

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

FINAL ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD
MONITORING PROJECT
2010-11 SEASON



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by

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Northern Region
Klamath and Trinity River Projects

Northern Region
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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-second annual report to the United States Bureau of Reclamation (Reclamation). The activities conducted January 1, 2010 through December 31, 2010 were performed under terms of Cooperative Agreement Number R11AC20520. The field work was conducted by personnel of the CDFG Klamath-Trinity Program. Cooperators of CDFG 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 2010. 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 six 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.

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We are grateful 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.

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 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 Jennifer Faler and the TRRP staff for their input and effort administering our projects and contracts.

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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2010-11 SEASON**

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

by

Mary Claire Kier

ABSTRACT

The California Department of Fish and Game's Trinity River Project conducted tagging and recapture operations from July 2010 through March 2011 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 in 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 1,525 Chinook salmon, 911 coho salmon, 938 fall steelhead and 144 brown trout (*Salmo trutta*). Using a Petersen mark-recapture methodology, fish tagged at the weirs and recovered at Trinity River Hatchery (TRH), we estimated a run size of 11,285 spring Chinook migrated into the Trinity River basin upstream of Junction City weir. Using tags returned by anglers we estimated 454 spring Chinook were harvested, yielding an escapement of 10,831 fish. An estimated run-size of 40,792 fall Chinook migrated past Willow Creek weir (WCW), of which an estimated 315 were harvested by anglers, yielding and escapement of 40,476 fish. The coho salmon (coho) run-size and escapement in the Trinity above Willow Creek was estimated at 7,947 fish. No coho were reported harvested by anglers. An estimated 8,451 (3,811 naturally produced and 4,640 hatchery produced) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 197 adult fall steelhead above the WCW, leaving 8,254 fish as potential spawners.

The coho salmon (coho) run-size and escapement in the Trinity River basin upstream of WCW was estimated at 7,947 fish. No coho were reported harvested by anglers. An estimated run-size of 8,451 (3,811 naturally produced and 4,640 hatchery produced) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 197 adult fall steelhead, yielding an escapement of 8,254 fish.

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) estimates 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 estimates 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 production 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.

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.

Additionally, tagging provides information to determine angler harvest and growth rates of brown trout.

METHODS

Trapping and Tagging

Trapping Locations and Periods

Trapping and tagging operations were conducted from July 29, 2010 through October 22, 2010 by TRP and HVTF personnel at two temporary weir sites located on the main stem Trinity River (Figure 1). The Junction City weir (JCW) is located 132.7 river kilometers (rkm) (~river mile (rm) 81.7) upstream from the Klamath River confluence (40° 41' 5.51" N, 123° 01' 35.55" W) near the town of Junction City. The JCW was operated July 29 through September 29, 2010, and is primarily operated to capture, measure, and tag spring-run Chinook salmon (spring Chinook). The Willow Creek weir (WCW), is located 36.5 rkm (~rm 22.7) upstream from the Trinity River's confluence with the Klamath River (40° 58' 29.85" N, 123° 38' 8.61" W) and was operated August 19 through October 22, 2010. The WCW is primarily operated to capture, measure, and tag fall-run Chinook salmon (fall Chinook).

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 exceeded 22° Celsius.

Weir and Trap Design

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

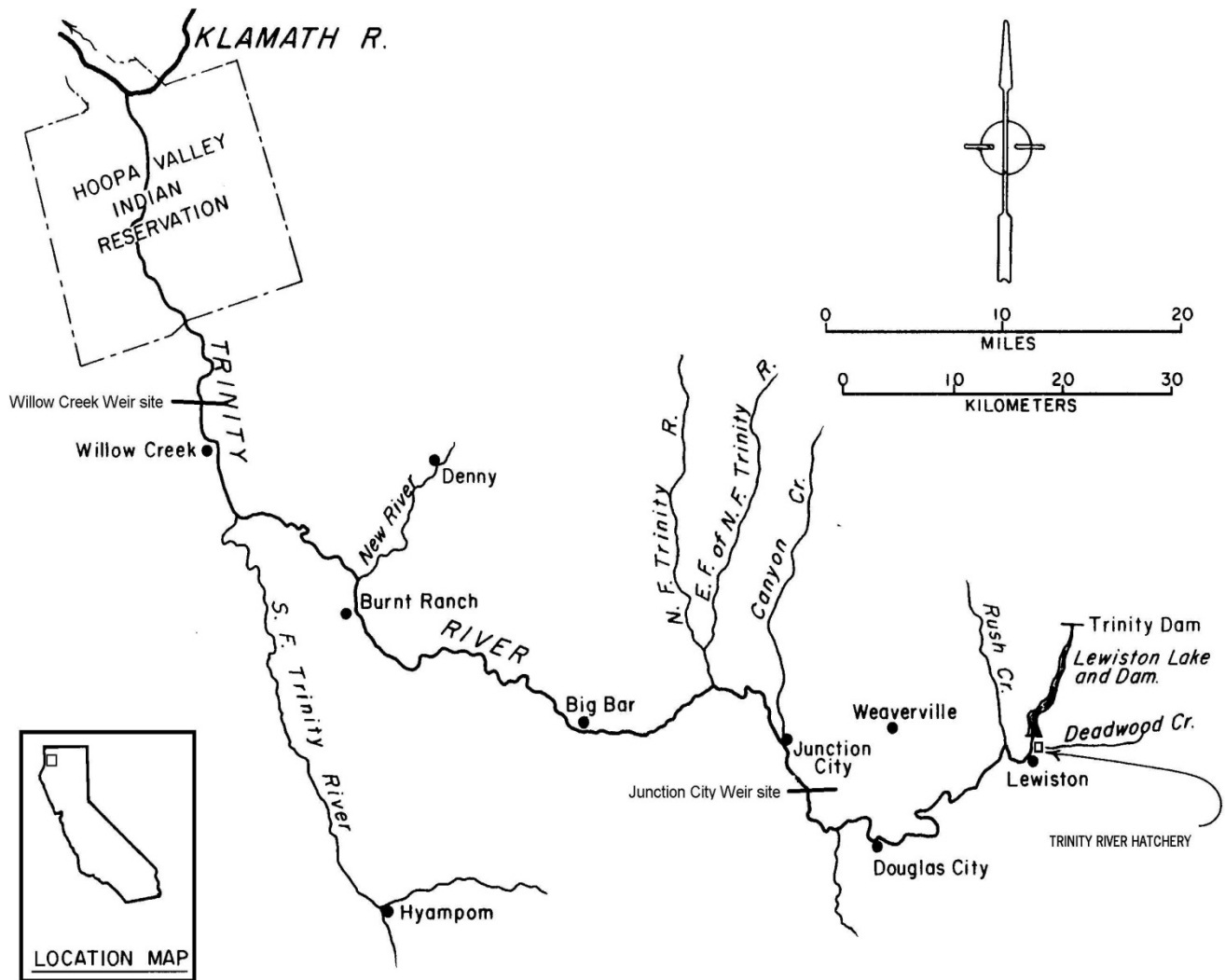


Figure 1. Location of trapping/tagging weirs near Willow Creek and Junction City, and Trinity River Hatchery, in the Trinity River basin, 2010 season.

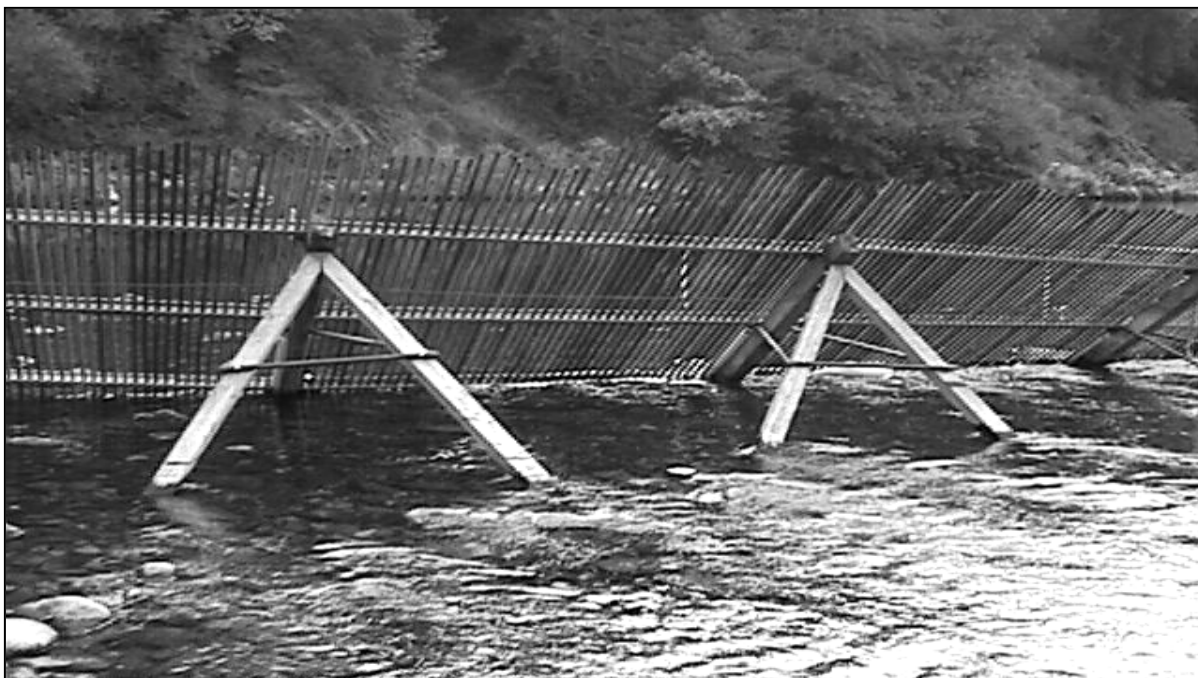


Figure 2. Photograph of Alaskan-style weir tripods, support channels and conduit (looking upstream).



Figure 3. Photo (looking downstream) of 2010 Willow Creek weir. Note the boat gate (left side of picture) 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 $\frac{1}{4}$ the length of the dorsal fin, anterior of the posterior edge of the dorsal fin. At both weirs one-third of the Chinook

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.

received \$10-reward tags, while the remaining two-thirds received non-reward tags. At WCW one-half of the adult steelhead received reward tags while the remaining fish received non-reward tags. All 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; had there been any brown trout trapped at WCW in 2010 they would have been tagged with non-reward FT-4s.

In addition, 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).

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

Each year there is temporal overlap of the spring and fall Chinook runs in the Trinity River, but the run timing varies year to year so dates must be ascertained to separate the two races, for analytical purposes, 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 2010 was between October 12 and October 22, 2010 (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, 244,661 marked fall yearling Chinook of CWT group 06-88-09 plus 751,089 unmarked fall yearling Chinook were released from TRH in October of 2008. The expanded estimate for each return from this group is 4.06992 $((244,661 + 751,089) / 244,661)$. Each CWT return is expanded by its production multiplier to estimate the total number of spring or fall Chinook that entered the hatchery. If more Chinook entered the hatchery on a particular sorting day than could be accounted for by the expansion of all CWT groups, the additional fish are considered naturally produced. Conversely, if fewer Chinook entered the hatchery on a particular sorting day than could be accounted for by expansion of all CWT groups that lack of fish would be recorded as a negative number of naturally produced fish in the daily CWT expansion...but that has not ever occurred (Sinnen, DFG, pers. com) These 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 Grilse Chinook and Coho Salmon

The size separating adult and grilse 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 grilse and adults. Fork length data from TRH Chinook was only used from weeks in which $\geq 90\%$ 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 grilse 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

All salmonid carcasses recovered at the weir were measured to the nearest cm FL and examined for wounds, tags, fin clips, and spawning condition. All heads from ad-clipped fish were removed for the potential recovery and decoding of the CWT. After processing, all carcasses were 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, 2011 were included in assessing harvest and catch and release rates. The limited number of 2010 tags returned after that date were processed for payment but not used for analysis.

Trinity River Hatchery Returns

The TRH fish ladder was opened September 3, 2010, closed October 12-22 to separate spring and fall Chinook and closed for the season March 8, 2011. The first spring Chinook spawning date was September 7. Hatchery personnel typically conduct fish spawning operations two days per week during the Chinook and coho spawn.

Additional spawn days occur during the peak of the runs in November. Steelhead spawning operations ensued one day per week from January 1 to March 8, 2011

All salmon and steelhead entering TRH are identified to species, sexed, examined for tags and clips, and measured to the nearest cm FL. Coho and adult steelhead that enter the hatchery prior to the start of spawning of those species receive upper caudal fin clips prior to live release to the river. Each salmon and steelhead that enters the TRH spawning house is measured to the nearest cm FL only once at the time of first TRH entry. Both coho and steelhead are known to make multiple returns to the hatchery within the same spawning season. We refer to these marked returns as "re-runs". The purpose of the upper caudal clip is to prevent double counting of fish that have been released live to the river but return on subsequent days.

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

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

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

Spawner Surveys

With crews from U.S. Fish and Wildlife Service, U.S. Forest Service, the Yurok Tribe, and Hoopa Valley Tribal Fisheries Program, TRP staff conducted spawner surveys in the upper Trinity River from Cedar Flat (rkm 78) upstream to Lewiston Dam (rkm 180) and from Hawkins Bar (rkm 64) to Weitchpec (rkm 0). Fish recovered in these surveys were examined for spawning success and Project tags. Results of these surveys are presented in Task 4 of this report.

Statistical Analyses

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 2010-11 spawning season there were not enough spring Chinook, fall Chinook, or coho salmon caught to stratify grilse 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 grilse/adults observed at each of the weirs for each species and applied those proportions to the run-size estimates to break them into grilse/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 grilse 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 run between April and September while fall Chinook migrate 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 37 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 2010 were designated fall Chinook.

We were unable to install the JCW until July 29, 2010 (JW 31) due to high river velocity at the weir site. The numbers of spring Chinook trapped were highest the first two weeks at 8.6 fish and 7.4 per night respectively; the fall Chinook comprised the majority of the run (as determined by CWT analysis) by JW 38 (Table 1, Figure 6). The weir was removed from the river September 29, 2010, on schedule.

At WCW in 2010, we installed the weir on August 19; we trapped that first night, and performed our first tagging of the season August 20 (JW 34). During the first three weeks of WCW trapping only 13 of 475 Chinook were marked with adipose clips indicating they were of hatchery origin, meaning the majority of the fish trapped were from natural production. Julian week 40 was our peak catch of fall Chinook with an average of 39.6 fish trapped per night. The catch dropped off after that, and during JW 43 we had only a single night of trapping before we had to remove the weir on October 22 for a storm event. We were unable to re-set the weir for the remainder of the season.

Size of Trapped Fish

Spring Chinook trapped at JCW and TRH averaged 69.4 and 73.7 cm FL, respectively, with a combined average 73.4 cm FL (Figure 8, Appendix 4). In 2010 the nadir separating grilse from adult spring Chinook was between 57 and 58 cm FL. Data from known age, hatchery-marked spring Chinook that entered TRH supported the minimum adult fork length of 58 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 58 cm FL to the observed population, an estimated 13.8% of the spring Chinook observed were grilse at JCW, and 9.1% at TRH. Historically the nadir between grilse and adult spring Chinook fork lengths averages 52 cm, and has only been greater than 56 cm two years since 1977. 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 grilse and adult. Non-averaged data are presented in the appendices.

Fall Chinook trapped at JCW, WCW and TRH averaged 65.0, 68.4 and 74.7 cm FL, respectively, with a combined mean FL of 73.9 cm. (Figure 9). The nadir on the fork length distribution between grilse and adult fall Chinook indicated a maximum grilse size of 61 cm FL. Data from known age, hatchery marked fall Chinook entering TRH supported this separation between grilse and adults; there was very little overlap between sizes of age 2 and age 3 fish (Appendix 3).

Using the maximum grilse size of 61 cm, fall Chinook grilse comprised 30.8% and 15.8% of the run observed at WCW and TRH respectively.

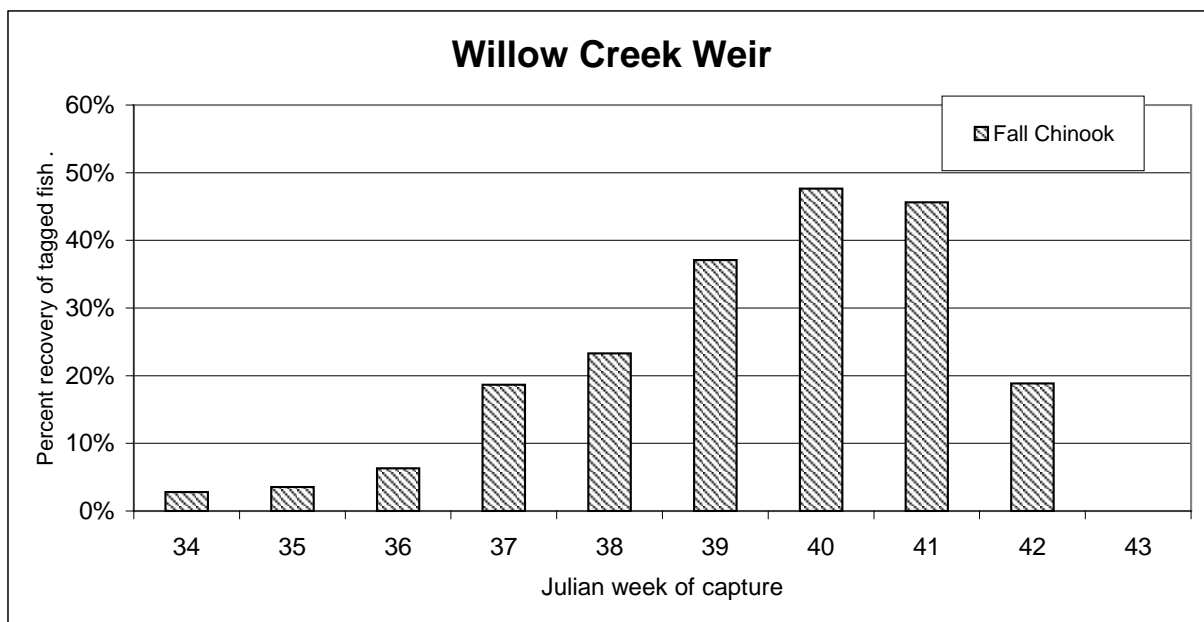
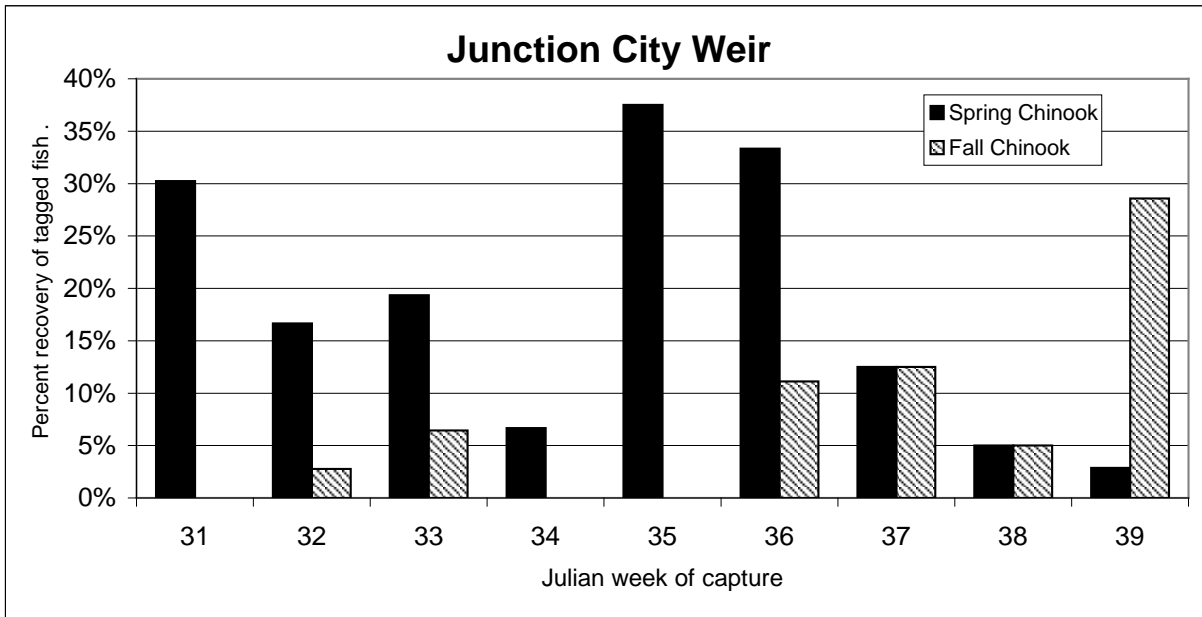


Figure 5. Percent recovery of Junction City weir and Willow Creek weir marked Chinook at Trinity River Hatchery during the 2010-11 season.

Table 1. Weekly summary of Chinook trapped in the Trinity River at Junction City weir during 2010. ^a

Julian week	Inclusive dates	Nights Trapped	Number trapped					Fish/night		
			Grilse ^b	Ad-clip Grilse	Adults	Ad-clip Adults	Total			
Spring Chinook										
31	30-Jul - 5-Aug	5	6	1	37	3	43	4	8.6	
32	6-Aug - 12-Aug	5	4	0	33	4	37	4	7.4	
33	13-Aug - 19-Aug	5	5	1	26	4	31	5	6.2	
34	20-Aug - 26-Aug	5	3	0	12	0	15	0	3.0	
35	27-Aug - 2-Sep	5	0	0	8	1	8	1	1.6	
36	3-Sep - 9-Sep	4	1	0	8	2	9	2	2.3	
37	10-Sep - 16-Sep	5	4	0	20	1	24	1	4.8	
Sub-total:		34	23	2	144	15	167	17		
Mean:									4.9	
Fall Chinook										
38	17-Sep - 23-Sep	5	8	0	12	0	20	0	4.0	
39	24-Sep - 30-Sep	4	10	0	25	7	35	7	8.8	
Sub-total:		9	18	0	37	7	55	7		
Mean:									6.1	
Grand total:		43	41	2	181	22	222	24		

a/ Trapping at Junction City weir took place July 30 - September 29, 2010 (Julian weeks 30-39).

b/ Spring Chinook <58 cm FL were considered grilse in 2010. Fall Chinook <62 cm FL were considered grilse.

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

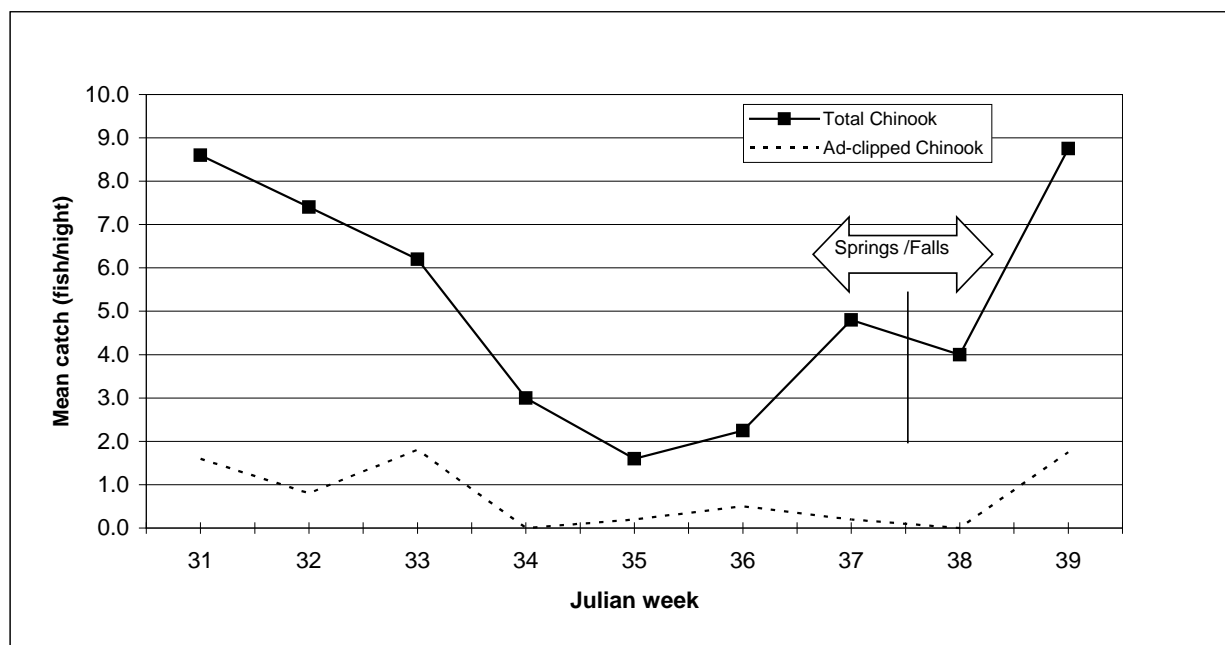


Figure 6. Mean catch of Chinook in the Trinity River at Junction City weir during 2010. Note the deliniation between the spring and fall runs at Julian week 38.

Table 2. Weekly summary of Chinook trapped in the Trinity River at Willow Creek weir during 2010. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped					Ad-clip total	Fish/night	
			Grilse ^b	Ad-clip Grilse	Adults	Ad-clip Adults	Total			
Fall Chinook										
34	20-Aug - 26-Aug	5	65	1	123	3	188	4	37.6	
35	27-Aug - 2-Sep	5	41	1	101	4	142	5	28.4	
36	3-Sep - 9-Sep	5	57	2	88	2	145	4	29.0	
37	10-Sep - 16-Sep	5	48	0	76	8	124	8	24.8	
38	17-Sep - 23-Sep	5	48	3	88	16	136	19	27.2	
39	24-Sep - 30-Sep	5	67	3	121	17	188	20	37.6	
40	1-Oct - 7-Oct	5	48	5	150	33	198	38	39.6	
41	8-Oct - 14-Oct	5	11	3	53	9	64	12	12.8	
42	15-Oct - 21-Oct	5	16	2	95	18	111	20	22.2	
43	22-Oct - 28-Oct	1			7		7	0	7.0	
Total:		46	401	20	902	110	1,303	130		
Mean:									28.3	

a/ Trapping at Willow Creek weir took place August 20 - October 22, 2010 (Julian weeks 34-43).

b/ Fall Chinook <62 cm FL were considered grilse in 2010. All Chinook trapped at WCW were fall Chinook in 2010.

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

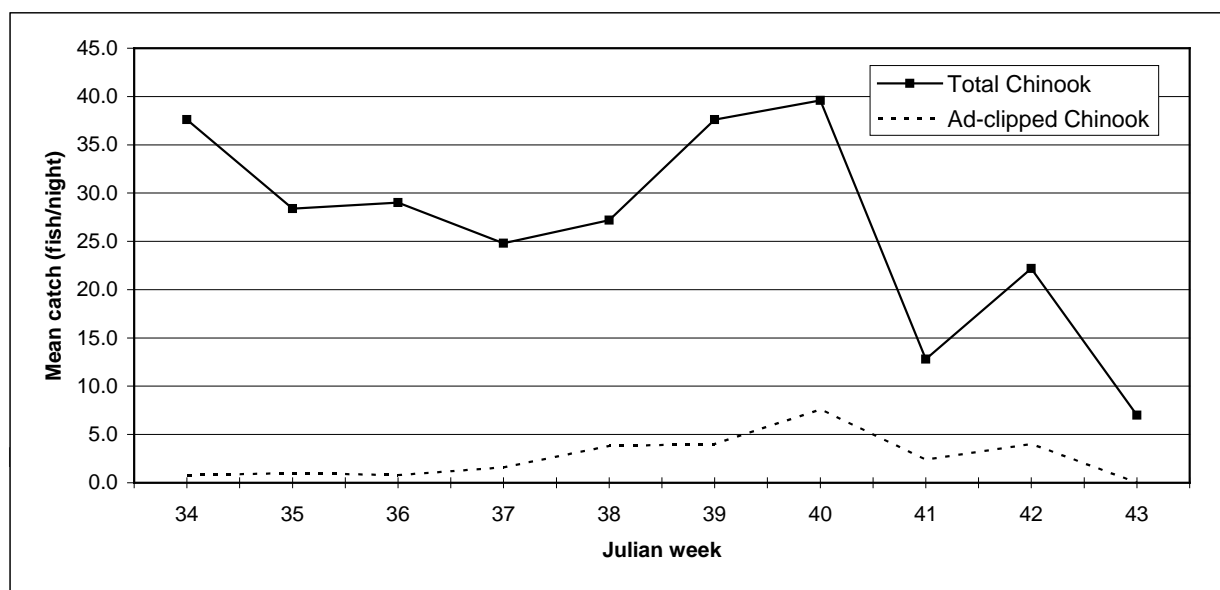


Figure 7. Mean catch of fall Chinook in the Trinity River at Willow Creek weir, 2010.

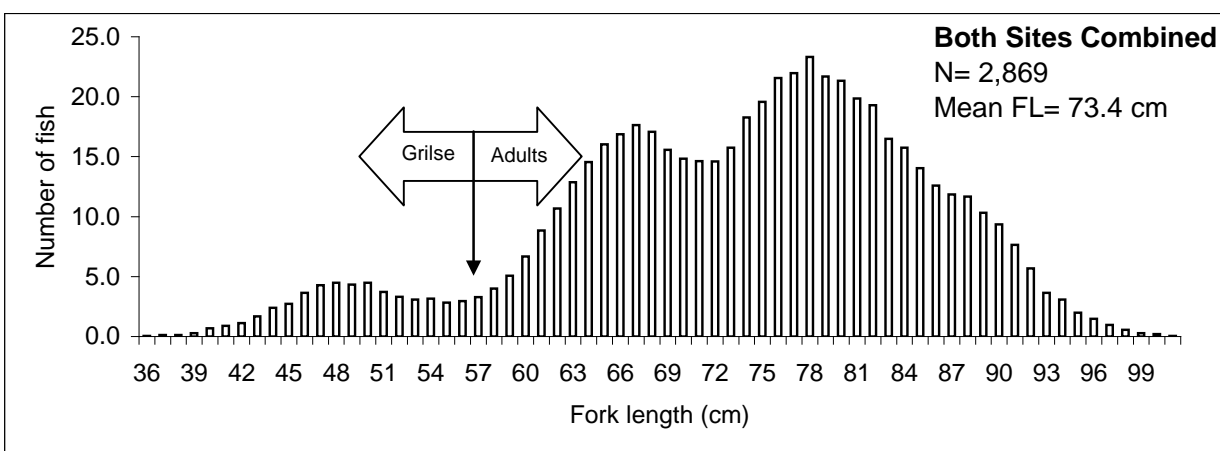
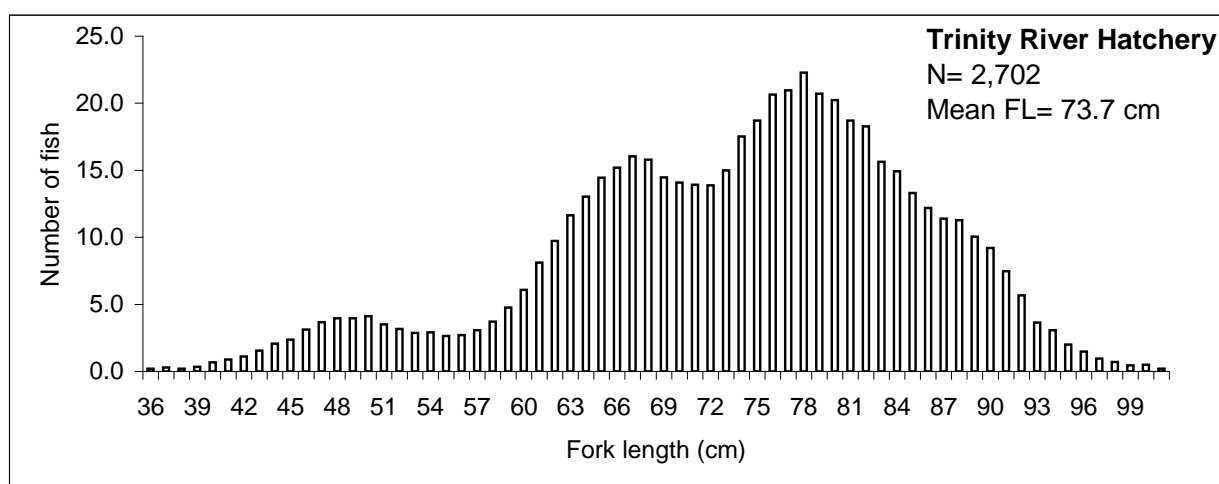
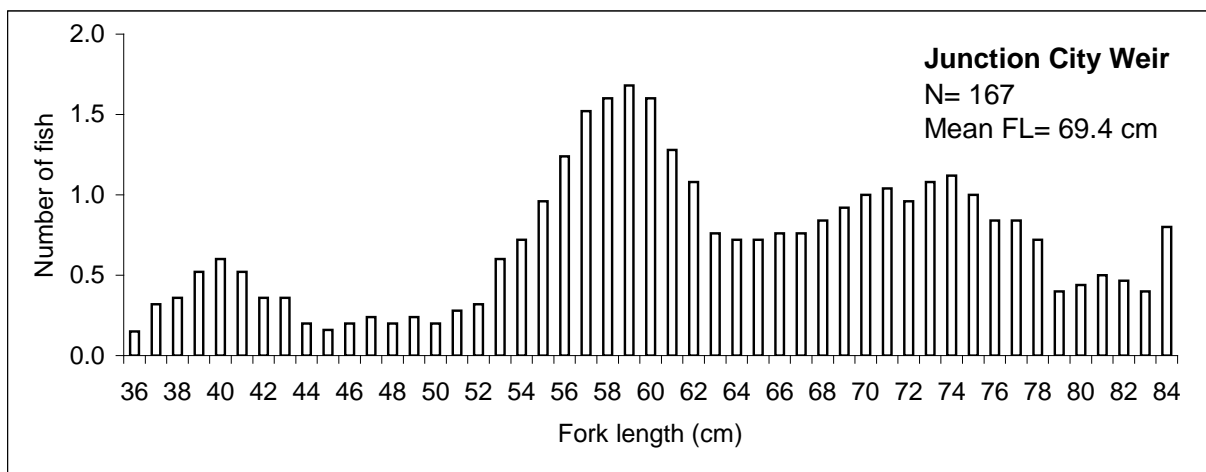


Figure 8. Spring Chinook fork lengths (cm) observed at Junction City weir, Trinity River Hatchery, and both sites combined during the 2010-11 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

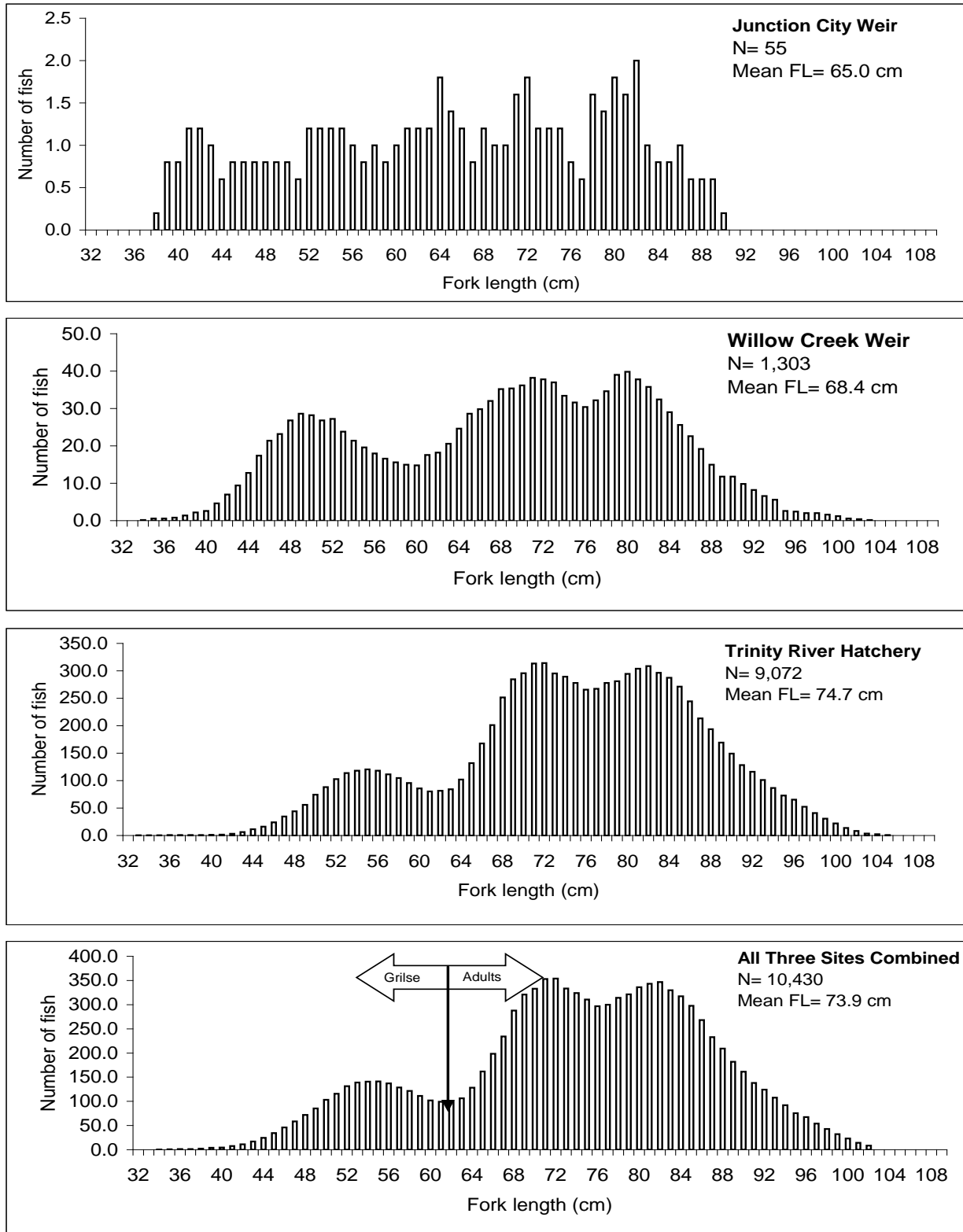


Figure 9. Fall Chinook fork lengths (cm) observed at Junction City weir, Willow Creek weir and Trinity River Hatchery and all sites combined during the 2010-11 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

Effectively Tagged Fish

A total of 167 spring Chinook were trapped at JCW, of which 166 (23 grilse and 143 adults) were effectively tagged (Appendix 4). There was one tagging mortality detected and zero caught and released spring Chinook from which anglers reported removing tags (Appendix 8). A total of 53 (32.3%) spring Chinook were tagged with reward tags (10 grilse and 43 adults); the remaining fish received non-reward tags. There were 55 (18 grilse and 37 adult) fall Chinook trapped at JCW in 2010, all of which were effectively tagged.

There were no spring Chinook trapped at WCW in 2010. A total of 1,303 fall Chinook were trapped at WCW, of which 1,281 were tagged. Of those 1,281 tagged fish (398 grilse and 883 adults), 1,266 of them (396 grilse and 870 adults) were effectively tagged (the number of effectively tagged fish excludes fish that were not tagged, tagging mortalities, and fish that had their tags removed by anglers (Appendix 5). There were 11 (two grilse and nine adult) tagging mortalities detected, and four (zero grilse, four adults) caught and released fall Chinook from which anglers reported removing tags (Appendix 9). Reward tags were placed on 427 (121 grilse and 306 adults), or 33.3%, of the fall Chinook trapped at WCW; non-reward tags on the remaining fish (277 grilse and 577 adults).

Incidence of Tags and Fin Clips

ad-clipped fish comprised 10.2% of the spring Chinook captured (17 of 167) at JCW (Appendix 4). Forty four (26.3%) of the 167 spring Chinook and six (35.5%) of the 17 ad-clipped spring Chinook tagged at JCW were subsequently recovered at TRH (Appendix 8). Four of those six TRH-recovered ad-clipped fish were released from the hatchery as yearlings.

Of the 1,303 fall Chinook trapped at WCW, 10.0% (130) were ad-clipped and of the 55 fall Chinook trapped at JCW, seven (12.7%) were ad-clipped (Appendix 5). Two hundred and eighty-five of the 1,281 (22.2%) fall Chinook tagged at WCW, and 18 of the 55 (32.7%) fall Chinook tagged at JCW were recovered at TRH. Of the 285 fall WCW recovered at TRH, 58 had ad-clips. Five of the seven ad-clipped fall Chinook tagged at JCW were also recovered at TRH.

Incidence of Gill-net Wounds, Hook Scars, and Predator Wounds

Four (2.4%) of the 167 spring Chinook trapped at JCW had gill net wounds, as did five (9.1%) of the falls. Crews also observed four wounds of unknown origin, 19 lamprey wounds, and two non-lamprey predator wounds on spring Chinook at JCW, and four lamprey wounds on the JCW fall Chinook.

Of the 1,303 fall Chinook trapped at WCW 189 (14.5%) had gill net wounds. Also observed were seven fish with ocean (healed) hooking scars; five (fresh) hooking wounds, 38 wounds of unknown origin, 61 with predator wounds; four with lamprey wounds, and two with fungus and/or disease.

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 2010-11 season.

CWT and release type ^a	Species	Race	Brood		Number of CWT fish	Origination Site	Number recovered / tagging site:	
			year	Date			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		2
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		2
068811-f	Chinook	spring	2008	06/01-15/2009	75,847	TRH		
068812-f	Chinook	spring	2008	06/01-15/2009	89,934	TRH		1
068813-f	Chinook	spring	2008	06/01-15/2009	64,175	TRH		1
shed tag ^b	Chinook	spring						
Total spring Chinook:							0	6
FALL CHINOOK								
065350-f	Chinook	fall	2006	06 /01-08 /2007	118,575	TRH	1	
065351-f	Chinook	fall	2006	06 /01-08 /2007	119,712	TRH		
065352-f	Chinook	fall	2006	06 /01-08 /2007	122,076	TRH	1	
065353-f	Chinook	fall	2006	06 /01-08 /2007	126,470	TRH	3	
065361-y	Chinook	fall	2006	10 /01-10 /2007	238,156	TRH	20	2
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	2	1
068809-y	Chinook	fall	2007	10/ 01-14 /2008	244,661	TRH	21	
065356-f	Chinook	fall	2008	06/01-15/2009	11,403	TRH		
065357-f	Chinook	fall	2008	06/01-15/2009	9,676	TRH		
065358-f	Chinook	fall	2008	06/01-15/2009	9,882	TRH		
065359-y	Chinook	fall	2008	10/01-15/2009	6,257	TRH		
068814-f	Chinook	fall	2008	06/01-15/2009	93,228	TRH	2	
068815-f	Chinook	fall	2008	06/01-15/2009	94,165	TRH		
068816-f	Chinook	fall	2008	06/01-15/2009	96,264	TRH	2	
068817-f	Chinook	fall	2008	06/01-15/2009	92,360	TRH		
068818-f	Chinook	fall	2008	06/01-15/2009	90,758	TRH		
068820-y	Chinook	fall	2008	10/01-15/2009	253,073	TRH		
608080000-f ^c	Chinook	fall	2008	04/29-08/20/09	17,618	TRH		
608080001-f ^c	Chinook	fall	2008	04/29-08/20/09	2,915	TRH	1	
shed tag ^b	Chinook	fall					5	2
Total fall Chinook:							58	5
COHO								
RM ^d	coho		2007	03/16-23/2009	457,534	TRH	419	1
RM ^d	coho		2008	04/06-08/2010	414,326	TRH	55	
Total coho:							474	1

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 <56 cm FL were classified as brood year 2008 and coho >55 cm FL were classified as brood year 2007. Age cutoff based on fork length distribution.

Coho Salmon

Run timing

Three coho salmon were trapped at JCW in 2010. 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 JW 40, with a mean of 65.4 per night trapped, decreasing through the rest of the season (Table 4, Figure 10), with a sampling season mean of ~19.8 fish trapped per night. A total of 908 coho salmon were trapped (146 grilse and 762 adults) at WCW during the 2010 season.

Size of Trapped Fish

The average FL of coho trapped at WCW and TRH was 63.8 and 66.3 cm, respectively (Figure 11, Appendix 6). The size separating grilse from adult was based on the combined fork length data from coho salmon trapped at WCW and those that entered TRH, smoothed with a moving average of 5 1-cm increments. This year all coho salmon <56 cm FL were considered grilse. Grilse comprised 16.1% and 11.9% of the coho salmon trapped at WCW and TRH respectively.

Effectively Tagged Fish

All three of the coho trapped at JCW were effectively tagged. Of the 908 coho trapped at WCW, 895 (144 grilse and 751 adults) were effectively tagged (Appendix 6). Due to poor condition (wounds or other stressors) 11 coho trapped at WCW were not tagged. There is no legal recreational coho fishery, though two coho were caught and released by anglers (Appendix 10). To discourage anglers from targeting coho, all coho were tagged with non-reward tags.

Incidence of Tags and Fin Clips

Eight hundred seven of the 908 (88.9%) coho trapped at WCW (140 grilse and 667 adults) bore right maxillary (RM) clips (Appendix 6), as did all three of the coho trapped and tagged at JCW. Four hundred ninety seven (55 grilse and 442 adults) of the WCW-tagged coho were recovered at TRH (Table 3), whereas only one of the three JCW coho was recovered at TRH.

Incidence of Gill-net Wounds, Hook Scars and Predator Wounds

Gill net wounds were found on 92 of the coho trapped at WCW; two had healed (ocean) hooking scars, three had fresh hooking wounds, 43 had unknown wounds; 81 had predator wounds (including lamprey marks); and five had fungus, or looked diseased. One of the three coho trapped at JCW had gill net marks; no other wounds were present.

Table 4. Weekly summary of coho trapped in the Trinity River at Willow Creek weir during 2010.^a

Julian week	Inclusive dates	Nights trapped	Number trapped						Fish / night
			Grilse ^b	Grilse w/ RM clips ^c	Adults	Adults w/ RM clips	Total trapped	Total RM clips	
34	20-Aug - 26-Aug	5	0	0	0	0	0	0	0.0
35	27-Aug - 2-Sep	5	0	0	0	0	0	0	0.0
36	3-Sep - 9-Sep	5	1	1	1	1	2	2	0.4
37	10-Sep - 16-Sep	5	1	1	4	4	5	5	1.0
38	17-Sep - 23-Sep	5	4	4	16	15	20	19	4.0
39	24-Sep - 30-Sep	5	46	46	227	201	273	247	54.6
40	1-Oct - 7-Oct	5	61	57	266	230	327	287	65.4
41	8-Oct - 14-Oct	5	33	31	237	206	270	237	54.0
42	15-Oct - 21-Oct	5	0	0	11	10	11	10	2.2
43	22-Oct - 28-Oct	1	0	0	0	0	0	0	0.0
Total		46	146	140	762	667	908	807	
Mean:									19.7

a/ Trapping at Willow Creek weir took place from August 20 - October 22, 2010.

b/ Coho <56cm FL were considered grilse.

c/ The right maxillary clipped fish are presented as a subset of the total grilse or adult coho caught.

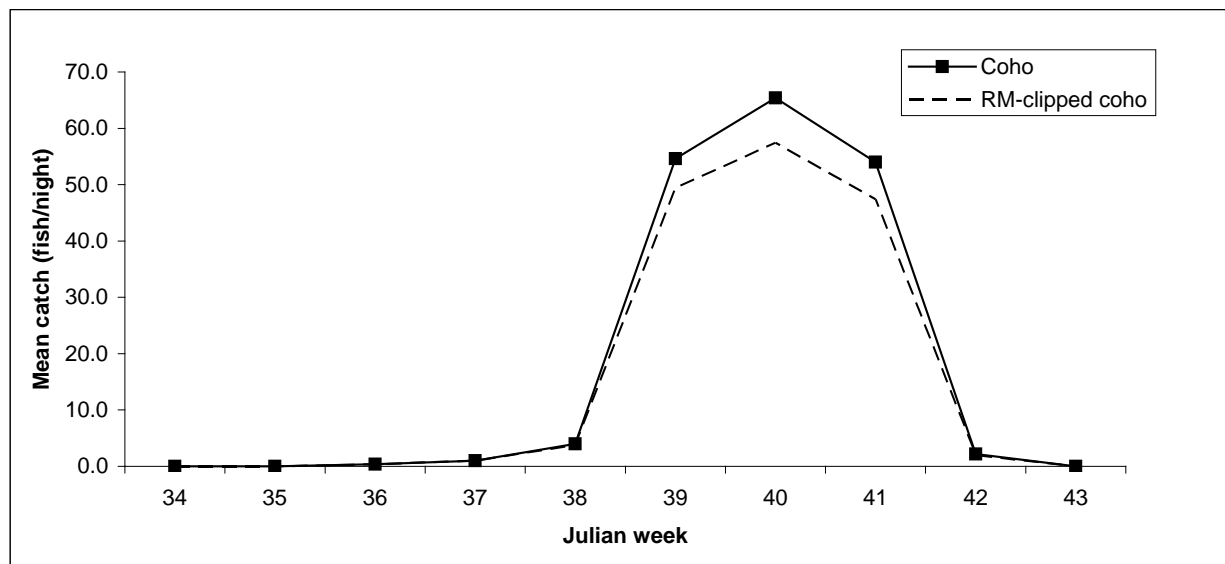


Figure 10. Mean catch of coho trapped in the Trinity River at Willow Creek weir during 2010.

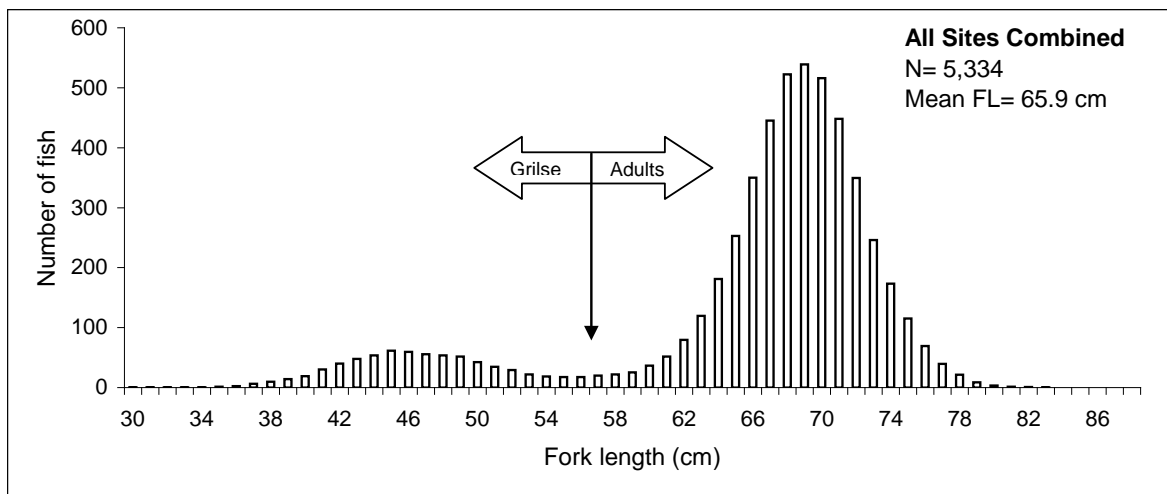
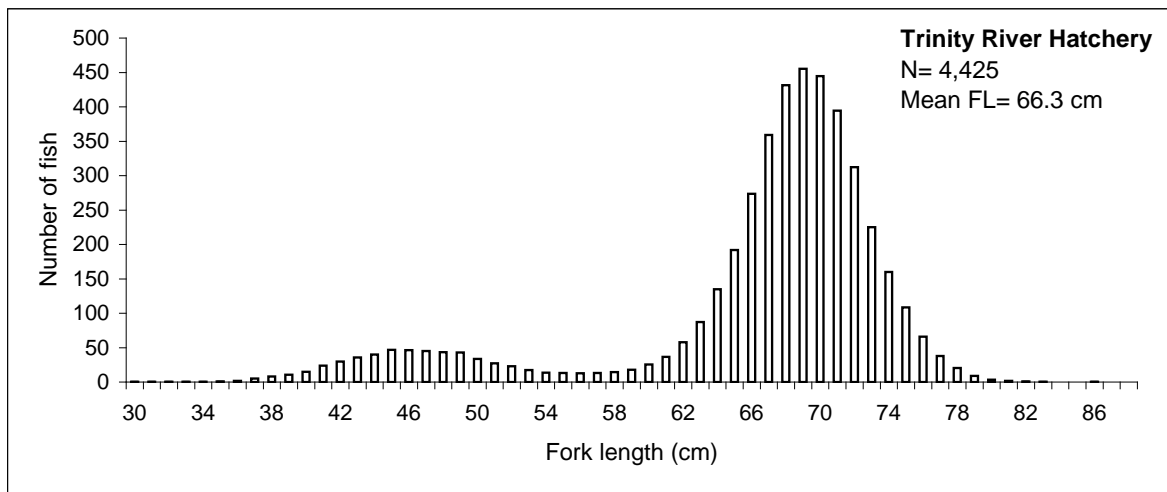
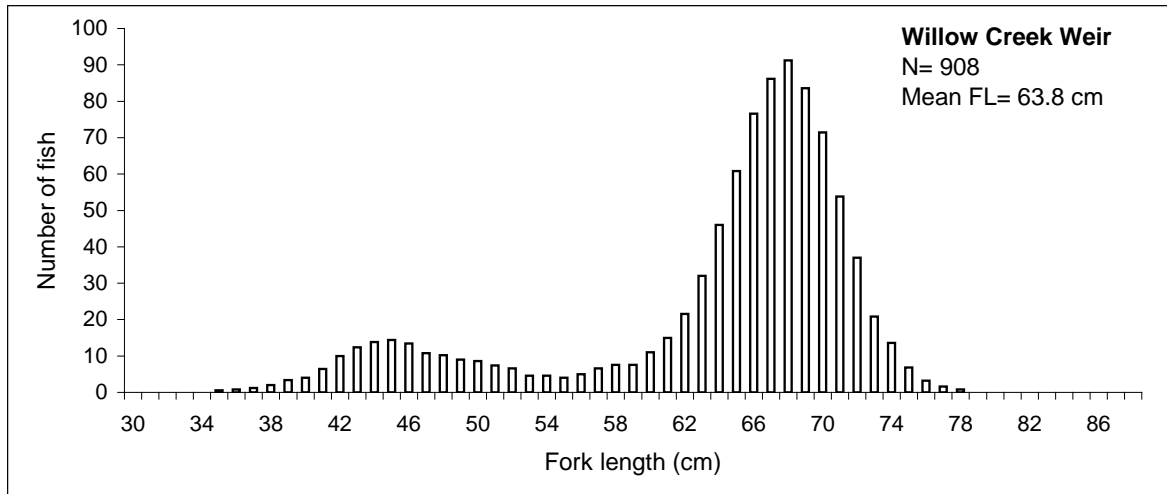


Figure 11. Coho salmon fork lengths (cm) observed at Willow Creek weir, Trinity River Hatchery and both sites combined during the 2010-11 season. The number of fish shown at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

Fall Steelhead

Run Timing

At JCW, 21 (18 adult and three half-pounder) steelhead were trapped all season, of which 10 adults, and the two half-pounder, had ad-clips. Julian week 39 yielded the highest number of fish trapped (eight), averaging 2.0 per night (Table 5, Figure 12). Of the 21 steelhead trapped, 13 were tagged, 12 of which had ad-clips. One JCW tagged steelhead was later recovered at TRH. The results of this particular tagging are purely qualitative in nature.

Nine hundred seventeen fall-run steelhead were trapped at WCW in 2010 (Table 6, Figure 13); 101 half-pounders (<42 cm FL) and 816 adults. The peak of the run was during JW 38 with an average of 63.2 fish per night trapped. The biggest week for half-pounders was also JW 38, when 39 were caught.

Size of Fish Trapped

Steelhead caught at JCW, WCW, and TRH averaged 56.0, 57.3 and 60.6 cm FL, respectively (Figure 14), with a mean combined FL for the three sites combined of 59.6 cm. Adult steelhead (> 41 cm FL) made up 85.7% and 88.9% of the steelhead trapped at JCW, and WCW, respectively.

Effectively Tagged Fish

Of the 816 adult steelhead trapped at WCW in 2010, 809 were tagged. Only adult fish were tagged. Seven were not tagged due to poor condition and one was deemed a tagging mortality (anytime a fish is found on the weir within 30 days of tagging and has not spawned it is considered a tagging mortality). Anglers reported removing tags from 75 caught and released fish, leaving 733 effectively tagged adult steelhead. Of the 809 tagged fish, reward-tags were attached to 402 while the remainder (406) received non-reward tags.

Incidence of Tags and Fin Clips

Ad-clips were found on 12 (57.1%) of the 21 steelhead at JCW, 448 (48.9%) at WCW and 2,100 (98.3%) at TRH (Appendix 7). Three of the steelhead at WCW we had tagged in previous years. All steelhead released from TRH have been ad-clipped prior to release since brood year 1997.

Incidence of Gill-net Wounds, Hook Scars and Predator Wounds

There were no wounds or scars seen on any steelhead at JCW in 2010. On the steelhead trapped at WCW we noted the following: 26 gill-net wounds; seven old hooking scars; one fresh hooking wound; 41 unknown wounds or scars; and 71 predator wounds.

Table 5. Weekly summary of fall-run steelhead trapped in the Trinity River at the Junction City weir during 2010.

Julian week	Inclusive dates	Nights trapped	Number trapped					Fish / night
			1/2 lbers ^b	Ad-clipped 1/2 lbers	Adults	Ad-clipped adults ^c	Total	
31	30-Jul - 5-Aug	5	1	1	3	0	4	0.8
32	6-Aug - 12-Aug	5	0	0	2	1	2	0.4
33	13-Aug - 19-Aug	5	0	0	0	0	0	0.0
34	20-Aug - 26-Aug	5	0	0	1	0	1	0.2
35	27-Aug - 2-Sep	5	0	0	1	0	1	0.2
36	3-Sep - 9-Sep	4	0	0	0	0	0	0.0
37	10-Sep - 16-Sep	5	0	0	0	0	0	0.0
38	17-Sep - 23-Sep	5	1	0	4	2	5	1.0
39	24-Sep - 30-Sep	4	1	1	7	7	8	2.0
Total:		43	3	2	18	10	21	12
Mean:								0.5

a/ Trapping at Junction City weir took place July 30 - September 29, 2010 (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 totals.

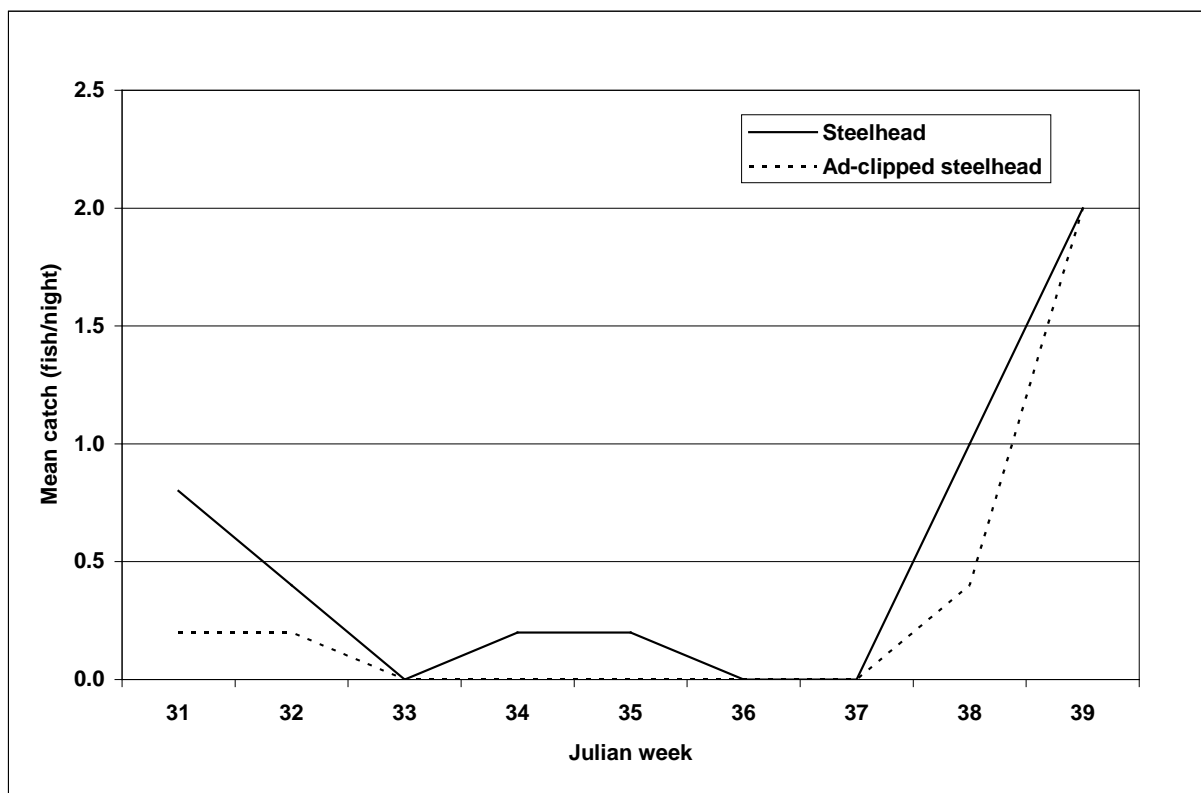


Figure 12. Mean catch of fall-run steelhead in the Trinity River at Junction City weir during 2010.

Table 6. Weekly summary of fall-run steelhead trapped in the Trinity River at the Willow Creek weir during 2010. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped					Ad-clip total	Fish/night
			1/2 lbers	Ad-clipped 1/2 lbers ^c	Adults	Ad-clipped Adults	Total		
34	20-Aug - 26-Aug	5	11	5	72	26	83	31	16.6
35	27-Aug - 2-Sep	5	15	9	63	27	78	36	15.6
36	3-Sep - 9-Sep	5	11	7	76	38	87	45	17.4
37	10-Sep - 16-Sep	5	11	7	27	14	38	21	7.6
38	17-Sep - 23-Sep	5	39	31	277	151	316	182	63.2
39	24-Sep - 30-Sep	5	4	2	129	76	133	78	26.6
40	1-Oct - 7-Oct	5	5	4	69	48	74	52	14.8
41	8-Oct - 14-Oct	5	5	4	97	63	102	67	20.4
42	15-Oct - 21-Oct	5			6	5	6	5	1.2
43	22-Oct - 28-Oct	1					0	0	0.0
Total:		46	101	69	816	448	917	517	
Mean:									19.9

a/ Trapping at Willow Creek weir took place August 20 - October 22, 2010 (Julian weeks 34 - 43).

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 totals.

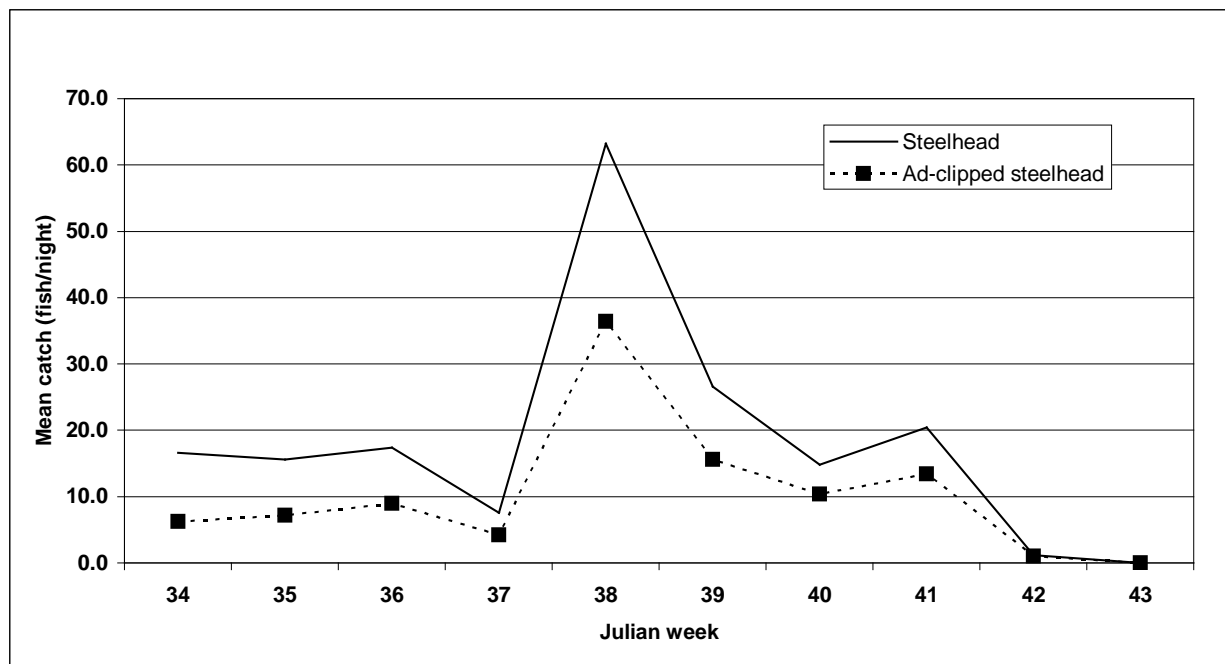


Figure 13. Mean catch of fall-run steelhead in the Trinity River at Willow Creek weir during 2010.

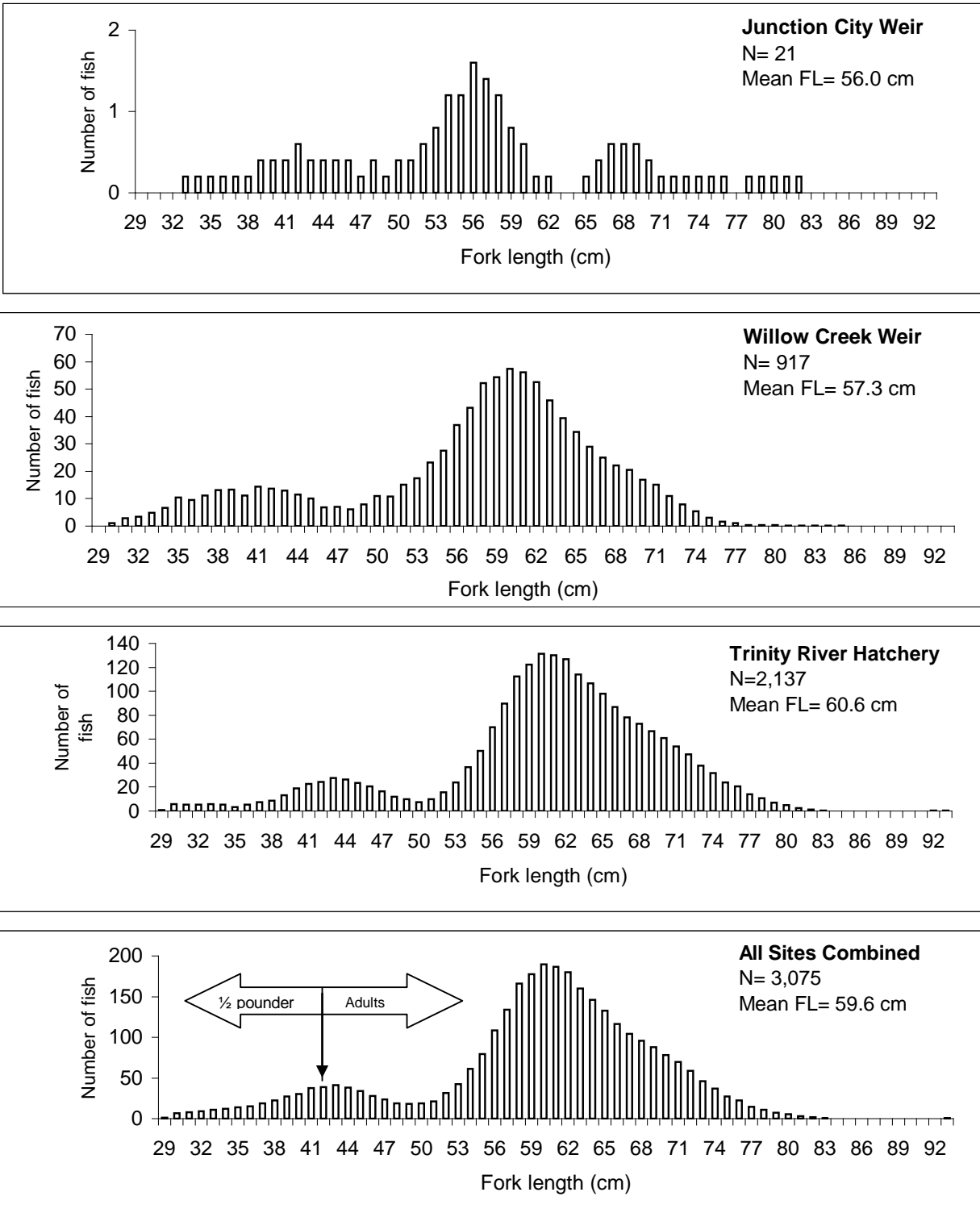


Figure 14. Steelhead fork lengths (cm) observed at Junction City weir, Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2010-11 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate 1/2 pounders (sub-adults) and adults for analysis.

Brown Trout

Capture Timing

During the 2010 sampling season, 144 brown trout were captured during 43 nights of trapping at JCW (Table 7, Figure 15). The highest catch occurred during Julian week 31 with a mean fish/night rate of 10.8. There were no brown trout trapped at WCW during 2010.

Size of Trapped Fish

Brown trout captured this season ranged in size from 33 to 63 cm FL (Table 8, Figure 16).

Effectively Tagged Fish

Of the 144 brown trout tagged at JCW in 2010, all of which were effective tags. Two Project-tagged brown trout were found in the carcass survey and one tag was found unattached to a fish. All of the brown trout at JCW were tagged with non-reward tags.

Incidence of Gill-net Wounds, Hook Scars and Predator Wounds

There were no gill-net wounds detected on brown trout at JCW in 2010, but 28 of the fish had readily discernible lamprey wounds on them. Two others had predator wounds of unknown origin.

Table 7. Weekly summary of brown trout trapped in the Trinity River at Junction City weir during 2010.^a

Julian week	Inclusive dates	Nights trapped	Number trapped	
			Total	Fish/night
31	30-Jul - 5-Aug	5	54	10.8
32	6-Aug - 12-Aug	5	49	9.8
33	13-Aug - 19-Aug	5	15	3.0
34	20-Aug - 26-Aug	5	5	1.0
35	27-Aug - 2-Sep	5	3	0.6
36	3-Sep - 9-Sep	4	1	0.3
37	10-Sep - 16-Sep	5	4	0.8
38	17-Sep - 23-Sep	5	3	0.6
39	24-Sep - 30-Sep	4	10	2.5
Total:		43	144	
Mean:				3.3

a/ Trapping at Junction City weir took place July 30 - September 29, 2010 (Julian weeks 31 - 39).

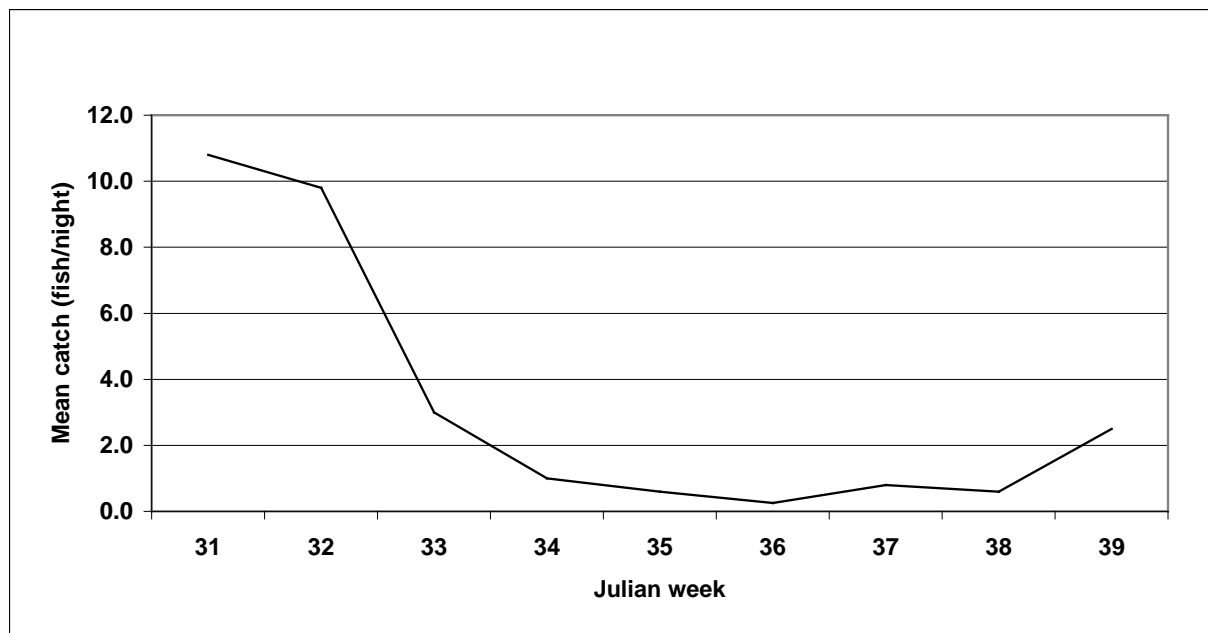


Figure 15. Mean catch of brown trout in the Trinity River at Junction City weir during 2010.

Table 8. Fork length of brown trout trapped in the Trinity River at Junction City weir during 2010.^a

Fork length (cm)	Julian week									Totals
	31	32	33	34	35	36	37	38	39	
33			1	1						2
34										0
35	1	1								2
36	3	1					1			5
37	3	1	1					1	1	7
38		1	1							2
39	5	5					1			11
40	5	2				1				8
41	4	1	1	1					3	10
42	2	5							2	9
43	5	1	3					1	2	12
44	2	3	1						1	7
45	4	7	4	1	1					17
46	2	4							1	7
47	2	1		1			2	1		7
48	2	3	2	1						8
49	4	3								7
50	3	2			1					6
51	3	2			1					6
52	1									1
53										0
54		3	1							4
55										0
56										0
57										0
58	2	1								3
59	1									1
60										0
61		1								1
62										0
63		1								1
Totals:	54	49	15	5	3	1	4	3	10	144
Mean FL:	44.2	45.5	43.5	42.8	48.7	40.0	42.3	42.3	42.0	44.3

a/ Trapping at Junction City weir took place July 30 - September 29, 2010 (Julian weeks 31 - 39).

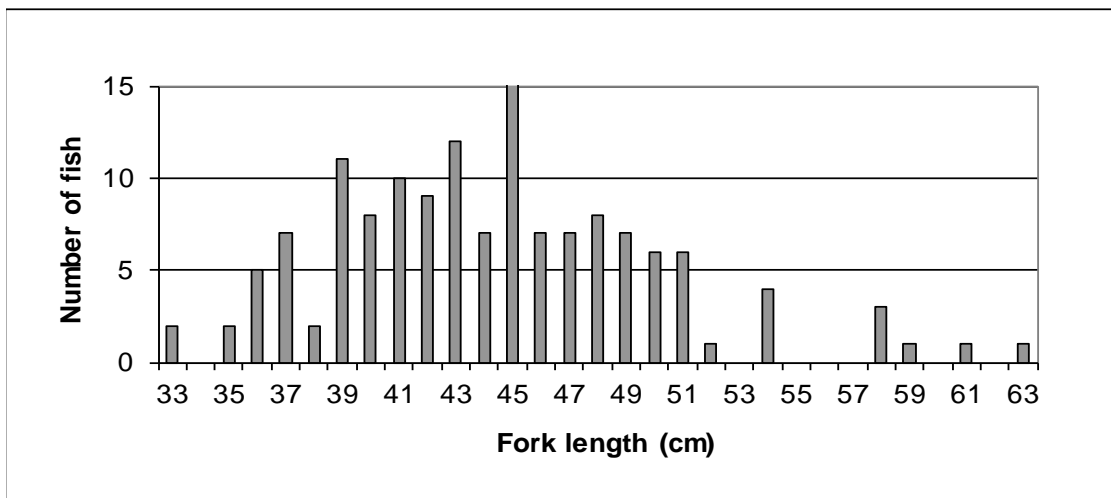


Figure 16. Fork length distribution of brown trout trapped in the Trinity River at Junction City weir during 2010.

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 8-11.

Of the 167 tagged spring Chinook at JCW 36.5% were recovered, whereas only 28.20% of the 1,336 fall Chinook tagged at JCW and WCW were recovered. Of the 900 coho tagged at WCW, 58.2% were recovered, as was 32.6% of the 820 adult fall steelhead recovered throughout the Trinity basin. Most of the recoveries, for all species, occurred at TRH.

Tag Returns by Anglers

The adult fall Chinook in-river quota for the Klamath River basin during the 2010-11 season was 12,000 split evenly between the lower (below the Highway 96 Bridge in Weitchpec) and upper basins. Thirty three percent of that 12,000 (3,960) is the Trinity River sport allocation, which is split 50/50 between two areas: Old Lewiston Bridge to Cedar Flat and Cedar Flat to Hawkins Bar. In addition to the quota, the fishing regulations were such that anglers were allowed to retain two spring Chinook or two daily bag limits which could equate to an angler possessing a total of nine fall Chinook (no more than six of those over 22 inches total length) four ad-clipped steelhead on the Trinity, only one on the Klamath. The take of coho was prohibited, while there was a total possession limit of 10 brown trout.

Spring Chinook

Anglers returned two reward (zero grilse and two adult) and one (zero grilse, one adult) non-reward tags from harvested spring Chinook tagged at JCW. Based on those tag returns, the estimated total harvest rate of Project-tagged spring Chinook upstream of JCW was 0% for grilse, 4.8% for adults. There were no tags reported from the catch and release fishery, and one found tag (with no fish still attached) (Appendix 8).

Fall Chinook

Anglers returned three reward (one grilse and two adult) and six (three grilse and three adult) non-reward tags from harvested fall Chinook tagged at WCW. Based on those tag returns, the estimated harvest rate of Project-tagged fall Chinook upstream of WCW was 1.0% for grilse and 0.6% for adults. Anglers reported the catch and release of zero grilse and three adult reward-tagged fall Chinook from WCW, and zero grilse and one adult non-reward tagged fish (Appendix 9). Using those numbers, the catch/release rates for fall Chinook upstream of the WCW were estimated at 0.0% of the tagged grilse and 1.0% of the tagged adults.

Coho Salmon

To discourage the harvest of threatened coho salmon, all coho salmon tagged at WCW and JCW received non-reward tags. No tags were returned from any harvested grilse or adult coho salmon tagged at WCW, though we did receive two tags from caught and released adult coho (Appendix 10). Catch and release rates for coho salmon above the WCW were estimated at 0.0% for grilse and 0.3% for adults based on that return.

Fall Steelhead

Anglers returned 89 tags from steelhead tagged at WCW. Of those 89 tags, 75 tags were from steelhead reported as caught/released, 13 from harvested fish, and one was a tag found loose (not attached to a steelhead when found) (Appendix 11). Based on tag return, an estimated 9.3% of the tagged steelhead migrating upstream of WCW were caught and released, and an estimated 2.4% (3.7% of ad-clipped, 0.7% non-ad-clipped) of the (reward-tagged) steelhead were harvested.

Brown Trout

All brown trout tagged at JCW received non-reward tags during 2010. Anglers returned four tags from caught and released tagged brown trout and two 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, 2010 to December 21, 2010 from TRH to Weitchpec. During the spawner surveys 12 spring (Appendix 8) and five fall Chinook tagged at JCW, and 41 fall Chinook (Appendix 9) and 23 coho (Appendix 10) tagged at WCW were recovered. There were zero Project-tagged steelhead, and only two Project-tagged brown trout recovered in the spawner survey in 2010. For additional information on the 2010 spawner survey refer to Task 4 of this report.

Trinity River Hatchery

Operation Dates

The fish ladder was opened September 03, with trapping and fish processing at TRH from September 07, 2010 (JW 36) through March 08, 2011 (JW 10). 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

Based on CWT recoveries, spring Chinook began entering TRH during JW 36 and continued through JW 40 (Figure 17, Table 9). Recovery of spring Chinook was highest the first week TRH was open (JW 36) when 185 CWTed fish entered the facility and decreased thereafter with only 10 CWTs recovered in JW 41 (and one straggler each in JWs 43 and 44). A total of 2,702 spring Chinook were recovered at TRH, from which

609 CWTs were recovered (Table 9). Based upon CWT expansion, an estimated 2,387 hatchery-origin spring Chinook entered TRH (Figure 17).

Of the 167 spring Chinook tagged at JCW, 39 (23.4%) were recovered at TRH. The mean FL for spring Chinook trapped at JCW was 69.4 cm, whereas the spring Chinook recovered at TRH averaged 73.4 cm FL (Figure 8, Appendix 4). There were no spring Chinook tagged at WCW in 2010.

Spring Chinook age composition at TRH based on CWT analysis was 7.7%, 26.5%, and 65.8% age 2, 3, and 4 year old fish, respectively (See Task 2 of this report). There were no 5 year old spring Chinook detected in 2010.

Fall Chinook

Based on the recovery of CWTs, the first fall Chinook entered TRH during JW 38 of 2010 (Figure 17, Table 11). The fall run peaked during JW 44 when an estimated 1,700 Chinook entered the facility, decreasing thereafter until the last Chinook entered during JW 51 of 2010. A total of 9,207 fall Chinook entered TRH, from which 2,143 CWTs were recovered (Table 11). Using CWT expansions, an estimated 8,356 (hatchery-origin) fall Chinook entered TRH.

There were 55 fall Chinook trapped at JCW in 2010. Thirteen of those 55 (23.6%) were recovered at TRH. Of the 1,281 tagged fall Chinook at WCW, 285 (22.2%) were recovered at TRH. The mean FL for fall Chinook trapped at JCW was 65.0 cm, at WCW was 68.4 cm, and at TRH was 74.7 cm (Figure 9). For all three sites combined the mean FL for fall Chinook 73.9 cm.

Fall Chinook age composition at TRH based on CWT analysis was 14.6%, 45.5%, and 39.8% age 2, 3, and 4 year old fish, respectively. There were no known-age 5 year old fall Chinook detected at TRH in 2010.

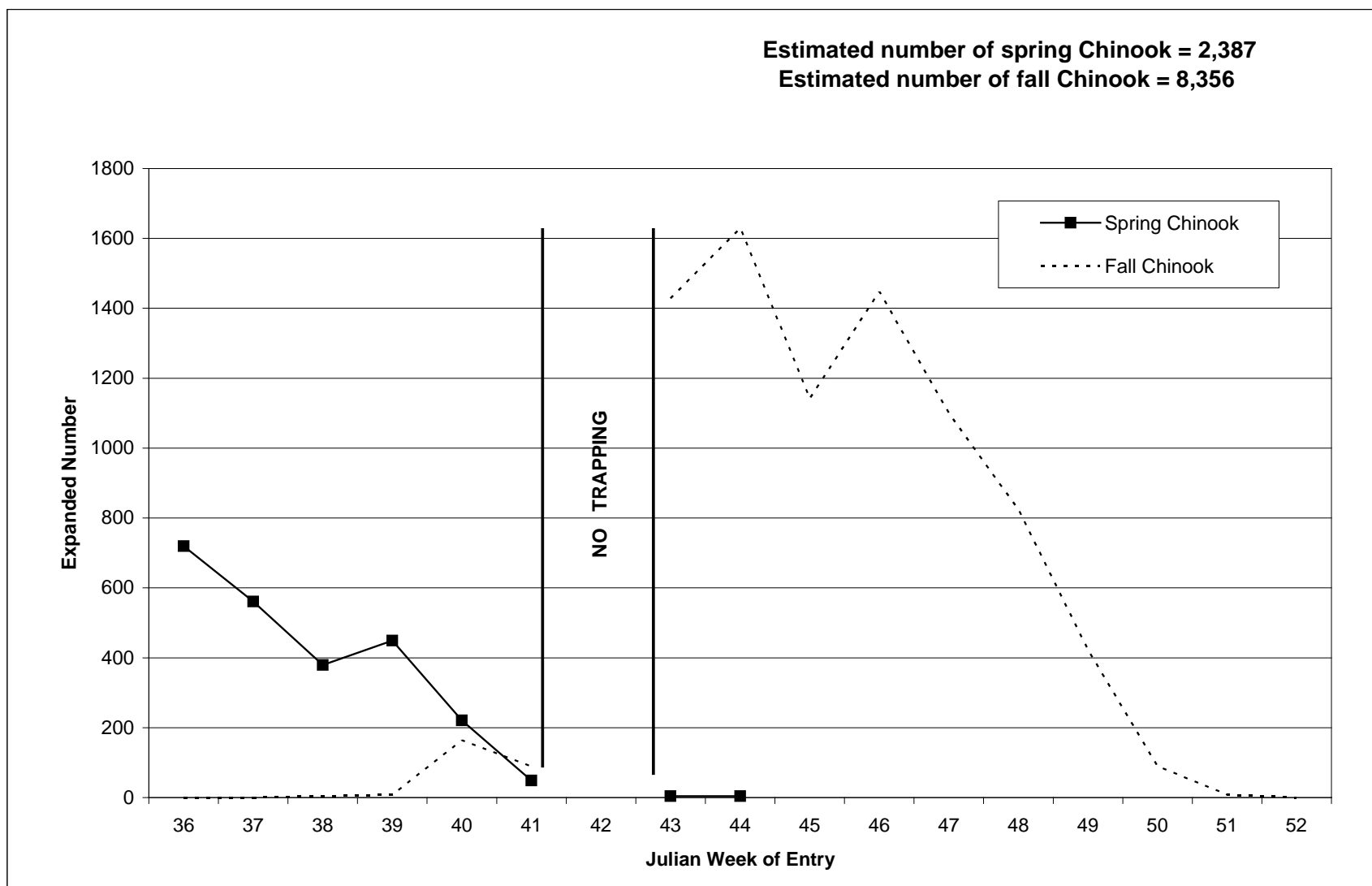


Figure 17. Estimated numbers of spring and fall Chinook that entered Trinity River Hatchery during the 2010-11 season, based on expansion of coded-wire tagged fish.

Table 9. Recoveries at Trinity River Hatchery of coded-wire tagged spring Chinook during the 2010-11 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	
065347-f	2006	1	1	1	2	0	0		0	0	5
065348-f	2006	3	5	1	6	0	0		0	0	15
065349-f	2006	0	1	1	6	3	1		0	0	12
065360-y	2006	147	91	52	51	11	2		0	1	355
068801-f	2007	4	3	0	1	0	0		0	0	8
068802-f	2007	6	9	11	5	0	1		0	0	32
068803-f	2007	2	2	2	5	5	0		0	0	16
068810-y	2007	13	20	17	26	19	5		0	0	100
068811-f	2008	0	5	4	3	0	0		0	0	12
068812-f	2008	1	0	3	3	9	3		1	0	20
068813-f	2008	0	2	2	2	7	0		0	0	13
No CWT ^e		8	4	1	4	3	1		0	0	21
Weekly totals:		185	143	95	114	57	13	0	1	1	
											609

a/ The fish ladder was open September 03, 2010 through March 08, 2011 (JWs 36-10; closed parts or all of JWs 41-43).

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

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

d/ The hatchery was closed to fish entry this week.

e/ No CWT's were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after October 07, 2010 (JW 40) were considered fall run.

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 2010-11 season.^a

Julian week ^b	Inclusive dates	Chinook					Coho		
		Total entering TRH	Spring run tagging site		Fall run tagging site		Total entering TRH	Tagging site	
			WCW	JCW	WCW	JCW		WCW	JCW
36	3-Sep - 9-Sep	866							
37	10-Sep - 16-Sep	594		3					
38	17-Sep - 23-Sep	483		7					
39	24-Sep - 30-Sep	488		10	2				
40	1-Oct - 7-Oct	314		17	8	3	21	5	
41	8-Oct - 14-Oct	114		2	7	1	52	1	
42	15-Oct - 21-Oct	--- NO TRAPPING DURING JULIAN WEEK 42 AT TRINITY RIVER HATCHERY ---							
43	22-Oct - 28-Oct	1951		4	46	2	929	102	1
44	29-Oct - 4-Nov	1782		1	63	2	725	92	
45	5-Nov - 11-Nov	1264			47	4	412	72	
46	12-Nov - 18-Nov	1623			72	0	382	41	
47	19-Nov - 25-Nov	1178			26	1	602	65	
48	26-Nov - 2-Dec	803			14		457	50	
49	3-Dec - 9-Dec	375			4		567	46	
50	10-Dec - 16-Dec	70					218	19	
51	17-Dec - 23-Dec	2					40	4	
52	24-Dec - 31-Dec						13	1	
1	1-Jan - 7-Jan						5		
2	8-Jan - 14-Jan						2		
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:		11,908	0	44	289	13	4,425	498	1

a/ The fish ladder was open September 03, 2010 through March 08, 2011 (JWs 36-10; 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.

Table 11. Recoveries at Trinity River Hatchery (TRH) of TRH-origin fall Chinook by coded-wire tag group during the 2010-11 season.

Coded-wire tag group and release type ^c	Brood year	Number of fall Chinook entering TRH, by Julian week ^{ab}														Totals
		38	39	40	41	42 ^d	43	44	45	46	47	48	49	50	51	
065350-f	2006		1				7	8	4	1						21
065351-f	2006			1			3	9	5		1	1				20
065352-f	2006						6		1	3	2	3				15
065353-f	2006			4			6	8	7	5	4	3	1			38
065361-y	2006	1		8	6		148	143	89	127	104	63	26	3	1	719
068804-f	2007			1			7	4	2	2	1					17
068805-f	2007						6	8	5	2						21
068806-f	2007			2			4	8	1	2						17
068807-f	2007			1			3	3	3	3	2	1				16
068808-f	2007			2			7	3	4	3	3					22
068809-y	2007		1	9	7		101	137	99	152	128	116	69	18		837
065356-f	2008							1	1	2		1				5
065357-f	2008							1		2						3
065358-f	2008							2	1		2					5
065359-y	2008						1			2						3
068814-f	2008			6			20	23	16	8	4	1				78
068815-f	2008			1			12	15	10	9	1	1	1			50
068816-f	2008			1			8	5	6	8	2	3	4			37
068817-f	2008			5			6	7	7	8	3	1	1			38
068818-f	2008			2					3	4	7	1	1	1	1	20
068820-y	2008			1	3		15	11	6	9	1	3				49
608080000-f	2008			1			2	2	1	2						8
608080001-f	2008				1		1									2
No CWT ^e							17	27	15	15	17	7	3	1		102
Weekly totals:		1	2	45	17	0	380	425	286	369	282	205	106	23	2	2,143

a/ The fish ladder was open September 03, 2010 through March 08, 2011 (JWs 36-10; closed parts or all of JWs 41-43).

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

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

d/ The hatchery was closed to fish entry this week.

e/ No CWTs were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after October 07, 2010 (JW 40) were considered fall Chinook.

Coho Salmon

The first coho entered TRH during JW 40 of 2010. The coho run peaked during JW 43 and the last coho entered TRH during JW 2 of 2011 (Table 12). A total of 4,425 coho (3,899 adults and 526 grilse) were recovered at TRH during the season. Four hundred ninety eight of the 908 coho trapped at WCW were recovered at TRH (55.6 % of the effectively tagged fish). The mean FL of coho trapped at WCW was 63.8 cm and the mean FL of all coho salmon recovered at TRH was 66.3 cm (Figure 11).

Of the 4,425 coho entering TRH, 4,222 (95.4%) were observed to have right maxillary (RM) clips, indicating they were of TRH origin, while 203 (4.6%) 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 12).

Based on length frequency analysis, TRH-produced, RM-clipped coho salmon were apportioned into two brood years. Coho < 56 cm FL (516) were considered grilse (age 2) from the 2008 brood year and accounted for 11.7% of the total trapped, while the remaining RM-clipped 3,706 (83.8%) >55 cm FL were considered adults (age 3) from the 2007 brood year. The 203 non-RM clipped coho (4.6% of total) which entered the hatchery were also considered grilse or adults based on their length (Table 12).

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 13). A total of 2,137 steelhead (2,037 adults >41 cm, FL) entered TRH during the season. Of the 809 adult fall steelhead tagged at WCW, 176 were recovered at TRH (Table 13, Appendix 7). The mean FL of effectively tagged steelhead at WCW was 59.9 cm and the mean FL of all adult steelhead recovered at TRH was 61.8 cm

Ad-clipped adults composed 55.0% of the steelhead trapped at WCW (448 of the 816) and 98.2% (2,000/2,037) of the steelhead that entered TRH this season (Appendix 7). Beginning with the 1997 brood year, all steelhead released from TRH have been ad-clipped prior to their release.

Table 12. Total number of coho, by brood year and clip, that returned to Trinity River Hatchery by Julian week during the 2010-11 season. ^a

Julian Week of Entry ^c	Inclusive Dates	Brood Year and Clip ^b				Total
		2008 (Grilse)		2007 (Adults)		
		No Clip	RM	No Clip	RM	
40	1-Oct - 7-Oct	1	8	1	11	21
41	8-Oct - 14-Oct	1	11	0	40	52
42	15-Oct - 21-Oct	0	0	0	0	0
43	22-Oct - 28-Oct	4	161	23	741	929
44	29-Oct - 4-Nov	1	113	20	591	725
45	5-Nov - 11-Nov	0	65	16	331	412
46	12-Nov - 18-Nov	0	34	11	337	382
47	19-Nov - 25-Nov	1	43	18	540	602
48	26-Nov - 2-Dec	0	17	31	409	457
49	3-Dec - 9-Dec	2	33	47	485	567
50	10-Dec - 16-Dec		17	23	178	218
51	17-Dec - 23-Dec		11	1	28	40
52	24-Dec - 31-Dec		1	2	10	13
1	1-Jan - 7-Jan		2		3	5
2	8-Jan - 14-Jan				2	2
Totals:		10	516	193	3,706	4,425

a/ The fish ladder was open September 03, 2010 through March 08, 2011 (JWs 36-10; closed parts or all of JWs 41-43).

b/ Coho <56 cm FL were considered of the 2008 brood year, and coho > 55 cm FL were considered of the 2007 brood year. Right maxillary clips are designated by RM.

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

Table 13. Total number of adult steelhead^a (>41 cm FL) entering Trinity River Hatchery (TRH) and number recovered that were tagged at Willow Creek weir (WCW) during the 2010-11 season.^b

Julian Week of Entry ^c	Inclusive Dates		Number Entering TRH	Recoveries from WCW
36	3-Sep	9-Sep		
37	10-Sep	16-Sep	2	
38	17-Sep	- 23-Sep	1	
39	24-Sep	- 30-Sep	1	
40	1-Oct	- 7-Oct	2	
41	8-Oct	- 14-Oct	3	
42	15-Oct	- 21-Oct	0	
43	22-Oct	- 28-Oct	22	2
44	29-Oct	- 4-Nov	43	1
45	5-Nov	- 11-Nov	40	4
46	12-Nov	- 18-Nov	16	0
47	19-Nov	- 25-Nov	18	0
48	26-Nov	- 2-Dec	10	1
49	3-Dec	- 9-Dec	63	6
50	10-Dec	- 16-Dec	269	36
51	17-Dec	- 23-Dec	220	19
52	24-Dec	- 31-Dec	163	15
1	1-Jan	- 7-Jan	73	10
2	8-Jan	- 14-Jan	46	4
3	15-Jan	- 21-Jan	225	21
4	22-Jan	- 28-Jan	249	11
5	29-Jan	- 4-Feb	161	16
6	5-Feb	- 11-Feb	122	12
7	12-Feb	- 18-Feb	91	9
8	19-Feb	- 25-Feb	112	3
9	26-Feb	- 4-Mar	35	1
10	5-Mar	- 11-Mar	50	5
Totals:			2,037	176

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

b/ The fish ladder was open September 03, 2010 - March 08, 2011 (JWs 36 -10; 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.

Run-size, Angler Harvest, and Spawner Escapement Estimates

Spring Chinook Salmon

An estimated 11,285 (9,731 adults and 1,554 grilse) 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 8,426–15,765 (Table 14). Spawning escapement above JCW was an estimated 10,822 fish, including 2,702 spring Chinook that entered TRH (Table 15). This year's run-size estimate is 65.0% of the 31 year average spring Chinook run-size of 17,350. Estimated spring Chinook run-size has ranged from 2,381 fish in 1991 to 62,692 fish in 1988 (Appendix 12). Anglers were estimated to have caught and kept 463 adults and zero grilse from the spring run.

Fall Chinook Salmon

An estimated 40,792 (28,238 adults and 12,554 grilse) 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 36,427-45,945 (Table 14). Trinity River fall Chinook spawner escapement, upstream of WCW, was estimated at 40,476 (12,427 grilse, 28,050 adult) fish, including 9,207 fall Chinook that entered TRH (Table 15). Harvest rates generated from tags applied at WCW were used to estimate 127 grilse and 188 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 13). This year's fall Chinook estimated run-size of 40,792 is 97.1% of the 41,991 mean run-size for the years since 1977.

Coho Salmon

An estimated 7,947 (6,669 adults and 1,278 grilse) coho migrated into the Trinity River basin upstream of the WCW in 2010. Based on the Normal Approximation, the 95% confidence interval for the coho run-size estimate upstream of WCW was 7,305-8,619 fish (Table 14). Of those estimated 7,947 fish, 4,425 are estimated to have entered TRH (Table 15). Estimated coho run-size, upstream of WCW, has ranged from 852 fish in 1994 to 59,079 fish in 1987 (Appendix 14). This year's run-size estimate was 46.6% of the 17,040 fish 34-year average. No tags were returned from harvested coho; therefore harvest rates generated from tags applied at WCW were estimated to be zero for both grilse and adults (Table 15).

Adult Fall Steelhead

An estimated 8,451 adult fall steelhead migrated upstream of WCW this season. The 95% confidence interval for the estimate, based on the Normal Approximation, was 7,305 - 9686 adult steelhead (Table 14). The adult steelhead spawning escapement was estimated at 8,254, of which 2,037 entered TRH. An estimated 25 naturally-produced and 172 TRH produced steelhead were harvested by anglers above WCW (Table 15). In the 27 years for which we have data since 1980, run-size estimates have ranged from 2,972 in 1998 to 53,885 in 2007 (Appendix 15). The mean estimated run-size for fall adult steelhead in the Trinity River above WCW across the period of record is 14,706 fish. This year's run was 57.5% of the average.

Table 14. Run-size estimates and 95% confidence limits for Trinity River basin spring and fall Chinook and coho salmon, and adult fall steelhead during the 2010-11 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum ^a	Number effectively tagged ^b	Trinity River Hatchery recoveries		Run-size estimate ^d	Confidence limits 1-p= 0.95	Confidence limit estimator
				Number examined for tags ^c	Number of tags in sample			
Spring Chinook	Upstream of Junction City weir	Grilse	23	245	8	1,554	8,426 - 15,765	Poisson Approximation
		Adults	143	2,457	31	9,731		
		Total	166	2,702	39	11,285		
Fall Chinook	Upstream of Willow Creek weir	Grilse	396	1,458	46	12,554	36,427 - 45,945	Poisson Approximation
		Adults	870	7,749	239	28,238		
		Total	1,266	9,207	285	40,792		
Coho	Upstream of Willow Creek weir	Grilse	144	526	56	1,278	7,305 - 8,619	Normal Approximation
		Adults	751	3,899	442	6,669		
		Total	895	4,425	498	7,947		
Fall run steelhead	Upstream of Willow Creek weir	Adults	733	2,037	176	8,451	7,305 - 9,686	Normal Approx

a/ Stratum: Grilse = 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 were based on the proportion of grilse to adults observed at Willow Creek weir and Trinity River Hatchery combined; for spring Chinook on Junction City weir grilse/adult ratio only; and fall Chinook on the Willow Creek weir ratio.

Table 15. 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 2010-11 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum ^a	Run-size estimate	Angler Harvest		Spawner Escapement		
				Harvest rate ^b	Number of fish ^c	Natural area spawners ^d	Trinity River Hatchery	Total
Spring Chinook	Upstream of Junction City weir	Grilse	1,554	0.0%	0	1,309	245	1,554
		Adults	9,731	4.8%	463	6,811	2,457	9,268
		Total	11,285		463	8,120	2,702	10,822
Fall Chinook	Upstream of Willow Creek weir	Grilse	12,554	1.0%	127	10,969	1,458	12,427
		Adults	28,238	0.7%	188	20,301	7,749	28,050
		Total	40,792		315	31,270	9,207	40,476
Coho	Upstream of Willow Creek weir	Grilse	1,278	0.0%	0	752	526	1,278
		Adults	6,669	0.0%	0	2,770	3,899	6,669
		Total	7,947		0	3,522	4,425	7,947
Fall-run adult steelhead	Upstream of Willow Creek weir	Natural	3,811	0.7%	25	3,749	37	3,786
		Hatchery	4,640	3.7%	172	2,468	2,000	4,468
		Total	8,451		197	6,217	2,037	8,254

a/ Stratum: Grilse = 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, spring flow releases from Lewiston Dam were much lower than the currently-mandated flows. JCW was historically installed in the beginning of May, trapping peak numbers of spring Chinook in late May to mid-June. Now the Trinity River main stem flows rarely recede to the 800 cubic feet per second (cfs) at Junction City (because of the scheduled water releases from Lewiston Dam) that JCW is able to be installed prior to mid-June, and sometimes not until much later. In 2010 the water year designation of "Normal" (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 end of July, effectively missing all but the tail end of the spring Chinook run. Once installed, we were able to maintain a five night per week sampling schedule, excluding holidays, getting in 43 days of trapping at JCW before it was pulled on schedule at the end of September. The effect of this flow-shortened sampling season was a relatively small proportion of fish marked at JCW and associated large confidence intervals (25.33% - 39.70%) around our 11,285 spring Chinook population estimate. We are actively scouting new Junction City weir sites that would allow for a longer sampling window and more robust data upon which to estimate that population.

The numbers of spring Chinook returning to the TRH was largest during the first week of hatchery operations (JW 36) for the 2010-11 season. That peak during the first week likely occurred because spring Chinook had been holding in the river over the summer months below the hatchery, at the end of anadromy caused by Lewiston Dam. Although it has been suggested to open the ladder earlier in the season to avoid the first week peak, TRH management prefers not to allow these fish into the hatchery until they are nearly ripe for spawning.

In 2010 there was no late-August Hoopa Tribe Ceremonial Boat Dance (an odd-numbered year event only) so we were able to install WCW in JW 34. Our site was plagued by a near-nightly infiltration of five bears, which may have caused an unquantifiable decline in the number of fish trapped despite our best efforts to keep the bears at bay. We did not see bear-gnawed fish carcasses on the river bank, but the bears spent a lot of time in and around the traps and weir and we speculate more salmon than normal were staying away from the weir until it was opened up for quick passage mid-day (we noticed, anecdotally, an increase in the number of fish holding below the trap in the late mornings). We also had an increase in bear-induced damage or activity (bending or raising of conduit leaving gaps in the weir wide enough for salmon to get through, and breaking of the upper boat-gate panels (the jump screens)).

Other than the bear battles we had no disruption to our five nights per week trapping schedule until October 22, when we pulled the conduit to prepare for a predicted storm. The flows forecast for the weekend of October 23-24 should have been such the weir could ride it out with conduit pulled (especially in light of the fact little rain had yet fallen so the ground would need be saturated before the flows increased much), but the storm front was unseasonably wet (a typhoon remnant, it was later revealed) that

increased the flow substantially above the predicted volume. The river topped out at 12,200 cfs (USGS Hoopa gauge), well above the 3,500 cfs predicted, causing a catastrophic weir blow out, effectively ending the 2010 season. It continued to rain on and off for the remainder of the fall without the river receding to a trappable level.

The extremely strong grilse component to both the spring and fall Chinook runs in 2008 continued to contribute robustly to the runs as four year olds, comprising 62.9 % of the springs, and 39.5%% of the falls in 2010 (see Task 2).

The disproportion of fall Chinook grilse trapped at WCW versus those trapped at TRH was not as pronounced in 2010 (30.8% v. 15.8%) as in 2009 (20.3% grilse at WCW versus 1.9% at TRH), but the possibility that the weir is somehow selectively trapping grilse has been suggested by some. We maintain much of this difference can be explained simply by larger numbers of grilse being naturally-produced than are hatchery-produced and that those naturally-produced grilse are escaping to the South Fork Trinity, the New River and other tributaries rather than to TRH. That the proportion of ad-clipped fall Chinook grilse to the total number of fall Chinook trapped is similar at both WCW and TRH (both sites less than 3.5% in 2010, and less than 1.0% in 2009), supports this supposition.

Too few grilse spring or fall Chinook or coho salmon were tagged to generate independent estimates for adults and grilse, therefore we used numbers of adults and grilse 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 proportion of grilse/adults caught at each respective weir only to the total estimate of spring Chinook or fall Chinook to come up with the proportion of grilse/adults in the run. For coho the division between grilse and adult was made purely by length frequency. The steelhead estimates above WCW are for adults only.

The escapement estimate is generated by subtracting from the run size estimate the harvest estimates, which are based on Project tags returned by anglers. In 2010 we received very few returned tags (ie nine of 1,265 fall Chinook tags) which has prompted us to come up with ideas to increase angler participation. We anticipate running a study with increased reward amounts in the near future to inform this process.

There were three coho caught at JCW in 2010; they were not included in the WCW coho discussion or figures. The WCW was installed prior to the arrival of the coho salmon run, which was concentrated there in Julian weeks 39 through 41. Only two coho were trapped at WCW in the two final weeks of sampling. Slightly more than half of all WCW-tagged coho were eventually recovered at TRH, and 92% of them were RM-clipped (hatchery-origin) fish. The coho numbers at TRH dropped dramatically after JW 49, and the last coho of the season was trapped at TRH JW 2.

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. We identified 13 total tagging mortalities (0.4%) out of more than 3,295 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. Funding for re-instated monitoring of the South Fork Trinity River should be sought/identified/acquired. It is the largest tributary in the Trinity River Basin and has great production potential for fall Chinook and steelhead.

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

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

* Eight day Julian week only during leap years

**Eight day Julian week every year

Appendix 2. Fork length distribution of coded-wire tagged, Trinity River Hatchery-produced, spring Chinook recovered at TRH during the 2010-11 season.^a

FL (cm)	Brood Years											Total
	2006				2007				2008			
	065347-f	065348-f	065349-f	065360-y	068801-f	068802-f	068803-f	068810-y	068811-f	068812-f	068813-f	
39									1			1
40									0			0
41									0			0
42									0			0
43									0	1	1	2
44									1	1	0	2
45									1	0	0	1
46									1	4	3	8
47									3	0	2	5
48									1	3	2	6
49									0	2	1	3
50							1		2	2	1	6
51							0		0	1	0	1
52							1		1	1	1	4
53							0		1	0	0	1
54							0			1	1	2
55					1		0			0	0	1
56					0			0		1	0	1
57			1		0			1		1	0	3
58			0		0		1	1		1	0	3
59			0		0	1	0	2		0	0	3
60			1		1	1	0	1		1	0	5
61			0		0	0	1	9			1	11
62			1		1	3	0	3				8
63			1		0	0	1	11				13
64			1		0	2	1	8				12
65			3		0	5	1	7				16
66			4		0	5	1	10				20
67			3		1	1	2	7				14
68		1	8		0	1	1	6				17
69		0	2		0	3	1	6				12
70		0	5		1	2	0	7				15
71		0	4		0	0	1	2				7
72		0	1	5	0	1	1	2				10
73		0	1	10	2	0	0	8				21
74		1	0	11	0	1	1	3				17
75		1	0	13	0	1	1	1				17
76		0	1	21	0	1	0	0				23
77		0	0	20	0	2	0	1				23
78		0	0	28	1	0	0	1				30
79		1	0	10		0	1	0				12
80		2	0	25		0	1	0				28
81	1	0	2	18		0		0				21
82	1	0	1	25		0		1				28
83	0	1	2	22		1						26
84	0	2	0	20		0						22
85	0	1	1	15		0						17
86	0	0	0	10		0						10
87	0	0	0	11		0						11
88	0	0	2	14		1						17
89	0	0	0	13								13
90	0	3	0	11								14
91	1	2	0	3								6
92	1		0	3								4
93	1		1	4								6
94				4								4
95				3								3
96				1								1
97				1								1
Totals:	5	15	12	355	8	32	16	100	12	20	13	588
Mean	87.8	82.9	82.1	80.4	67.3	68.5	68.7	66.4	47.3	50.1	49.0	

a/ The fish ladder was open September 03, 2010 - March 08, 2011 (closed all or parts of JW 41-43).

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

Appendix 3. Fork length distribution of coded-wire tagged, Trinity River Hatchery-produced, fall Chinook recovered at TRH during the 2010-11 season.^a

FL (cm)	Brood Year										
	2006					2007					
	065350-f	065351-f	065352-f	065353-f	065361-y	068804-f	068805-f	068806-f	068807-f	068808-f	068809-y
39											
40											
41											
42											
43											
44											
45											1
46											0
47											0
48											0
49											1
50											1
51											1
52											0
53											0
54					1						2
55					0						1
56					0			1			0
57					0			0			1
58					1			0			0
59					0			0			6
60					0	1		0			3
61					0	0		0			3
62					0	0	1	1			10
63					0	0	0	0	1		11
64					2	0	1	3	0		17
65					0	0	0	0	1	1	13
66					3	1	1	2	0	3	28
67					2	1	2	0	1	0	40
68					0	2	1	1	0	0	70
69					1	2	3	1	3	4	50
70					0	0	0	1	0	3	72
71					1	0	2	0	2	3	62
72					3	2	2	0	1	0	70
73					1	0	1	0	2	2	60
74					6	1	0	0	0	0	53
75		1	1		8	4	2	1	1	0	57
76	3	0	0		7	0	2	1	2	2	50
77	3	0	0	2	16	1	0	0	0	2	27
78	1	0	2	2	23	0	0	1	1	1	28
79	2	3	2	2	38	2	0	2	0	1	19
80	0	1	0	1	47		0	0	0		23
81	0	2	0	1	43		0	0	0		9
82	1	1	0	5	59		1	2	0		14
83	0	4	2	3	60		0		0		9
84	2	1	0	6	55		1		0		10
85	0	0	4	1	44		1		1		4
86	3	0	0	6	44						3
87	1	1	0	2	35						2
88	1	0	1	0	36						1
89	0	1	0	1	27						5
90	0	1	1	2	27						
91	1	1	0	0	22						
92	0	1	0	2	18						
93	0	2	0	0	18						
94	0		0	1	17						
95	1		0	0	14						
96	1		1	1	7						
97	0		0		8						
98	0		0		10						
99	1		0		5						
100			1		5						
101					3						
102					1						
103					0						
104					1						
Totals:	21	20	15	38	719	17	21	17	16	22	837
Mean:	83.8	84.4	84.6	84.5	84.9	71.8	72.0	70.6	72.0	71.4	72.1

a/ The fish ladder was open September 03, 2010 - March 08, 2011 (closed all or parts of JW 41-43).

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

Appendix 3 (continued). Fork length distribution of coded-wire tagged, Trinity River Hatchery-produced, fall Chinook recovered at TRH during the 2010-11 season.a

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	Total
39										1			1
40										0			0
41										0			0
42										1			1
43								1		0			1
44								0		0			0
45								1		1			3
46						1		1		4			6
47					1	1		1	1	7			11
48					1	1		0	1	7			10
49			1	1	2	0	2	3	2	3			15
50			0	0	3	1	2	1	1	7			16
51	1		1	1	3	3	2	0	0	4	1		17
52	1		0	0	4	5	1	3	0	5	1		20
53	1	1	1	0	2	1	5	2	1	2	1	1	18
54	0	0	0	0	13	6	4	3	3	3	1	0	36
55	0	1	0	1	3	6	3	3	4	2	1	0	25
56	0	0	1		8	5	1	5	0	1	2	0	24
57	0	0			11	4	3	5	2	1	1	0	28
58	1	1			7	6	5	3	0			0	24
59	0				4	6	4	1	2			1	24
60	1				5	2	1	4	0				17
61					3	1	1	0	1				9
62					4	0	1	0	0				17
63					0	0	0	1	0				13
64					2	0	0		1				26
65					0	0	1		0				16
66					2	0			1				41
67						1							47
68													74
69													64
70													76
71													70
72													78
73													66
74													60
75													75
76													67
77													51
78													59
79													71
80													72
81													55
82													83
83													78
84													75
85													55
86													56
87													41
88													39
89													34
90													31
91													24
92													21
93													20
94													18
95													15
96													10
97													8
98													10
99													6
100													6
101													3
102													1
103													0
104													1
Totals:	5	3	4	3	78	50	36	38	20	49	8	2	2,039
Mean	54.8	55.3	52.3	51.7	56.2	55.4	55.5	54.4	55.1	49.5	54.3	56.0	74.6

a/ The fish ladder was open September 03, 2010 - March 08, 2011 (closed all or parts of JW 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 2010-11 season.^a

FL (cm)	JCW		
	Total Trapped	Ad-clips ^b	Effective Tags ^c
45	3	0	3
46	5	0	5
47	1	0	1
48	4	1	4
49	2	1	2
50	1	0	1
51	1	0	1
52	1	0	1
53	0	0	0
54	1	0	1
55	2	0	2
56	2	0	2
57	0	0	0
58	1	0	1
59	0	0	0
60	4	0	4
61	3	1	3
62	7	0	7
63	4	0	4
64	6	0	6
65	11	0	11
66	10	2	10
67	9	1	9
68	6	0	6
69	4	1	4
70	3	0	3
71	5	0	5
72	1	1	1
73	5	1	5
74	4	0	4
75	4	1	4
76	5	0	5
77	3	0	3
78	7	1	6
79	6	1	6
80	5	0	5
81	3	0	3
82	6	1	6
83	8	2	8
84	3	0	3
85	1	0	1
86	3	1	3
87	3	0	3
88	0	0	0
89	4	1	4
Totals:	167	17	166
Mean FL:	69.4	72.1	69.3
Total grilse: ^d	23	2	23
Total adults:	144	15	143

a/ Trapping at JCW took place July 30 - September 29, 2010 (Julian weeks 24 - 39). All Chinook trapped before Julian week 38 at JCW were considered spring Chinook. There were no spring Chinook trapped at Willow Creek weir in 2010.

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 58cm FL were considered grilse.

Appendix 5. Fork length (FL) distribution of fall Chinook trapped and tagged at Junction City (JCW) weir and Willow Creek weir (WCW) during the 2010-11 season.^a

FL (cm)	JCW			WCW		
	Total Trapped	Ad-clips ^b	Effective Tags ^c	Total Trapped	Ad-clips ^b	Effective Tags ^c
36				1		
37				2		2
38				0		0
39				1		1
40	1		1	3		3
41	3		3	5		5
42	0		0	4		4
43	2		2	10		10
44	0		0	13		13
45	0		0	15		15
46	1		1	22		22
47	1		1	27		27
48	2		2	30		30
49	0		0	22		22
50	0		0	33		33
51	1		1	31		30
52	1		1	25	1	23
53	1		1	23	4	23
54	3		3	24	3	24
55	0		0	16	2	16
56	1		1	19	3	19
57	1		1	16	1	16
58	0		0	15	1	15
59	2		2	17	2	16
60	1		1	11	3	11
61	0		0	16	0	16
62	2		2	15	2	15
63	1		1	29	2	27
64	2	1	2	20	1	19
65	1	0	1	23	6	21
66	3	0	3	36	3	35
67	0	0	0	35	3	35
68	0	0	0	35	4	33
69	0	0	0	31	3	30
70	3	1	3	39	3	39
71	2	0	2	37	8	36
72	0	0	0	39	2	37
73	3	1	3	45	5	45
74	1	1	1	29	3	26
75	0	0	0	35	7	35
76	2	1	2	19	4	19
77	0	0	0	30	2	28
78	1	0	1	39	6	39
79	0	0	0	38	5	38
80	5	0	5	47	6	46
81	1	1	1	41	7	36
82	2	0	2	34	5	32
83	0	0	0	29	5	29
84	2	0	2	28	2	27
85	0	0	0	30	1	29
86	0	0	0	24	4	23
87	2	1	2	17	6	17
88	1		1	14	1	12
89				11	1	11
90				9	1	9
91				8	0	8
92				17	1	16
93				4	0	4
94				3	0	3
95				1	0	0
96				3	0	3
97				2	0	2
98				3	0	3
99				1	0	1
100				1	1	1
101				1		1
Totals:	55	7	55	1,303	130	1,266
Mean FL:	65.0	75.0	65.0	68.4	73.1	68.3
Total grilse: ^d	21	0	21	401	20	396
Total adults:	34	7	34	902	110	870

a/ Trapping at JCW took place July 30 - September 29, 2010; Chinook trapped >JW 37 at JCW were considered fall Chinook. Trapping at WCW took place August 20 - October 22, 2010; all Chinook trapped at WCW in 2010 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 62cm FL were considered grilse.

Appendix 6. Fork length (FL) distribution of coho salmon trapped at the Willow Creek weir (WCW) or Junction City weir (JCW), and recovered at Trinity River Hatchery (TRH) during the 2010-11 season.^a

FL (cm)	WCW				JCW			
	Total Trapped	RM-clips ^b	Effective Tags ^c	WCW tags recovered at TRH	Total Trapped	RM-clips ^b	Effective Tags ^c	JCW tags recovered at TRH
37	3	2	3	1				
38	1	0	1	0				
39	2	2	2	1				
40	4	4	4	2				
41	7	7	7	2				
42	6	6	6	1				
43	13	13	13	5				
44	20	20	20	6				
45	16	16	16	8				
46	14	14	14	2				
47	9	9	9	4				
48	8	8	8	5				
49	7	7	7	3				
50	13	11	12	6				
51	8	8	8	3				
52	7	7	7	3				
53	2	2	2	2				
54	3	2	2	1				
55	3	2	3	1				
56	8	8	8	4				
57	4	4	4	3				
58	7	7	7	2				
59	11	8	11	5				
60	8	8	8	2				
61	8	8	8	5				
62	21	18	21	10	1	1	1	
63	27	23	27	15	0	0	0	
64	44	40	41	23	0	0	0	
65	60	57	59	40	0	0	0	
66	78	69	77	46	0	0	0	
67	95	83	93	60	0	0	0	
68	106	93	105	58	1	1	1	1
69	92	79	90	47	0	0	0	
70	85	80	84	54	0	0	0	
71	40	36	40	28	0	0	0	
72	34	28	34	23	0	0	0	
73	18	10	18	10	0	0	0	
74	8	4	8	5	0	0	0	
75	4	2	4	1	0	0	0	
76	4	2	4	1	0	0	0	
77					0	0	0	
78					0	0	0	
79					0	0	0	
80					0	0	0	
81					0	0	0	
82					0	0	0	
83					0	0	0	
84					0	0	0	
85					0	0	0	
86					0	0	0	
87					0	0	0	
88					1	1	1	
Totals:	908	807	895	498	3	3	3	1
Mean FL:	63.8	63.4	63.8	65.1	72.7	72.7	72.7	68.0
Total grilse: ^d	146	140	144	56	0	0	0	0
Total adults:	762	667	751	442	3	3	3	1

a/ Trapping at WCW took place August 20 - October 22, 2010; Trapping at JCW took place July 30 - September 29, 2010. The fish ladder at TRH was open September 03, 2010 - March 08, 2011 (closed all or parts of JW 41-43).

b/ RM-clip = Right maxillary-clipped fish.

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

d/ Coho salmon less than 56 cm FL were considered grilse.

Appendix 7. Fork length (FL) distribution of steelhead trapped at the Willow Creek weir and Trinity River Hatchery during the 2010-11 season.^a

FL (cm)	Willow Creek weir			Trinity River Hatchery		
	Total Trapped	Ad-clips ^b	Effective Tags ^c	WCW tags recovered at TRH	Total Trapped	Ad-clips ^b
29					1	1
30					1	1
31	1				5	5
32	3				16	16
33	10	4			3	3
34	3	1			2	2
35	7	5			3	3
36	10	9			3	3
37	22	14			5	5
38	6	4			13	13
39	11	8			13	13
40	17	14			10	10
41	11	10			25	25
42	11	10	9	6	34	33
43	22	17	18	5	31	31
44	7	4	7	3	22	21
45	14	12	12	2	26	26
46	4	4	4	0	19	18
47	3	1	3	1	19	19
48	6	1	4	1	16	15
49	8	4	8	1	2	2
50	10	2	7	1	4	4
51	13	5	11	1	8	7
52	18	5	17	1	8	7
53	5	3	5	1	28	27
54	30	10	24	4	31	29
55	21	7	17	2	45	43
56	42	24	39	11	72	71
57	40	17	36	6	76	72
58	51	26	46	12	125	124
59	62	35	56	11	130	128
60	66	38	60	12	160	160
61	53	31	48	14	121	121
62	55	29	48	13	121	120
63	45	26	43	11	119	118
64	44	21	41	7	114	112
65	32	18	31	7	96	93
66	21	11	18	2	84	82
67	30	15	29	7	77	76
68	18	10	16	6	64	63
69	24	15	21	6	71	69
70	18	15	15	8	68	67
71	13	8	11	3	53	52
72	12	10	12	5	49	49
73	9	8	9	3	29	29
74	3	1	3	2	38	36
75	3	2	2	1	21	21
76	0	0	0		21	21
77	0	0	0		10	10
78	2	2	2		12	12
79	0	0	0		5	4
80	0	0	0		5	5
81	0	0	0		2	2
82	0	0	0		0	0
83	1	1	1		0	0
84					0	0
85					0	0
86					0	0
87					0	0
88					0	0
89					0	0
90					0	0
91					0	0
92					0	0
93					1	1
Totals:	917	517	733	176	2,137	2,100
Mean FL:	57.3	57.1	59.9	60.5	60.6	60.6
Total 1/2 pounders: ^d	101	69	0	0	100	100
Total adults:	816	448	733	176	2,037	2,000

a/ Trapping at WCW took place August 20 - October 22, 2010. The fish ladder at TRH was open September 03, 2010 - March 08, 2011 (closed all or parts of JW 41-43).

b/ Ad-clips= Adipose fin-clipped fish.

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

d/ Steelhead less than or equal to 41cm FL were considered half-pounders. Only adult steelhead (>41cm) were tagged at WCW.

Appendix 8. Fork length (FL) distribution of spring Chinook tagged at Junction City weir and subsequently recovered during the 2010-11 season. ^a

FL (cm)	Total Tagged	Recoveries						Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass ^c Recoveries	TRH ^d Recoveries	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g		
45	3							0	0.0
46	5			1				1	20.0
47	1			1				1	100.0
48	4			1				1	25.0
49	2			1				1	50.0
50	1			1				1	100.0
51	1			1				1	100.0
52	1			0				0	0.0
53	0			0				0	0.0
54	1			0				0	0.0
55	2			1				1	50.0
56	2			2				2	100.0
57	0			0				0	0.0
58	1			1				1	100.0
59	0			0				0	0.0
60	4			1				1	25.0
61	3			0				0	0.0
62	7			3				3	42.9
63	4		1	1				2	50.0
64	6		0	1				1	16.7
65	11		1	4		1		6	54.5
66	10		1	3		0		4	40.0
67	9		0	3		0		3	33.3
68	6		0	0		0		0	0.0
69	4		1	0		0		1	25.0
70	3		0	1		0		1	33.3
71	5		0	2		0		2	40.0
72	1		0	0		0		0	0.0
73	5		0	0		0		0	0.0
74	4		0	1		0		1	25.0
75	4		1	0		1		2	50.0
76	5		1	2		0		3	60.0
77	3		0	0		0		0	0.0
78	7	1	1	2		0		4	57.1
79	6		1	1		0		2	33.3
80	5		0	2		0		2	40.0
81	3		0	2		0		2	66.7
82	6		1	1		1		3	50.0
83	8		1	2				3	37.5
84	3		1	0				1	33.3
85	1		0	0				0	0.0
86	3		1	0			1	2	66.7
87	3			2				2	66.7
88	0							0	0.0
89	4							0	0.0
Grilse: ^h	23	0	0	9	0	0	0	9	39.1%
Adults:	144	1	12	35	0	3	1	52	36.1%
Total:	167	1	12	44	0	3	1	61	36.5%

a/ Trapping at Junction City took place July 30 - September 29, 2010 (Julian weeks 30-39). Chinook caught prior to Julian week 38 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 03, 2010 - March 08, 2011 (closed all or parts of JW 41-43).

e/ There were no spring Chinook tagged at JCw and reported as caught and released by anglers in 2010.

f/ Fish reported as harvested by anglers.

g/ Tags found on dead fish or found unattached.

h/ Spring Chinook <58 cm FL were considered grilse.

Appendix 9. Fork length (FL) distribution of fall Chinook tagged at Willow Creek and Junction City weirs and subsequently recovered during the 2010-11 season. ^a

FL (cm)	WCW + JCW Total Tagged	Recoveries					Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass Recoveries ^c	TRH Recoveries ^d	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g	
37	2						0	0.0
38	0						0	--
39	1						0	0.0
40	4						0	0.0
41	8						0	0.0
42	4						0	0.0
43	12		1				1	8.3
44	13		0				0	0.0
45	15		0	1			1	6.7
46	23		0	0			0	0.0
47	28		0	0			0	0.0
48	32		0	2			2	6.3
49	22		1	1		1	3	13.6
50	33		0	1		0	1	3.0
51	32	1	0	2		0	3	9.4
52	25	1	1	2		1	5	20.0
53	24	0	0	5		0	6	25.0
54	27	0	0	9		0	9	33.3
55	16	0	1	7		0	8	50.0
56	20	0	0	4		0	4	20.0
57	17	0	0	4		0	4	23.5
58	15	0	0	3		0	3	20.0
59	18	0	0	5		1	6	33.3
60	12	0	1	1		0	2	16.7
61	16	0	1	2		1	4	25.0
62	17	0	3	5		0	10	58.8
63	29	1	2	3		0	6	20.7
64	22	0	0	5	1	0	6	27.3
65	23	0	1	4	1	0	6	26.1
66	38	0	2	6	0	0	8	21.1
67	35	0	0	12	0	1	13	37.1
68	34	1	0	13	0	0	15	44.1
69	30	0	2	9	0	0	11	36.7
70	42	0	2	17	0	1	20	47.6
71	39	0	2	13	1	0	16	41.0
72	37	0	0	10	0	0	10	27.0
73	48	0	1	16	0	0	17	35.4
74	29	2	1	5	0	0	8	27.6
75	35	0	2	9	0	0	11	31.4
76	21	0	0	7	0	0	7	33.3
77	28	0	1	6	0	0	7	25.0
78	40	0	3	8	0	0	11	27.5
79	38	0	4	10	0	0	14	36.8
80	51	0	2	15	0	0	17	33.3
81	39	2	1	15	0	1	19	48.7
82	35	1	1	12	0	0	14	40.0
83	29	0	4	9	0	0	13	44.8
84	29	0	2	10	0	0	12	41.4
85	30	0	4	4	1	0	9	30.0
86	23	0		5		1	6	26.1
87	19	0		5		0	5	26.3
88	14	1		4		1	6	42.9
89	11	0		3			3	27.3
90	9	0		2			2	22.2
91	8	0		4			4	50.0
92	16	0		3			3	18.8
93	4	0		1			1	25.0
94	3	0		1			1	33.3
95	1	1		0			1	100.0
96	3			1			1	33.3
97	2			0			0	0.0
98	3			1			1	33.3
99	1			1			1	100.0
100	1						0	0.0
101	1						0	0.0
Grilse: ^h	419	2	6	49	0	4	31	7.4%
Adults:	917	9	40	254	4	5	346	37.7%
Total:	1,336	11	46	303	4	9	377	28.2%

a/ Trapping at Junction City weir took place July 30 - September 29, 2010; Chinook caught there after Julian week 37 were considered fall Chinook. Willow Creek trapping took place August 20 - October 22, 2010. All Chinook trapped at WCW in 2010 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 03, 2010 - March 08, 2011 (closed all or parts of JW 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/ Fall Chinook <62 cm FL were considered grilse in 2010.

Appendix 10. Fork length (FL) distribution of coho tagged at Willow Creek weir and Junction City weir and subsequently recovered during the 2010-11 season. ^a

FL (cm)	Total Tagged	Recoveries						Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass Recoveries ^c	TRH Recoveries ^d	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g		
37	3			1				1	33.3
38	1			0				0	0.0
39	2			1				1	50.0
40	4		1	1				2	50.0
41	7		0	3				3	42.9
42	6		0	1				1	16.7
43	13		0	4				4	30.8
44	20		0	6				6	30.0
45	16		1	8				9	56.3
46	14		0	2				2	14.3
47	9		0	4				4	44.4
48	8		0	5				5	62.5
49	7		0	3				3	42.9
50	12		0	6				6	50.0
51	8		0	4				4	50.0
52	7		0	5				5	71.4
53	2		0	1				1	50.0
54	2		0	1				1	50.0
55	3		0	1				1	33.3
56	8		0	4				4	50.0
57	4		0	2				2	50.0
58	7		1	2				3	42.9
59	11		0	5				5	45.5
60	8		0	2				2	25.0
61	8		0	5				5	62.5
62	22		0	8				8	36.4
63	27		0	15				15	55.6
64	41		1	24				25	61.0
65	59		1	40				41	69.5
66	77		2	48	1			51	66.2
67	94		3	61	0			64	68.1
68	106		3	59	1			63	59.4
69	91		5	47				52	57.1
70	84		2	54				56	66.7
71	40		0	28				28	70.0
72	34		0	22				22	64.7
73	18		0	9				9	50.0
74	8		0	5				5	62.5
75	4		1	1				2	50.0
76	4		2	1				3	75.0
77	0							0	--
78	0							0	--
79	0							0	--
80	0							0	--
81	0							0	--
82	0							0	--
83	0							0	--
84	0							0	--
85	0							0	--
86	0							0	--
87	0							0	--
88	1							0	0.0
Grilse: ^h	144	0	2	57	0	0	0	59	41.0%
Adults:	756	0	21	442	2	0	0	465	61.5%
Total:	900	0	23	499	2	0	0	524	58.2%

a/ Trapping at Junction City weir took place July 30 - September 29, 2010; Willow Creek weir trapping took place from August 20 - October 22, 2010. The three coho trapped at JCW are included in the above totals.

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 03, 2010 - March 08, 2011 (closed all or parts of JW 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 <56 cm FL were considered grilse in 2010.

Appendix 11. Fork length (FL) distribution of adult fall-run steelhead tagged at Willow Creek weir or Junction City weir and subsequently recovered during the 2010-11 season. ^a

FL (cm)	Total Tagged	Recoveries						Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass Recoveries ^c	TRH Recoveries ^d	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g		
42	10			6	1			7	70.0
43	21			5	3	1		9	42.9
44	8			3	0	0		3	37.5
45	14			2	2	0		4	28.6
46	4			0	0	0		0	0.0
47	3			1	0	0		1	33.3
48	6			1	2	0	1	4	66.7
49	8			1	0	0		1	12.5
50	10			1	3	0		4	40.0
51	13			1	2	0		3	23.1
52	18			1	1	0		2	11.1
53	5			1	0	0		1	20.0
54	28			4	4	0		8	28.6
55	20			2	2	1		5	25.0
56	43			11	2	0		13	30.2
57	41			6	4	0		10	24.4
58	51			12	5	0		17	33.3
59	62			11	6	1		18	29.0
60	67			13	6	2		21	31.3
61	53			14	5	1		20	37.7
62	55			13	7	1		21	38.2
63	45			11	2	3		16	35.6
64	44			7	3	0		10	22.7
65	32			7	1	2		10	31.3
66	21			2	3	0		5	23.8
67	31	1		7	0	0		8	25.8
68	19			5	2	0		7	36.8
69	25			6	3	0		9	36.0
70	18			8	3	0		11	61.1
71	13			3	2	0		5	38.5
72	12			5	0	1		6	50.0
73	9			3	0			3	33.3
74	4			2	0			2	50.0
75	3			1	1			2	66.7
76	0							0	--
77	0							0	--
78	2							0	0.0
79	0							0	--
80	1							0	0.0
81	0							0	--
82	0							0	--
83	1							0	0.0
Totals:	820	1	0	176	75	13	1	266	32.4%

a/ Trapping at Willow Creek took place August 20 - October 22, 2010; trapping at JCW took place July 30 - September 29, 2010.

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 2010 survey.

d/ The fish ladder was open September 03, 2010 - March 08, 2011 (closed all or parts of JW 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.

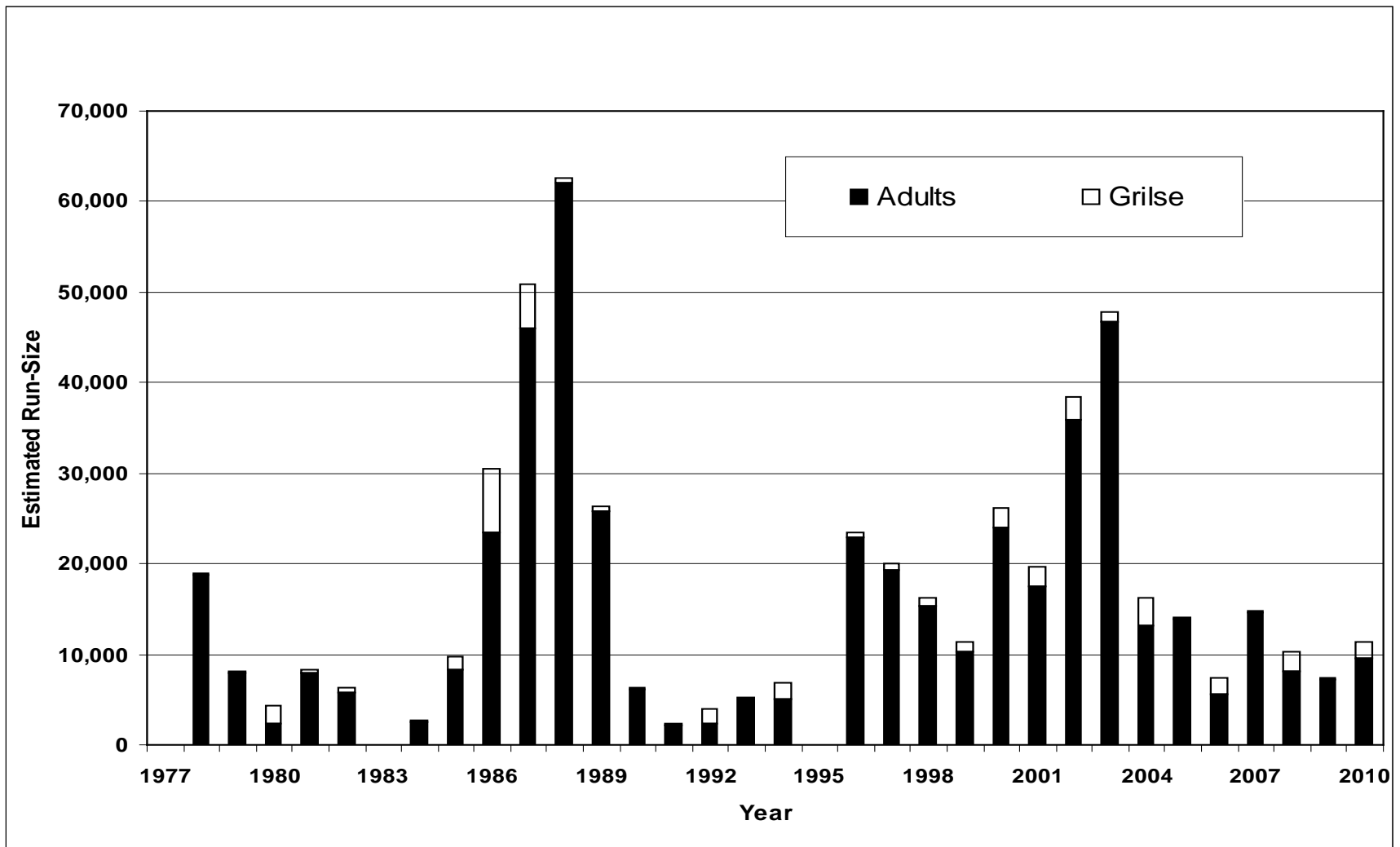
Appendix 12. Spring Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Junction City weir, 1977 - 2010.

Year	Run-size estimate					Spawner escapements						Angler harvest			
	Grilse		Adults		Total	Natural Area Spawners ^a			Trinity River Hatchery			Grilse	Adults	Total	
	Number	Percent	Number	Percent		Grilse	Adults	Total	Grilse	Adults	Total				
1977			no estimates				no estimates			385	1,124	1,509	no estimates		
1978	190	1.0	18,816	99.0	19,006	29	14,384	14,413	153	3,680	3,833	8	752	b/	760
1979	113	1.4	7,964	98.6	8,077	0	5,008	5,008	113	1,658	1,771	0	1,298		1,298
1980	1,949	45.9	2,301	54.1	4,250	1,312	1,614	2,926	353	547	900	284	140		424
1981	347	4.2	7,913	95.8	8,260	242	3,362	3,604	95	2,405	2,500	10	2,146		2,156
1982	656	10.3	5,731	89.7	6,387	387	3,868	4,255	150	1,226	1,376	119	637		756
1983			no estimates				no estimates			385	930	1,315	no estimates		
1984	255	9.4	2,465	90.6	2,720	140	1,354	1,494	76	736	812	39	375		414
1985	1,434	14.8	8,278	85.2	9,712	799	4,897	5,696	508	2,645	3,153	127	736	c/	863
1986	7,018	23.1	23,403	76.9	30,421	4,335	13,371	17,706	1,461	7,083	8,544	1,222	2,949		4,171
1987	4,858	9.5	46,016	90.5	50,874	2,577	29,083	31,660	1,387	8,466	9,853	894	8,467		9,361
1988	720	1.1	61,972	98.9	62,692	241	39,329	39,570	377	13,905	14,282	102	8,738		8,840
1989	502	1.9	25,804	98.1	26,306	435	18,241	18,676	17	4,983	5,000	50	2,580		2,630
1990	265	4.1	6,123	95.9	6,388	126	2,880	3,006	104	2,433	2,537	35	810		845
1991	190	8.0	2,191	92.0	2,381	92	1,268	1,360	71	614	685	27	309		336
1992	1,671	41.5	2,359	58.5	4,030	944	942	1,886	533	1,313	1,846	194	104	c/	298
1993	68	1.3	5,164	98.7	5,232	37	2,111	2,148	31	2,630	2,661	0	423	c/	423
1994	1,793	26.4	4,995	73.6	6,788	550	2,897	3,447	944	1,943	2,887	299	155	c/	454
1995			no estimates				no estimates			385	8,722	9,107	no estimates		
1996	489	2.1	22,927	97.9	23,416	370	16,283	16,653	119	5,131	5,250	0	1,513	c/	1,513
1997	768	3.8	19,271	96.2	20,039	543	13,049	13,592	225	4,892	5,117	0	1,330	c/	1,330
1998	802	5.0	15,365	95.0	16,167	567	9,057	9,624	184	4,679	4,863	51	1,629	c/	1,680
1999	1,028	9.1	10,265	90.9	11,293	440	5,968	6,408	547	3,671	4,218	41	626	c/	667
2000	2,159	8.3	23,923	91.7	26,082	1,264	10,846	12,110	571	11,594	12,165	324	1,483	c/	1,807
2001	2,065	10.5	17,556	89.5	19,621	1,178	10,284	11,462	629	6,366	6,995	258	906		1,164
2002	2,575	6.7	35,910	93.3	38,485	1,883	23,674	25,557	617	10,440	11,057	75	1,796		1,871
2003	1,039	2.2	46,756	97.8	47,795	909	30,211	31,120	130	14,512	14,642	0	2,033		2,033
2004	2,929	18.1	13,218	81.9	16,147	1,708	7,314	9,022	985	5,251	6,236	236	653		889
2005	55	0.4	13,929	99.6	13,984	30	6,003	6,033	25	6,966	6,991	0	961		961
2006	1,963	26.2	5,520	73.8	7,483	1,127	2,955	4,082	819	2,565	3,384	17	0		17
2007	135	0.9	14,700	99.1	14,835	80	8,154	8,234	55	5,981	6,036	0	565		565
2008	2,218	21.6	8,065	78.4	10,283	1,741	4,470	6,211	329	3,437	3,766	148	158		306
2009	260	3.5	7,166	96.5	7,426	191	3,724	3,915	69	3,000	3,069	0	442		442
2010	1,757	15.6	9,528	84.4	11,285	1,512	6,617	8,129	245	2,457	2,702	0	454		454

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.



Appendix 12 (continued). Spring Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Junction City weir, 1977 - 2010.

Appendix 13. Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2010.

Year	Run-size estimate					Spawner escapements						Angler harvest		
	Grilse			Adults		Natural Area Spawners ^a			Trinity River Hatchery			Grilse	Adults	Total
	Number	Percent	Number	Percent	Total	Grilse	Adults	Total	Grilse	Adults	Total			
1977	14,318	43.5	18,596	56.5	32,914	9,737	13,501	23,238	2,177	2,035	4,212	2,404	3,060	5,464
1978	6,037	14.0	37,086	86.0	43,123	4,712	31,052	35,764	1,325	6,034	7,359	Fishing closure		0
1979	5,665	35.0	10,520	65.0	16,185	3,936	8,028	11,964	964	1,335	2,299	765	1,157	1,922
1980	21,549	62.7	12,797	37.3	34,346	16,837	7,700	24,537	2,256	4,099	6,355	2,456	998	3,454
1981	8,366	28.6	20,884	71.4	29,250	5,906	15,340	21,246	1,004	2,370	3,374	1,456	3,174	4,630
1982	14,938	52.2	13,653	47.8	28,591	8,149	9,274	17,423	4,235	2,058	6,293	2,554	2,321	4,875
1983	1,240	4.7	25,138	95.3	26,378	853	17,284	18,137	271	5,494	5,765	116	2,360	2,476
1984	4,575	34.8	8,556	65.2	13,131	3,416	5,654	9,070	766	2,166	2,932	393	736	1,129
1985	53,062	81.6	11,954	18.4	65,016	29,454	9,217	38,671	18,166	2,583	20,749	5,442	154	5,596
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	9,358	9,723	371	1,348	1,719	22	328	350
1991	681	7.4	8,526	92.6	9,207	382	4,867	5,249	205	2,482	2,687	94	1,177	1,271
1992	2,932	20.7	11,232	79.3	14,164	2,563	7,139	9,702	211	3,779	3,990	158	314	472
1993	3,381	32.2	7,104	67.8	10,485	2,473	5,898	8,371	736	815	1,551	172	391	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	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	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	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	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	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	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	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	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	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	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	708
2005	899	3.2	27,332	96.8	28,231	751	12,717	13,468	48	13,758	13,806	100	856	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	124
2007	886	1.5	57,987	98.5	58,873	765	38,967	39,732	33	18,081	18,114	89	939	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	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	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	315

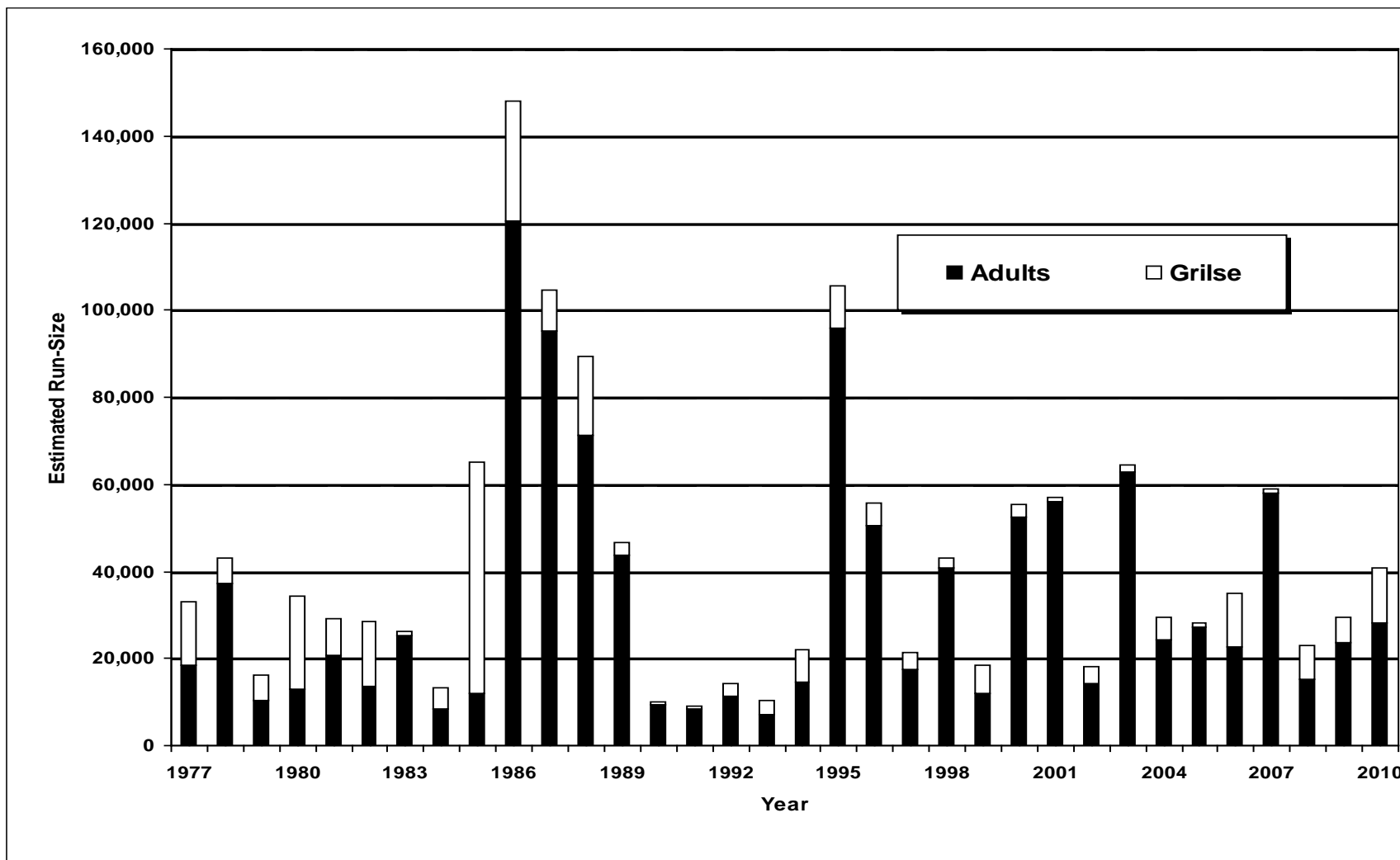
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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 1999-2010 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 and 12,000 in 2010.

Appendix 13 (continued). Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2010.



Appendix 14. Coho salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2010.

Year	Run-size estimate					Spawner escapements						Angler harvest		
	Grilse		Adults		Total	Natural Area Spawners ^a			Trinity River Hatchery			Grilse	Adults	Total
	Number	Percent	Number	Percent		Grilse	Adults	Total	Grilse	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 ^c	763
1986	18,909	67.6	9,063	32.4	27,972	13,034	6,247	19,281	5,402	2,589	7,991	473	227	700
1987	7,253	12.3	51,826	87.7	59,079	3,975	28,398	32,373	2,865	20,473	23,338	413	2,955	3,368
1988	2,731	7.0	36,173	93.0	38,904	1,850	22,277	24,127	743	12,073	12,816	138	1,823	1,961
1989	290	1.5	18,462	98.5	18,752	208	13,274	13,482	77	4,893	4,970	5	295	300
1990	412	10.6	3,485	89.4	3,897	234	1,981	2,215	173	1,462	1,635	5	42	47
1991	265	2.9	8,859	97.1	9,124	164	6,163	6,327	98	2,590	2,688	3	106	109
1992	2,378	23.0	7,961	77.0	10,339	1,168	5,565	6,733	1,210	2,372	3,582	0	24	24
1993	573	10.2	5,048	89.8	5,621	416	3,024	3,440	93	2,024	2,117	64	0	64
1994	613	71.9	239	28.1	852	453	105	558	160	134	294	0	0	0
1995	634	3.9	15,477	96.1	16,111	370	10,680	11,050	264	4,503	4,767	0	294	294
1996	1,269	3.5	35,391	96.5	36,660	1,149	25,308	26,457	120	9,835	9,955	0	248	248 ^d
1997	5,951	75.0	1,984	25.0	7,935	5,038	1,097	6,135	871	887	1,758	42	0	42 ^d
1998	2,471	19.8	10,009	80.2	12,480	1,494	5,995	7,489	977	4,014	4,991	0	0	0 ^d
1999	623	11.3	4,912	88.7	5,535	234	1,696	1,930	389	3,118	3,507	0	98	98 ^d
2000	5,486	35.3	10,046	64.7	15,532	4,560	6,585	11,145	926	3,461	4,387	0	0	0 ^d
2001	3,670	11.4	28,470	88.6	32,140	2,644	18,715	21,359	1,026	9,755	10,781	0	0	0 ^d
2002	1,709	10.7	14,307	89.3	16,016	1,006	7,812	8,818	703	6,495	7,198	0	0	0 ^d
2003	3,501	12.4	24,651	87.6	28,152	2,038	14,255	16,293	1,463	10,396	11,859	0	0	0 ^d
2004	5,819	15.0	33,063	85.0	38,882	4,742	23,117	27,859	1,077	9,906	10,983	0	40	40 ^d
2005	3,093	9.8	28,326	90.2	31,419	1,341	11,702	13,043	1,731	16,624	18,355	21	0	21 ^d
2006	1,369	6.8	18,709	93.2	20,078	708	8,870	9,578	661	9,839	10,500	0	0	0 ^d
2007	545	9.5	5,205	90.5	5,750	270	2,552	2,822	275	2,653	2,928	0	0	0 ^d
2008	2,379	23.8	7,603	76.2	9,982	1,730	3,064	4,794	649	4,539	5,188	0	0	0 ^d
2009	1,762	27.5	4,634	72.5	6,396	888	2,157	3,045	874	2,477	3,351	0	0	0 ^d
2010	1,278	16.1	6,669	83.9	7,947	752	2,770	3,522	526	3,899	4,425	0	0	0 ^d

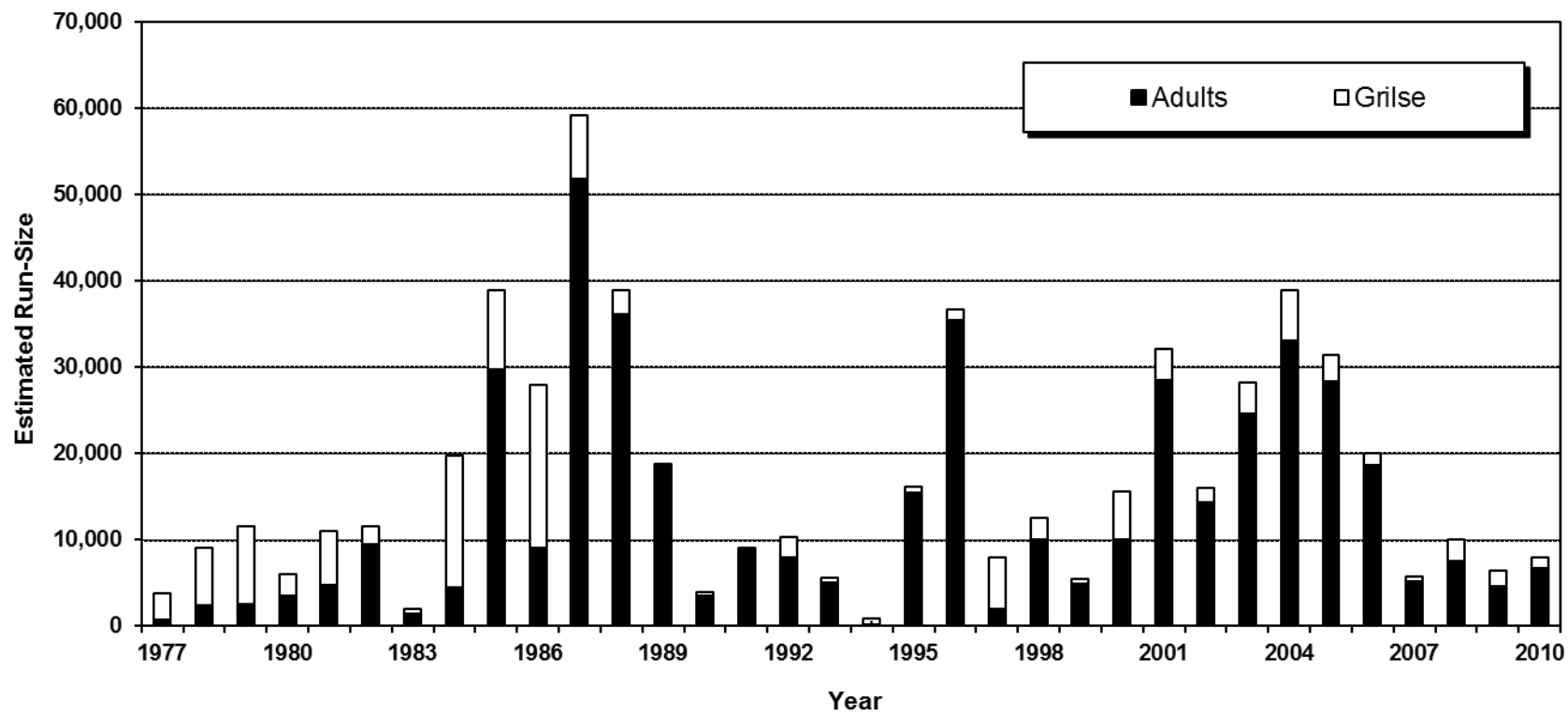
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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 than or equal to 56 cm total length beginning September 22, 1985.

d/ The 1996-2009 sport fishery was closed to the take of coho salmon.

Appendix 14 (continued). Coho salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2010.



Appendix 15. Fall-run adult steelhead (>41cm FL) run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2010.

Crack Well, 1977 - 2010.

Year	Run-size estimate					Spawner escapement						Angler harvest		
	Hatchery ^b		Wild ^c		Total	Natural Area Spawners ^a			Trinity River Hatchery			Hatchery	Wild	Total
						Hatchery	Wild	Total	Hatchery	Wild	Total			
1977			No estimates			No estimates			269	16	285	No estimates		
1978			"			"			628	55	683	"		
1979			"			"			329	53	382	"		
1980	8,449	33.7	16,645	66.3	25,094	5,101	14,462	19,563	1,903	102	2,005	1,445	2,081	3,526
1981			No estimates			No estimates			892	112	1,004	No estimates		
1982	2,106	20.0	8,426	80.0	10,532	971	6,889	7,860	634	79	713	501	1,458	1,959
1983	No estimates for hatchery/wild component				8,605			6,661			599			1,345
1984	"				7,833			6,430			142			1,261
1985	No estimates					No estimates					461	No estimates		
1986	"					"					3,780	"		
1987	"					"					3,007	"		
1988	No estimates for hatchery/wild component				12,743			11,926 ^d			817	"		
1989	"				37,276			28,933			4,765			3,578
1990	"				5,348			3,188			930			1,230
1991	"				11,417			8,631			446			2,340
1992	1,315	43.2	1,731	56.8	3,046	759	1,540	2,299	430	25	455	126	166	292
1993	1,894	58.4	1,349	41.6	3,243	801	1,176	1,977	875	10	885	218	163	381
1994	1,477	34.8	2,767	65.2	4,244	878	2,410	3,288	403	8	411	196	349	545
1995	1,595	37.2	2,693	62.8	4,288	1,424	1,867	3,291	24	681	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			No estimates			No estimates		
1998	"				2,972	"			"			"		
1999	"				5,470	"			"			"		
2000	"				8,042	"			"			"		
2001	"				12,638	"			"			"		
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

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

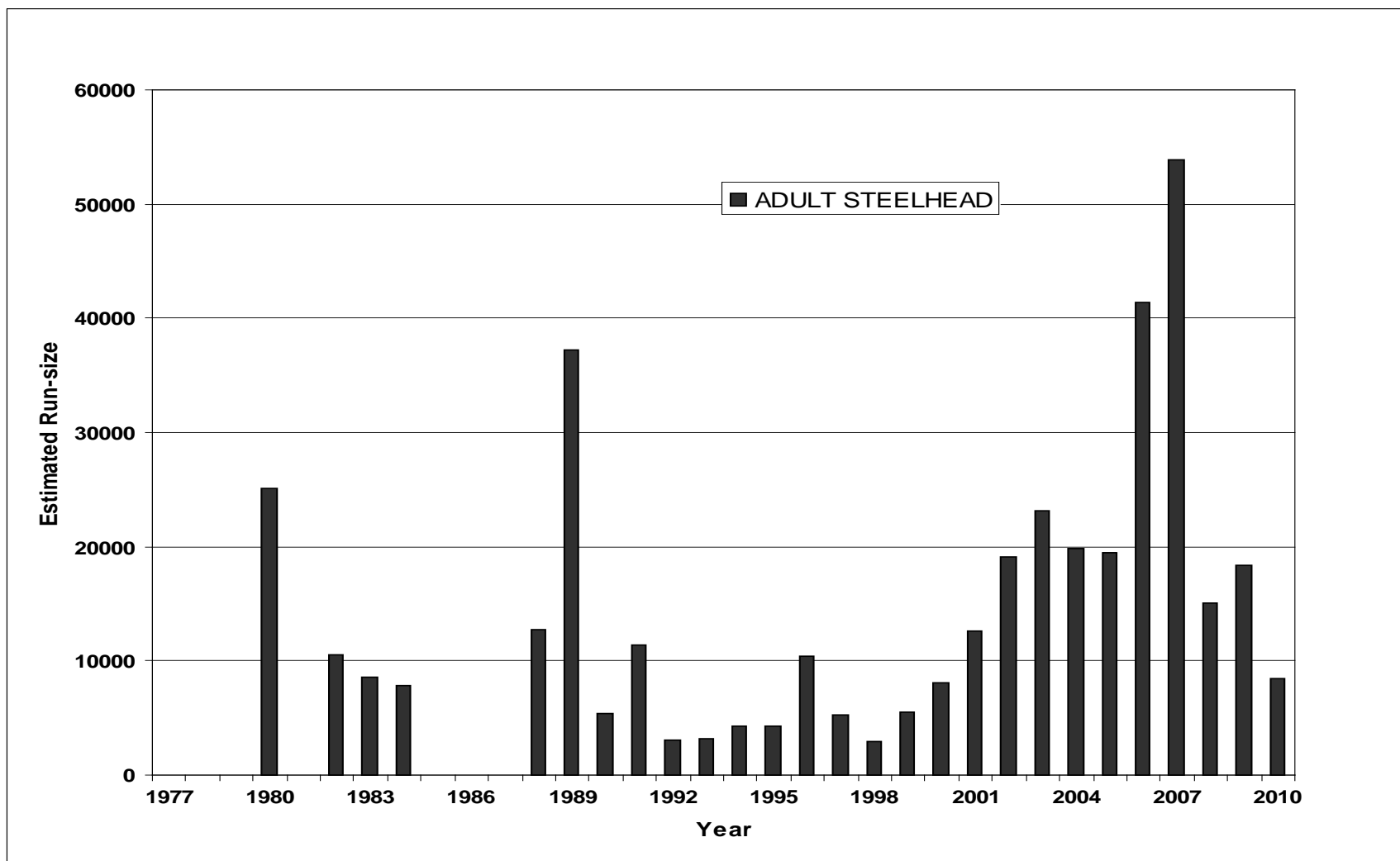
b/ Trinity River Hatchery-produced steelhead.

c/ Naturally produced steelhead.

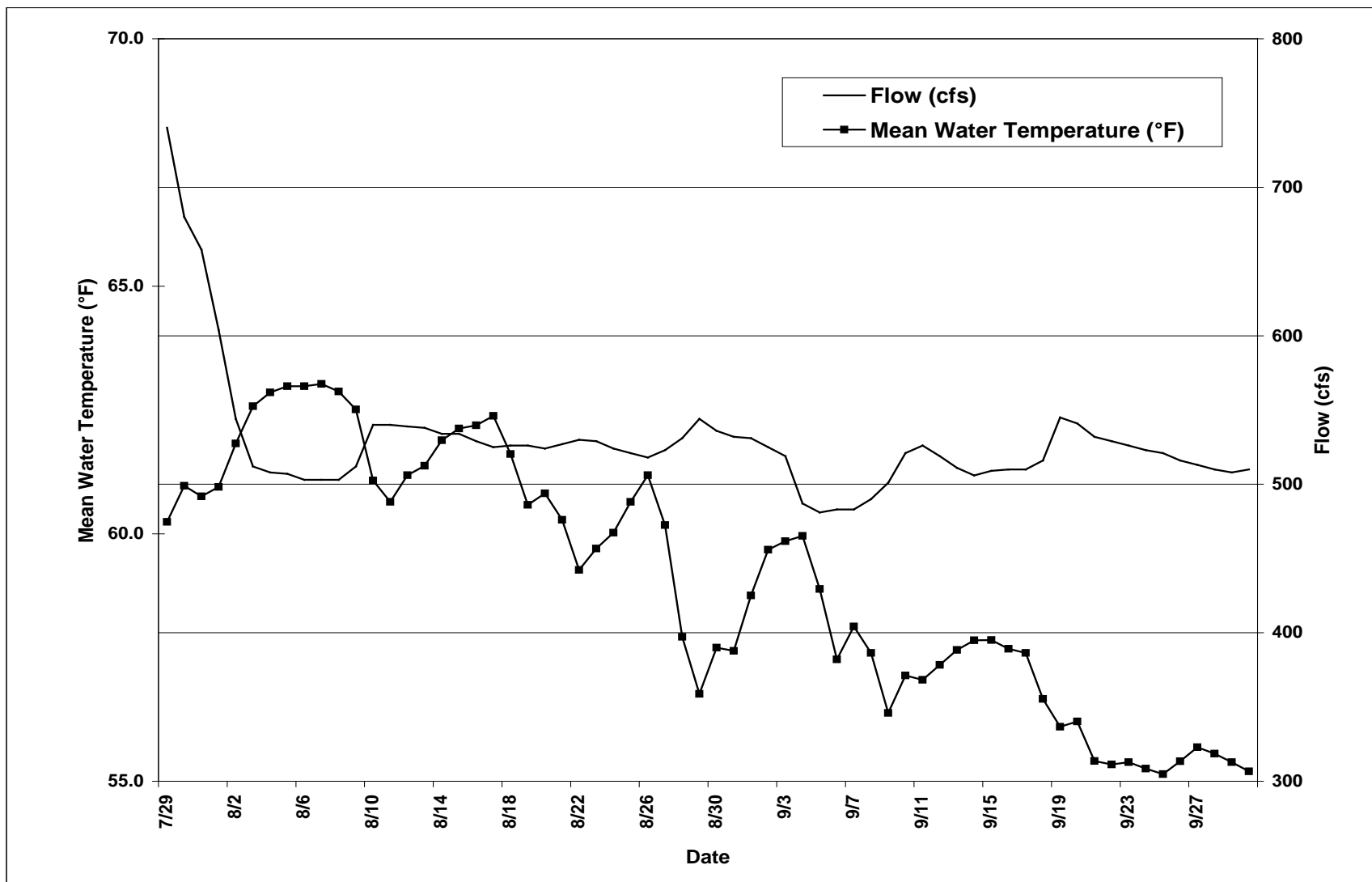
d/ The natural spawner escapement reflects an overestimate due to the unknown number of fish harvested by anglers upstream of Willow Creek Weir.

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

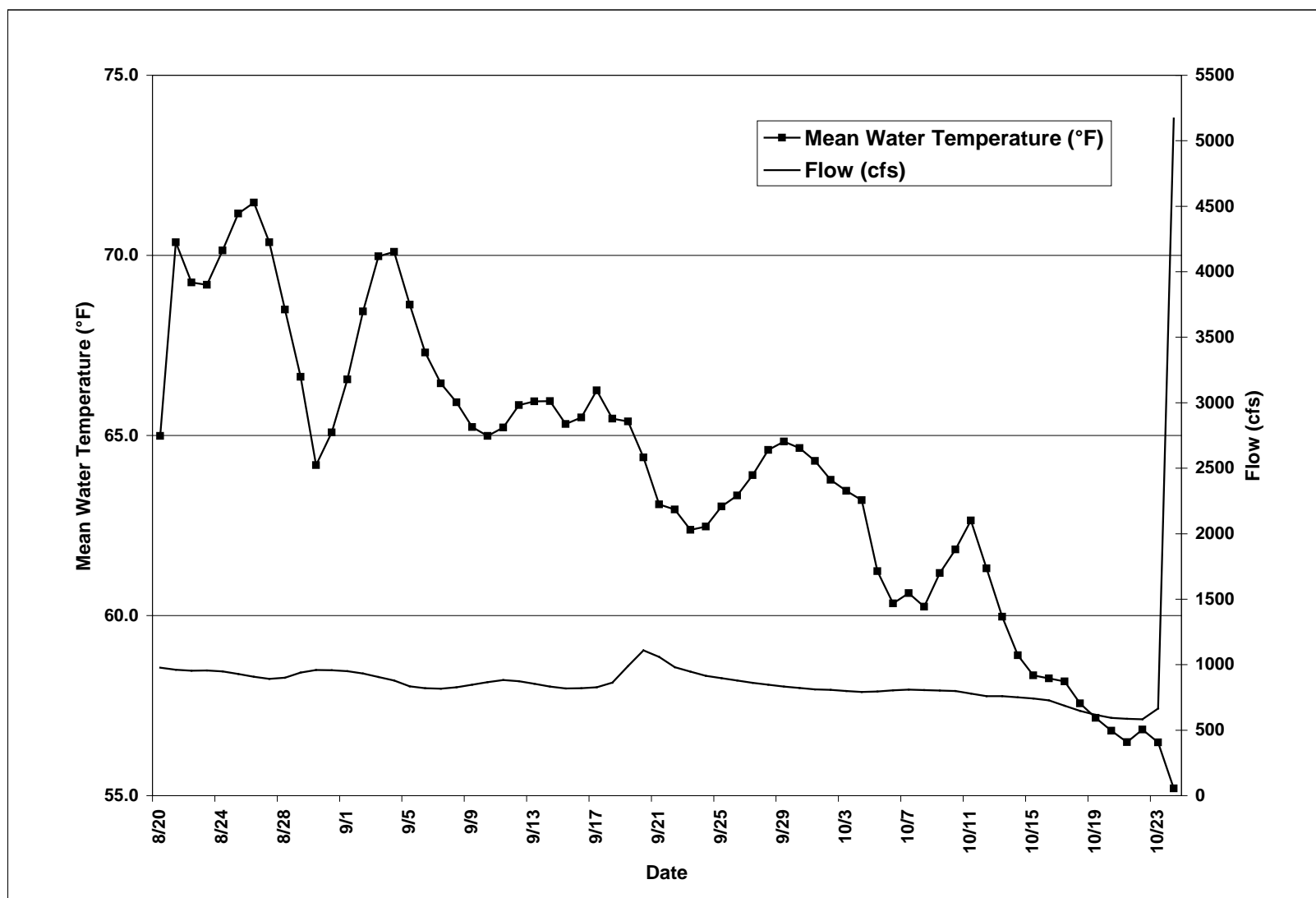
Appendix 15 (continued). Fall-run adult steelhead (>41cm FL) run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir, 1977 - 2010.



Appendix 16. Daily mean flow (CFS) recorded at the USGS gauge (11526250) of the Trinity River and water temperature at Junction City weir, 2010.



Appendix 17. Daily mean flow (CFS) recorded at the USGS gauge (11530000) of the Trinity River and water temperature at Willow Creek weir, 2010.



**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2010-11 SEASON**

**TASK 2
SURVIVAL AND CONTRIBUTIONS TO THE FISHERIES AND SPAWNER
ESCAPEMENTS MADE BY CHINOOK SALMON PRODUCED AT
TRINITY RIVER HATCHERY**

by

Wade Sinnen and Mary Claire Kier

ABSTRACT

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*). These 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.

For the 2010-2011 season we estimate a run-size of 6,780 naturally-produced and 4,505 hatchery-produced spring Chinook returned upstream of Junction City weir and a run-size of 24,393 naturally-produced and 15,853 hatchery-produced fall Chinook salmon returned to the Trinity River above the Willow Creek weir. After subtracting sport harvests and removing the grilse component, we estimate adult escapement of 5,213 naturally-produced and 3,781 hatchery-produced spring Chinook returned to the Trinity River above the Junction City weir. We estimate adult escapement of 14,616 naturally- and 13,335 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 adult spring Chinook and 62,000 naturally-produced and 9,000 hatchery-produced adult fall Chinook. For the 2010 season, the escapement of naturally-produced spring Chinook met approximately 91 percent of the TRRP production goal and the escapement of natural fall Chinook was approximately 24 percent of the goal.

Chinook in-river return rates (expressed as a percentage of release numbers) for the completed 2005 BY ranged from 0.044% to 0.202% for spring Chinook CWT groups, and from 0.017% to 0.296% 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 cohort reconstructions for Chinook and evaluate cohort performance or year class strength, and population growth rate.

INTRODUCTION

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 one million spring-run (spring) and three 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.

Escapement estimates for spring and fall Chinook are produced with 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 upstream of Junction City weir (for spring Chinook), or Willow Creek weir (for fall Chinook) 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 Sinnen, 2009, 2010a, 2010b, and 2011.

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.

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.

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) Grilse and adult total run-size,
- 2) Angler harvest rate of grilse 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 grilse 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_{adcwt} = number of salmon observed at TRH with an ad-clip and a CWT;

NH_{adclip} = total number of ad-clipped salmon observed at TRH; and

$N_{runsizeestimate}$ = run-size estimate.

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

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

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

where:

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

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

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

We estimated the total number of grilse 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:

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

where:

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

RESULTS

Coded-Wire Tag Recovery

We recovered 11,909 Chinook salmon at TRH in 2010, of which 2,753 (23.1%) had ad-clips. We recovered CWTs from 588 known spring Chinook and 2,041 known fall Chinook (Table 1). The remaining 124 ad-clipped fish had either shed their CWT (104) or the CWT was lost or unreadable (20). 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 11 release groups from the 2006 through 2008 BYs. Fall Chinook CWTs were composed of 23 release groups representing the 2006 through 2008 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 1,117 (132 grilse and 985 adults) CWT spring Chinook returned to the Trinity River above JCW during the 2010 season (Table 2) and 47 adult and zero grilse CWT fish were harvested by anglers during the season. Escapement of CWT spring Chinook was divided between 546 fish recovered at TRH and 392 estimated to spawn in natural areas (Table 2). Based on CWTs, the known age composition of the 2010 spring Chinook run was composed of 132 (11.8%) age 2; 283 (25.3%) age 3; 702 (62.9%) age 4; and zero (0.0%) age 5 fish (Table 2).

2005 Brood Year

The 2010 spawning season was the last year for returns of the 2005 BY. Anticipated returns of this brood were low in 2010 both because the age five component is historically very small for Trinity River Hatchery Chinook stocks and because the 2005 BY produced low returns for ages two, three and four. In fact, no known age five fish (CWT identified) were observed at TRH or elsewhere in the upper Trinity River basin in 2010. The total contribution of the 11 (eight yearling and three fingerling) 2005 BY tag code release groups that returned to the Trinity River were relatively low and ranged from 0.044 to 0.202 percent (Table 3). The final total return rate for the 2005 BY spring Chinook release group was approximately 0.115 percent.

2006 Brood Year

Spring Chinook from the 2006 BY have returned at age two, three and four. This brood continues to return in strong numbers (especially the yearling CWT group 065360), with approximately 1.26 percent of this release group returned as of the 2010 spawning season (Table 3).

2007 Brood Year

Four 2007 BY release groups (three fingerling and one yearling) returned as three-year-

olds this season. The yearling CWT group, 068810, continues to return at the highest rate of the BY (Table 3). Spring Chinook from this BY are expected to return as four- and five-year-olds during the next two years.

2008 Brood Year

Three 2008 BY release groups (all fingerling) returned as two year olds this season. Their return rate averaged 0.057 percent. Spring Chinook from this BY are expected to return as three, four and five-year-olds during 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 3,906 CWT (600 grilse and 3,306 adult) fall Chinook salmon returned to the Trinity River above WCW during the 2010-11 season and that anglers harvested six grilse and 22 adult CWT fall Chinook. Escapement of CWT fall Chinook was divided between 2,058 fish recovered at TRH and 1,819 estimated to have spawned in natural areas this season (Table 2).

The fall Chinook CWT run was composed of 600 (15.4%) age 2 fish, 1,763 (45.1%) age 3 fish, 1,543 (39.5%) age 4 fish, and zero (0.0%) age 5 fish.

2005 Brood Year

The 2005 BY continued its pattern of low contribution in 2010, with zero fall Chinook 2005 BY fish identified in the run. Through age five, then, the total returns for the five fingerling and one yearling groups ranged from 0.017% to 0.296% (Table 4). Age three returns were the most numerous for all release types of this BY. The fish released from this BY are considered to have completed their life cycle this season.

2006 Brood Year

Five release groups (four fingerlings and one yearling) have returned to date as two-three and four-year-old fish (Table 4). The yearling group, 065361, has experienced the best returns to date, with 1.344% through age four. Fish from this BY should return as five year olds in 2011.

2007 Brood Year

Six CWT groups (five fingerling and one yearling) from the 2007 BY returned as three-year-olds during the 2010 season (Table 4). Age two return rates were low for this BY, ranging from 0.000% to 0.025%, and not much improved as three-year-olds, with the exception of the yearling group which had a surprising 0.649% return. Adult returns from these groups will occur over the next two years.

2008 Brood Year

Twelve CWT groups (ten fingerling and two yearling) from the 2008 BY returned as two-year-olds during the 2010 season (Table 4). Percent return ranged from 0.039% - 0.168%. Adult returns from this BY will occur over the next three years.

Table 1. Release and recovery data for adipose fin-clipped Chinook recovered at Trinity River Hatchery (TRH) during the 2010-11 season.

Release data							Recovery data				
CWT ^a code	Egg source	Brood year	Date	Number	Size (# / lb)	Site	Males		Females		Total No.
							No.	FL ^b	No.	FL ^b	
Spring Chinook salmon											
065347	TRH	2006	06/1-08/07	65,914	64.2	TRH	3	92.0	2	81.5	5
065348	TRH	2006	06/1-08/07	86,088	76.2	TRH	6	89.3	9	78.7	15
065349	TRH	2006	06/1-08/07	74,456	76.2	TRH	3	88.0	9	80.1	12
065360	TRH	2006	10/1-10/07	74,456	11.7	TRH	171	84.3	184	76.8	355
068801	TRH	2007	06/2-12/08	55,773	96.0	TRH	5	67.8	3	66.3	8
068802	TRH	2007	06/2-12/08	73,822	96.0	TRH	17	70.4	15	66.4	32
068803	TRH	2007	06/2-12/08	50,488	112.0	TRH	9	70.7	7	66.1	16
068810	TRH	2007	10/1-14/08	96,803	11.4	TRH	56	67.3	44	65.2	100
068811	TRH	2008	06/1-15/09	75,847	37.9	TRH	12	47.3	0	----	12
068812	TRH	2008	06/1-15/09	89,934	54.5	TRH	20	50.1	0	----	20
068813	TRH	2008	06/1-15/09	64,175	47.0	TRH	13	49.0	0	----	13
Lost CWT ^{c e}							4	89.5	1	78.0	5
No CWT ^{d e}							6	77.5	10	73.3	16
Spring Chinook totals:							325		284		609
Fall Chinook salmon											
065350	TRH	2006	06/1-8/07	118,575	110.0	TRH	8	89.8	13	80.1	21
065351	TRH	2006	06/1-8/07	119,712	110.0	TRH	7	87.9	13	82.5	20
065352	TRH	2006	06/1-8/07	122,076	134.3	TRH	5	91.8	10	81.0	15
065353	TRH	2006	06/1-8/07	126,470	134.3	TRH	12	87.7	26	83.0	38
065361	TRH	2006	10/1-10/07	238,156	19.5	TRH	290	89.2	429	82.0	719
068804	TRH	2007	06/2-12/08	92,759	157.0	TRH	11	72.1	6	71.2	17
068805	TRH	2007	06/2-12/08	89,972	163.0	TRH	8	75.4	13	70.0	21
068806	TRH	2007	06/2-12/08	89,348	181.0	TRH	14	70.3	3	72.0	17
068807	TRH	2007	06/2-12/08	84,063	188.0	TRH	7	72.6	9	71.6	16
068808	TRH	2007	06/2-12/08	90,174	194.0	TRH	11	72.7	11	70.1	22
068809	TRH	2007	10/1-14/08	244,661	16.7	TRH	454	73.5	383	70.4	837
065356	TRH	2008	06/1-15/09	11,403	85.8	TRH	5	54.8	0	----	5
065357	TRH	2008	06/1-15/09	9,676	85.8	TRH	3	55.3	0	----	3
065358	TRH	2008	06/1-15/09	9,882	85.8	TRH	4	52.3	1	86.0	5
065359	TRH	2008	10/01-15/09	6,257	13.3	TRH	3	51.7	0	----	3
068814	TRH	2008	06/1-15/09	93,228	80.5	TRH	77	56.3	1	54.0	78
068815	TRH	2008	06/1-15/09	94,165	81.5	TRH	49	55.3	1	60.0	50
068816	TRH	2008	06/1-15/09	96,264	98.5	TRH	36	55.5	1	76.0	37
068817	TRH	2008	06/1-15/09	92,360	94.0	TRH	38	54.4	0	----	38
068818	TRH	2008	06/1-15/09	90,758	103.5	TRH	20	55.1	0	----	20
068820	TRH	2008	10/01-15/09	253,073	11.5	TRH	46	49.7	3	47.7	49
0608080000 ^f	TRH	2008	04/29 -08/20/09	17,618	various	River	8	54.3	0	----	8
0608080001 ^f	TRH	2008	04/29 -08/20/09	2,915	various	River	2	56.0	0	----	2
Lost CWT ^{c e}							9	78.0	6	78.3	15
No CWT ^{d e}							46	78.9	42	77.4	88
Fall Chinook totals:							1,173		971		2,144

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 2010-11 season.

Run-size estimates	Run-size estimate		Harvest rates		Percent TRH	Percent of ad-clips		Ad-clip + CWT		
	Grilse	Adults	Grilse	Adults	ad-clips + CWTs	Grilse	Adults	Grilse	Adults	Total
Spring Chinook (JCW)	1,554	9,731	0.0%	4.8%	97.30%	8.70%	10.40%	132	985	1,116
Fall Chinook (WCW)	12,554	28,238	1.0%	0.7%	96.00%	4.98%	12.20%	600	3,306	3,906

CWT code	BY	Age	TRH Total No.	% of Total	Run-size	Angler harvest	Spawning escapement		
							TRH	Natural	Total
Spring Chinook salmon									
Adults									
065347	06	4	5	0.9%	9	0	5	4	9
065348	06	4	15	2.8%	27	1	15	11	26
065349	06	4	12	2.2%	22	1	12	9	21
065360	06	4	357	65.4%	644	31	357	256	613
068801	07	3	8	1.5%	15	1	8	6	14
068802	07	3	32	5.9%	58	3	32	23	55
068803	07	3	16	3.0%	29	1	16	12	28
068810	07	3	101	18.4%	181	9	101	72	173
Totals:			546	100%	985	47	546	392	938
Grilse									
068811	08		12	26.6%	35	0	12	23	35
068812	08		20	44.5%	59	0	20	38	59
068813	08		13	28.9%	38	0	13	25	38
Totals:			45	100%	132	0	45	86	132
Total spring Chinook:			592		1,117	47	592	478	1,069
Fall Chinook salmon									
Adults									
065350	06	4	21	1.2%	40	0	21	18	40
065351	06	4	20	1.1%	38	0	20	18	38
065352	06	4	15	0.9%	28	0	15	13	28
065353	06	4	38	2.2%	72	0	38	33	72
065361	06	4	725	41.3%	1,364	9	725	630	1,355
068804	07	3	17	1.0%	32	0	17	15	32
068805	07	3	21	1.2%	40	0	21	18	40
068806	07	3	17	1.0%	32	0	17	15	32
068807	07	3	16	0.9%	30	0	16	14	30
068808	07	3	22	1.3%	42	0	22	19	41
068809	07	3	844	48.0%	1,587	11	844	733	1,576
Totals:			1,758	100%	3,306	22	1,758	1,526	3,284
Grilse									
065356	08	2	5	1.7%	10	0	5	5	10
065357	08	2	3	1.0%	6	0	3	3	6
065358	08	2	5	1.7%	10	0	5	5	10
065359	08	2	3	1.0%	6	0	3	3	6
068814	08	2	79	26.2%	157	2	79	77	156
068815	08	2	50	16.8%	101	1	50	49	100
068816	08	2	37	12.4%	74	1	37	36	74
068817	08	2	38	12.8%	77	1	38	37	76
068818	08	2	20	6.7%	40	0	20	20	40
068820	08	2	49	16.4%	99	1	49	48	98
0608080000	08	2	8	2.7%	16	0	8	8	16
0608080001	08	2	2	0.7%	4	0	2	2	4
Totals:			301	100%	600	6	301	293	594
Total fall Chinook:			2,058		3,906	28	2,058	1,819	3,878

Table 3. Run-size, percent return, in-river sport catch and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, spring Chinook salmon returning to the Trinity River basin upstream of Junction City weir during the period 2007-2010.

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
065330	2005	10/2-16/06	11,265	TRH	2	0	0.000	0	0	0	0
065330	2005				3	4	0.036	0	3	1	4
065330	2005				4	4	0.036	0	3	1	4
065330	2005				5	0	0.000	0	0	0	0
					Totals: d/	8	0.071	0	6	2	8
					Total adults: e/	8	0.071	0	6	2	8
065331	2005	10/2-16/06	11,247	TRH	2	0	0.000	0	0	0	0
065331	2005				3	1	0.009	0	1	0	1
065331	2005				4	4	0.036	0	3	1	1
065331	2005				5	0	0.000	0	0	0	0
					Totals: d/	5	0.044	0	4	1	2
					Total adults: e/	5	0.044	0	4	1	2
065332	2005	10/2-16/06	11,959	TRH	2	0	0.000	0	0	0	0
065332	2005				3	3	0.025	0	2	1	3
065332	2005				4	3	0.025	0	2	1	3
065332	2005				5	0	0.000	0	0	0	0
					Totals: d/	6	0.050	0	4	2	6
					Total adults: e/	6	0.050	0	4	2	6
065333	2005	06/1-7/06	93,920	TRH	2	6	0.006	0	5	0	5
065333	2005				3	62	0.066	1	42	19	61
065333	2005				4	33	0.035	2	22	9	31
065333	2005				5	0	0.000	0	0	0	0
					Totals: d/	101	0.108	3	69	28	97
					Total adults: e/	95	0.101	3	64	28	92
065334	2005	06/1-7/06	95,152	TRH	2	7	0.007	0	6	0	6
065334	2005				3	59	0.062	1	40	18	58
065334	2005				4	36	0.038	2	24	10	34
065334	2005				5	0	0.000	0	0	0	0
					Totals: d/	102	0.107	3	70	28	98
					Total adults: e/	95	0.100	3	64	28	92
065335	2005	06/1-7/06	74,036	TRH	2	5	0.007	0	4	0	4
065335	2005				3	82	0.111	2	56	25	81
065335	2005				4	27	0.036	2	18	7	25
065335	2005				5	0	0.000	0	0	0	0
					Totals: d/	114	0.154	4	78	32	110
					Total adults: e/	109	0.147	4	74	32	106
065342	2005	10/2-16/06	11,382	TRH	2	0	0.000	0	0	0	0
065342	2005				3	13	0.114	0	9	4	13
065342	2005				4	10	0.088	1	7	3	10
065342	2005				5	0	0.000	0	0	0	0
					Totals: d/	23	0.202	1	16	7	23
					Total adults: e/	23	0.202	1	16	7	23
065343	2005	10/2-16/06	11,510	TRH	2	0	0.000	0	0	0	0
065343	2005				3	7	0.061	0	5	2	7
065343	2005				4	6	0.052	0	4	2	6
065343	2005				5	0	0.000	0	0	0	0
					Totals: d/	13	0.113	0	9	4	13
					Total adults: e/	13	0.113	0	9	4	13
065344	2005	10/2-16/06	11,766	TRH	2	0	0.000	0	0	0	0
065344	2005				3	1	0.008	0	1	0	1
065344	2005				4	13	0.110	0	9	4	1
065344	2005				5	0	0.000	0	0	0	0
					Totals: d/	14	0.119	0	10	4	14
					Total adults: e/	14	0.119	0	10	4	14

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 2005. These fish have reached five years of age and are considered to have completed their life cycle.

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

Table 3. (continued) Run-size, percent return, in-river sport catch and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, spring Chinook salmon returning to the Trinity River basin upstream of Junction City weir during the period 2007-2010.

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
065345	2005	10/2-16/06	11,169	TRH	2	0	0.000	0	0	0	0
065345	2005				3	3	0.027	0	2	1	3
065345	2005				4	7	0.063	0	5	2	7
065345	2005				5	0	0.000	0	0	0	0
					Totals: d/	10	0.090	0	7	3	10
					Total adults: e/	10	0.090	0	7	3	10
065346	2005	10/2-16/06	27,309	TRH	2	1	0.004	0	1	0	1
065346	2005				3	19	0.070	0	13	6	19
065346	2005				4	12	0.044	1	8	3	11
065346	2005				5	0	0.000	0	0	0	0
					Totals: d/	32	0.117	1	22	9	31
					Total adults: e/	31	0.114	1	21	9	30
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
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
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
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
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
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
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
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
068811	2008	06/01-15/09	75,847	TRH	2	35	0.046	0	12	23	35
068812	2008	06/01-15/09	89,934	TRH	2	59	0.065	0	20	38	59
068813	2008	06/01-15/09	64,175	TRH	2	38	0.059	0	13	25	38

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 2005. These fish have reached five years of age and are considered to have completed their life cycle.

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

Table 4. 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 upstream of Willow Creek weir during the period 2007 through 2010.

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
065336	2005	06/1-7/06	104,760	TRH	2	0	0.000	0	0	0	0
065336	2005				3	15	0.014	0	8	7	15
065336	2005				4	3	0.003	0	2	1	3
065336	2005				5	0	0.000	0	0	0	0
Totals: ^d						18	0.017	0	10	8	18
Total adults: ^e						18	0.017	0	10	8	18
065337	2005	06/1-7/06	126,404	TRH	2	0	0.000	0	0	0	0
065337	2005				3	50	0.040	1	26	23	49
065337	2005				4	2	0.002	0	1	1	2
065337	2005				5	0	0.000	0	0	0	0
Totals: ^d						52	0.041	1	27	24	51
Total adults: ^e						52	0.041	1	27	24	51
065338	2005	06/1-7/06	119,293	TRH	2	0	0.000	0	0	0	0
065338	2005				3	27	0.023	1	14	13	27
065338	2005				4	5	0.004	0	3	1	4
065338	2005				5	0	0.000	0	0	0	0
Totals: ^d						32	0.027	1	17	14	31
Total adults: ^e						32	0.027	1	17	14	31
065339	2005	06/1-7/06	127,742	TRH	2	0	0.000	0	0	0	0
065339	2005				3	35	0.027	1	18	16	34
065339	2005				4	11	0.009	0	7	3	10
065339	2005				5	0	0.000	0	0	0	0
Totals: ^d						46	0.036	1	25	19	44
Total adults: ^e						46	0.036	1	25	19	44
065340	2005	06/1-7/06	10,267	TRH	2	0	0.000	0	0	0	0
065340	2005				3	8	0.078	0	4	4	8
065340	2005				4	0	0.000	0	0	0	0
065340	2005				5	0	0.000	0	0	0	0
Totals: ^d						8	0.078	0	4	4	8
Total adults: ^e						8	0.078	0	4	4	8
065341	2005	10/2-16/06	227,903	TRH	2	16	0.007	2	4	10	14
065341	2005				3	522	0.229	10	270	243	513
065341	2005				4	137	0.060	3	90	44	134
065341	2005				5	0	0.000	0	0	0	0
Totals: ^d						675	0.296	15	364	297	661
Total adults: ^e						659	0.289	13	360	287	647
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
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

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 2005. These fish have reached five years of age and are considered to have completed their life cycle.

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

Table 4. (continued) Run-size, percent return, in-river sport catch, and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire tagged, fall Chinook returning to the Trinity River upstream of Willow Creek weir during the period 2007 through 2010.

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
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
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
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
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
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
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
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
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
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
065356	2008	06/1-15/09	11,403	TRH	2	10	0.085	0	5	5	10
065357	2008	06/1-15/09	9,676	TRH	2	6	0.060	0	3	3	6
065358	2008	06/1-15/09	9,882	TRH	2	10	0.101	0	5	5	10
065359	2008	10/01-15/09	6,257	TRH	2	6	0.093	0	3	3	6
068814	2008	06/1-15/09	93,228	TRH	2	157	0.168	2	79	77	156
068815	2008	06/1-15/09	94,165	TRH	2	101	0.107	1	50	49	100
068816	2008	06/1-15/09	96,264	TRH	2	74	0.077	1	37	36	74
068817	2008	06/1-15/09	92,360	TRH	2	77	0.083	1	38	37	76
068818	2008	06/1-15/09	90,758	TRH	2	40	0.044	0	20	20	40
068820	2008	10/01-15/09	253,073	TRH	2	99	0.039	1	49	48	98
0608080000 ^f	2008	04/29 -08/20/09	17,618	River	2	16	0.088	0	8	8	16
0608080001 ^f	2008	04/29 -08/20/09	2,915	River	2	4	0.134	0	2	2	4

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 2005. These fish have reached five years of age and are considered to have completed

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 TRH-origin spring Chinook component of the total run of spring Chinook returning to the Trinity River upstream of JCW was composed of 4,505 (535 grilse and 3,970 adult) fish of TRH origin. This represents 34.4% (535/1,554) of the grilse, 40.8% (3,970/9,731) of the adult run, and 39.9% (4,505/11,285) overall (Table 5). The total escapement of natural and hatchery produced adult spring Chinook is estimated at 5,487 and 3,781 fish respectively.

The contribution of TRH-produced fall Chinook, upstream of WCW, was estimated to be 15,853 (2,429 grilse and 13,424 adults), which represents 38.9% (15,853/40,792) of the total estimated fall Chinook run. Trinity River Hatchery-produced fall Chinook were estimated to contribute 19.3% (2,429/12,554) of the two-year-olds (grilse) and 47.5% (13,424/28,238) of the total adult run this season.

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 2010-11 season.^a

CWT code ^b	BY ^c	Age	TRH	Run- size	Expanded run-size ^e	Angler harvest	Expanded	Spawning escapement					
			angler harvest				Expanded TRH ^f	TRH	River	Expanded River	Total	Expanded total	
Spring Chinook													
Adults													
065347	06	4	4.19	9	38	0	2	5	21	4	15	9	36
065348	06	4	4.23	27	115	1	5	15	64	11	46	26	110
065349	06	4	4.13	22	90	1	4	12	50	9	36	21	86
065360	06	4	4.01	644	2,582	31	123	357	1,433	256	1,027	613	2,459
068801	07	3	4.03	15	58	1	3	8	32	6	23	14	56
068802	07	3	4.12	58	238	3	11	32	132	23	95	55	227
068803	07	3	4.09	29	119	1	6	16	66	12	47	28	113
068810	07	3	4.02	181	729	9	35	101	404	72	290	173	694
Total spring Chinook adults:				985	3,970	47	189	546	2,202	392	1,578	938	3,781
Grilse													
068811	08	2	4.05	35	141	0	0	12	48	23	92	1	141
068812	08	2	4.06	59	241	0	0	20	82	38	157	4	239
068813	08	2	4.13	38	153	0	0	13	53	25	100	7	153
Total spring Chinook grilse:				132	535	0	0	45	183	86	350	12	533
TOTAL SPRING CHINOOK:				1,117	4,505	47	189	592	2,386	478	1,928	950	4,314
Fall Chinook													
Adults													
065350	06	4	4.24	40	169	0	1	21	90	18	78	40	168
065351	06	4	4.21	38	160	0	1	20	85	18	74	38	159
065352	06	4	3.9	28	111	0	1	15	59	13	51	28	110
065353	06	4	3.99	72	288	0	2	38	153	33	133	72	286
065361	06	4	4.05	1,364	5,525	9	37	725	2,937	630	2,550	1,355	5,488
068804	07	3	4.03	32	130	0	1	17	69	15	60	32	129
068805	07	3	4.08	40	163	0	1	21	86	18	75	40	162
068806	07	3	4.05	32	131	0	1	17	69	15	60	32	130
068807	07	3	4.03	30	122	0	1	16	65	14	56	30	122
068808	07	3	4.02	42	168	0	1	22	89	19	77	41	167
068809	07	3	4.07	1,587	6,459	11	43	844	3,434	733	2,982	1,576	6,416
Total fall Chinook adults:				3,306	13,424	22	89	1,758	7,138	1,526	6,197	3,284	13,335
Grilse													
065356	08	2	4.03	10	41	0	0	5	20	5	20	10	40
065357	08	2	4.03	6	24	0	0	3	12	3	12	6	24
065358	08	2	4.03	10	41	0	0	5	20	5	20	10	40
065359	08	2	4.00	6	24	0	0	3	12	3	12	6	24
068814	08	2	4.08	157	641	2	6	79	321	77	314	156	635
068815	08	2	4.07	101	410	1	4	50	205	49	200	100	406
068816	08	2	4.02	74	299	1	3	37	150	36	146	74	296
068817	08	2	4.03	77	309	1	3	38	155	37	151	76	305
068818	08	2	4.05	40	163	0	2	20	82	20	80	40	161
068820	08	2	4.02	99	396	1	4	49	199	48	194	98	392
0608080000 ^g	08	2	3.98	16	64	0	1	8	32	8	31	16	63
0608080001 ^g	08	2	4.03	4	16	0	0	2	8	2	8	4	16
Total fall Chinook grilse:				600	2,429	6	25	301	1,217	293	1,187	594	2,404
TOTAL FALL CHINOOK:				3,906	15,853	28	114	2,058	8,355	1,819	7,384	3,878	15,739

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.

g/ Experimental groups released off-site for screw trap efficiency studies.

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 preclude operating there until late June, or as was the case this year, late July, so may affect our spring Chinook CWT estimates, while early storms (which seem to be increasing in frequency) can cause us to miss segments of the fall Chinook run at WCW, potentially affecting our fall CWT estimates. By the time the weir was blown out effectively ending trapping in 2010, however, most of the fall run Chinook had already passed (see Task 1, Table 2, Figure 7)..

We also assume that 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 2010 carcass surveys (Task 4) were generally consistent with TRH recoveries; although no 2008 BY spring CWT group Chinook were recovered this year.

Estimated in-river 2005 BY spring Chinook return rates of fingerling (0.12%) and yearling (0.10%) TRH releases fell well below the 20 year data set averages of 0.53 percent and 1.06 percent, respectively (Appendix 1). Fall Chinook fingerlings from the 2005 BY experienced an even lower return than their spring counterparts, returning at a meager rate of 0.03 percent. While the fall Chinook yearling releases fared an order of

magnitude better, returning at a rate of 0.3 percent, that return was still only roughly 20 percent of the average return over the 20 years on record (Appendix 2).

The contribution of hatchery-produced spring Chinook to total run-size was estimated at 39.9 percent of the run upstream of Junction City weir (Appendix 3), the second lowest annual contribution to the overall run and only the second year in 20 that the contribution has been less than 40 percent. Similarly, the contribution of hatchery-produced fall Chinook to total run-size, upstream of Willow Creek weir, was estimated at 38.9 percent (Appendix 4). The reason for the low rate of hatchery fish in both the spring and fall runs of Chinook this year is unknown, but may be related to improved freshwater conditions for natural Chinook and/or habitat and flow improvements made by the Trinity River Restoration Program.

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 2011-12.
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.

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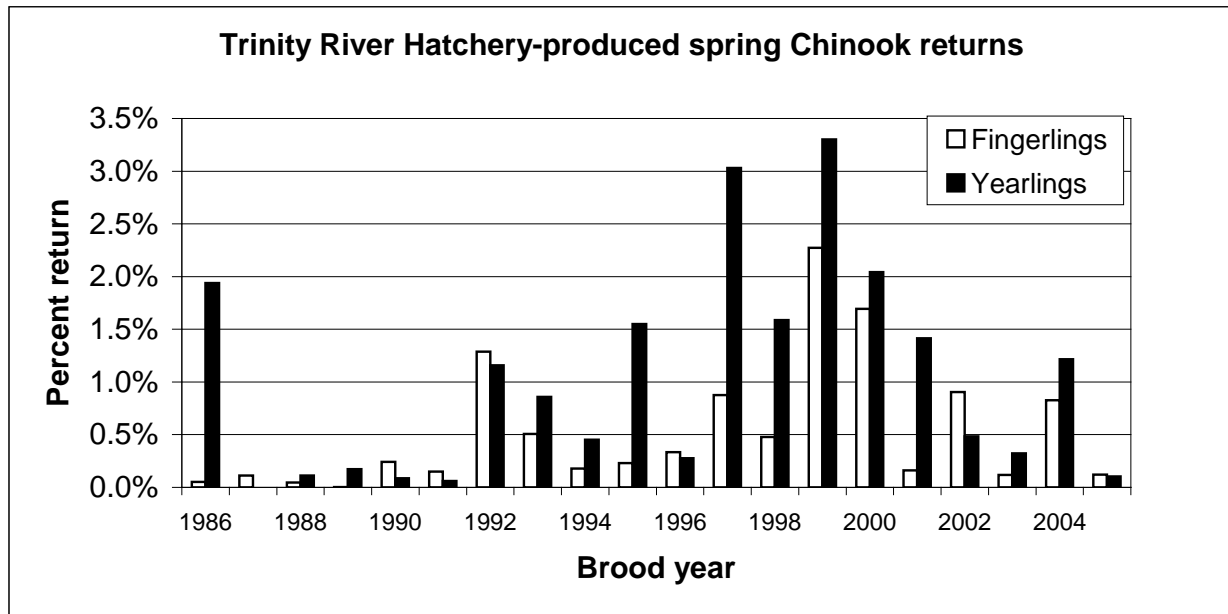
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Appendix 1. Percent return of Trinity River Hatchery produced, coded-wire tagged, spring Chinook salmon, brood years 1986-2005. ^a

Brood year	Fingerling releases			Yearling releases		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	197,113	103	0.05%	101,030	1,960	1.94%
1987	185,718	208	0.11%	---	---	---
1988	181,698	84	0.05%	98,820	112	0.11%
1989	186,413	7	0.00%	102,555	176	0.17%
1990	196,908	479	0.24%	94,639	82	0.09%
1991	198,277	297	0.15%	110,797	68	0.06%
1992	215,038	2,766	1.29%	109,856	1,272	1.16%
1993	222,056	1,125	0.51%	111,525	958	0.86%
1994	113,236	202	0.18%	113,491	513	0.45%
1995 ^a	196,211	450	0.23%	101,934	1,581	1.55%
1996	222,950	743	0.33%	112,464	312	0.28%
1997	209,155	1,834	0.88%	147,507	4,471	3.03%
1998	176,968	845	0.48%	137,602	2,186	1.59%
1999	148,380	3,372	2.27%	129,919	4,288	3.30%
2000	261,193	4,422	1.69%	99,304	2,029	2.04%
2001	253,248	412	0.16%	104,627	1,480	1.41%
2002	244,754	2,217	0.91%	106,139	514	0.48%
2003	265,556	310	0.12%	104,974	339	0.32%
2004	253,830	2,095	0.83%	104,478	1,269	1.21%
2005	263,108	317	0.12%	107,607	111	0.10%
Means:	209,591	1,114	0.53%	110,488	1,248	1.06%

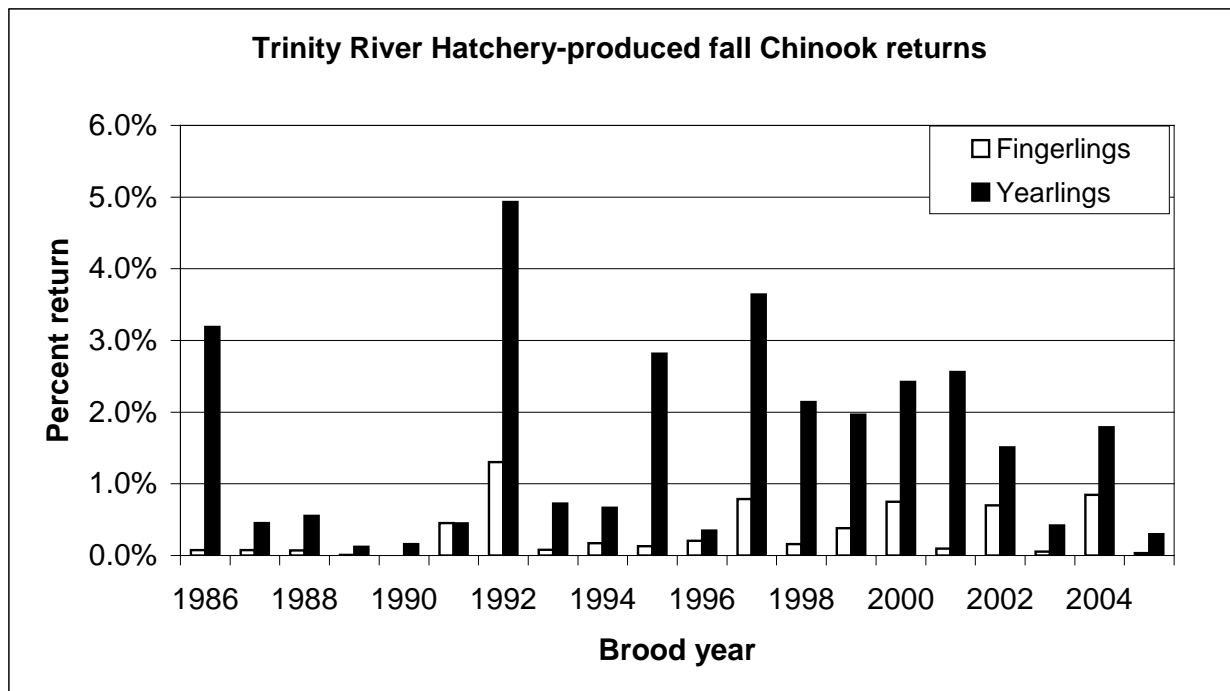
a/ Based on estimated returns upstream of Junction City weir. No estimate was produced in 1995, therefore returns of age 2 through 5 Chinook from that year are hatchery returns only. Does not include ocean harvest, in-river harvest, and escapement below Junction City weir.



Appendix 2. Percent return of Trinity River Hatchery-produced, coded-wire tagged, fall Chinook salmon, brood years 1986-2005.

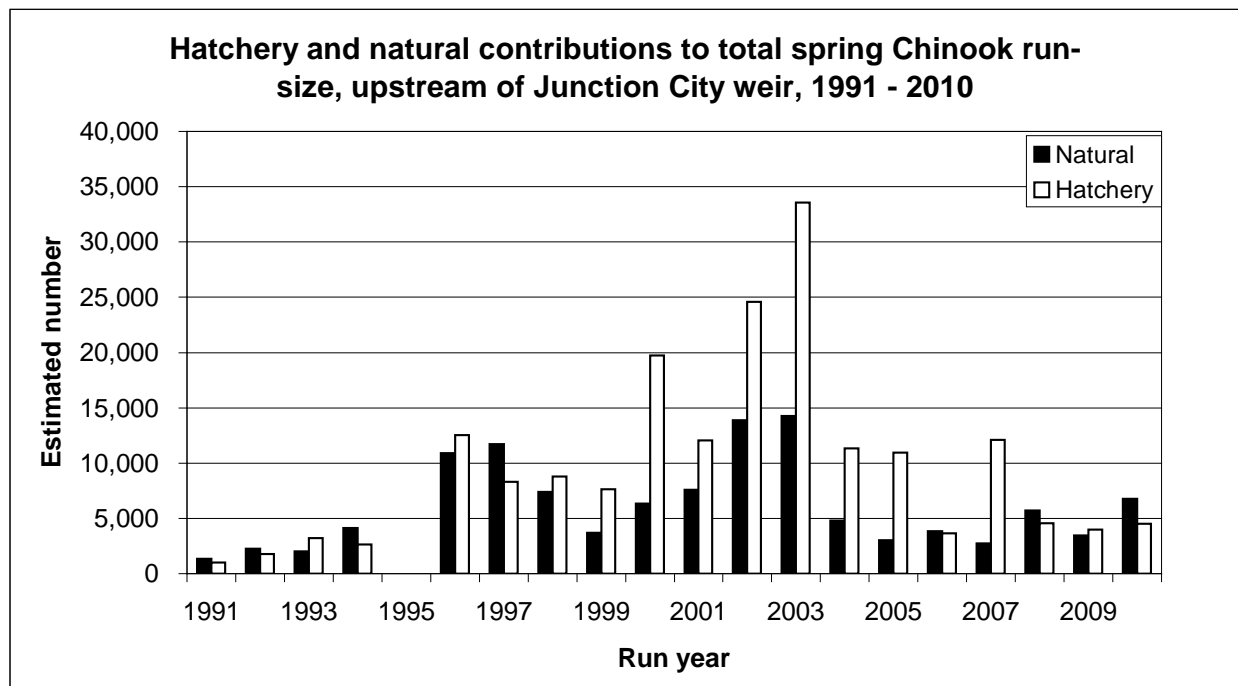
Brood year	Fingerling releases			Yearling releases		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	393,955	292	0.07%	153,700	4,899	3.19%
1987	172,980	129	0.07%	92,300	418	0.45%
1988	194,197	138	0.07%	143,934	796	0.55%
1989	201,622	21	0.01%	143,978	174	0.12%
1990	---	---	---	103,040	166	0.16%
1991	206,416	937	0.45%	115,300	517	0.45%
1992	192,032	2,503	1.30%	108,894	5,369	4.93%
1993	201,032	158	0.08%	110,336	798	0.72%
1994	216,563	374	0.17%	113,124	756	0.67%
1995	216,051	285	0.13%	110,327	3,106	2.82%
1996	217,981	445	0.20%	112,746	394	0.35%
1997	216,772	1,707	0.79%	313,080	11,396	3.64%
1998	184,781	292	0.16%	334,726	7,173	2.14%
1999	181,301	693	0.38%	296,892	5,833	1.96%
2000	522,316	3,909	0.75%	216,593	5,245	2.42%
2001	499,919	476	0.10%	230,055	5,894	2.56%
2002	508,963	3,563	0.70%	236,319	3,561	1.51%
2003	534,219	289	0.05%	225,798	944	0.42%
2004	486,369	4,125	0.85%	218,386	3,909	1.79%
2005	488,466	157	0.03%	227,903	675	0.30%
Means:	307,154	1,079	0.34%	180,372	3,101	1.56%

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



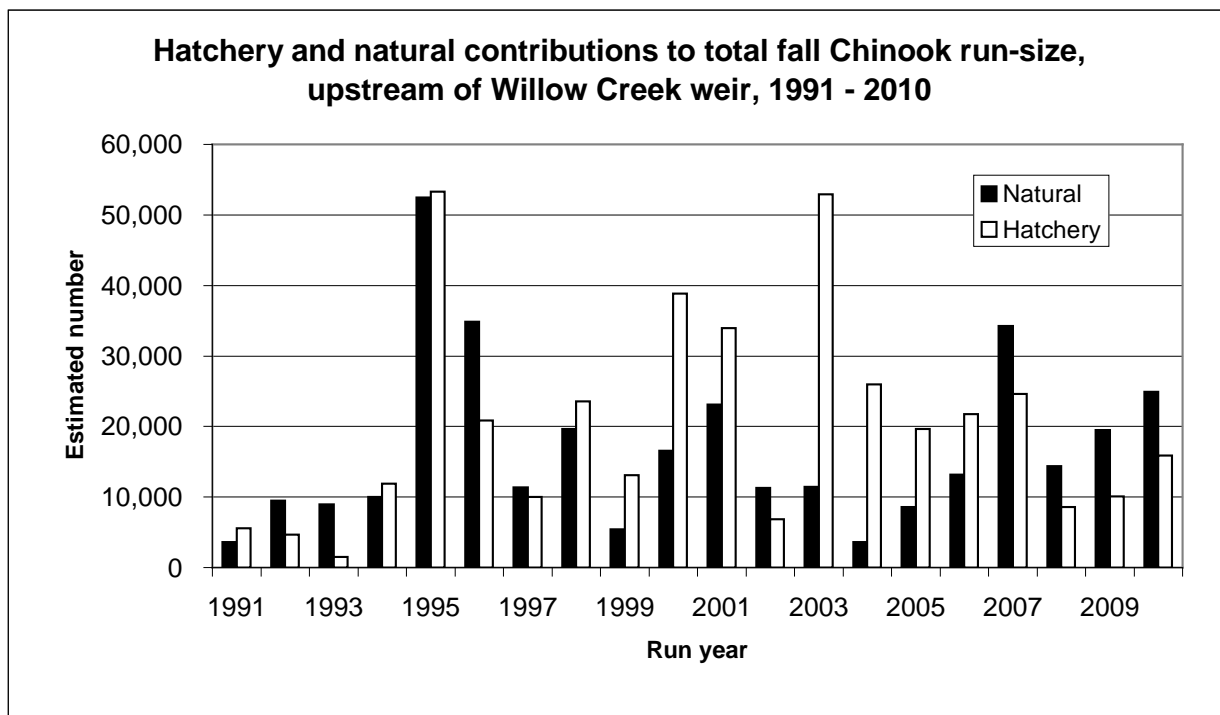
Appendix 3. Estimated contributions of Trinity River Hatchery-produced, spring Chinook salmon to total estimated run-size above Junction City weir, 1991-2010 seasons.

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%
Means:	15,935	9,837	6,098	57.5%



Appendix 4. Estimated contributions of Trinity River Hatchery-produced fall Chinook salmon to total estimated run-size above Willow Creek weir, 1991-2010 seasons.

Year	Run-size	TRH component	Natural component	% TRH composition
1991	9,207	5,597	3,610	60.8%
1992	14,164	4,651	9,513	32.8%
1993	10,485	1,499	8,986	14.3%
1994	21,924	11,880	10,044	54.2%
1995	105,725	53,263	52,462	50.4%
1996	55,646	20,824	34,822	37.4%
1997	21,347	9,977	11,370	46.7%
1998	43,189	23,536	19,653	54.5%
1999	18,516	13,081	5,435	70.6%
2000	55,473	38,881	16,592	70.1%
2001	57,109	33,984	23,125	59.5%
2002	18,156	6,884	11,272	37.9%
2003	64,362	52,944	11,418	82.3%
2004	29,534	25,956	3,578	87.9%
2005	28,231	19,674	8,557	69.7%
2006	34,912	21,768	13,144	62.4%
2007	58,873	24,633	34,240	41.8%
2008	22,997	8,585	14,412	37.3%
2009	29,593	10,072	19,521	34.0%
2010	40,792	15,853	24,939	38.9%
Means:	37,012	20,177	16,835	52.2%



**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2010-11 SEASON**

TASK 3

**RELATIVE RETURN RATES AND CONTRIBUTIONS TO SPAWNING ESCAPEMENT
MADE BY NATURALLY- AND HATCHERY-PRODUCED COHO
IN THE TRINITY RIVER BASIN**

by

Steve Cannata and John Hileman

ABSTRACT

Task 3 of this report provides quantitative estimates of the annual run-size and escapement of naturally- and hatchery-produced coho salmon (*Oncorhynchus kisutch*) in the Trinity River for the 2010-11 spawning season. Petersen type mark- recapture methods are used to estimate escapement numbers. The coho escapement estimates provide short term feedback to assess adaptive management actions and help evaluate success of long term Trinity River Restoration Program goals. The response from coho to recent changes in flow management is particularly important as they are listed as threatened under both the federal and State endangered species acts.

For the 2010-11 spawning season, we estimate a run-size of 7,947 coho (95%CI = 7,305-8,619) returned to the Trinity River, upstream of the Willow Creek weir (WCW). The run was composed of approximately 1,278 jacks (age 2) and 6,669 adult (age 3) coho. Approximately 89 percent (7,086 fish) of the run was composed of fish propagated and released from TRH. These include 4,222 returning to TRH and an estimate of 2,864 TRH stock returning to natural spawning areas. Approximately 861 naturally produced coho (709 adults and 52 grilse) returned to the Trinity River above the WCW with 204 of these entering TRH. Escapement targets set by the TRRP are for 2,100 coho to return to the TRH and 1,400 naturally produced coho to spawn in natural areas. The 2010-11 coho run-size estimates were below the target goal for naturally produced coho but exceeded target returns to the TRH. We estimate 0.36 percent of BY 2007 returned as two-year-olds in 2009-2010 and 1.27 percent returned as three-year-olds in 2010-2011 for a total BY return of 1.63 percent. We estimate 0.30 percent of the TRH BY 2008 coho returned as two-year-olds in 2010-2011. In April 2011, approximately 491,000 yearling coho of the 2009 BY were marked 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. Assessments of the number of adults returning to spawn (escapement) of key species such as coho salmon (*Oncorhynchus kisutch*) therefore provide essential short-term feedback to annual TRRP management actions and for evaluation of long-term natural fish production objectives (TRRP 2009). The California Department of Fish and Game's (CDFG) Trinity River Project (TRP) staff perform empirical studies to provide the annual escapement estimates recommended by the Trinity River Restoration Program (2009). This report updates the existing baseline assessments for the 2010-11 spawning season. 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 is needed to monitor recovery of the species.

The Trinity River coho population is composed of both naturally- and hatchery-produced stocks. Mixing of these stocks occurs during migration to natural spawning areas and within the TRH. For this report, natural spawning areas are considered mainstem and tributary reaches upstream of the Willow Creek weir (WCW) located on the main-stem Trinity River at river kilometer (rkm) 35 to TRH located at the base of Lewiston Dam (rkm 180) which is a barrier to upstream migration. The annual natural coho escapement target set by the TRRP is 1,400 adult fish in natural areas. 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 (Table A1)]. Each year the TRH propagates and releases approximately 500,000 yearling coho salmon to compensate for the loss of their habitat and production in the Trinity River upstream of Lewiston Dam. A Task 3 objective to identify 100 percent of the TRH produced coho with right maxillary clips (RM) enables separate escapement estimates for hatchery and natural coho stocks. Since 1997, the annual escapement goal to TRH of 2,100 coho has been exceeded except for the 1997 spawning season even though more TRH produced coho stray to natural areas than enter the hatchery (Table A1).

The coho run-size is estimated with Peterson mark-recapture methods using the Willow Creek weir to capture and mark fish. Recapture of fish occurs at the TRH. Run-size is the number coho estimated to migrate to the Trinity River Basin above the Willow Creek weir and spawner escapement is the number of those fish that survive in-river harvests. However, because coho are listed as threatened under both the federal and State

endangered species acts, sport take of coho is not permitted within the study area so run-size and escapement estimates should be equal. All estimates are stratified to jack (or grilse) and adults and include annual return rates for each brood year (BY) produced at TRH. Quantitative results are mainly drawn from analysis of coho population estimates presented in Task 1 of this report.

METHODS

TRH-Produced Coho Run-Size, Escapement, and In-River Harvest

The escapement total is estimated with a Peterson type mark-and-recapture study that is reliant on marking upstream migrating fish with spaghetti tags (tags) at the WCW and recapture of fish as they enter the TRH. Trapping and tagging operations at the WCW were conducted August 20, 2010 to October 22, 2010. The first coho was captured at the weir the week of September 3, 2010. 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, 2010 to the week of January 8, 2010. The fish are stratified into grilse and adult classes based on the 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 clipss 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 grilse and adult coho is determined by performing length frequency analysis using WCW and TRH data sets. The number of grilse 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:

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

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 grilse 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

Marking of all 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 five 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 five percent of the fish are examined the total number of no clips is divided by the total sample x 100 to obtain the percent marking error.

RESULTS

TRH-Produced and Natural Coho Run-Size, Escapement, and In-River Harvest

Nine hundred-eight coho were trapped at the WCW in 2010. From these, 895 were effectively tagged for the mark-recapture sample population. Using a Peterson type mark-recapture formula (Task 1) we estimate the total coho run-size for the 2010-11 season above WCW was 7,947 (95% CI = 7,305-8,619) fish (Table 1).

We observed 89.2 percent of the coho captured and tagged at the WCW with right maxillary-clips, which indicates the proportion of TRH fish in the run-size estimate. Therefore, we estimate the run consisted of approximately 7,086 TRH-produced fish and 861 naturally-produced fish. A total of 204 coho without RM clips entered the TRH indicating approximately 657 naturally produced coho (619 adults and 42 grilse) returned to natural areas.

The size separating grilse and adults was determined at 56 cm FL (Task 1). Therefore 139 grilse (21%) and 659 adults with RM clips were captured and marked at the WCW. Five grilse (5.2%) and 92 adults tagged in the sample were without RM clips indicating they are most likely from natural production. From these data we estimate the 2010-11 coho run was composed of 1,278 grilse and 6,669 adults.

Anglers did not return any tags from harvested coho salmon in 2010, therefore we estimate that no harvest occurred upstream of WCW. With no detected harvest, the coho run-size and spawner escapement are equal in number. 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 unknowledgeable anglers due to mistaken identity or a lack of knowledge concerning the closure.

After their return to spawn in 2010, coho from the 2007 BY completed their typical three-year life cycle. Based on age three coho run-size estimates presented above (Table 2) and age two estimates for 2009, the percent return rate for 2007 BY TRH-produced coho was 1.63 percent (Table 2). This (2010) is the first year for returns of the TRH

We conducted a quality control check to determine our clipping effectiveness for coho March 4 - 9, 2011. 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 490,839 coho were effectively clipped and released (Table 1). 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 2009 coho were volitionally released from TRH March 15 – 28, 2011. These fish are expected to return as grilse and adults in 2011 and 2012, respectively.

Table 3. Production, marking totals, and quality control data for 2009 brood year coho salmon reared at Trinity River Hatchery and volitionally released March 15 through March 28, 2011.

	Hatchery raceway							
	G3-4	H1-2	H3-4	I1-2	I3-4	J1-2	J3-4	Totals
<i>Marking totals</i>								
Number clipped	70,926	71,650	74,140	71,130	65,601	68,094	72,107	493,648
Post-clip mortalities	154	989	618	179	140	406	323	2,809
Total marked	70,772	70,661	73,522	70,951	65,461	67,688	71,784	490,839
<i>Quality control parameters</i>								
Number examined	1,445	1,489	1,504	1,501	1,329	1,367	1,423	10,058
Number without clips	0	0	1	0	1	0	1	3
Un-clipped ratio	0	0	0.000665	0	0.000752	0	0.000703	0.00030
Mean fork length (mm)	154.3	161	149.9	169.3	166.9	154.2	156.1	158.7
Fork length range (mm)	90 - 253	80 - 274	92 - 256	80 - 289	116 - 283	80 -270	91 -240	80 - 289
<i>Release totals</i>								
Clipped releases	70,772	70,661	73,522	70,951	65,461	67,688	71,784	490,839
Un-clipped releases	0	0	49	0	49	0	50	149
Percentage clipped	100.00%	100.00%	99.93%	100.00%	99.92%	100.00%	99.93%	99.97%
Total released	70,772	70,661	73,571	70,951	65,510	67,688	71,834	490,988

DISCUSSION

The 2010 coho escapement estimate of 7,947 fish is ranked the fourth lowest return to the Trinity River of the past thirteen 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 = $17,013 \pm 6521$). The 2010 escapement of 696 naturally produced adult coho to natural areas continued to be below the TRRP goal of 1,400 adults for the fourth consecutive year. 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 (Table A1)]. 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.

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 (Appendix 1). 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.

This season we recovered 169 coho carcasses in the main stem Trinity River (Task 4). Of these, 106 (62.7%) were RM clipped. Based on 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 90 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 2007 coho BY produced at TRH was estimated at 1.63 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 run, could be a factor this season. Trapping catch per unit effort (Task 1. Table 4, Figure 10) at WCW indicated that the run of coho was declining, but not completely over, prior to weir removal due to high flows on October 22, 2010. We typically strive to operate the WCW into mid-November. 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 should be consistent with federal and state strategies and objectives.

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Appendix 1. Naturally and Trinity River Hatchery-produced coho salmon run-size, in-river angler harvest and spawner escapement estimates for the Trinity River upstream of Willow Creek Weir for 1997-2010.

Run year	Strata	Run-size Estimate			Spawner Escapement						Angler harvest		
					Natural			Trinity River Hatchery					
		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	42	654	696	10	194	204	0	0	0
	TRH	1,233	5,852	7,085	707	2,113	2,820	516	3,706	4,222	0	0	0

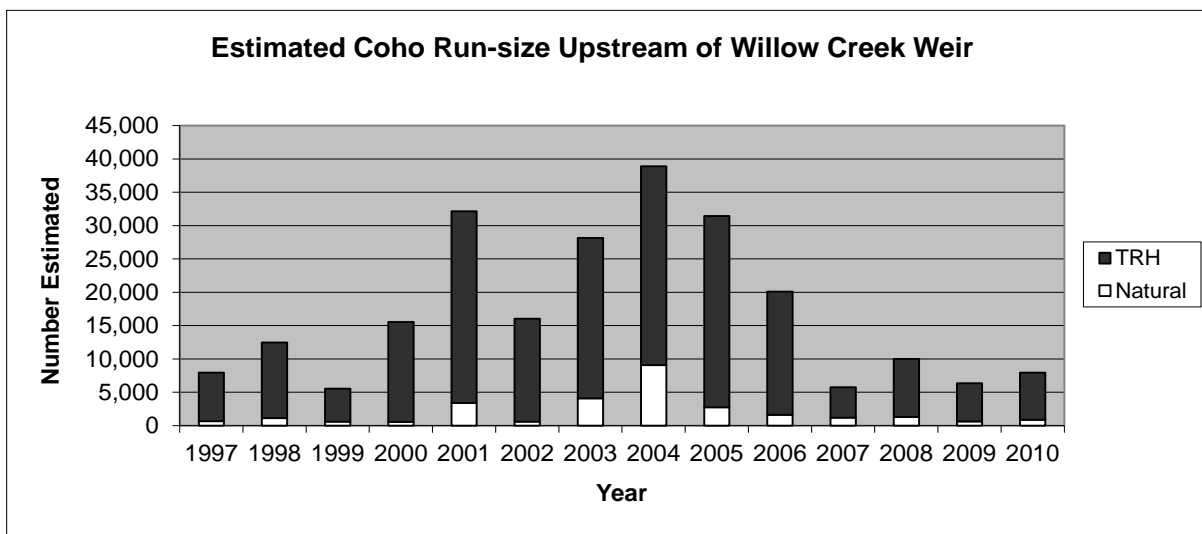


Figure A1. Coho salmon run-size estimates for upstream Willow Creek weir 1997-2010.

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 1994-2007.

Release data				Return data						
Brood year	Date	Effective Number	Site	Age	Run-size	% of release	In-river harvest	Spawner Escapement		
								TRH	Natural	Total
1994	3/17-21/96	72,311	TRH	2	970	1.34%	0	105	865	970
				3	1,732	2.40%	0	867	865	1,732
				Totals:	2,702	3.74%	0	972	1,730	2,702
1995	3/17-21/97	580,880	TRH	2	5,552	0.96%	39	858	4,655	5,513
				3	9,008	1.55%	0	3,899	5,109	9,008
				Totals:	14,560	2.51%	39	4,757	9,764	14,521
1996	3/16-20/98	513,663	TRH	2	2,340	0.46%	0	969	1,371	2,340
				3	4,357	0.85%	86	3,015	1,256	4,271
				Totals:	6,697	1.30%	86	3,984	2,627	6,611
1997	3/15-22/99	517,196	TRH	2	592	0.11%	0	381	211	592
				3	9,704	1.88%	0	3,407	6,297	9,704
				Totals:	10,296	1.99%	0	3,788	6,508	10,296
1998	3/15-20/00	493,233	TRH	2	5,289	1.07%	0	916	4,373	5,289
				3	25,395	5.15%	0	9,625	15,770	25,395
				Totals:	30,684	6.22%	0	10,541	20,143	30,684
1999	3/15-22/01	512,986	TRH	2	3,373	0.66%	0	1,024	2,349	3,373
				3	13,849	2.70%	0	6,409	7,440	13,849
				Totals:	17,222	3.36%	0	7,433	9,789	17,222
2000	3/17-19/02	524,238	TRH	2	1,571	0.30%	0	688	883	1,571
				3	20,721	3.95%	0	9,730	10,991	20,721
				Totals:	22,292	4.25%	0	10,418	11,874	22,292
2001	3/17-19/03	416,201	TRH	2	3,338	0.80%	0	1,449	1,889	3,338
				3	24,162	5.81%	40	8,835	15,287	24,122
				Totals:	27,500	6.60%	40	10,284	17,176	27,460
2002	3/15-18/04	516,906	TRH	2	5,665	1.10%	0	1,068	4,597	5,665
				3	25,678	4.97%	0	15,704	9,974	25,678
				Totals:	31,343	6.06%	0	16,772	14,571	31,343
2003	3/14-18/05	520,847	TRH	2	3,012	0.58%	21	1,269	1,721	2,990
				3	17,123	3.29%	0	7,454	9,669	17,123
				Totals:	20,135	3.90%	21	8,723	11,390	20,113
2004	3/15-20/06	545,199	TRH	2	1,331	0.24%	0	657	674	1,331
				3	4,048	0.74%	0	2,436	1,612	4,048
				Totals:	5,379	0.99%	0	3,093	2,286	5,379
2005	3/15-20/07	511,961	TRH	2	503	0.10%	0	270	233	503
				3	6,381	1.25%	0	4,177	2,204	6,381
				Totals:	6,884	1.34%	0	4,447	2,437	6,884
2006	3/15-20/08	455,482	TRH	2	2,290	0.50%	0	643	1,647	2,290
				3	4,067	0.89%	0	2,386	1,681	4,067
				Totals:	6,357	1.40%	0	3,029	3,328	6,357
2007	3/16-20/09	457,478	TRH	2	1,645	0.36%	0	871	774	1,645
				3	5,852	1.28%	0	3,706	2,146	5,852
				Totals:	7,497	1.64%	0	4,577	2,920	7,497

Appendix 2 Continued.

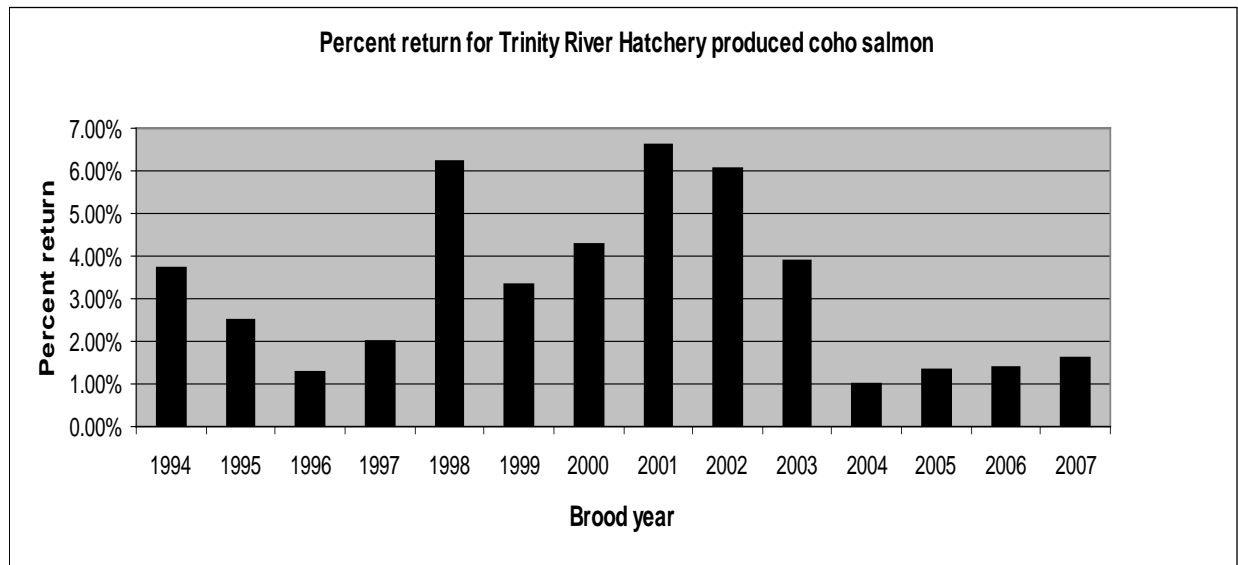


Figure A2. Percent return for Trinity River Hatchery produced coho salmon brood years 1994-2007.

**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2010 SEASON**

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

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, 2010 to December 20, 2010, from the area of Lewiston Dam to Cedar Flat [(101.6 river kilometers (rkm))] and from Hawkins Bar to Weitchpec (rkm 64.1). 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 3,871 Chinook, 693 coho salmon, 19 steelhead (*O. mykiss*), and 91 brown trout (*Salmo trutta*) carcasses. Coded wire tag (CWT) recoveries from adipose fin-clipped Chinook indicate spring Chinook carcasses outnumbered fall Chinook carcasses through Julian week 43 (ending October 28, 2010). With this Julian week separation, 1,006 spring Chinook carcasses and 2,865 fall Chinook carcasses were recovered. Coded wire tag recoveries also allow separation of 2 year old grilse from adults (greater than 2 years of age). Analysis of CWTs indicates 95.45 percent of spring Chinook and 83.51 percent of fall Chinook were adults. Recovery of adipose fin-clipped Chinook carcasses also indicate 1.7 percent of the spring and 5.5 percent of the fall Chinook carcasses observed were of hatchery origin. Over the course of the survey, 604 Chinook carcasses were marked, of which (204) 33.8 percent were recaptured. The Schaefer with Law's Adjustment mark-recapture model estimates the lowest in-river escapement of 10,668 Chinook salmon (2,010 spring Chinook and 6,188 fall Chinook). The Weekly Peterson model provides the highest estimate of 11,508 Chinook salmon (2,186 spring Chinook and 6,730 fall Chinook). The recovery of hatchery clipped coho salmon and adipose-clipped steelhead carcasses indicate that 86.7 percent of coho salmon and 42.1 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 (USFWS) 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.

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, 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, 2010 and December 20, 2010. Two rafting teams consisting of DFG 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)

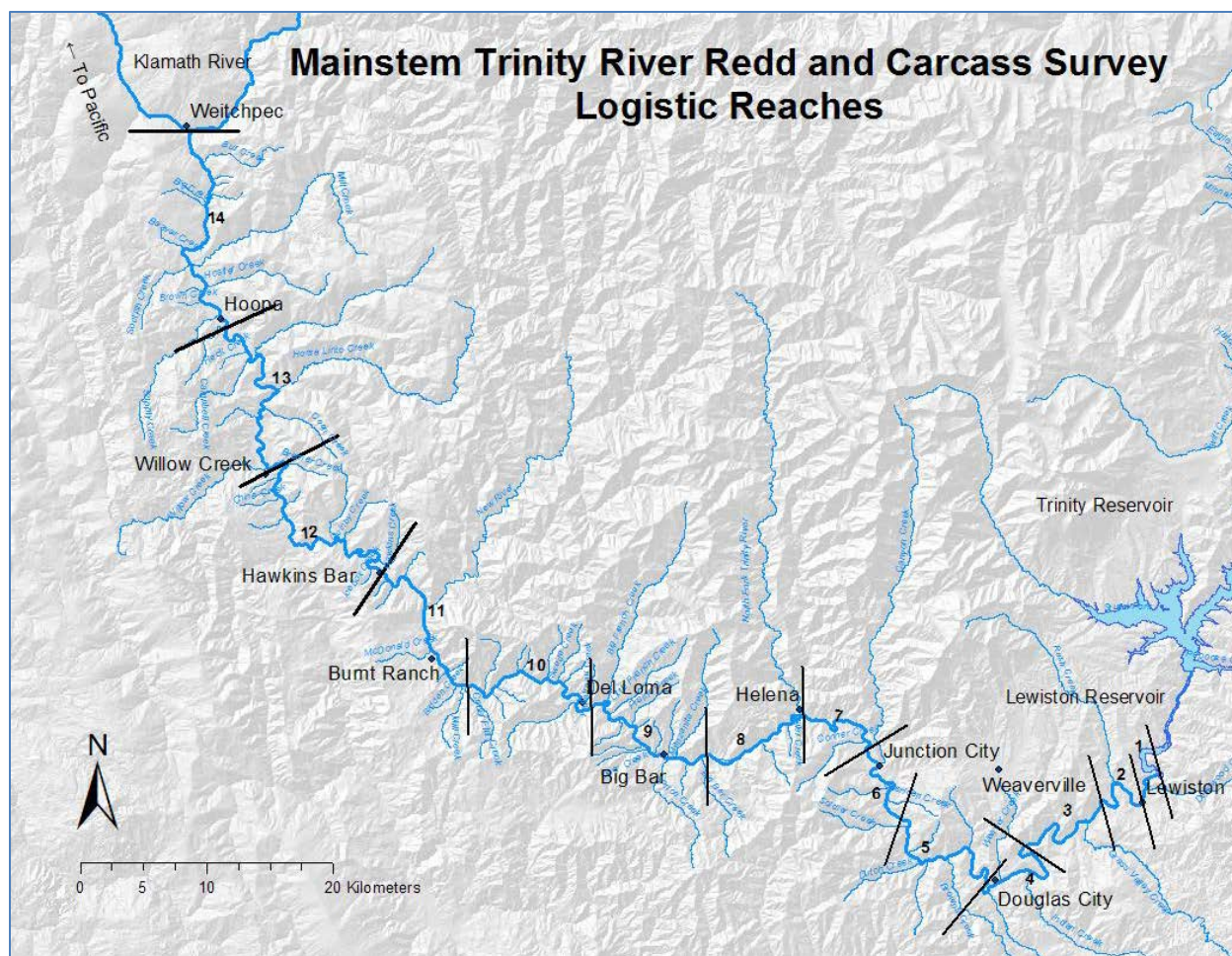


Figure 1. Survey reaches for 2010 Trinity River main stem spawner survey. Map courtesy of USFWS.

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 down stream. 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):

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

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. Spring Chinook carcasses were predominant through Julian week 43 (October 22, 2010 to October 28, 2010), after which fall Chinook recoveries were most numerous. For the purpose of analysis, all Chinook recoveries prior to and during Julian week 43 are classified as spring Chinook and all subsequent carcass recoveries are classified as fall Chinook (Figure 2).

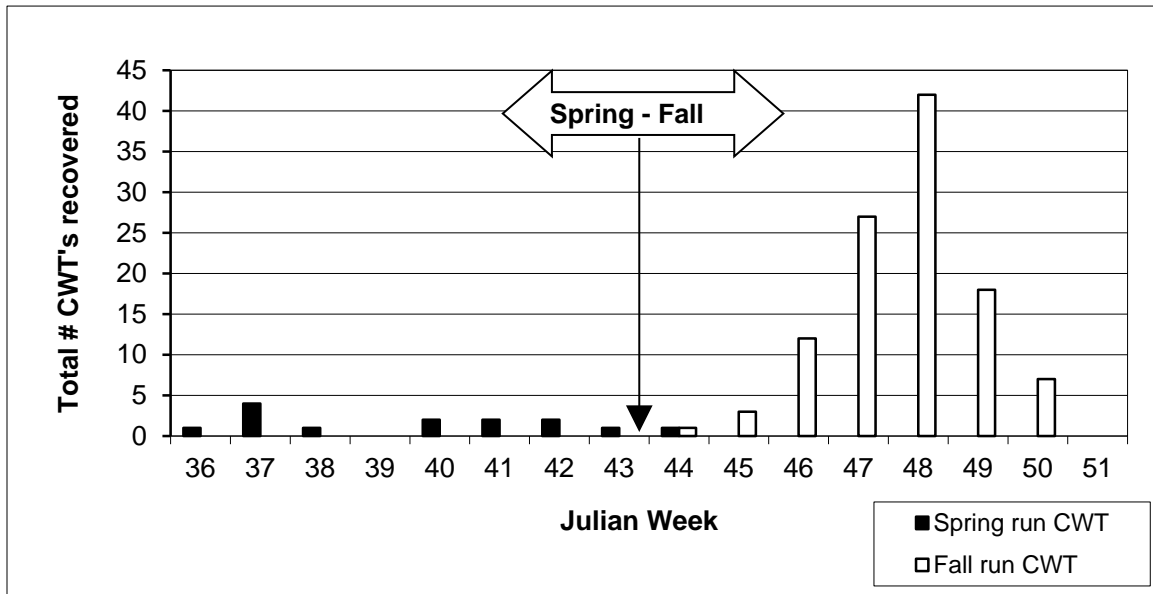


Figure 2. Weekly proportion of coded-wire tagged spring and fall Chinook observed in the 2010 main stem Trinity River spawner survey

Temporal Carcass Distribution

A total of 3,871 Chinook carcasses were encountered during the survey. Recovery of Chinook carcasses peaked during Julian week 48 (November 26, 2010 to December 2, 2010) when 897 carcasses were counted. The first coho salmon carcass was recovered during Julian week 43 (October 22, 2010 to October 28, 2010). A total of 693 coho salmon carcasses were recovered during the survey with peak recovery number of 192 during both Julian week 48 (November 26, 2010 to December 2, 2010) (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.

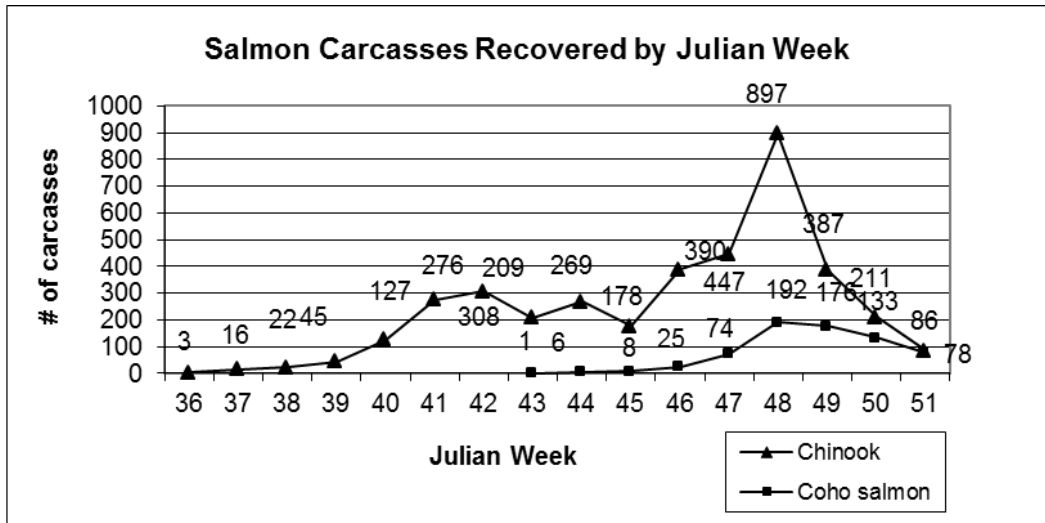


Figure 3. Chinook and coho salmon carcasses collected by Julian week during the 2010 Trinity River main stem spawner survey.

Carcass Distribution

A total of 3,871 Chinook carcasses were recovered during Julian weeks 36 to 51 (September 7, 2010 to December 20, 2010) in the 14 survey sections (Table 2). Of the 3,871 Chinook carcasses encountered, 2,450 (63.3%) were recovered in reaches 1 and 2, and 1,588 (41.1%) of the carcasses were recovered in reach 1 alone. Reaches 8 and 10 had the fewest carcasses (5 in both reaches) and 380 (9.8%) of encountered carcasses were downstream of reach 5 (Table 2).

Table 2. Recovery of all Chinook salmon by Julian week and section during 2010 main stem Trinity River spawner survey.

Section	Number of surveys	Julian week of Chinook recovery																Section Totals
		36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
1	15	3	8	10	7	17	31	28	15	ns	60	87	235	634	265	134	54	1,588
2	14	ns	3	3	8	23	36	53	46	62	ns	136	136	180	102	42	32	862
3	14	ns	3	5	11	32	56	55	26	46	25	51	44	32	11	18	ns	415
4	13	ns	1	0	11	37	66	76	44	72	38	30	5	ns	9	7	ns	396
5	13	ns	0	3	6	12	42	41	38	30	16	30	3	7	ns	2	ns	230
6	13	ns	0	0	0	1	22	36	24	46	17	16	9	11	ns	7	ns	189
7	13	ns	0	1	0	2	11	17	10	11	12	11	11	6	ns	1	ns	93
8	4	ns	0	ns	1	ns	3	ns	1	ns	ns	ns	ns	ns	ns	ns	ns	5
9	6	ns	1	ns	1	ns	9	ns	5	ns	9	ns	1	ns	ns	ns	ns	26
10	6	ns	0	ns	0	ns	ns	1	ns	0	1	ns	3	ns	ns	ns	ns	5
12	5	ns	ns	ns	ns	0	ns	0	ns	2	ns	16	ns	27	ns	ns	ns	45
13	4	ns	ns	ns	ns	2	ns	1	ns	0	ns	5	ns	ns	ns	ns	ns	8
14	4	ns	ns	ns	ns	1	ns	0	ns	0	ns	8	ns	ns	ns	ns	ns	9
Totals	124	3	16	22	45	127	276	308	209	269	178	390	447	897	387	211	86	3,871

Spring Chinook Salmon

A total of 1,006 Chinook carcasses were classified as spring-run during the survey, of which 352 were classified as condition-one (Table 3). Spring Chinook carcass recovery by reach ranged from 235 in reach 4 to zero in reach 12. Spring Chinook carcass density was greatest in reach 1 at 36.06 fish/rkm.

Table 3. Number, density, incidence of ad-clips, project tags, and condition of spring Chinook recovered during the 2010 main stem Trinity River spawner survey 1/

Reach	Length (km)	Number observed	Density (fish/km)	C-1	C-2	Adipose Clips		Project tags	
						Total	C1	Total	C1
1	3.3	119	36.06	43	69	7	6	2	1
2	7.1	172	24.23	37	127	5	1	4	0
3	10.9	188	17.25	72	110	2	1	1	1
4	10.8	235	21.76	77	144	2	1	5	2
5	14.7	142	9.66	72	69	1	0	2	1
6	8.6	83	9.65	31	51	0	0	1	0
7	8.9	41	4.61	15	26	0	0	1	0
8	10.8	5	0.46	1	4	0	0	0	0
9	13.8	16	1.16	1	15	0	0	1	0
10	14.7	1	0.07	0	1	0	0	0	0
12	22.4	0	0.00	0	0	0	0	0	0
13	21.1	3	0.14	2	1	0	0	0	0
14	21.3	1	0.05	1	0	0	0	0	0
Total	103.6	1,006	9.71	352	617	17	9	17	5

1/ All Chinook recovered prior to Julian week 44 (Oct.29 - Nov. 4) 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

Fall Chinook Salmon

A total of 2,865 Chinook carcasses were classified as fall-run during the survey, of which 339 were classified as condition-one (Table 4). Fall Chinook carcass recovery by reach ranged from 1,469 in reach 1 to 0 in both reaches 8. Fall Chinook carcass density was greatest in reach 1 at 445.15 fish/rkm and dropped considerably to 97.18 fish/rkm 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 2010 main stem Trinity River spawner survey. 1/

Reach	Length (km)	Number observed	Density (fish/km)	Condition		Adipose Clips		Project tags	
				C-1	C-2	Total	C1	Total	C1
1	3.3	1,469	445.15	142	1,225	112	39	11	1
2	7.1	690	97.18	62	564	39	18	14	0
3	10.9	227	20.83	39	164	6	4	7	0
4	10.8	161	14.91	26	97	1	0	4	2
5	14.7	88	5.99	24	48	0	0	2	2
6	8.6	106	12.33	13	86	0	0	3	0
7	8.9	52	5.84	6	41	0	0	2	0
8	10.8	0	0.00	0	0	0	0	0	0
9	13.8	10	0.72	3	7	0	0	0	0
10	14.7	4	0.27	0	4	0	0	0	0
12	22.4	45	2.01	16	28	0	0	0	0
13	21.1	5	0.24	2	3	0	0	0	0
14	21.3	8	0.38	6	2	0	0	2	1
Total	168.4	2,865	17.01	339	2,269	158	61	45	6

1/ All Chinook recovered after Julian week 43 (Oct.22 - Oct. 28) 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 weir

Coho Salmon

A total of 693 coho salmon carcasses were recovered during the survey, of which 211 were classified as condition-one (Table 5). Coho carcass recovery by reach ranged from 345 (49.78%) in reach 1 to zero in reaches 8, 9, 10, 13, and 14. Coho salmon carcass density was greatest in reach 1 at 104.55 fish/rkm and dropped considerably to 38.17 fish/rkm in reach 2. Coho salmon carcass density downstream from reach 4 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 2010 main stem Trinity River spawner survey.

Reach	Length (km)	Number observed	Density (fish/km)	Right Maxillary (Project tags)					
				C-1	C-2	Total	C1	Total	C1
1	3.3	345	104.55	96	225	305	80	10	4
2	7.1	271	38.17	86	174	236	75	6	2
3	10.9	40	3.67	16	21	29	13	3	1
4	10.8	12	1.11	2	5	6	2	1	0
5	14.7	12	0.82	8	3	12	8	2	2
6	8.6	8	0.93	1	7	8	1	0	0
7	8.9	2	0.22	0	2	2	0	0	0
8	10.8	0	0.00	0	0	0	0	0	0
9	13.8	0	0.00	0	0	0	0	0	0
10	14.7	0	0.00	0	0	0	0	0	0
12	22.4	3	0.13	2	1	3	2	0	0
13	21.1	0	0.00	0	0	0	0	0	0
14	21.3	0	0.00	0	0	0	0	0	0
Total	168.4	693	149.60	211	438	601	181	22	9

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 91 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 1 with greatest numbers recovered in reach 3. No project tags were recovered from steelhead carcasses in 2010.

Table 6. Number, density, incidence of adipose clips, and project tags recovered during the 2010 main stem Trinity River spawner survey

Reach	Length (km)	Steelhead			Brown Trout		
		Number Observed	Density (fish/km)	Adipose Clip ₁	Number Observed	Density (fish/km)	Project Tags ₂
1	3.3	11	3.33	6	12	3.64	0
2	7.1	4	0.56	2	18	2.54	0
3	10.9	2	0.18	0	29	2.66	1
4	10.8	1	0.09	0	9	0.83	0
5	14.7	0	0.00	0	14	0.95	0
6	8.6	1	0.12	0	6	0.70	1
7	8.9	0	0.00	0	2	0.22	0
8	10.8	0	0.00	0	0	0.00	0
9	13.8	0	0.00	0	0	0.00	0
10	14.7	0	0.00	0	1	0.07	0
12	22.4	0	0.00	0	0	0.00	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	91	0.54	2

1/ Adipose clipped steelhead presumably from Trinity River Hatchery with 100% hatchery

2/ Spaghetti tags applied at Willow Creek and Junction City weirs

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 ($n = 967$ averaged 76.03 cm. and ranged between 35-105 cm. (Figure 4). Grilse (FL < 58 cm) accounted for 4.55% (44/967) of the measured spring Chinook.

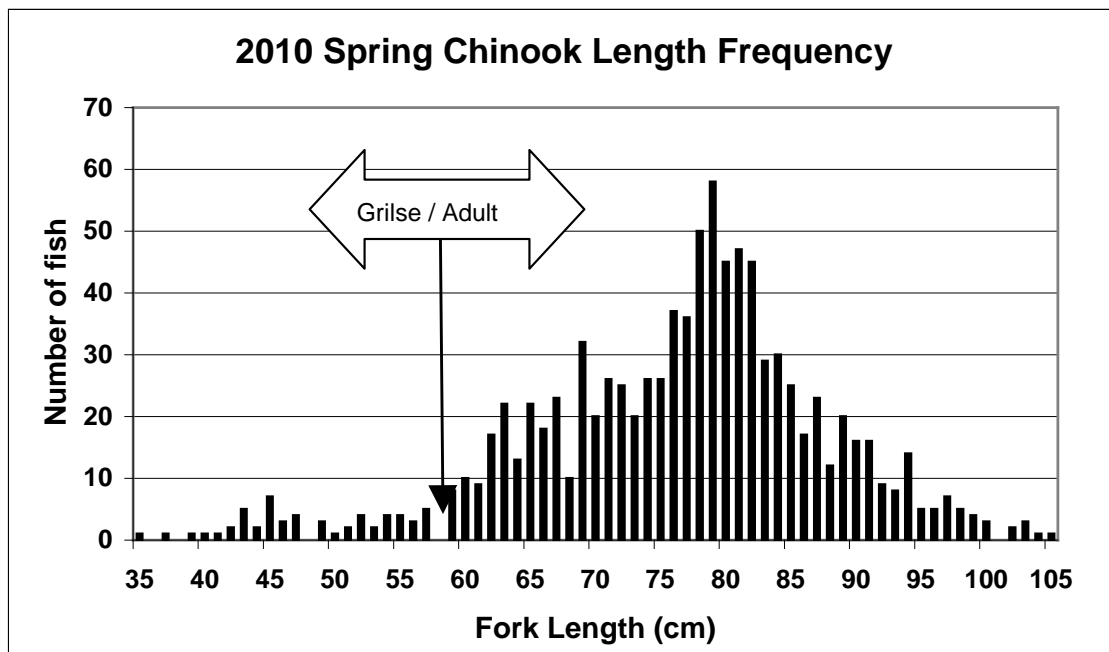


Figure 4. Length frequency histogram for all condition 1 and 2 spring Chinook measured during the 2010 main stem Trinity spawner survey.

Fall Chinook Salmon

Fork lengths obtained from fall Chinook ($n = 2,607$) averaged 74.83 cm and ranged between 30-114 cm. (Figure 5). Grilse (FL <62 cm) accounted for 16.49% (430/2,607) of measured fall Chinook.

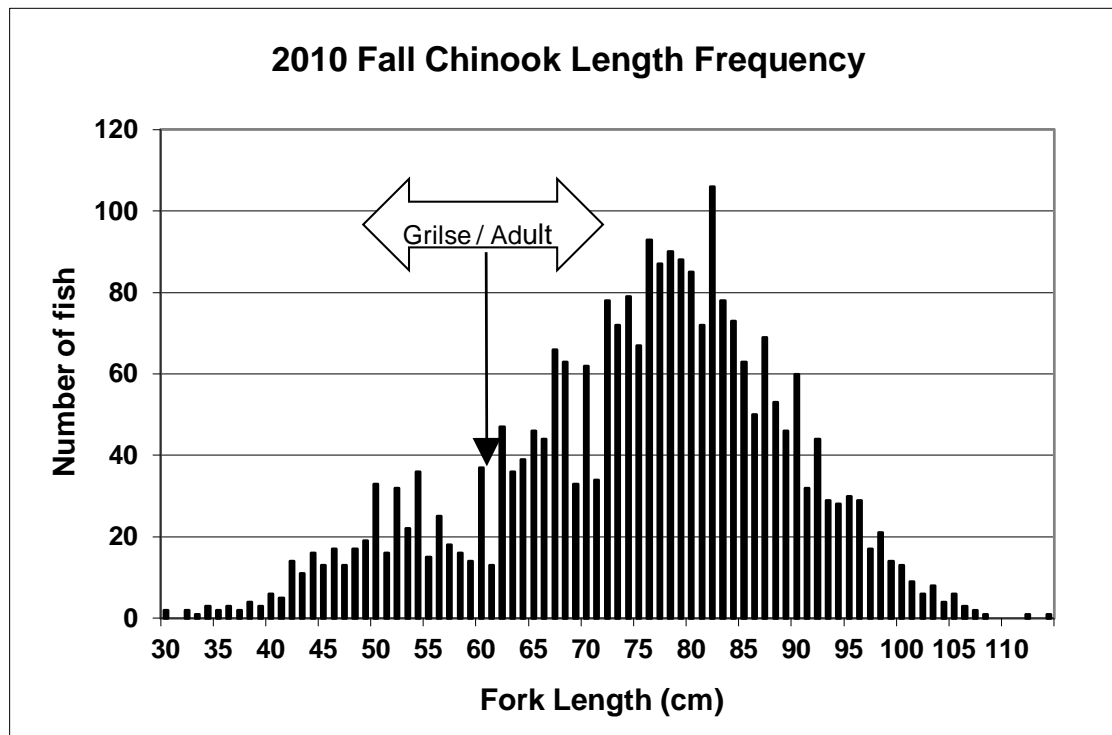


Figure 5. Length frequency histogram for all condition 1 and 2 fall Chinook measured during the 2010 main stem Trinity spawner survey.

Coho Salmon

Fork lengths of measured coho salmon ($n = 645$) averaged 68.48 cm and ranged from 41-87 cm. (Figure 6). Grilse (FL < 56 cm) accounted for 2.64% (17/645) of measured coho salmon.

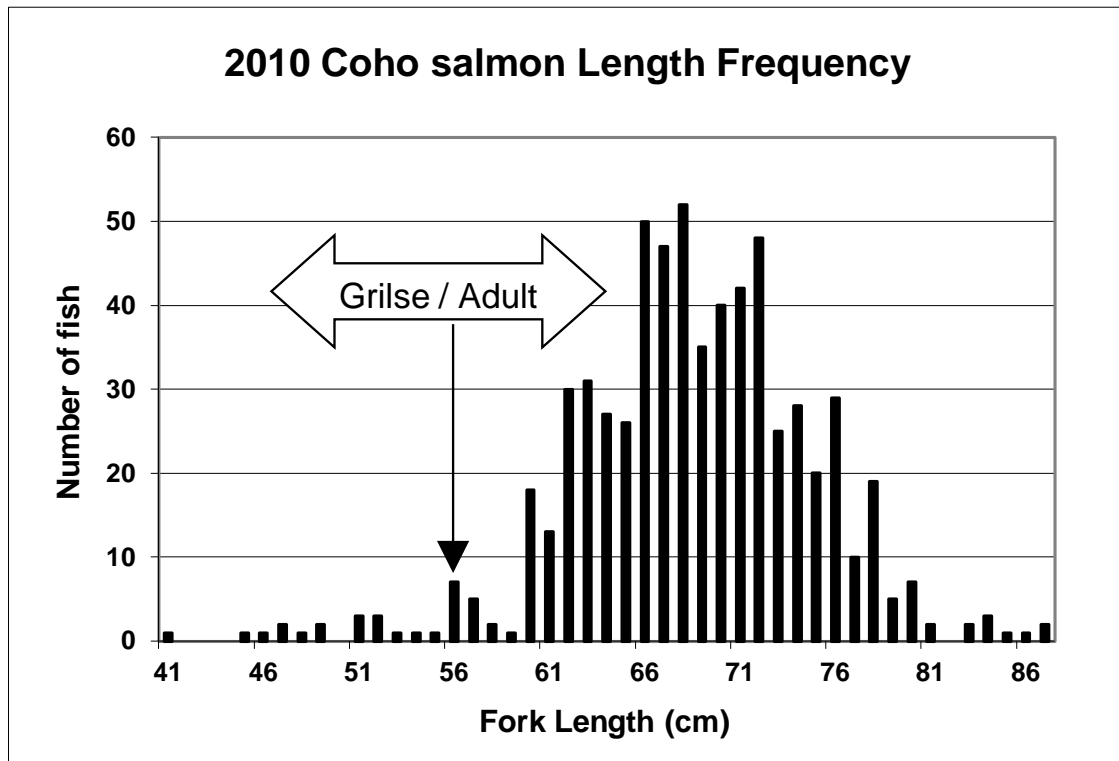


Figure 6. Length frequency for all condition-1 and -2 coho salmon measured during the 2010 main stem Trinity River spawner survey.

Adult Sex Composition and Female Pre-Spawn Mortality

Spring Chinook Salmon

Of the spring Chinook recovered that were sexed; 426 were sexed as males and 553 as females, a male to female ratio of 0.77:1 (Table 7). Gender was indiscernible on 27 fish due to advanced decomposition. Forty four (7.96%) of the 553 female spring Chinook carcasses evaluated were determined to be pre-spawn mortalities.

Table 7. Male to female ratio and prespawn mortality of spring Chinook during 2010 main stem Trinity River spawner survey

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	119	28	90	10	1	0.31	11.11%
2	172	83	82	5	7	1.01	6.10%
3	188	75	109	6	4	0.69	5.50%
4	235	113	109	3	13	1.04	2.75%
5	142	60	81	2	1	0.74	2.47%
6	83	32	51	9	0	0.63	17.65%
7	41	19	22	3	0	0.86	13.64%
8	5	3	1	0	1	3.00	0.00%
9	16	10	6	4	0	1.67	66.67%
10	1	1	0	0	0	0.00	0.00%
12	0	0	0	0	0	0.00	0.00%
13	3	2	1	1	0	2.00	100.00%
14	1	0	1	1	0	0.00	100.00%
Total	1,006	426	553	44	27	0.77	7.96%

Fall Chinook Salmon

Of the fall Chinook recovered that were sexed; 1,373 were sexed as males and 1,306 were sexed as females, for a male: female ratio of 1.05:1 (Table 8). Gender was indiscernible on 186 fish due to advanced decomposition. One hundred and sixteen (8.88%) of the 1,306 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 2010 main stem Trinity River spawner survey by reach.

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	1,469	619	810	59	40	0.76	7.28%
2	690	411	229	30	50	1.79	13.10%
3	227	130	72	5	25	1.81	6.94%
4	161	76	47	3	38	1.62	6.38%
5	88	27	44	2	17	0.61	4.55%
6	106	47	50	8	9	0.94	16.00%
7	52	19	27	2	6	0.70	7.41%
8	0	0	0	0	0	0.00	0.00%
9	10	6	4	0	0	1.50	0.00%
10	4	2	2	0	0	1.00	0.00%
12	45	27	17	7	1	1.59	41.18%
13	5	5	0	0	0	0.00	0.00%
14	8	4	4	0	0	1.00	0.00%
Total	2,865	1,373	1,306	116	186	1.05	8.88%

Coho Salmon

Of the 693 coho salmon recovered that were sexed; 324 were sexed as males and 353 were sexed as females, for a male: female ratio of 0.92: 1 (Table 9). Grilse have been included in number of males, and gender was indiscernible on 16 fish due to advanced decomposition. Fifty two (14.73%) of 353 female coho salmon carcasses examined were determined to be pre-spawn mortalities.

Table 9. Male to female ratio and prespawn mortality of coho salmon during 2010 main stem Trinity River spawner survey by reach.

Reach	Total Coho	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	345	145	196	23	4	0.74	11.73%
2	271	140	128	24	3	1.09	18.75%
3	40	22	16	2	2	1.38	12.50%
4	12	4	3	0	5	1.33	0.00%
5	12	8	3	2	1	2.67	66.67%
6	8	3	4	0	1	0.75	0.00%
7	2	1	1	0	0	1.00	0.00%
8	0	0	0	0	0	0.00	0.00%
9	0	0	0	0	0	0.00	0.00%
10	0	0	0	0	0	0.00	0.00%
12	3	1	2	1	0	0.50	50.00%
13	0	0	0	0	0	0.00	0.00%
14	0	0	0	0	0	0.00	0.00%
Total	693	324	353	52	16	0.92	14.73%

Incidence of Hatchery Produced Chinook and Coho Salmon

Spring Chinook Salmon

During the spring-run period, 2.56 % (n = 9) of condition-one and 1.69% (n = 17) of all spring Chinook bore ad-clips. One hundred percent of all ad-clipped spring Chinook were recovered above reach 6. CWTs were recovered from 14 Chinook encountered during the spring Chinook recovery period, all but one were spring-run. During the period associated with the spring-run, 3 ad-clipped Chinook were recovered in which no CWTs were found. The majority of CWTs were represented by the 2006 spring-run yearling release group (n=7, 41.18%) and 2006 spring-run fingerling release group (n=4, 23.53%). All other CWTs were represented by 2007 brood year spring-run yearling (n=2, 11.76%) and 2007 brood year fingerling release groups (n=1, 5.88%).

Table 10. Release and recovery data for coded-wire tagged, Trinity River Hatchery produced Chinook salmon recovered during the 2010 Trinity River spawner survey.

Release data					Recovery data				
			Release	Production	Recovery period ₃				Expanded
CWT Code	Brood year	Age	type ₁	multiplier ₂	Spring	Fall	Total	% of subtotal	total
Spring Chinook									
65349	2006	4	Sf	4.13275	4		4	23.53	16.531
65360	2006	4	Sy	4.01047	7		7	41.18	28.073
68803	2007	3	Sf	4.09192	1		1	5.88	4.092
68810	2007	3	Sy	4.02374	1	1	2	11.76	8.047
No CWT recovered ₄					3		3	17.65	
				Subtotal:	16	1	17	100.00	56.744
Fall Chinook									
65350	2006	4	Ff	4.23540		2	2	1.60	8.471
65351	2006	4	Ff	4.20807		2	2	1.60	8.416
65352	2006	4	Ff	4.18405		4	4	3.20	16.736
65353	2006	4	Ff	3.98763		2	2	1.60	7.975
65361	2006	4	Fy	4.05413		36	36	28.80	145.949
68804	2007	3	Ff	4.03391		2	2	1.60	8.068
68805	2007	3	Ff	4.07660		2	2	1.60	8.153
68806	2007	3	Ff	4.05128		4	4	3.20	16.205
68807	2007	3	Ff	4.03393		2	2	1.60	8.068
68808	2007	3	Ff	4.01949		4	4	3.20	16.078
68809	2007	3	Fy	4.06992		37	37	29.60	150.587
68814	2008	2	Ff	4.08246		5	5	4.00	20.412
68815	2008	2	Ff	4.07340		3	3	2.40	12.220
68816	2008	2	Ff	4.01831		3	3	2.40	12.055
68817	2008	2	Ff	4.02600		1	1	0.80	4.026
68820	2008	2	Ff	4.02446		1	1	0.80	4.024
No CWT recovered ₄						15	15	12.00	
				Subtotal:	0	125	125	100.00	447.444
				Grand Totals	16	126	142		504.188

1/ Release types: Sf-Spring Chinook fingerling, Sy-Spring Chinook yearling; Ff-Fall Chinook fingerling, Fy Fall

2/ Hatchery production multiplier used to account for untagged releases of the same brood year, race and

3/ Spring Chinook recovery period was September 14, 2009 to October 28, 2009. Later recoveries were all

4/ CWT was not present or was lost during recovery.

Based on expansion of all CWT codes recovered during the spring period, an estimated 57 (5.9%) of the 969 condition 1 and condition 2 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 spawner survey was 4.43% age 4 and 1.21% age 3 (Table 10).

Fall Chinook Salmon

During the fall-run period 17.99% (n = 61) of the condition-1 and 5.51% (n = 158) of all fall Chinook bore ad-clips (Table 4). Observed ad-clip rates in reach 1 and 2 for fall Chinook were 16.8% (n=57; condition-1) and 5.27% (n=151; all carcasses) respectively. In reach 3, fall Chinook ad-clip rates of 1.18% (n=4; condition-1) and 2.09% (n=6; all carcasses) were observed. CWTs were recovered from 110 of the total Chinook encountered during the fall Chinook recovery period; all of which were fall Chinook. During the period associated with the fall-run, 15 ad-clipped Chinook were recovered in which no CWTs were found. The majority of CWTs during the fall-run recovery period were represented by 2007 fall yearling releases (n=37; 29.60%). All other CWTs were represented by the following brood year groups; 2006 fall brood year yearlings (n=36, 28.8%), 2006 fall brood year fingerlings (n=10, 8.0%), 2007 fall brood year fingerling (n=14, 11.2%), and 2008 spring brood year fingerling (n=13, 10.4%).

Based on expansion of all CWT codes recovered during the fall-run period, an estimated 448 (17.2%) of the 2,608 condition 1 and condition 2 fish recovered were of TRH origin (Table 4). Based on expansions of all fall CWT groups, the estimated age structure of TRH fall Chinook recovered in the main stem Trinity River spawner survey was 6.55% age 4, 7.23% age 3, and 1.84% age 2 (Table 10).

Coho Salmon

During the course of the survey, 85.78% (n = 181) of condition-1 and 86.72% (n = 601) 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 86.72% of adult coho salmon recovered during the survey were of TRH origin.

Incidence of Project Marked Salmon

Spring Chinook Salmon

A total of 17 Project tags applied at the Junction City and Willow Creek weirs were recovered in survey reaches 1 through 14 (Table 3). Five of these were recovered on condition-1 carcasses. No spring Chinook Project tags were found on carcasses downstream of reach 9 (Table 3). During the course of the survey, 11 tags from the

Junction City weir and 6 tags from the Willow Creek weir were recovered prior to Julian week 44.

Fall Chinook Salmon

A total of 45 Project tags applied at Junction City and Willow Creek weirs were recovered during the survey (Table 4). Six of these were recovered on condition-1 carcasses. During the course of the survey, 39 tags from the Willow Creek weir and 6 tags from the Junction City weir were recovered after Julian week 43. Spaghetti tags were found in all reaches except 8 through 13, and 25 (55.56%) were found in reaches 1 and 2 (Table 4).

Coho salmon

A total of 22 Project tags applied at the Willow Creek weir were recovered during the survey (Table 5). Nine of these were recovered on condition-1 carcasses. None of these were recovered below reach 5.

Steelhead/Rainbow trout

No Project tags were found on steelhead carcasses during this survey.

Brown Trout

Two Project tags were found on a brown trout carcass during this survey in reach 3 and reach 6 during Julian Week 46.

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 2010 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, six hundred and four (15.60%) of Chinook were marked, and two hundred and four (33.77%) of those fish were subsequently recaptured (Appendix 6). The upper reaches (reaches 1-5) had a lower marking rate of 14.52% and a slightly higher recapture rate of 38.66% than the survey in its entirety (Appendices 5&6). The lower reaches (reaches 6-10) had a marking rate of 25.53%, and a recapture rate of 8.25% (Appendix 6). Estimates could not be made for spring-run in the lower reaches due to low numbers of recaptures (2 recaptures). 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 the 2010 Trinity River spawner survey.

Estimator	Reaches 1-5	Reaches 1-14	Reaches 1-5 (95% CI)	Reaches 1-14 (95% CI)
Petersen	9,004	11,426	956	1,238
Weekly Stratified Petersen	8,916	11,508	995	1,240
Schaefer	8,705	11,272	973	1,241
Schaefer with Law's adjustment	8,198	10,668	973	1,241

The different estimators produced estimates which range from 10,688 to 11,508 Chinook for the entire survey, and from 8,198 to 9,004 for the upper reaches 1-5 (Table 11). Adding in the 95% Confidence interval, the estimates ranged from 9,447 to 12,748 for the entire survey, and from 7,225 to 9,960 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 2010 Trinity River spawner survey above Junction City.

Estimator	Spring	Fall	Ratio of spring to fall Chinook
Petersen	2,208	6,796	0.3249
Weekly stratified Petersen	2,186	6,730	
Schaefer	2,134	6,570	
Schaefer w/ Law's adjustment	2,010	6,188	

Estimates for the different runs in the entire survey ranged from 2,772 to 2,969 for spring Chinook and 67,895 to 8,517 for fall Chinook (Table 13). The estimates for the upper reaches ranged from 2,010 to 2,208 for spring Chinook and 6,188 to 6,796 for fall Chinook (Table 12). The results of the carcass survey indicate spring to fall Chinook ratios of 0.3511:1 for the entire survey and 0.3249:1 for the upper reaches (Tables 12 & 13).

Table 13. In-river escapement estimates for spring and fall Chinook collected during 2010 Trinity River spawner survey in all reaches.

Estimator	Spring	Fall	Ratio of spring to fall Chinook
Petersen	2,969	8,487	0.3511
Weekly stratified Petersen	2,991	8,517	
Schaefer	2,929	8,343	
Schaefer w/ Law's adjustment	2,772	7,895	

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	38.00%
2003	25.20%
2004	25.20%
2005	32.50%
2006	18.14%
2007	19.28%
2008	10.27%
2009	8.37%
2010	5.67%

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 (Appendices 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 3 and 4). 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 2010 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 2000-2010.

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

Appendix 2. Total fall Chinook carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2010.

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

Appendix 3. Total coho salmon carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2010

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

Appendix 4. Salmon female prespaw mortality rates observed in the Trinity River spawner survey 1955 through 2010.

Study	Literature	Spring-run Chinook			Fall-run Chinook			Total Chinook			Coho salmon		
		Spaw ned	Not Spaw ne	% Not spaw ne	Spaw ned	Not Spaw ne	% Not Spaw ne	Spaw ned	Not Spaw ne	% Not Spaw ned	Spaw ned	Not Spaw n	% Not Spaw ned
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	current study	553	44	7.96	1,306	116	8.9	1,859	160	8.6	353	52	14.7

Appendix 5. Carcass mark recapture statistics and estimates observed on main stem Trinity River spawner surveys 2005-2010.

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

Appendix 6. Trinity River upper (reaches 1-5) and lower (reaches 6-14) reaches expansion matrix for Chinook mark-recapture estimators during 2010 survey.

Upper Reaches (1-5)	Captured	Marked	Recaptured	Marking Rate	Recapture Rate	Petersen	Stratified Petersen	Schaefer	Schaefer w/ Law's adjustment
Spring /b	856	291	58	34.00%	19.93%	2,208	2,186	2,134	2,010
Fall /b	2,635	216	138	8.20%	63.89%	6,796	6,730	6,570	6,188
Both	3,491	507	196	14.52%	38.66%	9,004	8,916	8,705	8,198
Lower Reaches (6-14)									
Spring /b	150	51	2	34.00%	3.92%	1,637	843	1,468	1,429
Fall /b	230	46	6	20.00%	13.04%	2,510	1,293	2,251	2,192
Both a/	380	97	8	25.53%	8.25%	4,148	2,136	3,718	3,621

a/ These estimates were made in violation of the rule requiring at least 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
2010-11 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 (Ocean to Hwy 96 Bridge in Weitchpec) August 6, 2010 through November 4, 2010 to estimate the sport fishery harvests 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 3,562 (2,057 adults and 1,505 grilse) Chinook salmon and 61 (61 adults and 0 half-pounders) steelhead were harvested. The 2010 in-river sport quota of 12,000 adult Chinook salmon was not met. Twenty-eight Chinook salmon (9 adults and 19 grilse) caught before August 15, 2010 are considered spring-run fish. Hatchery fish represented an estimated 24.45 percent (871/3,562) of the sport harvest in the lower Klamath River. Trinity River Hatchery (TRH) origin fish represented 16.00 percent of the estimated harvest and 8.45 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 (Boydston 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, 2010 through June 30, 2011. 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 onto 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 (245.7 rkm). 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.

Quotas and harvest management

The Klamath River Chinook quota is implemented in the following manner: Fifty per cent of the total in-river quota is dedicated to the lower Klamath River (rkm 0 to 68.8). The other half is apportioned to the mid Klamath River (17%) (rkm 68.8 to 306) and the Trinity River (33%). 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 2010 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, 2010 in the lower Klamath River and September 1, 2010 in the Trinity River and the Klamath River above the Hwy 96 Bridge in Weitchep. 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: One “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 Weitchep (Areas 1 and 2) are included in this report. Areas upstream of the Hwy 96 Bridge in Weitchep 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 (2.8 mi) 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 2010. 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 2010 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, it 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 2010 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. Which Area starts the Creel Census 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 was collected.
- 5) For Chinook salmon missing an adipose fin, (possessed a CWT) the head

- was removed and retained by staff.
- 6) The number and species of fish caught and released (actually released not lost) by the angler was recorded as juveniles, grilse or adults.
 - 7) In Area 1 only, the angler was questioned whether they fished the mouth or from a boat and if fish were harvested above or below the Hwy 101 Bridge.
 - 8) Was this a professionally guided trip?

Harvest and Effort Estimating Procedures

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

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

where: Estimate total = estimates of catch or effort

Daily total = Daily counts of catch or effort

N = Number of fishing days in week

n = number of sample days

l = boat sampling ratio

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

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

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

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

same between both the unsampled 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 spell out 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.

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 2010. Chinook salmon harvested in the lower Klamath fishery ranged in size from 22 to 105 cm in fork length (Figure 1). The adult portion of Chinook harvested ranged from in size 61 to 105 cm FL and averaged 79 cm FL. The grilse component of the angler harvest ranged in size from 22 to 60 cm FL and averaged 50 cm FL.

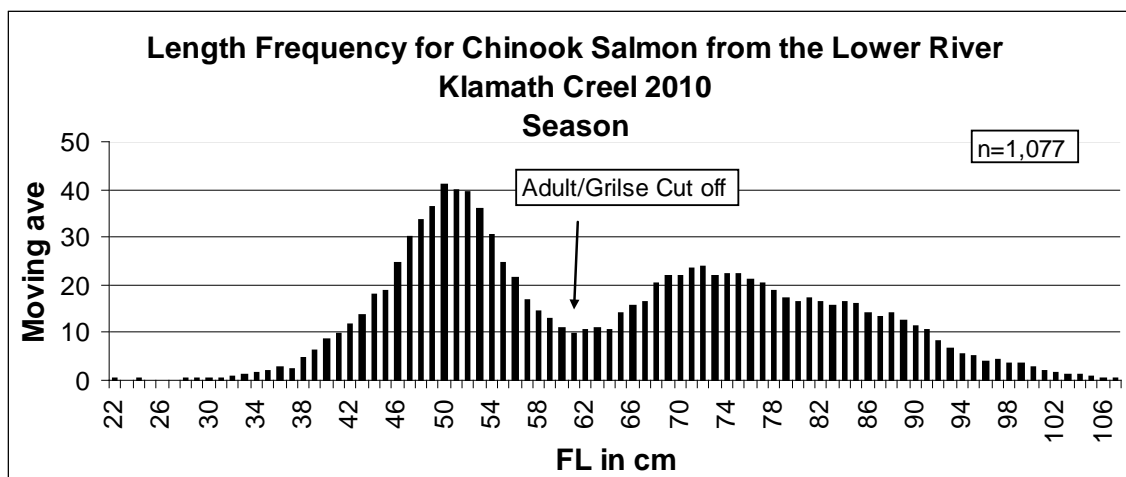


Figure 1. Fork length frequency of Chinook salmon harvested in the lower Klamath River during the 2010 season.

Harvested steelhead ranged in size from 37 to 77 cm FL and averaged 59.4 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. Half-pounder steelhead ranged in size from 34 to 41 cm FL and the adult steelhead ranged in size from 42 to 79 cm FL.

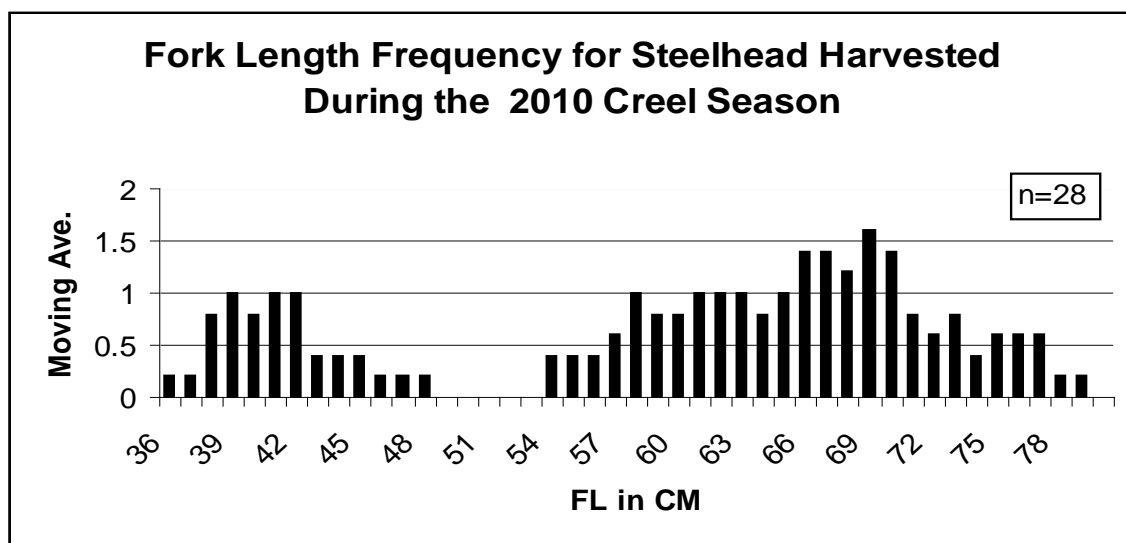


Figure 2. Length frequency of steelhead harvested in the lower Klamath River during the 2010 season.

Estimated Angler Effort and Harvest

During the 2010 season, CDFG estimate anglers made a total of 11,516 trips in Areas 1 and 2 combined. Of the 11,516 trips; 4,003 were in Area 1, and 7,513 were in Area 2 (Table 1). These trips resulted in a total effort of 58,842 fishing hours. As in previous seasons, boat anglers out-numbered shore anglers in both Areas (Table 1).

Anglers did not meet their quota of 12,000 adult fall run Chinook for the basin this season. Nor did anglers in the lower Klamath River meet their 6,000 fish quota. A total of 3,562 (2,057 adults and 1,505 grilse) Chinook salmon and 61(61 adults and 0 half-pounders) steelhead were harvested (Table 1). During Julian week 32, 28 (9 adult and 19 grilse) spring-run Chinook salmon were harvested. The total of fall-run Chinook harvested was 3,534 (2,048 adults and 1,486 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 2010 lower Klamath River creel census.

Site Location	Angler		Steelhead		Chinook Salmon	
	Trips	Hours	1/2 lbers	Adults	Grilse	Adults
Area 1 - Mouth to Hwy 101 Bridge						
Shore	770	2,193	0	0	0	35
Boats	3,233	10,627	0	4	164	492
Total	4,003	12,820	0	4	164	527
Area 2 - Hwy 101 to Hwy 96						
Shore	1,239	3,924	0	8	26	73
Boats	6,274	42,098	0	49	1,315	1,457
Total	7,513	46,022	0	57	1,341	1,530
2010 Total	11,516	58,842	0	61	1,505	2,057
2009	14,736	67,160	7	192	1,926	3,158
2008	10,827	56,005	2	55	3,947	1,056

2010 Harvest and Effort Patterns

The average fishing trip length during the 2010 season was 5.1 hours (Table 2). This is longer than the last few years (2002-2010) and longer than the 4.0 hours average trip length over the previous 19 years (1992-2010). Anglers fished longer trips, caught fewer adult fish, but a great deal more grilse Chinook.

Table 2. Number of angler trips, hours, and average length of trip in the lower Klamath River sport fishery for the last nineteen seasons, 1992-2010.

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

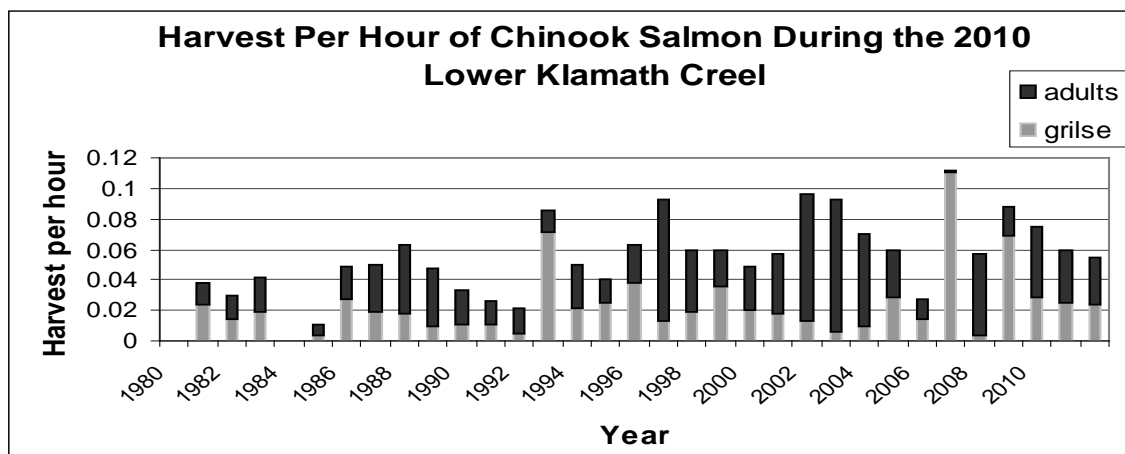


Figure 3. Chinook salmon harvested per hour of angler effort during the lower Klamath River creel survey, 1980 – 2010.

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 1,188 half-pounders, 563 adult steelhead, 207 grilse, and 92 adult Chinook salmon (Tables 3 and 4). In addition an estimated 7 grilse and 76 adult coho salmon were released this season. The majority of coho salmon caught and released occurred in Area 2. Anglers tend to fish later into the season in Area 2 when coho are present. As in all years, if the quota is met early 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 not met in 2010.

Table 3 Number of estimated Chinook and coho salmon and steelhead caught and released from the lower Klamath River, 1994-2010.

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	1188	563	7	76

Table 4. Summary of estimated angler catch and release effort of Chinook salmon and steelhead during the 2010 lower Klamath River creel census.

Site Location	Angler		Steelhead		Chinook Salmon	
	Trips	Hours	1/2 lbers	Adults	Grilse	Adults
Area 1 - Mouth to Highway 101 Bridge						
Shore	770	2,193	5	8	2	0
Boats	3,233	10,627	102	74	30	39
Total	4,003	12,820	107	82	32	39
Area 2 - Highway 101 to HWY 96						
Shore	1,239	3,924	361	58	49	2
Boats	6,274	42,098	720	396	126	51
Total	7,513	46,022	1,081	454	175	53
2010 Total	11,516	58,842	1,188	536	207	92
2009	14,736	67,160	975	485	338	292
2008	10,827	56,005	2	55	3,947	1,056

Harvest Timing

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

Fewer steelhead were harvested than last season. Harvest of adult steelhead peaked in JW 33 (Figure 6). The peak week of half-pounder catch and release was JW 34 (Figure 7). No half-pounders were reported harvested this season.

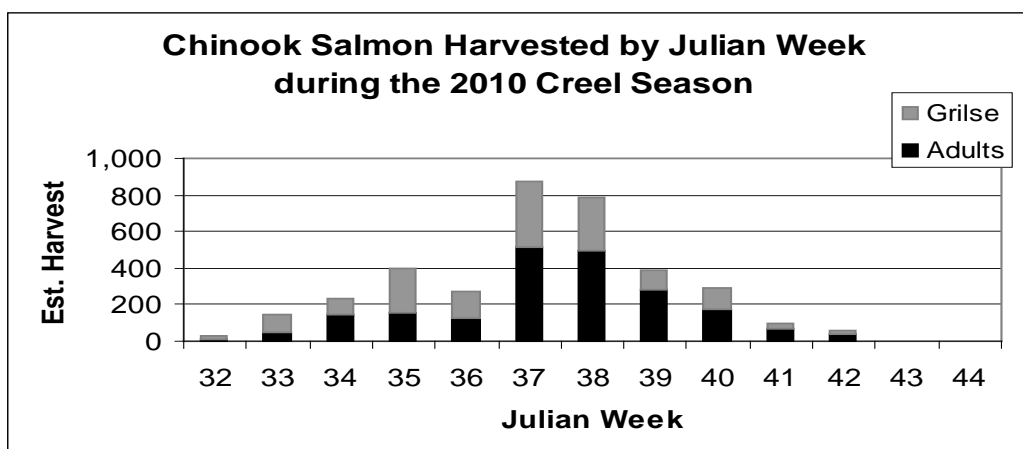


Figure 4. Estimated harvest of Chinook salmon in the lower Klamath River during the 2010 season.

Table 5. Harvest, release and angler effort by Julian week during the 2010 lower Klamath River creel census.

Julian Week	Angler Trips Hours		Harvest				Released			
			Steelhead		Chinook		Steelhead		Chinook	
			1/2 lbers	Adults	Grilse	Adults	1/2 lbers	Adults	Grilse	Adults
32	534	1,884	0	9	19	9	70	51	5	0
33	861	3,325	0	2	93	52	186	128	7	0
34	1,389	5,596	0	9	90	142	227	83	28	9
35	1,364	6,409	0	9	245	152	163	64	23	7
36	1,303	6,527	0	11	155	122	135	44	19	9
37	2,000	11,626	0	9	355	518	92	40	44	27
38	1,448	7,858	0	2	285	497	52	30	9	7
39	1,279	7,965	0	5	110	280	14	52	9	12
40	698	4,216	0	5	119	171	14	21	9	0
41	347	1,867	0	0	23	72	61	12	40	19
42	237	1,327	0	0	12	42	105	7	2	2
43	30	123	0	0	0	0	61	5	12	0
44	27	118	0	0	0	0	9	0	0	0
Total	11,515	58,841	0	61	1,506	2,057	1,187	536	207	92

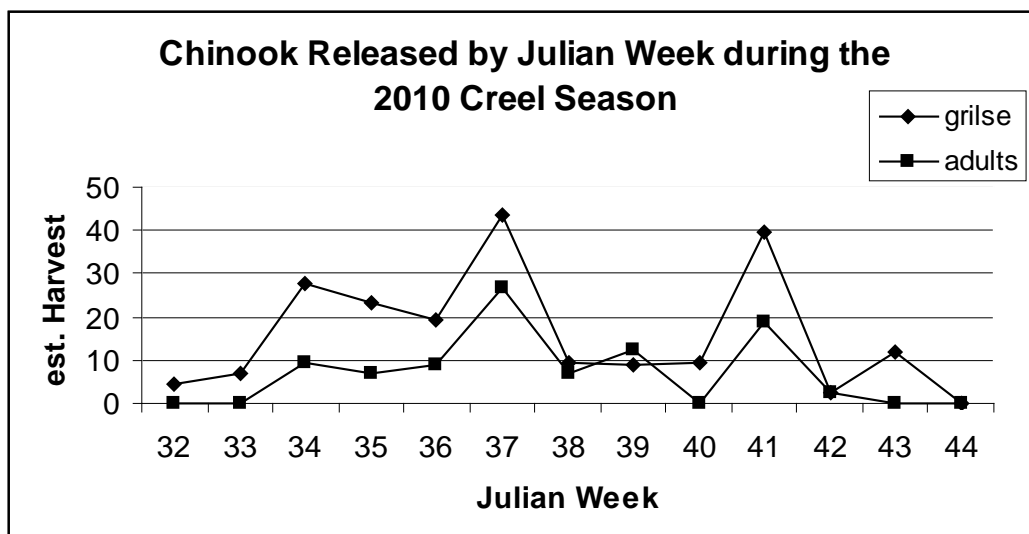


Figure 5. Estimate of Chinook salmon caught and released in the lower Klamath River during the 2010 season.

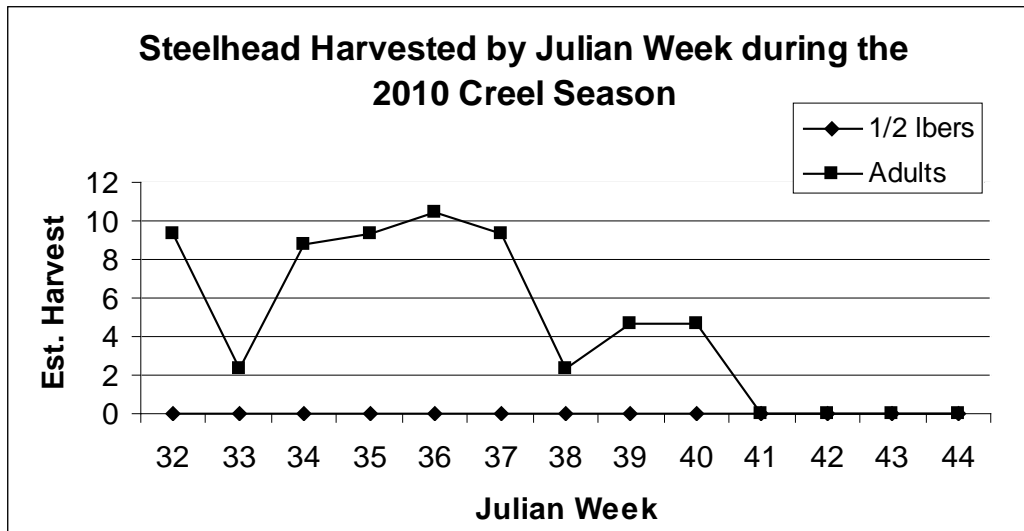


Figure 6. Estimated harvest of steelhead in the lower Klamath River during the 2010 season.

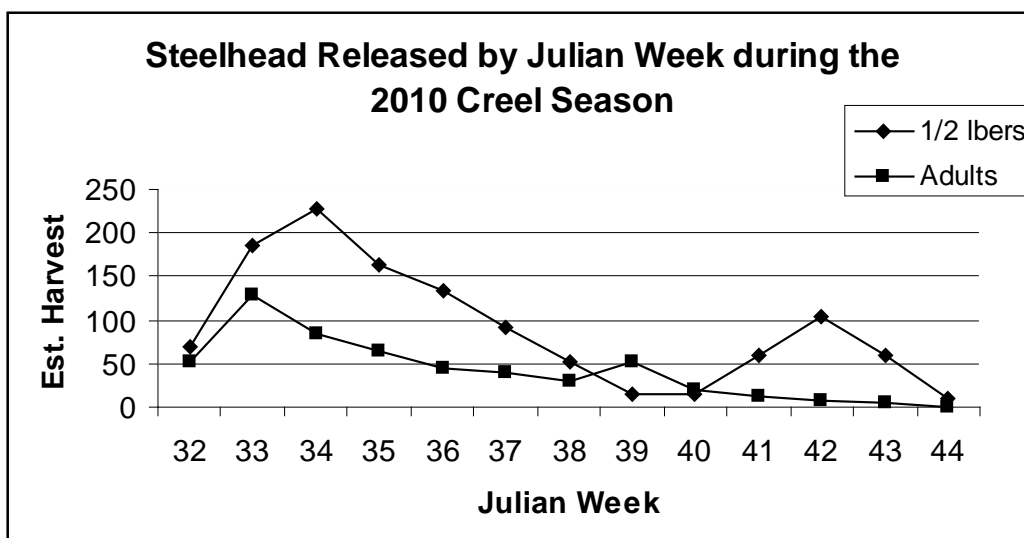


Figure 7. Estimate of steelhead caught and released in the lower Klamath River during the 2010 season.

Coded-Wire Tag Recovery

KRP personnel recovered the heads of 76 adipose fin-clipped and coded-wire-tagged (Ad+CWT) Chinook salmon during Julian Weeks 34 through 41 of the 2010 season. There were three 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 two

heads. This left 74 tags to decode. Of these 74 heads, three were from outside the basin (Columbia River). This left 71 CWT's of Klamath- Trinity Basin origin; 43 were adult salmon while 28 were grilse salmon.

No Trinity River Hatchery (TRH) spring Chinook heads were recovered. Recoveries of fin-clipped, fall-run Chinook salmon adults ranged in size from 64 to 94 cm. Grilse ranged in size from 34 cm to 69 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 5.21 percent (73/1,399) of the actual Chinook salmon sampled. Expansions were made for creel sampling and hatchery production multiplier for each tag group. Based on these expansions, CDFG estimated 871 hatchery fish were harvested (Table 7). Hatchery fish represented an estimated 24.45 percent (871/3,562) of the entire sport harvest in the lower Klamath River

Iron Gate Hatchery (IGH) Origin Chinook Salmon

CDFG decoded 17 random recovered tags from Klamath River origin Chinook. These Chinook salmon represent 11 different tag codes; one from the 2006 Brood Year, one from the 2007 Brood Year and nine from the 2008 Brood Year at IGH (Table 6). When expanded for creel sampling and hatchery production multipliers for each tag group, IGH origin fish account for 8.45 percent (301/3,562) of the total sport harvest (Table 7). The IGH origin Chinook were harvested between Julian weeks 33 to 39 (Figure 8).

Trinity River Hatchery (TRH) Origin Chinook Salmon

CDFG decoded a total of 54 randomly recovered tags of IGH fall-run Chinook origin. These Chinook salmon represent 11 different tag codes; none from the 2006 Brood Year, five from the 2007 Brood Year and six from the 2008 Brood Year at IGH (Table 6). TRH origin fish represented 16.00 percent (570/3,562) of the total sport harvest (Table 7). IGH origin Chinook were harvested between Julian Weeks 35 to 42 (Figure 8).

During the 2010 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 Julian week 36 and 38. The bulk of the Trinity River fall-run tags were collected during Julian weeks 37 and 39, No more coded-wire tagged Chinook salmon were recovered after Julian week 42 (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, 2010 season .

		Julian Week											
CWT Code	Brood Year	32	33	34	35	36	37	38	39	40	41	42	Total
Trinity River Hatchery Fall													
65361	2007						2	2	1	1	1		7
68804	2007					1							1
68805	2007					1							1
68806	2007								1				1
68809	2007						8	17	3	2			30
65357	2008					1							1
68814	2008						4		1	1			6
68815	2008						1			1			2
68817	2008					1							1
68818	2008							1		1			2
68820	2008					2							2
Iron Gate Hatchery													
601020704	2006					1	1						2
608020001	2007							1					1
608020002	2008					1							1
608020004	2008					1							1
608020005	2008							1					1
608020006	2008					1		1					2
68644	2008			1		2							3
68645	2008					1	1						2
68646	2008							2					2
68647	2008						1						1
68648	2008							1					1
													0
100000						2							2
200000													0
300000													0
400000													0
Total		0	0	1	0	15	18	26	6	6	1	0	73

Table 7. Fall Chinook salmon harvest proportioned by hatchery origin of the 2010 lower Klamath River sport harvest, expanded for creel sampling and hatchery production multiplier.

Total Fall-run Chinook Salmon	IGH Expanded	TRH Expanded	Estimated Total Hatchery	Per cent Hatchery
Grilse 1,506	162	178	340	22.6
Adults 2,057	139	392	531	25.8
Total 3,563	301	570	871	24.4

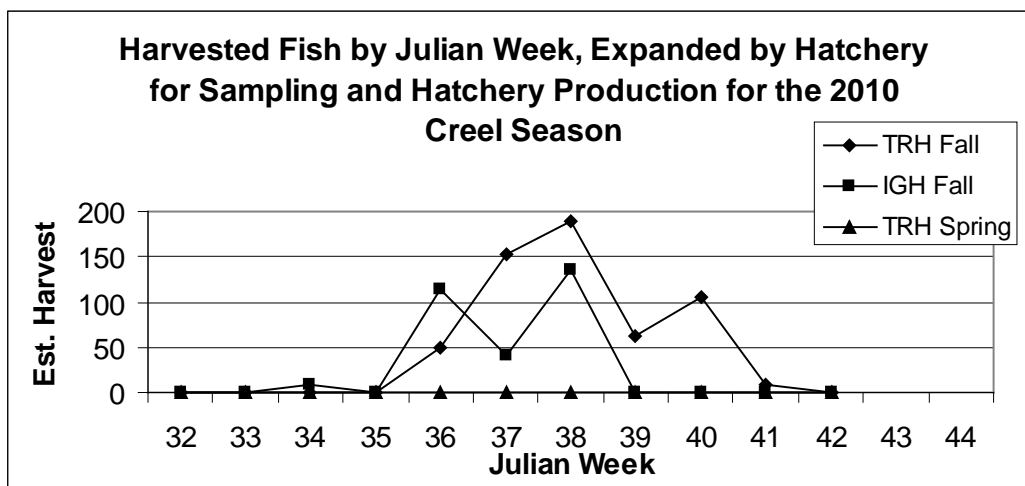


Figure 8. Timing by Julian week of coded wire tags, expanded for sampling and by individual tag code, recovered from Chinook salmon in the lower Klamath River 2010 creel season.

DISCUSSION

The lower Klamath River sport Chinook fishery is composed of fish produced naturally from the Klamath and Trinity river basins and fish produced at IGH and TRH. Based on creel sampling and hatchery production expansion factors, the estimated 2010 sport harvest was composed of approximately 24.5 percent hatchery and 75.5 naturally produced Chinook. The hatchery contribution was composed of 8.45 percent IGH Chinook and 16 percent TRH Chinook. In contrast, the previous twelve years of hatchery contributions to lower Klamath River Chinook harvests have averaged 15 percent TRH Chinook and 23 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.

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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.

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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2010-2011 SEASON**

**TASK 6
JUVENILE COHO SALMON SUMMER DISTRIBUTION
IN THE UPPER TRINITY RIVER**

ABSTRACT

California Department of Fish and Game (CDFG) used direct observation surveys with mask and snorkel to detect naturally produced juvenile coho salmon (*Oncorhynchus kisutch*) in side channel and alcove habitat in the upper Trinity River. The surveys were conducted during two days; June 22-23, 2010. Observations of coho young-of-the-year (YOY) were recorded at 41 side channel or alcove sites located in the upper Trinity River from river kilometer (rkm) 170 to rkm 180. Thirty-six of the observation sites have received habitat improvement treatments associated with the Trinity River Restoration Program. Habitat improvements include improving river and fish access and addition of woody debris. Unimproved sites were deemed to contain natural characteristics attractive to juvenile coho. The discharge from Lewiston Dam at the time the surveys was approximately 2,150 cubic feet per second (cfs). The numbers of YOY coho detected at each observation site ranged from 0 to 17 fish. Coho presence was detected at all sites except one habitat improvement site.

INTRODUCTION

A past study conducted by California Department of Fish and Game (CDFG) found that summer juvenile coho salmon (*Oncorhynchus kisutch*) distribution in the upper Trinity River is highly clustered around slower backwater, off-channel areas, such as alcoves and side channels. Within these habitats, non-emergent vegetation and large and small wood debris is cover preferred by juvenile coho. Juvenile coho also preferred water column velocities of less than 1 foot per second, depths averaging less than 3 feet and water temperatures between 9 and 12 °C (Garrison and Sinnen 2008). Garrison and Sinnen (2008) made their observations during summer base flows of 450 cubic-feet-per-second (cfs). The present study was performed during higher flows of 2,150 cfs to monitor juvenile coho salmon use of side channel habitats modified by TRRP and naturally functioning off-channel areas.

A goal of the Trinity River Restoration Program (TRRP) is to increase natural production of juvenile coho through habitat modifications based on the type of information provided by Garrison and Sinnen (2008) and this study. Increasing natural production in the

upper Trinity River by improving juvenile rearing habitat is included in CDFG's recovery strategies for State and federally listed as threatened coho (CDFG 2004). Recent improvements to side channel areas made by the (TRRP) include opening access to flow and addition of wood debris to increase channel complexity and to provide cover elements for juvenile coho side channels.

METHODS

Direct observation surveys with mask and snorkel were conducted in seven side channel or alcove habitat areas located in the Upper Trinity River from river kilometer (rkm) 170 to rkm 180 (Figure 1). The surveys were performed by CDFG staff on June 22-23, 2010. Stream flow below Lewiston Dam at the time of the survey was approximately 2,150 cubic feet per second (cfs). River temperature was recorded at 10°C (50°F) for both survey days. The Sven Olbertson and Saw Mill areas were accessed by foot on June 22. The remaining areas were access by floating downstream in a raft on June 23.

Single count coho observations were made by two snorkelers moving upstream within side channels or alcoves. Observation points were identified based on upon observed presence or counts of coho within the side channel or alcove habitat area. Waypoints locating the observation points were determined by a third person on shore using a hand held Garmin™ global positioning navigation device.^a The third person recorded all information on data forms including coho counts, waypoint datum, indicated if the fish were associated with the right or left bank or middle of the channel, and if observations were within a TRRP habitat improvement site. The observation waypoints were plotted on the study area map below.

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.

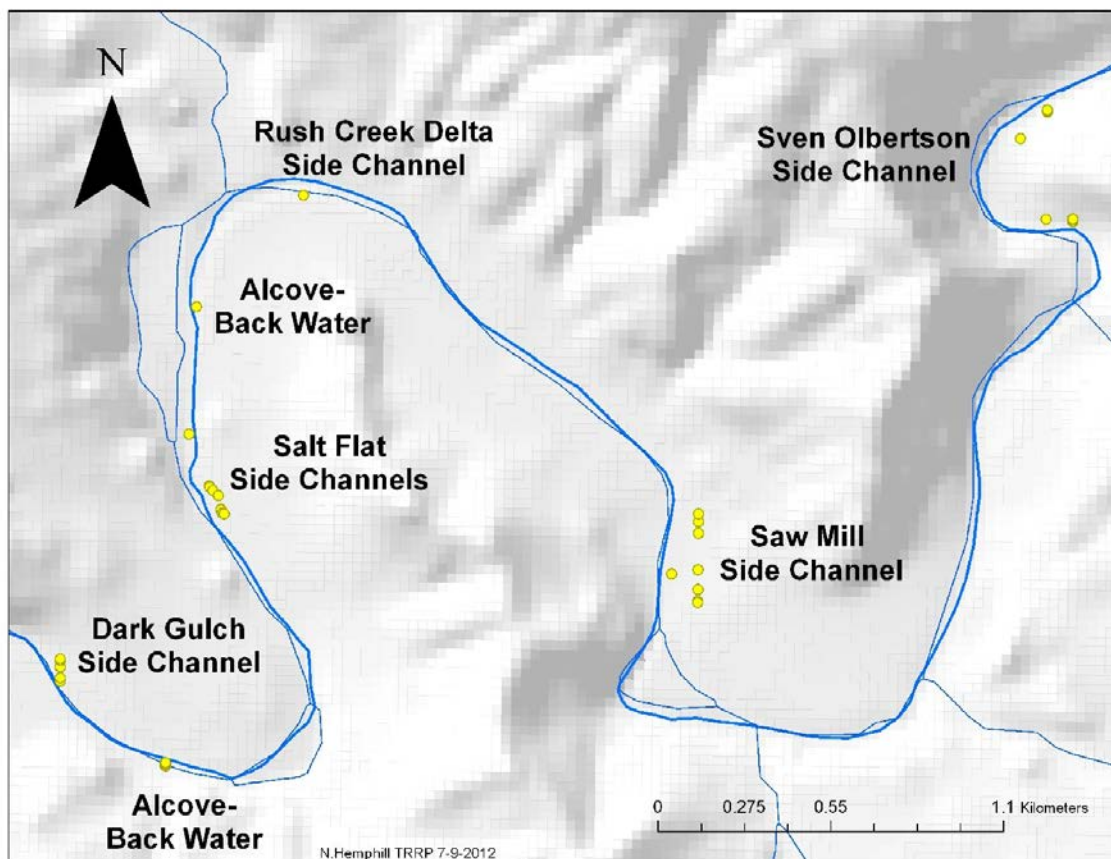


Figure 1. Direct observation study area map showing approximate locations of side channel and alcove habitat areas and juvenile coho observation points, August 2010.

RESULTS

Observations of naturally produced juvenile coho were recorded at 41 sites located in the upper Trinity River from rkm 170 to rkm 180. The numbers of YOY coho detected at each observation site ranged from zero to 17 fish (Table 1). Coho presence was detected at all sites except one habitat improvement site located at site 19 within the Saw Mill side channel area. However, ten juvenile Chinook salmon (*Oncorhynchus tshawytscha*) were observed at site 19.

Table 1. Observation site information and counts of coho salmon during mask and snorkel surveys of upper Trinity River, August 2010.

Site No.	Date	Map Location	River Kilometer	Coho Count	Channel Type	Bank (R,M,L)	Restoration Site (Y/N)
1	6/22	Sven Olb ¹	179.52	3	SC ²	R	Y
2	6/22	Sven Olb	179.53	2	SC	L	Y
3	6/22	Sven Olb	179.54	15	SC	R	Y
4	6/22	Sven Olb	179.40	3	SC	L	Y
5	6/22	Sven Olb	179.12	12	SC	L	Y
6	6/22	Sven Olb	179.06	3	SC	R	Y
7	6/22	Sven Olb	179.04	1	SC	L	Y
8	6/22	Sven Olb	179.03	6	SC	L	Y
9	6/22	Sven Olb	179.01	7	SC	L	Y
10	6/22	Sven Olb	178.98	11	SC	L	Y
11	6/22	Saw Mill	176.15	7	SC	R	Y
12	6/22	Saw Mill	176.16	12	SC	L	Y
13	6/22	Saw Mill	176.10	20	SC	L	Y
14	6/22	Saw Mill	176.01	6	SC	L	Y
15	6/22	Saw Mill	175.90	2	SC	L	Y
16	6/22	Saw Mill	175.74	10	SC	L	Y
17	6/22	Saw Mill	175.70	2	SC	L	Y
18	6/22	Saw Mill	175.68	12	SC	R	Y
19	6/23	Saw Mill	175.48	0	SC	L	Y
20	6/23	Rush Creek	173.95	7	SC	L	N
21	6/23	Salt Flat	172.80	3	SC	L	Y
22	6/23	Salt Flat	172.78	1	SC	L	Y
23	6/23	Salt Flat	172.82	1	Alcove	R	Y
24	6/23	Salt Flat	172.64	12	SC	R	Y
25	6/23	Salt Flat	172.64	2	SC	L	Y
26	6/23	Salt Flat	172.63	1	SC	L	Y
27	6/23	Salt Flat	172.60	2	SC	L	Y
28	6/23	Salt Flat	172.55	12	SC	L	Y
29	6/23	Salt Flat	172.55	3	SC	R	Y
30	6/23	Salt Flat	172.53	3	SC	L	Y
31	6/23	Salt Flat	172.53	2	SC	R	Y
32	6/23	Salt Flat	172.48	4	SC	R	Y
33	6/23	Dark Gulch	171.10	2	Alcove	L	N
34	6/23	Dark Gulch	171.11	1	Alcove	L	N
35	6/23	Dark Gulch	171.12	17	Alcove	L	N
36	6/23	Dark Gulch	171.13	3	Alcove	L	N
37	6/23	Dark Gulch	170.75	3	SC	R	Y
38	6/23	Dark Gulch	170.74	1	SC	R	Y
39	6/23	Dark Gulch	170.70	7	SC	R	Y
40	6/23	Dark Gulch	170.68	1	SC	R	Y
41	6/23	Dark Gulch	170.67	2	SC	L	Y

¹ Sven Olbertson

² Side Channel

DISCUSSION

This study was not designed to detect coho preference for any naturally occurring or modified habitats. It was done to perform a low level qualitative assessment of juvenile coho use of a select area within the upper Trinity River including sites that have received habitat improvement treatments. However, this study further documents juvenile coho use of side channels and alcoves in the upper Trinity River. The fish were observed during flows of 2,150 cfs from June 22-23, 2009. The observations add to coho use of off-channel habitats baseline data. Previous surveys of the upper Trinity River found juvenile coho use of side channels and alcoves during July 25 and September 22, 2006 during summer base flows of 450 cfs (Garrison and Sinnen 2008). Several other studies (eg. Bell et al 2001, Beechie et al 1994, Swales and Levings 1989) have demonstrated the importance of off-channel habitat for winter rearing and flooding episodes. Collectively these other studies and our observations indicate slow flowing side channels and alcoves in the upper Trinity River are likely critical coho habitat during summer months and over a range of flows (450 and 2,150 cfs). Surveys for juvenile coho use of off-channel habitat in the upper Trinity River during the other seasons and flows would add to the upper Trinity River baseline data.

Garrison and Sinnen (2008) observed in-stream cover in off-channel habitat was predominantly provided by emergent vegetation and small wood debris. They reported infrequent abundance of large wood as protective cover for coho in off-channel areas. They also noted poor large wood recruitment potential to off-channel areas due to damming of the river and past logging projects. Given this information, additions of large wood should be considered when planning side channel improvement projects. Large wood will provide a beneficial increase in shelter complexity and can provide channel forming elements to maintain side channel morphology. In addition, the loss of ample supplies of cool water is identified as a primary factor associated with severely depleted or extirpated coho populations in many California streams (CDFG 2004). Utilizing the cool Trinity River flows to supply side channels and other off-channel habitats emerges as an important adaptive management strategy to increase quality of juvenile coho rearing area. Thus, careful planning to maintain or increase the area and complexity of slow flowing side channel and alcove habitat should remain a high priority goal of the TRRP.

RECOMMENDATIONS

1. The TRRP should continue management efforts to improve habitat conditions to support natural juvenile coho rearing habitat in the upper Trinity River.
2. Carefully designed studies should be planned to monitor coho use of future coho habitat improvement sites prior to project construction and post construction to evaluate project effectiveness.

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