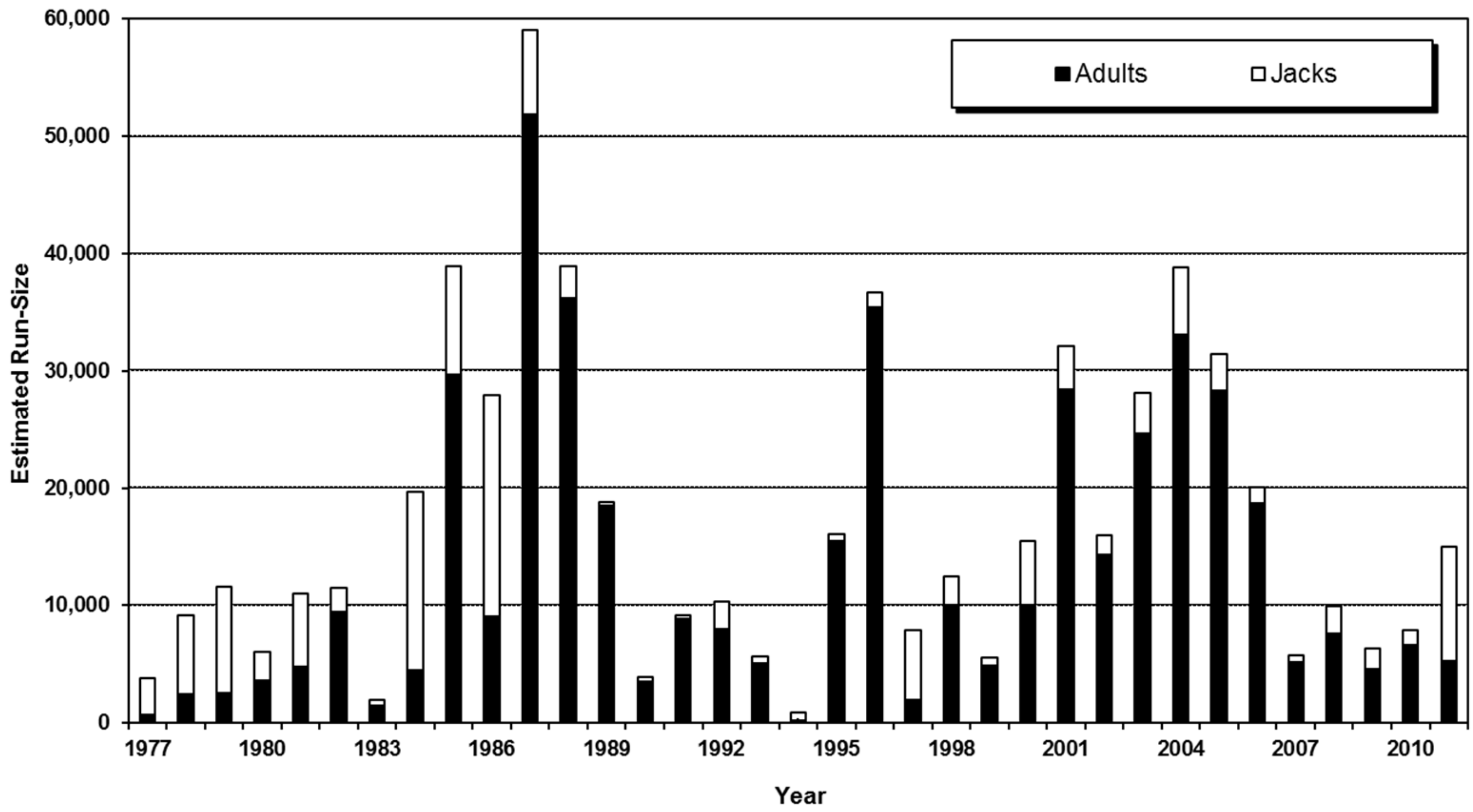


Appendix 12. Coho run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2011.

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

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 1996-2011 sport fishery was closed to the take of coho salmon.
e/ Jacks are two year old fish, adults are three years.

Appendix 12 (continued). Coho run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2011.

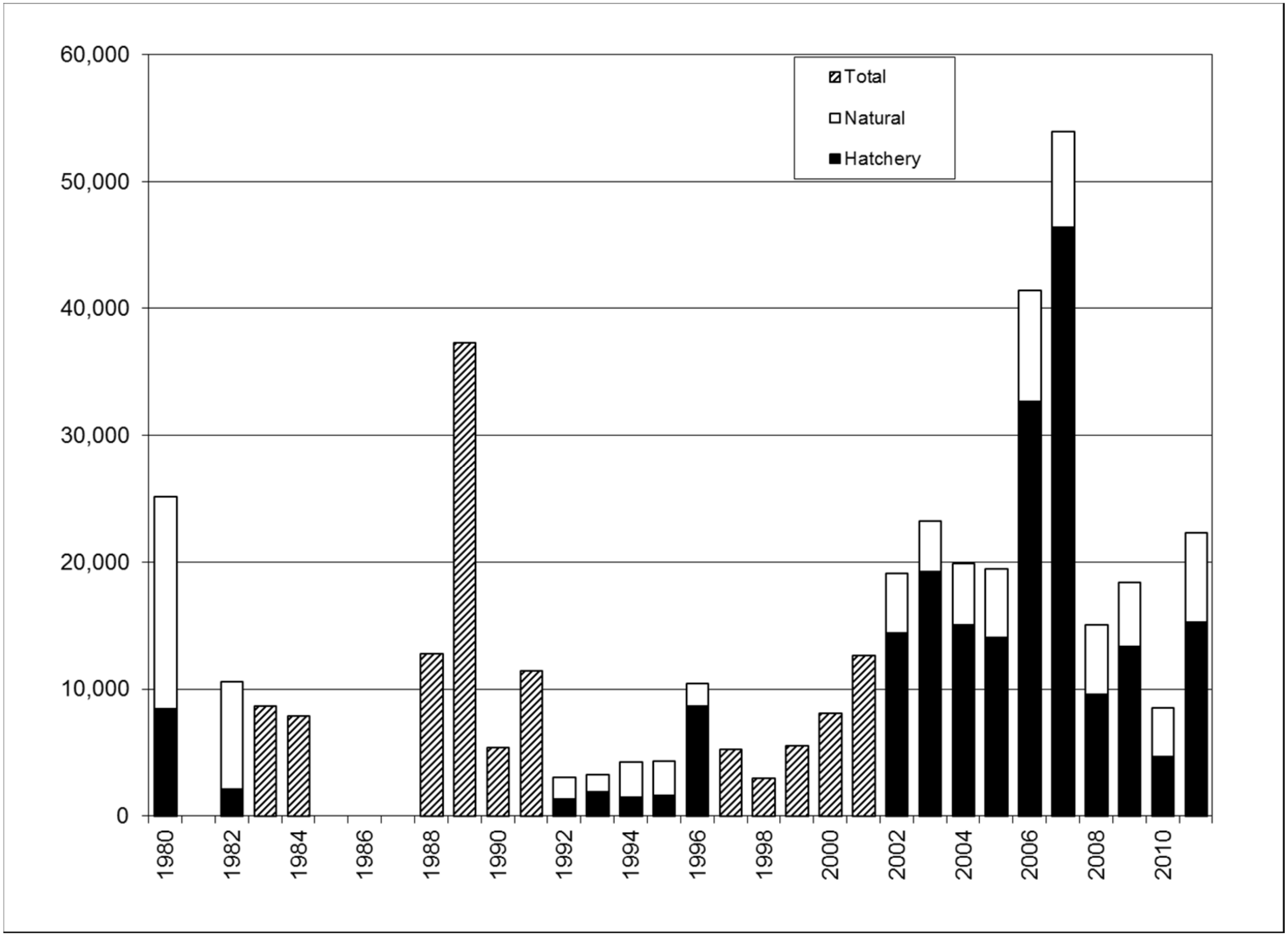


Appendix 13. Adult steelhead run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2011.

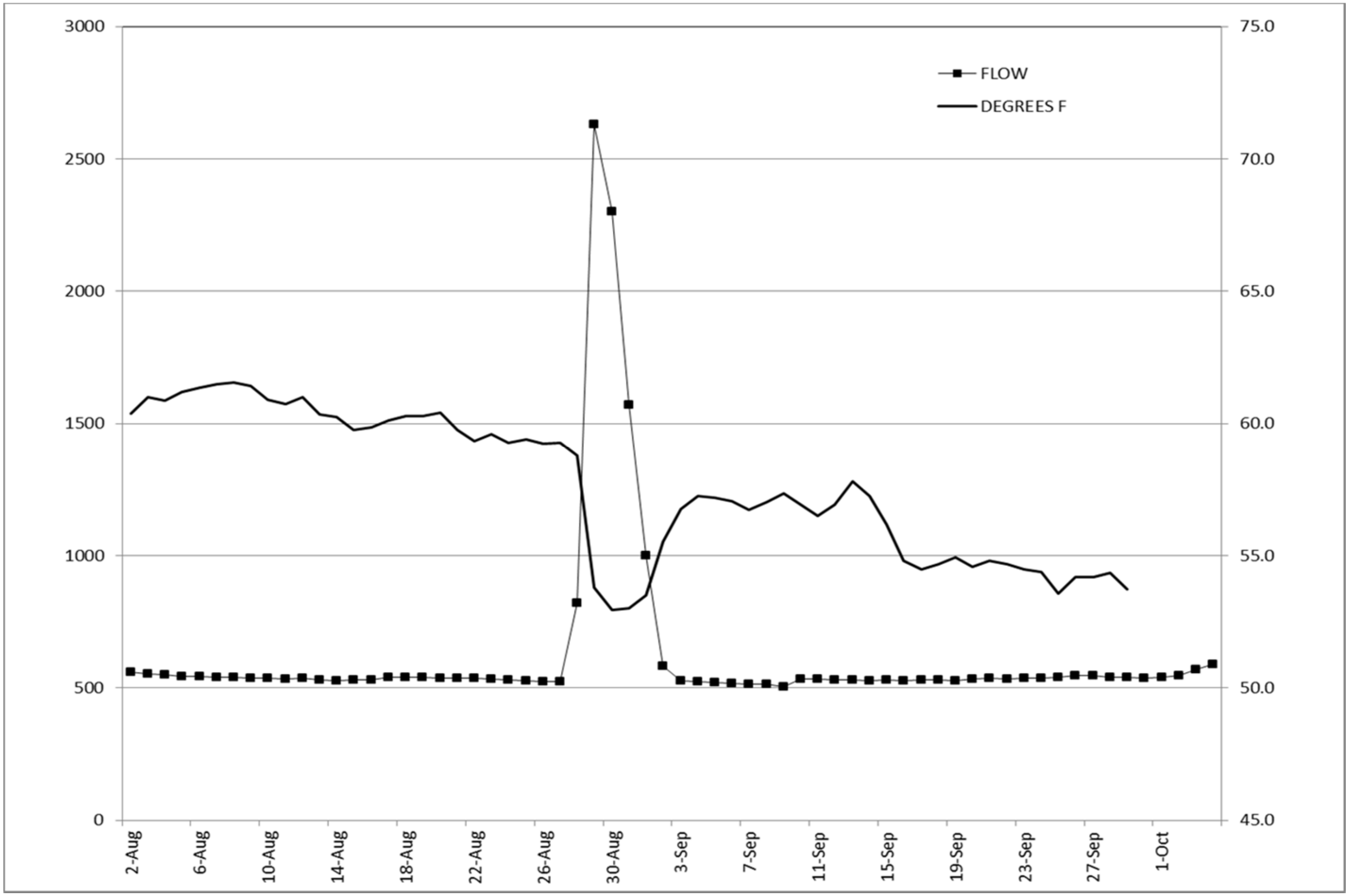
	Run-size estimate					Spawner escapement						Angler harvest		
						Natural Area Spawners[a]			Trinity River Hatchery					
	Hatchery[b]		Wild[c]			Hatchery	Wild	Total	Hatchery	Wild	Total	Hatchery	Wild	Total
Year	Number	Percent	Number	Percent	Total									
1977			No estimates				No estimates		269	16	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		516
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	7,730	4,566	12,296	5,966	42	6,008	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]

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.

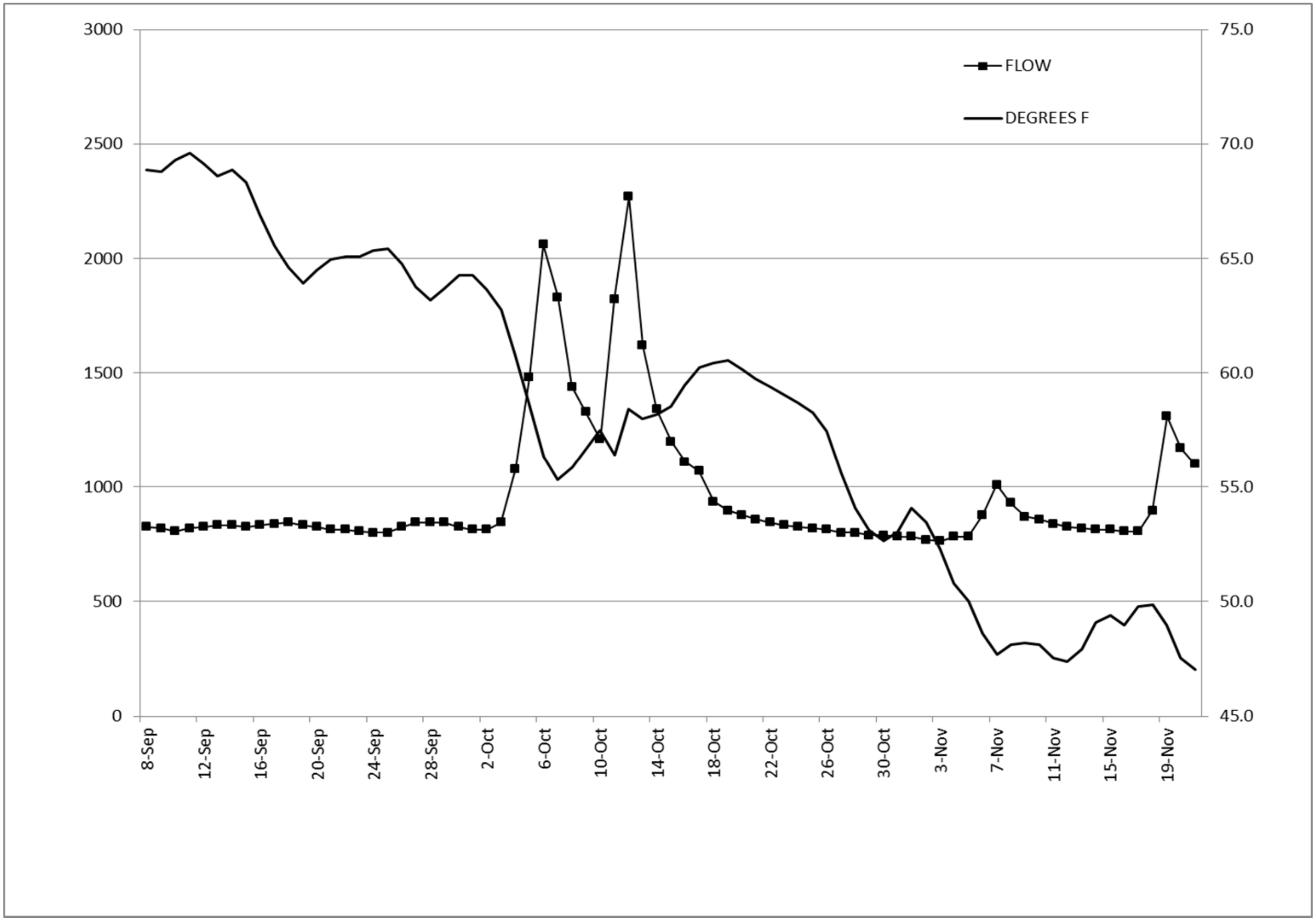
Appendix 13 (continued). Adult steelhead run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2011.



Appendix 14. Daily mean flow (CFS) recorded at USGS gauge (11526250) and water (°F) temperature for Trinity River near Junction City, 2011.



Appendix 15. . Daily mean flow (CFS) recorded at USGS gauge (11526250) and water (°F) temperature for Trinity River near Willow Creek weir.



ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2011-12 SEASON

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

by

Mary Claire Kier

ABSTRACT

An estimated run-size of 9,373 naturally-produced and 9,846 hatchery-produced spring Chinook returned upstream of Junction City weir and a run-size of 47,943 naturally-produced and 32,875 hatchery-produced fall Chinook salmon returned to the Trinity River above the Willow Creek weir during the 2011-12 season. We estimate adult escapement of 5,781 naturally-produced and 5,351 hatchery-produced spring Chinook returned to the Trinity River above the Junction City weir. We estimate adult escapement of 17,156 naturally- and 27,535 hatchery-produced fall Chinook returned to the river above the Willow Creek weir. The annual adult escapement goals set by the TRRP for Trinity River are 6,000 naturally-produced and 3,000 hatchery-produced adult spring Chinook and 62,000 naturally-produced and 9,000 hatchery-produced adult fall Chinook. For the 2011 season, the escapement of naturally-produced spring Chinook met approximately 96 percent of the TRRP production goal and the escapement of natural fall Chinook was approximately 28 percent of the goal.

Chinook in-river return rates (expressed as a percentage of release numbers) for the completed 2006 BY ranged from 0.086 percent to 1.301 percent for spring Chinook CWT groups, and from 0.167 percent to 1.360 percent 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 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 fall-run (fall) and spring-run (spring) 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 Game's (CDFG) Trinity River Hatchery (TRH) personnel annually propagate and release approximately 4.3 million juvenile Chinook salmon (Chinook). These include approximately 1.4 million spring-run (spring) and 2.9 million fall-run (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 percent 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 CDFG'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 CDFG 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 staff implant CWTs in the snouts of approximately 25 percent 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 CDFG 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 Willow Creek and Junction City). 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, 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-4[1/] 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.

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

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, and ANOVA statistical methods, data points >2 SDs from the mean and data points < 2SDs 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:

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

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 <u>and</u> a CWT;
NH_{adclip} = total number of ad-clipped salmon observed at TRH; and
$N_{runsizeestimate}$ = run-size estimate.

Independent estimates were generated for jacks (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 <u>and</u> 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 22,303 Chinook salmon at TRH in 2011, of which 5,067 (22.7%) had ad - clips. We recovered CWTs from 1,494 known spring Chinook and 3,396 known fall Chinook (Table 1). The remaining 177 ad-clipped fish had either shed their CWT (127) or the CWT was lost or unreadable (50). 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 17 release groups from the 2006 through 2009 BYs. Fall Chinook CWTs were composed of 30 release groups representing the 2006 through 2009 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 2,395 (1,317 jacks and 1,078 adults) CWT spring Chinook returned to the Trinity River above JCW during the 2011 season (Table 2) and zero adult and 15 jack CWT fish were harvested by anglers during the season. Escapement of CWT spring Chinook was divided between 1,506 fish recovered at TRH and 874 estimated to spawn in natural areas (Table 2). Based on CWTs, the known age composition of the 2011 hatchery produced spring Chinook run was composed of 1,078 (45.0%) age 2; 717 (29.9%) age 3; 552 (23.1%) age 4; and 48 (2.0%) age 5 fish (Table 2).

2006 Brood Year

The 2011 spawning season was the last year for returns of the 2006 BY. Although the age five component of the run is historically very small for Trinity River Hatchery Chinook stocks, the yearling release of this brood group continued to perform well with a 0.040 return. The total contribution of the four (three fingerling and one yearling) 2006 BY tag code release groups that returned to the Trinity River ranged from 0.086 (a fingerling group) to 1.301 percent (the yearling group) (Table 3). The final total return rate for all 2006 BY spring Chinook release groups was approximately 0.268 percent (Appendix 1).

2007 Brood Year

Spring Chinook from the 2007 BY have returned at age two, three and four. The three fingerling and one yearling groups continue to return at a below average rate, with approximately 0.99 percent of this release group returned as of the 2011 spawning season (Table 3). These fish are expected to continue their returns for one additional year.

Table 1. Release and recovery data for adipose fin-clipped Chinook recovered at Trinity River Hatchery (TRH) during the 2011-12 season.

Release data							Recovery data				
CWT[a] code	Egg source	Brood year	Date	Number	Size (# / lb)	Site	Males No.	Males FL[b]	Females No.	Females FL[b]	Total No.
Spring Chinook salmon											
065347	TRH	2006	06/1-08/07	65,914	64.2	TRH	1	80.0	0	--	1
065348	TRH	2006	06/1-08/07	86,088	76.2	TRH	1	98.0	1	87.0	2
065349	TRH	2006	06/1-08/07	74,456	76.2	TRH	0	--	1	83.0	1
065360	TRH	2006	10/1-10/07	74,456	11.7	TRH	17	93.3	11	82.6	28
068801	TRH	2007	06/2-12/08	55,773	96.0	TRH	8	80.1	14	76.1	22
068802	TRH	2007	06/2-12/08	73,822	96.0	TRH	14	87.3	22	77.6	36
068803	TRH	2007	06/2-12/08	50,488	112.0	TRH	12	83.3	16	78.6	28
068810	TRH	2007	10/1-14/08	96,803	11.4	TRH	151	84.0	134	76.7	285
068811	TRH	2008	06/1-15/09	75,847	37.9	TRH	19	70.7	77	65.3	96
068812	TRH	2008	06/1-15/09	89,934	54.5	TRH	74	71.2	129	67.1	203
068813	TRH	2008	06/1-15/09	64,175	47.0	TRH	34	72.5	93	65.6	127
068819	TRH	2008	10/1-15/09	104,078	8.1	TRH	30	63.8	25	61.9	55
068821	TRH	2009	06/1-8/10	63,456	44.0	TRH	238	50.6	4	60.8	242
068822	TRH	2009	06/1-8/10	82,259	55.0	TRH	268	51.2	2	50.0	270
068831	TRH	2009	06/1-8/10	7,234	55.0	TRH	36	49.9	1	63.0	37
068832	TRH	2009	06/1-8/10	8,104	55.0	TRH	36	51.3	4	69.3	40
068836	TRH	2009	10/1-9/10	108,824	8.6	TRH	21	42.7	0	--	21
Lost CWT[c,e]							6		6		12
No CWT[d,e]							27		13		40
					Spring Chinook totals:		993		553		1,546
Fall Chinook salmon											
065350	TRH	2006	06/1-8/07	118,575	110.0	TRH	1	92.0	1	88.0	2
065351	TRH	2006	06/1-8/07	119,712	110.0	TRH	1	87.0	0	--	1
065361	TRH	2006	10/1-10/07	238,156	19.5	TRH	8	95.8	9	86.2	17
068804	TRH	2007	06/2-12/08	92,759	157.0	TRH	2	82.5	9	77.3	11
068805	TRH	2007	06/2-12/08	89,972	163.0	TRH	3	76.3	6	80.2	9
068806	TRH	2007	06/2-12/08	89,348	181.0	TRH	6	85.0	8	78.5	14
068807	TRH	2007	06/2-12/08	84,063	188.0	TRH	3	85.3	10	78.4	13
068808	TRH	2007	06/2-12/08	90,174	194.0	TRH	4	81.8	8	79.3	12
068809	TRH	2007	10/1-14/08	244,661	16.7	TRH	118	87.1	174	80.0	292
065356	TRH	2008	06/1-15/09	11,403	85.8	TRH	14	74.7	12	69.5	26
065357	TRH	2008	06/1-15/09	9,676	85.8	TRH	7	74.6	13	69.3	20
065358	TRH	2008	06/1-15/09	9,882	85.8	TRH	9	73.3	17	69.1	26
065359	TRH	2008	10/01-15/09	6,257	13.3	TRH	26	67.4	8	66.8	34
068814	TRH	2008	06/1-15/09	93,228	80.5	TRH	125	74.1	157	70.1	282
068815	TRH	2008	06/1-15/09	94,165	81.5	TRH	121	73.5	159	69.7	280
068816	TRH	2008	06/1-15/09	96,264	98.5	TRH	103	72.5	115	70.1	218
068817	TRH	2008	06/1-15/09	92,360	94.0	TRH	88	73.3	89	69.2	177
068818	TRH	2008	06/1-15/09	90,758	103.5	TRH	95	72.5	58	69.6	153
068820	TRH	2008	10/01-15/09	253,073	11.5	TRH	830	68.3	546	65.9	1,376
0608080000[f]	TRH	2008	04/29 -08/20/09	17,618	various	River	8	74.4	13	69.1	21
0608080001[f]	TRH	2008	04/29 -08/20/09	2,915	various	River	1	71.0	2	71.0	3
068823	TRH	2009	06/1-8/10	85,136	91.0	TRH	113	55.4	2	61.0	115
068824	TRH	2009	06/1-8/10	89,959	113.0	TRH	85	54.7	3	58.3	88
068825	TRH	2009	06/1-8/10	91,310	133.0	TRH	27	51.9	0	--	27
068826	TRH	2009	06/1-8/10	88,851	134.0	TRH	12	52.8	0	--	12
068827	TRH	2009	06/1-8/10	90,929	186.0	TRH	8	50.5	0	--	8
068828	TRH	2009	06/1-8/10	39,642	114.0	TRH	18	54.0	0	--	18
068833[f]	TRH	2009	06/1-8/10	5,664	316.0	River	1	55.0	0	--	1
068834[f]	TRH	2009	06/1-8/10	5,270	316.0	River	1	52.0	0	--	1
068837	TRH	2009	10/1-9/10	230,461	11.6	TRH	138	49.4	1	50.0	139
Lost CWT[c,e]							30		8		38
No CWT[d,e]							51		36		87
					Fall Chinook totals:		2,057		1,464		3,521

a/ CWT = Coded-wire tag.
b/ FL = Mean fork length in cm.
c/ CWT lost or un-readable during recovery.
d/ No CWT was detected.
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 2011-12 season.

	Run-size estimate		Harvest rates		TRH ad-clips +	Percent of ad-clips observed at weirs		Ad-clip + CWT run-size estimates		
Run-size estimates	Jacks	Adults	Jacks	Adults	CWTs	Jacks	Adults	Jacks	Adults	Total
Spring Chinook (JCW)	8,087	11,132	1.4%	0.0%	97.3%	13.7%	12.2%	1,078	1,317	2,396
Fall Chinook (WCW)	35,277	45,542	2.6%	1.9%	97.4%	3.4%	15.7%	1,176	6,949	8,125

CWT code	BY	Age	TRH Total No.	% of total	Run-size	Angler harvest	Spawning escapement TRH	Natural	Total
Spring Chinook salmon									
Adults									
065347	06	5	1.0	0.1%	1.5	0.0	1.0	0.5	1.5
065348	06	5	2.0	0.2%	3.0	0.0	2.0	1.0	3.0
065349	06	5	1.0	0.1%	1.5	0.0	1.0	0.5	1.5
065360	06	5	28.2	3.2%	41.7	0.0	28.2	13.5	41.7
068801	07	4	22.2	2.5%	32.7	0.0	22.2	10.6	32.8
068802	07	4	36.3	4.1%	53.6	0.0	36.3	17.4	53.6
068803	07	4	28.1	3.2%	41.6	0.0	28.1	13.5	41.6
068810	07	4	287.1	32.2%	424.4	0.0	287.1	137.3	424.4
068811	08	3	96.6	10.8%	142.8	0.0	96.6	46.2	142.8
068812	08	3	205.2	23.0%	303.3	0.0	205.2	98.2	303.3
068813	08	3	128.1	14.4%	189.3	0.0	128.1	61.3	189.3
068819	08	3	55.5	6.2%	82.0	0.0	55.5	26.5	82.0
		Totals:	891.1	100.0%	1,317.4	0.0	891.1	426.3	1,317.4
Jacks									
068821	09	2	243.4	39.6%	426.6	5.9	243.4	177.2	420.6
068822	09	2	273.2	44.4%	478.6	6.7	273.2	198.8	472.0
068831	09	2	37.3	6.1%	65.3	0.9	37.3	27.2	64.4
068832	09	2	40.4	6.6%	70.7	1.0	40.4	29.4	69.8
068836	09	2	21.1	3.4%	37.0	0.5	21.1	15.4	36.4
		Totals:	615.3	100.0%	1,078.3	15.0	615.3	447.9	1,063.3
		Spring Totals:	1,506.4		2,395.7		1,506.4	874.3	2,380.7
Fall Chinook salmon									
Adults									
065350	06	5	2.0	0.1%	4.7	0.1	2.0	2.6	4.6
065351	06	5	1.0	0.0%	2.4	0.0	1.0	1.3	2.3
065361	06	5	17.2	0.6%	39.6	0.7	17.2	21.6	38.8
068804	07	4	11.1	0.4%	25.6	0.5	11.1	14.0	25.1
068805	07	4	9.1	0.3%	21.0	0.4	9.1	11.5	20.6
068806	07	4	14.2	0.5%	32.7	0.6	14.2	17.9	32.1
068807	07	4	13.2	0.4%	30.3	0.6	13.2	16.6	29.7
068808	07	4	12.1	0.4%	27.9	0.5	12.1	15.3	27.4
068809	07	4	294.9	9.8%	678.6	12.7	294.9	371.0	666.0
065356	08	3	26.2	0.9%	60.4	1.1	26.2	33.0	59.3
065357	08	3	20.2	0.7%	46.4	0.9	20.2	25.4	45.6
065358	08	3	26.3	0.9%	60.6	1.1	26.3	33.1	59.5
065359	08	3	34.3	1.1%	78.9	1.5	34.3	43.1	77.4
068814	08	3	285.4	9.5%	656.7	12.3	285.4	359.0	644.4
068815	08	3	283.3	9.4%	652.0	12.2	283.3	356.5	639.8
068816	08	3	220.2	7.3%	506.6	9.5	220.2	277.0	497.1
068817	08	3	178.7	5.9%	411.2	7.7	178.7	224.8	403.5
068818	08	3	154.4	5.1%	355.2	6.6	154.4	194.2	348.6
068820	08	3	1,391.8	46.1%	3,202.6	59.9	1,391.8	1,750.9	3,142.7
0608080000	08	3	21.2	0.7%	48.9	0.9	21.2	26.7	47.9
0608080001	08	3	3.0	0.1%	7.0	0.1	3.0	3.8	6.9
		Totals:	3,020.0	100.0%	6,949.2	129.9	3,020.0	3,799.2	6,819.2
Jacks									
068823	09	2	116.4	28.1%	330.8	8.5	116.4	205.9	322.2
068824	09	2	89.0	21.5%	253.0	6.5	89.0	157.4	246.4
068825	09	2	27.2	6.6%	77.4	2.0	27.2	48.2	75.4
068826	09	2	12.2	2.9%	34.5	0.9	12.2	21.5	33.6
068827	09	2	8.0	1.9%	22.9	0.6	8.0	14.2	22.3
068828	09	2	18.2	4.4%	51.7	1.3	18.2	32.2	50.4
068833	09	2	1.0	0.2%	2.9	0.1	1.0	1.8	2.8
068834	09	2	1.0	0.2%	2.9	0.1	1.0	1.8	2.8
068837	09	2	140.6	34.0%	399.6	10.3	140.6	248.7	389.3
		Totals:	413.6	100.0%	1,175.6	30.3	413.6	731.6	1,145.3
		Fall Totals:	3,433.6		8,124.7	160.3	3,433.6	4,530.9	7,964.5

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 2007 through 2011.

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
065347	2006	06/1-08/07	65,914	TRH	2	15	0.023	1	9	5	14
065347	2006				3	43	0.065	3	29	12	41
065347	2006				4	9	0.014	0	5	4	9
065347	2006				5	1	0.002	0	1	0	1
				Totals: d/		69	0.104	4	44	21	65
				Total adults: e/		54	0.081	3	35	16	51
065348	2006	06/1-08/07	86,088	TRH	2	15	0.000	1	9	5	14
065348	2006				3	51	0.059	3	34	14	48
065348	2006				4	27	0.032	1	15	11	26
065348	2006				5	3	0.003	0	2	1	3
				Totals: d/		96	0.094	5	60	31	91
				Total adults: e/		81	0.094	4	51	26	77
065349	2006	06/1-08/07	74,456	TRH	2	10	0.013	1	6	4	10
065349	2006				3	31	0.042	2	21	9	30
065349	2006				4	22	0.029	1	12	9	21
065349	2006				5	1	0.002	1	0	1	2
				Totals: d/		64	0.086	5	40	23	63
				Total adults: e/		54	0.073	4	34	19	53
065360	2006	10/1-10/07	104,019	TRH	2	51	0.049	3	30	18	48
065360	2006				3	617	0.593	38	412	167	579
065360	2006				4	644	0.619	31	357	256	613
065360	2006				5	42	0.040	28	13	42	55
				Totals: d/		1,354	1.301	100	813	483	1,295
				Total adults: e/		1,303	1.252	97	783	465	1,247
068801	2007	06/2-12/08	55,773	TRH	2	2	0.004	0	1	1	2
068801	2007				3	15	0.026	1	8	6	14
068801	2007				4	33	0.059	0	22	11	33
068802	2007	06/2-12/08	73,822	TRH	2	7	0.009	0	4	3	7
068802	2007				3	58	0.078	3	32	23	55
068802	2007				4	54	0.073	0	36	17	54
068803	2007	06/2-12/08	73,822	TRH	2	7	0.009	0	4	3	7
068803	2007				3	29	0.039	1	16	12	28
068803	2007				4	42	0.056	0	28	13	42
068810	2007	10/01-14/08	96,803	TRH	2	12	0.012	0	7	5	12
068810	2007				3	181	0.187	9	101	72	173
068810	2007				4	424	0.438	0	287	137	424
068811	2008	06/01-15/09	75,847	TRH	2	35	0.046	0	12	23	35
068811					3	143	0.188	0	97	46	143
068812	2008	06/01-15/09	89,934	TRH	2	59	0.065	0	20	38	59
068812					3	303	0.337	0	205	98	303
068813	2008	06/01-15/09	64,175	TRH	2	38	0.059	0	13	25	38
068813	2008				3	189	0.295	0	128	61	189
068819	2008	10/1-15/09	104,078	TRH	2	0	0.000	0	0	0	0
068819	2008				3	82	0.079	0	55	27	82
068821	2009	06/01-8/10	63,456	TRH	2	427	0.672	6	243	177	421
068822	2009	06/01-8/10	82,259	TRH	2	479	0.582	7	273	199	472
068831	2009	06/01-8/10	7,234	TRH	2	65	0.903	1	37	27	64
068832	2009	06/01-8/10	8,104	TRH	2	71	0.873	1	40	29	70
068836	2009	10/1-9/10	108,824	TRH	2	37	0.034	1	21	15	36

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 2006. 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.

with nearly as many returns in two years as the 2007 BY groups have managed in three. One of the fingerling groups (068812) with 0.402 percent return is the highest performer of this BY (Table 3). Spring Chinook from this BY are expected to return as four- and five-year-olds over the next two years.

2009 Brood Year

Five 2009 BY release groups (four fingerling, one yearling) returned as two year olds this season (Table 3). Their return rate averaged 0.613 percent. Spring Chinook from this BY are expected to return as three, four and five-year-olds for the next three years.

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 8,124 CWT (1,175 jacks and 6,949 adult) fall Chinook salmon returned to the Trinity River above WCW during the 2011-12 season and that anglers harvested 30 jacks and 130 adult CWT fall Chinook. Escapement of CWT fall Chinook was divided between 3,433 fish recovered at TRH and 4,531 estimated to have spawned in natural areas this season (Table 2). Based on CWTs, the known age composition of the 2011 fall Chinook run was: 1,175 (14.5%) age 2 fish, 1,763 (74.9%) age 3 fish, 1,543 (10.0%) age 4 fish, and zero (0.6%) age 5 fish.

2006 Brood Year

The 2011 spawning season was the last year for returns of the 2006 BY. The total contribution of the five (one yearling and four fingerling) 2006 BY tag code release groups that returned to the Trinity River ranged from 0.167 to 1.36 percent (Table 4). The final total return rate for all 2006 BY fall Chinook release groups was approximately 0.564 percent (Appendix 2).

2007 Brood Year

Six release groups (five fingerling and one yearling) from the 2007 BY returned as two and three and four-year-olds during the 2011 season (Table 4). The yearling group, 068809, has experienced the best returns to date, with 0.951 percent through age four. The fish released from this BY are expected to return for one additional year.

2008 Brood Year

Twelve CWT groups (ten fingerling and two yearling) from the 2008 BY returned as two and three-year-olds during the 2011 season (Table 4). Percent return of this BY ranged from 0.240 - 1.265 percent this year, with both the yearling groups performing well. Adult returns from these groups will occur over the next two years.

2009 Brood Year

Nine CWT groups (eight fingerling and one yearling) from the 2009 BY releases returned as two-year-olds during 2011 (Table 4). Percent return ranged from 0.025 – 0.389. Surprisingly fingerling group (068823) had the highest return for this BY. Adult returns from this BY will occur over the next three 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 2007 through 2011.

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
065350	2006	06/1-8/07	118,575	TRH	2	63	0.053	2	34	27	61
065350	2006				3	111	0.094	3	73	35	108
065350	2006				4	40	0.034	0	21	18	40
065350	2006				5	5	0.004	0	2	3	5
			Totals: d/			219	0.184	5	130	83	213
			Total adults: e/			156	0.131	3	96	56	152
065351	2006	06/1-8/07	119,712	TRH	2	53	0.044	1	29	23	52
065351	2006				3	116	0.097	3	76	37	113
065351	2006				4	38	0.032	0	20	18	38
065351	2006				5	2	0.002	0	1	1	2
			Totals: d/			209	0.175	4	126	79	205
			Total adults: e/			156	0.131	3	97	56	153
065352	2006	06/1-8/07	122,076	TRH	2	35	0.029	1	19	15	34
065352	2006				3	141	0.116	3	93	45	138
065352	2006				4	28	0.023	0	15	13	28
065352	2006				5	0	0.000	0	0	0	0
			Totals: d/			204	0.167	4	127	73	200
			Total adults: e/			169	0.138	3	108	58	166
065353	2006	06/1-8/07	126,470	TRH	2	42	0.033	1	23	18	41
065353	2006				3	103	0.081	2	68	33	101
065353	2006				4	72	0.057	0	38	33	72
065353	2006				5	0	0.000	0	0	0	0
			Totals: d/			217	0.172	3	129	84	214
			Total adults: e/			175	0.138	2	106	66	173
065361	2006	10/1-10/07	238,156	TRH	2	81	0.034	2	44	35	79
065361	2006				3	1,755	0.737	42	1,154	559	1,713
065361	2006				4	1,364	0.573	9	725	630	1,355
065361	2006				5	40	0.017	1	17	22	39
			Totals: d/			3,240	1.360	54	1,940	1,245	3,186
			Total adults: e/			3,159	1.326	52	1,896	1,210	3,107

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 2006. These fish have reached five years of age and are considered to have completed their life
e/ The term "adults" includes Cinook 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 2007 through 2011.

Release data						Estimated returns					
CWT [a] code	Brood year	Date [b]	Number	Site	Age	Run-size	% of release	River harvest	Spawning escapement TRH [c]	Spawning escapement Natural	Spawning escapement Total
068804	2007	06/2-12/08	92,759	TRH	2	4	0.004	0	2	2	4
068804	2007				3	32	0.034	0	17	15	32
068804	2007				4	26	0.028	0	11	14	25
068805	2007	06/2-12/08	89,972	TRH	2	2	0.002	0	1	1	2
068805	2007				3	40	0.044	0	21	18	40
068805	2007				4	21	0.023	0	9	11	21
068806	2007	06/2-12/08	89,348	TRH	2	2	0.002	0	1	1	2
068806	2007				3	32	0.036	0	17	15	32
068806	2007				4	33	0.037	1	14	18	32
068807	2007	06/2-12/08	84,063	TRH	2	2	0.002	0	1	1	2
068807	2007				3	30	0.036	0	16	14	30
068807	2007				4	30	0.036	0.57	13	17	30
068808	2007	06/2-12/08	90,174	TRH	2	0	0.000	0	0	0	0
068808	2007				3	42	0.047	0	22	19	41
068808	2007				4	28	0.031	1	12	15	27
068809	2007	10/1-14/08	244,661	TRH	2	60	0.025	1	32	27	59
068809	2007				3	1,587	0.649	11	844	733	1,576
068809	2007				4	679	0.277	12.69	295	371	666
065356	2008	06/1-15/09	11,403	TRH	2	10	0.085	0	5	5	10
065356	2008			TRH	3	60	0.530	1	26	33	59
065357	2008	06/1-15/09	9,676	TRH	2	6	0.060	0	3	3	6
065357	2008			TRH	3	46	0.480	1	20	25	46
065358	2008	06/1-15/09	9,882	TRH	2	10	0.101	0	5	5	10
065358	2008			TRH	3	61	0.613	1	26	33	59
065359	2008	10/01-15/09	6,257	TRH	2	6	0.093	0	3	3	6
065359	2008			TRH	3	79	1.261	1	34	43	77
068814	2008	06/1-15/09	93,228	TRH	2	157	0.168	2	79	77	156
068814	2008			TRH	3	657	0.704	12	285	359	644
068815	2008	06/1-15/09	94,165	TRH	2	101	0.107	1	50	49	100
068815	2008			TRH	3	652	0.692	12	283	356	640
068816	2008	06/1-15/09	96,264	TRH	2	74	0.077	1	37	36	74
068816	2008			TRH	3	507	0.526	9	220	277	497
068817	2008	06/1-15/09	92,360	TRH	2	77	0.083	1	38	37	76
068817	2008			TRH	3	411	0.445	8	179	225	403
068818	2008	06/1-15/09	90,758	TRH	2	40	0.044	0	20	20	40
068818	2008			TRH	3	355	0.391	7	154	194	349
068820	2008	10/01-15/09	253,073	TRH	2	99	0.039	1	49	48	98
068820	2008			TRH	3	3,203	1.265	60	1,392	1,751	3,143
0608080000 [f]	2008	04/29 - 08/20/09	17,618	River	2	16	0.088	0	8	8	16
0608080000 [f]	2008			River	3	49	0.277	1	21	27	48
0608080001 [f]	2008	04/29 - 08/20/09	2,915	River	2	4	0.134	0	2	2	4
0608080001 [f]	2008			River	3	7	0.240	0	3	4	7
068823	2009	06/1 - 8/10	85,136	TRH	2	331	0.389	9	116	206	322
068824	2009	06/1 - 8/10	89,959	TRH	2	253	0.281	7	89	157	246
068825	2009	06/1 - 8/10	91,310	TRH	2	77	0.085	2	27	48	75
068826	2009	06/1 - 8/10	88,851	TRH	2	35	0.039	1	12	21	34
068827	2009	06/1 - 8/10	90,929	TRH	2	23	0.025	1	8	14	22
068828	2009	06/1 - 8/10	39,642	TRH	2	52	0.130	1	18	32	50
068833	2009	06/1 - 8/10	5,664	TRH	2	3	0.051	0	1	2	3
068834	2009	06/1 - 8/10	5,270	TRH	2	3	0.054	0	1	2	3
068837	2009	10/01 - 09/10	230,461	TRH	2	400	0.173	10	141	249	389

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 2006. 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.

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 9,846 fish. This represents 55.6 percent (4,495/8,087) of the jacks, 48.1 percent (5,351/11,132) of the adult run, and 51.2 percent (9,846/19,219) overall (Table 5). Of the 5,351 TRH-origin adult spring Chinook in the run-size estimate, 3,619 escaped to TRH, while 1,731 escaped to areas outside of the hatchery.

The estimated contribution of TRH-origin fall Chinook to the Trinity River run-size estimate upstream of WCW was 32,875 fish. This represents 13.6 percent (4,815/35,277) of the jacks, 61.6 percent (28,060/45,542) of the adults and 40.7 percent (32,875/80,819) overall. Of the 28,060 TRH-origin adult fall Chinook in the run-size estimate, an estimated 12,194 escaped to the hatchery, leaving an in-river escapement of 15,341.

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. Thus, 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. Yet another source of potential bias is vulnerability of capture. 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, early August, so likely affects our spring Chinook CWT estimates, while early storms (which seem to be

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 2011-12 season. [a]

CWT code b/	BY c/	Age	TRH expansion factor d/	Run-size	Expanded run-size e/	Angler harvest	Expanded angler harvest	Spawning escapement: TRH f/	Expanded TRH	River	Expanded River	Escapement Total	Expanded total
Spring Chinook													
Adults													
065347	06	5	4.19	1.49	6.26	0.0	0	1.01	4.22	0.49	2.04	1.49	6.26
065348	06	5	4.23	2.97	12.57	0.0	0	2.01	8.49	0.96	4.08	2.97	12.57
065349	06	5	4.13	1.49	6.17	0.0	0	1.01	4.15	0.49	2.01	1.49	6.17
065360	06	5	4.01	41.69	167.18	0.0	0	28.20	113.10	13.49	54.09	41.69	167.18
068801	07	4	4.03	32.75	131.97	0.0	0	22.15	89.25	10.60	42.72	32.75	131.97
068802	07	4	4.12	53.64	220.98	0.0	0	36.28	149.49	17.35	71.50	53.64	220.98
068803	07	4	4.09	41.59	170.09	0.0	0	28.13	115.05	13.46	55.04	41.59	170.09
068810	07	4	4.02	424.38	1,706.02	0.0	0	287.05	1,153.94	137.33	552.08	424.38	1,706.02
068811	08	3	4.05	142.79	578.28	0.0	0	96.58	391.15	46.21	187.13	142.79	578.28
068812	08	3	4.07	303.30	1,234.43	0.0	0	205.15	834.96	98.15	399.47	303.30	1,234.43
068813	08	3	4.13	189.34	781.98	0.0	0	128.07	528.92	61.27	253.06	189.34	781.98
068819	08	3	4.09	81.98	335.29	0.0	0	55.45	226.78	26.53	108.52	81.98	335.29
			Total adult	1,317.41	5,351.23	0.0	0	891.08	3,619.50	426.33	1,731.73	1,317.41	5,351.23
Jacks													
068821	09	2	4.15	426.57	1,770.19	5.9	24.60	243.43	1,010.20	177.21	735.39	1.00	1,745.59
068822	09	2	4.18	478.65	2,000.74	6.7	27.81	273.15	1,141.77	198.84	831.17	1.00	1,972.93
068831	09	2	4.21	65.34	275.19	0.9	3.82	37.29	157.04	27.15	114.32	1.00	271.36
068832	09	2	4.21	70.74	297.94	1.0	4.14	40.37	170.03	29.39	123.77	4.00	293.80
068836	09	2	4.09	36.96	150.99	0.5	2.10	21.09	86.17	15.35	62.72	7.00	148.89
			Total Jacks	1,078.26	4,495.06	15.0	62.48	615.33	2,565.20	447.94	1,867.38	14.00	4,432.58
	Total spring Chinook			**2,395.67**	**9,846.29**	**15.0**	**62.48**	**1,506.41**	**6,184.70**	**874.27**	**3,599.11**	**1,331.41**	**9,783.81**
Fall Chinook													
Adults													
065350	06	5	4.24	4.67	19.81	0.1	0.37	2.03	8.61	2.55	10.83	4.58	19.44
065351	06	5	4.21	2.37	9.97	0.0	0.19	1.03	4.33	1.30	5.45	2.32	9.78
065361	06	5	4.05	39.55	160.18	0.7	3.00	17.19	69.61	21.62	87.57	38.81	157.18
068804	07	4	4.03	25.60	103.18	0.5	1.93	11.13	44.84	14.00	56.41	25.12	101.25
068805	07	4	4.08	20.99	85.64	0.4	1.60	9.12	37.22	11.48	46.82	20.60	84.04
068806	07	4	4.05	32.67	132.30	0.6	2.47	14.20	57.49	17.86	72.33	32.06	129.82
068807	07	4	4.03	30.31	122.16	0.6	2.29	13.17	53.09	16.57	66.79	29.75	119.87
068808	07	4	4.02	27.94	112.33	0.5	2.10	12.14	48.81	15.28	61.41	27.42	110.23
068809	07	4	4.07	678.64	2,762.07	12.7	51.65	294.93	1,200.34	371.03	1,510.08	665.95	2,710.42
065356	08	3	4.03	60.39	243.38	1.1	4.55	26.25	105.77	33.02	133.06	59.26	238.83
065357	08	3	4.03	46.44	187.15	0.9	3.50	20.18	81.33	25.39	102.32	45.57	183.65
065358	08	3	4.03	60.62	244.31	1.1	4.57	26.35	106.17	33.14	133.57	59.49	239.74
065359	08	3	4.00	78.87	315.46	1.5	5.90	34.27	137.10	43.12	172.47	77.39	309.56
068814	08	3	4.08	656.70	2,679.34	12.3	50.10	285.39	1,164.39	359.03	1,464.85	644.42	2,629.24
068815	08	3	4.07	652.00	2,653.62	12.2	49.62	283.35	1,153.21	356.46	1,450.79	639.80	2,604.00
068816	08	3	4.02	506.59	2,036.49	9.5	38.08	220.15	885.02	276.96	1,113.39	497.12	1,998.41
068817	08	3	4.03	411.18	1,657.07	7.7	30.99	178.69	720.13	224.80	905.95	403.49	1,626.08
068818	08	3	4.05	355.23	1,438.69	6.6	26.90	154.38	625.23	194.21	786.55	348.59	1,411.78
068820	08	3	4.02	3,202.56	12,874.28	59.9	240.75	1,391.77	5,594.91	1,750.90	7,038.62	3,142.67	12,633.53
06080800	08	3	3.98	48.86	194.44	0.9	3.64	21.23	84.50	26.71	106.31	47.94	190.81
06080801	08	3	4.03	6.99	28.17	0.1	0.53	3.04	12.24	3.82	15.40	6.86	27.64
			Total adult	6,949.17	28,060.04	130.0	524.73	3,019.97	12,194.34	3,799.25	15,340.96	6,819.22	27,535.31
Jacks													
068823	09	2	4.19	330.76	1,385.47	8.5	35.73	116.38	487.47	205.85	862.26	322.23	1,349.74
068824	09	2	4.09	252.96	1,035.76	6.5	26.71	89.00	364.43	157.43	644.62	246.43	1,009.05
068825	09	2	4.07	77.42	315.45	2.0	8.14	27.24	110.99	48.18	196.32	75.42	307.31
068826	09	2	4.11	34.54	142.05	0.9	3.66	12.15	49.98	21.49	88.40	33.64	138.38
068827	09	2	4.06	22.86	92.83	0.6	2.40	8.05	32.66	14.23	57.77	22.27	90.43
068828	09	2	4.03	51.73	208.57	1.3	5.38	18.20	73.38	32.19	129.81	50.39	203.19
068833	09	2	4.53	2.88	13.04	0.1	0.34	1.01	4.59	1.79	8.12	2.80	12.71
068834	09	2	4.53	2.86	12.97	0.1	0.34	1.01	4.57	1.78	8.07	2.79	12.64
068837	09	2	4.03	399.56	1,609.18	10.3	41.50	140.59	566.18	248.68	1,001.50	389.26	1,567.68
			Total Jacks	1,175.56	4,815.31	30.3	124.18	413.62	1,694.25	731.63	2,996.87	1,145.25	4,691.13
		Total fall Chinook		**8,124.73**	**32,875.35**	**160.3**	**648.91**	**3,433.59**	**13,888.59**	**4,530.87**	**18,337.84**	**7,964.46**	**32,226.43**

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.

increasing in frequency) can cause us to miss segments of the fall Chinook run at WCW, potentially affecting our fall CWT estimates. Though there were some storms in early October, and an incumbent decrease in effort, the peak of the fall run Chinook appears to have passed (see Task 1, Table 2, Figure 7).

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 2011 carcass surveys (Task 4) appeared generally consistent with TRH recoveries; with the exception of a single release group (068809) which returned in strong numbers to the hatchery, but were completely, and inexplicably, unrepresented in the carcass survey.

Estimated in-river 2006 BY spring Chinook return rates of TRH fingerlings (0.10%) were meager in comparison to the 21 year data set average of 0.51 percent, though the yearlings (1.30%) were slightly above the 1.07 percent average (Appendix 1). Estimated fall Chinook 2006 BY fingerling in-river returns were, at 0.17 percent, about half of the 21 year mean of 0.33 percent. The fall Chinook yearling releases fared better, returning at a rate of 1.36 percent, only slightly less than the 1.55 percent average (Appendix 2).

The 2009 BY fingerling release groups of spring Chinook returned in their first year at an extraordinary rate, ranging from 0.582 to 0.903 percent (Table 3). This will be a BY to watch in coming years.

The contribution of hatchery-produced spring Chinook to total run-size was estimated at 51.2 percent of the run upstream of Junction City weir (Appendix 3). Similarly, the contribution of hatchery-produced fall Chinook to total run-size, upstream of Willow Creek weir, was estimated at 40.1 percent (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 2012-13.

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. Collect information and report on CWT recoveries from Klamath basin in-river and ocean recreational, and Tribal net fisheries.

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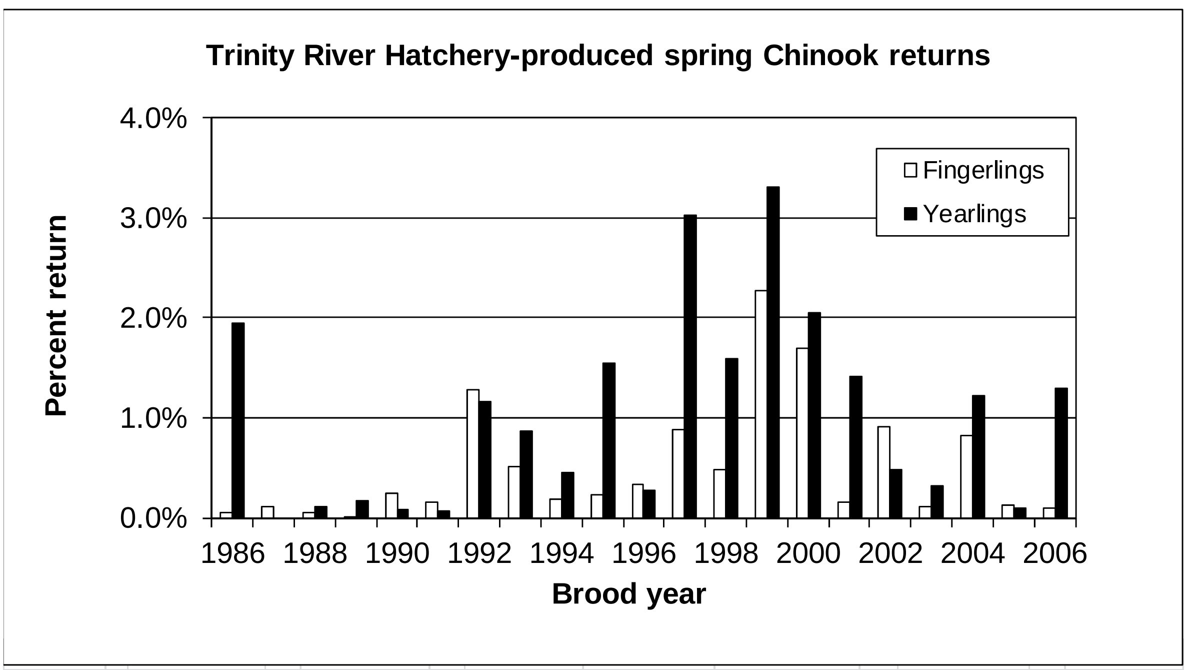
APPENDICES

Appendix 1. Percent return of Trinity River Hatchery-produced, coded-wire tagged, spring Chinook salmon, brood years 1986-2006. [a]

	Fingerling releases			Yearling releases		
Brood year	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%
Means:	210,394	1,072	0.51%	110,164	1,254	1.07%

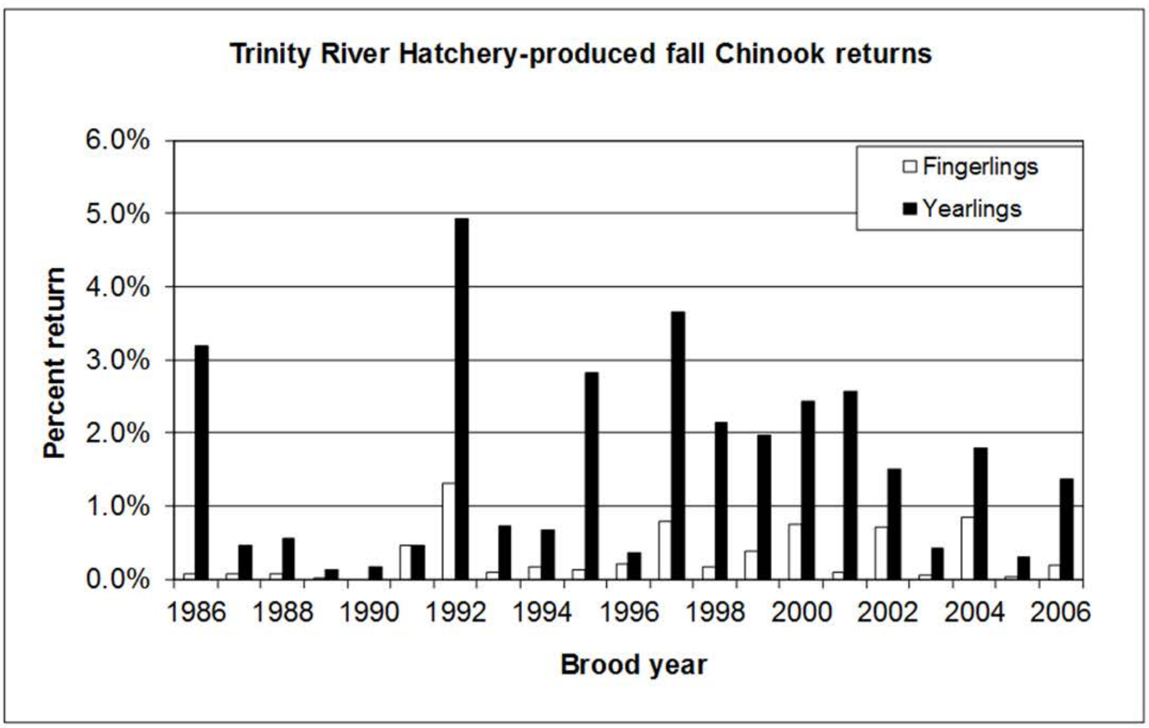
a/ Based on estimated returns upstream of Junction City weir. No estimate was produced in 1995, therefore returns of age 2 through 5 Chinook from that year are hatchery returns only. Does not include ocean harvest, in-river harvest, and escapement below Junction City weir.



Appendix 2. Percent return of Trinity River Hatchery produced, coded wire tagged fall Chinook, brood years 1986 – 2006.

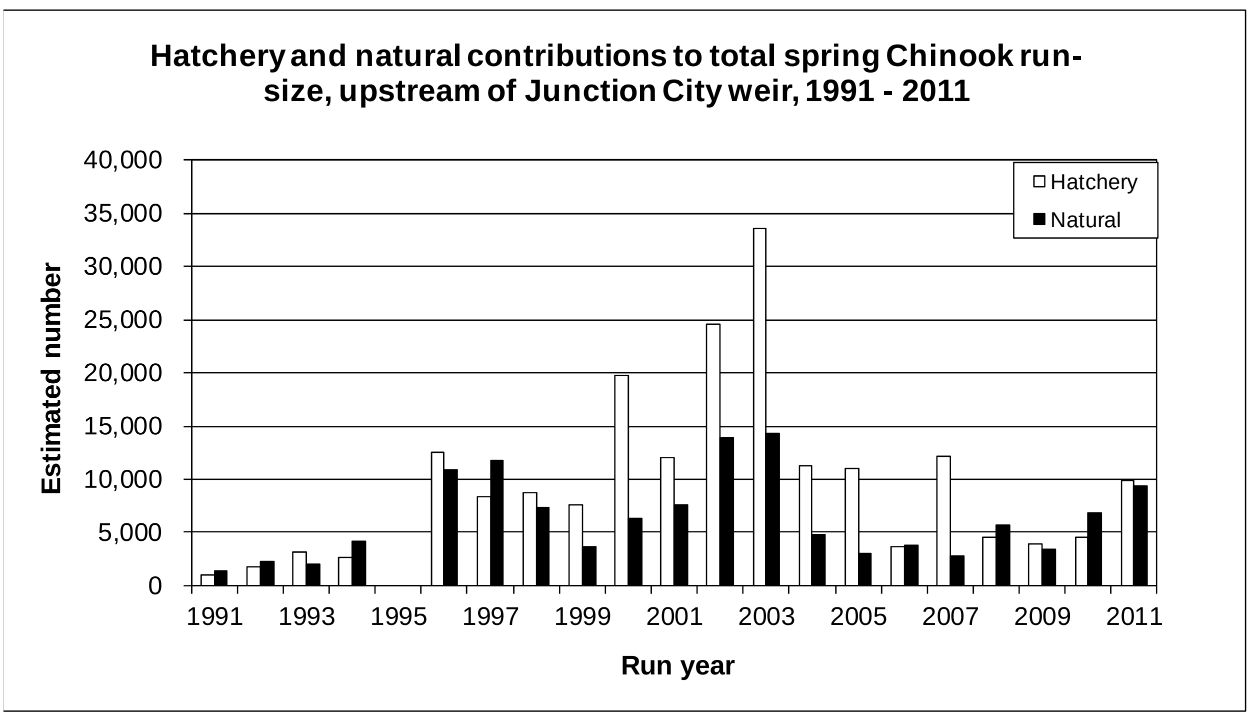
	Fingerling releases			Yearling releases		
Brood year	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	393,955	292	0.07%	153,700	4,899	3.19%
1987	172,980	129	0.07%	92,300	418	0.45%
1988	194,197	138	0.07%	143,934	796	0.55%
1989	201,622	21	0.01%	143,978	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%
Means:	316,138	1,067	0.33%	183,123	3,108	1.55%

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



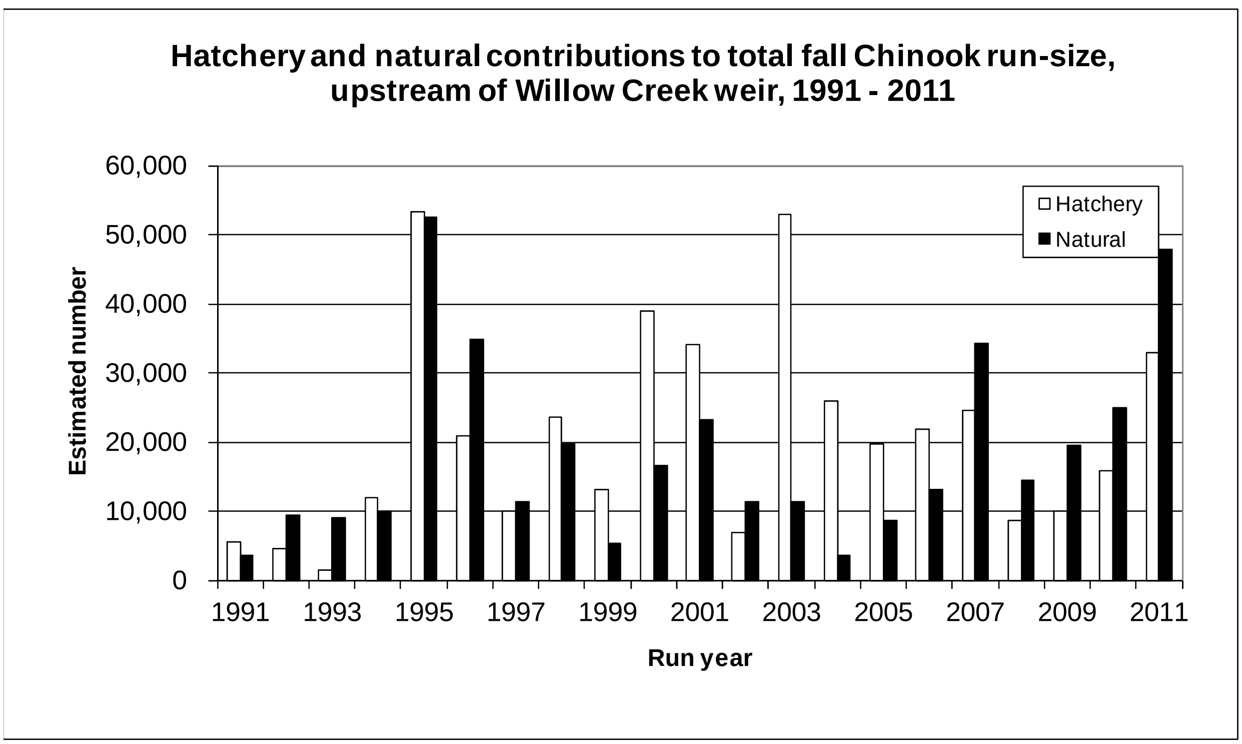
Appendix 3. Estimated contributions of Trinity River Hatchery-produced, spring Chinook salmon to total estimated run-size above Junction City weir, 1991-2011 seasons.

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%
Means:	16,100	9,838	6,262	57.2%



Appendix 4. Estimated contribution of Trinity River Hatchery produced fall Chinook to total estimated run-size above Willow Creek weir, 1991 – 2011.

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%
Means:	39,098	20,782	18,316	51.6%



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ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2011-12 SEASON

TASK 3
RELATIVE RETURN RATES AND CONTRIBUTIONS TO SPAWNING ESCAPEMENT MADE BY NATURALLY AND HATCHERY PRODUCED COHO SALMON IN THE TRINITY RIVER BASIN

by

Steve Cannata

ABSTRACT

This report provides the 2011 update for annual monitoring of run-size and escapement of naturally and hatchery produced coho salmon (*Oncorhynchus kisutch*) returning to the Trinity River upstream of Willow Creek, California. Annual monitoring of coho escapement contributes short-term and long term data needed to evaluate progress towards Trinity River Restoration Program (TRRP) goals to increase anadromous salmon populations (USDOI 2000 and TRRP 2009).

The monitoring efforts utilize Petersen type mark-recapture procedures to generate annual run-size estimates of naturally and hatchery produced coho salmon. For the 2011-12 spawning season, we estimate a run-size of 15,040 coho [95 % confidence interval (CI): 12,562 to 18,249] returned to the Trinity River, upstream of the Willow Creek weir (WCW). The run was composed of approximately 9,722 jacks (age 2) and 5,318 adult (age 3) coho. Approximately 91 percent (13,627 fish) of the run was composed of coho propagated and released from Trinity River Hatchery (TRH). These include 4,575 counted at TRH and an escapement estimate of 9,009 TRH stock to natural spawning areas. In addition, one TRH produced jack was reported harvested by a sport angler which represented an estimated expanded harvest of 44 jacks for the year. Escapement targets are for 2,100 adult coho to return to the TRH. The 2011-12 coho escapement to TRH was well above target returns.

We estimate naturally produced coho escapement at 1,413 (1,205 adults and 208 jacks) fish with 235 (21 jacks and 214 adults) of these entering TRH. The naturally produced coho escapement to natural areas estimate is 187 jacks and 991 adults. The TRRP escapement goal of naturally produced adult coho is 1,400 adult fish. The 2011-12 escapement of 1,205 naturally produced adult coho is the largest in the last five years, but is below the TRRP goal.

We estimate 0.30 percent of BY 2008 TRH coho returned as two-year-olds in 2010-2011 and 0.99 percent returned as three-year-olds in 2011-2012 for a total TRH BY 2008 return of 1.29 percent. We estimate 1.94 percent of the TRH BY 2009 coho returned as two-year-olds in the 2011-2012 season. In-river run estimates do not include ocean fishery impacts, in-river tribal fishery impacts or in-river sport fishery impacts downstream of WCW.

In April 2012, approximately 491,000 yearling coho of the 2010 BY were marked with right maxillary clips and released from TRH.

TASK OBJECTIVE

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

INTRODUCTION

A fundamental objective of the Trinity River Restoration Program (TRRP) is to increase natural production of anadromous salmonid populations in the Trinity River. Trinity River flow release management strategies from Lewiston Dam and habitat restoration efforts are means in use by TRRP intended to increase in natural fish production. Monitoring the number of adults returning to spawn for key species such as coho salmon (*Oncorhynchus kisutch*) provides essential short-term feedback to TRRP management actions and evaluation of long-term natural fish production objectives (TRRP 2009).

The California Department of Fish and Game’s (CDFG) Trinity River Project (TRP) staff use Peterson type mark-recapture methods to generate annual coho run-size population estimates. This report updates the existing baseline with results from the 2011-12 spawning season. Annual coho monitoring data has been reported by TRP since 1977. The coho escapement data are particularly important because Trinity River coho are listed as “threatened” under both the federal and State endangered species acts. Current status and trend information collected from the Trinity River adds to efforts monitoring recovery of the species.

The Trinity River coho population is composed of both hatchery 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 dams block access to approximately 177 river kilometers [(rkm) 110 miles] of salmonid spawning and rearing habitat. The Trinity River Hatchery (TRH) was built at the base of Lewiston Dam to mitigate for the loss of salmonid production including an estimated 5,000 adult coho. Current mitigation goals for TRH are to annually raise 500,000 yearling coho salmon. Coho juveniles are released in March after rearing for 14-15 months. A project objective is to mark 100 percent of the juvenile coho with right maxillary (RM) clips prior to their release from the TRH. This enables separate run-size estimates for both hatchery and natural coho stocks.

Naturally produced stocks are considered offspring from fish that spawn in natural areas within the main-stem and tributary reaches throughout the Trinity River downstream of Lewiston Dam. The annual natural coho escapement target set by the TRRP is 1,400 adult fish.

METHODS

Run-size and Escapement Estimates

Coho run-size is estimated by Peterson type mark-and-recapture methods. Upstream migrating coho are marked with spaghetti tags (tags) at the WCW and recaptured and inspected for weir tags at the TRH. Trapping and tagging operations at the WCW were conducted August 20, 2011 to November 22, 2011. Coho trapped at the weir are enumerated, inspected for maxillary clips (indicating TRH stock) and measured to fork-length (FL). The ratio of natural to TRH stocks observed at WCW is used in the analysis to estimate the natural escapement.

All coho entering TRH are counted, inspected for tags and measured to the nearest centimeter (cm) fork length (FL). Coho were collected at TRH from the week of October 1, 2011 to the week of January 8, 2012. The fish are stratified into jacks and adult classes based on analyses of length frequency distribution. A detailed description of mark and recapture methods, the population estimator used, and the assumptions underlying the validity of run-size estimates are provided in Task 1 of this report. To estimate the contribution of TRH-produced coho to run-size, escapement and in-river angler harvest above WCW, the following information is required:

1. Marking of coho production released from TRH.
2. Recovery totals of marked and unmarked coho returning to TRH.
3. Total coho run-size above WCW.
4. The percentage of marked coho salmon observed at WCW.
5. In-river angler harvest rates on coho above WCW.
6. Specific age class determinations.

Additionally, we assume that coho right-maxillary clips do not regenerate and that the mark is recognizable.

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

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

N_{RM} = the estimated number of coho above WCW with a right-maxillary clip;
NW_{RM} = the number of coho observed at WCW that were right-maxillary clipped;
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 un-marked coho above the weir we use the equation:

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

where, N_N = the estimated number of naturally produced coho above WCW.

The size separating jacks and adult coho is determined by length frequency analysis using WCW and TRH data sets. The number of jacks and adults in the coho run was determined by multiplying the proportion of each observed at WCW times the total run-size estimate. The number of RM coho for each age strata is estimated by multiplying the ratio of marked to unmarked coho observed at Willow Creek weir with the total age stratified run-size estimate. The remaining coho are considered naturally produced.

Coho harvest rate estimates are developed using angler tag return data presented in Task 1. Harvest rates are applied to the age stratified coho run to produce a harvest estimate. The estimate is apportioned to either RM clipped or naturally produced coho based on tag returns. Coho 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 Trinity River Hatchery escapement and natural escapement. Hatchery escapement is a direct count of RM clipped and unmarked coho that entered TRH, while natural escapement is estimated by the following equation:

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

where $N_{Naturalescapement}$ = the estimated number of coho 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-marked and unmarked coho.

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 and 2010b.

Juvenile Coho Marking at Trinity River Hatchery

Estimates of natural and TRH coho stock run-size and escapement involves several steps beginning with an objective to mark all TRH produced fish with right-maxillary clips prior to their release from the hatchery. Marking TRH yearling coho is performed by CDFG personnel in a marking shed placed parallel to the raceways. The shed is moved along raceways with a fork lift, utilizing slots in each shed for this purpose. Raceways containing coho are segregated with removable barriers to isolate clipped from un-marked coho.

Coho are anaesthetized with carbon dioxide and their right maxillary (RM) bone removed with a pair of sharp surgical scissors. Marked fish are tallied with a manual counter and returned to hatchery raceways. Observed mortalities of marked coho are counted and subtracted from the daily effectively marked total.

To determine overall marking success, we examine a sample of approximately two percent of the marked coho just prior to their release into the river. These fish are anaesthetized with carbon dioxide, measured to the nearest millimeter (mm) fork length (FL), and checked for quality of the maxillary clip. If more than 3/4 of the bone was excised it is considered a good clip; less than that is considered a poor clip and the fish is re-clipped. Fish with no clips are counted, then clipped and returned to the raceway. After two percent of the fish are examined the total number of non-clips is divided by the total sample x 100 to obtain the percent marking error.

RESULTS

Run-size and Escapement Estimates

Three hundred sixty-two coho were trapped at the WCW in 2011. The first coho was trapped September 8 and the last coho of the season was trapped November 18. The mark-recapture sample population included 346 effectively tagged coho. Coho were trapped and inspected for weir tags at the TRH from October 1 through the week of January 1, 2012. Recoveries at the TRH totaled 4,810 coho of which 110 were (recaptures) marked with WCW tags. Using the Peterson type mark-recapture formula, we estimate the total coho run-size for the 2011-12 season above WCW was 15,040 coho [95 % confidence interval (CI): 12,562 to 18,249] fish.

For the 2011-12 spawning season the size separating jacks and adults was determined at 58 cm FL (Task 1). We estimate 229 jacks and 99 adults with RM clips were captured and marked at the WCW. Five jacks and 29 adults tagged in the WCW sample were without RM clips (indicating they were most likely from natural production). In total, we observed 90.6 percent of the coho trapped at the WCW had right maxillary-clips, which indicates the proportion of TRH fish in the run-size estimate. Therefore, we estimate the run consisted of 13,627 TRH-produced fish (9,514 jacks and 4,113 adults) and 1,413 naturally-produced fish (208 jacks and 1,205 adults). The adult escapement of 1,205 coho is below the TRRP escapement goal of 1,400 adults.

A total of 235 coho (21 jacks and 214 adults) without RM clips (naturally produced) entered TRH and an estimated 1,178 naturally produced coho (187 jacks and 991 adults) returned to natural areas. We estimate 9,009 coho (6,606 jacks and 2,403 adults) produced at TRH also escaped to natural areas while 4,575 (2,865 jacks and 1,710 adults) TRH produced coho returned to the hatchery (Table 1).

Table 1. Run-size, in-river sport catch, and spawner escapement estimates for naturally- and Trinity River Hatchery-produced coho salmon, upstream of Willow Creek weir during the 2011-12 season.

				Angler	Spawning escapement	
Strata	BY a/	Age b/	Run-size	harvest	TRH c/	Natural area
Naturally-Produced	2009	2	208	0	21	187
	2008	3	1,205	0	214	991
		Totals:	1,413	0	235	1,178
TRH-Produced	2009	2	9,514	44	2,865	6,606
	2008	3	4,113	0	1,710	2,403
		Totals:	13,627	44	4,575	9,009
	Grand totals:		15,040	44	4,810	10,186

a/ BY=Brood year
b/ Age classes are determined using fork length frequency analysis.
c/ TRH=Trinity River Hatchery

One weir tag removed from a coho salmon was returned by a sport angler in 2011. The fish was a jack produced at the TRH and based on the angler tag return rate it represents harvest of 44 jacks. Therefore the escapement of coho jacks is less than the run-size by 44 fish. Although the sport take of coho, a state and federally listed threatened species on the Trinity River, has been prohibited since 1995; some fish are occasionally harvested by anglers due to mistaken identity or a lack of knowledge of the law.

After their return to spawn in 2011, coho from the 2008 BY completed their typical three-year life cycle. Based on age three coho run-size estimates presented above (Table 1) and age two estimates for 2010, the percent return rate for 2008 BY TRH-produced coho was 1.29 percent. Estimated spawning escapement of 2008 BY TRH-produced coho consisted of 2,226 (41.7%) fish that entered TRH and 3,110 (58.3%) fish estimated to have spawned in natural areas (Table 2). This (2011) is the first year for returns of the TRH produced coho from the 2009 BY. The percent return of age 2 coho from the 2009 BY coho was 1.93%. These fish will return during the 2011-12 season as three-year-olds. Annual run-size estimates for TRH produced coho jacks and adults

1997-2011 are presented in Figure 2. A recent history of coho population parameters is presented in Tables and Figures A1-A7 in the Appendix.

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 2011- 12 season.

Release Data					Estimated Returns						
	Brood						% of	River	Spawning Escapement		
Clip a/	Year	Date	Number b/	Site	Age c/	Run-size	release	harvest	TRH d/	Natural	Total
RM	08	3/16-20/09	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
RM	09	4/6-8/10	490,839	TRH	2	9,514	1.93	44	2,865	6,606	9,471

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

Trinity River Project personnel performed RM clips on BY 2010 yearling coho. We began marking coho in January and finished in early March, 2012. Post clipping mortalities totaled 128 fish. We conducted a quality control check to determine our clipping effectiveness for coho March 4 - 9, 2012. We measured and examined approximately 2% of the coho in each raceway. The percentage of coho with proper clips within each raceway ranged from 99.9% to 100% and averaged 99.9% for the 10,058 fish examined. Based on these data we estimate that 488,716 coho were effectively clipped and released (Table 3). Coho averaged 159 mm FL and ranged in size from 80 to 289 mm FL. We estimate that 149 unmarked coho were released for a total release number of 490,988 fish. All BY 2010 coho were volitionally released from TRH March 15 – 28, 2012. These fish are expected to return as jacks and adults in 2012 and 2013, respectively.

Table 3. Production, marking totals, and quality control data for 2010 brood year coho salmon reared at Trinity River Hatchery and volitionally released March 15 through March 28, 2012.

	Hatchery raceway							
	G3-4	M1-2	M3-4	N1-2	N3-4	O1-2	O3-4	Totals
Marking totals								
Number clipped	64,059	66,665	69,974	70,643	71,297	75,060	75,146	488,844
Post-clip mortalities	1	12	11	28	21	25	30	128
Total marked	64,058	66,653	69,963	70, 615	71,276	75,035	71,116	488,716
Quality control parameters								
Number examined	1,328	1,347	1,394	1,541	1,426	1,421	1,503	9,777
Number without clips	0	6	3	4	0	0	0	13
Un-clipped ratio	0.00	0.00450	0.0022	0.0026	0.0000	0.0000	0.0000	0.0013
Mean fork length (mm)	146.1	140.9	143.8	144.2	140.0	146.3	143.8	143.4
Fork length range (mm)	80 - 285	98 - 258	104 - 261	98 - 250	89 - 2288	98 -290	79 -230	79 - 290
Release totals								
Clipped releases	60,058	66,653	69,963	70,615	71,276	71,035	75,116	488,716
Un-clipped releases	0	297	151	183	0	0	50	632
Percentage clipped	100.00%	99.55%	99.74	99.74%	100%	100.00%	100%	99.87%
Total released	64,058	70,661	70,114	70,951	71,276	71,035	75,116	489,348

DISCUSSION

The 2011-12 coho run-size estimate of 15,040 fish is ranked eighth largest (median value) among the past fifteen coho spawning seasons. The total annual run-size estimates of coho salmon returning since 1997 have ranged from approximately 5,400 to 38,000 fish (mean and 95% CI = 16,881 ± 6034). The 2011-12 escapement of 1,205 naturally produced adult coho is the largest in the last five years, but is below the TRRP goal of 1,400 adults and is below a multi-year trend line (Figure A-2). Since 1997 the annual escapement estimate of natural coho to natural areas has ranged from 232 to 7,830 and met or exceeded the TRRP target in five years [i.e. 2001, 2003, 2004, 2005 and 2006 (Figure A-6). The annual escapement goal of 2,100 TRH-produced adult coho has been exceeded each year since 1998.

Hatchery produced coho continued (as in past years) to return as jacks at a much higher rate than naturally produced fish. This year's coho run was composed of 65 percent jacks with 98.6 percent of these produced by TRH. Only 208 naturally produced coho jacks returned in 2011-12 which comprised 1.4 percent of the total run and 14.7 percent of the natural production.

Several factors may influence natural coho production in the Trinity River, including the loss of juvenile rearing areas, TRRP management actions, and interactions with hatchery stocks. In addition, ocean conditions play a large role in coho production. Because escapement of TRH coho has also declined in recent years, similar factors may be acting on both hatchery and natural coho stocks (Figures A-1 – A-6).
In all but four years, including this year, the estimated number of hatchery-produced coho that spawned in natural areas has surpassed those that entered TRH (Table A-1 and Figure A-5). This indicates that TRH-produced coho stray at substantial rates. Our main stem carcass surveys (Task 4) have demonstrated that, similar to TRH-produced Chinook, TRH-produced coho do spawn outside of the facility and that coho carcass recoveries are greatest in areas near TRH.

For the 2011 season we recovered 261 coho carcasses during carcass surveys along the main stem Trinity River (Task 4). Of these, 163 (62.5%) were RM clipped indicating they were of TRH origin. 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 percent marked) has consistently shown that the marked percentage of coho has been substantial, 77 to 94 percent of the total estimated (Appendix 1). This season we estimated that approximately 91 percent of the run was composed of TRH-produced coho. While interactions with TRH stocks are viewed as detrimental to natural coho for many reasons the hatchery 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).

Total life cycle in-river returns of the 2008 coho BY produced at TRH was estimated at 1.3 percent. This is the fourth lowest in-river return rate over the last thirteen coho cohort cycles (Appendix 1). Return rates have ranged from a low of 0.98 percent for BY 2004 coho to 6.61 percent for BY 2001 coho. Return rates of coho to the Trinity basin, unlike Chinook salmon, are in theory minimally affected by commercial and sport harvest, since the take of coho has been prohibited in these fisheries since 1994. The Native American gill-net fisheries may harvest substantial numbers of coho, but it is doubtful that this harvest rate approaches historical harvest rates for all combined fisheries (ocean sport, commercial, in-river sport, and gill-net).

A potential source of estimate bias, not trapping through the entire coho run, could be a factor. The weir was removed on November 21 due to high flows, however and our trapping data indicates that no coho were trapped over the last three days of weir operations. Since our efforts represent the majority of work to quantify the hatchery vs. wild runs and survival and contribution rates of returning coho, we feel it is important to present the available information. It must be noted that any bias in coho run-size estimates would be reflected in natural areas since the number entering the hatchery are actual counts.

RECOMMENDATIONS

1. Continue marking all hatchery coho stocks
2. Continue mark-recapture population study using WCW
3. Study hatchery interactions with natural coho stocks
4. Perform life-cycle monitoring of natural coho stocks
5. Coho management for the Trinity River should be consistent with federal and state strategies and objectives

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APPENDICES

Table A-1. Naturally 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 1997-2011.

					Spawner Escapement								
Run		Run-size Estimate			Natural			Trinity River Hatchery			Angler harvest		
year	Strata	Grilse	Adults	Total	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	208	1,205	1,413	187	991	1,178	21	214	235	0	0	0
	TRH	9,514	4,113	13,627	6,606	2,403	9,009	2,865	1,710	4,575	44	0	44

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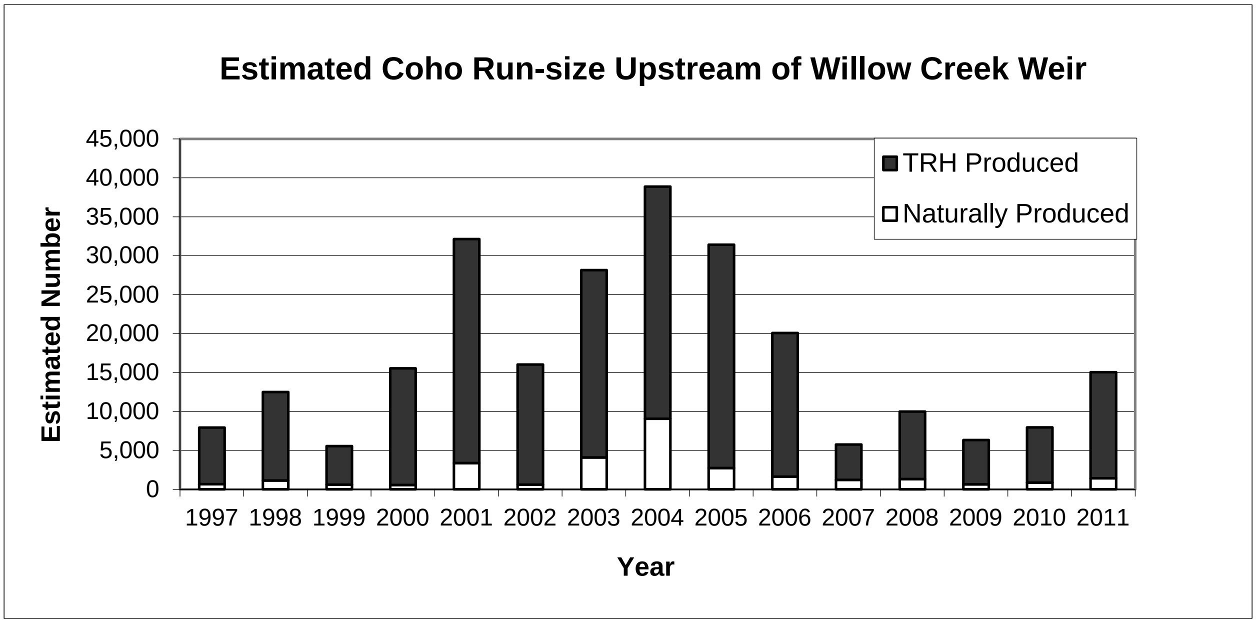

Figure A-1. Annual coho salmon run-size estimates upstream of Willow Creek weir, 1997-2011.

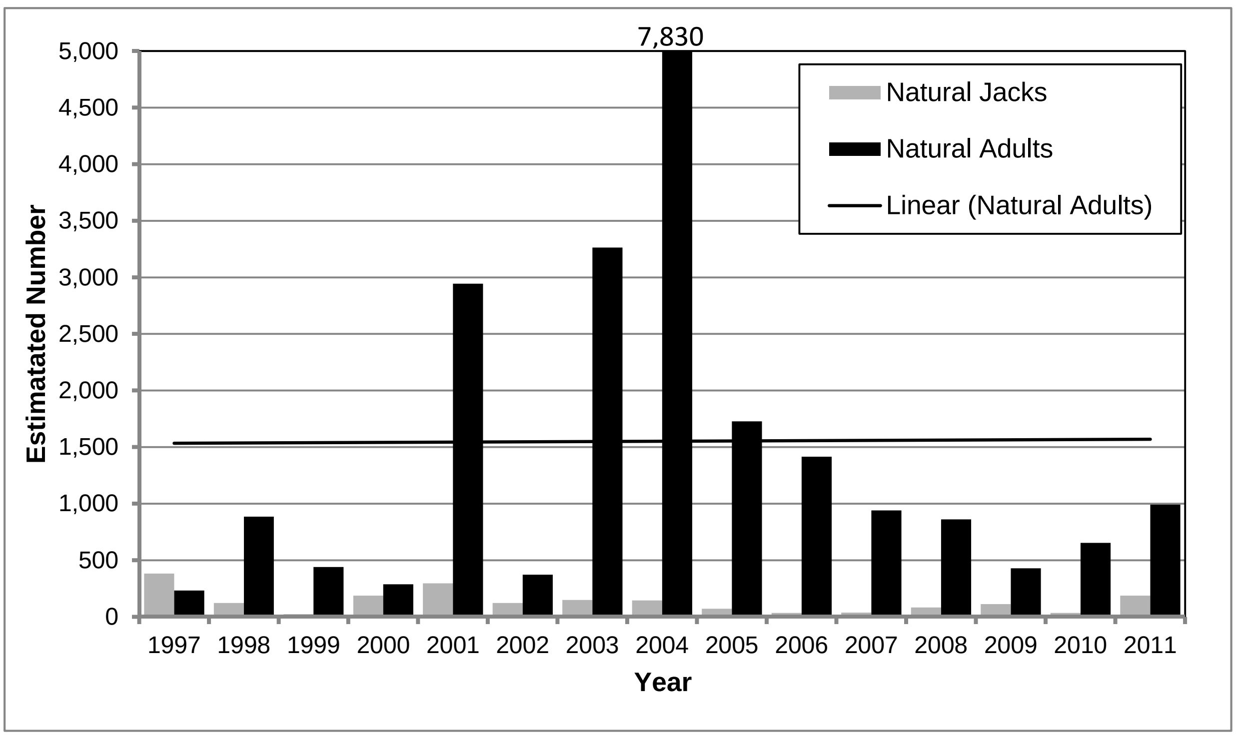

Figure A-2. Escapement estimates of naturally produced adult and jack coho salmon to natural areas above Willow Creek weir 1997-2011. Naturally produced adult escapement estimates to natural areas have ranged from 232 in 1997 to 7,830 in 2004 (mean and 95% CI 1,552 ± 1,087). The 2011 escapement is below the multi-year trend, but is the highest return since 2006.

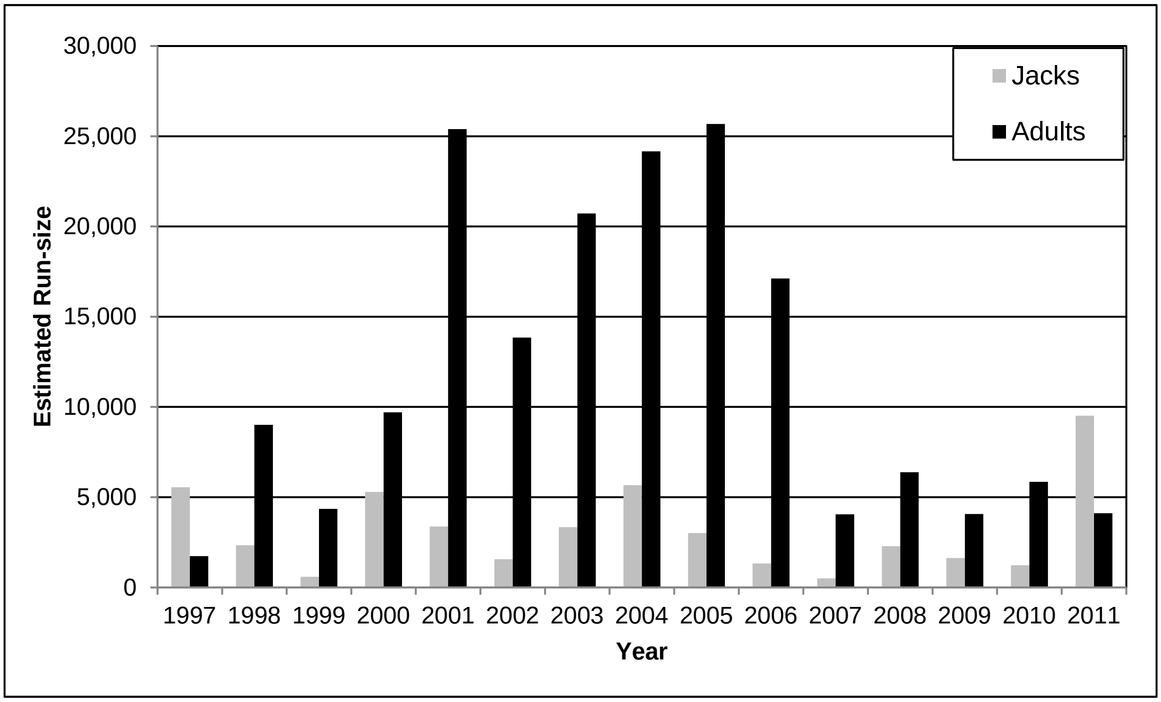

Figure A-3. Annual run-size estimates of Trinity River Hatchery (TRH) produced coho salmon returning to TRH and to the Trinity River above Willow creek weir, 1997 – 2011.

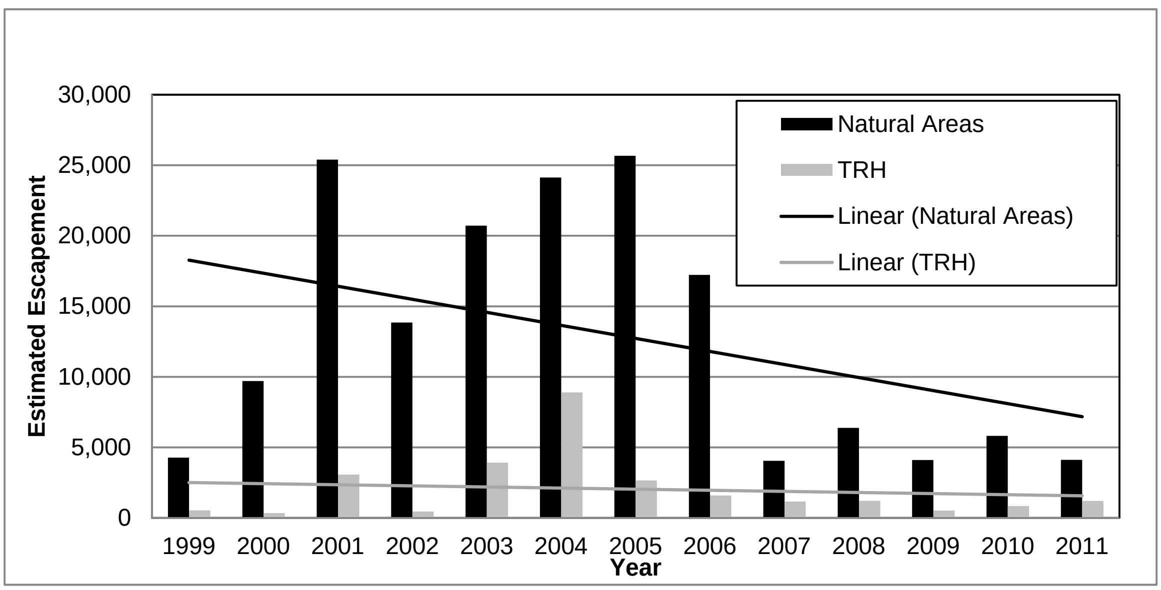

Figure A-4. Total adult coho escapement estimates to Trinity River natural areas above Willow Creek weir and to Trinity River Hatchery, 1999-2011. The trend line shows little change in escapement trajectory to the hatchery, and a decline in escapement to natural areas.

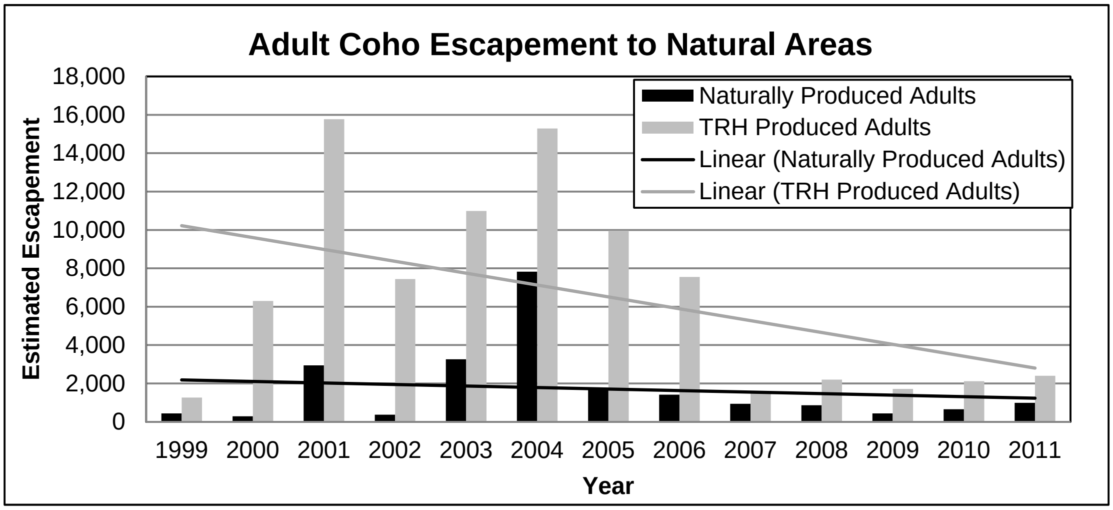

Figure A-5. Adult escapement of naturally produced and hatchery produced coho to Trinity River natural areas above Willow Creek weir 1999-2011.

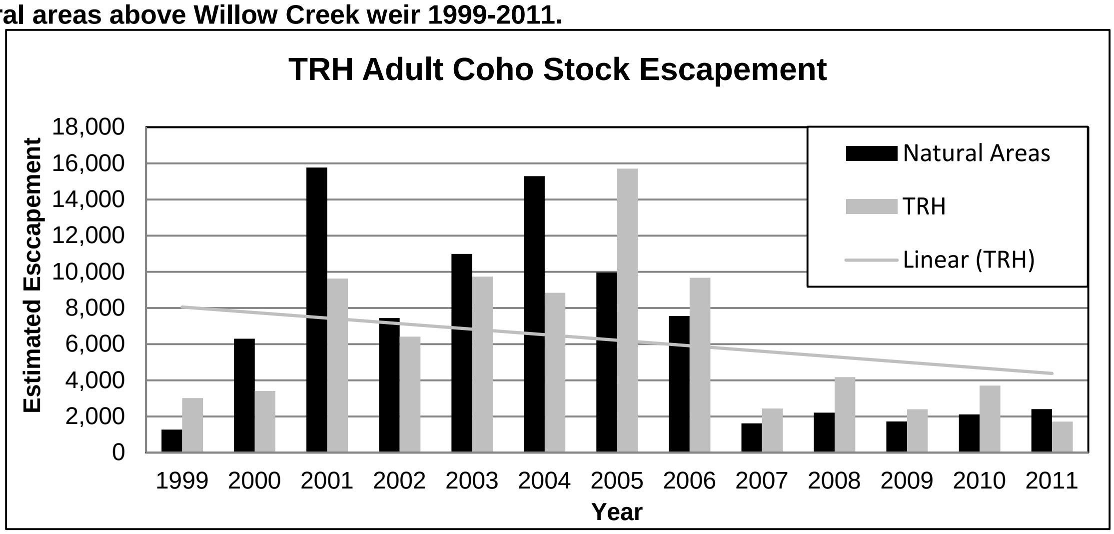

Figure A-6. Adult escapement of Trinity River Hatchery produced coho stocks to natural areas of the Trinity River above Willow Creek weir (trend) and Trinity River Hatchery 1999 – 2011.

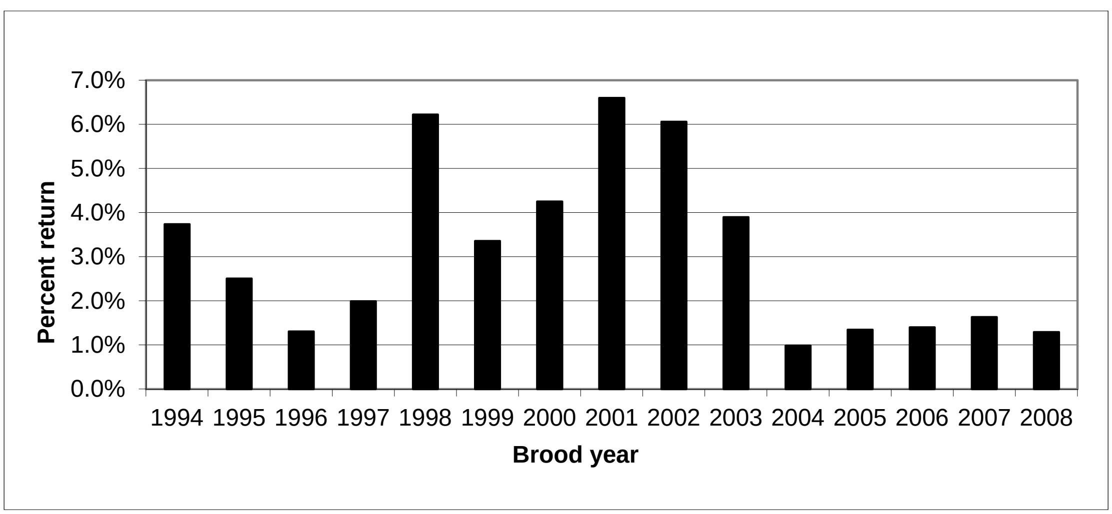

Figure A-7. Percent return for Trinity River Hatchery coho salmon brood years 1994-2008.

Appendix 2. Run-size, harvest and spawner escapement estimates for right maxillary clipped, Trinity River Hatchery-produced coho salmon returning to the Trinity River, upstream of Willow Creek weir, brood years 1994-2008.

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	6381
				Totals:	6,884	1.34%	0	4,447	2,437	6,884
2006	3/15-20/08	455,482	TRH	2	2,290	0.50%	0	643	1,647	2,290
				3	4,067	0.89%	0	2,386	1,681	4,067
				Totals:	6,357	1.40%	0	3,029	3,328	6,357
2007	3/16-20/09	457,478	TRH	2	1,645	0.36%	0	871	774	1,645
				3	5,852	1.28%	0	3,706	2,146	5,852
				Totals:	7,497	1.64%	0	4,577	2,920	7,497
2008	4/6-8/10	413,178	TRH	2	1,233	0.30%	0	516	707	1,233
				3	4,113	0.99%	0	1,710	2,403	4,113
				Totals:	5,346	1.29%	0	2,226	3,110	5,336

ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2011 SEASON

TASK 4
CHINOOK SALMON SPAWNING SURVEYS IN THE UPPER TRINITY RIVER

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by

Andrew Hill

ABSTRACT

The California Department of Fish & Game's Trinity River Project in cooperation with the Yurok Tribal Fisheries Program, Hoopa Valley Tribal Fisheries and the U.S. Fish and Wildlife Service perform annual salmon carcass and redd surveys in the main stem Trinity River. This report presents data collected from carcass surveys conducted September 7, 2011 to December 27, 2011, from the area of Lewiston Dam to Cedar Flat [101.6 river kilometers (rkm)] and from Hawkins Bar to Weitchpec (64.1 rkm). Survey data includes carcass abundance, sex ratio, age, spatial and temporal distribution, and pre-spawning mortality of Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*). 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.

This year's survey identified 10,078 Chinook, 261 coho salmon, 19 steelhead (*O. mykiss*), and 83 brown trout (*Salmo trutta*) carcasses. Coded wire tag (CWT) recoveries from adipose fin-clipped Chinook indicate spring Chinook carcasses out-numbered fall Chinook carcasses through Julian week 44 (beginning November 4, 2011). With this Julian week separation, 4,039 spring Chinook carcasses and 6,039 fall Chinook carcasses were recovered. Analysis of fork length distribution indicates 71.80 percent of spring Chinook and 88.97percent of fall Chinook were adults. Recovery of adipose fin-clipped Chinook carcasses indicate 9.68 percent of the spring and 26.1 percent of the fall Chinook carcasses observed were of hatchery origin. Over the course of the survey, 1,772 Chinook carcasses were marked, of which (776) 43.79 percent were recaptured. The Schaefer with Law's Adjustment mark-recapture model estimates the lowest in-river escapement of 20,872 Chinook salmon (8,365 spring Chinook and 12,507 fall Chinook). The Weekly Peterson model provides the highest estimate of 24,310 Chinook salmon (9,743 spring Chinook and 14,567 fall Chinook). The recovery of hatchery clipped coho salmon and adipose-clipped steelhead carcasses indicate that 62.45 percent of coho salmon and 42.11 percent of steelhead

carcasses were of hatchery origin. Adult coho salmon represented 97.36 percent of all coho salmon recovered.

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.
- To estimate in-river escapement of spring and fall Chinook utilizing mark-recapture and multiple estimators.

INTRODUCTION

The California Department of Fish & Game's (CDFG) 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 (USWFS) conducted a carcass and redd 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).

Reporting responsibilities for the project were divided into two parts: 1) CDFG 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). Redd survey information included in this report was summarized by the USFWS. The completion of phase one of the Trinity River Restoration Programs concluded with an independent review of all of their projects in 2012. The decision was made to combine reporting responsibilities for this project, and beginning with the 2012 spawning season the USFWS will be reporting on combined red and carcass spawning surveys coauthored by CDFG and other partners.

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, estimates produced from the mark-recapture carcass 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). Reaches were surveyed between September 7, 2011 and December 27, 2011. Two rafting teams consisting of CDFG 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)

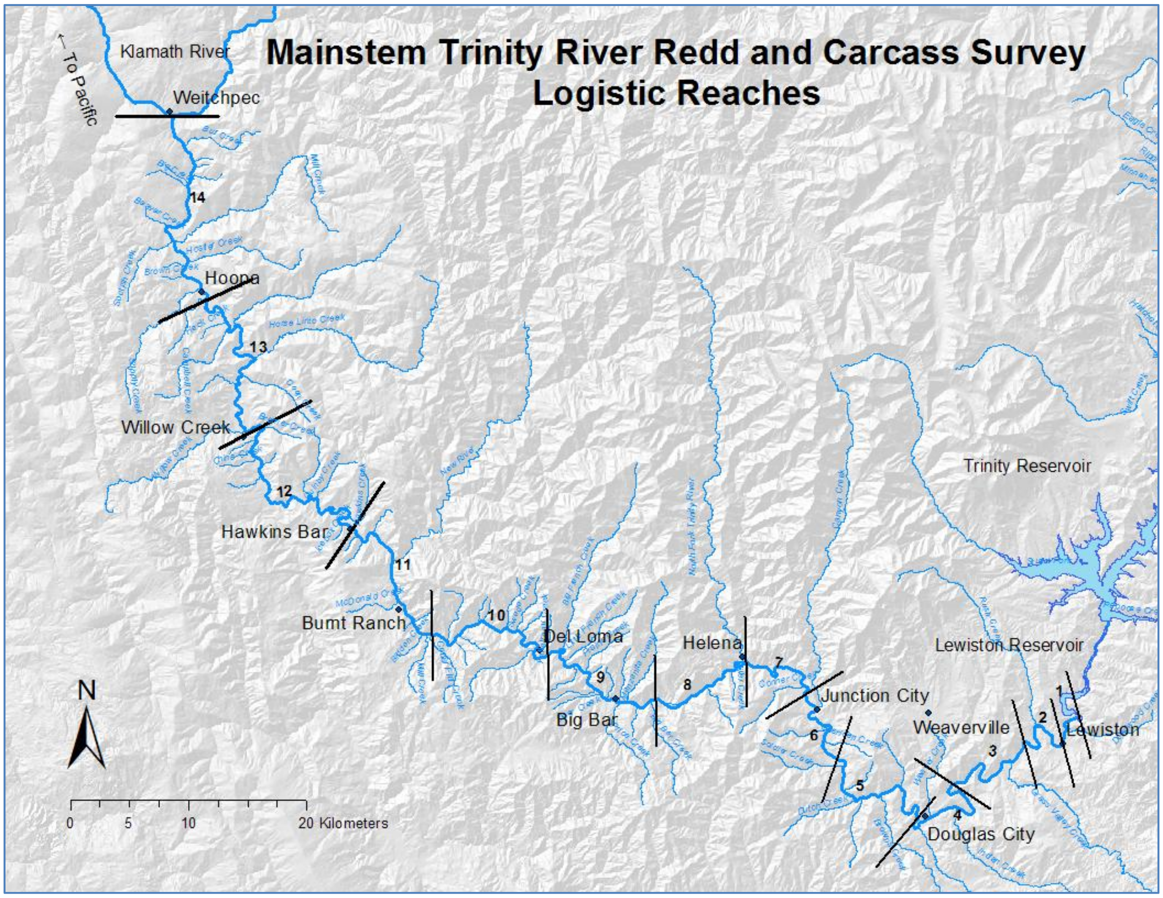

Figure 1. Survey reaches for 2011 Trinity River main stem spawner survey. Map courtesy of USFWS.

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.

Spring/ Fall Chinook Separation

In the Trinity River, there is a temporal and spatial overlap in the spring and fall Chinook runs. Since there is annual variation in spring and fall Chinook run timing, a date separating the two races is determined. Most adipose fin-clipped Chinook carcasses recovered during the survey contained coded wire tags (CWTs), which are implanted in their snouts prior to release from Trinity River Hatchery (TRH). CWTs are race and brood year specific and are currently implanted in approximately 25% of all TRH Chinook juveniles. The week separating spring and fall Chinook runs was established when the percentage of fall Chinook recoveries (based on CWT analysis) was greater than spring Chinook.

Carcasses encountered in 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 Chinook carcasses were marked with week specific jaw tags and returned to moving water. These carcasses were then available for recapture providing the means to estimate an in-river escapement using several mark-recapture estimators. More decomposed (condition-2 and condition-3) carcasses are not marked due to theoretical reduced probability of being recaptured. Estimators used to calculate the estimate include a pooled Petersen (Chapman, 1951), a weekly stratified Petersen, the Schaefer (Ricker, 1975) and a modified Schaefer (Law, 1994).

Carcasses that were recovered during the survey were identified to species and gender, and examined for hatchery clips and any tags (Trinity River Project (Project), or other 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 Project 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 percent 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. All condition-1 Chinook carcasses were marked with a week specific jaw tag and returned to moving water. All condition-2 and condition-3 Chinook, marked recaptures, 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.

To estimate in-river escapement in the main stem Trinity River, two generally accepted mark-recapture models were employed. The simplest of these models used is the Petersen mark-recapture estimator as described by Ricker (1975). The Petersen estimator calculates seasonal escapement by incorporating data from the entirety of the survey period. We also employed a weekly stratified Petersen to further analyze weekly population substructure. The second model used is the Schaefer estimator as described by Schaefer (1951). We also employed a modified Schaefer estimator as described by Law (1994). This model differs from the original Schaefer in that the number of tags applied after the first week is subtracted from the population estimate to account for sampling with replacement. Schaefer's original model was based on sampling without replacement. However, sampling with replacement occurs during the salmon spawning season.

The Petersen model as described by Ricker (1975):

$N_{ij} = ((M_i)(C_j)/R_{ij})$

Where: N_{ij} = population size in tagging period *i* recovery period *j*,
M_i = number of carcasses tagged in the *i*th tagging period,
C_j = number of carcasses recovered in the *j*th recovery period, and,
R_{ij} = number of carcasses tagged in the *i*th spawning period recaptured in the *j*th recovery period.

The Schaefer model as described by Schaefer (1951):

$N_{ij} = \sum (R_{ij}((M_i/R_i)(C_j/R_j)))$

Where: N_{ij} = population size in tagging period *i* and recovery period *j,*
R_{ij} = number of carcasses tagged in the *i*th spawning period and recaptured in the *j*th recovery period,
M_i = number of carcasses tagged in the *i*th tagging period,
C_j = number of carcasses recovered in the *j*th recovery period,
R_i = total recapture of carcasses tagged in the *i*th tagging period, and
R_j = total recapture of carcasses tagged in the *j*th tagging period
.

The Schaefer model as modified by Law (1994):

$N_{ij}=\sum (R_{ij}(M_iC_j/R_iR_j)-M_i)$

Where: N_{ij} = population size in tagging period *i* recovery period *j*,
R_{ij} = number of carcasses tagged in the *i*th spawning period and recaptured in the *j*th recovery period,
M_i = number of carcasses tagged in the *i*th tagging period,
C_j = number of carcasses recovered in the *j*th recovery period,
R_i = total recapture of carcasses tagged in the *i*th tagging period, and
R_j = total recapture of carcasses tagged in the *j*th tagging period.

RESULTS

Spring/ Fall Chinook Separation

From CWT extraction of adipose fin-clipped carcasses, the only overlap of spring and fall Chinook runs occurred during Julian week 44, 45, and 47. Spring Chinook carcasses were predominant through Julian week 44 (November 4, 2011 to November 11, 2011), after which fall Chinook recoveries were most numerous. For the purpose of analysis, all Chinook recoveries prior to and during Julian week 44 are classified as spring Chinook and all subsequent carcass recoveries are classified as fall Chinook (Figure 2).

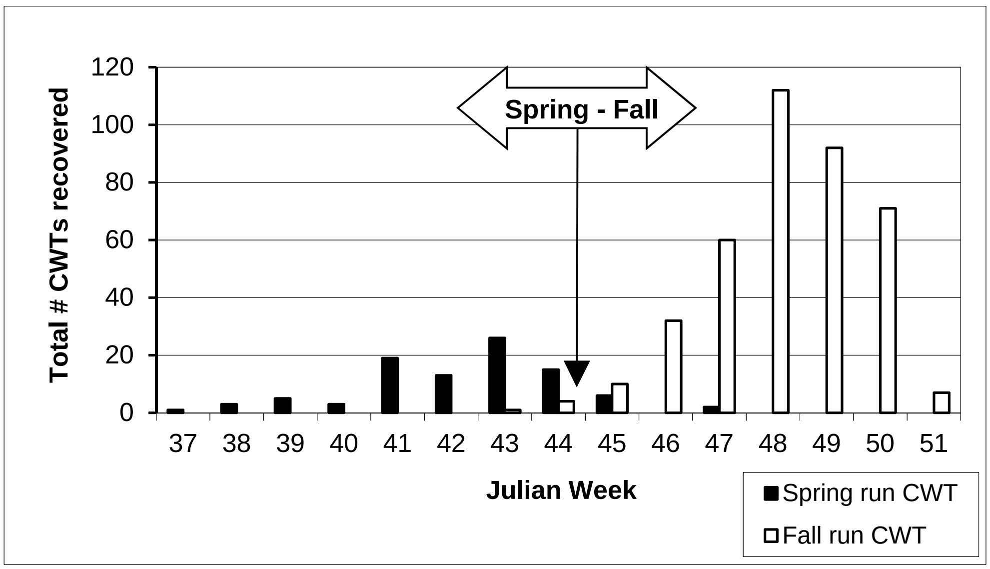

Figure 2. Weekly proportions of coded-wire tagged spring and fall Chinook observed in the 2011 main stem Trinity River spawner survey.

Temporal Carcass Distribution

A total of 10,078 Chinook carcasses were encountered during the survey. Recovery of Chinook carcasses peaked during Julian week 48 (November 26, 2011 to December 2, 2011) when 1,465 carcasses were counted. The first coho salmon carcass was recovered during Julian week 41 (October 8, 2011 to October 14, 2011). A total of 261 coho salmon carcasses were recovered during the survey with peak recovery number of 76 during both Julian week 50 (December 10, 2011 to December 16, 2011) (Figure 3). It should 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.

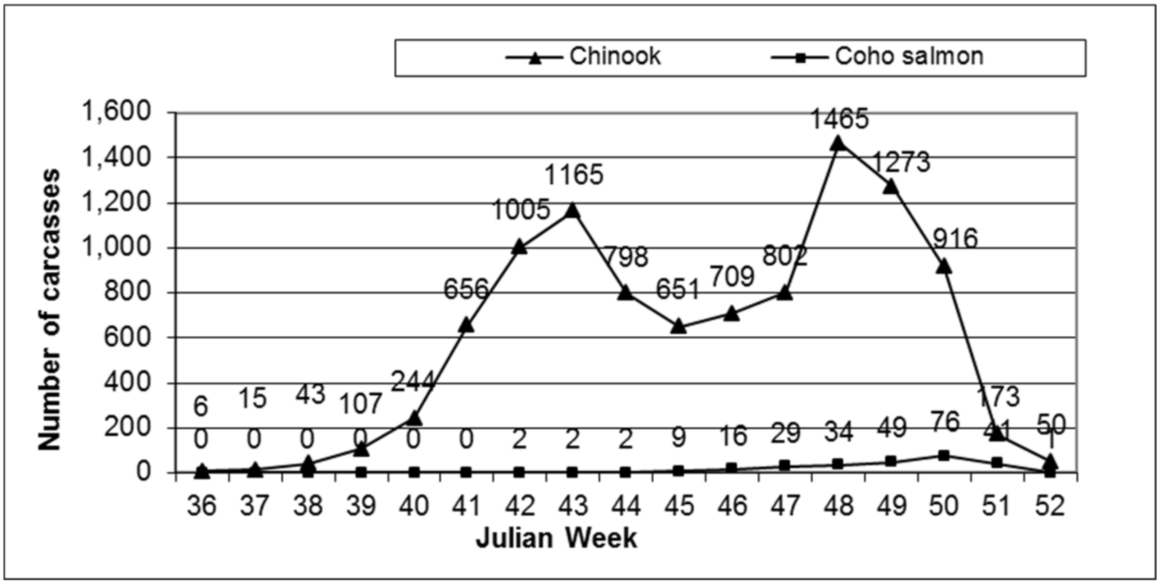

Figure 3. Chinook and coho salmon carcasses collected by Julian week during the 2011 Trinity River main stem spawner survey.

Carcass Distribution

A total of 10,078 Chinook carcasses were recovered during Julian weeks 36 to 52 (September 7, 2011 to December 27, 2011) in the 14 survey sections (Table 2). Of the 10,078 Chinook carcasses encountered, 5,698 (56.6%) were recovered in reaches 1 and 2, and 3,291 (32.7%) of the carcasses were recovered in reach 1 alone. Reach 8 had the fewest carcasses (n=40) and 1,842 (18.3%) of encountered carcasses were downstream of reach 5 (Table 2).

Table 2. Recovery of all Chinook salmon by Julian week and section during 2011 main stem Trinity River spawner survey.

Section	Number of	Julian week of Chinook recovery																	Section
	surveys	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	Totals
1	16	6	4	9	27	34	115	153	132	142	119	127	386	651	764	497	125	ns	3,291
2	15	ns	4	16	12	36	164	259	246	172	102	229	273	427	264	155	48	ns	2,407
3	13	ns	6	10	22	72	119	149	173	109	99	57	ns	101	55	18	ns	ns	990
4	12	ns	1	6	28	67	161	162	169	115	ns	75	ns	41	26	13	ns	ns	864
5	13	ns	0	2	9	25	58	166	131	104	67	67	ns	35	13	7	ns	ns	684
6	13	ns	0	0	1	5	22	61	71	79	49	58	42	10	10	ns	ns	ns	408
7	13	ns	0	0	0	4	7	41	76	67	32	37	25	11	11	ns	ns	ns	311
8	4	ns	0	ns	1	0	ns	ns	ns	ns	39	ns	ns	ns	ns	ns	ns	ns	40
9	8	ns	0	ns	4	1	5	ns	104	ns	100	ns	76	ns	40	ns	ns	ns	330
10	8	ns	0	ns	3	0	5	ns	63	ns	44	ns	ns	43	36	ns	ns	ns	194
12	6	ns	ns	ns	ns	ns	ns	6	ns	7	ns	36	ns	85	ns	105	ns	50	289
13	5	ns	ns	ns	ns	ns	ns	4	ns	1	ns	14	ns	61	ns	68	ns	ns	148
14	5	ns	ns	ns	ns	ns	ns	4	ns	2	ns	9	ns	ns	54	53	ns	ns	122
Totals	131	6	15	43	107	244	656	1,005	1,165	798	651	709	802	1,465	1,273	916	173	50	10,078

Spring Chinook Salmon

A total of 4,039 Chinook carcasses were classified as spring-run during the survey, of which 1,025 were classified as condition-one (Table 3). Spring Chinook carcass recovery by reach ranged from 909 in reach 2 to one in reach 8. Spring Chinook carcass density was greatest in reach 1 at 188.48 fish/km.

Table 3. Number, density, incidence of ad-clips, Project tags, and condition of spring Chinook recovered during the 2011 main stem Trinity River spawner survey.[1]

Reach	Length (km)	Number observed	Density (fish/km)	C-1	C-2	Adipose Clips Total	Adipose Clips C1	Project tags Total	Project tags C1
1	3.3	622	188.48	184	425	75	33	1	0
2	7.1	909	128.03	155	715	24	9	7	0
3	10.9	660	60.55	135	484	10	4	0	0
4	10.8	709	65.65	167	503	1	1	3	0
5	14.7	495	33.67	150	331	1	1	3	0
6	8.6	239	27.79	88	149	0	0	0	0
7	8.9	195	21.91	68	126	0	0	0	0
8	10.8	1	0.09	0	1	0	0	0	0
9	13.8	114	8.26	38	76	0	0	0	0
10	14.7	71	4.83	27	44	1	0	1	1
12	22.4	13	0.58	8	5	0	0	0	0
13	21.1	5	0.24	2	1	0	0	1	0
14	21.3	6	0.28	3	3	0	0	0	0
Total	103.6	4,039	38.99	1,025	2,863	112	48	16	1

1/ All Chinook recovered prior to Julian week 45 were considered spring

2/ Condition-1 fish are those with at least one clear eye

3/ Condition-2 fish are those with both eyes cloudy

4/ Adipose clipped Chinook presumed to contain CWT

5/ Spaghetti tags applied at Junction City weir or Willow Creek weir.

Fall Chinook Salmon

A total of 6,039 Chinook carcasses were classified as fall-run during the survey, of which 1,155 were classified as condition-one (Table 4). Fall Chinook carcass recovery by reach ranged from 2,669 in reach 1 to 39 in reach 8. Fall Chinook carcass density was greatest in reach 1 at 808.79 fish/km and dropped considerably to 210.99 fish/km in reach 2. Below reaches 1 and 2 carcass density was considerably less.

Table 4. Number, density, incidence of ad-clips, Project tags, and condition of fall Chinook recovered during the 2011 main stem Trinity River spawner survey.[1]

Reach	Length (km)	Number observed	Density (fish/km)	C-1	C-2	Adipose Clips Total	Adipose Clips C1	Project tags Total	Project tags C1
1	3.3	2,669	808.79	448	2,160	348	108	41	7
2	7.1	1,498	210.99	243	1,204	120	54	26	6
3	10.9	330	30.28	46	259	9	3	1	0
4	10.8	155	14.35	20	116	3	1	2	0
5	14.7	189	12.86	39	114	2	2	2	1
6	8.6	169	19.65	51	106	2	0	3	0
7	8.9	116	13.03	38	68	0	0	1	0
8	10.8	39	3.61	8	27	0	0	0	0
9	13.8	216	15.65	43	161	0	0	0	0
10	14.7	123	8.37	26	77	0	0	0	0
12	22.4	276	12.32	105	169	0	0	1	0
13	21.1	143	6.78	46	96	0	0	0	0
14	21.3	116	5.45	42	73	0	0	1	0
Total	168.4	6,039	35.86	1,155	4,630	484	168	78	14

1/ All Chinook recovered after Julian week 44 were considered fall Chinook

2/ Condition-1 fish are those with at least one clear eye

3/ Condition-2 fish are those with both eyes cloudy

4/ Adipose clipped Chinook presumed to contain CWT

5/ Spaghetti tags applied at Junction City or Willow Creek weir

Coho Salmon
A total of 261 coho salmon carcasses were recovered during the survey, of which 110 were classified as condition-one (Table 5). Coho carcass recovery by reach ranged from 111 in reach 2 to zero in reach 8. Coho salmon carcass density was greatest in reach 1 at 33.33 fish/km and dropped considerably to 15.63 fish/km in reach 2. Coho salmon carcass density downstream from reach 2 was less than 2 fish per kilometer.

Table 5. Number, density, incidence of right maxillary (RM) clips, Project tags, and condition of coho salmon recovered during the 2011 main stem Trinity River spawner survey.

	Length	Number	Density			Right Maxillary Clip		Project tags	
Reach	(km)	observed	(fish/km)	C-1	C-2	Total	C1	Total	C1
1	3.3	110	33.33	39	70	74	28	2	2
2	7.1	111	15.63	47	63	70	27	4	3
3	10.9	16	1.47	9	7	10	7	1	1
4	10.8	6	0.56	3	3	1	0	1	0
5	14.7	5	0.34	4	1	4	4	0	0
6	8.6	2	0.23	2	0	1	1	0	0
7	8.9	2	0.22	1	1	0	0	0	0
8	10.8	0	0.00	0	0	0	0	0	0
9	13.8	4	0.29	2	2	2	1	0	0
10	14.7	1	0.07	1	0	0	0	0	0
12	22.4	2	0.09	1	1	0	0	0	0
13	21.1	1	0.05	0	1	0	0	0	0
14	21.3	1	0.05	1	0	1	1	0	0
Total	168.4	261	52.33	110	149	163	69	8	6

1/ Condition-1 (C-1) fish are those with at least one clear eye
2/ Condition-2 (C-2) fish are those with both eyes cloudy
3/ Right maxillary (RM) clipped coho salmon
4/ Spaghetti tags applied at Willow Creek weir

Steelhead and Brown Trout

A total of 19 steelhead carcasses and 83 brown trout carcasses were recovered during the survey (Table 6). Steelhead density with and without the adipose fin clip was highest in reach 1, which is closest to the hatchery. Brown trout density was highest in reach 4 with greatest numbers recovered in reach 5. No project tags were recovered from steelhead carcasses in 2011.

Table 6. Number, density, incidence of adipose clips and Project tags on steelhead and brown trout recovered during the 2011 main stem Trinity River spawner survey.

		Steelhead			Brown Trout		
	Length	Number	Density	Adipose	Number	Density	Project
Reach	(km)	Observed	(fish/km)	Clip1	Observed	(fish/km)	Tags2
1	3.3	11	3.33	6	0	0.00	0
2	7.1	4	0.56	2	6	0.85	0
3	10.9	2	0.18	0	16	1.47	1
4	10.8	1	0.09	0	20	1.85	0
5	14.7	0	0.00	0	23	1.56	1
6	8.6	1	0.12	0	7	0.81	1
7	8.9	0	0.00	0	4	0.45	0
8	10.8	0	0.00	0	1	0.09	0
9	13.8	0	0.00	0	4	0.29	0
10	14.7	0	0.00	0	1	0.07	0
12	22.4	0	0.00	0	1	0.04	0
13	21.1	0	0.00	0	0	0.00	0
14	21.3	0	0.00	0	0	0.00	0
Total	168.4	19	0.11	8	83	0.49	3

1/ Adipose clipped steelhead presumably from Trinity River Hatchery with 100% hatchery clip rate
2/ Floy tags applied at Junction City weir

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.

Spring Chinook Salmon
Fork lengths of spring Chinook (n = 3,986 averaged 70.37 cm. and ranged between 27-115 cm. (Figure 4). Grilse (FL < 60 cm) accounted for 28.20% (1,124/3,986) of the measured spring Chinook.

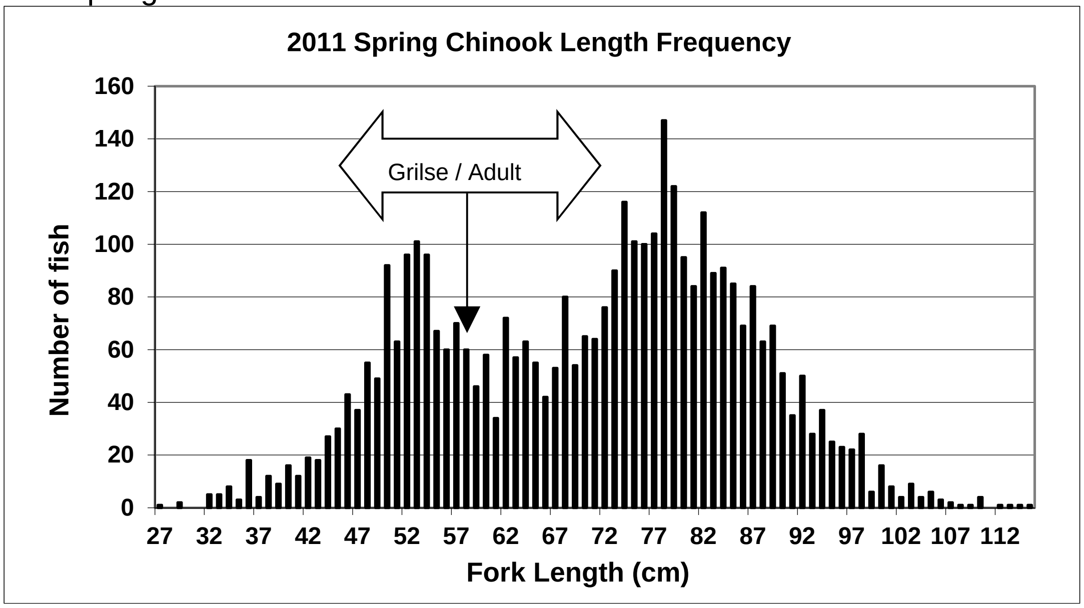

Figure 4. Length frequency for all condition-1 and -2 spring Chinook measured during the 2011 main stem Trinity River spawner survey.

Fall Chinook Salmon
Fork lengths obtained from fall Chinook (n = 5,776) averaged 71.89 cm and ranged between 33-112 cm. (Figure 5). Grilse (FL <58 cm) accounted for 11.03% (637/5,776) of measured fall Chinook.

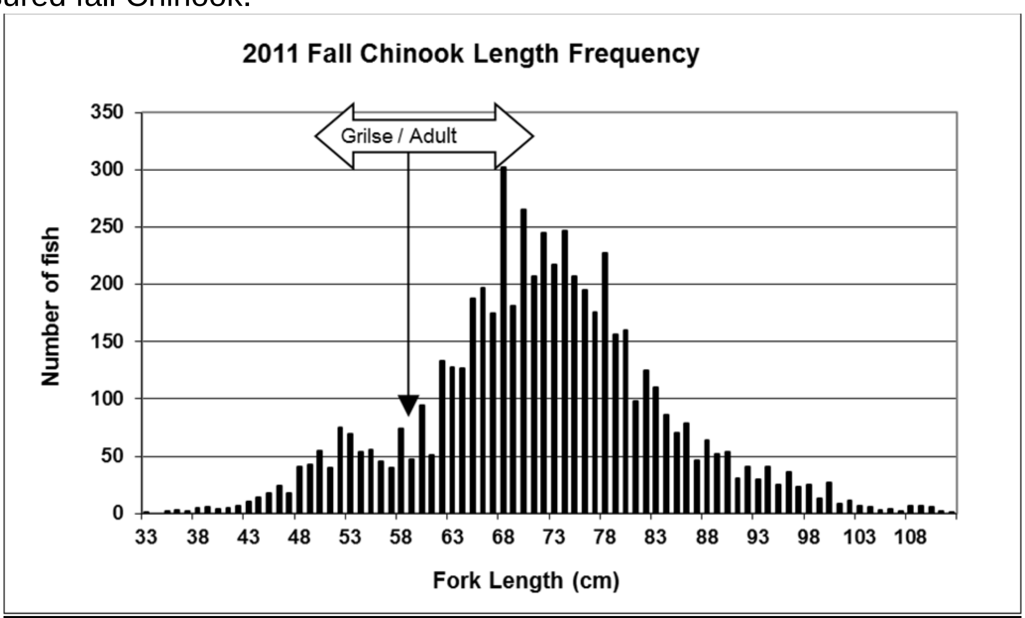

Figure 5. Length frequency for all condition-1 and -2 fall Chinook measured during the 2011 main stem Trinity spawner survey.

Coho Salmon
Fork lengths of measured coho (n = 259) averaged 65.08 cm and ranged from 32-90 cm. (Figure 6). Grilse (FL < 58 cm) accounted for 18.53% (48/259) of measured coho.

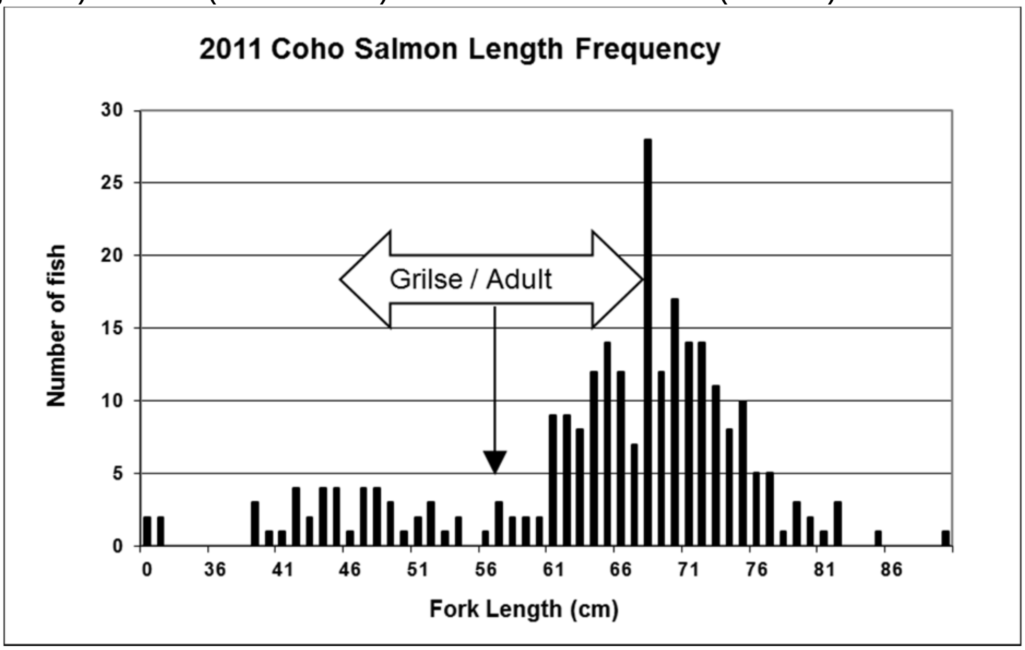

Figure 6. Length frequency for all condition-1 and -2 coho measured during the 2011 main stem Trinity River spawner survey.

Adult Sex Composition and Female Pre-Spawn Mortality

Spring Chinook Salmon
Of the spring Chinook recovered that were sexed; 2,255 were sexed as males and 1,622 as females, a male to female ratio of 1.39:1 (Table 7). Gender was indiscernible on 162 fish due to advanced decomposition. Seventy nine (4.87%) of the 1,622 female spring Chinook carcasses evaluated were determined to be pre-spawn mortalities.

Table 7. Male to female ratio and pre-spawn mortality of spring Chinook during the 2011 main stem Trinity River spawner survey.

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Pre-spawn Mortality (Females)
1	622	245	364	25	13	0.67	6.87%
2	909	576	288	11	45	2.00	3.82%
3	660	366	254	8	40	1.44	3.15%
4	709	432	240	6	37	1.80	2.50%
5	495	263	218	3	14	1.21	1.38%
6	239	137	94	1	8	1.46	1.06%
7	195	111	82	11	2	1.35	13.41%
8	1	1	0	0	0	0.00	0.00%
9	114	71	43	5	0	1.65	11.63%
10	71	43	27	4	1	1.59	14.81%
12	13	7	6	1	0	1.17	16.67%
13	5	0	3	2	2	0.00	66.67%
14	6	3	3	2	0	1.00	66.67%
Total	4,039	2,255	1,622	79	162		
					Average	1.39	4.87%

Fall Chinook Salmon

Of the fall Chinook recovered that were sexed; 2,375 were sexed as males and 3,387 were sexed as females, for a male: female ratio of 0.70:1 (Table 8). Gender was indiscernible on 277 fish due to advanced decomposition. One hundred and eighty one (5.34%) of the 3,387 adult female fall Chinook carcasses examined were determined to be pre-spawn mortalities.

Table 8. Male to female ratio and pre-spawn mortality of fall Chinook during the 2011 main stem Trinity River spawner survey.

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Pre-spawn Mortality (Females)
1	2,669	736	1,869	103	64	0.39	5.51%
2	1,498	732	709	41	57	1.03	5.78%
3	330	186	117	5	27	1.59	4.27%
4	155	75	57	0	23	1.32	0.00%
5	189	72	79	1	38	0.91	1.27%
6	169	80	74	6	15	1.08	8.11%
7	116	56	49	3	11	1.14	6.12%
8	39	24	11	2	4	2.18	18.18%
9	216	109	94	4	13	1.16	4.26%
10	123	61	42	5	20	1.45	11.90%
12	276	125	148	9	3	0.84	6.08%
13	143	67	75	1	1	0.89	1.33%
14	116	52	63	1	1	0.83	1.59%
Total	6,039	2,375	3,387	181	277		
					Average	0.70	5.34%

Coho Salmon

Of the 261 coho salmon recovered that were sexed; 130 were sexed as males and 128 were sexed as females, for a male: female ratio of 1.02: 1 (Table 9). Grilse have been included in number of males, and gender was indiscernible on 3 fish due to advanced decomposition. Sixteen (12.50%) of 128 female coho salmon carcasses examined were determined to be pre-spawn mortalities.

Table 9. Male to female ratio and pre-spawn mortality of coho salmon during 2011 main stem Trinity River spawner survey by reach.

Reach	Total Coho	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Pre-spawn Mortality (Females)
1	110	56	53	4	1	1.06	7.55%
2	111	57	53	7	1	1.08	13.21%
3	16	9	7	2	0	1.29	28.57%
4	6	4	2	0	0	2.00	0.00%
5	5	2	3	1	0	0.67	33.33%
6	2	1	1	0	0	1.00	0.00%
7	2	0	1	0	1	0.00	0.00%
8	0	0	0	0	0	0.00	0.00%
9	4	0	4	1	0	0.00	25.00%
10	1	1	0	0	0	0.00	0.00%
12	2	0	2	0	0	0.00	0.00%
13	1	0	1	0	0	0.00	0.00%
14	1	0	1	1	0	0.00	100.00%
Total	261	130	128	16	3		
					Average	1.02	12.50%

Incidence of Hatchery Produced Chinook and Coho Salmon

Spring Chinook Salmon

During the spring-run period, 4.68 % (n = 48) of condition-one and 2.77% (n = 112) of all spring Chinook bore ad-clips. CWT's were recovered from 95 Chinook encountered during the spring Chinook recovery period, all but eight were spring-run. During the period associated with the spring-run, fourteen ad-clipped Chinook were recovered in which no CWT's were found. The majority of CWT's collected during the spring recovery period were represented by the 2009 brood year spring fingerling release group (n=32, 36.78%) and 2008 brood year spring-run fingerling (n=24, 27.59%). All other CWT's were represented by 2007 spring fingerling (n=15, 17.24%), 2007 spring yearling (n=12, 13.79%), 2008 spring yearling (n=2, 2.30%), and 2006 brood year fingerling release groups (n=2, 2.30%).

Based on expansion of all CWT codes recovered during the spring period, an estimated 391 (9.68%) of the total 4,039 fish recovered were of TRH origin (Table 3). Based on expansions of all spring-run CWT groups, an estimated age structure of TRH spring

Chinook recovered in the main stem Trinity River spawning survey was 2.06% age 5, 32.21% age 4, 30.35% age 3, and 35.39 % age 2 (Table 10).

Fall Chinook Salmon

During the fall-run period 14.55% (n = 168) of the condition-1 and 8.01% (n = 484) of all fall Chinook bore ad-clips (Table 4). Observed ad-clip rates in reach 1 and 2 for fall Chinook were 14.0% (n=162; condition-1) and 7.8% (n=468; all carcasses) respectively. CWTs were recovered from 389 Chinook encountered during the fall Chinook recovery period; all but eight were fall Chinook. During the period associated with the fall-run, 38 ad-clipped Chinook were recovered in which no CWTs were found. The majority of CWTs during the fall-run recovery period were represented by 2008 fall fingerling releases (n=168; 43.19%). All other CWTs were represented by the following brood year groups; 2007 fall brood year fingerlings (n=84, 21.59%), 2008 fall brood yearlings (n=80, 20.57%), 2009 fall brood year fingerling (n=19, 4.88%), 2008 fall brood year fingerlings (n=14, 3.60%), 2006 fall brood year yearlings (n=8, 2.06%), 2008 fall brood year yearlings (n=5, 1.29%), 2009 brood year yearling (n=2, 0.54%), and 2006 spring brood year fingerling (n=1, 0.26%).

Based on expansion of all CWT codes recovered during the fall-run period, an estimated 1,574 (26.1%) of the total 6,039 fish recovered were of TRH origin (Table 5). Based on expansions of all fall CWT groups, the estimated age structure of TRH fall Chinook recovered in the main stem Trinity River spawning survey was 2.33% age 5, 21.74% age 4, 69.30% age 3, and 6.64% age 2 (Table 10).

Coho Salmon

During the course of the survey, 62.73% (n = 69) of condition-1 and 62.45% (n = 163) of all coho salmon recovered bore right maxillary (RM) clips (Table 5). Coho RM clip rates for condition-1 carcasses were highest in reach one. Based on a 100% clip rate of Trinity River Hatchery (TRH) produced juvenile coho salmon, an estimated 62.45% of all coho salmon recovered during the survey were of TRH origin.

Table 10. Release and recovery data for coded-wire tagged, Trinity River Hatchery produced Chinook salmon recovered during the 2011 Trinity River spawner survey.

Release data					Recovery data				
			Release	Production	Recovery period3				Expanded
CWT Code	Brood year	Age	type1	multiplier2	Spring	Fall	Total	% of subtotal	total
Spring Chinook									
65360	2006		Sy	4.01047	2		2	1.83	8.021
68801	2007		Sf	4.02822	4		4	3.67	16.113
68802	2007		Sf	4.11559	4		4	3.67	16.462
68803	2007		Sf	4.09192	7	2	9	8.26	36.827
68810	2007		Sy	4.02374	12	2	14	12.84	56.332
68811	2008		Sf	4.04538	4		4	3.67	16.182
68812	2008		Sf	4.06624	12	2	14	12.84	56.927
68813	2008		Sf	4.12789	8	1	9	8.26	37.151
68819	2008		Sy	4.09357	2		2	1.83	8.187
68821	2009		Sf	4.14985	3		3	2.75	12.450
68822	2009		Sf	4.18498	24	1	25	22.94	104.625
68831	2009		Sf	4.21136	2		2	1.83	8.423
68832	2009		Sf	4.21175	3		3	2.75	12.635
No CWT recovered4					14		14	12.84	
				Subtotal:	101	8	109	100.00	390.335
Fall Chinook									
65351	2006		Ff	4.20807		1	1	0.23	4.208
65361	2006		Fy	4.05413		8	8	1.87	32.433
68804	2007		Ff	4.03391		8	8	1.87	32.271
68805	2007		Ff	4.07660		2	2	0.47	8.153
68806	2007		Ff	4.05128		4	4	0.94	16.205
68807	2007		Ff	4.03393		2	2	0.47	8.068
68808	2007		Ff	4.01949	1	68	69	16.16	277.345
68820	2008		Fy	4.02446	2	80	82	19.20	330.006
65356	2008		Ff	4.03385		4	4	0.94	16.135
65357	2008		Ff	4.03390		5	5	1.17	20.170
65358	2008		Ff	4.03370		5	5	1.17	20.169
65359	2008		Fy	4.00112		5	5	1.17	20.006
68814	2008		Ff	4.08246		30	30	7.03	122.474
68815	2008		Ff	4.07340	1	40	41	9.60	167.009
68816	2008		Ff	4.01831		30	30	7.03	120.549
68817	2008		Ff	4.02600		39	39	9.13	157.014
68818	2008		Ff	4.05019		20	20	4.68	81.004
68820	2008		Ff	4.02446			0	0.00	0.000
608080000	2008		Ff	3.97520		8	8	1.87	31.802
608080001	2008		Ff	4.03156		1	1	0.23	4.032
68823	2009		Ff	4.18876		10	10	2.34	41.888
68824	2009		Ff	4.09463	4		4	0.94	16.379
68825	2009		Ff	4.07450		2	2	0.47	8.149
68826	2009		Ff	4.11311		2	2	0.47	8.226
68827	2009		Ff	4.06006		2	2	0.47	8.120
68833	2009		Ff	4.53266		1	1	0.23	4.533
68834	2009		Ff	4.52903		2	2	0.47	9.058
68837	2009		Fy	4.02733		2	2	0.47	8.055
No CWT recovered4						38	38	8.90	
				Subtotal:	8	419	427	100.00	1,573.458
				Grand Totals	109	427	536		1,963.793

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/ Spring Chinook recovery period was September 7, 2011to November 4, 2011. Later recoveries cosidered Fall Chinook

4/ CWT was not present or was lost during recovery

Incidence of Project Marked Salmon

Spring Chinook Salmon
A total of 16 Project tags applied at the Junction City and Willow Creek weirs were recovered in survey reaches 1 through 14 (Table 3). One of these was recovered on condition-1 carcasses. During the course of the survey, 10 tags from the Junction City weir and 6 tags from the Willow Creek weir were recovered prior to Julian week 45.

Fall Chinook Salmon
A total of 78 Project tags applied at Junction City and Willow Creek weirs were recovered during the survey (Table 4). Fourteen of these were recovered on condition-1 carcasses. During the course of the survey, 78 tags from the Willow Creek weir and 0 tags from the Junction City weir were recovered after Julian week 44. Spaghetti tags were found in all reaches except 8,9,10, and 13. 67 (85.9%) were found in reaches 1 and 2 (Table 5).

Coho Salmon
A total of 8 Project tags applied at the Willow Creek weir were recovered during the survey (Table 5). Six of these were recovered on condition-1 carcasses. None of these were recovered below reach 4.

Steelhead/Rainbow trout
No Project tags were found on steelhead carcasses during this survey.

Brown Trout
Three Project tags were found on brown trout carcasses during this survey in reach 3, reach 5 and reach 6.

In-river Escapement Estimates

This season, a mark-recapture methodology was employed on the upper Trinity River to estimate in-river escapement of Chinook (Tables 11, 12, & 13). Mark-recapture techniques were historically used on the Trinity, and were recently reintroduced during the carcass survey in 2005. During the 2011 survey, crews marked all condition-1 Chinook with week specific jaw tags. Fish are subsequently recaptured to produce weekly estimates. During the course of the survey, one thousand seven hundred seventy two (17.58%) of Chinook were marked, and seven hundred seventy six (43.79%) of those fish were subsequently recaptured (Appendix 6). The upper reaches (reaches 1-5) had a lower marking rate of 15.47% and a slightly higher recapture rate of 54.08% than the survey in its entirety (Appendices 5 & 6). The lower reaches (reaches 6-10) had a marking rate of 27.79%, and a recapture rate of 17.47% (Appendix 6). All estimators used in this report require at least 25 recaptures to produce reliable results.

Table 11. In-river escapement estimates for Chinook collected during 2011 Trinity River spawner survey.

Estimator	Reaches 1-5	Reaches 1-14	Reaches 1-5 (95% CI)	Reaches 1-14 (95% CI)
Peterson	15,220	22,998	738	1,167
Weekly Stratified Peterson	16,911	24,310	1,464	1,846
Schaefer	15,284	22,644	1,220	1,837
Schaefer with Law's adjustment	14,010	20,872	1,220	1,837

The different estimators produced estimates which range from 20,872 to 24,310 Chinook for the entire survey, and from 14,010 to 16,911 for the upper reaches 1-5 (Table 11). Adding in the 95% confidence interval, the estimates ranged from 19,035 to 26,156 for the entire survey, and from 12,790 to 18,375 for the upper reaches. These results indicate there is a 5% chance that the true estimate falls outside of the confidence intervals.

Table 12. In-river escapement estimates for spring and fall Chinook collected during 2011 Trinity River spawner survey above Junction City.

Estimator (Above J.C. (reach 1-5))	Spring	Fall	Ratio of spring to fall Chinook
Petersen	6,274	8,946	
Weekly stratified Petersen	6,971	9,940	0.4122
Schaefer	6,300	8,984	
Schaefer w/ Law's adjustment	5,775	8,235	

Estimates for the different runs in the entire survey ranged from 8,365 to 9,743 for spring Chinook and 12,507 to 14,567 for fall Chinook (Table 13). The estimates for the upper reaches ranged from 5,775 to 6,971 for spring Chinook and 8,235 to 9,940 for fall Chinook (Table 12). The results of the carcass survey indicate spring to fall Chinook ratios of 0.4008:1 for the entire survey and 0.4122:1 for the upper reaches (Tables 12 & 13).

Table 13. In-river escapement estimates for spring and fall Chinook collected during 2011 Trinity River spawner survey in all reaches.

Estimator Entire survey (reach 1-14)	Spring	Fall	Ratio of spring to fall Chinook
Petersen	9,217	13,781	
Weekly stratified Petersen	9,743	14,567	0.4008
Schaefer	9,075	13,569	
Schaefer w/ Law's adjustment	8,365	12,507	

DISCUSSION

When looking at the spring and fall runs 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). During the 2010 season, crews recovered slightly more total Chinook than during the 2009 field season (Appendix 1). Coho salmon carcass numbers were the highest since 2005. When comparing yearly data, it is important to acknowledge differences in survey timing 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.

Prior to 1996, CDFG conducted mark recapture carcass recovery surveys which allowed for estimation of the total numbers of spawners in each survey reach. Due to inclusion of redd data collection and other crew constraints during the 1996-2004 seasons, carcass totals were then solely based on total numbers of carcasses recovered. With the reintroduction of a mark recapture methodology in 2005, we will continue to display the number of carcasses observed per reach, independent of mark recapture, for comparison with past years. Current mark recapture efforts do not produce reach escapement estimates, as weekly efficiencies by reach are sporadic and highly variable.

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, & 3). 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.

This years' Chinook numbers as a whole show this same trend, but a deviation from this trend has occurred for the second time with spring Chinook and not for fall Chinook. This year, reach 4 had the greatest percentage of spring Chinook (235/1,006; 23.36%) than any other reach. This deviation may be due to decreased hatchery contribution to the spring run (Table 14). This decrease has resulted in more naturally spawning spring Chinook in the Trinity River which may be due to restoration activities.

Table 14. Hatchery contribution from previous years to spring Chinook spawning in the main stem Trinity River.

Year	Hatchery Contribution (%)
2002	36.40%
2003	24.00%
2004	28.60%
2005	25.70%
2006	13.00%
2007	19.28%
2008	10.27%
2009	8.34%
2010	5.67%
2011	9.68%

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: 0.77:1 for spring Chinook and 1.05:1 for fall Chinook.

Trinity River Chinook salmon pre-spawn mortalities for years when more than 100 females were examined have ranged from 0.0 to 62.8% for spring Chinook, and 0.7 to 43.7% for fall Chinook (Appendix 4). Pre-spawn mortality rates observed this year were 7.96% for spring Chinook and 8.88% for fall 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 14.73%. It is 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.

Mark Recapture Estimators

Carcass mark recapture or capture recapture estimators are commonly used by the Department to estimate in-river escapement of salmon; these estimators have been used in Central Valley tributaries including the American and Sacramento since the early 1970's (Snider, Reavis and Hill, 1999). In the Klamath basin, the Department currently utilizes both the Petersen and Schaefer estimators to produce in-river escapements from carcass survey data (S. Borok, pers comm, 2005). It is important to acknowledge the limitations and potential biases associated with these estimators. If basic assumptions are violated, or bias is excessively high, options should be pursued to refine these estimators or another estimator should be selected.

The Petersen estimator is the most popularly used mark recapture model in fisheries management. However, it is often portrayed as a crude application because it is a closed population model, and its assumptions concerning zero births or death (immigration and survival) are rarely met. With respect to salmon carcass surveys, the Petersen model has been found to consistently overestimate population estimates, sometimes exceeding 250% of the true population (Law, 1994). Stratifying Petersen estimates by week can minimize some of the bias created by births and deaths..

The Schaefer estimator is commonly used as an alternative to the simple pooled Petersen when the assumptions of equal mixing, homogenous capture, or homogenous recapture probabilities will not hold (Schwarz et al, 2002). When these assumptions are violated, stratifying capture and recaptures by time or location and using either a stratified Petersen or Schaefer estimator may be appropriate. Law (1994) found the Schaefer estimator to be less positively biased than the Petersen estimator, but cautioned that it also overestimates populations, especially at low survival and low catch rates. Law (1994) suggests the use of the Jolly-Seber open population mark recapture model for use in salmon carcass population estimates, but recognized that on larger rivers, the Jolly-Seber may produce estimates that are consistently low. It is also possible that the basic assumption of equal mixing of tagged carcasses with all carcasses may be violated, in which case, recaptured carcasses may constitute a different sub-population.

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.

Carcass condition is a potential source of bias in the mark-recapture estimators due to the fact that fall Chinook carcass eyes appear to rot more quickly than spring Chinook carcasses. The decrease in marking rates is apparent as the season progresses. Only condition-1 carcasses are marked, and that criterion is met when at least one of the carcass eyes is clear. Since fall Chinook carcasses rot quicker and both eyes are often cloudy even at the time of spawning, a lower percentage of fall Chinook carcasses (11.83%) were classified as condition-1 than spring Chinook carcasses (34.99%) (Tables 4 and 5). This accounts for the different marking rates between spring and fall Chinook. Therefore, due to the higher marking rates for spring Chinook, the estimates may be more efficient for spring Chinook than fall Chinook due to the higher marking rate.

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 and used to calculate capture efficiency. An additional problem which may necessitate more frequent surveying is predation and removal of carcasses. No direct evidence of carcass removal by predation was observed during the 2011 season, but we assume that predation does exist. 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. Mark recapture estimators should be statistically evaluated for bias, and the Jolly-Seber model should be considered if bias is found to be excessive, thus minimizing the potential of producing unacceptable estimates.

3. In future years, the entire survey area should be surveyed on a consistent temporal basis (e.g. once each week) if possible.

4. 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.

5. More research into carcass deterioration rate differences between spring-run and fall-run Chinook and how it may influence the mark and recapture estimates.

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APPENDICES

Appendix 1. Total spring Chinook carcasses recovered by reach during the main stem Trinity River spawning survey 2000-2011

Spring Chinook														
	Reach													
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**12**	**13**	**14**	**Total**
2000	695	368	101	52	11	5	4	1	2	2	ns	ns	ns	1,241
2001	383	331	137	113	8	12	19	3	2	2	ns	ns	ns	1,010
2002	951	641	311	214	169	245	124	20	46	8	ns	ns	ns	2,729
2003	2643	1139	551	285	267	239	93	9	21	4	ns	ns	ns	5,251
2004	431	345	172	96	83	37	20	1	0	2	ns	ns	ns	1,187
2005	566	267	119	93	75	36	31	8	22	7	ns	ns	ns	1,224
2006	306	303	191	186	108	44	38	1	9	8	ns	ns	ns	1,194
2007	418	384	163	215	106	73	26	1	14	6	2	0	3	1,411
2008	227	181	132	149	99	149	42	2	3	2	0	5	2	993
2009	137	129	235	187	90	131	81	0	48	0	0	2	0	1,040
2010	119	172	188	235	142	83	41	5	16	1	0	3	1	1,006
2011	622	909	660	709	495	239	195	1	114	71	13	5	6	4,039

Appendix 2. Total fall Chinook carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2011.

Fall Chinook														
	Reach													
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**12**	**13**	**14**	**Total**
2000	3,644	979	174	50	25	10	1	7	13	6	ns	ns	ns	4,909
2001	3,217	872	136	118	23	14	75	12	32	6	ns	ns	ns	4,505
2002	569	462	89	100	46	66	84	25	32	13	ns	ns	ns	1,486
2003	6,050	2656	886	385	84	91	50	23	72	24	ns	ns	ns	10,321
2004	2,319	714	188	178	58	40	64	17	44	16	ns	ns	ns	3,638
2005	1,370	440	104	67	44	20	17	1	18	15	ns	ns	ns	2,096
2006	1,780	649	222	142	69	80	57	4	38	32	ns	ns	ns	3,073
2007	2,243	847	167	116	96	94	20	2	15	21	0	1	0	3,322
2008	863	504	183	206	125	112	90	15	78	75	150	136	35	2,571
2009	925	547	249	155	78	83	86	12	93	58	42	39	12	2,379
2010	1,469	690	227	161	88	106	52	0	10	4	45	5	8	2,865
2011	2,669	1,498	330	155	189	169	116	39	216	123	276	143	116	6,039

Appendix 3. Total coho salmon carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2011.

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

Appendix 4. Salmon female prespawn mortality rates observed in the Trinity River spawner survey 1955 through 2011.

Study	Literature	Spring-run Chinook			Fall-run Chinook			Total Chinook			Coho salmon		
Year	Source	Spawned	Not Spawned	% Not spawned	Spawned	Not Spawned	% Not spawned	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)			49.9			18.8						
1988	Zuspan (1991)	11	27	71.1	479	372	43.7	490	399	44.9			
1989	Zuspan (1992a)	194	327	62.8	1,546	464	23.1	1,740	791	31.3			
1990	Zuspan (1992b)	76	21	21.6	104	6	5.5	180	27	13.0			
1991	Zuspan (1994)	22	0	0	162	2	1.2	184	2	1.1			
1992	Aguilar/Zuspan (1995)	48	3	5.9	133	1	0.7	181	4	2.2			
1993	Aguilar (1995)	115	5	4.2	180	12	6.3	295	17	5.4			
1994	Aguilar/Davis (1995)	202	2	1	380	12	3.1	582	14	2.3			
1995	Zuspan (1997)	2,711	517	16	8,502	3,188	27.3	11,213	3,705	24.8			
1996	Zuspan (1997)	1,243	42	3.3	11,058	90	7.8	2,301	132	5.4			
1997	Zuspan (1998)	1,263	34	2.6	491	28	5.4	1,754	62	3.4			
2000	Sinnen/Null (2002)	559	17	3	1,940	146	7	2,499	163	6.1	89	13	12.7
2001	Sinnen (2004)	327	22	6.3	963	98	9.2	1,290	120	8.5	236	22	8.5
2002	Sinnen/Currier (2004)	1,117	67	5.7	625	11	1.7	1,742	77	4.2	56	8	12.5
2003	Sinnen/Knechtle (2006)	3,173	220	6.5	5,526	730	11.7	8,699	950	9.8	210	39	15.7
2004	Sinnen/Currier (2005)	646	60	8.5	1,864	100	5.1	2,510	160	6.0	1,042	187	15.2
2005	Garrison (2006)	603	48	7.4	1,003	70	6.5	1,606	118	6.8	414	78	15.9
2006	Hill(2007)	481	37	7.1	1,138	11	1.0	1,619	48	3.0	288	31	9.7
2007	Hill (2008)	915	74	7.5	2,158	185	7.9	3,073	259	7.8	97	11	10.2
2008	Hill (2009)	424	40	8.6	1,180	70	5.6	1,604	110	6.4	154	22	12.5
2009	Hill (2010)	626	34	5.3	1,343	66	4.9	1,969	100	5.1	95	15	15.8
2010	Hill (2011)	553	44	7.96	1,306	116	8.9	1,859	160	8.6	353	52	14.7
2011	current study	1,543	79	4.87	3,206	181	5.34	4,749	260	5.19	112	16	14.30

Appendix 5. Carcass mark recapture statistics and estimates observed on main stem Trinity River spawner surveys 2005-2011.

2005	Captured	Marked	Recaptured	Marking Rate	Recapture Rate	Petersen	Stratified Petersen	Schaefer	Schaefer w/ Law's
Spring Run	1,385	533	143	38.40%	26.80%	3,158	3,539	3,256	2,855
Fall Run	2,436	553	341	22.70%	61.70%	5,407	6,060	5,574	4,890
Both	3,821	1,086	484	28.40%	44.60%	8,565	9,600	8,831	7,745
2006									
Spring Run	1,204	443	110	36.80%	24.80%	3,567	3,958	4,039	3,661
Fall Run	3,210	663	351	20.70%	52.90%	9,172	10,176	10,386	9,412
Both	4,414	1,106	461	25.10%	41.70%	12,739	14,134	14,425	13,073
2007									
Spring	1,505	491	95	32.60%	19.30%	4,162	3,845	3,984	3,756
Fall	3,528	322	180	9.10%	55.90%	10,684	9,871	10,226	9,642
Both	5,033	813	275	16.20%	33.80%	14,846	13,716	14,210	13,398
2008									
Spring	993	384	69	38.67%	17.97%	3,065	3,111	3,869	3,621
Fall	2,571	507	219	19.72%	43.20%	7,937	8,056	10,016	9,375
Both	3,564	891	288	25.00%	32.32%	11,002	11,167	13,885	12,997
2009									
Spring	1,040	358	39	34.42%	10.89%	3,050	4,068	2,917	2,707
Fall	2,379	333	196	14.00%	58.86%	6,977	9,304	6,673	6,192
Both	3,419	691	235	20.21%	34.01%	10,027	13,372	9,590	8,899
2010									
Spring	1,006	342	60	34.00%	17.54%	2,969	2,991	2,929	2,772
Fall	2,865	262	144	9.14%	54.96%	8,457	8,517	8,343	7,895
Both	3,871	604	204	15.60%	33.77%	11,426	11,508	11,272	10,668
2011									
Spring	4,039	976	289	24.16%	29.61%	9,217	9,743	9,075	8,365
Fall	6,039	796	487	13.18%	61.18%	13,781	14,567	13,569	12,507
Both	10,078	1,772	776	17.58%	43.79%	22,998	24,310	22,644	20,872

Appendix 6. Trinity River upper (reaches 1-5) and lower (reaches 6-14) reaches expansion matrix for Chinook mark-recapture estimators during 2011 survey.

Upper Reaches (1-5)	Captured	Marked	Recaptured	Marking Rate	Recapture Rate	Petersen	Stratified Petersen	Schaefer	Schaefer w/ Law's adjustment
Spring /b	3395	742	269	21.86%	36.25%	6,274	6,971	6,300	5,775
Fall /b	4,841	532	420	10.99%	78.95%	8,946	9,940	8,984	8,235
Both	8,236	1274	689	15.47%	54.08%	15,220	16,911	15,284	14,010
Lower Reaches (6-14)									
Spring /a,b	644	234	20	36.34%	8.55%	3,554	4644	1,143	1,109
Fall /b	1198	264	67	22.04%	25.38%	6,612	8,939	2,126	2,063
Both	1792	498	87	27.79%	17.47%	10,166	13,283	3,270	3,173

a/ These estimates were made in violation of the rule requiring at lest 25 recaptures

b/ Spring and fall estimates were made by using spring/fall ratios

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ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2011-12 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, 2011 through November 4, 2011 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 8,793 (2,943 adults and 5,850 grilse) Chinook salmon and 199 (179 adults and 20 half-pounders) steelhead were harvested. The 2011 in-river sport quota was 7,900 adult Chinook salmon. The lower Klamath River portion of the quota (3,950 adult Chinook salmon) was met on September 21st. One hundred and fifty Chinook salmon (seven adults and 143 grilse) caught before August 15, 2011 are considered spring-run fish. Hatchery fish represented an estimated 18.32 percent (1,611/8,793) of the sport harvest in the lower Klamath River. Trinity River Hatchery (TRH) origin fish represented 7.63 percent of the estimated harvest and 10.69 percent 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 CDFG to provide data for run-size estimates since 1978 (Boydstun 1979, 1980; Lee 1984a, 1984b, 1985, Lau 1992-1997; Pisano 1998; Borok 1999-2004, Hanson 2005-2009). This report covers the period from July 1, 2011 through June 30, 2012. It provides sport harvest data and a description of the CDFG 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 CDFG 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.

<u>Quotas and Harvest Management</u>

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%). CDFG 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 CDFG 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 2011 season, fishing regulations allowed anglers to harvest three Chinook salmon per day (up to two adult Chinook) and one hatchery trout or one hatchery steelhead per day. These regulations started on August 15, 2011 in the lower Klamath River and September 1, 2011 in the Trinity River and the Klamath River above the Hwy 96 Bridge in Weitchepec. 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, CDFG 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 Weitchpec (Areas 1 and 2) are included in this report. Areas upstream of the Hwy 96 Bridge in Weitchpec to Iron Gate Dam (Area 3) were not directly surveyed by CDFG 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 2011. 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 2011 season fishing the mouth was not closed at any time. If 15 percent of the lower river quota had been caught below the Hwy 101 Bridge (3,375 adult fall-run Chinook salmon) the spit (100 yards of the channel through the sand spit formed at the Klamath River mouth) would be closed to sport fishing. The quota was not met this season.
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.

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.

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).

Creel Census Methods

Study methods and procedures used in Areas 1 and 2 during the 2011 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).

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 is 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 Game 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:

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

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
I = 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:

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

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.

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, CDFG 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 - grilse 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 –grilse (or jack) age break is reported. Pre-season regulations spell out the size of adult Chinook salmon at 22 inches or 56 centimeters (total length). We met the quota at this size structure. Post-season when adjusting for true grilse/adult cut off based on scale analysis and CWTs, a number of adults were reclassified as grilse, thus the quota was not actually met.

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 2011. Chinook salmon harvested in the lower Klamath fishery ranged in size from 27 to 101 cm in fork length (FL). The adult portion of Chinook harvested ranged from in size 63 to 101 cm FL and averaged 87 cm FL. The grilse component of the angler harvest ranged in size from 27 to 62 cm FL and averaged 47 cm FL (Figure 1).

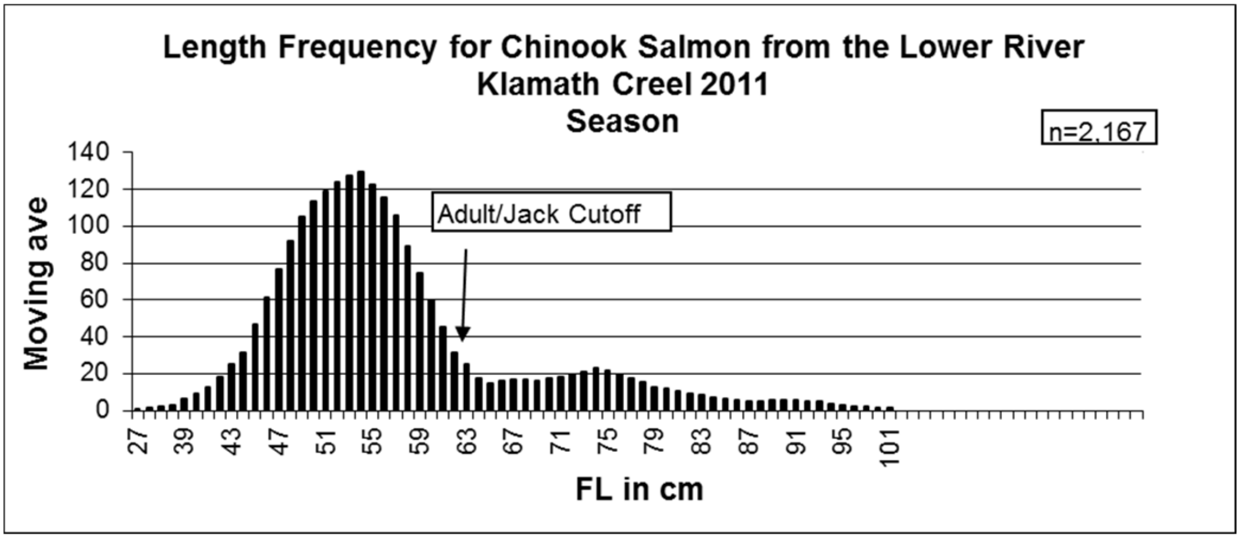

Figure 1. Fork length frequency of Chinook salmon harvested in the lower Klamath River during the 2011 season.

Harvested steelhead ranged in size from 48 to 65 cm FL and averaged 57 cm FL (Figure 2). 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.

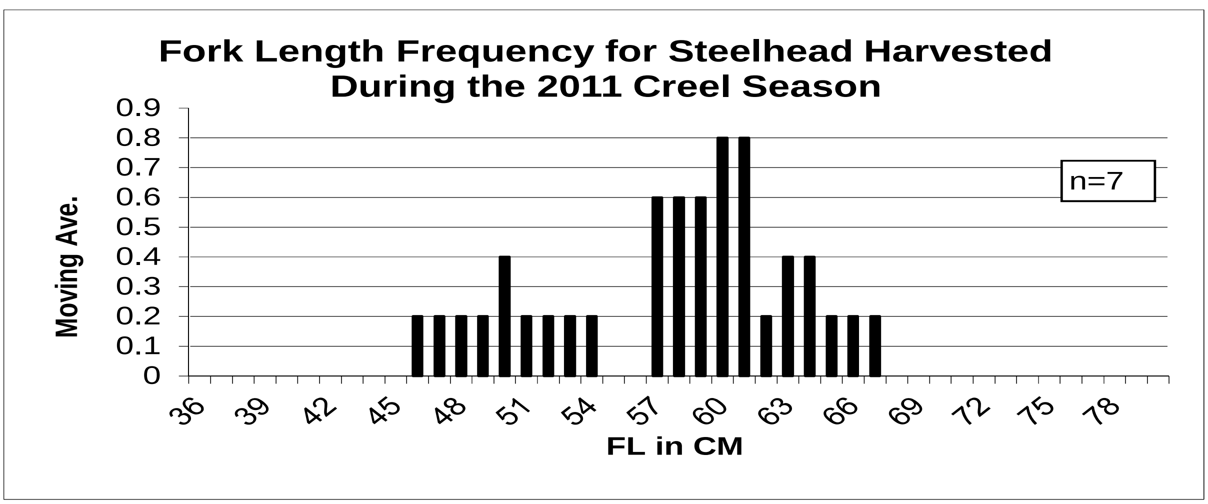

Figure 2. Length frequency of steelhead harvested in the lower Klamath River during the 2011 season.

Estimated Angler Effort and Harvest

During the 2011 season, CDFG estimate anglers made a total of 11,833 trips in Areas 1 and 2 combined. Of the 11,833 trips; 4,165 were in Area 1, and 7,668 were in Area 2 (Table 1). These trips resulted in a total effort of 56,759 fishing hours. As in previous seasons, boat anglers out-numbered shore anglers in both Areas (Table 1).

Anglers in the lower river did meet their quota of 3,950 adult fall run Chinook season on September 21, 2011. A total of 8,793 (2,943 adults and 5,850 grilse) Chinook salmon and 199 (179 adults and 20 half-pounders) steelhead were harvested (Table 1). During Julian week 32, 150 (seven adult and 143 grilse) spring-run Chinook salmon were harvested. The total of fall-run Chinook harvested was 8,643 (2,936 adults and 5,707 grilse) fish. Fourteen adult coho were estimated harvested this season.

Table 1. Summary of estimated angler effort and harvest of Chinook salmon and steelhead during the 2011 lower Klamath River creel census.

Site		Angler		Steelhead		Chinook Salmon	
Location		Trips	Hours	1/2 lbers	Adults	Grilse	Adults
		Area 1 - Mouth to Highway 101 Bridge					
Shore		1,028	3,078	0	7	144	212
Boats		3,138	7,786	0	17	523	445
Total		4,165	10,864	0	24	667	657
		Area 2 - Highway 101 to HWY 96					
Shore		1,312	4,102	2	12	131	100
Boats		6,356	41,793	17	143	5,052	2,186
Total		7,668	45,895	20	155	5,183	2,286
Grand Total		11,833	56,759	20	179	5,850	2,943
2010		11,516	58,842	0	61	1,505	2,057
2009		14,736	67,160	7	192	1,926	3,158

2011 Harvest and Effort Patterns

The average fishing trip length during the 2011 season was 4.8 hours. This is slightly less than the 2010 season and longer than the 4.2 hours average trip length over the previous years (Figure 3 and Table 2). Anglers fished longer trips and caught fewer adult fish, but a great deal more grilse Chinook.

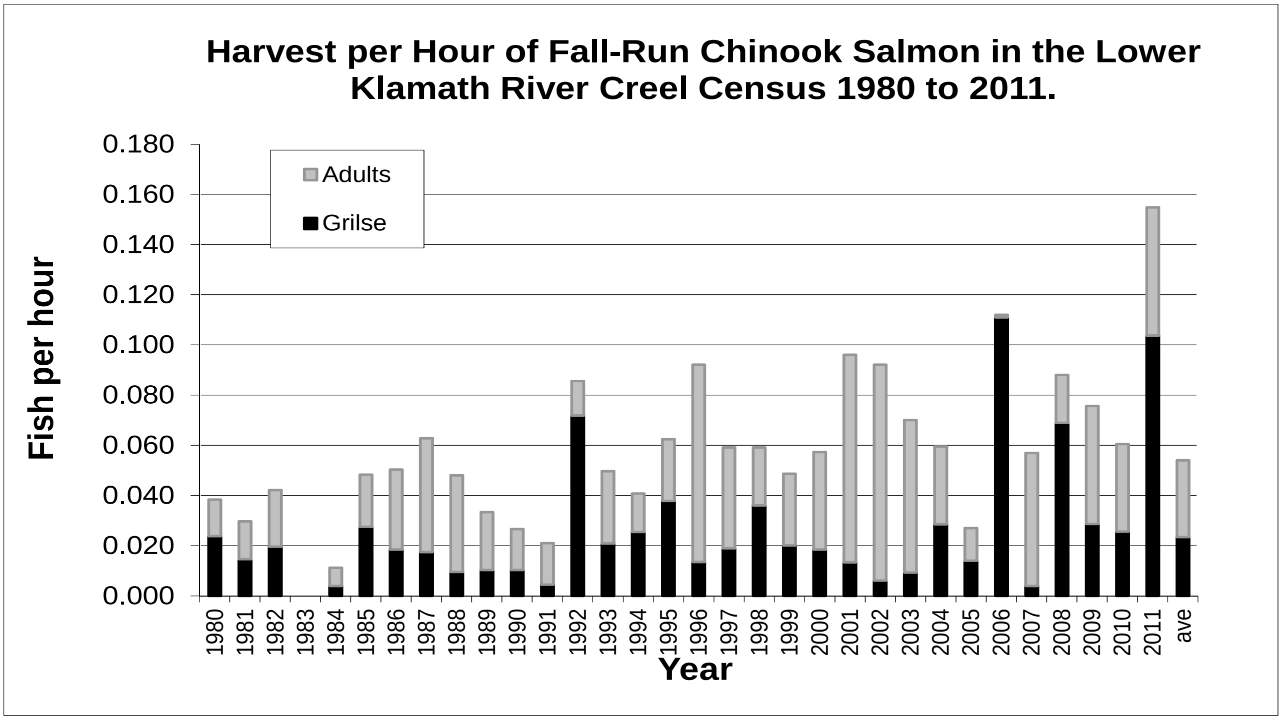

Figure 3. Chinook salmon harvested per hour of angler effort during the lower Klamath River creel survey,, 1980-2011.

Table 2. Number of angler trips, hours, and average length of trip in the lower Klamath River sport fishery 1992 – 2011.

Year	Total Angler		Average
	Trips	Hours	Hours/Trip
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

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. CDFG estimated anglers released 1,555 half-pounders, 786 adult steelhead, 1,287 grilse, and 2,221 adult Chinook salmon (Tables 3 and 4). No coho salmon were reported harvested or 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. The quota was met on September 21, 2011.

Table 3 Estimated number of Chinook and coho salmon and steelhead caught and released from the lower Klamath River, 1994-2011.

Year	Chinook		Steelhead		Coho	
	Grilse	Adults	<42mm FL	>41mm FL	Grilse	Adults
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

Table 4. Summary of estimated angler catch and release effort of Chinook salmon and steelhead during the 2011 lower Klamath River creel census.

Site	Angler		Steelhead		Chinook Salmon	
Location	Trips	Hours	1/2 lbers	Adults	Grilse	Adults
	Area 1 - Mouth to Highway 101 Bridge					
Shore	1,028	3,078	2	2	9	20
Boats	3,138	7,786	124	51	75	273
Total	4,165	10,864	126	54	85	294
	Area 2 - Highway 101 to HWY 96					
Shore	1,312	4,102	531	156	86	24
Boats	6,356	41,793	898	576	1,116	1,903
Total	7,668	45,895	1,429	732	1,202	1,927
Grand Total	11,833	56,759	1,555	786	1,287	2,221
2010	11,516	58,842	1,188	536	207	92
2009	14,736	67,160	975	485	338	292

Harvest Timing

Angler effort and Chinook harvest peaked in JW 37. This was true for both grilse and adult Chinook salmon (Figure 4 and Table 5).

Fewer steelhead were harvested than last season. Harvest of adult steelhead peaked in JW 37 (Figure 6). The peak week of half-pounder catch and release was JW 40 (Figure 7). Twenty half-pounders were reported harvested this season.

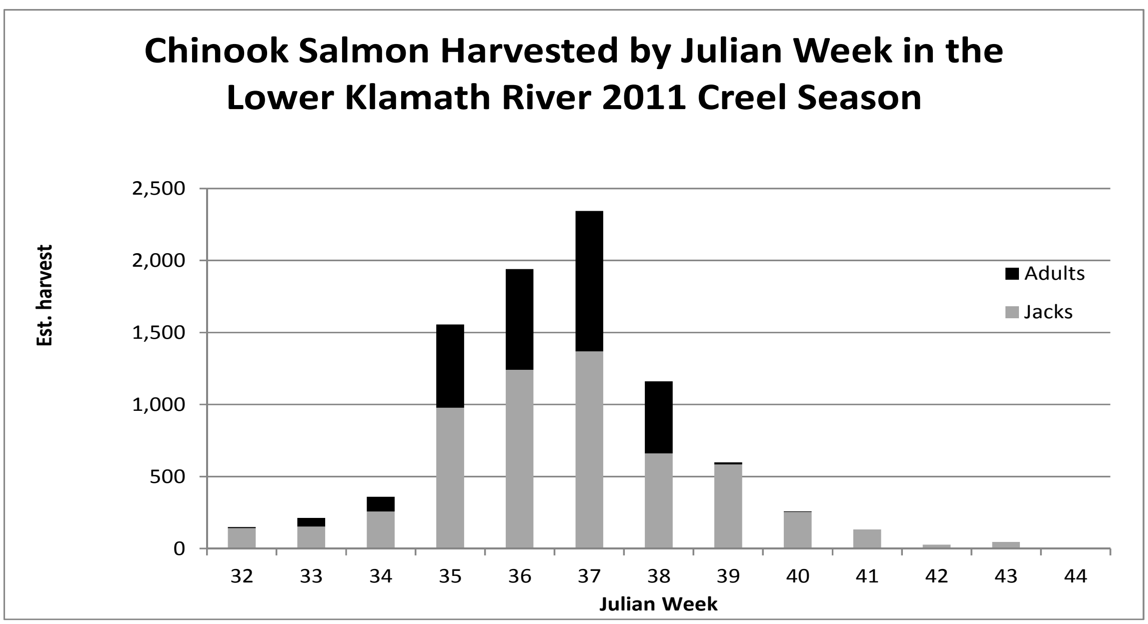

Figure 4. Estimated harvest of Chinook salmon in the lower Klamath River during the 2011 season.

Table 5. Harvest, release and angler effort by Julian week during the 2011 lower Klamath River creel census

	Angler		Harvested				Catch and Release			
			Steelhead		Chinook		Steelhead		Chinook	
Julian Week	Trips	Hours	1/2 lbers	Adult	Jacks	Adults	1/2 lbers	Adult	Jacks	Adults
32	455	2,120	0	14	143	7	238	140	67	4
33	635	2,739	0	24	153	60	183	54	14	0
34	1,001	3,734	0	21	258	101	239	50	5	15
35	1,351	5,681	2	20	978	579	51	32	183	164
36	1,834	8,579	2	17	1,242	699	65	73	263	98
37	2,638	11,572	0	31	1,369	976	109	71	244	239
38	1,631	9,364	0	12	661	502	142	75	74	272
39	1,154	6,301	0	19	585	14	51	108	163	681
40	500	2,956	5	9	254	5	259	104	114	296
41	238	1,294	5	5	133	0	72	16	37	252
42	114	658	0	0	28	0	5	0	26	40
43	191	1,256	0	7	47	0	75	33	33	114
44	91	506	7	0	0	0	68	30	65	47
	11,833	56,759	20	179	5,850	2,943	1,555	786	1,287	2,221

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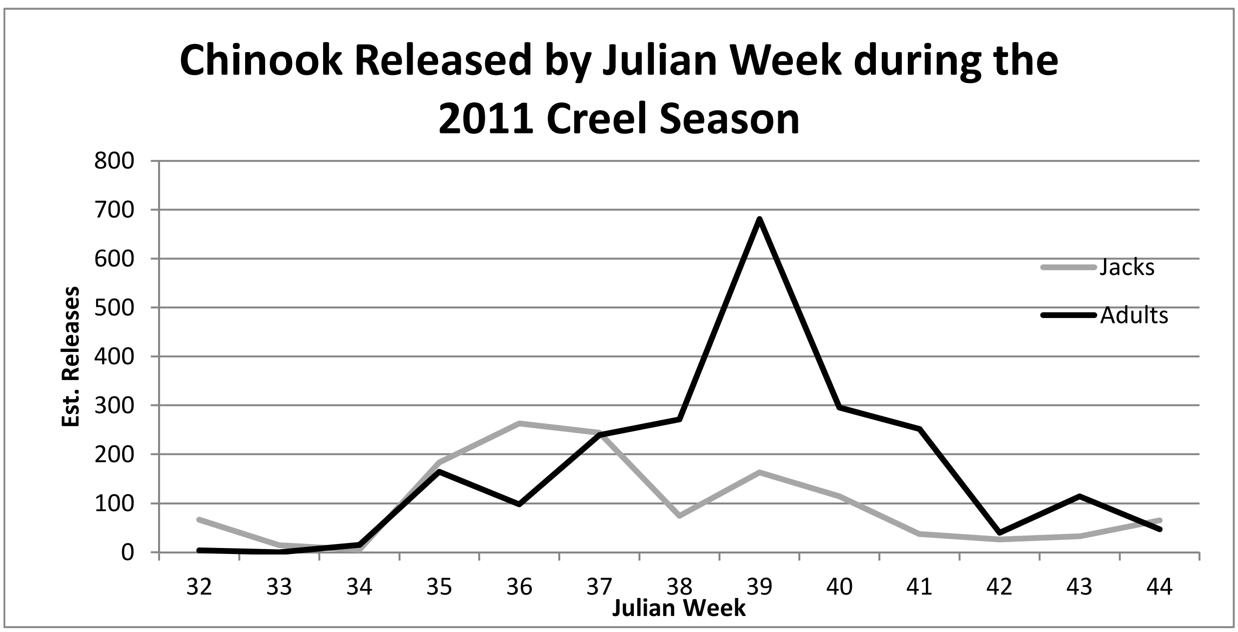

Figure 5. Estimate of Chinook salmon caught and released in the lower Klamath River during the 2011 season.

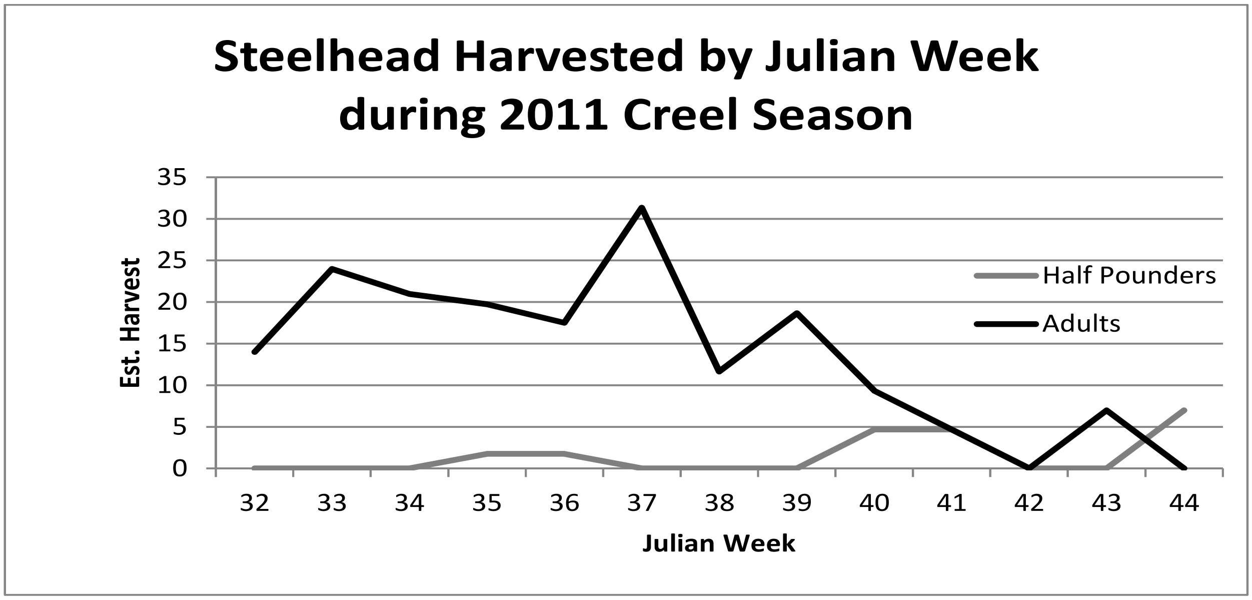

Figure 6. Estimated harvest of steelhead in the lower Klamath River during the 2011 season.

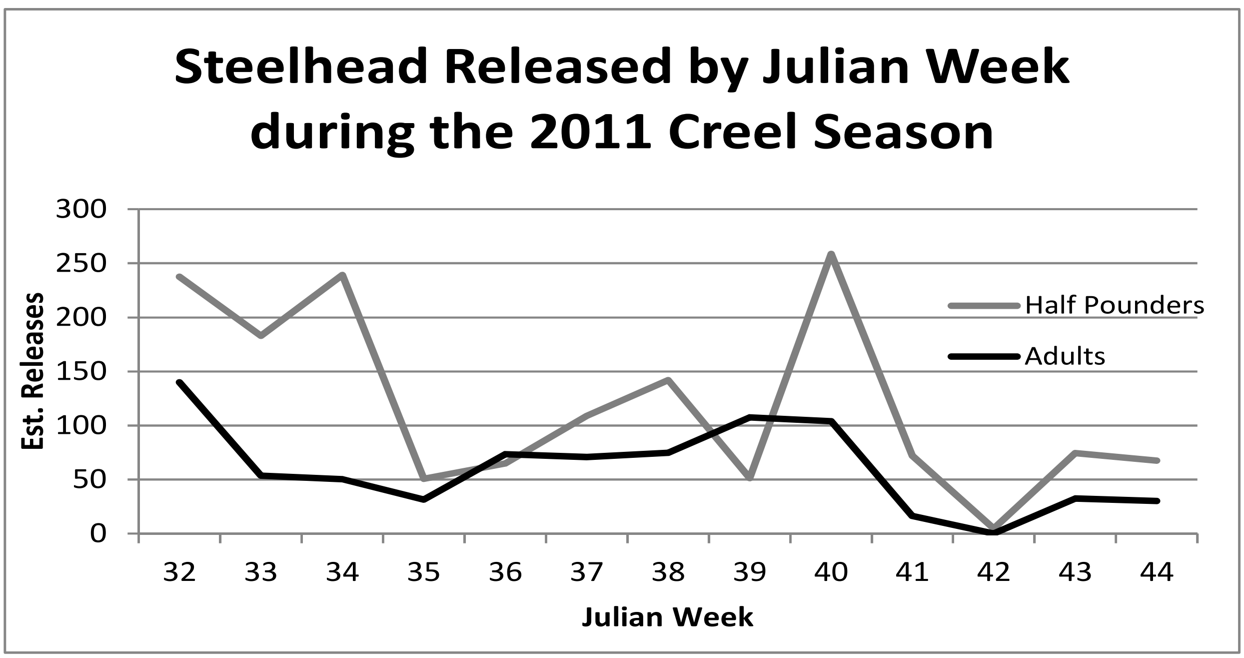

Figure 7. Estimate of steelhead caught and released in the lower Klamath River during the 2011 season.

Coded-Wire Tag Recovery

KRP personnel recovered the heads of 190 adipose fin-clipped and coded-wire-tagged (Ad+CWT) Chinook salmon JW 32 through 40 of the 2011 season. There were nine non-random recoveries (NRR), wherein anglers and or resort owners saved their fish heads for our 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 8). CWTs were not recovered from seven heads and four tags were lost during the recovery process, leaving 179 tags to decode. Of these 179 heads all were of Klamath-Trinity basin origin, 64 were from adult salmon while 115 were jack salmon. Two Trinity River Hatchery (TRH) spring Chinook heads were recovered, both were jacks.

Recoveries of fin-clipped, fall-run Chinook salmon adults ranged in size from 49 to 94 cm and jacks ranged in size from 44 cm to 76 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 4.59 percent (179/3,893) of the actual Chinook sampled. Expansions were made for creel sampling and hatchery production multiplier for each tag group. Based on these expansions, CDFG estimated 1,629 hatchery fish were harvested (Table 7). Hatchery fish represented an estimated 18.52 percent (1,629/8,793) of the entire sport harvest in the lower Klamath River

Iron Gate Hatchery (IGH) Origin Chinook Salmon

CDFG decoded 108 random recovered tags from Klamath River origin Chinook. These Chinook salmon represent 16 different tag codes; one from the 2007 Brood Year, 8 from the 2008 Brood Year and seven from the 2009 Brood Year at IGH (Table 6). When expanded for creel sampling and hatchery production multipliers for each tag group, IGH origin fish account for 11.49 percent (1,011/8,793) of the total sport harvest (Table 7). The IGH origin Chinook were harvested between Julian weeks 34 to 41 (Figure 8).

Trinity River Hatchery (TRH) Origin Chinook Salmon

CDFG decoded a total of 69 randomly recovered tags of TRH fall-run Chinook origin. These fall-run Chinook salmon represent 13 different tag codes; one from the 2007 Brood Year, five from the 2008 Brood Year and seven from the 2009 Brood Year at TRH (Table 6). TRH origin fall-run fish represented 7.02 percent (618/8,793) of the total sport harvest (Table 7). There were 2 spring-run TRH origin Chinook representing two different 2009 brood years. TRH fall-run origin Chinook were harvested between Julian weeks 36 to 40 (Figure 8).

During the 2011 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 40 (Figure 8).

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, 2011 season .

		Julian Week									
CWT Code	Brood Year	32	33	34	35	36	37	38	39	40	Total
Trinity River Hatchery Spring											
68822	2009					1					1
68836	2009			1							1
Trinity River Hatchery Fall											
68809	2007						3	2			5
68814	2008						2				2
68815	2008						6				6
68816	2008				1	1	2	1			5
68817	2008					1		1			2
68820	2008				5	3	9	4			21
68823	2009						1	1	1		3
68824	2009					1			1		2
68825	2009						1				1
68828	2009								1		1
68833	2009							1			1
68834	2009								1		1
68837	2009					1	5	4	8	1	19
Iron Gate Hatchery											
608020006	2007						2				2
68643	2008						1				1
68644	2008			1		1					2
68645	2008				2	1		1			4
68646	2008			1				2			3
68647	2008				3	2	1	1			7
68648	2008						1				1
68661	2008						1				1
68662	2008				1	1					2
68710	2009				3	5	5	1			14
68711	2009				4	9	9	5			27
68712	2009	1			4	9	3	1		1	19
68713	2009				4		7	1			12
68714	2009				1	4	2	1			8
68715	2009						1	1			2
68716	2009				1	1	1				3
100000				1	1	1	3	1			7
200000							4				4
300000											0
400000											0
Total		1	0	4	30	42	70	29	12	2	190

Table 7. Fall Chinook salmon harvest proportioned by hatchery origin of the 2011 lower Klamath River sport harvest, expanded for creel sampling and hatchery production multiplier.

Total Fall-run Chinook Salmon Harvest		IGH Expanded	TRH Expanded	Estimated Total Hatchery	% Harvest Hatchery
Grilse	5,850	719	235	954	16
Adults	2,943	292	383	675	23
Total	8,793	1,011	618	1,629	18

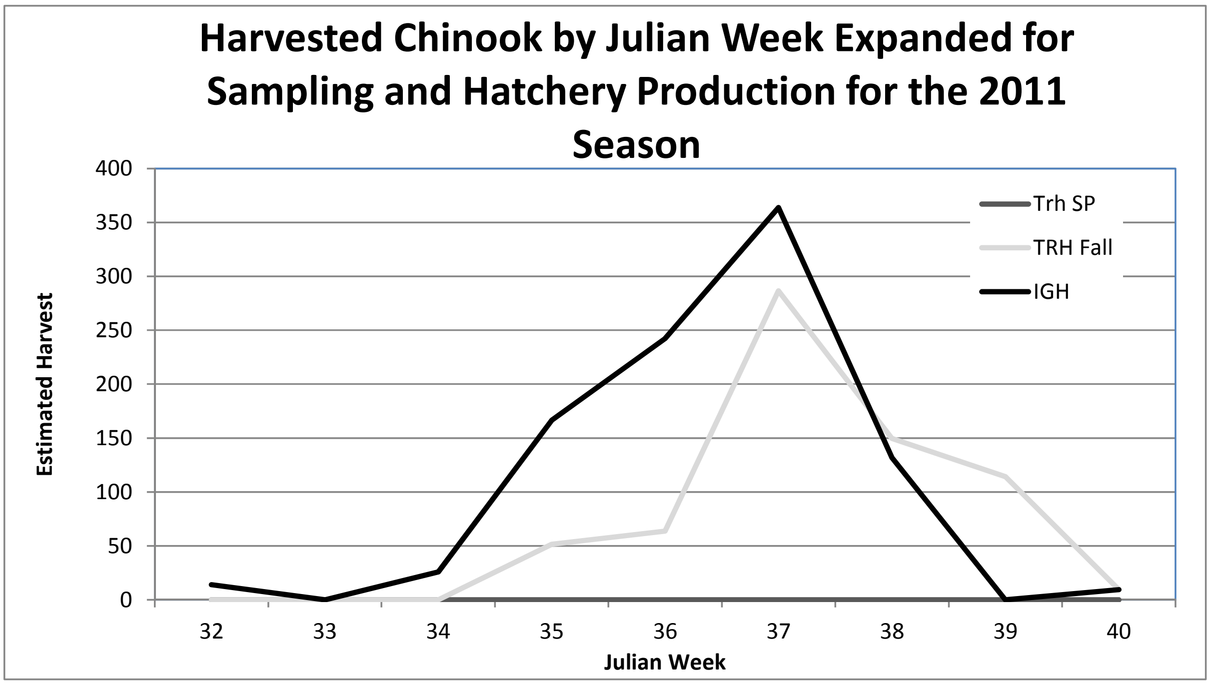

Figure 8. Timing by Julian week of coded wire tags, expanded for sampling and by individual tag code, recovered from Chinook salmon in the lower Klamath River 2011 creel season.

DISCUSSION

Pre-season regulations spell out the size of adult Chinook salmon at 22 inches or 56 centimeters (total length). We met the quota at this size structure. Post-season when adjusting for true grilse/adult cut off based on scale analysis and CWTs, a number of adults were reclassified as grilse, thus the quota was not actually met.

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 2011 sport harvest was composed of approximately 18.33 percent hatchery and 81.67 naturally produced Chinook. The hatchery contribution was composed of 10.85 percent IGH Chinook and 7.02 percent TRH Chinook. In contrast, the previous 23 years of hatchery contributions to lower Klamath River Chinook harvests have averaged 12 percent TRH Chinook and 17 percent IGH. 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 10) 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.

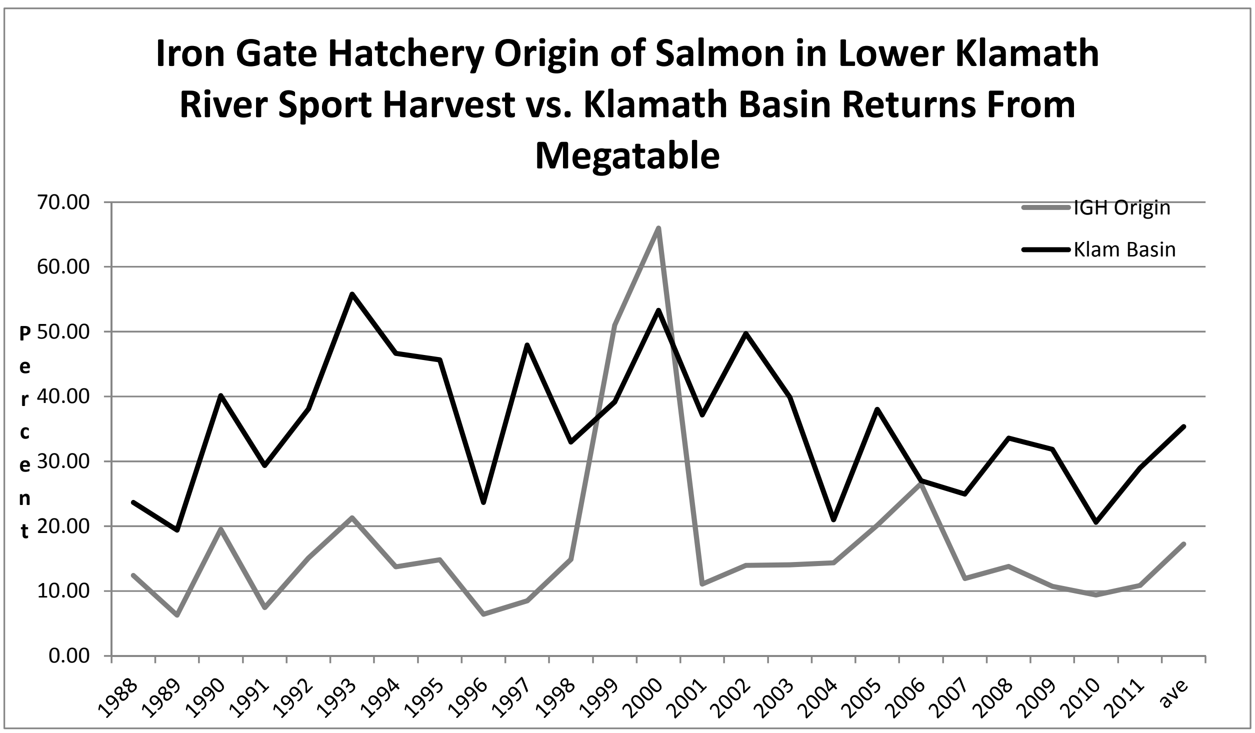

Figure 9. Percent of Iron Gate Hatchery origin salmon from the lower Klamath sport creel as compared to salmon returning to the Klamath portion of the basin from the megatable.

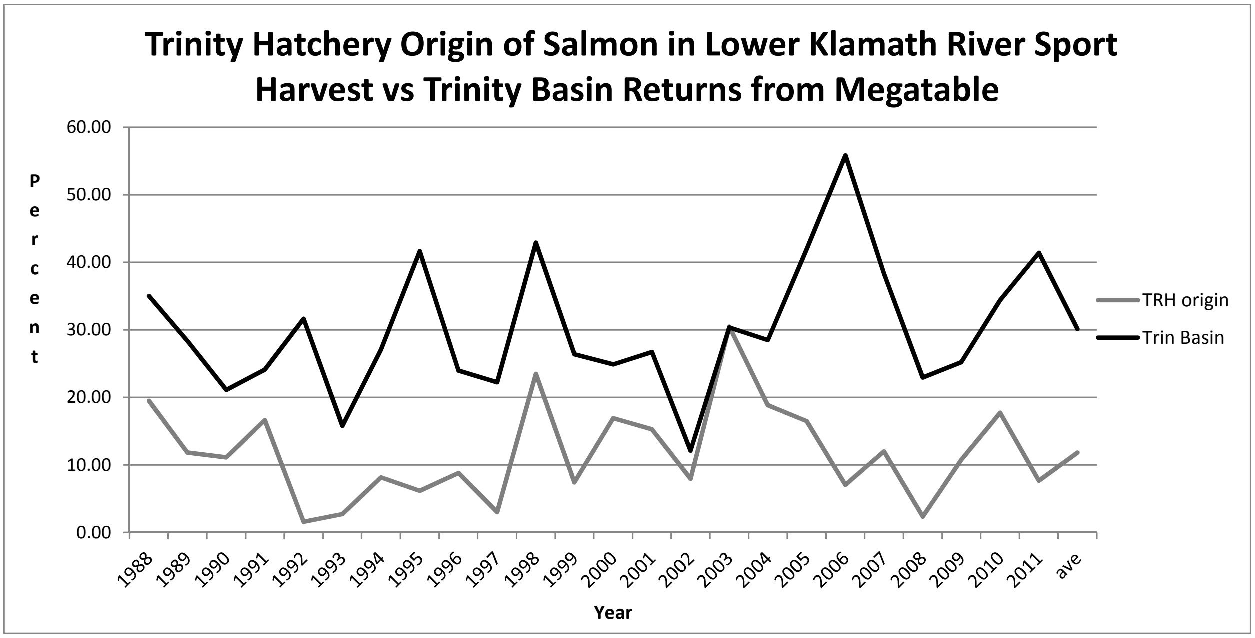

Figure 10. Percent of Trinity River Hatchery origin salmon from the lower Klamath sport creel as compared to salmon returning to the Trinity portion of the basin from the megatable.

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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		
Hatchery Spawners	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
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		
Angler Harvest	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	Totals
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		
Totals	Grilse	Adults	Totals	Grilse	Adults	Totals	Grilse	Adults	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**