State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

FINAL ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD
MONITORING PROJECT
2009-2010 SEASON

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2009-2010 SEASON

Authored by:

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Northern Region
Klamath and Trinity River Projects

Northern Region
601 Locust Street
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July 2011

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Foreward

This is the twenty-first annual report to the United States Bureau of Reclamation (USBOR). This year's activities were conducted under terms of Cooperative Agreement Number R11AC20520, and cover the period of January 1, 2009 through December 31, 2009. The field work was conducted by personnel of the California Department of Fish and Game's (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 the USBOR for cooperative and singular work performed during FFY 2009. Please refer to those respective agency/tribal fisheries departments or USBOR for information regarding other projects/studies.

This year's CDFG work was comprised of six separate projects (Tasks) performed on the lower Klamath River, main stem Trinity River, and at Trinity River Hatchery. The necessity for performing our Klamath-Trinity basin monitoring activities have been outlined in several Acts of Congress including Public Law 386 (69 Stat. 719), August 12, 1955; Public Law 98-541, October 24, 1984; "Trinity River Basin Fish and Wildlife Management Reauthorization Act" of 1995; and Trinity River "Record of Decision", 2000.

Acknowledgements

Thank you to the CDFG technicians who made possible our field seasons: Carmen Arey, Nancy Barnes, Linda Battin, Jason Coburn, Daniel Dempsey, Becky Dutra, Melissa Gordon, Mark Kerr, Carl Meredith, Todd Newhouse, Justin Pabich, Roddy Park, Warren Peterson, Vanessa Rosenthal, Daniel Santsche, Jane Sartori, Guy Smith, Ron Smith, Cadella Thomas, Cindy Walker and Eileen Williams. Thanks too to Brenda Tuel for the office support. A special thanks to Linda Allan who, after coming to the Trinity River Project in 1984 (after a year on the Smith River) has been there, steadfastly assisting the biologists of CDFG Weaverville, ever since. Linda retired in 2010

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 also greatly appreciate the cooperation of the CDFG Trinity River Hatchery staff during salmonid recovery, and the following landowners: Doris Chase, Tom O'Gorman, Pierre LeFuel, the Bureau of Land Management and the U.S. Forest Service.

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 Mike Hamman and the TRRP staff for their input and effort administering our projects and contracts.

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ANNUAL REPORT
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2009-10 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 (TRP) conducted tagging and recapture operations from June 2009 through March 2010 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 project is conducted by the California Department of Fish and Game (CDFG) in cooperation with the Hoopa Valley Tribal Fisheries Department (HVTF). Two main stem weirs were placed in the Trinity River near the towns of Junction City and Willow Creek, and trapped 1,469 Chinook salmon, 202 coho salmon, 1,730 fall steelhead and 171 brown trout (*Salmo trutta*).

Based on Project-tagged fish recovered at Trinity River Hatchery (TRH) and on the return of reward tags by anglers, an estimated 7,426 spring Chinook migrated into the Trinity River basin upstream of Junction City weir (JCW). An estimated 442 spring Chinook were caught by anglers, leaving 6,984 fish as potential spawners. An estimated 29,593 fall Chinook migrated past Willow Creek weir (WCW), of which an estimated 704 were caught by anglers, leaving 28,889 potential spawners.

The coho salmon (coho) run in the Trinity River basin upstream of WCW was estimated at 6,396 fish. Zero coho were estimated as harvested by anglers, leaving all 6,396 as potential spawners.

An estimated 18,361 (5,047 naturally produced and 13,314 hatchery produced) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 1,530 adult fall steelhead above the WCW, leaving 16,831 fish as potential spawners.

TASK OBJECTIVES

1. To determine the size, composition, distribution, and timing of adult Chinook salmon, coho salmon, and steelhead runs in the Trinity River basin.

2. To determine the in-river angler harvest and spawner escapements of Trinity River Chinook salmon and coho salmon, and steelhead.

INTRODUCTION

The California Department of Fish and Game's TRP, in cooperation with the HVTF, conducts annual tagging and recapture operations of adult Chinook and coho salmon, and fall steelhead in the main stem Trinity River. This effort determines the composition (race and proportion of hatchery-marked[1/] or Project-tagged[2/] fish), distribution, and timing of Chinook salmon, coho salmon, and fall steelhead runs in the Trinity River basin. Recaptures of hatchery-marked or Project-tagged fish are used to develop run-size, angler harvest, and spawner escapement estimates for Chinook and coho salmon, and steelhead runs. Additionally, tagging of brown trout continued to determine angler harvest and growth rates.

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). In 1978, similar studies were added to include spring-run Chinook salmon (spring Chinook). Steelhead were dropped from the program in 1985 through 1989 and reinstated in 1990. Results of these studies are available from California Department of Fish and Game (Heubach and Hubbell (1980); Heubach (1984a, 1984b); Heubach et al. (1992a, 1992b); Lau et al. (1994, 1998, 2000); Zuspan et al. (1985, 1995); Zuspan and Sinnen (1995); Sinnen and Hanson (1996); Zuspan (1996, 1997); Sinnen et al. (2001); Sinnen and Reese (2002, 2004); Reese (2004); Reese and Sinnen (2004); Sinnen and Knechtle (2005); Knechtle and Sinnen (2006, 2007, 2009), Sinnen and Kier (2009), and Kier and Sinnen (2010)).

Earlier studies were funded by the U.S. Bureau of Reclamation (USBR), and with Anadromous Fish Act funds administered by the U.S. Fish and Wildlife Service and National Marine Fisheries Service. The USBR has funded the program from October 1, 1989 through the present.

Prior to the current program, all efforts to measure salmon and steelhead populations in the Trinity River basin had been restricted to portions of the upper main stem Trinity River and several of its tributaries, including the South Fork Trinity River and some of its

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[1] Adipose fin-clipped and coded-wire-tagged (Ad and CWT), hatchery-produced Chinook and right-maxillary-clipped coho salmon.
[2] Spaghetti tags applied by CDFG personnel to returning spawning-run fish.

tributaries (Moffett and Smith (1950); Gibbs (1956); LaFaunce (1965a, 1965b, 1967); Weber (1965); Rogers (1970, 1972, 1973a, 1973b, 1982); Miller (1975); and Smith (1975). Earlier efforts did not include fish which used the main stem and tributaries of the lower Trinity River nor attempt to determine the proportion of hatchery fish in the runs and the rates at which various runs contributed to the fisheries. To develop a comprehensive management plan for the Trinity River basin, it was decided all salmon stocks utilizing the basin must be considered, though the majority of the monitoring funding is now main stem Trinity River specific.

METHODS

Trapping and Tagging

Trapping Locations and Periods

Trapping and tagging operations were conducted by TRP and HVTF personnel from June through late November 2009 at temporary weir sites near the towns of Willow Creek and Junction City on the main stem Trinity River. The downstream site, WCW, was located 36.5 km upstream from the Trinity River's confluence with the Klamath River (40º 58’ 29.85” N, 123º 38’ 8.61” W). The upstream site, JCW, was located 132.7 km upstream from the Klamath River confluence (40º 41’ 5.51” N, 123º 01’ 35.55” W) (Figure 1). In general, prior to 1995, JCW was operated from May through November. Since a court-mandated flow regime change was instituted in 1995, JCW has operated from late-June or mid-July (the earliest the weir can be effectively installed with the higher regulated flows) through September, with the exception of 2005 when an attempt was made to obtain additional estimates and JCW was operated from mid-July through the end of November. WCW is typically operated from mid-August through November. Most fall Chinook spawning occurs upstream of WCW, while the majority of spring Chinook spawning occurs upstream of JCW.

The JCW was operated July 17 through September 30, 2009, and the WCW was operated August 31 through November 19, 2009. At both weir sites, trapping was 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 was opened for at least five hours to allow fish to pass unimpeded through the weir, and it was generally opened over the weekend as well. Occasionally, trapping schedules were modified to allow for holidays or high flows which prevented trapping in a safe manner. Trapping and tagging were not conducted if stream temperatures exceeded 22º Celsius.

Weir and Trap Design

Since 1989, a Bertoni (Alaskan) weir design has been used at both sites (Figures 2-4). The weir is supported by wooden tripods set 2.5 m apart. Weir panels consisted of 3.0 m x 1.9 cm (10 ft x ¾ in) electrical conduit spaced 5.1 cm apart on center, leaving a gap of 3.2 cm between conduits. Conduit pieces are supported by three sections of aluminum channel arranged 0.92 m apart, which are connected to the supporting tripods. The tripods are anchored with cable to 1.8 m stakes driven into the stream bottom. The weir panels are angled at roughly a 45º angle, with the top of the weir standing 1.8 m above the river bottom.

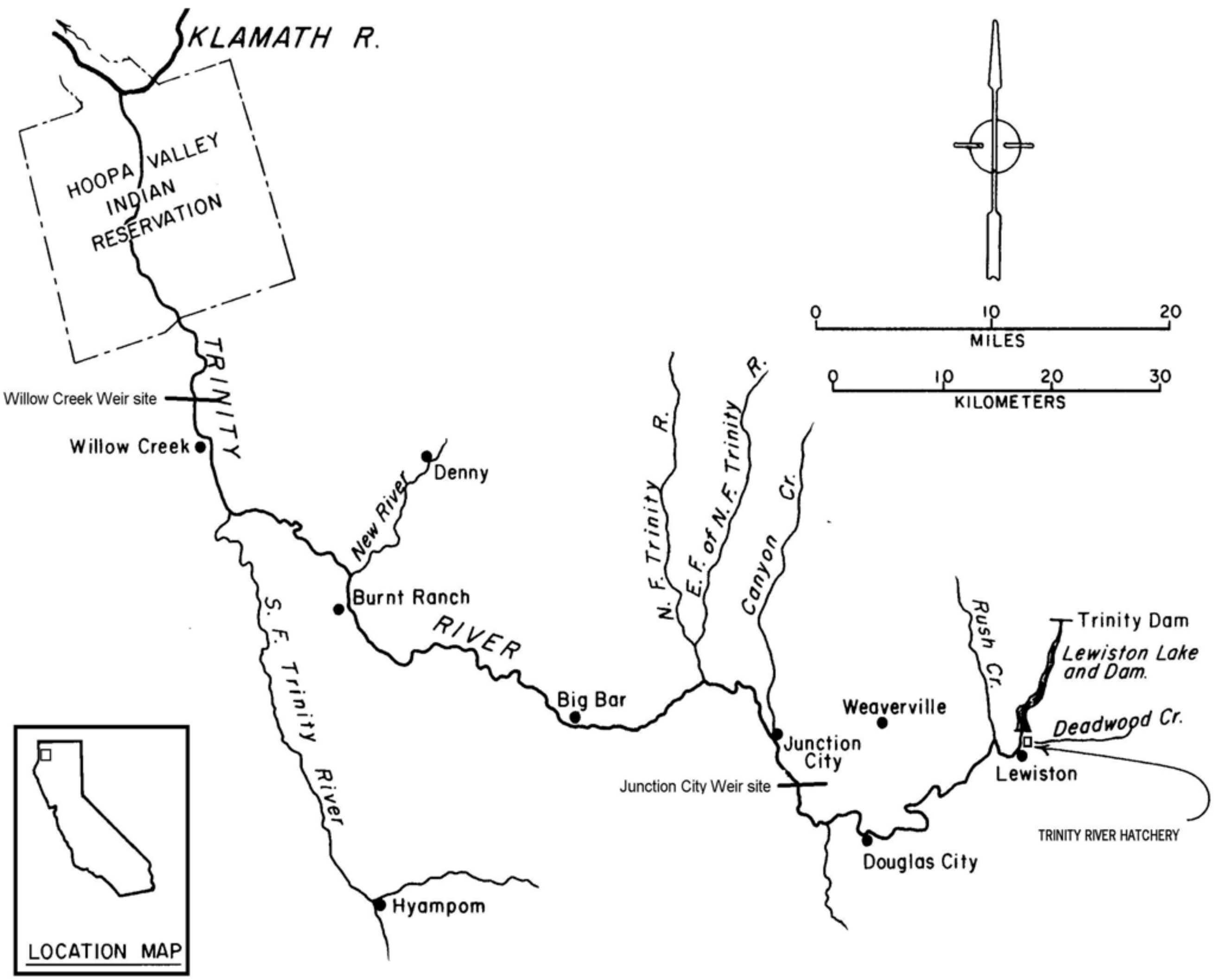


Figure 1. Location of trapping/tagging weirs for anadromous salmonids near Willow Creek and Junction City in the main stem Trinity River, 2009 season.

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

Figure 3. Photo (looking downstream) of 2009 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 in 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 a livestock gate and was sloped downstream, even with the weir.

Processing of Fish

At both weirs, all trapped salmonids were 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 were inserted using an applicator needle through the fish's back approximately two cm below the base of the dorsal fin and ¼ the length of the dorsal fin, anterior of the posterior edge of the dorsal fin. At both weirs one-third of the Chinook received $10-reward tags, while the remaining two-thirds received non-reward tags. At

[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.

WCW one-half of the adult steelhead received reward tags while the remaining fish received non-reward tags, while all the steelhead tagged at JCW were tagged with non-reward tags. Juvenile, or “half-pounder”, steelhead were not tagged at either weir. Coho were tagged with non-reward tags at WCW, though none were tagged (nor trapped) at JCW. At JCW, brown trout were tagged with serially numbered (Floy) FD-94 anchor tags, while any brown trout tagged at WCW were done so with FT-4 spaghetti non-reward tags.

Determining the Separation between Spring and Fall Chinook Runs at the Weirs

Each year there is a temporal overlap in the spring and fall Chinook runs in the Trinity River. Run timing varies between years, and each season dates are assigned that separate the spring and fall Chinook runs. This separation is determined by comparing proportions of known and estimated spring and fall Chinook trapped at the weirs each week. The week in which the proportion of fall Chinook exceeds spring Chinook is designated as the first week of the fall Chinook run at that 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.

A recovered Project-tagged Chinook is identified as either a spring or a fall Chinook based on two separate criteria. First, some Chinook tagged at the weirs have coded-wire tags (CWTs) which were placed in their snouts as juveniles at TRH. These fish are identifiable by the absence of their adipose fin, which is clipped off (ad-clipped) during the CWT tagging process. If these fish are recovered at the hatchery or during spawner surveys, the CWT code (which is determined after the CWT is removed from the snout of the fish and read using a microscope) indicates whether they were spring or fall fish. Second, non-CWTed Chinook (Project-tagged at the weir then recovered at the hatchery) are classified as either spring or fall fish based on the date they entered the hatchery. If they entered the hatchery during the period associated with the spring run (based on CWT recoveries at the hatchery) they were considered spring Chinook. The Chinook entering the hatchery during the period associated with the fall run (based on CWT recoveries) were considered fall Chinook.

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

Throughout this report we refer to fall-run adult steelhead, when in actuality we are reporting on a mix of runs. Most of the steelhead we encounter at the WCW are undoubtedly fall-run steelhead, but there is temporal over-lap in the run-timing of the summer, fall, and winter runs, as evidenced by a higher proportion of fish caught without adipose 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.

Estimating Numbers of Spring and Fall Chinook at Trinity River Hatchery
As at the weirs, there is an overlap in the return timing of spring and fall Chinook into TRH. To estimate the respective numbers of spring and fall Chinook without CWTs that entered TRH, the numbers of tags recovered from each returning CWT group were 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, 126,729 fall Chinook of CWT group 06-52-99 plus 382,157 unmarked fall Chinook were released from TRH in June of 2003. The expanded estimate for each return from this group is 4.015 (126,729+382,157/126,729). Each CWT return was expanded by its production multiplier to estimate the total number of spring and 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 were considered to be naturally produced. These fish were 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.

To estimate spring and fall Chinook run-sizes, a separation date at the hatchery was assigned between the two runs. The separation date was the week in which fall Chinook out-numbered spring Chinook based on the expansion of CWTs.

Size Discrimination Between Adult and Grilse Chinook and Coho Salmon
The size separating adult and grilse spring and fall Chinook was 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 entered TRH whose exact age was known. Fork length data from TRH Chinook was only used from weeks in which ≥ 90% of the Chinook could be designated as either spring run or fall run as explained by the expansion of CWTs.

Coho salmon do not receive CWTs, therefore exact ages are unknown. The separation of grilse and adult coho salmon was based entirely on length-frequency analysis.

Chinook and coho salmon length-frequency data collected at the weirs and TRH were smoothed with a moving average of five 1-cm increments to determine the nadir separating grilse and adults.

Size Discrimination Between Adult and Immature Steelhead
All steelhead >41 cm FL were considered adults, and steelhead ≤41 cm FL captured at the weirs were assumed to be half-pounders (assumed to have migrated to, and back from, the ocean). Steelhead ≤41 cm FL that entered TRH were not counted and were classified as sub-adults.

Recovery of Tagged Fish

<u>Weir Recovery</u>
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.

<u>Tagging Mortalities</u>
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 ≤21 days after tagging. Tagged fish recovered dead more than 21 days after tagging, or those that had spawned, regardless of the number of days after tagging, were not considered tagging mortalities.

<u>Angler Tag Returns</u>
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 location.

Tags returned to the TRP Arcata field office through May 31, 2010 were included in assessing harvest and catch and release rates. Tags returned after that date were processed for payment but not used for analysis.

<u>Trinity River Hatchery Returns</u>
The TRH fish ladder was open September 08 through March 10, 2010. TRH closed the fish ladder between October 13 and October 24 (Julian week (JW) 42 plus a couple of days on each side of JW 42) as a means of separation of the spring and fall Chinook races, based on CWT analysis of recovered Chinook. Hatchery personnel typically conducted fish spawning operations two days per week during the Chinook and coho spawn. Additional spawn days occurred during the peak of the runs in November. Steelhead spawning operations ensued one day per week from January into March.

All salmon and steelhead entering TRH were identified to species, sexed, examined for tags and clips, and measured to the nearest cm FL. Each salmon and steelhead that enters the TRH spawning house is measured to the nearest cm FL only once.

Since fish are measured and counted only once, individual fish are marked at the time of first TRH entry. Coho and adult steelhead that come through the hatchery prior to the start of the TRH spawning of those species get upper caudal fin clips prior to live release to the river. Both coho and steelhead are known to make multiple returns to the hatchery trap 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 ripe or unripe. Ripe salmon are either spawned or excised, and ripe steelhead either spawned or returned to the river. Unripe salmon are either moved to holding tanks for further ripening (up to 14 days) or are excised, and unripe steelhead 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 were 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 were recorded from all holdover fish when processed.

TRH routinely holds over unripe fish at the beginning of the spawning of each of the races of Chinook, coho and steelhead. Once the TRH egg-take quota is reached they cease to hold fish over.

In the database the Project-tagged salmon and steelhead recovered at TRH were generally assigned the FL recorded for them at the weir. The heads of all ad-clipped salmon were 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 performed extraction and decoding of those 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 was estimated by subtracting from the total tagged those fish that were classified as tagging mortalities, tagged fish recovered downstream of the tagging site, and angler caught and released fish.

Run-size Estimates

Run-size estimates were calculated using Chapman's version[4/] of the Petersen Single Census Method (Ricker 1975):

[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).

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

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.

Annually, TRP staff attempt to tag and recover enough fish to obtain 95% confidence within ±10% of the run-size estimate. The confidence interval estimator is selected using criteria established by Chapman (1948). This year 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 run size as a whole. We then used the proportion of grilse/adults observed (at the JC weir and TRH combined for spring Chinook, at the WC weir and TRH combined for coho, and at WCW only for fall Chinook) and applied those proportions to the run-size estimate to break it into grilse/adult numbers.

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

Assumptions of run size estimates are: 1) Fish trapped and released from the weir were a random sample representative of the population; 2) Tagged and untagged fish were equally vulnerable to recapture at TRH; 3) All Project tags were recognized upon recovery; 4) Tagged and untagged fish were randomly mixed throughout the population and among the fish recovered at TRH; and 5) All tag loss was accounted for.

Angler Harvest and Catch and Release Rates and Harvest Estimates

When reward tags are returned 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 were calculated for each species (and run of Chinook) by dividing the number of angler-returned tags from harvested fish by the number of fish that were effectively tagged. Independent harvest rates were calculated for grilse and adult salmon. Catch and release rate for each species (and run of Chinook) were 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 numbers of fish harvested upstream of each weir were 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 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
Chinook were designated as either spring-run (spring) or fall-run (fall) based on recovery of coded-wire tags or entry-timing into Trinity River Hatchery. For purpose of analysis, the spring/fall separation point is a hard date, but in reality the timing of the two runs of Chinook frequently overlaps.

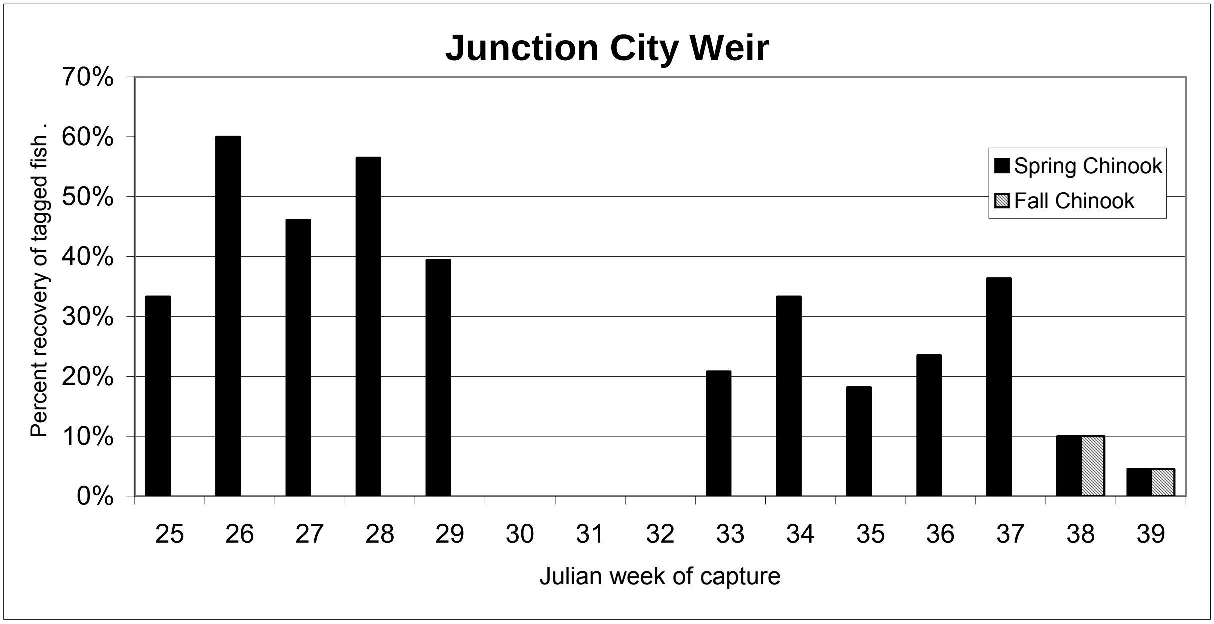
Both spring and fall Chinook were trapped at JCW (Figure 5) in 2009. Spring Chinook trapping peaked during JW 28 at 11.5 fish per night decreasing in a patternless manner, eventually yielding to fall Chinook in JW 39 (Table 1, Figure 6).

At WCW in 2009, we were unable to install the weir until 30 August (JW 35) due to flow releases from Lewiston Dam to facilitate the Hoopa Valley Tribal Boat Dance. Because of the relatively late start we did not trap any spring Chinook. Julian week 38 was our peak catch of fall Chinook with 61.8 fish trapped per night. The catch dropped off fairly dramatically after that, averaging fewer than 10 Chinook per night through the remainder of the season (Table 2, Figure 7). We removed the weir from the river, for the season, on 19 November (JW 47).

Size of Trapped Fish
Spring Chinook trapped at JCW and TRH averaged 66.8 and 68.1 cm FL, respectively, with a combined average 68.0 cm FL (Figure 8, Appendix 4). The nadir between grilse and adult spring Chinook indicated a maximum grilse size of 49 cm FL. Data from known age, hatchery-marked spring Chinook that entered TRH reinforced a minimum adult fork length of 50 cm. There was no overlap between sizes of age 2 and age 3 fish (Appendix 2), though quite a bit of overlap was seen between the age 3, 4 and 5 fish. Applying the minimum adult size of 50 cm FL to observed populations of Chinook, an estimated 2.2% of the spring Chinook observed were grilse at JCW, and 3.5% at TRH. Historically, the maximum spring Chinook grilse FL averages 52 cm, and has only been greater than 56 cm once, since 1977.

Fall Chinook trapped at WCW and TRH averaged 64.8 and 69.3 cm FL, respectively, with a combined average FL of 68.7 cm. (Figure 9). The nadir between grilse and adult fall Chinook indicated a maximum grilse size of 54 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 54 cm, fall Chinook grilse comprised 20.3% and 1.8% of the run observed at WCW and TRH respectively. The maximum grilse FL averages 54 cm over the 33 year period of record.



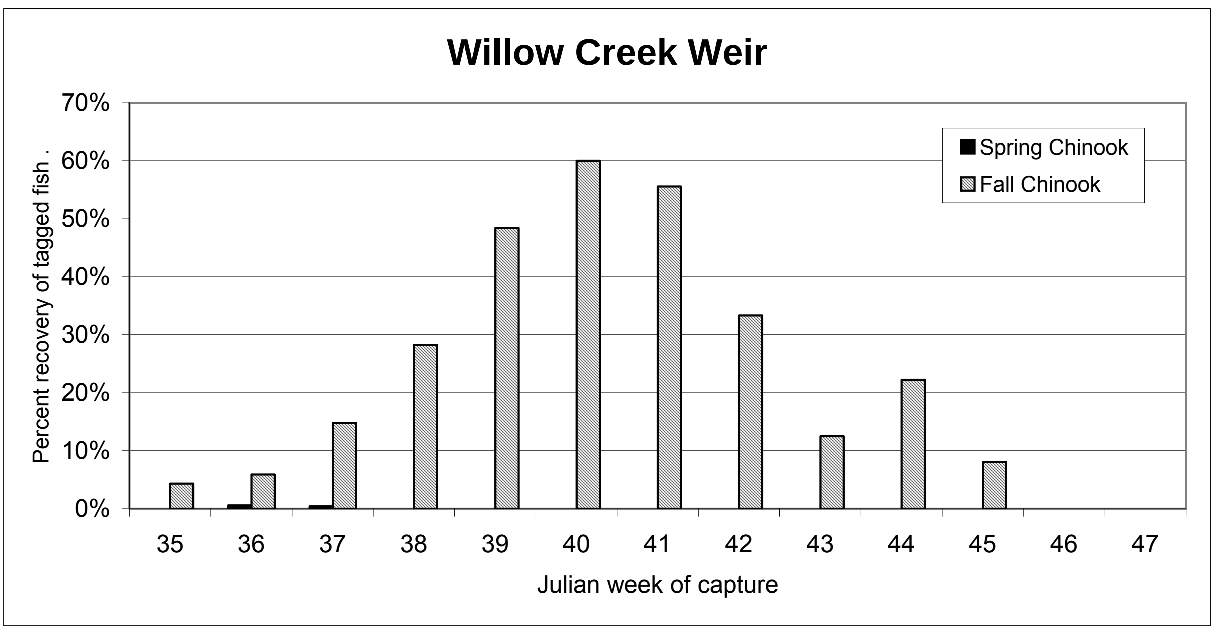


Figure 5. Percent recovery of Junction City weir and Willow Creek weir marked Chinook at Trinity River Hatchery during the 2009-10 season.

Table 1. Weekly summary of Chinook trapped in the Trinity River at Junction City weir during 2009. [a]

Julian week	Inclusive dates	Nights Trapped	Number trapped: Grilse [b]	Ad-clips	Adults	Ad-clips [c]	Total	Ad-clip total	Fish/night
Spring Chinook									
24	11-Jun - 17-Jun	1			0	0	0	0	0.0
25	18-Jun - 24-Jun	5			10	3	10	3	2.0
26	25-Jun - 1-Jul	5			45	9	45	9	9.0
27	2-Jul - 8-Jul	5			40	5	40	5	8.0
28	9-Jul - 15-Jul	4			46	7	46	7	11.5
29	16-Jul - 22-Jul	4			33	4	33	4	8.3
30	23-Jul - 29-Jul	4			4	1	4	1	1.0
31	30-Jul - 5-Aug	5			1	1	1	1	0.2
32	6-Aug - 12-Aug	4			2	0	2	0	0.5
33	13-Aug - 19-Aug	4	1		23	1	24	1	6.0
34	20-Aug - 26-Aug	1	0		3	0	3	0	3.0
35	27-Aug - 2-Sep	3	1		10	1	11	1	3.7
36	3-Sep - 9-Sep	3	4		13	1	17	1	5.7
37	10-Sep - 16-Sep	4	1		10	1	11	1	2.8
38	17-Sep - 23-Sep	4	2		8	0	10	0	2.5
	Sub-total:	56	9	0	248	34	257	34	
	Mean:								4.6
Fall Chinook									
39	24-Sep - 30-Sep	5	3	1	19	3	22	4	4.4
	Sub-total:	5	3	1	19	3	22	4	
	Mean:								4.4
	Grand total:	61	12	1	267	37	279	38	

a/ Trapping at Junction City weir took place June 16 - September 30, 2009 (Julian weeks 24-39).
b/ Spring Chinook <50 cm FL were considered grilse in 2009.
c/ Adipose fin-clipped Chinook. Number shown is a subset of weekly grilse and adults totals.

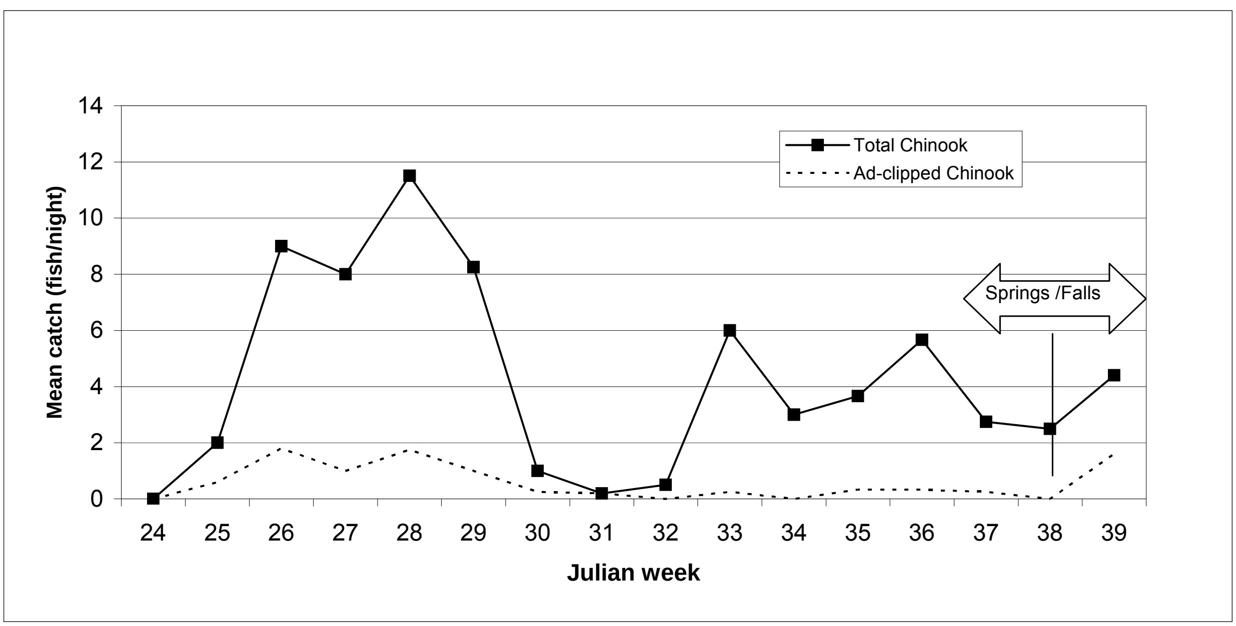


Figure 6. Mean catch of Chinook in the Trinity River at Junction City weir during 2009. Note the deliniation between the spring and fall runs at Julian week 38.

Table 2. Weekly summary of Chinook trapped in the Trinity River at Willow Creek weir during 2009. [a]

Julian week	Inclusive dates	Nights trapped	Number trapped: Grilse [b]	Ad-clips	Adults	Ad-clips [c]	Total	Ad-clip total	Fish/night
Fall Chinook									
35	27-Aug - 2-Sep	2	26		68	2	94	2	47.0
36	3-Sep - 9-Sep	5	38		132	1	170	1	34.0
37	10-Sep - 16-Sep	6	79	1	178	14	257	15	42.8
38	17-Sep - 23-Sep	5	63	2	246	29	309	31	61.8
39	24-Sep - 30-Sep	5	20		171	32	191	32	38.2
40	1-Oct - 7-Oct	4	2		23	4	25	4	6.3
41	8-Oct - 14-Oct	4	0		36	9	36	9	9.0
42	15-Oct - 21-Oct	4	1		25	5	26	5	6.5
43	22-Oct - 28-Oct	4	2		15	1	17	1	4.3
44	29-Oct - 4-Nov	5	2		16	3	18	3	3.6
45	5-Nov - 11-Nov	7	4		32	2	36	2	5.1
46	12-Nov - 18-Nov	5	5		6	0	11	0	2.2
47	19-Nov - 25-Nov	1	0		0	0	0	0	0.0
	Total:	57	242	3	948	102	1,190	105	
	Mean:								20.9

a/ Trapping at Willow Creek weir took place August 31 - November 19, 2009 (Julian weeks 35-47).

b/ Chinook <55 cm FL were considered grilse in 2009. All Chinook trapped at WCW were fall Chinook in 2009.

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

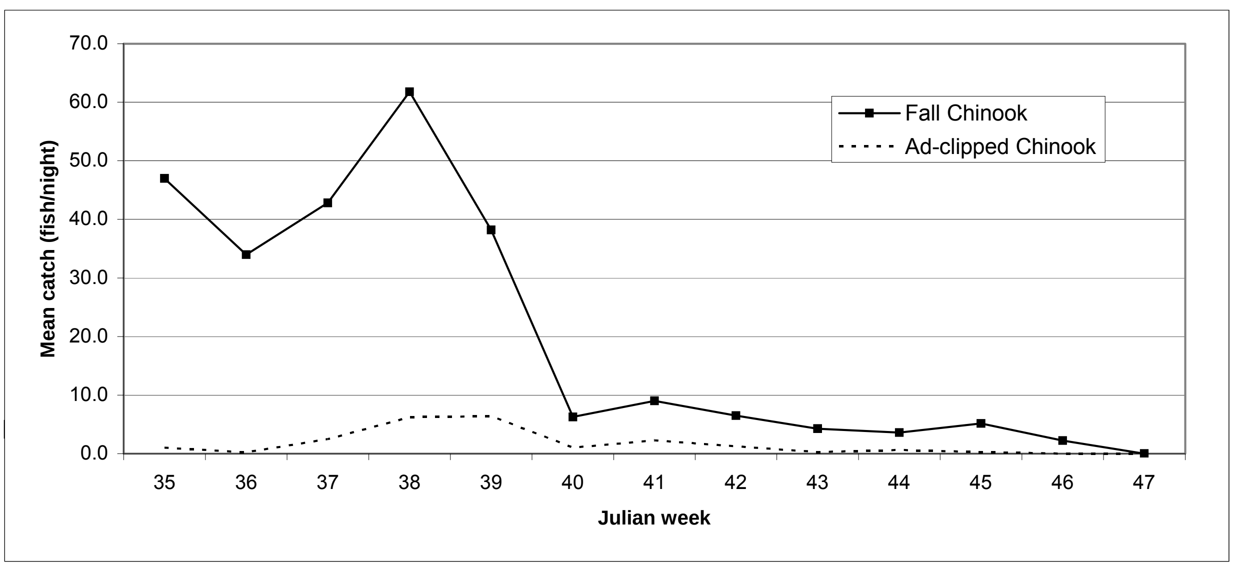


Figure 7. Mean catch of fall Chinook in the Trinity River at Willow Creek weir, 2009.

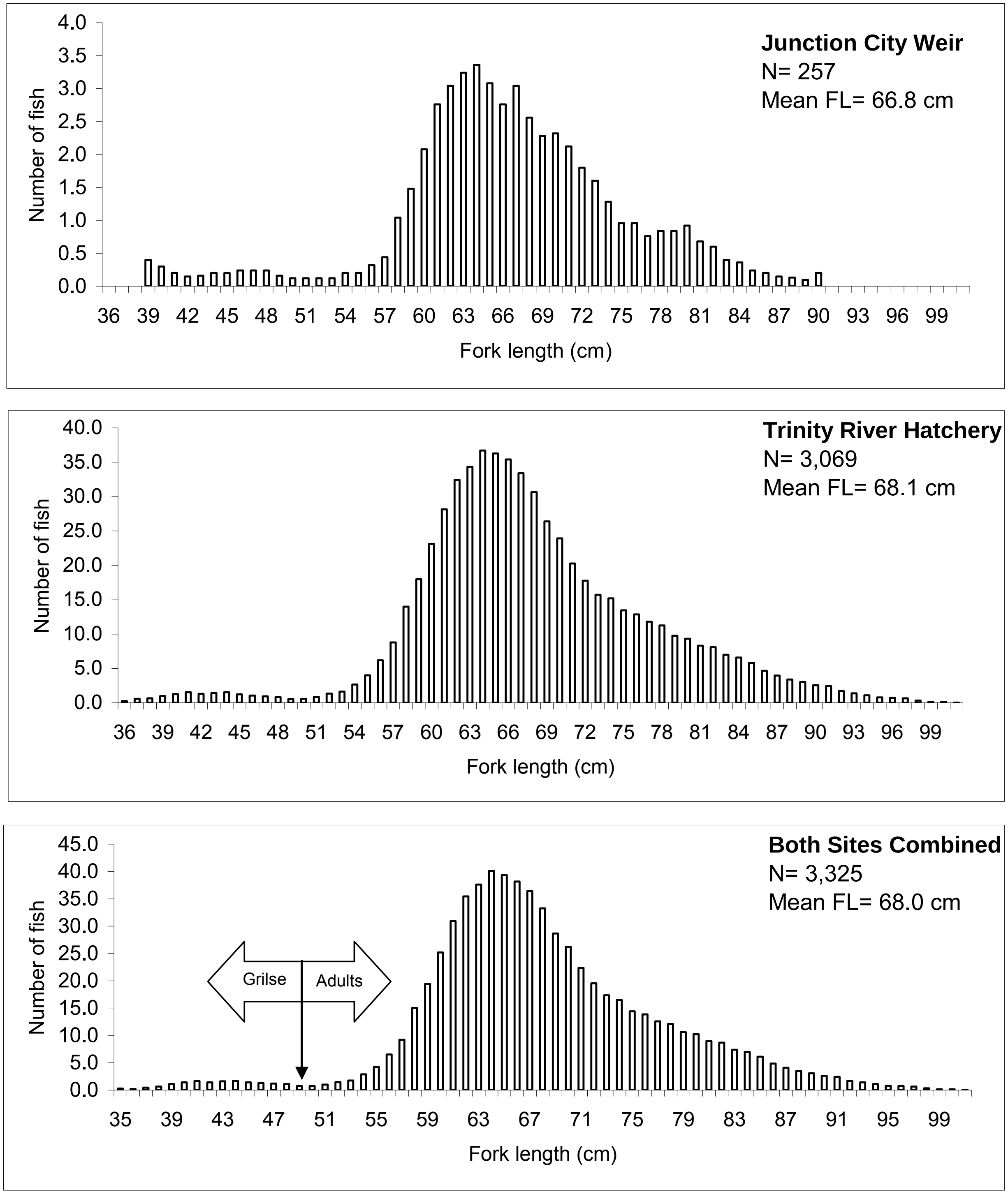


Figure 8. Spring Chinook fork lengths (cm) observed at Junction City weir, Trinity River Hatchery, and both sites combined during the 2009-10 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

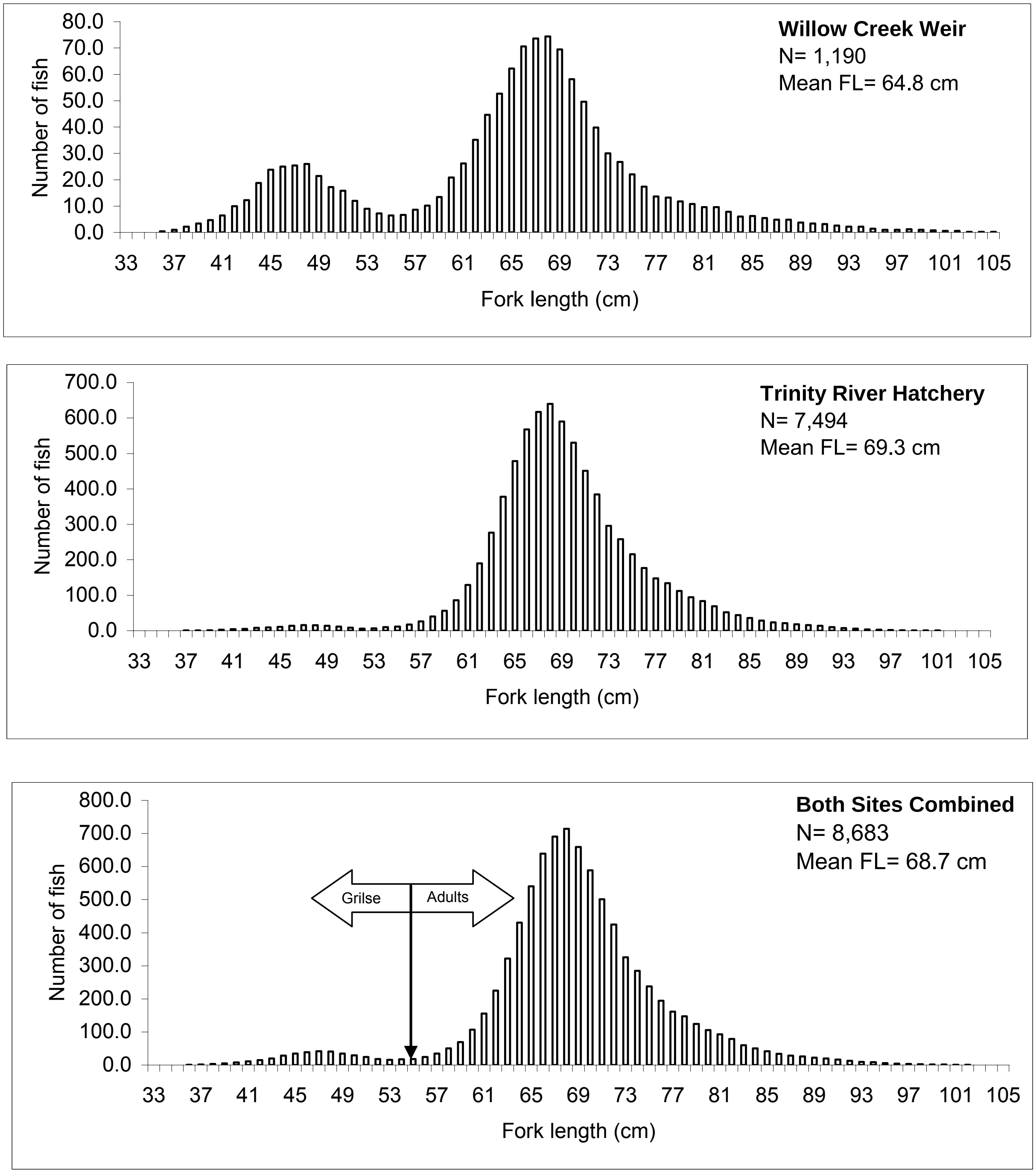


Figure 9. Fall Chinook fork lengths (cm) observed at Willow Creek weir and Trinity River Hatchery and both sites combined during the 2009-10 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

Effectively Tagged Fish
A total of 257 spring Chinook were trapped at JCW, of which 253 (9 grilse and 244 adults) were effectively tagged (Appendix 4). There were three tagging mortalities detected and one caught and released spring Chinook from which anglers reported removing tags (Appendix 8). A total of 81 (32.0%) spring Chinook were tagged with reward tags (1 grilse and 80 adults); the remaining fish received non-reward tags. There were 22 (3 grilse and 19 adult) fall Chinook trapped at JCW in 2009, all of which were effectively tagged.

There were no spring Chinook trapped at WCW in 2009. A total of 1,190 fall Chinook were trapped at WCW, of which 1,166 were tagged. Of those 1,166 tagged fish (238 grilse and 924 adults), 1,148 of them (230 grilse and 918 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 one adult tagging mortality detected and 17 (eight grilse, nine adults) caught and released fall Chinook from which anglers reported removing tags (Appendix 9). Reward tags were placed on 377 (83 grilse and 294 adults), or 32.8%, of the fall Chinook trapped at WCW; non-reward tags on the remaining fish (147 grilse and 624 adults).

Incidence of Tags and Fin Clips
Ad-clipped fish comprised 13.2% of the spring Chinook captured (34 of 257) at JCW, and 18.2% (4 of 22) of the fall Chinook (Appendix 4 and 5). Twenty one of the 34 ad-clipped spring Chinook (61.8%) tagged at JCW were subsequently recovered at TRH (Table 3); 16 of those were released from the hatchery as yearlings in October 2007.

Of the 1,190 fall Chinook trapped at WCW, 8.8% (105) were ad-clipped (Appendix 5), and 293 (24.6%) were later recovered at TRH (Table 3), 62 of which had ad-clips. Of the 62 TRH returnees, 60 were three year old fall Chinook, 38 of which were released in October of 2007, and 2 were four year olds released as yearlings in October 2006.

Incidence of Gill-net Wounds, Hook Scars, and Predator Wounds
Sixty-five (25.3%) of the 257 spring Chinook trapped at JCW had gill net wounds, as did six (27.3%) of falls. Crews also noted one old hooking scar, seven wounds of unknown origin and three predator wounds on spring Chinook at JCW, and three wounds of unknown origin on the JCW fall Chinook.

Of the 1,190 fall Chinook trapped at WCW 247 (20.7%) had gill net wounds. Also observed were seven fish with new hooking wounds; 29 with unknown wounds; 50 with predator wounds; 12 with fungus; and nine with apparent 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 2009-10 season.

CWT and release type[a]	Species	Race	Brood year	Date	Number of CWT fish	Origination Site	Number recovered / tagging site: WCW	JCW
SPRING CHINOOK								
065319-f	Chinook	spring	2004	06/01-08/2005	91,301	TRH		
065320-f	Chinook	spring	2004	06/01-08/2005	90,290	TRH		
065321-f	Chinook	spring	2004	06/01-08/2005	72,239	TRH		
065326-y	Chinook	spring	2004	10/03-11/2005	104,478	TRH		1
065333-f	Chinook	spring	2005	06/ 01-07 /2006	93,920	TRH		
065334-f	Chinook	spring	2005	06/ 01-07 /2006	95,152	TRH		
065335-f	Chinook	spring	2005	06/ 01-07 /2006	74,036	TRH		
065330-y	Chinook	spring	2005	10/ 02-16 /2006	11,265	TRH		
065331-y	Chinook	spring	2005	10/ 02-16 /2006	11,247	TRH		
065332-y	Chinook	spring	2005	10/ 02-16 /2006	11,959	TRH		
065342-y	Chinook	spring	2005	10/ 02-16 /2006	11,382	TRH		
065343-y	Chinook	spring	2005	10/ 02-16 /2006	11,510	TRH		
065344-y	Chinook	spring	2005	10/ 02-16 /2006	11,766	TRH		
065345-y	Chinook	spring	2005	06/ 01-07 /2006	11,169	TRH		
065346-y	Chinook	spring	2005	06/ 01-07 /2006	27,309	TRH		1
065347-f	Chinook	spring	2006	06/ 01-08 /2007	65,914	TRH		
065348-f	Chinook	spring	2006	06/ 01-08 /2007	86,088	TRH		3
065349-f	Chinook	spring	2006	06/ 01-08 /2007	74,456	TRH		
065360-y	Chinook	spring	2006	10/ 01-10 /2007	104,019	TRH		16
068801-f	Chinook	spring	2007	06/ 02-12 /2008	55,773	TRH		
068802-f	Chinook	spring	2007	06/ 02-12 /2008	73,822	TRH		
068810-y	Chinook	spring	2007	10/ 01-14 /2008	96,803	TRH		
shed tag[b]	Chinook	spring						
						Total spring Chinook:	0	21
FALL CHINOOK								
065324-f	Chinook	fall	2004	06/ 01-08 /2005	122,180	TRH		
065327-y	Chinook	fall	2004	10/ 03-11 /2005	218,386	TRH		
065336-f	Chinook	fall	2005	06/ 01-07 /2006	104,760	TRH		
065337-f	Chinook	fall	2005	06/ 01-07 /2006	126,404	TRH		
065338-f	Chinook	fall	2005	06/ 01-07 /2006	119,293	TRH		
065339-f	Chinook	fall	2005	06/ 01-07 /2006	127,742	TRH		
065341-y	Chinook	fall	2005	10/ 02-16 /2006	227,903	TRH	2	
065350-f	Chinook	fall	2006	06 /01-08 /2007	118,575	TRH	6	
065351-f	Chinook	fall	2006	06 /01-08 /2007	119,712	TRH	3	
065352-f	Chinook	fall	2006	06 /01-08 /2007	122,076	TRH	5	
065353-f	Chinook	fall	2006	06 /01-08 /2007	126,470	TRH	5	
065361-y	Chinook	fall	2006	10 /01-10 /2007	238,156	TRH	38	
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		
068809-y	Chinook	fall	2007	10/ 01-14 /2008	244,661	TRH		
shed tag[b]	Chinook	fall					3	
						Total fall Chinook:	62	0
COHO								
RM[c]	coho		2006	03/17-25/2008	455,557	TRH	54	
RM[c]	coho		2007	03/16-23/2009	457,534	TRH	43	
						Total coho:	97	0

a/ f = fingerling; y = yearling

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

c/ Since 1996, all coho produced at TRH have received a right maxillary clip (RM). Coho < 54 cm FL were classified as brood year 2007 and coho >53 cm FL were classified as brood year 2006. Age cutoff based on fork length distribution.

Coho Salmon

Run timing

No coho salmon were trapped at JCW in 2009. At WCW we trapped our first coho of the season during JW 37. The largest component of the coho run passed through the weir during JW 39, with a mean of 14.8 per night trapped, decreasing through the rest of the season (Table 4, Figure 10), with a sampling season mean of 3.5 fish trapped per night. A total of 202 coho salmon were trapped (105 grilse and 97 adults) at WCW during the 2009 season.

Size of Trapped Fish

The average FL of coho trapped at WCW and TRH was 52.5 and 59.7 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. This year all coho salmon <54 cm FL were considered grilse. Grilse comprised 52.0% and 26.1% of the coho salmon trapped at WCW and TRH respectively.

Effectively Tagged Fish

Of the 202 coho trapped at WCW, 186 (93 grilse and 93 adults) were effectively tagged (Appendix 6). Due to poor condition (wounds or other stressors) 14 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

One hundred eighty four of the 202 (91.1%) coho trapped at WCW (98 grilse and 86 adults) bore right maxillary (RM) clips (Appendix 6). Ninety seven of the WCW-tagged coho were recovered at TRH (Table 3).

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

Gill net wounds were found on 12 of the coho trapped at WCW; 11 had unknown wounds; 20 had predator wounds; one had fungus, and two looked diseased.

Table 4. Weekly summary of coho trapped at Willow Creek weir during 2009.[a]

Julian week	Inclusive dates	Nights trapped	Number trapped: Grilse[b]	Grilse w/ RM clips[c]	Adults	Adults w/ RM clips	Total trapped	Total RM clips	Fish / night
35	27-Aug - 2-Sep	2	0	0	0	0	0	0	0.0
36	3-Sep - 9-Sep	5	0	0	0	0	0	0	0.0
37	10-Sep - 16-Sep	6	2	2	8	8	10	10	1.7
38	17-Sep - 23-Sep	5	13	12	12	12	25	24	5.0
39	24-Sep - 30-Sep	5	39	39	35	30	74	69	14.8
40	1-Oct - 7-Oct	4	4	3	5	5	9	8	2.3
41	8-Oct - 14-Oct	4	16	16	4	4	20	20	5.0
42	15-Oct - 21-Oct	4	12	12	4	3	16	15	4.0
43	22-Oct - 28-Oct	4	8	6	8	6	16	12	4.0
44	29-Oct - 4-Nov	5	6	5	2	2	8	7	1.6
45	5-Nov - 11-Nov	7	4	3	15	13	19	16	2.7
46	12-Nov - 18-Nov	5	1	0	3	2	4	2	0.8
47	19-Nov - 25-Nov	1	0	0	1	1	1	1	1.0
Total		57	105	98	97	86	202	184	
Mean:									3.5

a/ Trapping at Willow Creek weir took place from August 31 - November 19, 2009 (Julian weeks 35-47).
b/ Coho <54 cm FL were considered grilse.
c/ The right maxillary clipped fish are presented as a subset of the total grilse or adult coho caught.

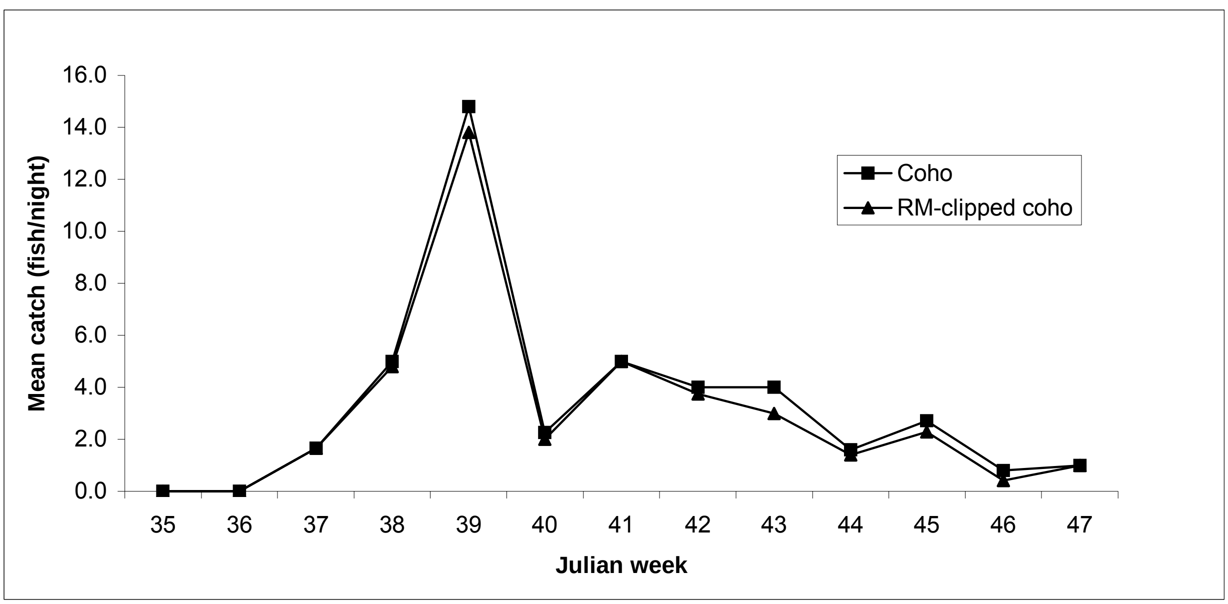
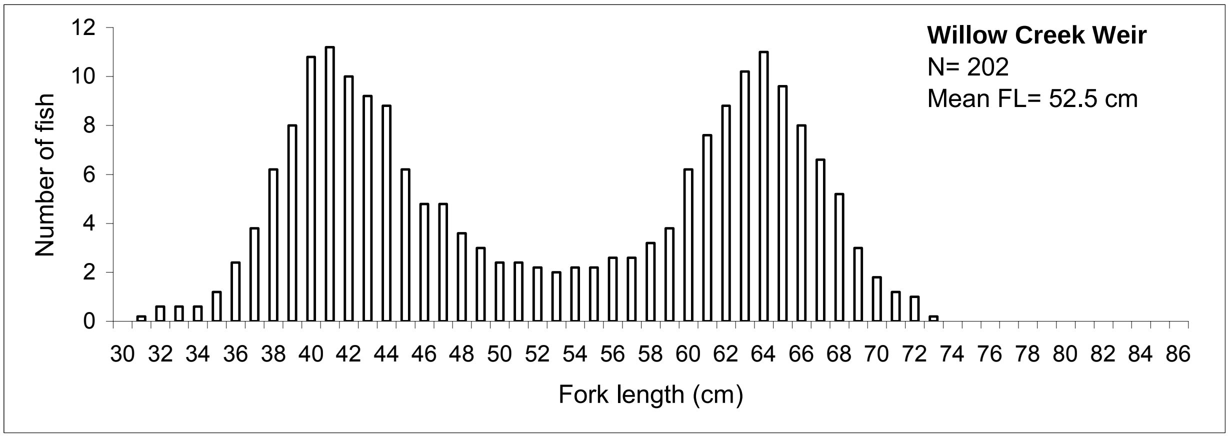
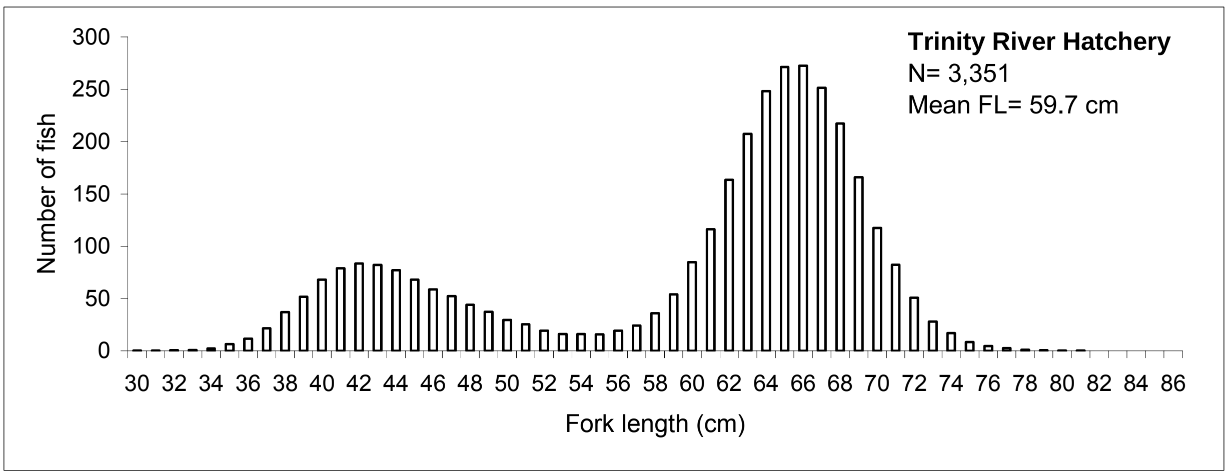


Figure 10. Mean catch of coho trapped at Willow Creek weir during 2009.





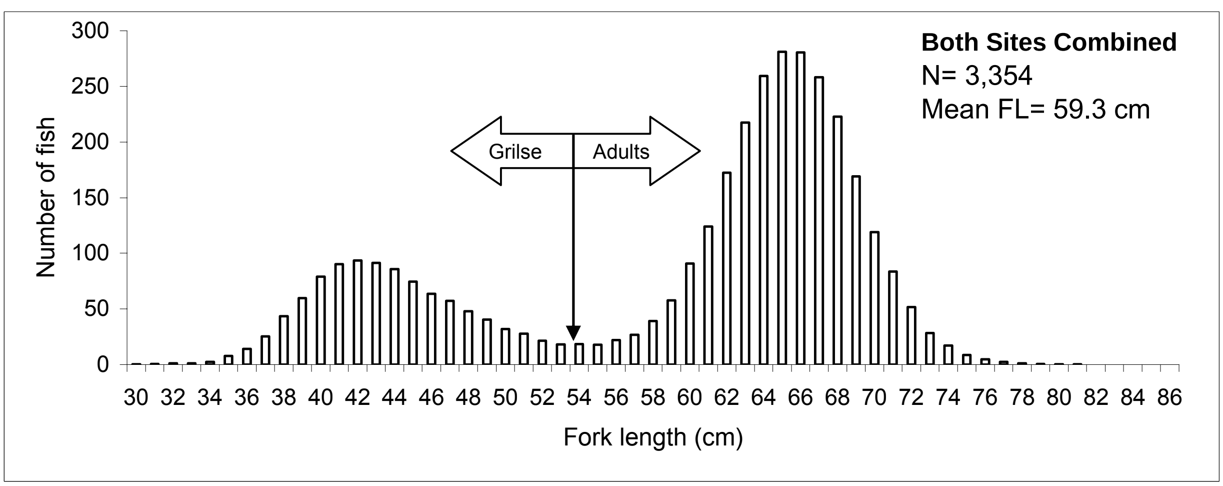


Figure 11. Coho salmon fork lengths (cm) observed at Willow Creek Weir and Trinity River Hatchery and both sites combined during the 2009-10 season. The number of fish shown at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

Fall Steelhead

Run Timing

At JCW, 56 (55 adult and one half-pounder) steelhead were trapped all season, of which 28 adults, and the one half-pounder, had ad-clips. Julian week 27 yielded the highest number of fish trapped (14), averaging 2.8 per night (Table 5, Figure 12). Adipose fin-clipped steelhead were again tagged at JCW in 2009; the results of this particular tagging are purely qualitative in nature. Of the 30 tagged fish, six were later recovered at TRH.

Sixteen hundred seventy four fall-run steelhead were trapped at WCW in 2009 (Table 6, Figure 13); 37 half-pounders (<42 cm FL) and 1,637 adults. The peak of the run was during JW 39 with an average of 66.8 fish per night trapped. The biggest week for half-pounders was JW 42, when 25 were caught; it was also the only Julian week in which more than four were caught.

Size of Fish Trapped

Steelhead caught at JCW, WCW, and TRH averaged 58.6, 60.1 and 61.2 cm FL, respectively (Figure 14), with a mean combined FL for the three sites combined of 60.9 cm. Adult steelhead (> 41 cm FL) made up 98.2% and 97.8% of the steelhead trapped at JCW, and WCW, respectively.

Effectively Tagged Fish

Of the 1,637 adult steelhead trapped at WCW in 2009, 1,619 were tagged. Only adult fish were tagged. Twelve were not tagged due to poor condition and six were declared tagging mortalities (anytime a fish is found on the weir within 30 days of tagging and has not spawned it is considered a tagging mortality). Four of the six tagging mortalities, in addition to a DFG Project tag, received a radio tag in a cooperative study being performed by the Yurok Tribal Fisheries Department. Anglers reported removing tags from 182 caught and released fish, leaving 1,437 effectively tagged adult steelhead. One of the adult steelhead trapped wore a Project tags from the previous year. Of the 1,625 tagged fish, reward-tags were attached to 810 while the remainder (815) received non-reward tags.

Incidence of Tags and Fin Clips

Ad-clips were found on 29 (51.8%) of the steelhead at JCW, 1,204 (71.9%) at WCW and 4,268 (99.6%) at TRH (Appendix 7). Steelhead trapped at WCW were also noted as having other clips as well: 6-left maxillary plus ad-clip; and 2-right maxillary plus ad-clip. 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

At JCW one gill-net wound and two predator wounds were noted on steelhead in 2009. On the steelhead trapped at WCW we noted the following: 81 gill-net wounds; two old hooking scars; 19 fresh hooking wounds; 28 unknown wounds or scars; 161 predator wounds, one fish with fungus and one with disease.

Table 5. Weekly summary of fall-run steelhead trapped at the Junction City weir during 2009. [a]

Julian week	Inclusive dates	Nights trapped	Number trapped: Half pounders [b]	Ad-clips		Adults	Ad-clips [c]		Total	Ad-clip total	Fish / night
24	11-Jun - 17-Jun	1				0	0		0	0	0.0
25	18-Jun - 24-Jun	5				3	3		3	3	0.6
26	25-Jun - 1-Jul	5				9	2		9	2	1.8
27	2-Jul - 8-Jul	5				14	4		14	4	2.8
28	9-Jul - 15-Jul	4				1	0		1	0	0.3
29	16-Jul - 22-Jul	4				2	2		2	2	0.5
30	23-Jul - 29-Jul	4				4	2		4	2	1.0
31	30-Jul - 5-Aug	5				2	2		2	2	0.4
32	6-Aug - 12-Aug	4				0	0		0	0	0.0
33	13-Aug - 19-Aug	4				0	0		0	0	0.0
34	20-Aug - 26-Aug	1				0	0		0	0	0.0
35	27-Aug - 2-Sep	3				3	1		3	1	1.0
36	3-Sep - 9-Sep	3				2	2		2	2	0.7
37	10-Sep - 16-Sep	4				5	4		5	4	1.3
38	17-Sep - 23-Sep	4				3	3		3	3	0.8
39	24-Sep - 30-Sep	5	1	1		7	3		8	4	1.6
	Total:	61	1	1	0	55	28	0	56	29	
	Mean:										0.9

a/ Trapping at Junction City weir took place June 16 - September 30, 2009 (Julian weeks 24 - 39).
b/ Steelhead <42 cm FL were considered half-pounders.
c/ Adipose fin-clipped steelhead. Number shown is a subset of weekly half-pounder and adult totals.

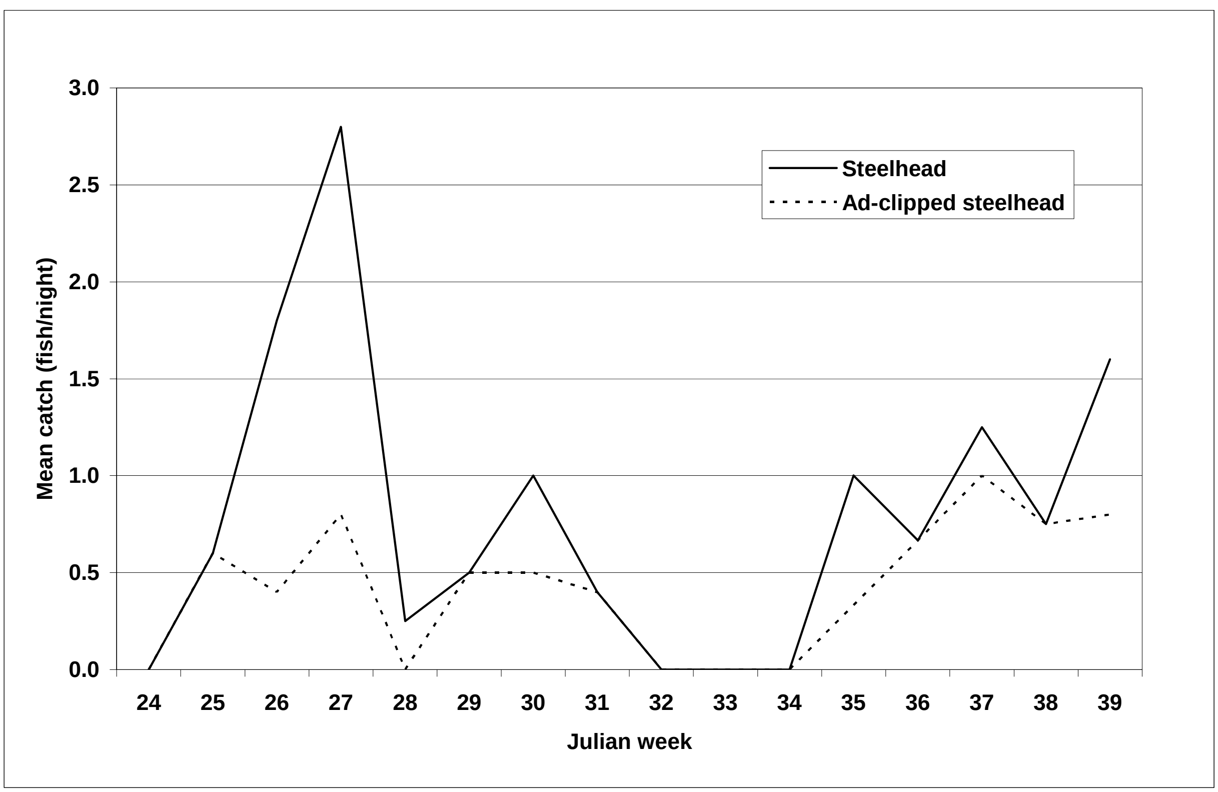


Figure 12. Mean catch of fall-run steelhead at Junction City weir during 2009.

Table 6. Weekly summary of fall-run steelhead trapped at the Willow Creek weir during 2009. [a]

Julian week	Inclusive dates	Nights trapped	Number trapped: Half pounders [b]	Ad-clips [c]		Adults	Ad-clips		Total	Ad-clip total	Fish/ night
35	27-Aug - 2-Sep	2				33	17		33	17	16.5
36	3-Sep - 9-Sep	5				35	20		35	20	7.0
37	10-Sep - 16-Sep	6	4	3		149	119		153	122	25.5
38	17-Sep - 23-Sep	5	2	0		311	264		313	264	62.6
39	24-Sep - 30-Sep	5	1	1		333	250		334	251	66.8
40	1-Oct - 7-Oct	4	0	0		23	19		23	19	5.8
41	8-Oct - 14-Oct	4	2	2		223	177		225	179	56.3
42	15-Oct - 21-Oct	4	25	10		229	139		254	149	63.5
43	22-Oct - 28-Oct	4	0	0		22	14		22	14	5.5
44	29-Oct - 4-Nov	5	0	0		9	7		9	7	1.8
45	5-Nov - 11-Nov	7	3	1		250	150		253	151	36.1
46	12-Nov - 18-Nov	5				13	7		13	7	2.6
47	19-Nov - 25-Nov	1				7	4		7	4	7.0
	Total:	57	37	17	0	1,637	1,187	0	1,674	1,204	
	Mean:										29.4

a/ Trapping at Willow Creek weir took place August 31 - November 19, 2009 (Julian weeks 35 - 46).
b/ Steelhead <42 cm FL were considered half-pounders.
c/ Adipose fin-clipped steelhead. Number shown is a subset of weekly half-pounder and adult totals.

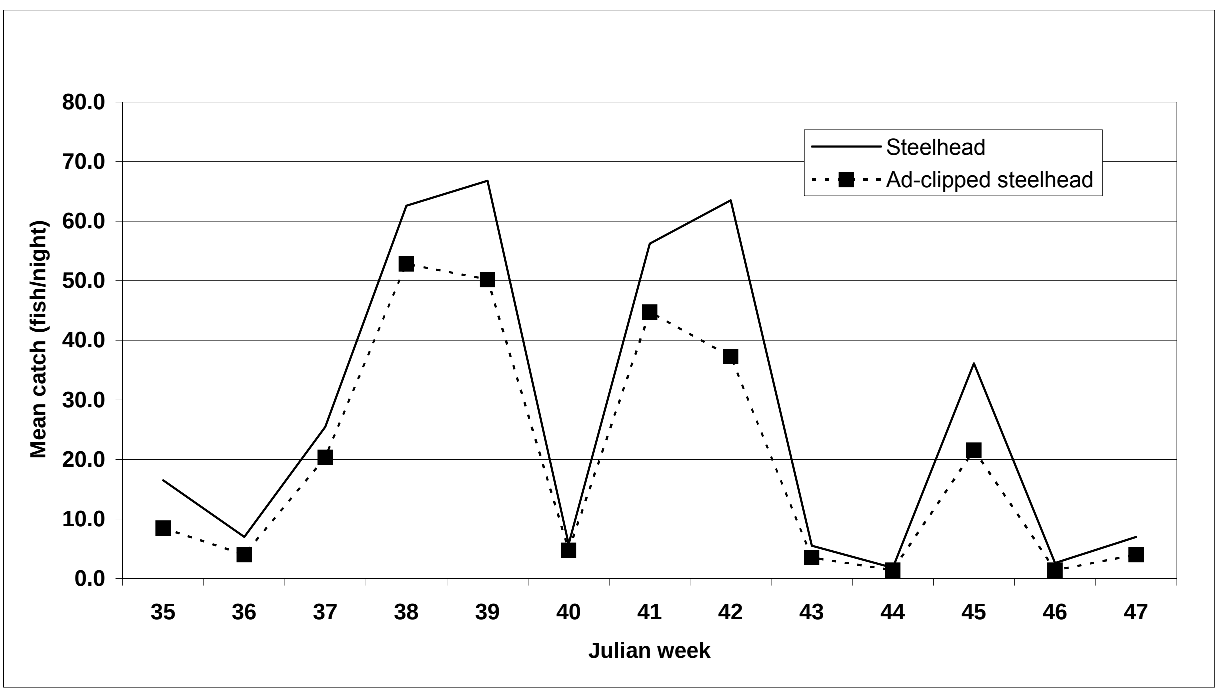


Figure 13. Mean catch of fall-run steelhead at Willow Creek weir during 2009.

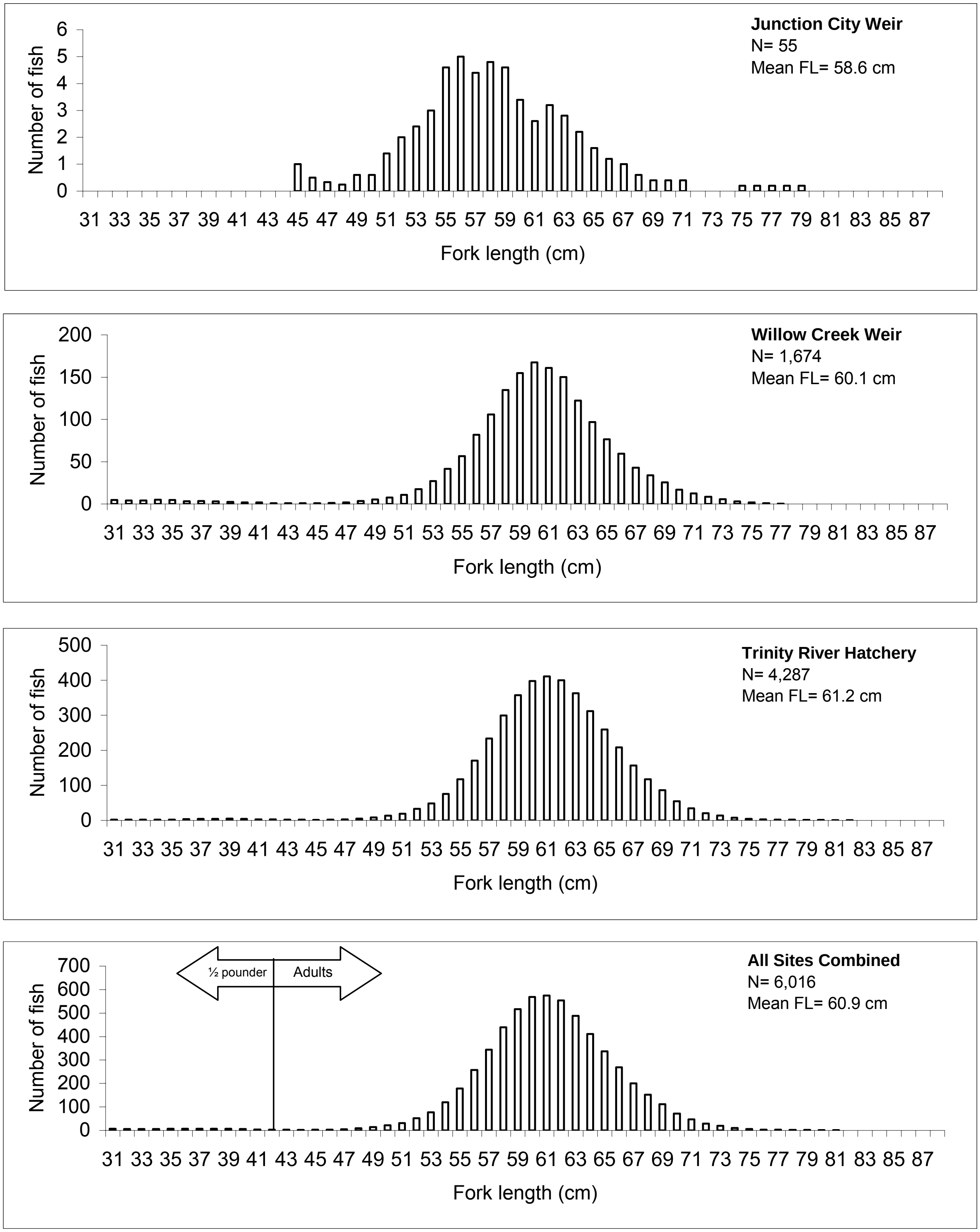


Figure 14. Steelhead fork lengths (cm) observed at Junction City weir, Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2009-10 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate ½ pounders (sub-adults) and adults for analysis.

Brown Trout

Capture Timing

During the 2009 sampling season, 169 brown trout were captured during 61 nights of trapping at JCW (Table 7, Figure 15). The highest catch occurred during Julian week 26 with a mean fish/night rate of 9.0. Only two brown trout were trapped at WCW during 2009.

Size of Trapped Fish

Brown trout captured this season ranged in size from 31 to 70 cm FL (Table 8, Figure 16). Three brown trout tagged in previous years were recaptured at JCW in 2009, one tagged in 2005 (tagged at 43cm FL, recaptured at 56cm FL) and two browns tagged in 2007 (each with about 6 cm/year increase in growth from the previous year).

Effectively Tagged Fish

Of the 169 brown trout tagged at JCW in 2009, three were reported as caught/released by anglers, leaving 166 effective tags. One Project-tagged brown trout was reported as harvested. 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 2009, but nine of the fish had readily discernable lamprey wounds on them. One other wound of unknown origin was noted. Neither of the two browns trapped at WCW had distinguishing marks.

Table 7. Weekly summary of brown trout trapped in the Trinity River at Junction City weir during 2009. [a]

Julian week	Inclusive dates			Nights trapped	Number trapped Total	Number trapped Fish/night
24	11-Jun	-	17-Jun	1	1	1.0
25	18-Jun	-	24-Jun	5	27	5.4
26	25-Jun	-	1-Jul	5	45	9.0
27	2-Jul	-	8-Jul	5	30	6.0
28	9-Jul	-	15-Jul	4	11	2.8
29	16-Jul	-	22-Jul	4	20	5.0
30	23-Jul	-	29-Jul	4	15	3.8
31	30-Jul	-	5-Aug	5	6	1.2
32	6-Aug	-	12-Aug	4	1	0.3
33	13-Aug	-	19-Aug	4	0	0.0
34	20-Aug	-	26-Aug	1	0	0.0
35	27-Aug	-	2-Sep	3	2	0.7
36	3-Sep	-	9-Sep	3	1	0.3
37	10-Sep	-	16-Sep	4	4	1.0
38	17-Sep	-	23-Sep	4	3	0.8
39	24-Sep	-	30-Sep	5	3	0.6
			Total:	61	169	
			Mean:			2.8

a/ Trapping at Junction City weir took place June 16 - September 30, 2009 (Julian weeks 24 - 39).

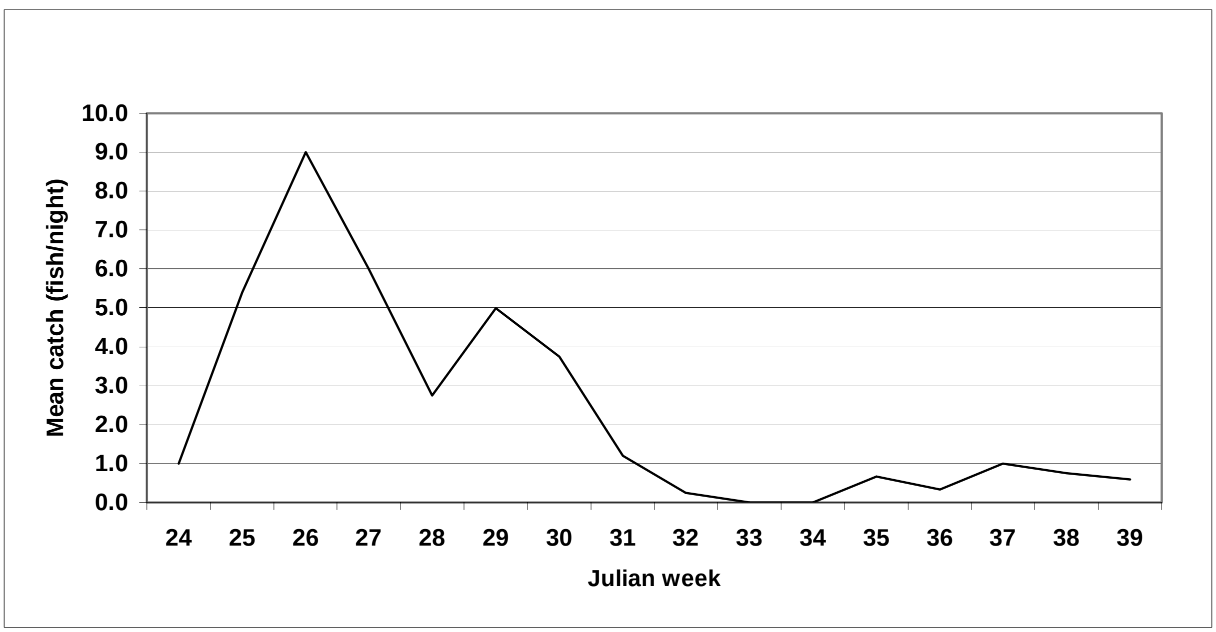


Figure 15. Mean catch of brown trout (fish/night) at Junction City weir, by Julian week, during 2009.

Table 8. Fork length of brown trout trapped by Julian week at Junction City weir during 2009.[a]

Fork length (cm)	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	Totals
31							1										1
32							0										0
33							0										0
34						1	0										1
35						0	0										0
36						1	0										1
37				1		0	1										2
38				0		0	1										1
39		1		0	1	0	0										2
40		1		1	0	1	1	1									5
41		0		2	2	1	0										5
42		0		0	1	1	3	1									6
43		0	3	0	1	1	1										6
44		0	1	2	1	2	0					1					7
45		1	4	1	0	3	1								1		11
46		0	2	0	0	0	1	2				1				1	7
47		0	2	1	0	1	2										6
48		2	1	2	0	1	0		1								7
49		0	4	3	1	0	0	1						1	1		11
50		0	0	4	1	0	0							1			6
51		3	1	4	1	0	0							1		1	11
52		1	1	0	0	1	0										3
53		1	4	0	0	1	0										6
54		1	3	0	1	1	0									1	7
55		2	4	3	0	1	2						1				13
56		4	3	0	1	1	0										9
57		1	3	1		0	0	1									6
58		4	1	1		0	0							1	1		8
59		1	1	0		0	0										2
60		0	1	2		1	0										4
61		1	1	1		1	0										4
62		2	2	0			0										4
63		1	3	0			0										4
64				0			0										0
65				0			1										1
66				0													0
67				0													0
68	1			0													1
69				0													0
70				1													1
Totals:	1	27	45	30	11	20	15	6	1	0	0	2	1	4	3	3	169
Mean FL:	68.0	54.1	52.7	50.6	46.4	47.3	45.0	46.7	48.0	--	--	45.0	55.0	52.0	50.7	50.3	50.5

a/ Trapping at Junction City weir took place June 16 - September 30, 2009 (Julian weeks 24 - 39).

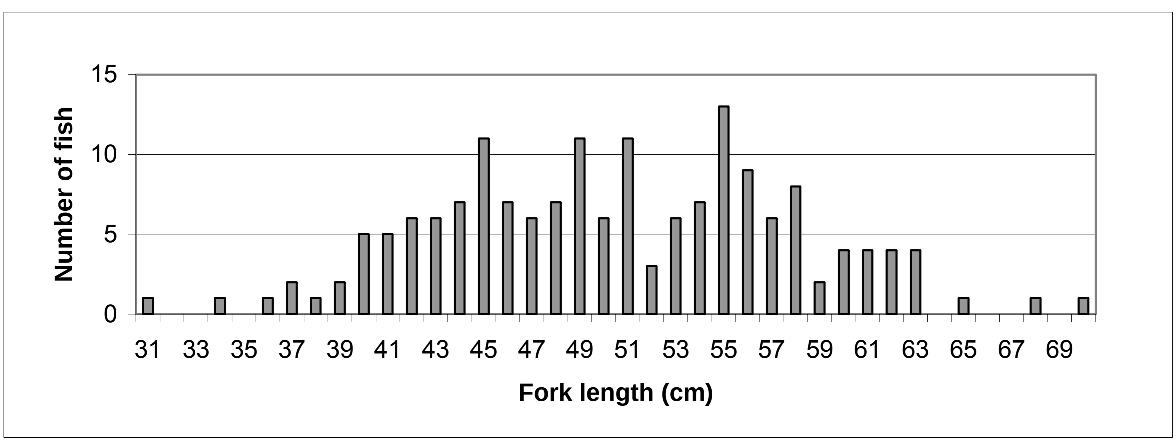


Figure 16. Fork length distribution of brown trout trapped at Junction City weir during 2009.

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 279 tagged Chinook at JCW 47.7% were recovered, whereas 34.0% of the 1,166 tagged WCW fall Chinook were recovered. Of the 188 coho tagged at WCW, 53.2% were recovered, as were 37.0% of the 1,625 adult fall steelhead recovered throughout the Trinity basin. Most of the recoveries, for all species, occurred at TRH.

Tag Returns by Anglers

Department of Fish and Game fishing regulations limit harvest each year, thereby affecting the return of tags. The adult fall Chinook sport quota for the Klamath River basin during the 2009-10 season was 30,800, split evenly between the lower (below the Highway 96 Bridge in Weitchpec) and upper basins. Thirty three percent of that 30,800 (10,164) is the Trinity River sport allocation, which is split 50/50 between two areas: Old Lewiston Bridge to Cedar Flat and Cedar Flat to the confluence of the Trinity and Klamath rivers. Anglers were allowed to retain two ad-clipped steelhead on the Trinity, only one on the Klamath. The take of coho was prohibited.

Spring Chinook

Anglers returned five reward (zero grilse and five adult) and two (zero grilse and two 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, 2.9% for adults. Anglers reported the catch and release of zero grilse and one tagged adult, and one found tag (with no fish still attached) (Appendix 8). The catch and release rate, therefore, for tagged adult spring Chinook was estimated at 1.2%.

Fall Chinook

Anglers returned nine reward (two grilse and seven adult) and seven (three grilse and four 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 2.2% for grilse and 1.2% for adults. Anglers reported the catch and release of three grilse and six adult reward-tagged fall Chinook from WCW, and five grilse and three adult non-reward tagged fish (Appendix 9). Using those numbers, the catch/release rates for fall Chinook upstream of the WCW were estimated at 3.4% 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, one each from caught and released grilse and adult coho (Appendix 10). Catch and release rates for coho salmon above the WCW were estimated at 1.1% for both grilse and adults based on that return.

Fall Steelhead
Anglers returned 264 tags from steelhead tagged at WCW. Of those 264 tags, 180 tags were from steelhead reported as caught/released, 81 from harvested fish, and 3 were tags found loose (not attached to a steelhead when found) (Appendix 11). Based on tag return, an estimated 11.2% of the tagged steelhead migrating upstream of WCW were caught and released, and an estimated 8.3% (10.3% of ad-clipped, 3.0% non-ad-clipped) of the (reward-tagged) steelhead were harvested.

Brown Trout
All brown trout tagged at JCW received non-reward tags during 2009. Anglers returned one tag from a caught and released brown trout tagged during the season, one from a harvested fish, one tag found loose, and one tag was recovered in the upper main stem spawner surveys.

Spawner Surveys

Main stem Trinity spawner surveys were conducted from September 14, 2009 to December 22, 2009 from TRH to Weitchpec. During the spawner surveys 11 spring and two fall Chinook tagged at JCW (Appendix 8), 69 fall Chinook tagged at WCW (Appendix 9), and 2 coho (Appendix 10) were recovered. There were no steelhead recovered in the spawner survey in 2009 (Appendix 11). For additional information on the 2009 spawner survey refer to Task 4 of this report.

Trinity River Hatchery

Operation Dates
The fish ladder and trapping facility at TRH were operated from September 08, 2009 (JW 36) through March 10, 2010 (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 was 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 42 (Figure 17, Table 9). Recovery of spring Chinook was at it’s highest the first week TRH was open (JW 36) when 226 CWTed fish entered the facility and decreased thereafter with only six CWTs recovered in JW 41. Based upon CWT expansion, an estimated 3,033 spring Chinook entered TRH (Figure 17).

Of the 257 spring Chinook tagged at JCW, 105 (40.9%) were recovered at TRH. The mean FL for effectively tagged JCW spring Chinook was 66.8 cm, whereas the spring Chinook recovered at TRH averaged 68.1 cm FL (Figure 8, Appendix 4). There were no spring Chinook tagged at WCW in 2009.

A total of 3,033 spring Chinook were recovered at TRH, from which 652 CWTs were recovered (Table 9). Spring Chinook age composition at TRH based on CWT analysis was 1.8%, 76.1%, 16.1%, and 6.0% age 2, 3, 4 and 5 year old fish, respectively (See Task 2 of this report).

Fall Chinook

Based on the recovery of CWTs, the first fall Chinook entered TRH during JW 38 of 2009 (Figure 17, Table 11). The fall run peaked during JW 45 when an estimated 2,120 Chinook entered the facility, decreasing thereafter until the last Chinook entered during JW 2 of 2010. Using CWT expansions, an estimated 7,530 fall Chinook entered TRH.

There were 22 fall Chinook tagged at JCW in 2009. Two of those 22 (9.1%) were recovered at TRH. Of the 1,166 tagged fall Chinook at WCW, 289 (24.8%) were recovered at TRH. The mean FL for effectively tagged WCW fall Chinook was 64.8 cm while the mean FL for fall Chinook trapped at TRH was 69.3 cm (Figure 9). A total of 7,530 fall Chinook entered TRH, from which 1,613 CWTs were recovered (Table 11). Fall Chinook age composition at TRH based on CWT analysis was 2.3%, 90.8%, 6.4%, and 0.5% age 2, 3, 4, and 5 year old fish, respectively.

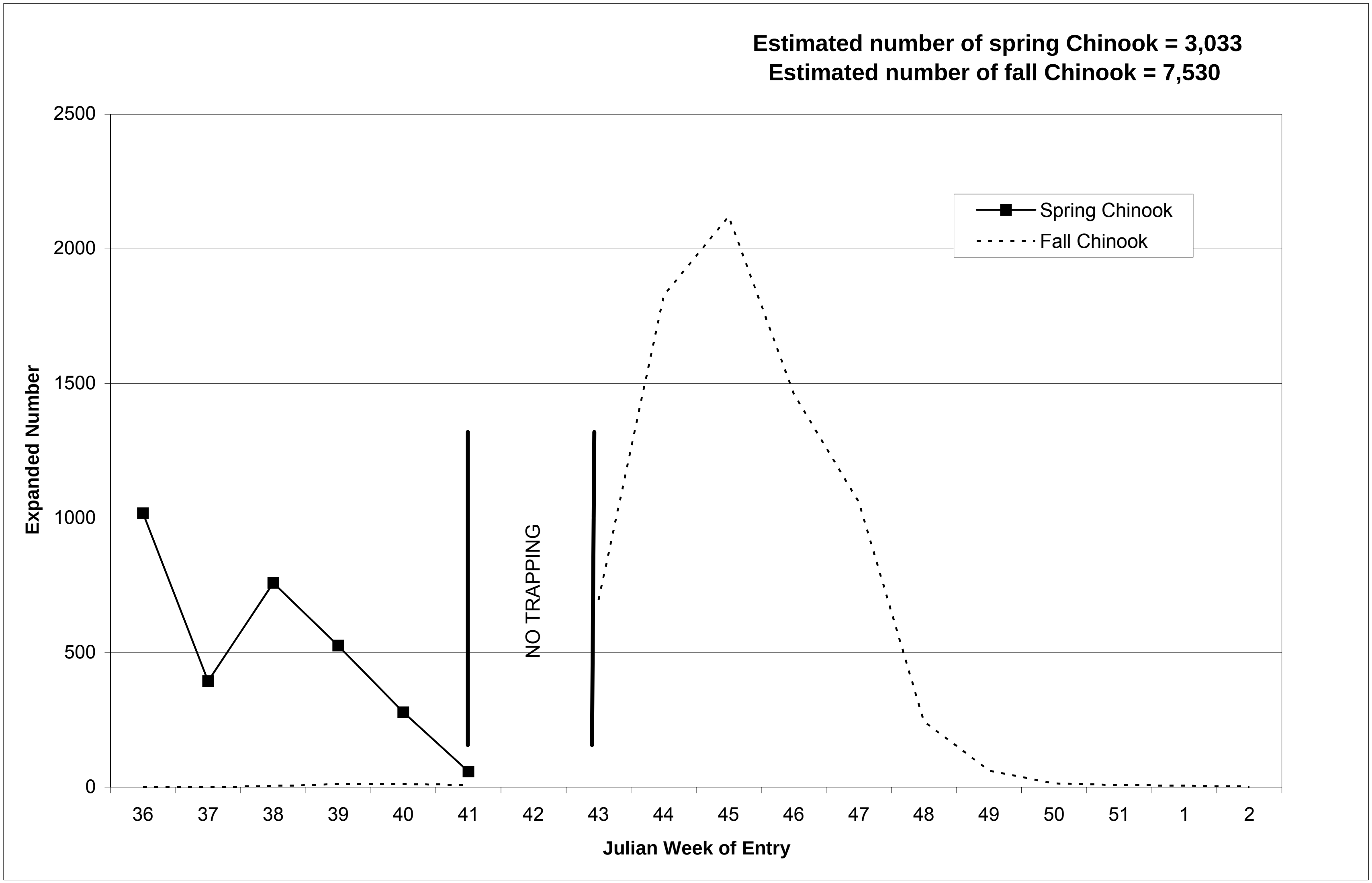


Figure 17. Estimated numbers of spring and fall Chinook that entered Trinity River Hatchery during the 2009-10 season, based on expansion of coded-wire tagged fish.

Table 9. Recoveries at Trinity River Hatchery of coded-wire tagged spring Chinook during the 2009-10 season.

Coded-wire tag number and release type [c]	Brood year	Number of spring Chinook entering TRH, by Julian week [a b]											Totals
		36	37	38	39	40	41	42 [d]	43	44	45	46	
065319-f	2004	1		1									2
065320-f	2004		1	1									2
065321-f	2004			1									1
065326-y	2004	6	3	8	7	8	2						34
065330-y	2005	1			2								3
065331-y	2005	1			2								3
065332-y	2005	1		1									2
065333-f	2005	2	8	9	2	1							22
065334-f	2005	4	4	8	7	1							24
065335-f	2005	2	7	6	2	1							18
065342-y	2005	2	2		2		1						7
065343-y	2005			1		3							4
065344-y	2005		2	2	3	2							9
065345-y	2005	1	1	2		1							5
065346-y	2005	2		4	1	1							8
065347-f	2006	6	5	7	9	2							29
065348-f	2006	3	6	10	6	9							34
065349-f	2006	4	4	3	6	4							21
065360-y	2006	177	83	100	36	13	3						412
068801-f	2007			1									1
068802-f	2007			2	1	1							4
068810-y	2007	1	2	1	2	1							7
No CWT [e]		12	7	9	4	4	0						36
	Weekly totals:	226	135	177	92	52	6	0	0	0	0	0	
											Grand Total:		688

a/ The fish ladder was open September 08, 2009 through March 10, 2010 (JWs 36-10; closed parts or all of JWs 41-43).
b/ Entry week was the week that fish were initally sorted; they may have actually entered the hatchery during the previous sorting week.
c/ Release types are either fingerling (f) or yearling (y).
d/ The hatchery was closed to fish entry this week.
e/ No CWT's were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after October 14, 2009 (JW 41) were considered fall run.

Table 10. Total number and numbers of Willow Creek weir (WCW) and Junction City weir (JCW) tagged Chinook and coho that entered Trinity River Hatchery (TRH) during the 2009-10 season.[a]

		Chinook					Coho		
		Total entering	Spring run tagging site		Fall run tagging site		Total entering	Tagging site	
Julian week of entry [b]	Inclusive dates	TRH	WCW	JCW	WCW	JCW	TRH	WCW	JCW
36	3-Sep - 9-Sep	331		31					
37	10-Sep - 16-Sep	228		15					
38	17-Sep - 23-Sep	716		34					
39	24-Sep - 30-Sep	882		13					
40	1-Oct - 7-Oct	717		8	1		1		
41	8-Oct - 14-Oct	195		4	1	1	0		
42	15-Oct - 21-Oct	0		0	0	0	0		
43	22-Oct - 28-Oct	443		2	36	1	534	23	
44	29-Oct - 4-Nov	949			116		608	23	
45	5-Nov - 11-Nov	2,116			65		442	12	
46	12-Nov - 18-Nov	2,229			41		346	10	
47	19-Nov - 25-Nov	1,426			25		1,118	19	
48	26-Nov - 2-Dec	221			2		112	3	
49	3-Dec - 9-Dec	82			2		91	1	
50	10-Dec - 16-Dec	14			0		37	3	
51	17-Dec - 23-Dec	8			0		53	3	
52	24-Dec - 31-Dec	5			1		3		
1	1-Jan - 7-Jan	2					5		
2	8-Jan - 14-Jan						0		
3	15-Jan - 21-Jan						1		
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:	10,564	0	107	290	2	3,351	97	0

a/ The fish ladder was open September 08, 2009 through March 10, 2010 (JWs 36-10; closed parts or all of JWs 41-43).
b/ Entry week was the week that fish were initally sorted; they may have actually entered the hatchery during the previous sorting week.

Table 11. Recoveries at Trinity River Hatchery of coded-wire tagged fall Chinook during the 2009-10 season.

Coded-wire tag number and release type [c]	Brood year	Number of fall Chinook entering TRH, by Julian week [a b]																			Totals
		36	37	38	39	40	41	42 [d]	43	44	45	46	47	48	49	50	51	52	1	2	
065324-f	2004									1	1										2
065327-y	2004									2	2	1	2								7
065336-f	2005								1		1										2
065337-f	2005									1											1
065338-f	2005									1	1	1									3
065339-f	2005									2	4	1									7
065341-y	2005								6	15	25	18	22	1	2	1					90
065350-f	2006								13	25	20	12	3								73
065351-f	2006				1				7	21	26	8	11	2							76
065352-f	2006					1			10	22	32	19	9								93
065353-f	2006								7	10	17	16	14	2	2						68
065361-y	2006			1	1	1	1		120	256	298	239	175	42	13	4	1	2			1,154
068804-f	2007									2											2
068805-f	2007								1												1
068806-f	2007									1											1
068807-f	2007									1											1
068809-y	2007								1	12	12	1	3	2	1						32
No CWT [e]									11	27	34	27	22	4	3	1					129
Weekly totals:		0	0	1	2	2	1	0	177	399	473	343	261	53	21	6	1	2	0	0	1,742

a/ The fish ladder was open September 08, 2009 through March 10, 2010 (JWs 36-10; closed parts or all of JWs 41-43).
b/ Entry week was the week that fish were initally sorted, although they may have actually entered the hatchery during the previous sorting week.
c/ Release types are either fingerling (f) or yearling (y).
d/ The hatchery was closed to fish entry this week.
e/ No CWTs were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after October 21, 2009 (JW 42) were considered fall Chinook.

Coho Salmon

The first coho entered TRH during JW 40 of 2009. The coho run peaked during JW 47 and the last coho entered TRH during JW 3 of 2010 (Table 12). A total of 3,351 coho (2,477 adults and 874 grilse) were recovered at TRH the season. Ninety seven of the 202 coho trapped at WCW were recovered at TRH (52.1 % of those effectively tagged). The mean FL of coho trapped at WCW was 52.5 cm and the mean FL of all coho salmon recovered at TRH was 59.7 cm (Appendix 6).

Of the 3,351 coho entering TRH, 3,261 (97.3%) were observed to have right maxillary (RM) clips, indicating they were of TRH origin, while 90 (2.7%) 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 salmon $\leq$ 54 cm FL were considered grilse (age 2) from the 2007 brood year and accounted for 26.1% of the total, while the remaining 2,477 (73.9%) were considered adults (age 3) from the 2006 brood year. The 90 non- RM clipped coho which entered the hatchery were also considered grilse or adults based on their length (Appendix 6).

Fall Steelhead

Steelhead were recovered almost every week that the fish ladder and trap at TRH was open, though they did not arrive in sizeable numbers until the last week of October (JW 43) (Table 13). A total of 4,251 adult steelhead (>41 cm, FL) entered TRH during the season. Of the 1,437 adult fall steelhead effectively tagged at WCW, 332 were recovered at TRH (Table 13, Appendix 7). The mean FL of effectively tagged steelhead at WCW was 60.1 cm and the mean FL of all adult steelhead recovered at TRH was 61.2 cm

Ad-clipped adults composed 72.0% of the steelhead trapped at WCW (1,204 of the 1,674) and 99.6% (4,268/4,287) 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 2009-10 season. [a]

Julian Week of Entry [c]	Inclusive Dates			2007 (Grilse) No Clip	2007 (Grilse) RM	2006 (Adults) No Clip	2006 (Adults) RM	Total
40	1-Oct	-	7-Oct		0		1	1
41	8-Oct	-	14-Oct		0		0	0
42	15-Oct	-	21-Oct		0		0	0
43	22-Oct	-	28-Oct		221	8	305	534
44	29-Oct	-	4-Nov	2	178	11	417	608
45	5-Nov	-	11-Nov	1	221	14	206	442
46	12-Nov	-	18-Nov		118	6	222	346
47	19-Nov	-	25-Nov		72	35	1,011	1,118
48	26-Nov	-	2-Dec		14	3	95	112
49	3-Dec	-	9-Dec		22	4	65	91
50	10-Dec	-	16-Dec		9	4	24	37
51	17-Dec	-	23-Dec		10	2	41	53
52	24-Dec	-	31-Dec		2		1	3
1	1-Jan	-	7-Jan		3		2	5
2	8-Jan	-	14-Jan		0		0	0
3	15-Jan	-	21-Jan		1		0	1
			Totals:	3	871	87	2,390	3,351

Brood Year and Clip [b]

a/ The fish ladder was open September 08, 2009 through March 10, 2010 (JWs 36-10; closed parts or all of JWs 41-43).

b/ Coho <54 cm FL were considered of the 2007 brood year, and coho > 53 cm FL were considered of the 2006 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 2009-10 season.[b]

Julian Week of Entry [c]	Inclusive Dates			Number Entering TRH	Recoveries from WCW
36	3-Sep		9-Sep	2	
37	10-Sep		16-Sep	1	
38	17-Sep	-	23-Sep	2	
39	24-Sep	-	30-Sep	1	
40	1-Oct	-	7-Oct	1	
41	8-Oct	-	14-Oct	0	
42	15-Oct	-	21-Oct	0	
43	22-Oct	-	28-Oct	40	
44	29-Oct	-	4-Nov	29	5
45	5-Nov	-	11-Nov	38	4
46	12-Nov	-	18-Nov	51	6
47	19-Nov	-	25-Nov	44	5
48	26-Nov	-	2-Dec	12	1
49	3-Dec	-	9-Dec	46	1
50	10-Dec	-	16-Dec	7	1
51	17-Dec	-	23-Dec	261	30
52	24-Dec	-	31-Dec	298	20
1	1-Jan	-	7-Jan	374	30
2	8-Jan	-	14-Jan	795	55
3	15-Jan	-	21-Jan	738	43
4	22-Jan	-	28-Jan	456	41
5	29-Jan	-	4-Feb	263	20
6	5-Feb	-	11-Feb	286	20
7	12-Feb	-	18-Feb	218	16
8	19-Feb	-	25-Feb	132	20
9	26-Feb	-	4-Mar	103	11
10	5-Mar	-	11-Mar	53	3
			Totals:	4,251	332

a/ Steelhead <42 cm FL are considered sub-adults and were not counted at TRH.
b/ The fish ladder was open September 08, 2009 - March 10, 20010 (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 7,426 (7,166 adults and 260 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 6,166–9,054 (Table 14). Spawning escapement above JCW was estimated at 6,724 adult fish, including 3,000 spring Chinook that entered TRH (Table 15). This year's run-size estimate is 42.3% of the 30 year average spring Chinook run-size of 17,553. 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 442 adults and zero grilse from the spring run (Table 15).

Fall Chinook Salmon
An estimated 29,593 (23,575 adults and 6,018 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 26,449-33,293 (Table 14). Trinity River fall Chinook spawner escapement, upstream of WCW, was estimated at 28,889 (5,873 grilse, 23,016 adult) fish, including 7,494 fall Chinook that entered TRH (Table 15). Harvest rates generated from tags applied at WCW were used to estimate 145 grilse and 559 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 29,593 fish is 70.4% of the 42,028 fish mean run-size for all the years since 1977.

Coho Salmon
An estimated 6,396 (4,634 adults and 1,762 grilse) coho migrated into the Trinity River basin upstream of the WCW in 2009. Based on the Poisson Approximation, the 95% confidence interval for the coho run-size estimate upstream of WCW was 5,271-7,846 fish (Table 14). Of those estimated 6,396 fish, 2,477 adults are estimated to have entered TRH (Table 15). Estimated coho salmonrun-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 36.9% of the 17,316 fish 33-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 18,361 adult fall steelhead migrated upstream of WCW this season. The 95% confidence interval for the estimate, based on the Normal Approximation, was 16,519-20,306 adult steelhead (Table 14). The adult steelhead spawning escapement was estimated at 16,831, of which 4,251 entered TRH. An estimated 154 naturally-produced and 1,376 TRH produced steelhead were harvested by anglers above WCW (Table 15). In the 26 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 14,946 fish. This year’s run was 122.8% 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 2009-2010 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum [a]	Number effectively tagged [b]	Trinity River Hatchery recoveries: Number examined for tags [c]	Trinity River Hatchery recoveries: Number of tags in sample	Run-size estimate [d]	Confidence limits 1-p= 0.95	Confidence limit estimator
Spring Chinook	Upstream of Junction City weir	Grilse	9	69	3	260		
		Adults	244	3,000	101	7,166		Poisson
		Total	253	3,069	104	7,426	6,166 - 9,054	Approximation
Fall Chinook	Upstream of Willow Creek weir	Grilse	230	141	3	6,018		
		Adults	918	7,353	287	23,575	26,449 - 33,293	Poisson
		Total	1,148	7,494	290	29,593		Approximation
Coho	Upstream of Willow Creek weir	Grilse	93	874	41	1,762		
		Adults	93	2,477	56	4,634	5,271 - 7,846	Poisson
		Total	186	3,351	97	6,396		Approximation
Fall run steelhead	Upstream of Willow Creek weir	Adults	1,437	4,251	332	18,361	16,519 - 20,306	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 2009-10 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum [a]	Run-size estimate	Angler Harvest: Harvest rate [b]	Angler Harvest: Number of fish [c]	Spawner Escapement: Natural area spawners [d]	Spawner Escapement: Trinity River Hatchery	Spawner Escapement: Total
Spring Chinook	Upstream of Junction City weir	Grilse	260	0.0%	0	191	69	260
		Adults	7,166	6.2%	442	3,724	3,000	6,724
		Total	7,426		442	3,915	3,069	6,984
Fall Chinook	Upstream of Willow Creek weir	Grilse	6,018	2.4%	145	5,732	141	5,873
		Adults	23,575	2.4%	559	15,663	7,353	23,016
		Total	29,593		704	21,395	7,494	28,889
Coho	Upstream of Willow Creek weir	Grilse	1,762	0.0%	0	888	874	1,762
		Adults	4,634	0.0%	0	2,157	2,477	4,634
		Total	6,396		0	3,045	3,351	6,396
Fall-run adult steelhead	Upstream of Willow Creek weir	Natural	5,047	3.1%	154	4,876	17	4,893
		Hatchery	13,314	10.3%	1,376	7,704	4,234	11,938
		Total	18,361		1,530	12,580	4,251	16,831

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

The yearly water allocation (flow and schedule) adopted by the Bureau of Reclamation, after input from the Trinity Management Council, had the river at a level conducive to mid-June installation of the JCW, a month earlier than the previous year. The State of California Governor-mandated furloughs made sampling more than four days a week at Junction City problematic. We were able generally to maintain our standard five day a week sampling schedule at WCW, at least when storm-fed flows did not require that conduit be pulled.

The larger than normal (3000 cfs in 2009 v. 1860 cfs in 2007) late-August HVTF Ceremonial Boat Dance flows necessitated temporary removal of the weir at Junction City and the late installation of WCW, reducing the number of overall trap days. The rain storm (high water) event and conduit pull in mid-October may have resulted in missed fish, but both the Chinook and coho runs had peaked weeks prior to that time (and JCW was already out for the season) so we likely only missed a pulse of steelhead. With a wet storm looming on the horizon, and reduced catch of all target species, we pulled WCW for the season on November 19, 2009.

The extremely strong grilse component to both the spring and fall Chinook runs in 2008 did translate into a robust three year-old Chinook cohort in 2009 (76.1 % of the springs and 90.8% of the falls), the size of the runs were not great, however, at 42.3% and 70.4% of average for the 33 year data set, spring and fall, respectively. The coho fared even less well at only 36.6% of the average run size, while the steelhead run was once again the strongest of the four runs at 123% of average (ranking 9th of 23 years on record).

We again saw much larger numbers of grilse at WCW this year than at TRH (20.3% of Chinook at WCW versus 1.9% at TRH), though nothing close to the nearly 52% observed at WCW in 2008. Until we have established, or re-established, monitoring on tributary streams we will have to continue to assume that those “excess” grilse are likely natural-produced fish headed into the South Fork Trinity, the New River and other tributaries. The fact that such a small percentage of them were ad-clipped (1.2% grilse versus 10.8% of adults) supports that assumption. It is not surprising so few grilse enter TRH as there is a standing policy to spawn them only if no other milt is available, thereby effectively selecting against that life-history type.

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. For spring Chinook the total run-size estimate was stratified based on the ratio of adults and grilse observed at JCW and TRH combined, for fall Chinook the estimate was not stratified, but was based on the WCW grilse/adult ratio only. For coho the division between grilse and adult was made purely by length frequency. The steelhead estimates above WCW are for adults only.

There were no coho caught at JCW in 2009. The WCW was installed prior to the arrival of the coho salmon run, which was concentrated in Julian weeks 38 through 43. We only caught five coho in the two final weeks of sampling. Slightly more than half of all WCW-tagged coho were eventually recovered at TRH, and all of those fish were RM-clipped (hatchery-origin) fish. There were no WCW-tagged coho trapped at TRH after JW 51, and the last coho of the season was trapped at TRH JW 3.

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 sure that not 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 trapping is suspended if water temperatures exceed 21°C. We identified 10 total tagging mortalities (0.3%) out of more than 3,323 fish handled at the two weirs; four of those mortalities were ad-clipped steelhead radio-tagged by Yurok Tribal Fisheries Department staff engaged in a straying study (for more information on that study contact Kyle DeJulio at YTF).

Before the 2000 Record of Decision, spring flow releases from Lewiston Dam were much lower than currently-mandated flows. JCW was historically installed in the beginning of May, trapping peak numbers of spring Chinook in late May and early June. Now, depending upon the water year classification and resulting flow regime, JCW is unable to be installed prior to mid-June or July, when Lewiston Dam releases allow the Trinity River main stem flows to recede below 800 cfs at Junction City. We hope to soon have a resistance board weir installed in lieu of the Alaskan-style JCW, a move we are anticipating will allow for a longer, more effective sampling season.

RECOMMENDATIONS

1. 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 equivilents

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

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

Appendix 2. Fork length distribution of coded-wire tagged, Trinity River Hatchery-produced, spring Chinook recovered at TRH during the 2009-10 season.[a]

FL	2004				2005											2006			
(cm)	065319-f	065320-f	065321-f	065326-y	065330-y	065331-y	065332-y	065333-f	065334-f	065335-f	065342-y	065343-y	065344-y	065345-y	065346-y	065347-f	065348-f	065349-f	065360-y
36																			
37																			
38																			
39																			
40																			
41																			
42																			
43																			
44																			
45																			
46																			
47																			2
48																			0
49																			0
50																			0
51																			0
52																			1
53																			1
54																			3
55																			3
56																			8
57																			7
58																1			15
59																0	1		19
60																1	1		29
61																0	0	1	30
62																2	3	1	33
63																3	1	0	30
64																1	0	3	48
65																1	2	3	33
66																3	4	0	30
67								1								2	3	0	27
68								0	1							5	2	0	24
69								0	3				1	1		3	2	1	15
70				1				1	2				0	0	1	1	3	3	24
71				0				1	1	2			1	0	1	1	1	1	5
72				1	1	1		1	1	0	2	2	2	0	0	1	0	1	4
73				0	0	0		0	1	2	0	1	0	0	1	0	1	0	8
74				0	0	1		3	0	2	0	0	0	0	0	0	3	2	1
75				3	1	0	1	0	0	1	0	0	0	0	1	0	2	1	4
76				1	1	0	0	0	2	0	1	0	1	1	0	2	0	2	1
77				2		0	0	0	1	0	1	0	0	0	0	0	0	0	1
78				1		1	0	1	3	1	1	0	1	0	0	0	3	1	4
79		1		4			0	1	2	1	0	0	1	0	0	0	0	1	1
80		0		1			0	3	0	2	1	1	0	0	0	0	0		0
81		0		1			1	1	1	1	0		0	1	0	1	1		0
82		0		5				4	0	2	0		0	0	1	1	0		0
83		1		1				1	1	1	1		0	0	0		1		0
84			1	3				0	2	0			0	0	0				0
85				2				1	0	0			0	1	0				0
86				0				1	1	1			0	0	0				1
87				1				0	2	0			1	1	1				
88				0				0		1			1		1				
89				1				0		0					0				
90				0				1		0					1				
91				1				1		0									
92	1			1						1									
93				2															
94				0															
95				2															
96																			
97																			
98	1																		
99																			
100																			
101																			
102																			
103																			
Totals:	2	2	1	34	3	3	2	22	24	18	7	4	9	5	8	29	34	21	412
Mean	95.0	81.0	84.0	82.4	74.3	74.7	78.0	79.2	76.8	79.0	76.9	74.3	76.9	79.6	79.5	67.8	69.4	69.7	64.2

a/ The fish ladder was open September 08, 2009 - March 10, 2010 (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 2009-10 season.[a]

	2004		2005					2006					2007					
FL (cm)	065324-f	065327-y	065336-f	065337-f	065338-f	065339-f	065341-y	065350-f	065351-f	065352-f	065353-f	065361-y	068804-f	068805-f	068806-f	068807-f	068809-y	Total
39																	1	1
40																	0	0
41																	0	0
42												1					5	6
43												0					1	1
44												0					1	1
45												0					3	3
46												0				1	5	6
47												0					5	5
48												0					5	5
49												0		1	1		5	7
50												0	2				0	2
51												0					0	0
52												2					1	3
53												0						0
54												1						1
55												2						2
56											1	4						5
57											0	3						3
58								1			0	6						7
59							1	0			1	8						10
60							0	1			1	10						12
61							0	0		1	0	27						28
62							0	2	4	2	2	27						37
63							0	4	4	4	5	48						65
64							0	5	4	3	2	69						83
65							0	4	5	3	2	99						113
66							0	7	4	5	6	94						116
67							1	8	11	5	3	121						149
68		1					1	3	2	11	11	126						155
69		0					0	8	10	4	5	97						124
70		0					1	9	10	14	7	103						144
71		0					2	6	2	7	1	64						82
72		0					0	5	1	8	4	49						67
73		0					3	2	6	6	6	51						74
74		0					2	0	2	6	5	39						54
75		0				1	5	2	3	2	1	23						37
76		0			1	1	6	2	2	2	0	25						39
77		0			0	0	7	0	1	2	0	20						30
78		0	1		0	1	4	0	0	0	2	13						21
79		0	0		1	1	4	1	2	1	1	12						23
80		0	0	1	0	0	6	0	1	2	0	5						15
81		0	0		0	0	8	1	0	1	1	1						12
82	1	1	0		0	1	8	1	0	0	0	0						12
83	0	0	0		0	0	6	1	0	1	0	4						12
84	1	0	1		0	1	5		0	1	1							10
85		1			0	0	4		0	1								6
86		1			0	0	1		0	0								2
87		0			0	1	4		0	1								6
88		1			0		3		1									5
89		0			0		3		0									3
90		0			0		2		0									2
91		0			0		0		1									1
92		0			1		2											3
93		1					1											2
94		0																0
95		0																0
96		0																0
97		0																0
98		1																1
Totals:	2	7	2	1	3	7	90	73	76	93	68	1,154	2	1	1	1	32	1,613
Mean	83.0	85.7	81.0	80.0	82.3	80.1	80.4	68.7	69.5	70.6	69.0	68.2	50.0	49.0	49.0	46.0	46.0	68.8

a/ The fish ladder was open September 08, 2009 - March 10, 2010 (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 2009-10 season.[a]

	JCW		
FL (cm)	Total Trapped	Ad-clips[b]	Effective Tags[c]
41	2		2
42	1		1
43	0		0
44	0		0
45	1		1
46	3		3
47	1		1
48	1		1
49	0		0
50	1		1
51	1		1
52	0		0
53	1		1
54	0		0
55	1		1
56	3	2	3
57	0	0	0
58	4	0	4
59	3	1	3
60	16	2	16
61	14	2	14
62	15	3	15
63	21	0	20
64	10	2	10
65	21	3	19
66	17	2	16
67	8	1	8
68	13	2	13
69	17	4	17
70	9	2	9
71	10	1	10
72	9	0	9
73	8	1	8
74	9	0	9
75	4	1	4
76	2	0	2
77	1	0	1
78	8	1	8
79	4	0	4
80	6	1	6
81	2	0	2
82	3	1	3
83	2	1	2
84	2	0	2
85	1	0	1
86	1	1	1
87	0		0
88	1		1
Totals:	257	34	253
Mean FL:	66.8	67.7	66.8
Total grilse:[d]	9	0	9
Total adults:	248	34	244

a/ Trapping at JCW took place June 16 - September 30, 2009 (Julian weeks 24 - 39). All Chinook trapped at JCW were considered spring Chinook. There were no spring Chinook trapped at WCW in 2009.

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 50cm 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 2009-10 season.[a]

	JCW			WCW		
FL (cm)	Total Trapped	Ad-clips[b]	Effective Tags[c]	Total Trapped	Ad-clips[b]	Effective Tags[c]
38				2		2
39				3		3
40	1		1	6		6
41	0		0	6		6
42	0		0	6		6
43	1		1	11		10
44	0		0	21		20
45	0		0	17	2	17
46	0		0	39	0	39
47	0		0	31	1	27
48	0		0	17	0	16
49	1	1	1	23	0	21
50	0		0	20	0	18
51	0		0	16	0	16
52	0		0	10	0	10
53	0		0	10	0	9
54	0		0	4	0	4
55	0		0	5	0	5
56	1		1	7	0	6
57	0		0	6	1	6
58	0		0	11	2	11
59	0		0	14	2	14
60	0		0	13	2	13
61	0		0	23	4	23
62	1		1	43	4	42
63	0		0	38	3	36
64	0		0	59	10	57
65	1		1	60	7	57
66	2		2	63	10	62
67	1	1	1	91	10	87
68	3	1	3	80	10	79
69	1		1	74	10	71
70	0		0	64	5	62
71	1		1	38	4	38
72	0		0	35	1	34
73	2	1	2	37	4	35
74	0		0	25	1	23
75	1		1	15	2	14
76	0		0	22	1	22
77	1		1	11	1	11
78	1		1	14	0	13
79	1		1	6	1	6
80	0		0	13	1	13
81	0		0	15	3	15
82	0		0	6	0	6
83	0		0	8	1	8
84	1		1	6	1	6
85	0		0	4	0	4
86	0		0	6	0	6
87	0		0	7	0	7
88	1		1	4	1	3
89				3		3
90				4		4
91				1		1
92				5		5
93				3		3
94				0		0
95				2		2
96				1		1
97				1		0
98				1		1
99				0		0
100				3		2
101				0		0
102				0		0
103				0		0
104				0		0
105				1		1
Totals:	22	4	22	1,190	105	1,148
Mean FL:	67.5	64.3	67.5	64.8	67.2	64.8
Total grilse:[d]	3	1	3	242	3	230
Total adults:	19	3	19	948	102	918

a/ Trapping at JCW took place July 16 - September 30, 2009; chinook trapped in JW 39 were considered fall Chinook. WCW took place August 31 - November 19, 2009 (Julian weeks 35-47). All Chinook trapped at WCW were considered fall Chinook in 2009.

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 55 cm FL were considered grilse.

Appendix 6. Fork length (FL) distribution of coho salmon trapped at Willow Creek weir (WCW), and recovered at Trinity River Hatchery (TRH) during the 2009-10 season.[a]

	WCW			TRH		
FL (cm)	Total Trapped	RM-clips [b]	Effective Tags [c]	WCW tags recovered at TRH	Total Trapped	RM-clips [b]
29					1	1
30					0	0
31					0	0
32					0	0
33	1				1	1
34	2				2	2
35	0				0	0
36	0				7	7
37	3	2	3	1	22	22
38	7	6	6	3	27	27
39	9	8	8	3	52	51
40	12	12	12	2	78	78
41	9	8	8	4	80	79
42	17	17	14	6	103	103
43	9	9	9	3	82	82
44	3	3	3	3	75	75
45	8	8	6	3	71	71
46	7	7	7	4	54	54
47	4	4	4	3	59	59
48	2	2	2	1	34	34
49	3	3	3	1	44	44
50	2	2	1	0	30	30
51	4	4	4	2	20	20
52	1	1	1	1	20	19
53	2	2	2	1	13	13
54	2	2	2	1	13	13
55	1	1	1	1	15	15
56	5	5	5	3	20	19
57	1	1	1	1	18	17
58	4	3	4	3	31	31
59	2	2	2	1	37	37
60	4	4	4	2	73	72
61	8	8	8	7	111	108
62	13	11	13	9	171	168
63	11	9	10	5	190	185
64	8	8	8	4	273	266
65	11	11	11	6	292	283
66	12	12	12	9	315	305
67	6	4	5	1	287	269
68	3	1	3	1	195	183
69	1	1	0	0	169	164
70	4	2	3	1	121	115
71	1	1	1	1	58	56
72					44	37
73					20	19
74					11	11
75					7	7
76					3	3
77					1	1
78					1	1
79					1	1
Totals:	202	184	186	97	3,352	3,258
Mean FL:	52.5	52.4	53.0	54.6	59.7	59.5
Total grilse: [d]	105	98	93	41	875	872
Total adults:	97	86	93	56	2,477	2,386

a/ Trapping at WCW took place August 31 - November 19, 2009 (Julian weeks 35-47). The fish ladder was open September 08, 2009 - March 10, 2010 (closed all or parts of JW 41-43). There were no coho trapped at Junction City weir in 2009.

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 54 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 2009-10 season.[a]

	Willow Creek weir			Trinity River Hatchery		
FL (cm)	Total Trapped	Ad-clips[bc]	Effective Tags[d]	WCW tags recovered at TRH	Total Trapped	Ad-clips[b]
31	1				4	4
32	4	2			0	0
33	9	1			3	3
34	2	2			0	0
35	5	1			4	3
36	4	1			2	1
37	3	3			3	3
38	2	2			9	9
39	4	2			2	2
40	1	1			6	6
41	2	2			3	3
42	0	0			1	1
43	1	0	1		1	1
44	1	1	1		2	2
45	0	0	0		4	3
46	2	0	2		1	1
47	1	0	0		0	0
48	2	0	2		4	4
49	4	1	3		5	5
50	9	3	6		16	16
51	10	3	10		18	18
52	12	7	10	3	25	24
53	18	11	17	1	31	31
54	38	27	32	4	73	73
55	57	43	51	8	93	92
56	82	58	66	13	157	157
57	87	62	74	16	232	232
58	145	121	124	29	299	296
59	158	114	142	27	387	386
60	202	157	173	36	422	421
61	182	145	160	30	445	443
62	150	109	133	35	438	438
63	112	83	92	34	365	364
64	105	75	99	34	331	328
65	62	38	57	15	235	234
66	55	38	49	13	189	188
67	49	39	45	15	176	175
68	26	14	26	8	110	110
69	23	14	22	6	74	74
70	16	8	12	2	38	38
71	14	7	14	3	32	32
72	5	2	5		18	18
73	5	4	5		10	10
74	2	2	2		5	5
75	2	1	2		4	4
76					1	1
77					2	2
78					1	1
79					4	4
80					1	1
81					0	0
82					0	0
83					0	0
84					1	1
Totals:	1,674	1,204	1,437	332	4,287	4,268
Mean FL:	60.1	60.3	60.7	61.5	61.2	61.2
Total 1/2 pounders:[e]	37	17	0	0	36	34
Total adults:	1,637	1,187	1,437	332	4,251	4,234

[a] Trapping at WCW took place August 31 - November 19, 2009 (Julian weeks 35-47). The fish ladder was open September 08, 2009 - March 10, 2010 (closed all or parts of JW 41-43).

[b] Ad-clips= Adipose fin-clipped fish.

[c] Other clips included: 1-left maxillary, 1-left maxillary + ad-clip, and 1-right maxillary clip.

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

[e] 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 Chinook salmon tagged at Junction City weir and subsequently recovered during the 2009-10 season. [a]

		Recoveries							
FL (cm)	Total Tagged	Tag Morts [b]	Carcass [c] Recoveries	TRH [d] Recoveries	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
40	1							0	0.0
41	2			1				1	50.0
42	1			0				0	0.0
43	1			0				0	0.0
44	0			0				0	--
45	1			0				0	0.0
46	3			2				2	66.7
47	1			0				0	0.0
48	1			0				0	0.0
49	1		1	0				1	100.0
50	1		0	0				0	0.0
51	1		0	0				0	0.0
52	0		0	0				0	--
53	1		0	0				0	0.0
54	0		0	0				0	--
55	1		0	0				0	0.0
56	4		0	3				3	75.0
57	0		0	0				0	--
58	4		0	2		1		3	75.0
59	3		0	2		0		2	66.7
60	16		1	10		1		12	75.0
61	14		0	5		0		5	35.7
62	16		0	11		0		11	68.8
63	21	1	0	8		1		10	47.6
64	10	0	0	7		1		8	80.0
65	22	2	2	8		1		13	59.1
66	19		0	8		0		8	42.1
67	9		0	4		0		4	44.4
68	16		3	3		0		6	37.5
69	18		3	6	1	0		10	55.6
70	9		0	4		0		4	44.4
71	11		1	3		2		6	54.5
72	9		0	4				4	44.4
73	10		0	3				3	30.0
74	9		0	3			1	4	44.4
75	5		0	1				1	20.0
76	2		0	0				0	0.0
77	2		0	2				2	100.0
78	9		1	2				3	33.3
79	5		0	1				1	20.0
80	6		1	1				2	33.3
81	2			1				1	50.0
82	3			0				0	0.0
83	2			2				2	100.0
84	3			1				1	33.3
85	1							0	0.0
86	1							0	0.0
87	0							0	--
88	2							0	0.0
Grilse: [h]	12	0	1	3	0	0	0	4	33.3
Adults:	267	3	12	105	1	7	1	129	48.3
Total:	279	3	13	108	1	7	1	133	47.7

a/ Trapping at Junction City took place June 16 - September 30, 2009 (Julian weeks 24-39).
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 08, 2009 - March 10, 2010 (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/ Spring Chinook <50 cm FL were considered grilse.

Appendix 9. Fork length (FL) distribution of fall Chinook tagged at Willow Creek weir and subsequently recovered during the 2009-10 season. [a]

		Recoveries							
FL (cm)	Total Tagged	Tag Morts [b]	Carcass Recoveries [c]	TRH Recoveries [d]	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
38	2							0	0.0
39	3							0	0.0
40	6							0	0.0
41	6		1					1	16.7
42	6		0					0	0.0
43	11		0	2	1			3	27.3
44	21		1	0	1			2	9.5
45	17		1	0	0	1		2	11.8
46	39		1	1	0	1		3	7.7
47	29		0	0	2	1		3	10.3
48	17		0	0	1	0		1	5.9
49	22		0	0	1	0		1	4.5
50	19		0	0	1	1		2	10.5
51	16		0	0	0	1		1	6.3
52	10		0	0	0	0		0	0.0
53	10		0	0	1	0		1	10.0
54	4		0	0	0	0		0	0.0
55	5		0	2	0	0		2	40.0
56	6		1	2	0	0		3	50.0
57	6		0	1	0	0		1	16.7
58	11		2	3	0	0		5	45.5
59	14		0	3	0	0		3	21.4
60	13		0	7	0	0		7	53.8
61	23		3	11	0	0		14	60.9
62	43		4	15	1	0		20	46.5
63	37		1	16	1	0		18	48.6
64	58		5	23	1	0		29	50.0
65	58		3	25	1	0		29	50.0
66	63		3	26	1	0		30	47.6
67	88		2	30	1	2		35	39.8
68	79		2	28	0	0	1	31	39.2
69	72		4	22	1	1		28	38.9
70	64	1	4	20	1	1		27	42.2
71	38		3	14	0	2		19	50.0
72	34		4	10	0	1		15	44.1
73	35		6	10	0	1		17	48.6
74	24		3	2	1	2		8	33.3
75	14		2	2		0		4	28.6
76	22		4	4		0		8	36.4
77	11		1	2		0		3	27.3
78	13		1	2		1		4	30.8
79	6		0	1				1	16.7
80	13		1	0				1	7.7
81	15		2	4				6	40.0
82	6		1	0				1	16.7
83	8		2	0				2	25.0
84	6		0	1				1	16.7
85	4		0	0				0	0.0
86	6		0	1				1	16.7
87	7		1	1				2	28.6
88	3			1				1	33.3
89	3			0				0	0.0
90	4			0				0	0.0
91	1			0				0	0.0
92	5			1				1	20.0
93	3							0	0.0
94	0							0	--
95	2							0	0.0
96	1							0	0.0
97	0							0	--
98	1							0	0.0
99	0							0	--
100	2							0	0.0
101	0							0	--
102	0							0	--
103	0							0	--
104	0							0	--
105	1							0	0.0
Grilse: [h]	238	0	4	3	8	5	0	20	8.4
Adults:	928	1	65	290	9	11	1	377	40.6
Total:	1,166	1	69	293	17	16	1	397	34.0

a/ Trapping at Willow Creek took place August 31 - November 19, 2009 (Julian weeks 35-47). All Chinook trapped at WCW in 2009 were considered fall run.
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 08, 2009 - March 10, 2010 (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 <55 cm FL were considered grilse.

Appendix 10. Fork length (FL) distribution of coho tagged at Willow Creek weir and subsequently recovered during the 2009-10 season. [a]

		Recoveries							
FL (cm)	Total Tagged	Tag Morts [b]	Carcass Recoveries [c]	TRH Recoveries [d]	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
37	3			1				1	33.3
38	6			3				3	50.0
39	8			3				3	37.5
40	12		1	2				3	25.0
41	8			4				4	50.0
42	15			6	1			7	46.7
43	9			3				3	33.3
44	3			3				3	100.0
45	6			3				3	50.0
46	7			4				4	57.1
47	4			3				3	75.0
48	2			1				1	50.0
49	3			1				1	33.3
50	1			0				0	0.0
51	4			2				2	50.0
52	1			1				1	100.0
53	2			1				1	50.0
54	2			1				1	50.0
55	1			1				1	100.0
56	5		1	3				4	80.0
57	1			1				1	100.0
58	4			3				3	75.0
59	2			1				1	50.0
60	4			2				2	50.0
61	8			7				7	87.5
62	13			9				9	69.2
63	11			5	1			6	54.5
64	8			4				4	50.0
65	11			6				6	54.5
66	12			9				9	75.0
67	5			1				1	20.0
68	3			1				1	33.3
69	0			0				0	--
70	3			1				1	33.3
71	1			1				1	100.0
Grilse: [h]	94	0	1	41	1	0	0	43	45.7
Adults:	94	0	1	56	1	0	0	58	61.7
Total:	188	0	2	97	2	0	0	101	53.7

a/ Trapping at Willow Creek weir took place from August 31 - November 19, 2009 (Julian weeks 35-47). There were no coho trapped at JCW during the 2009 season.

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 08, 2009 - March 10, 2010 (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 <54 cm FL were considered grilse.

Appendix 11. Fork length (FL) distribution of adult fall-run steelhead tagged at Willow Creek weir and subsequently recovered during the 2009-10 season. [a]

FL (cm)	Total Tagged	Recoveries: Tag Morts [b]	Carcass Recoveries [c]	TRH Recoveries [d]	Angler Released [e]	Angler Harvest [f]	Angler Found Tags [g]	Total Recoveries	% Recoveries
43	1							0	0.0
44	1							0	0.0
45	0							0	--
46	2							0	0.0
47	1				1			1	100.0
48	2				0			0	0.0
49	4				1			1	25.0
50	9				3			3	33.3
51	10				0			0	0.0
52	12			3	2	1		6	50.0
53	18			1	1	1		3	16.7
54	38	1		5	5	2		13	34.2
55	57	1		9	5	1	1	17	29.8
56	82	0		11	16	7	0	34	41.5
57	85	0		16	11	7	0	34	40.0
58	144	0		29	20	9	0	58	40.3
59	157	0		27	15	8	0	50	31.8
60	200	1		36	26	15	1	79	39.5
61	180	1		30	19	7	1	58	32.2
62	148	1		35	14	7		57	38.5
63	110	0		33	18	5		56	50.9
64	105	0		36	6	1		43	41.0
65	62	1		14	4	2		21	33.9
66	55			14	6	5		25	45.5
67	49			16	4	2		22	44.9
68	26			7	0	1		8	30.8
69	23			5	1			6	26.1
70	16			2	4			6	37.5
71	14			3				3	21.4
72	5							0	0.0
73	5							0	0.0
74	2							0	0.0
75	2							0	0.0
Totals:	1,625	6	0	332	182	81	3	604	37.2

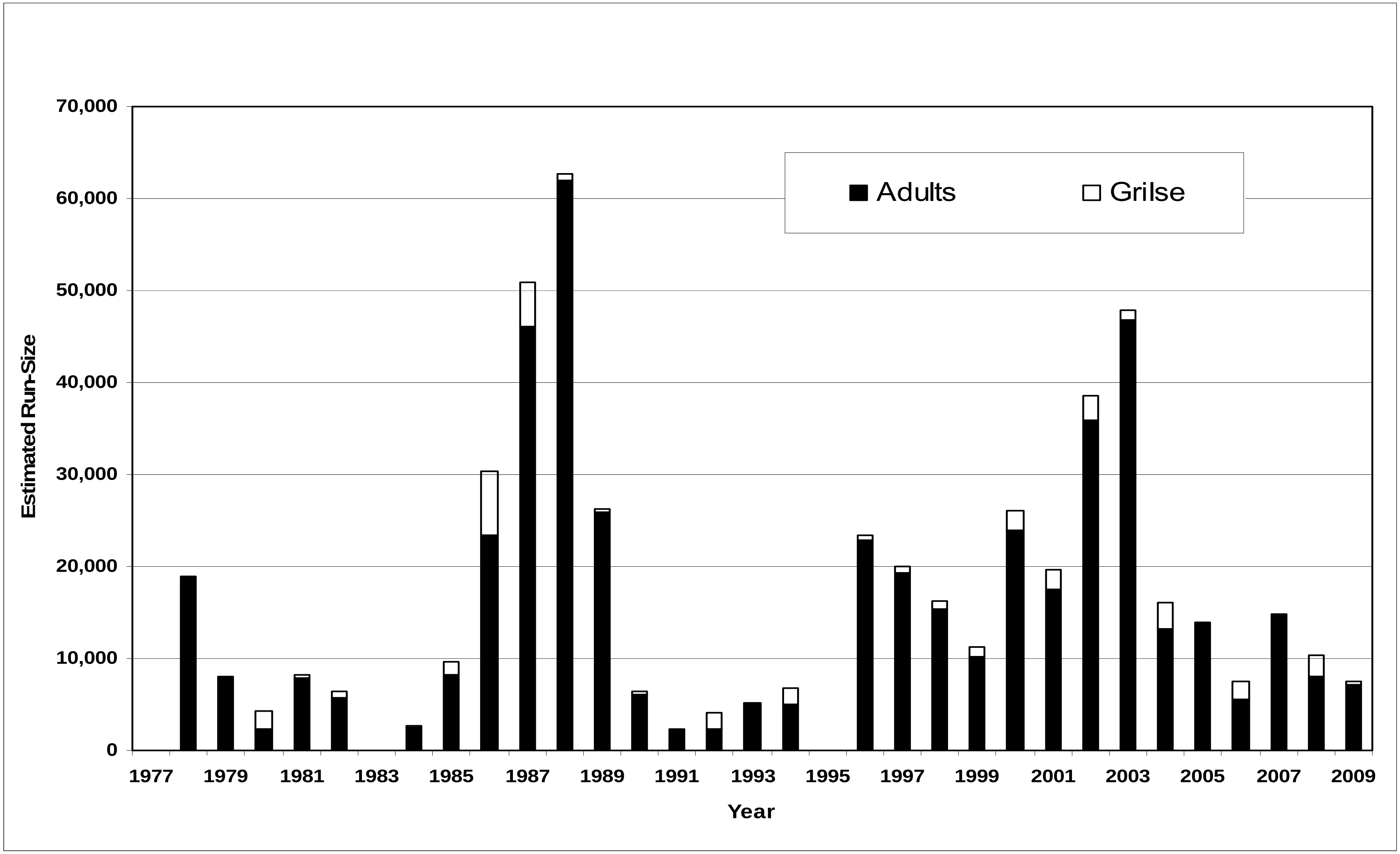
a/ Trapping at Willow Creek took place August 31 - November 19, 2009 (Julian weeks 35 - 47).
b/ Tagged fish found dead and unspawned within 30 days of tagging.
c/ Fish recovered in upper Trinity River carcass surveys. There were no steelhead recovered in the 2009 survey.
d/ The fish ladder was open September 08, 2009 - March 10, 2010 (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 from 1977 through 2009.

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

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 from 1977 through 2009.



Appendix 13. Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2009.

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

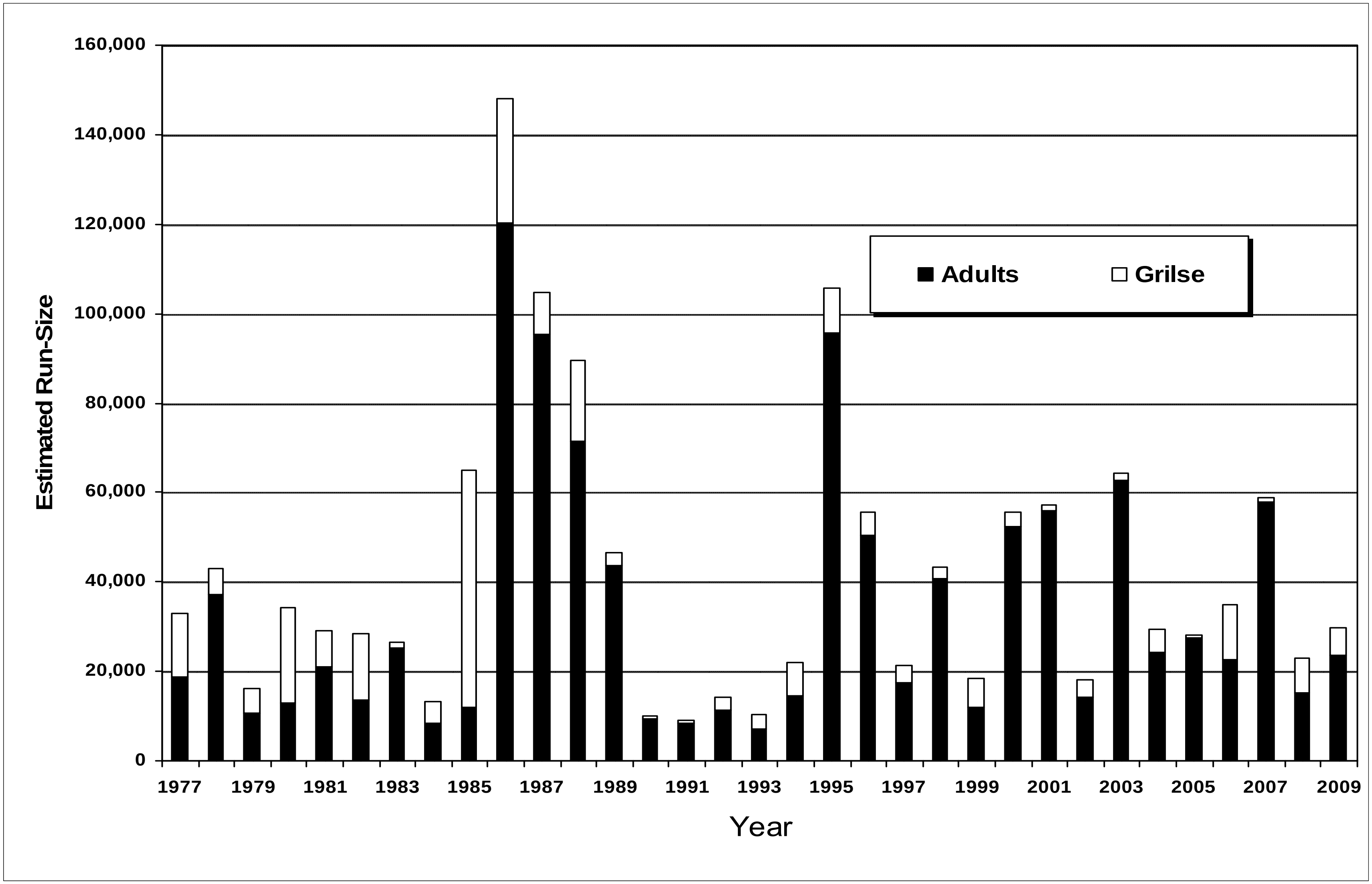
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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 1999-2008 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, and 30,800 in 2009.

Appendix 13 (continued). Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2009.



Appendix 14. Coho salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2009.

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

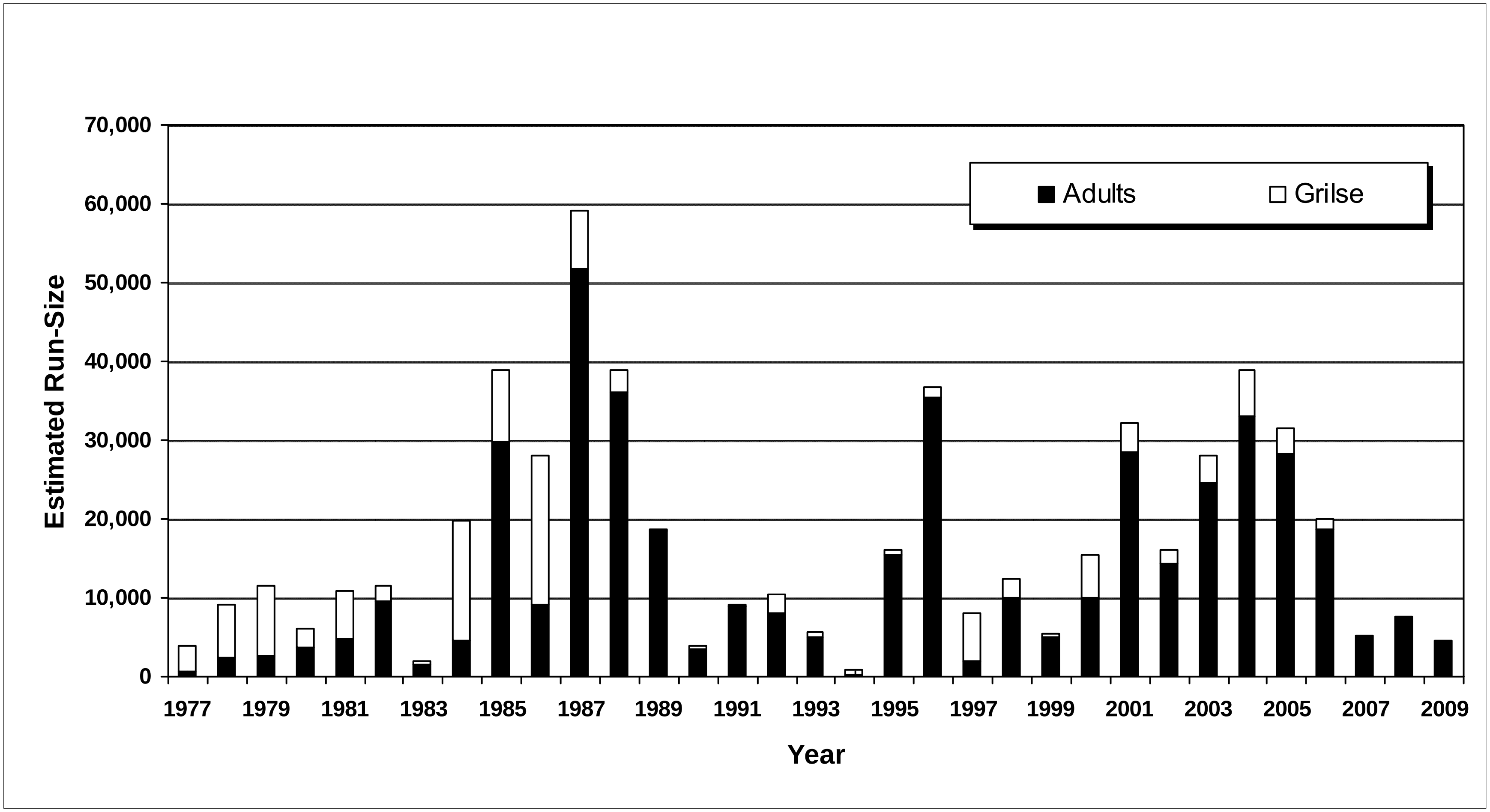
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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 from 1977 through 2009.

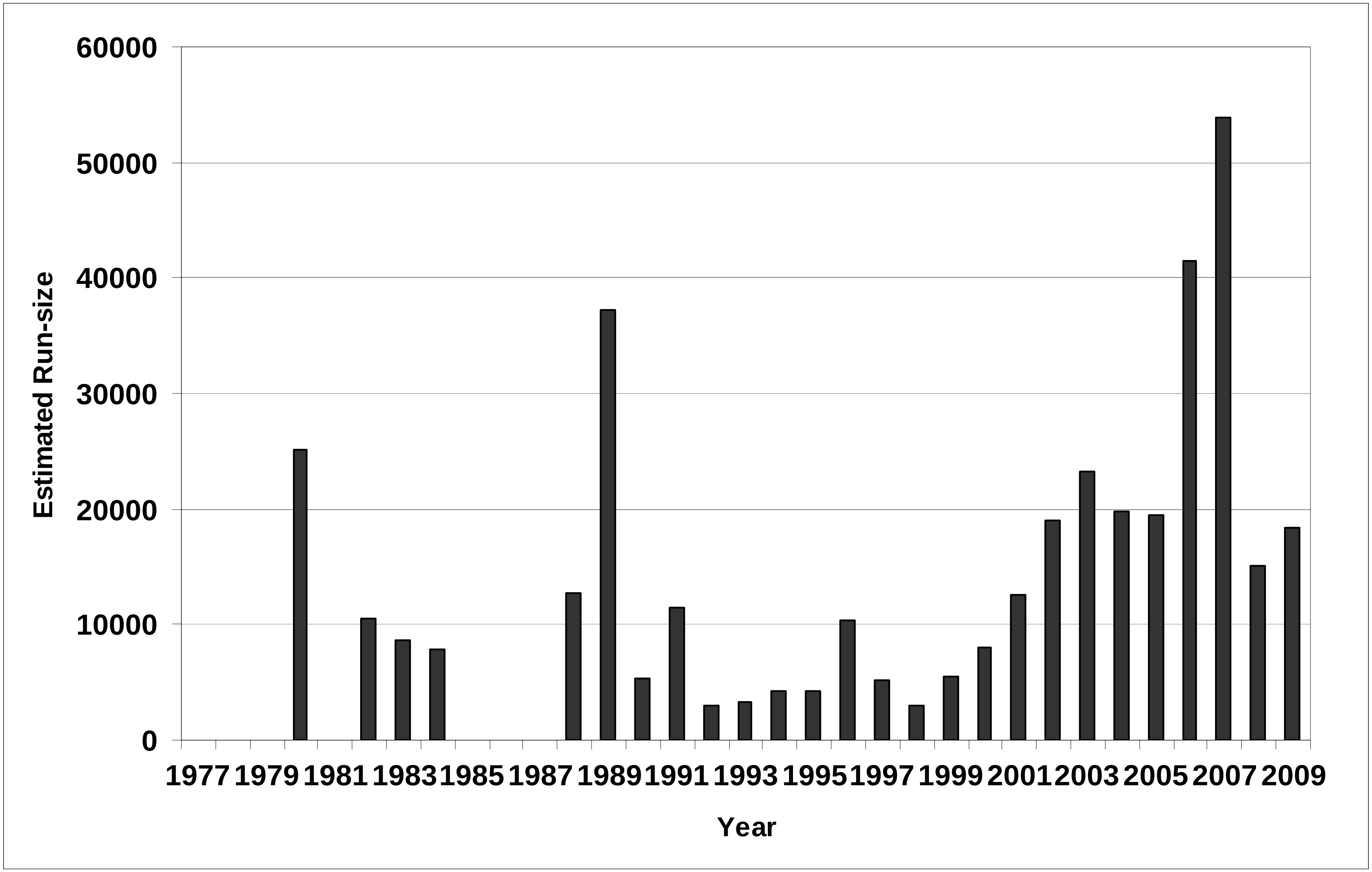


Appendix 15. Fall-run adult steelhead (>41cm FL) run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2009.

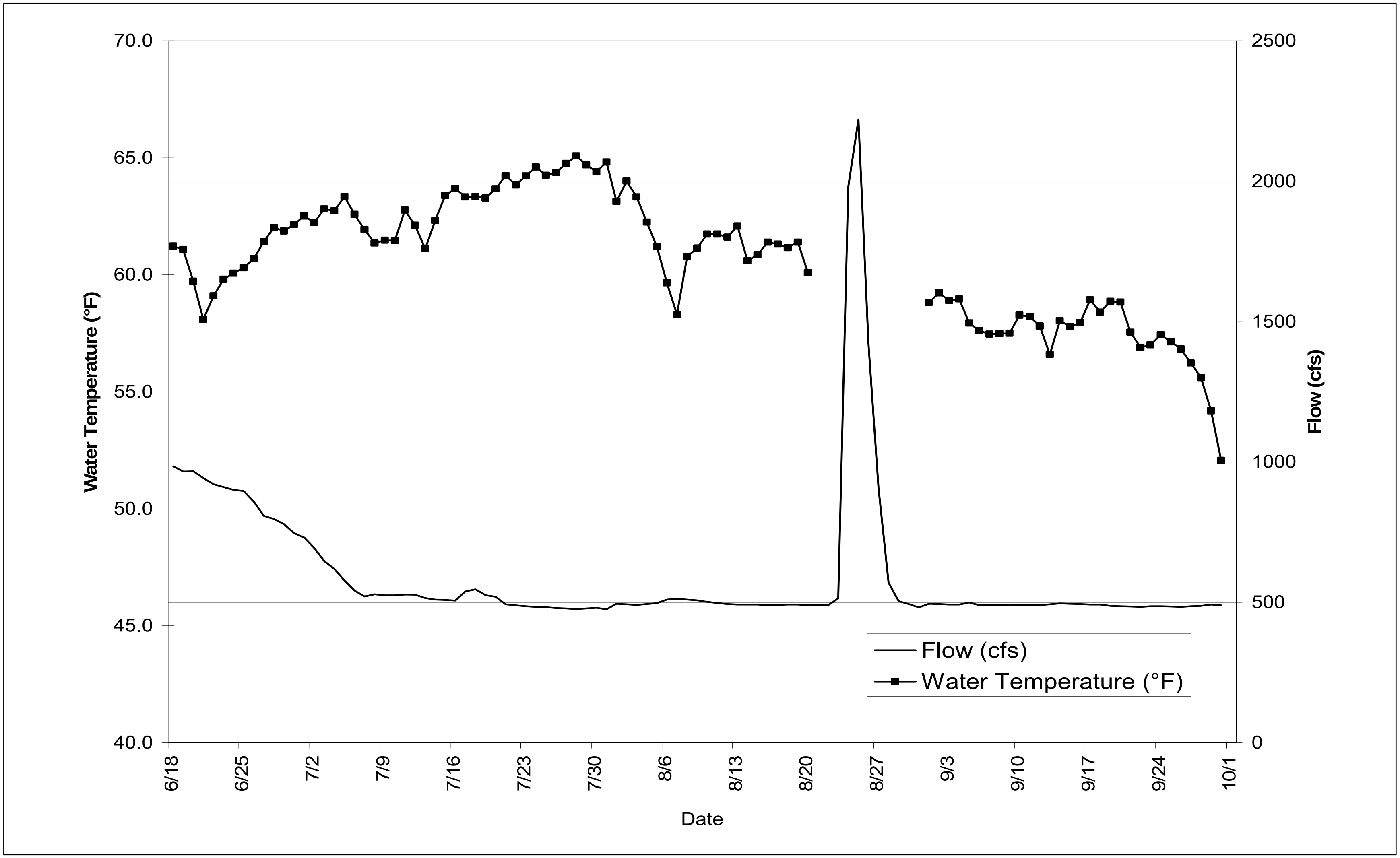
	Run-size estimate					Spawner escapement						Angler harvest		
						Natural Area Spawners[a]			Trinity River Hatchery					
	Hatchery[b]		Wild[c]			Hatchery	Wild	Total	Hatchery	Wild	Total	Hatchery	Wild	Total
Year	Number	Percent	Number	Percent	Total									
1977			No estimates				No estimates		269	16	285		No estimates	
1978			"				"		628	55	683		"	
1979			"				"		329	53	382		"	
1980	8,449	33.7	16,645	66.3	25,094	5,101	14,462	19,563	1,903	102	2,005	1,445	2,081	3,526
1981			No estimates				No estimates		892	112	1,004		No estimates	
1982	2,106	20.0	8,426	80.0	10,532	971	6,889	7,860	634	79	713	501	1,458	1,959
1983	No estimates for hatchery/wild component				8,605			6,661			599			1,345
1984		"			7,833			6,430			142			1,261
1985		No estimates				No estimates					461	No estimates		
1986		"					"				3,780		"	
1987		"					"				3,007		"	
1988	No estimates for hatchery/wild component				12,743			11,926 [d]			817		"	
1989		"			37,276			28,933			4,765			3,578
1990		"			5,348			3,188			930			1,230
1991		"			11,417			8,631			446			2,340
1992	1,315	43.2	1,731	56.8	3,046	759	1,540	2,299	430	25	455	126	166	292
1993	1,894	58.4	1,349	41.6	3,243	801	1,176	1,977	875	10	885	218	163	381
1994	1,477	34.8	2,767	65.2	4,244	878	2,410	3,288	403	8	411	196	349	545
1995	1,595	37.2	2,693	62.8	4,288	1,424	1,867	3,291	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		4,267	No estimates		429	No estimates		516
1998		"			2,972	"		2,463	"		441	"		68 [e]
1999		"			5,470	"		3,817	"		1,571	"		82 [e]
2000		"			8,042	"		7,097	"		768	"		177 [e]
2001		"			12,638	"		9,938	"		2,333	"		367 [e]
2002	14,408	75.6	4,650	24.4	19,058	7,730	4,566	12,296	5,966	42	6,008	697	57	754 [e]
2003	19,245	83.0	3,947	17.0	23,192	8,717	3,837	12,554	10,182	42	10,224	346	68	414 [e]
2004	15,038	75.7	4,817	24.3	19,855	8,937	4,732	13,669	5,688	37	5,725	413	48	461 [e]
2005	14,049	72.4	5,363	27.6	19,412	5,782	5,280	11,062	8,080	63	8,143	187	20	207 [e]
2006	32,609	78.8	8,781	21.2	41,390	20,272	8,660	28,932	11,509	38	11,547	828	83	911 [e]
2007	46,379	86	7,506	14	53,885	31,923	7,405	39,328	11,366	31	11,397	3,090	70	3,160 [e]
2008	9,538	64	5,477	36	15,015	6,680	5,415	12,095	2,471	24	2,495	386	38	424 [e]
2009	13,314	73	5,047	27	18,361	7,704	4,877	12,581	4,234	17	4,251	1,376	154	1,530 [e]

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.

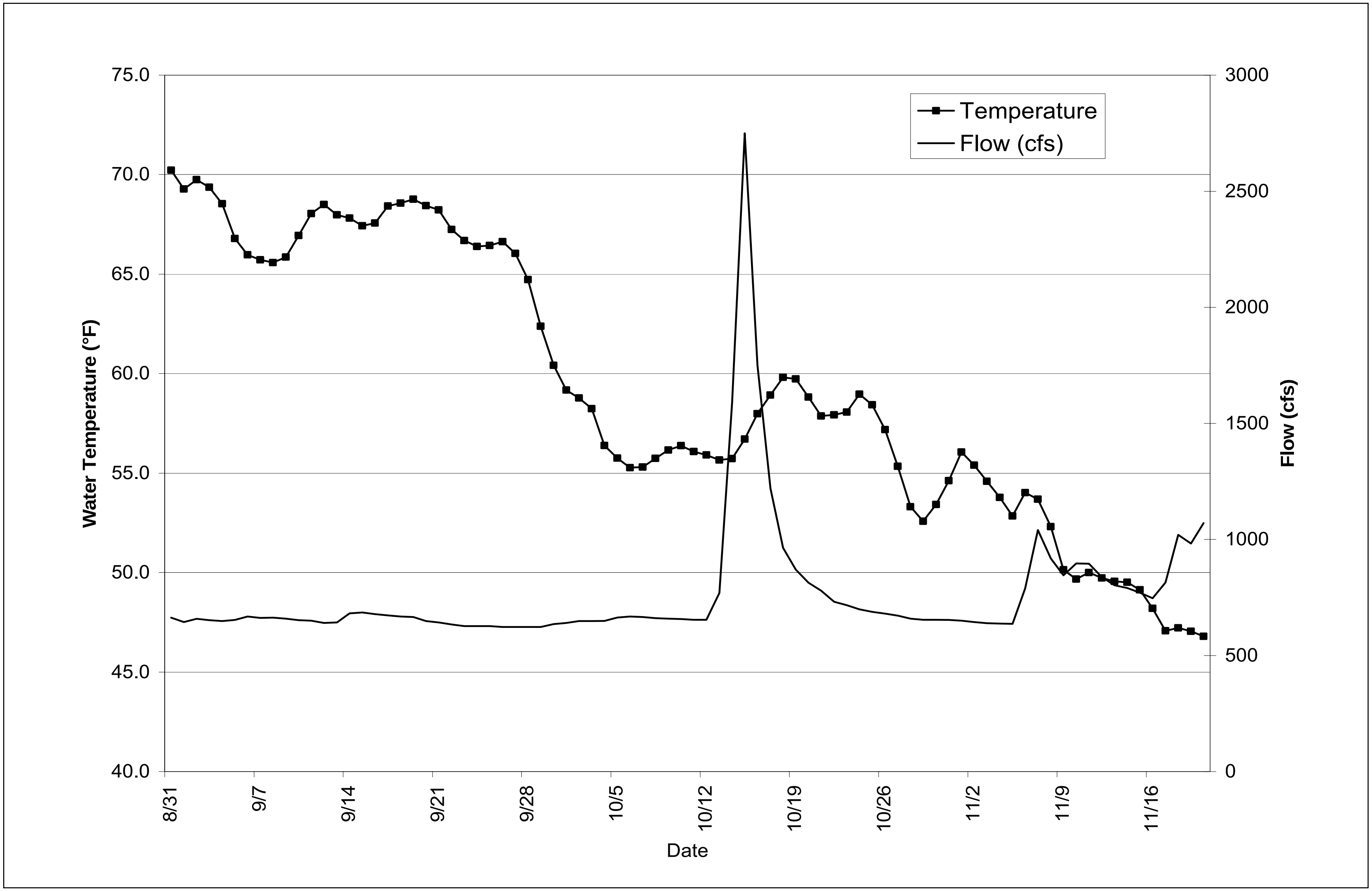
Appendix 15 (continued). Fall-run adult steelhead (>41cm FL) run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2009.



Appendix 16. Daily mean flow (CFS) recorded at the USGS guage (11526250) of the Trinity River and water temperature at Junction City weir, 2009.



Appendix 17. Daily mean flow (CFS) recorded at the USGS guage (11530000) of the Trinity River and water temperature at Willow Creek weir, 2009.



ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2009-10 SEASON

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

by

Wade Sinnen

ABSTRACT

Recovery of marked spring-run (spring) and fall-run (fall) Chinook salmon *(Oncorhynchus tshawytscha)* at Trinity River Hatchery (TRH) was conducted between September 8, 2009 and March 10, 2010. Of the 10,564 Chinook salmon that entered TRH, we recovered 2,433 adipose fin-clipped (AD) Chinook salmon, 23.0 % of the total. Of these, coded-wire tags (CWT) were recovered from 652 spring Chinook and 1,613 fall Chinook salmon.

We estimated that 979 marked (AD+CWT) spring Chinook returned to the Trinity River upstream of the Junction City weir (JCW) and 2,466 marked fall Chinook returned to the Trinity River upstream of the Willow Creek weir (WCW) during the 2009-10 season.

Estimated in-river run-size, angler harvest, and spawner escapements of marked TRH spring and fall Chinook salmon for the 2004 through 2007 brood years (BY's) are presented. Complete returns are only available for both runs of fish from the 2004 BY. These fish have reached age five and are considered to have completed their life cycle. Chinook in-river return rates (expressed as a percentage of release numbers) for the completed 2004 BY ranged from 0.685% to 0.968% for spring Chinook fingerling CWT groups and 0.432% to 0.91% for fall Chinook fingerlings. Returns of spring Chinook released as yearlings was estimated at 1.22%, while fall Chinook yearlings returned at a rate of 1.79%.

Total spring Chinook run-size, upstream of Junction City Weir, was estimated to be composed of 3,973 (53.5%) Trinity River Hatchery produced fish and 3,453 naturally produced fish. Similar estimates for fall Chinook, upstream of Willow Creek Weir, were 10,072 (34.0%) hatchery produced fish and 19,521 naturally produced fish.

TASK OBJECTIVES

To determine relative return rates and the contribution to spawning escapement and in-river sport fisheries made by Chinook salmon produced at Trinity River Hatchery, and to evaluate experimental hatchery management practices aimed at increasing adult returns, while reducing competition among wild fish.

INTRODUCTION

During the period of June 17, 2009 through March 10, 2010, the California Department of Fish and Game's (CDFG) Trinity River Project recaptured Chinook salmon returning to the Trinity River at two temporary main stem weir sites and Trinity River Hatchery (TRH) from previously marked brood years (BY's). Marked Chinook (AD+CWT) were identified by an adipose fin-clip (AD). These fish were implanted with a binary coded-wire tag (CWT) prior to their release from TRH as either smolts or yearlings. Both spring-run (spring) and fall-run (fall) Chinook were representatively marked at a rate of approximately 25%. Prior to 1995, the CDFG was responsible for the coded-wire tagging program at TRH. Beginning in 1995, the coded-wire tagging program at TRH has been conducted by the Hoopa Valley Tribal (HVT) Fisheries Department. Due to the change in responsibilities, the Department will no longer report on the juvenile tagging effort at TRH. Our efforts are directed at the recovery of these coded-wire tagged fish and analyzing the information derived from their recovery. This study is a continuation of previous studies conducted by the CDFG and is reliant on data presented in Sinnen 2000, 2002, 2004a, 2004b, 2005, 2006, 2008, 2009, 2010.

METHODS

Marking of Chinook Salmon at Trinity River Hatchery

As previously mentioned, the HVT representatively marks (AD+CWT) approximately 25% of all Chinook salmon at TRH. As such, the HVT is responsible for conducting 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 fish marked correctly is recorded on standard release forms and sent to the DFG 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 4 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 Basin.

Main Stem Weirs

We examined 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), was located approximately 47 KM downstream of Lewiston Dam, the uppermost point of anadromy. The lower site, Willow Creek weir (WCW), was located 143 KM downstream of Lewiston dam and approximately 36.5 KM upstream of the Trinity River and Klamath River confluence near Weitchpec.

Both weirs are operated to capture a sample of migrating salmon and steelhead for the purpose of estimating in-river run-size of spring and fall Chinook salmon, coho salmon and fall-run 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 runs of fall Chinook, coho and 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 (AD-clip) indicates the fish is of hatchery origin and may contain a coded-wire tag (CWT), implanted as juveniles prior to their release from Trinity River Hatchery. The CWT code identifies the race, release type (fingerling or yearling) and brood year of each fish. Each Chinook that is deemed in good condition is tagged with a serially numbered floy tag (project tag) and immediately released. After the weirs are removed for the season the number and ratio of Ad-clipped to non-clipped Chinook salmon used to estimate the proportion of each run that is of hatchery origin. Cohort tables are maintained for in-river returns of hatchery produced Chinook salmon.

Coded-Wire Tag Recovery

Trinity River Hatchery (TRH)

All Chinook salmon which enter TRH are examined for 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 dissection, CWT extraction and decoding in the laboratory.

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) was assigned to the head tag to indicate such.

All CWTs recovered during the dissection were read using a Nikon SMZ-1 Stereozoom microscope equipped with a 10X widefield eyepiece. The microscope has a continuous magnification zoom range of 7X to 30X. The code was identified and transferred to the head tag. All head tags and corresponding CWT codes were 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 was a single record in our database ready for pertinent analysis.

Estimation Techniques

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, and 4) Proportion of CWT groups recovered at TRH. 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:

$$N_{CWT} = \frac{NW_{ADclip}}{NW} \times \frac{NH_{ADCWT}}{NH_{ADclip}} \times N_{run\text{-}size\ estimate}$$

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 <u>and</u> a CWT; NH_{ADclip} = total number of AD-clipped salmon observed at TRH; and $N_{run\text{-}size\ estimate}$ = 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:

$$F_{CWT\ group} = \frac{NH_{CWT\ group}}{NH_{ADCWT}}$$

where, $F_{CWT\ group}$ = fraction of the salmon population with a specific CWT code; and $NH_{CWT\ group}$ = 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:

$$N_{CWT\ group} = N_{CWT} \times F_{CWT\ group}$$

where, $N_{CWT\ group}$ = 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:

$$SF_{CWT\ group} = N_{CWT\ group} \times N_{harvest\ rate\ estimate}$$

where, $SF_{CWT\ group}$ = number of salmon of a specific CWT group caught in the Trinity River sport fishery; and $N_{harvest\ rate\ estimate}$ = harvest rate estimate.

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

$$N_{CWT\ escapement} = N_{CWT\ group} - SF_{CWT\ group}$$

where, $N_{CWT\ escapement}$ = 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:

$$N_{CWT\ natural\ escapement} = N_{CWT\ escapement} - NH_{CWT\ group}$$

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

As stated above, estimating the total return of individual CWT groups depends on a basin run-size estimate. In evaluating the return of CWT hatchery Chinook, we normally 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 upstream of the JCW (river km [RKM] 137.1) and the WCW (RKM 36.4), 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.

In this report, we present estimated contribution rates of TRH-produced Chinook salmon to total spring and fall Chinook run-sizes. This is accomplished 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.

RESULTS

Coded-Wire Tag Recovery

We recovered 10,564 Chinook salmon at TRH this season, of which 2,433 (23.0%) bore AD-clips. We recovered CWTs from 652 known spring Chinook and 1,613 known fall Chinook (Table 1). The remaining 168 AD-clipped fish had either shed their CWT (134) or the CWT was lost or unreadable (34). 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 23 release groups from the 2004 through 2007 BY’s. Fall Chinook CWTs were composed of 18 groups representing the 2004 through 2007 BY’s (Table 1).

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

<u>Spring-run Chinook Salmon</u>

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 estimated that 979 (21 grilse and 959 adults) CWTed spring Chinook salmon returned to the Trinity River above JCW during the 2009 season (Table 2).

An estimated 59 adult and zero grilse CWTed fish were harvested by anglers during the season. Escapement of CWTed spring Chinook was divided between 652 fish recovered at TRH and 268 estimated to have spawned in natural areas (Table 2). The year’s run of known aged CWTed spring Chinook was composed of the following: 21 (2.2%) age 2; 742 (76.0%) age 3; 155 (15.9%) age 4; and 58 (5.9%) age 5 fish (Table 2).

2004 Brood Year
Four spring Chinook CWT groups from the 2004 BY completed their life cycle this season, having reached the age of five. Cumulative age two through five in-river return rat estimates, expressed as a percentage of release numbers, ranged from 0.685% to 0.968% for fingerling release groups. The one yearling release group, 065326, experienced a return rate of 1.22% (Table 3). Thus, yearlings returned at a rate approximately twice lf that of their fingerling released cohorts. All release types experienced their highest returns as age three fish, although similar returns were noted for age three and four-year old fish from the yearling release group.

2005 Brood Year
Spring Chinook from the 2005 brood year will complete their life cycle next year. To date, fish from this brood have returned through age four. Both fingerling and yearling release groups have experienced poor returns (less than 0.2% to date), which is approximately 3 times less than the completed 2004 BY returns (Table 3). It is not expected that return rates for this brood will increase much since the age five component is historically very small for Trinity River Hatchery Chinook stocks.

2006 Brood Year
Spring Chinook from the 2006 brood year have returned as age two and three thus far. Based on early returns ranging from 0.055% to 0.642%, this brood is appears to be stronger than 2005 BY spring Chinook (Table 3), particularly the yearling group (065360).

2007 Brood Year
Three 2007 BY release groups (2 fingerling and 1 yearling) returned as two-year-olds this season. Thus far, the yearling CWT group, 068810, has experienced the highest return rate (Table 3). Spring Chinook from this BY are expected to return as three through five-year-olds during the next three years.

Table 1. Release and recovery data for adipose fin-clipped chinook recovered at Trinity River Hatchery (TRH) during the 2009-10 season.

Release data							Recovery data				
CWT a/ code	Egg source	Brood year	Date	Number	Size (No./lb)	Site	Males No.	Males FL b/	Females No.	Females FL b/	Total
Spring-run Chinook salmon											
065319	TRH	2004	06/1-8/05	91,301	38.0	TRH	2	95.0	0	-----	2
065320	TRH	2004	06/1-8/05	90,290	38.0	TRH	0	-----	2	81.0	2
065321	TRH	2004	06/1-8/05	72,239	48.0	TRH	1	84.0	0	-----	1
065326	TRH	2004	10/3-11/05	104,478	9.9	TRH	14	86.6	20	79.5	34
065330	TRH	2005	10/2-16/06	11,265	13.3	TRH	1	72.0	2	75.5	3
065331	TRH	2005	10/2-16/06	11,247	13.3	TRH	1	78.0	2	73.0	3
065332	TRH	2005	10/2-16/06	11,959	13.3	TRH	1	81.0	1	75.0	2
065333	TRH	2005	06/1-7/06	93,920	56.0	TRH	12	82.3	10	75.6	22
065334	TRH	2005	06/1-7/06	95,152	56.0	TRH	8	83.5	16	73.5	24
065335	TRH	2005	06/1-7/06	74,036	54.5	TRH	8	83.6	10	75.3	18
065342	TRH	2005	10/2-16/06	11,382	13.3	TRH	3	77.0	4	76.8	7
065343	TRH	2005	10/2-16/06	11,510	13.3	TRH	1	73.0	3	74.7	4
065344	TRH	2005	10/2-16/06	11,766	13.3	TRH	4	80.5	5	74.0	9
065345	TRH	2005	10/2-16/06	11,169	13.3	TRH	4	80.5	1	76.0	5
065346	TRH	2005	10/2-16/06	27,309	13.3	TRH	3	88.3	5	74.2	8
065347	TRH	2006	06/1-08/07	65,914	64.2	TRH	13	69.3	16	66.6	29
065348	TRH	2006	06/1-08/07	86,088	76.2	TRH	15	69.9	19	69.1	34
065349	TRH	2006	06/1-08/07	74,456	76.2	TRH	13	71.3	8	67.1	21
065360	TRH	2006	10/1-10/07	74,456	11.7	TRH	225	65.6	187	62.5	412
068801	TRH	2007	06/2-12/08	55,773	96.0	TRH	1	40.0	0	-----	1
068802	TRH	2007	06/2-12/08	73,822	96.0	TRH	4	44.5	0	-----	4
068803	TRH	2007	06/2-12/08	50,488	112.0	TRH	0	-----	0	-----	0
068810	TRH	2007	10/1-14/08	96,803	11.4	TRH	7	40.4	0	-----	7
Lost CWT c/ e/							6	69.7	6	65.6	12
No CWT d/ e/							13	70.0	11	69.5	24
				Spring-run chinook salmon totals:			360		328		688
Fall-run Chinook salmon											
065322	TRH	2004	06/4-10/05	123,231	66.0	TRH	0	-----	0	-----	0
065323	TRH	2004	06/4-10/05	120,440	73.0	TRH	0	-----	0	-----	0
065324	TRH	2004	06/4-10/05	122,180	82.0	TRH	1	84	1	82.0	2
065325	TRH	2004	06/4-10/05	120,518	78.0	TRH	0	-----	0	-----	0
065328	TRH	2004	06/4-10/05	8,110	110.0	TRH	0	-----	0	-----	0
065329	TRH	2004	06/4-10/05	5,917	110.0	TRH	0	-----	0	-----	0
065327	TRH	2004	10/20/05	218,386	14.3	TRH	3	92.3	4	80.8	7
065336	TRH	2005	06/1-7/06	104,760	101.1	TRH	1	84	1	78	2
065337	TRH	2005	06/1-7/06	126,404	101.1	TRH	0	-----	1	80	1
065338	TRH	2005	06/1-7/06	119,293	108.8	TRH	1	92	2	77.5	3
065339	TRH	2005	06/1-7/06	127,742	108.8	TRH	2	81.5	5	79.6	7
065340	TRH	2005	06/1-7/06	10,267	157.0	TRH	0	-----	0	-----	0
065341	TRH	2005	10/2-16/06	227,903	19.8	TRH	31	84.4	59	78.3	90
065350	TRH	2006	06/1-8/07	118,575	110.0	TRH	36	69.8	37	67.7	73
065351	TRH	2006	06/1-8/07	119,712	110.0	TRH	40	71.2	36	67.6	76
065352	TRH	2006	06/1-8/07	122,076	134.3	TRH	53	71.7	40	69.1	93
065353	TRH	2006	06/1-8/07	126,470	134.3	TRH	33	71.0	35	67.2	68
065361	TRH	2006	10/1-10/07	238,156	19.5	TRH	651	69.2	503	67.0	1,154
068804	TRH	2007	06/2-12/08	92,759	157.0	TRH	2	50.0	0	-----	2
068805	TRH	2007	06/2-12/08	89,972	163.0	TRH	1	49.0	0	-----	1
068806	TRH	2007	06/2-12/08	89,348	181.0	TRH	1	49.0	0	-----	1
068807	TRH	2007	06/2-12/08	90,174	188.0	TRH	1	46.0	0	-----	1
068809	TRH	2007	10/1-14/08	244,661	16.7	TRH	32	46.0	0	-----	32
Lost CWT c/ e/							14	72.4	8	67.3	22
No CWT d/ e/							59	69.6	51	68.8	110
				Fall-run chinook salmon totals:			962		783		1,745

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-run or fall-run chinook based on entry date into Trinity River Hatchery.

Table 2. Run-size, angler harvest, and spawner escapement estimates for Trinity River Hatchery produced, coded-wire tagged, spring- and fall-run Chinook salmon returning to the Trinity River during the 2009-10 season.

Run-size estimates	Run Size estimate Grilse	Run Size estimate Adults	Harvest rates Grilse	Harvest rates Adults	TRH Ads With CWTs	% weir Ad clips Grilse	% weir Ad clips Adults	Ad+CWT Run-size estimates Grilse	Ad+CWT Run-size estimates Adults	Ad+CWT Run-size estimates Total
Sp. Chinook (JCW)	260	7,166	0.0%	6.2%	0.965	4.80%	13.86%	12	959	971
Fall Chinook (WCW)	6,018	23,575	2.4%	2.4%	0.937	1.24%	10.85%	70	2,396	2,466

CWT code	BY	Age	TRH Total No.	% of Total	Run-size	Angler harvest	Spawning escapement TRH	Spawning escapement Natural	Spawning escapement Total
Spring-run Chinook salmon									
Adults									
065319	04	5	2	0.3%	3	0	2	1	3
065320	04	5	2	0.3%	3	0	2	1	3
065321	04	5	1	0.2%	1	0	1	0	1
065326	04	5	34	5.3%	51	3	34	14	48
065330	05	4	3	0.5%	4	0	3	1	4
065331	05	4	3	0.5%	4	0	3	1	4
065332	05	4	2	0.3%	3	0	2	1	3
065333	05	4	22	3.4%	33	2	22	9	31
065334	05	4	24	3.8%	36	2	24	10	34
065335	05	4	18	2.8%	27	2	18	7	25
065342	05	4	7	1.1%	10	1	7	3	10
065343	05	4	4	0.6%	6	0	4	2	6
065344	05	4	9	1.4%	13	1	9	4	13
065345	05	4	5	0.8%	7	0	5	2	7
065346	05	4	8	1.3%	12	1	8	3	11
065347	06	3	29	4.5%	43	3	29	12	41
065348	06	3	34	5.3%	51	3	34	14	48
065349	06	3	21	3.3%	31	2	21	9	30
065360	06	3	412	64.4%	617	38	412	167	579
		Totals:	640	1	959	59	640	259	899
Grilse									
068801	07	2	1	8.3%	1	0	1	0	1
068802	07	2	4	33.3%	4	0	4	0	4
068810	07	2	7	58.3%	7	0	7	0	7
		Totals:	12	1	12	0	12	0	12
Fall-run Chinook salmon									
Adults									
065324	04	5	2	0.1%	3	0	2	1	3
065327	04	5	7	0.4%	11	0	7	3	10
065336	05	4	2	0.1%	3	0	2	1	3
065337	05	4	1	0.1%	2	0	1	0	1
065338	05	4	3	0.2%	5	0	3	1	4
065339	05	4	7	0.4%	11	0	7	3	10
065341	05	4	90	5.7%	137	3	90	44	134
065350	06	3	73	4.6%	111	3	73	35	108
065351	06	3	76	4.8%	116	3	76	37	113
065352	06	3	93	5.9%	141	3	93	45	138
065353	06	3	68	4.3%	103	2	68	33	101
065361	06	3	1,154	73.2%	1,755	42	1,154	559	1,713
		Totals:	1,576	1	2,396	57	1,576	764	2,340
Grilse									
068804	07	2	2	5.4%	4	0	2	2	4
068805	07	2	1	2.7%	2	0	1	1	2
068806	07	2	1	2.7%	2	0	1	1	2
068807	07	2	1	2.7%	2	0	1	1	2
068809	07	2	32	86.5%	60	1	32	27	59
		Totals:	37	1	70	2	37	31	68

Table 3. Run-size, percent return, in-river sport catch and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire-tagged spring-run Chinook salmon returning to the Trinity River upstream of Junction City weir during the period 2006 through 2009.

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
065319	2004	06/1-8/05	91,301	TRH	2	49	0.054	0	33	16	49
					3	526	0.576	20	224	281	505
					4	47	0.051	1	32	14	46
					5	3	0.003	0	2	1	3
				Totals: d/		625	0.685	21	291	312	603
				Total adults: e/		576	0.631	21	258	296	554
065320	2004	06/1-8/05	90,290	TRH	2	91	0.101	1	61	29	90
					3	628	0.696	24	268	336	604
					4	49	0.054	1	33	15	48
					5	3	0.003	0	2	1	3
				Totals: d/		771	0.854	26	364	381	745
				Total adults: e/		680	0.753	25	303	352	655
065321	2004	06/1-8/05	72,239	TRH	2	88	0.122	1	59	28	87
					3	545	0.754	21	232	292	524
					4	65	0.090	1	44	19	63
					5	1	0.001	0	1	0	1
				Totals: d/		699	0.968	23	336	339	675
				Total adults: e/		611	0.846	22	277	311	588
065326	2004	10/3-11/05	104,478	TRH	2	16	0.015	0	11	5	16
					3	611	0.585	23	260	327	587
					4	591	0.566	12	402	178	580
					5	51	0.049	3	34	14	48
				Totals: d/		1,269	1.215	38	707	524	1,231
				Total adults: e/		1,253	1.199	38	696	519	1,215
065330	2005	10/2-16/06	11,265	TRH	2	0	0.000	0	0	0	0
					3	4	0.036	0	3	1	4
					4	4	0.036	0	3	1	4
065331	2005	10/2-16/06	11,247	TRH	2	0	0.000	0	0	0	0
					3	1	0.009	0	1	0	1
					4	4	0.036	0	3	1	1
065332	2005	10/2-16/06	11,959	TRH	2	0	0.000	0	0	0	0
					3	3	0.025	0	2	1	3
					4	3	0.025	0	2	1	3
065333	2005	06/1-7/06	93,920	TRH	2	6	0.006	0	5	0	5
					3	62	0.066	1	42	19	61
					4	33	0.035	2	22	9	31

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 2004. 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-produce coded-wire-tagged spring-run chinook salmon returning to the Trinity River upstream of Junction City Weir during the period 2006 through 2009.

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
065334	2005	06/1-7/06	95,152	TRH	2	7	0.007	0	6	0	6
					3	59	0.062	1	40	18	58
					4	36	0.038	2	24	10	34
065335	2005	06/1-7/06	74,036	TRH	2	5	0.007	0	4	0	4
					3	82	0.111	2	56	25	81
					4	27	0.036	2	18	7	25
065342	2005	10/2-16/06	11,382	TRH	2	0	0.000	0	0	0	0
					3	13	0.114	0	9	4	13
					4	10	0.088	1	7	3	13
065343	2005	10/2-16/06	11,510	TRH	2	0	0.000	0	0	0	0
					3	7	0.061	0	5	2	7
					4	6	0.052	0	4	2	7
065344	2005	10/2-16/06	11,766	TRH	2	0	0.000	0	0	0	0
					3	1	0.008	0	1	0	1
					4	13	0.110	0	9	4	1
065345	2005	10/2-16/06	11,169	TRH	2	0	0.000	0	0	0	0
					3	3	0.027	0	2	1	3
					4	7	0.063	0	5	2	3
065346	2005	10/2-16/06	27,309	TRH	2	1	0.004	0	1	0	1
					3	19	0.070	0	13	6	19
					4	12	0.044	1	8	3	19
065347	2006	06/1-08/07	65,914	TRH	2	15	0.023	1	9	5	14
					3	43	0.065	3	29	12	41
065348	2006	06/1-08/07	86,088	TRH	2	15	0.017	1	9	5	14
					3	51	0.059	3	34	14	48
065349	2006	06/1-08/07	74,456	TRH	2	10	0.013	1	6	4	10
					3	31	0.042	2	21	9	30
065360	2006	10/1-10/07	104,019	TRH	2	51	0.049	3	30	18	48
					3	617	0.593	38	412	167	579
068801	2007	06/2-12/08	55,773	TRH	2	2	0.004	0	1	1	2
068802	2007	06/2-12/08	73,822	TRH	2	7	0.009	0	4	3	7
068810	2007	10/01-14/08	96,803	TRH	2	12	0.012	0	7	5	12

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 2004. 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.

Fall-run Chinook Salmon

Based on 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 CWTed fish at TRH, we estimated that 2,466 CWTed fall Chinook salmon returned to the Trinity River above WCW during the 2009-10 season. We estimated that anglers harvested 2 grilse and 57 adult CWTed fall Chinook. Escapement of CWTed fall Chinook was divided between 1,613 fish recovered at TRH and 795 estimated to have spawned in natural areas this season (Table 2).

The fall Chinook CWT run was composed of 70 (2.8%) age 2 fish, 2,226 (90.5%) age 3 fish, 158 (6.4%) age 4 fish, and 14 (0.57%) age five fish (Table 2).

2004 Brood Year
The 2004 BY releases were composed of six fingerling and one yearling release groups and have completed their life cycle this season, having reached the age of five. Return rates for fingerling releases ranged between 0.043% and 0.092%. The lone yearling group, 065327 returned at a rate of 1.79%, which is approximately two and half times that of the mean fingerling group return rates (Table 4). All Chinook from the 2004 BY experienced their highest returns as three-year-old fish (Table 4).

2005 Brood Year
The 2005 BY is represented by six CWT groups, of which five are fingerling groups and one a yearling group. In contrast to the good returns of the 2004 BY releases, fall Chinook from the 2005 BY are returning at a much lower rate. Through age four returns, all groups have returned at rates less than 0.3% (Table 4). Age three returns have been the most numerous for all release types to date. Fish released from this BY are expected to return as five-year-olds during the 2010 season.

2006 Brood Year
Five release groups (four fingerlings and one yearling) have returned to date as two- and three-year-old fish (Table 4). The yearling group, 065361, has experienced the best returns to date, surpassing 0.75% through age 3. Fish from both release types should return as four and five-year-olds in 2010 and 2011, respectively.

2007 Brood Year
Five CWT groups (four fingerlings and one yearling) from the 2007 BY returned as two-year-olds during the 2009 season (Table 4). Age two return rates have been low so far, surpassing 2005 BY returns for age two, but considerably less than 2006 BY returns through age two. Adult returns from these groups will occur over the next three years.

Table 4. Run-size, percent return, in-river sport catch, and spawner escapement estimates for Trinity River Hatchery-produced, coded-wire-tagged fall-run chinook salmon returning to the Trinity River upstream of Willow Creek Weir during the period 2006 through 2009.

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
065322	2004	06/4-10/05	123,231	TRH	2	348	0.282	4	225	119	344
					3	684	0.555	11	463	210	673
					4	89	0.072	2	46	41	87
					5	0	0.000	0	0	0	0
				Totals:		1,121	0.910	17	734	370	1,104
				Adult totals:		773	0.627	13	509	251	760
065323	2004	06/4-10/05	120,440	TRH	2	294	0.244	3	190	101	291
					3	632	0.525	10	427	194	621
					4	103	0.086	2	53	48	101
					5	0	0.000	0	0	0	0
				Totals:		1,029	0.854	15	670	343	1,013
				Adult totals:		735	0.610	12	480	242	722
065324	2004	06/4-10/05	122,180	TRH	2	204	0.167	2	132	70	202
					3	566	0.463	9	383	174	557
					4	91	0.074	2	47	42	89
					5	3	0.002	0	2	1	3
				Totals:		864	0.707	13	564	287	851
				Adult totals:		660	0.540	11	432	217	649
065325	2004	06/4-10/05	120,518	TRH	2	305	0.253	3	197	105	302
					3	705	0.585	11	477	216	693
					4	101	0.084	2	52	47	99
					5	0	0.000	0	0	0	0
				Totals:		1,111	0.9219	16	726	368	1,094
				Adult totals:		806	0.6688	13	529	263	792
065327	2004	10/20/05	218,386	TRH	2	155	0.071	2	100	53	153
					3	3,022	1.384	49	2,045	928	2,973
					4	721	0.330	13	373	335	708
					5	11	0.000	1	7	3	10
				Totals:		3,909	1.785	65	2,525	1,319	3,844
				Adult totals:		3,754	1.714	63	2,425	1,266	3,691
065328	2004	06/4-10/05	8,110	TRH	2	8	0.099	0	5	3	8
					3	21	0.259	0	14	7	21
					4	6	0.074	0	3	3	6
					5	0	0.000	0	0	0	0
				Totals:		35	0.4316	0	22	13	35
				Adult totals:		27	0.3329	0	17	10	27
065329	2004	06/4-10/05	5,917	TRH	2	8	0.135	0	5	3	8
					3	21	0.355	0	14	7	21
					4	2	0.034	0	1	1	2
					5	0	0.000	0	0	0	0
				Totals:		31	0.5239	0	20	11	31
				Adult totals:		23	0.3887	0	15	8	23
065336	2005	06/1-7/06	104,760	TRH	2	0	0.000	0	0	0	0
					3	15	0.014	0	8	7	15
					4	3	0.003	0	2	1	3

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 2003. 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-run chinook salmon returning to the Trinity River upstream of Willow Creek Weir during the period 2006 through 2009.

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
065337	2005	06/1-7/06	126,404	TRH	2	0	0.000	0	0	0	0
					3	50	0.040	1	26	23	49
					4	2	0.002	0	1	1	2
065338	2005	06/1-7/06	119,293	TRH	2	0	0.000	0	0	0	0
					3	27	0.023	1	14	13	27
					4	5	0.004	0	3	1	4
065339	2005	06/1-7/06	127,742	TRH	2	0	0.000	0	0	0	0
					3	35	0.027	1	18	16	34
					4	11	0.009	0	7	3	10
065340	2005	06/1-7/06	10,267	TRH	2	0	0.000	0	0	0	0
					3	8	0.078	0	4	4	8
					4	0	0.000	0	0	0	0
065341	2005	10/2-16/06	227,903	TRH	2	16	0.007	2	4	10	14
					3	522	0.229	10	270	243	513
					4	137	0.060	3	90	44	134
065350	2006	06/1-8/07	118,575	TRH	2	63	0.053	2	34	27	61
					3	111	0.094	3	73	35	108
065351	2006	06/1-8/07	119,712	TRH	2	53	0.044	1	29	23	52
					3	116	0.097	3	76	37	113
065352	2006	06/1-8/07	122,076	TRH	2	35	0.029	1	19	15	34
					3	141	0.116	3	93	45	138
065353	2006	06/1-8/07	126,470	TRH	2	42	0.033	1	23	18	41
					3	103	0.081	2	68	33	101
065361	2006	10/1-10/07	238,156	TRH	2	81	0.034	2	44	35	79
					3	1,755	0.737	42	1,154	559	1,713
068804	2007	06/2-12/08	92,759	TRH	2	4	0.004	0	2	2	4
068805	2007	06/2-12/08	89,972	TRH	2	2	0.002	0	1	1	2
068806	2007	06/2-12/08	89,348	TRH	2	2	0.002	0	1	1	2
068807	2007	06/2-12/08	84,063	TRH	2	2	0.002	0	1	1	2
068809	2007	10/1-14/08	244,661	TRH	2	60	0.025	1	32	27	59

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 2001. 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.

Contribution of Hatchery Produced Chinook to Total Estimated Run-Size

The contribution of hatchery-produced spring and fall Chinook to the overall Trinity River basin run-size estimates for the two races of Chinook are presented in Table 5. We estimate that the 2009 run of spring Chinook was composed of 3,973 (85 grilse and 3,888 adult) fish of TRH origin. This represents 32.7% (85/260) of the grilse, 54.3% (3,888/7,166) of the adult run, and 53.5% (3,973/7,426) of the total run estimated upstream of JCW.

The fall run, upstream of WCW, was estimated to be composed of 10,072 (285 grilse and 9,787 adults) TRH-produced Chinook, which represents 34.0% (10,072/29,593) of the total estimated run. Hatchery produced fall Chinook were estimated to contribute 4.7% (285/6,018) of the two-year-olds (grilse) and 41.5% (9,787/23,575) of the 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 2009-10 season. a/

CWT code b/	BY c/	Age	TRH expansion factor d/	Run-size	Expanded run-size e/	Angler harvest	Expanded angler harvest	Spawning escapement: TRH f/	Expanded TRH	River	Expanded River	Escapement Total	Expanded total
Spring-run Chinook				***Adults***									
065319	04	5	4.20	3	13	0	1	2	8	1	3	3	12
065320	04	5	4.20	3	13	0	1	2	8	1	3	3	12
065321	04	5	4.49	1	7	0	0	1	4	0	2	1	6
065326	04	5	4.14	51	211	3	13	34	141	14	57	48	198
065330	05	4	4.00	4	18	0	1	3	12	1	5	4	17
065331	05	4	4.00	4	18	0	1	3	12	1	5	4	17
065332	05	4	4.00	3	12	0	1	2	8	1	3	3	11
065333	05	4	4.05	33	133	2	8	22	89	9	36	31	125
065334	05	4	4.07	36	146	2	9	24	98	10	40	34	137
065335	05	4	4.39	27	118	2	7	18	79	7	32	25	111
065342	05	4	4.00	10	42	1	3	7	28	3	11	10	39
065343	05	4	4.00	6	24	0	1	4	16	2	6	6	22
065344	05	4	4.00	13	54	1	3	9	36	4	15	13	51
065345	05	4	4.00	7	30	0	2	5	20	2	8	7	28
065346	05	4	4.00	12	48	1	3	8	32	3	13	11	45
065347	06	3	4.19	43	182	3	11	29	122	12	49	41	171
065348	06	3	4.23	51	215	3	13	34	144	14	58	48	202
065349	06	3	4.13	31	130	2	8	21	87	9	35	30	122
065360	06	3	4.01	617	2,474	38	153	412	1,652	167	670	579	2,322
			Total adults:	959	3,888	59	240	640	2,596	259	1,052	899	3,648
				Grilse									
068801	07	2	4.02	2	8	0	0	1	4	1	4	1	8
068802	07	2	4.12	7	29	0	0	4	16	3	12	4	29
068810	07	2	4.02	12	48	0	0	7	28	5	20	7	48
			Total grilse:	21	85	0	0	12	49	9	36	12	85
Fall-run chinook salmon				***Adults***									
065324	04	5	4.05	3	12	0	0	2	8	1	4	3	12
065327	04	5	4.31	11	47	0	0	7	30	4	17	11	47
065336	05	4	4.71	3	14	0	0	2	9	1	5	3	14
065337	05	4	4.04	2	8	0	0	1	4	1	4	2	8
065338	05	4	4.25	5	21	0	0	3	13	2	9	5	21
065339	05	4	4.03	11	44	0	0	7	28	4	16	11	44
065341	05	4	4.17	137	571	3	13	90	375	44	183	134	559
065350	06	3	4.24	111	471	3	13	73	310	35	148	108	458
065351	06	3	4.21	116	488	3	13	76	320	37	156	113	476
065352	06	3	4.18	141	589	3	13	93	389	45	188	138	577
065353	06	3	4.00	103	412	2	8	68	272	33	132	101	404
065361	06	3	4.05	1,755	7,108	42	170	1,154	4,674	559	2,264	1,713	6,938
			Total adults:	2,398	9,787	56	229	1,576	6,432	766	3,126	2,342	9,558
				Grilse									
068804	07	2	4.03	4	16	0	0	2	8	2	8	4	16
068805	07	2	4.08	2	8	0	0	1	4	1	4	2	8
068806	07	2	4.05	2	8	0	0	1	4	1	4	2	8
068807	07	2	4.03	2	8	0	0	1	4	1	4	2	8
068809	07	2	4.07	60	244	1	4	32	130	27	110	59	240
			Total grilse:	70	285	1	4	37	150	32	130	69	281

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.

DISCUSSION

Since CWT estimates are based, in part, on the overall run-size estimates for each race of Chinook, CWT estimates are subject to the precision and potential biases associated with the mark-recapture estimates performed under Task 1 of this report. The potential impact of this would be most relevant in regard to the number of fish estimated to have spawned in “natural” areas. This is due to the fact that hatchery recoveries are actual counts, while CWTed fish estimated to have spawned naturally are the remaining estimated number of fish 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.

Several other potential biases that could distort our CWT run-size estimates are vulnerability of capture, run-timing, and the assumption that CWT fish that enter the hatchery are representative of the entire CWT population. Assumptions of our CWT estimates include equal probability of capture for hatchery and wild fish and capture of Chinook throughout the entire run. The second assumption, due to trapping constraints at JCW which preclude operating our weir there until late June, may affect our spring-run Chinook CWT estimates. 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 2009 carcass surveys (Task 4) were generally consistent with TRH recoveries with the exception of age 2 hatchery fish. No age 2 hatchery fish were recovered this year in main stem carcass surveys. Estimated in-river 2004 BY spring Chinook return rates of fingerling (0.825%) and yearling (1.215%) TRH releases surpassed the nineteen year average in our data set (Appendix 1). Compared to the previous BY (2003), spring Chinook fingerling and yearling releases from the 2004 BY returned at a rate 7 and 3 times that of fish from the 2003 BY for fingerling and yearlings, respectively.

Fall Chinook from the 2004 BY experienced similar patterns of return as their spring Chinook counterparts. Fall Chinook yearling releases returned at a rate just over twice (1.79% vs. 0.85%) that of their fingerling released siblings (Appendix 2). Return rates for yearling releases were slightly above the long term average (Appendix 2). Fingerling release groups returned at a rate more than double the long term average.

The contribution of hatchery-produced spring Chinook to total run-size was an estimated 53.5% of the run upstream of Junction City weir (Appendix 3). This is slightly lower than the long term average of 58.5% and is the third best in the last 11 years. The contribution of hatchery-produced fall Chinook to total run-size, upstream of Willow Creek weir, was estimated at 34.0% (Appendix 4), the third lowest estimated rate since 1991. 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 due to hatchery fish performing poorly or wild fish surviving reasonably well, compared to their hatchery counterparts. This metric, hatchery/wild ratio, has been proposed to the Trinity River Restoration Program as a performance indicator for naturally produced Trinity River Chinook stocks. Two of the premises behind the use of this metric are maintenance of the marking program at the hatchery and static release numbers of Chinook salmon.

Run-size estimates may have potential bias (see Task 1), which under most scenarios would tend to be positive. However, this bias should not affect hatchery contribution rates since total CWT grilse and adult run-sizes are based on AD clip rates observed at either JCW or WCW times the total estimated grilse and adult 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 with dates of weir operations (i.e. spring Chinook at JCW) more than their wild counterparts at the weirs, the estimated contribution of hatchery fish could be biased.

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 2010-11.

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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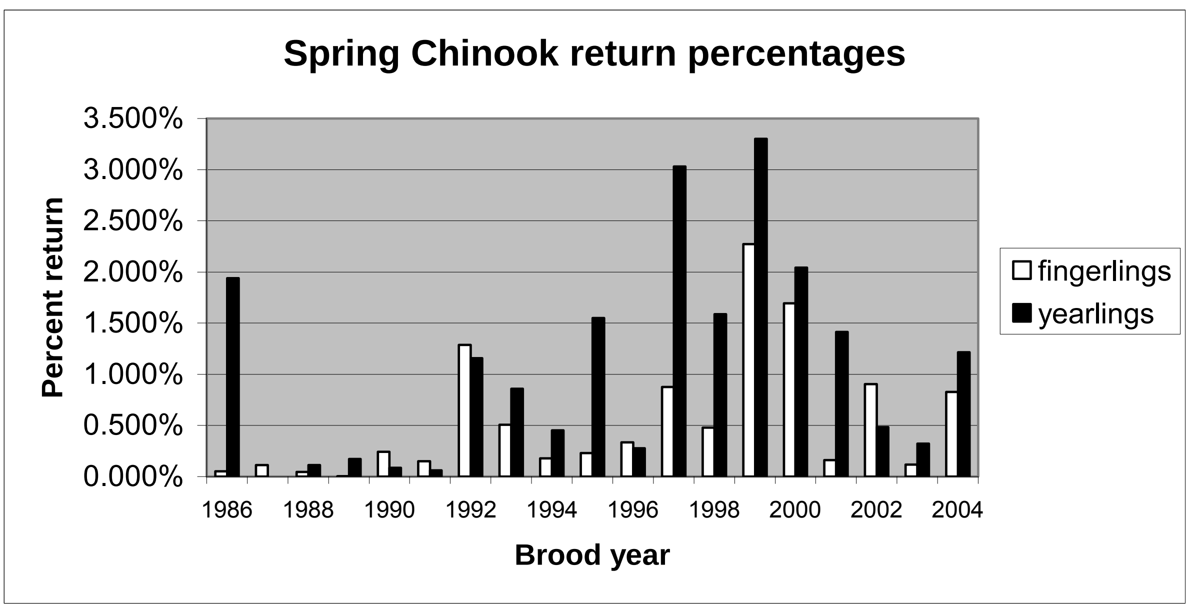
Appendix 1. Percent return of Trinity River Hatchery produced, coded-wire tagged, spring-run Chinook salmon, brood years 1986-2004. a/

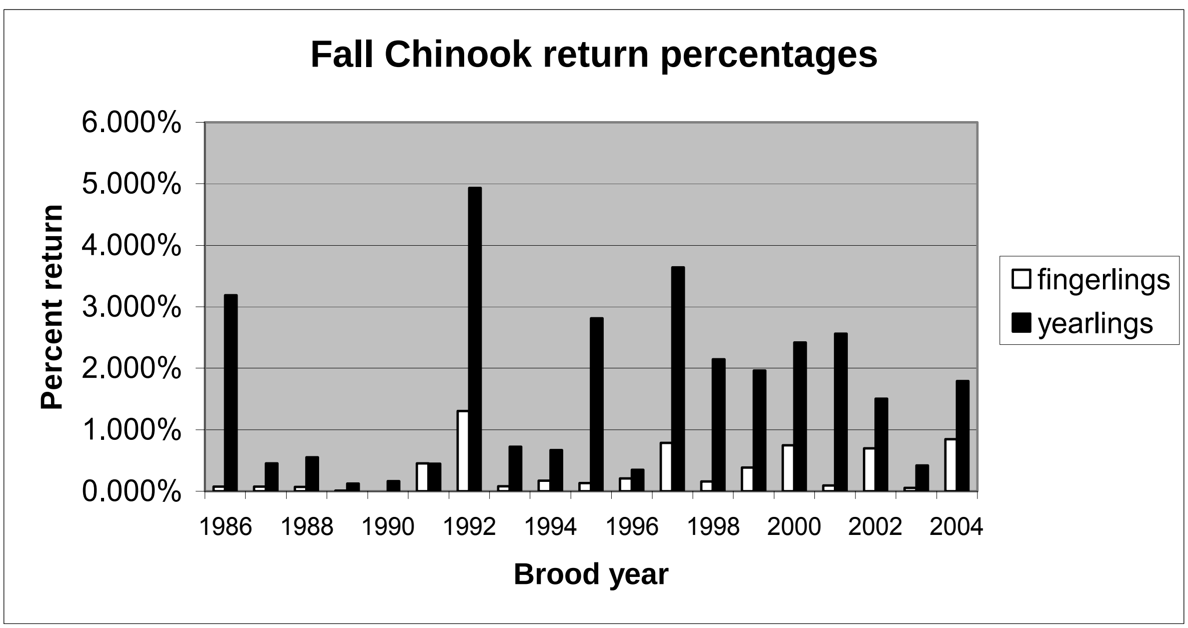
Brood year		Fingerling releases: Number released	Number of returns	Percent return	Yearling releases: Number released	Number of returns	Percent return
1986		197,113	103	0.052%	101,030	1,960	1.940%
1987		185,718	208	0.112%	---	---	---
1988		181,698	84	0.046%	98,820	112	0.113%
1989		186,413	7	0.004%	102,555	176	0.172%
1990		196,908	479	0.243%	94,639	82	0.087%
1991		198,277	297	0.150%	110,797	68	0.061%
1992		215,038	2,766	1.286%	109,856	1,272	1.158%
1993		222,056	1,125	0.507%	111,525	958	0.859%
1994		113,236	202	0.178%	113,491	513	0.452%
1995	a/	196,211	450	0.229%	101,934	1,581	1.551%
1996		222,950	743	0.333%	112,464	312	0.277%
1997		209,155	1,834	0.877%	147,507	4,471	3.031%
1998		176,968	845	0.477%	137,602	2,186	1.589%
1999		148,380	3,372	2.273%	129,919	4,288	3.301%
2000		261,193	4,422	1.693%	99,304	2,029	2.043%
2001		253,248	412	0.163%	104,627	1,480	1.415%
2002		244,754	2,217	0.906%	106,139	514	0.484%
2003		265,556	310	0.117%	104,974	339	0.323%
2004		253,830	2,095	0.825%	104,478	1,269	1.215%
Means:		206,774	1,156	0.55%	110,648	1,312	1.12%



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-run Chinook salmon, brood years 1986-2004. a/

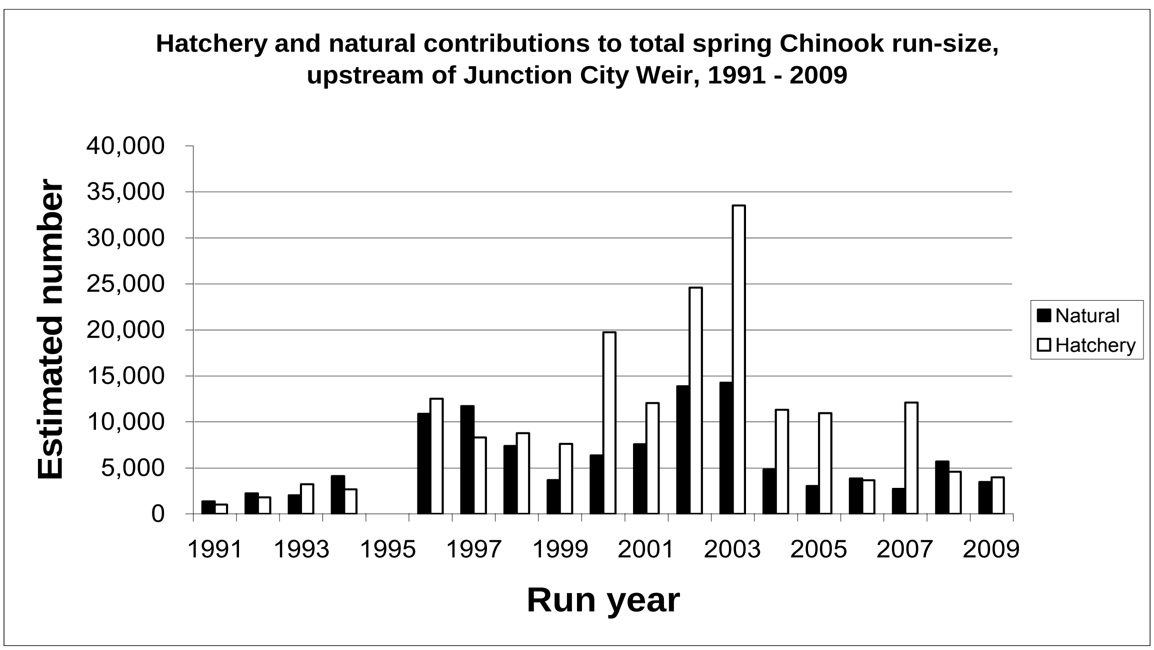
	Fingerling releases			Yearling releases		
Brood year	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	393,955	292	0.074%	153,700	4,899	3.187%
1987	172,980	129	0.075%	92,300	418	0.453%
1988	194,197	138	0.071%	143,934	796	0.553%
1989	201,622	21	0.010%	143,978	174	0.121%
1990				103,040	166	0.161%
1991	206,416	937	0.454%	115,300	517	0.448%
1992	192,032	2,503	1.303%	108,894	5,369	4.930%
1993	201,032	158	0.079%	110,336	798	0.723%
1994	216,563	374	0.173%	113,124	756	0.668%
1995	216,051	285	0.132%	110,327	3,106	2.815%
1996	217,981	445	0.204%	112,746	394	0.349%
1997	216,772	1,707	0.787%	313,080	11,396	3.640%
1998	184,781	292	0.158%	334,726	7,173	2.143%
1999	181,301	693	0.382%	296,892	5,833	1.965%
2000	522,316	3,909	0.748%	216,593	5,245	2.422%
2001	499,919	476	0.095%	230,055	5,894	2.562%
2002	508,963	3,563	0.700%	236,319	3,561	1.507%
2003	534,219	289	0.054%	225,798	944	0.418%
2004	486,369	4,125	0.848%	218,386	3,909	1.790%
Means:	297,082	1,130	0.35%	177,870	3,229	1.62%



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

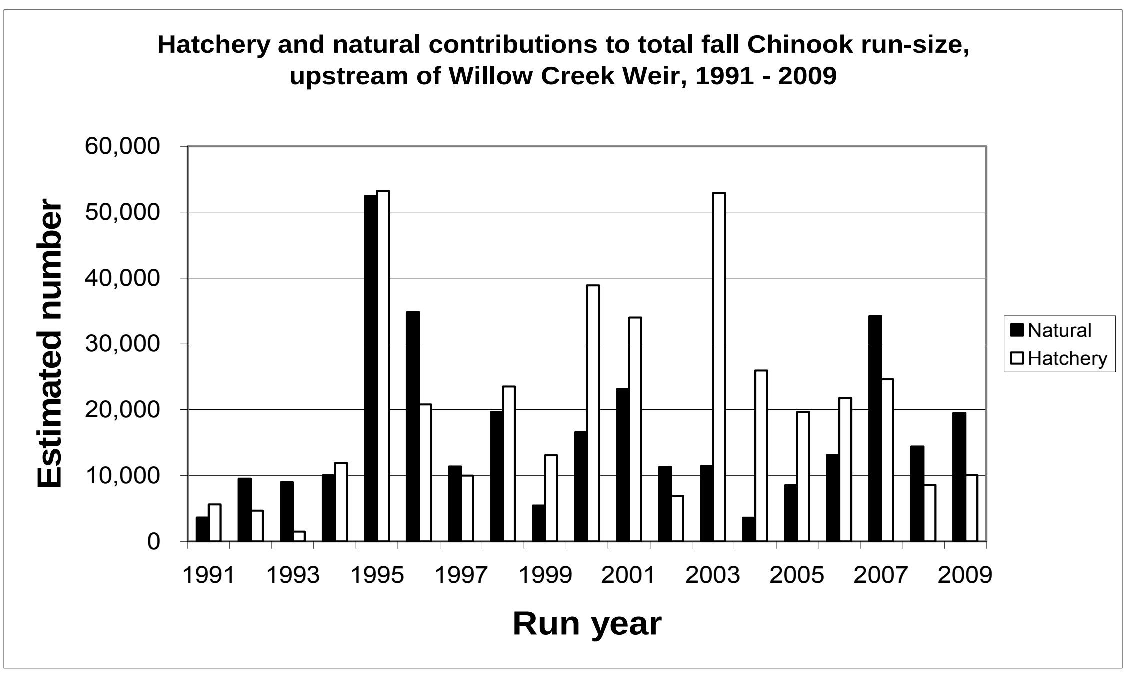
Appendix 3. Estimated contributions of Trinity River Hatchery-produced, spring-run chinook salmon, to total estimated run-size above Junction City weir, 1991-2009 seasons.

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%
Means:	16,194	10,134	6,060	58.5%



Appendix 4. Estimated contributions of Trinity River Hatchery-produced, fall-run chinook salmon, to total estimated run-size above Willow Creek weir, 1991-2009 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%
Means:	36,813	20,405	16,408	52.9%



ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2009-2010 SEASON

TASK III
SURVIVAL AND SPAWNER ESCAPEMENTS MADE BY COHO SALMON PRODUCED AT TRINITY RIVER HATCHERY

by

Wade Sinnen and John Hileman

ABSTRACT

Project personnel effectively marked 413,178 yearling coho salmon (*Oncorhynchus kisutch*) from the 2008 brood year (BY) with a right maxillary (RM) clip prior to their release from Trinity River Hatchery (TRH) in April of 2010. These fish are expected to return as two and three-year-old fish during the 2010-11 and 2011-12 seasons respectively.

An estimated 6,396 coho salmon returned to the Trinity River, upstream of the Willow Creek Weir (WCW), during the 2009-10 season. We estimated the TRH-produced component of this run to be 5,753 fish, approximately 90% of the total. Spawning escapement of TRH-produced coho was divided between 3,261 fish which entered TRH and 2,492 fish estimated to have spawned outside of the hatchery facility.

TRH-produced coho from the 2006 BY (age 3) are considered to have completed their life cycle this year. An estimated 6,398 grlise and adult coho from the 2006 BY returned to the Trinity River basin, upstream of Willow Creek weir, the past two seasons. This represents 1.4% of the 455,623 marked coho yearlings released from TRH in March of 2008. Estimated TRH-produced coho returns from the 2007 brood year are complete for age two returns only. An estimated 1,645 coho have returned thus far, representing 0.36% of the number released.

TASK OBJECTIVES

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

Coho salmon are propagated at Trinity River Hatchery (TRH) by the California Department of Fish and Game (CDFG) as mitigation for lost habitat/coho production upstream of Lewiston Dam. The Trinity River Project, an element of CDFG, is responsible for marking coho prior to their release from the hatchery facility and estimation of the naturally- and hatchery-produced components of coho salmon returning to the Trinity River basin upstream of Willow Creek Weir (WCW). Beginning with the 1994 brood year, all coho salmon reared at TRH have received a right maxillary (RM) clip prior to release. Prior to the 1994 brood year, a portion of the coho production was coded-wire tagged similar to the Chinook marking program at TRH. With the advent of coho becoming listed as a threatened species pursuant to the Federal Endangered Species Act (ESA) in 1994, the CDFG began a program to mark 100% of the hatchery production so that a more thorough analysis of hatchery and natural stocks could be accomplished.

METHODS

There are two phases involved in this task; marking all coho produced at TRH and estimating coho run-size, harvest, and escapement of TRH- and naturally-produced coho salmon returning to the Trinity basin. The latter phase is partially accomplished under Task 1 of this report. In this section we present release and recovery data that is used to estimate the hatchery- and naturally-produced component of the 2008-09 coho run above WCW. Data compilation and analysis is reliant upon previously reported data in Sinnen and Null, 2002; Sinnen and Moore, 2000; Sinnen, 2004a, 2004b, 2005, 2006, 2008; and Sinnen and Hileman, 2009, 2010a and 2010b.

Marking at Trinity River Hatchery

Marking of coho is performed by CDFG personnel in marking shed which is placed parallel to the raceways at TRH. The shed is moved along raceways with a fork lift, utilizing slots in each shed for this purpose. Raceways are segregated with removable barriers to isolate clipped coho from un-marked fish.

Coho are anaesthetized with carbon dioxide and have 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 ponds. Observed mortalities of marked coho are counted and subtracted from the daily effectively tagged total.

To determine overall marking accuracy, we examine a sample 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. We estimate the total number of coho in each raceway by adding marked totals with the estimated unmarked totals minus mortalities. The number of unmarked fish is determined using quality control data collected just prior to the release date.

TRH-produced coho run-size, escapement, and in-river harvest

To estimate the contribution of TRH-produced coho to run-size, escapement and in-river angler harvest above Willow Creek Weir (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.

The assumptions underlying the validity of run-size estimates are discussed under Task 1 of this report. Additionally, we assume that coho right-maxillary marks do not regenerate and that the mark is recognizable.

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

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

where NRM = the estimated number of coho salmon above Willow Creek weir with a right maxillary clip;
NWRM = the number of coho salmon observed at Willow Creek weir that were right-maxillary clipped;
NW = the total number of coho salmon observed at Willow Creek weir;
NCohorun = total estimated run of coho salmon above Willow Creek weir.

To estimate the number of un-marked coho salmon above the weir we used the equation:

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

where, NN = the estimated number of naturally produced coho above Willow Creek weir.

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 right maxillary-clipped coho for each age strata is estimated by multiplying the ratio of marked to unmarked coho observed at Willow Creek weir times 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, Hcoho = the estimated number of coho salmon harvested by anglers upstream of Willow Creek weir.

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 NNaturalescapement = the estimated number of coho salmon above Willow Creek weir estimated to have spawned in natural areas; and
NTRHescapement = the number of coho salmon that entered TRH.

All estimates are stratified by grilse and adults and by RM - marked and unmarked coho salmon.

RESULTS

Marking at Trinity River Hatchery

Staff personnel marked (RM clips) approximately 436,427 2008 BY coho, representing 99.75% of the entire production at TRH. We began marking coho in late December, 2009 and finished in late March, 2010.

We performed a quality control check to determine our clipping effectiveness for coho in each raceway on March 22-24 2010. We measured and examined approximately 2% of the coho in each raceway. The percentage of coho with proper clips ranged from

99.5% to 99.9% and averaged 99.75% for the 8,694 fish examined. We also recorded 21,397 post-clip mortalities. Based on these data we estimate that 413,178 coho were effectively clipped and released (Table 1). These fish ranged in size from 81 to 334 mm, fork length (FL), with a range of mean lengths of 132 to 161 mm, FL. We estimate that 1,036 unmarked coho were released for a total release number of 414,214 fish. All BY 2008 coho were volitionally released from TRH April 4 – 6, 2010.

Contribution of TRH-Produced Coho to Escapement and in-River Sport Fisheries

Total (natural and TRH-produced) coho run-size for the 2009-10 season, above WCW, was estimated at 6,396 fish (Task 1), of which 1,762 were grilse (age 2) and 4,634 were adults (age 3). Age classes were determined using length frequency analysis. The size separating grilse and adults was 54 cm FL (Task 1). Therefore all coho < 54 cm, FL were considered grilse and larger fish as adults.

The percentage of right maxillary-clipped (RM) coho observed at WCW was 93% (98/105) for grilse salmon and 89% (86/97) for adults. Based on this information the overall marked coho total observed at WCW for the 2009-10 season was 91% (184/202). Based on RM-clipped coho at WCW and recovery of Project-marked coho at TRH, we estimate that the 2009-10 coho run was composed of 643 naturally-produced fish and 5,753 TRH-produced fish (Table 2.).

Anglers did not return any tags from harvested coho salmon this year, therefore we estimated that no harvest occurred, upstream of WCW. The sport take of coho, a state and federally listed threatened species on the Trinity River, has been prohibited since 1995; however, some fish are occasionally harvested by unknowledgeable anglers due to mistaken identity or a lack of knowledge concerning the closure.

Table 1. Production, marking totals, and quality control data for 2008 brood year coho salmon reared at Trinity River Hatchery and released April 6 through April 8, 2010.

	Hatchery raceway					
	G3-4	H1-2	H3-4	I1-2	I3-4	Totals
Marking totals						
Number clipped	79,753	92,791	91,243	85,679	85,109	434,575
Post-clip mortalities	1,047	4,309	4,324	5,855	5,862	21,397
total marked	78,706	88,482	86,919	79,824	79,247	413,178
Quality control parameters						
Number examined	1,416	1,919	1,821	1,788	1,747	8,691
Number without clips	3	9	2	5	3	22
Un-clipped ratio	0.002119	0.00469	0.001098	0.002796	0.001717	0.002531
Mean fork length (mm)	157.9	161.2	156.2	155.6	160.7	131.9
Fork length range (mm)	101 - 289	103 - 281	105 - 281	81 - 302	119 - 297	81 - 334
Release totals						
Clipped releases	78,706	88,482	86,919	79,824	79,247	413,178
Un-clipped releases	167	415	95	223	136	1,036
Percentage clipped	99.8%	99.5%	99.9%	99.7%	99.8%	99.7%
Total released	78,873	88,897	87,014	80,047	79,383	414,214

Table 2. Run-size, in-river sport catch, and spawner escapement estimates for naturally- and TRH-produced coho salmon, upstream of Willow Creek weir for the 2009-10 return year.

					Spawning escapement	
Strata	BY a/	Age b/	Run-size	Angler harvest	TRH c/	Natural
Naturally	07	2	117	0	3	114
Produced	06	3	525	0	87	438
		Totals:	642	0	90	552
TRH	07	2	1,645	0	871	774
Produced	06	3	4,108	0	2,390	1,718
		Totals:	5,753	0	3,261	2,492
	Grand totals:		6,396	0	3,351	3,044

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

Based on age three coho run-size estimates presented above (Table 2) and age two estimates provided last year, the percent return for BY 2006, TRH-produced coho was 1.40% (Table 3). Coho from the 2006 BY have reached three years of age and are considered to have completed their life cycle. Percent return of two- year-old 2007 BY coho was 0.36%. These fish will return during the 2010-11 season as three-year-olds.

Spawning escapement of 2006 BY, TRH-produced coho consisted of 3,033 (47.4%) fish that entered TRH and 3,365 (52.6%) fish estimated to have spawned in natural areas (Table 3).

Estimated escapement in 2009-10 of TRH-produced, two-year-old coho from the 2007 BY was 871 (52.9%) hatchery spawners and 774 (47.1%) fish estimated to have spawned in natural areas (Table 3).

Table 3. Run-size, percent return, in-river angler harvest and spawner escapement estimates for Trinity River Hatchery-produced coho salmon returning to the Trinity River upstream of the Willow Creek weir during the period 2008 through 2009.

Release Data					Estimated Returns						
	Brood						% of	River	Spawning Escapement		
Clip a/	Year	Date	Number b/	Site	Age c/	Run-size	release	harvest	TRH d/	Natural	Total
RM	06	3/16-20/08	455,623	TRH	2	2,290	0.50	0	643	1,647	2,290
					3	4,108	0.89	0	2,390	1,718	4,108
					Totals:	6,398	1.40	0	3,033	3,365	6,398
RM	07	3/16-20/09	457,478	TRH	2	1,645	0.36	0	871	774	1,645

a/ Identifying clip. Beginning with the 1994 brood year, all coho salmon released from Trinity River Hatchery received right maxillary (RM) clips.
b/ Number of marked (RM) coho estimated released.
c/ Age classes are determined using length frequency analysis.
d/ TRH= Trinity River Hatchery, actual count.

DISCUSSION

Since estimation of TRH-produced contribution rates to overall coho run-size, escapement and harvest are directly related to the total coho run-size estimates produced under Task 1 of this report, it must be noted that the information presented under Task 3 is generally only moderately rigorous, statistically speaking, due to low numbers of coho marked at WCW. This season we only trapped 202 coho, of which we effectively tagged 186 coho. The total coho run-size estimate of 6,396 fish, produced under Task 1 of this report, had confidence intervals (1-p=0.95) within 18 -23% of the point estimate. Confidence intervals can range up to 35% in some years. Another source of potential bias, not trapping through the entire run, did not appear to be a major factor this season. Trapping CPUE (Task 1. Table 4, Figure 10) at WCW indicated that the run of coho was declining, but not completely over, prior to its removal November 19th. 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.

In-river returns of 2006 BY coho, estimated at 1.40%, 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% for BY 2004 coho to 6.61% for BY 2001 coho. Since coho are raised to slightly larger than yearling size (spawned in late November through early January and released in March of the following year) it would seem reasonable that survival rates could potentially be high. Return rates of coho to the Trinity basin, unlike

Chinook salmon, are in theory minimally affected by ocean and in-river 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).

In all but four years, including this year, the estimated number of hatchery-produced coho that have 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 in the main stem Trinity River (Task 4). Of these, 106 (62.7%) were RM clipped.

Despite potential run estimate biases, coho trends, based on trapping data at Willow Creek weir, indicate that coho runs returning to the upper Trinity basin are heavily supported by TRH production. Coho run estimates, upstream of WCW, (years in which all TRH-produced coho have been 100% marked) have consistently shown that the marked percentage of coho has been substantial, 77 to 94% of the estimated total (Appendix 2). This season we estimated that approximately 90% of the run was composed of TRH-produced coho.

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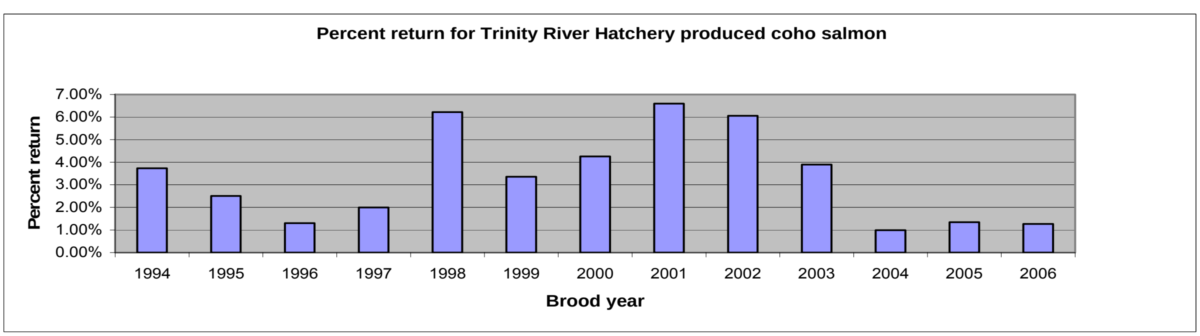
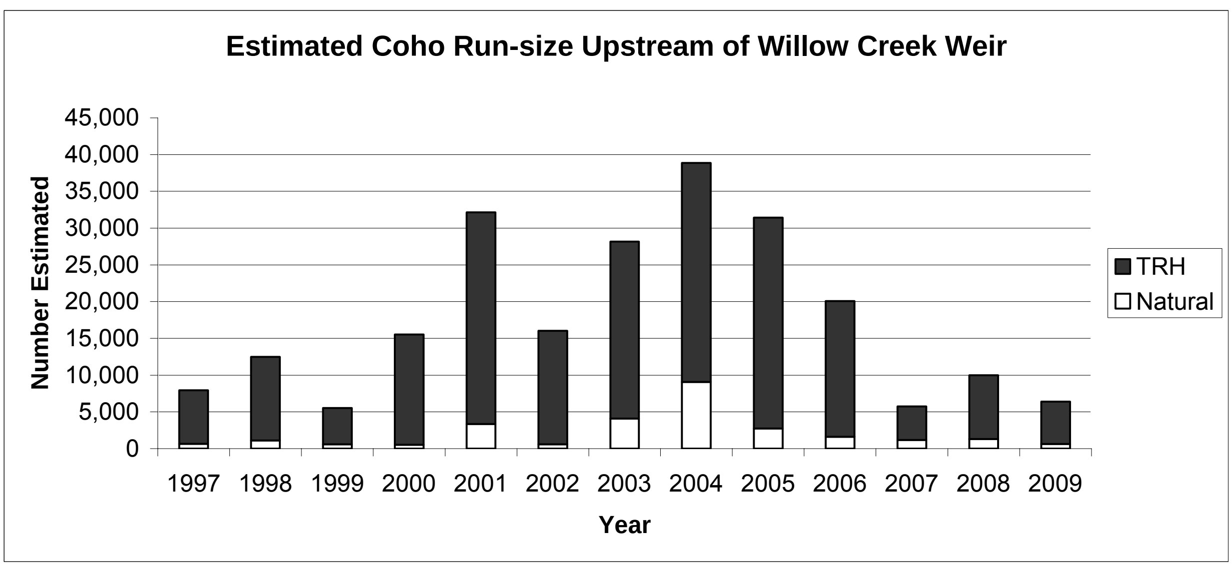
Appendix 1. Run-size, harvest and spawner escapement estimates for right maxillary clipped, Trinity River Hatchery-produced coho salmon returning to the Trinity River, upstream of Willow Creek weir, brood years 1994-2006.

Release data				Return data						
								Spawner Escapement		
Brood year	Date	Effective Number	Site	Age	Run-size	% of release	In-river harvest	TRH	Natural	Total
1994	3/17-21/96	72,311	TRH	2	970	1.34%	0	105	865	970
				3	1,732	2.40%	0	867	865	1,732
				Totals:	2,702	3.74%	0	972	1,730	2,702
1995	3/17-21/97	580,880	TRH	2	5,552	0.96%	39	858	4,655	5,513
				3	9,008	1.55%	0	3,899	5,109	9,008
				Totals:	14,560	2.51%	39	4,757	9,764	14,521
1996	3/16-20/98	513,663	TRH	2	2,340	0.46%	0	969	1,371	2,340
				3	4,357	0.85%	86	3,015	1,256	4,271
				Totals:	6,697	1.30%	86	3,984	2,627	6,611
1997	3/15-22/99	517,196	TRH	2	592	0.11%	0	381	211	592
				3	9,704	1.88%	0	3,407	6,297	9,704
				Totals:	10,296	1.99%	0	3,788	6,508	10,296
1998	3/15-20/00	493,233	TRH	2	5,289	1.07%	0	916	4,373	5,289
				3	25,395	5.15%	0	9,625	15,770	25,395
				Totals:	30,684	6.22%	0	10,541	20,143	30,684
1999	3/15-22/01	512,986	TRH	2	3,373	0.66%	0	1,024	2,349	3,373
				3	13,849	2.70%	0	6,409	7,440	13,849
				Totals:	17,222	3.36%	0	7,433	9,789	17,222
2000	3/17-19/02	524,238	TRH	2	1,571	0.30%	0	688	883	1,571
				3	20,721	3.95%	0	9,730	10,991	20,721
				Totals:	22,292	4.25%	0	10,418	11,874	22,292
2001	3/17-19/03	416,201	TRH	2	3,338	0.80%	0	1,449	1,889	3,338
				3	24,162	5.81%	40	8,835	15,287	24,122
				Totals:	27,500	6.60%	40	10,284	17,176	27,460
2002	3/15-18/04	516,906	TRH	2	5,665	1.10%	0	1,068	4,597	5,665
				3	25,678	4.97%	0	15,704	9,974	25,678
				Totals:	31,343	6.06%	0	16,772	14,571	31,343
2003	3/14-18/05	520,847	TRH	2	3,012	0.58%	21	1,269	1,721	2,990
				3	17,123	3.29%	0	7,454	9,669	17,123
				Totals:	20,135	3.90%	21	8,723	11,390	20,113
2004	3/15-20/06	545,199	TRH	2	1,331	0.24%	0	657	674	1,331
				3	4,048	0.74%	0	2,436	1,612	4,048
				Totals:	5,379	0.99%	0	3,093	2,286	5,379
2005	3/15-20/07	511,961	TRH	2	503	0.10%	0	270	233	503
				3	6,381	1.25%	0	4,177	2,204	6381
				Totals:	6,884	1.34%	0	4,447	2,437	6,884
2006	3/15-20/08	455,482	TRH	2	1,645	0.36%	0	871	774	1,645
				3	4,108	0.90%	0	2,390	1,718	4,108
				Totals:	5,753	1.26%	0	3,261	2,492	5,753



Appendix 2. Naturally and Trinity River Hatchery-produced coho salmon run-size, in-river angler harvest and spawner escapment estimates for the Trinity River upstream of Willow Creek Weir for 1997-2009.

					Spawner Escapement								
Run		Run-size Estimate			Natural			Trinity River Hatchery			Angler harvest		
year	Strata	Grilse	Adults	Total	Grilse	Adults	Total	Grilse	Adults	Total	Grilse	Adults	Total
1997	Natural	399	252	651	383	232	615	13	20	33	3	0	3
	TRH	5,552	1,732	7,284	4,655	865	5,520	858	867	1,725	39	0	39
1998	Natural	131	1,001	1,132	123	886	1,009	8	115	123	0	0	0
	TRH	2,340	9,008	11,348	1,371	5,109	6,480	969	3,899	4,868	0	0	0
1999	Natural	31	555	586	23	440	463	8	103	111	0	12	12
	TRH	592	4,357	4,949	211	1,256	1,467	381	3,015	3,396	0	86	86
2000	Natural	197	342	539	187	288	475	10	54	64	0	0	0
	TRH	5,289	9,704	14,993	4,373	6,297	10,670	916	3,407	4,323	0	0	0
2001	Natural	298	3,075	3,373	296	2,945	3,241	2	130	132	0	0	0
	TRH	3,373	25,395	28,768	2,349	15,770	18,119	1,024	9,625	10,649	0	0	0
2002	Natural	138	458	596	123	372	495	15	86	101	0	0	0
	TRH	1,571	13,849	15,420	883	7,440	8,323	688	6,409	7,097	0	0	0
2003	Natural	163	3,930	4,093	149	3,264	3,413	14	666	680	0	0	0
	TRH	3,338	20,721	24,059	1,889	10,991	12,880	1,449	9,730	11,179	0	0	0
2004	Natural	154	8,901	9,055	145	7,830	7,975	9	1,071	1,080	0	0	0
	TRH	5,665	24,162	29,827	4,597	15,287	19,884	1,068	8,835	9,903	0	40	40
2005	Natural	81	2,648	2,729	71	1,728	1,799	10	920	930	0	0	0
	TRH	3,012	25,678	28,690	1,270	9,974	11,244	1,721	15,704	17,425	21	0	21
2006	Natural	38	1,586	1,624	34	1,416	1,450	4	170	174	0	0	0
	TRH	1,331	17,123	18,454	674	7,454	8,128	657	9,669	10,326	0	0	0
2007	Natural	42	1,157	1,199	37	940	977	5	217	222	0	0	0
	TRH	503	4,048	4,551	233	1,612	1,845	270	2,436	2,706	0	0	0
2008	Natural	89	1,223	1,312	83	861	944	6	362	368	0	0	0
	TRH	2,290	6,381	8,671	1,647	2,204	3,851	643	4,177	4,820	0	0	0
2009	Natural	117	525	642	114	438	552	3	87	90	0	0	0
	TRH	1,645	4,108	5,753	774	1,718	2,492	872	2,386	3,258	0	0	0



ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2009 SEASON

TASK IV
SALMON SPAWNER SURVEYS IN THE UPPER TRINITY RIVER

by

Andrew Hill

ABSTRACT

A spawning survey monitoring the escapement of Chinook and coho salmon was conducted on the Trinity River from September 14, 2009 to December 22, 2009. This survey was a joint-agency effort including staff from California Department of Fish and Game (CDFG) Trinity River Project (TRP), Yurok Tribal Fisheries (YTF), Hoopa Valley Tribal Fisheries (HVTF), U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS). The survey focused on the main stem Trinity River from the Lewiston Dam to Cedar Flat (101.6 river kilometers) and from Hawkins Bar to Weitchpec (64.1 river kilometers). The section from Cedar Flat to Hawkins Bar is not surveyed due to safety concerns. The survey did not include any tributaries. During the survey, 3,419 Chinook (*Oncorhynchus tshawytscha*), 169 coho salmon (*Oncorhynchus kisutch*), 13 steelhead (*Oncorhynchus mykiss*), and 65 brown trout (*Salmo trutta*) were recovered.

This survey focused on Chinook carcasses recovered throughout the spawning season including both spring and fall Chinook. Coded wire tag (CWT) recoveries from adipose fin-clipped Chinook indicate spring Chinook carcasses outnumbered fall Chinook carcasses until after Julian week 43 (ending October 28, 2009). With this Julian week separation, 1,040 spring Chinook carcasses were recovered, and 2,379 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), so 93.4% spring Chinook and 94.6% fall Chinook were adults. The recovery of these adipose fin-clipped Chinook carcasses also indicated 8.34% of the spring and 11.14% of the fall carcasses observed in the main stem surveys were of hatchery origin. The Schaefer with Law's Adjustment mark-recapture model estimates the lowest in-river escapement of 8,899 Chinook salmon (2,707 spring and 6,192 fall). The Weekly Peterson model provides the highest estimate of 13,372 Chinook salmon (4,068 spring and 9,304 fall).

All fresh Chinook carcasses (condition-1) were marked with numbered jaw tags and returned to the water for a mark-recapture estimate of in-river escapement. Over the course of the survey, 691 Chinook carcasses were marked, of which (235) 34.0% were subsequently recaptured. The Schaefer with Law's Adjustment mark-recapture model estimates the lowest in-river escapement of 8,899 Chinook salmon (2,707 spring and

6,192 fall). The Weekly Peterson model provides the highest estimate of 13,372 Chinook salmon (4,068 spring and 9,304 fall).

The recovery of hatchery clipped coho salmon and adipose-clipped steelhead carcasses indicate that 62.72% of coho salmon and 38.46% of steelhead carcasses are from hatchery origin. Adult coho salmon represented 92.6% of all coho salmon recovered.

TASK OBJECTIVES

1. To determine the size, sex composition, and hatchery component of Chinook and coho salmon spawning populations in the main stem Trinity River.
2. To determine the incidence of pre-spawning mortality among naturally spawning Chinook and coho salmon in the main stem Trinity River.
3. To determine the temporal and spatial distribution of the naturally spawning populations of Chinook and coho salmon within the main stem Trinity River.
4. To estimate in-river escapement of spring and fall utilizing mark-recapture and multiple estimators.

INTRODUCTION

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

Reporting responsibilities for the project were divided into two parts: 1) CDFG was responsible for reporting on the carcass survey portion of the study, and 2) the USFWS for the redd enumeration part of the study. 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. Pertinent metrics to be analyzed over time include spawner density, spawner distribution, and prespawn 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 14, 2008 and December 22, 2009. 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)

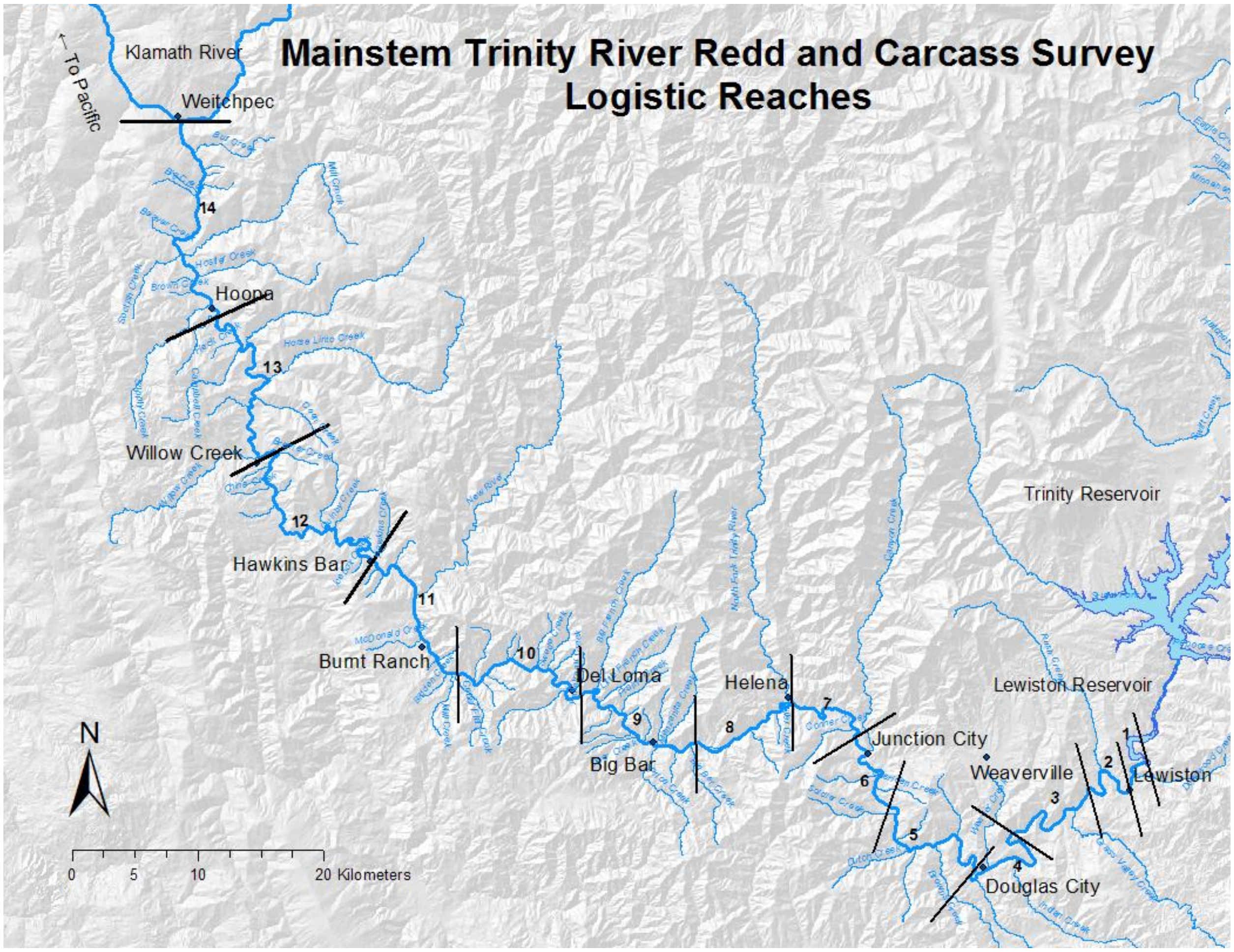


Figure 1. Survey reaches for 2009 Trinity River main stem spawner survey. Map courtesy of USFWS.

Surveys were conducted using 12-ft NRS™ Otter 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 proceeded 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 as 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. 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, 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) 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 direct observation of ovaries. Fish were classified as either spawned or un-spawned based upon percent egg retention. Females retaining the majority of their eggs were classified as un-spawned; conversely females retaining very few eggs 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,
R_{ij} = number of carcasses tagged in the *i*th spawning period and recaptured in the *j*th recovery period,

The Schaefer model as described by Schaefer (1951)

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

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

The Schaefer model as modified by Law (1994):

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

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

RESULTS

Spring/ Fall Chinook Separation

From CWT extraction of adipose fin-clipped carcasses, the only overlap of spring and fall Chinook runs occurred during Julian week 44. Spring Chinook carcasss were predominant through Julian week 43 (October 22, 2009 to October 28, 2009), 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).

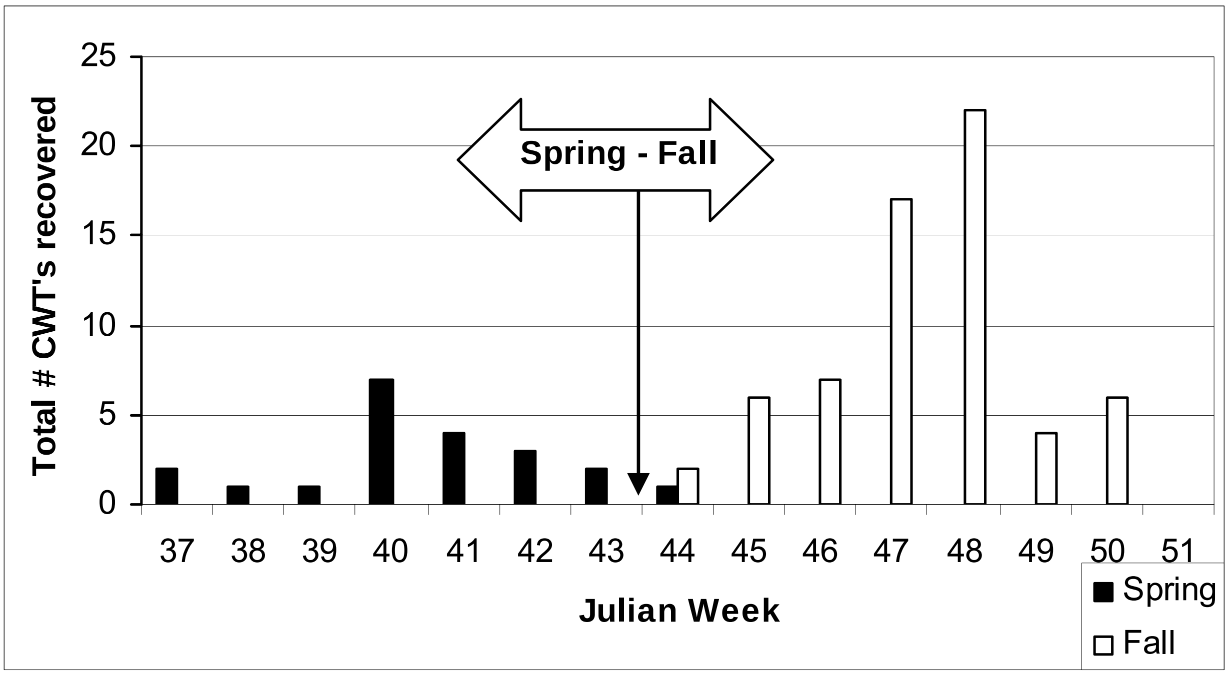


Figure 2. Weekly proportions of coded-wire tagged spring and fall Chinook observed in the 2009 main stem Trinity River spawner survey.

Temporal Carcass Distribution

A total of 3,419 Chinook carcasses were encountered during the survey. Recovery of Chinook carcasses peaked during Julian week 48 (November 26, 2009 to December 2, 2009) when 521 carcasses were counted. The first coho salmon carcass was recovered during Julian week 39 (September 24, 2009 to September 30, 2009). A total of 169 coho salmon carcasses were recovered during the survey with peak recovery number of 39 during both Julian weeks 47 and 48 (November 19, 2009 to December 2, 2009) (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.

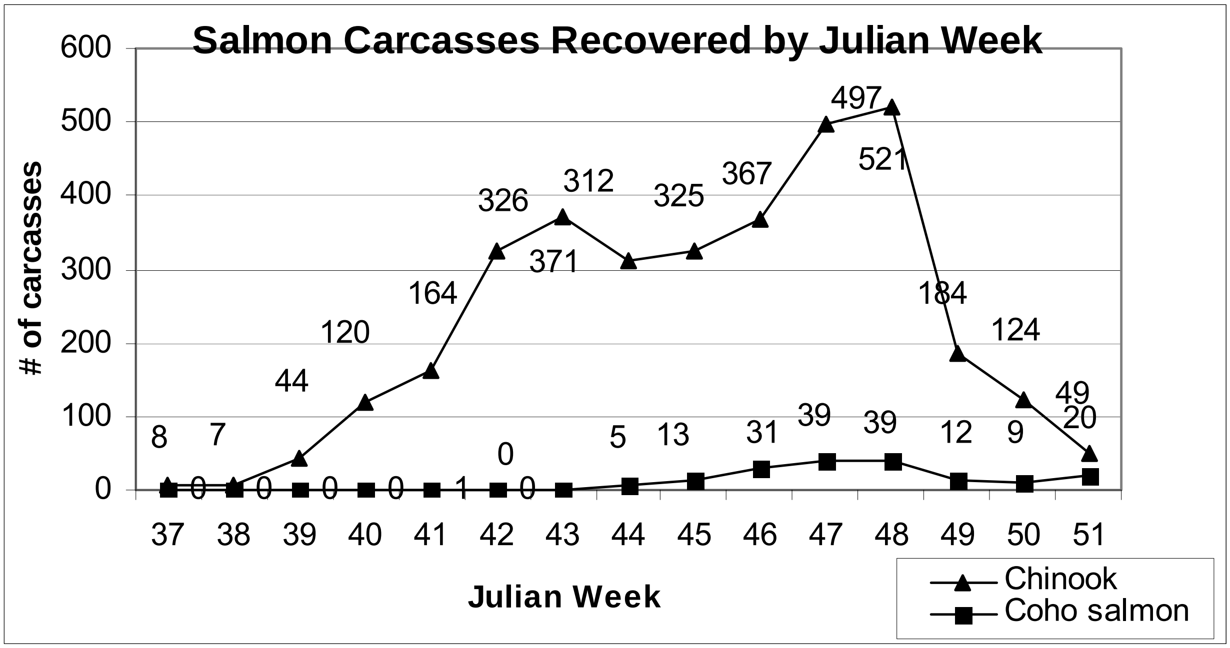


Figure 3. Chinook and coho salmon carcasses collected by Julian week during the 2009 Trinity River main stem spawner survey.

Carcass Distribution

A total of 3,419 Chinook carcasses were recovered during Julian weeks 37 to 51 (September 14, 2009 to December 22, 2009) in the 14 survey sections (Table 2). Of the 3,419 Chinook carcasses encountered, 1,739 (50.83%) were recovered in reaches 1 and 2, and 1,069 (30.27%) of the carcasses were recovered in reach 1 alone. Reaches 8 and 14 had the fewest carcasses (12 in both reaches) and 20.09% of encountered carcasses were downstream of reach 5 (Table 2).

Redd Distribution

Similar to carcass recovery, Chinook redds were encountered most frequently in reach 1 with a total of 4,162 redds enumerated during the 2009 survey (Table 3). A total of 846 (20.33%) redds were enumerated in reach 1, and the fewest redds (57) were observed in reach 8. Peak redd enumeration occurred during Julian week 40 where 598 redds were counted.

Table 2. Recovery of all Chinook salmon by Julian week and section during the 2009 main stem Trinity River spawner survey.

Section	Number of surveys	Julian week of Chinook salmon recovery															Section Totals
		37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
1	15	3	2	5	21	32	42	32	46	73	111	222	289	86	70	28	1,062
2	15	1	2	11	15	32	26	42	51	76	80	130	131	36	25	18	676
3	14	3	1	13	41	54	54	69	43	83	56	29	ns	26	9	3	484
4	12	ns	1	8	26	31	57	64	74	48	12	10	ns	11	ns	0	342
5	10	ns	0	4	11	ns	42	33	30	ns	22	10	13	3	ns	ns	168
6	11	0	0	3	3	15	51	59	23	15	24	ns	21	ns	ns	ns	214
7	11	1	1	0	3	ns	54	22	22	22	14	17	11	ns	ns	ns	167
8	6	0	ns	0	ns	ns	ns	0	ns	7	ns	3	ns	2	ns	ns	12
9	6	0	ns	0	ns	ns	ns	48	ns	ns	39	44	ns	10	ns	ns	141
10	6	ns	0	ns	0	ns	ns	ns	20	ns	2	30	ns	ns	6	ns	58
12	6	ns	ns	ns	0	ns	0	ns	3	ns	3	ns	22	ns	14	ns	42
13	5	ns	ns	ns	0	ns	ns	2	ns	1	4	ns	34	ns	ns	ns	41
14	5	ns	ns	ns	ns	0	ns	0	ns	0	ns	2	ns	10	ns	ns	12
Totals	122	8	7	44	120	164	326	371	312	325	367	497	521	184	124	49	3,419

Table 3. Summary of weekly redd enumeration from main stem Trinity River 2009 survey

Section	Julian Week															Section Totals
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
1	12	4	51	77	76	15	19	38	136	74	202	75	31	16	20	846
2	1	3	50	84	71	19	14	26	30	47	53	38	26	8	15	485
3	6	52	67	118	56	48	34	37	32	15	12	ns	23	10	4	514
4	ns	53	69	95	32	22	47	41	20	9	3	ns	4	ns	0	395
5	ns	29	51	73	ns	62	48	27	ns	21	8	14	6	0	ns	339
6	ns	2	56	116	26	76	42	80	11	12	ns	0	ns	ns	0	421
7	ns	ns	19	35	ns	99	17	35	13	4	0	0	ns	ns	ns	222
8	ns	ns	ns	ns	ns	ns	33	ns	17	ns	7	ns	0	ns	ns	57
9	ns	ns	3	ns	ns	ns	143	ns	ns	64	18	ns	0	ns	ns	228
10	ns	ns	ns	ns	ns	ns	ns	96	ns	ns	26	0	ns	ns	ns	122
12	ns	ns	ns	ns	ns	13	ns	38	7	32	ns	88	ns	34	ns	212
13	ns	ns	ns	ns	ns	ns	4	ns	40	99	ns	110	1	ns	ns	254
14	ns	ns	ns	ns	ns	ns	ns	ns	4	ns	30	ns	33	ns	0	67
Totals	19	143	366	598	261	354	401	418	310	377	359	325	124	68	39	4,162

a/ Data table provided by U.S. Fish and Wildlife Service

Spring Chinook Salmon

A total of 1,040 Chinook carcasses were classified as spring-run during the survey, of which 371 were classified as condition-one (Table 4). Spring Chinook carcass recovery by reach ranged from 235 in reach 3 to zero in reaches 8, 10, 12, and 14. Spring Chinook carcass density was greatest in reach 1 at 41.52 fish/km.

Table 4. Number, density, incidence of ad-clips, project tags, and condition of spring Chinook recovered during the 2009 main stem Trinity River spawner survey 1/

	Length	Number	Density			Adipose Clips		Project tags	
Reach	(km)	observed	(fish/km)	C-1	C-2	Total	C1	Total	C1
1	3.3	137	41.52	33	100	16	8	1	0
2	7.1	129	18.17	27	101	8	2	2	0
3	10.9	235	21.56	75	146	0	0	7	4
4	10.8	187	17.31	60	109	0	0	4	3
5	14.7	90	6.12	36	47	0	0	1	1
6	8.6	131	15.23	67	60	0	0	1	1
7	8.9	81	9.10	47	32	0	0	1	0
8	10.8	0	0.00	0	0	0	0	0	0
9	13.8	48	3.48	25	21	0	0	0	0
10	14.7	0	0.00	0	0	0	0	0	0
12	22.4	0	0.00	0	0	0	0	0	0
13	21.1	2	0.09	1	1	0	0	0	0
14	21.3	0	0.00	0	0	0	0	0	0
Total	103.6	1,040	10.04	371	617	24	10	17	9

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 2,379 Chinook carcasses were classified as fall-run during the survey, of which 368 were classified as condition-one (Table 5). Fall Chinook carcass recovery by reach ranged from 925 in reach 1 to 12 in both reaches 8 and 14. Fall Chinook carcass density was greatest in reach 1 at 280.30 fish/km and dropped considerably to 77.04 fish/km in reach 2. Below reaches 1 and 2 carcass density was considerably less.

Table 5. Number, density, incidence of ad-clips, project tags, and condition of fall Chinook recovered during the 2009 main stem Trinity River spawner survey. 1/

	Length	Number	Density			Adipose Clips		Project tags	
Reach	(km)	observed	(fish/km)	C-1	C-2	Total	C1	Total	C1
1	3.3	925	280.30	115	784	64	23	25	4
2	7.1	547	77.04	60	429	10	4	12	4
3	10.9	249	22.84	48	180	9	3	8	2
4	10.8	155	14.35	23	103	0	0	9	1
5	14.7	78	5.31	16	54	0	0	4	3
6	8.6	83	9.65	20	41	0	0	1	0
7	8.9	86	9.66	26	43	0	0	5	1
8	10.8	12	1.11	3	8	0	0	0	0
9	13.8	93	6.74	14	58	0	0	0	0
10	14.7	58	3.95	18	35	0	0	1	0
12	22.4	42	1.88	7	32	0	0	0	0
13	21.1	39	1.85	14	25	0	0	0	0
14	21.3	12	0.56	4	8	0	0	0	0
Total	168.4	2,379	14.13	368	1,800	83	30	65	15

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 169 coho salmon carcasses were recovered during the survey, of which 35 were classified as condition-one (Table 6). Coho carcass recovery by reach ranged from 81 (47.93%) in reach 1 to zero in reaches 6, 8, 12, and 13. Coho salmon carcass density was greatest in reach 1 (24.55 fish/km) and dropped considerably to 7.32 fish/km in reach 2. Coho salmon carcass density downstream from reach 3 was less than 2 fish per kilometer.

Table 6. Number, density, incidence of right maxillary (RM) clips, Project tags, and condition of coho salmon recovered during the 2009 main stem Trinity River spawner survey.

Reach	Length (km)	Number observed	Density (fish/km)	C-1	C-2	Right Maxillary (		Project tags	
						Total	C1	Total	C1
1	3.3	81	24.55	20	60	55	13	0	0
2	7.1	52	7.32	7	39	29	7	3	1
3	10.9	21	1.93	2	19	12	0	1	0
4	10.8	5	0.46	2	3	5	2	0	0
5	14.7	2	0.14	1	1	2	1	0	0
6	8.6	0	0.00	0	0	0	0	0	0
7	8.9	2	0.22	0	2	1	0	0	0
8	10.8	0	0.00	0	0	0	0	0	0
9	13.8	4	0.29	1	3	1	1	0	0
10	14.7	1	0.07	1	0	0	0	0	0
12	22.4	0	0.00	0	0	0	0	0	0
13	21.1	0	0.00	0	0	0	0	0	0
14	21.3	1	0.05	1	0	1	1	0	0
Total	168.4	169	35.02	35	127	106	25	4	1

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 13 steelhead carcasses and 65 brown trout carcasses were recovered during the survey (Table 7). 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 3, and one Project tag turned up in reach 5. For the second year in a row a brown trout was observed in reach 1.

Table 7. Number, density, incidence of adipose clips, and project tags recovered during the 2009 main stem Trinity River spawner survey

		Steelhead				Brown Trout		
Reach	Length (km)	Number Observed	Density (fish/km)	Adipose Clip1	Project Tags2	Number Observed	Density (fish/km)	Project Tags2
1	3.3	4	1.21	3	0	1	0.3	0
2	7.1	1	0.14	1	0	10	1.41	0
3	10.9	0	0	0	0	21	1.93	0
4	10.8	0	0	0	0	10	0.93	0
5	14.7	0	0	0	0	8	0.54	1
6	8.6	0	0	0	0	5	0.58	0
7	8.9	4	0.45	1	0	3	0.34	0
8	10.8	1	0.09	0	0	0	0	0
9	13.8	1	0.07	0	0	7	0.51	0
10	14.7	1	0.07	0	0	0	0	0
12	22.4	0	0	0	0	0	0	0
13	21.1	0	0	0	0	0	0	0
14	21.3	1	0.05	0	0	0	0	0
Total	168.4	13	0.08	5	0	65	0.39	1

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

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 = 984 averaged 70.6 cm. and ranged between 32-106 cm. (Figure 4). Grilse (FL < 50 cm) accounted for 6.61% (65/984) of the measured spring Chinook.

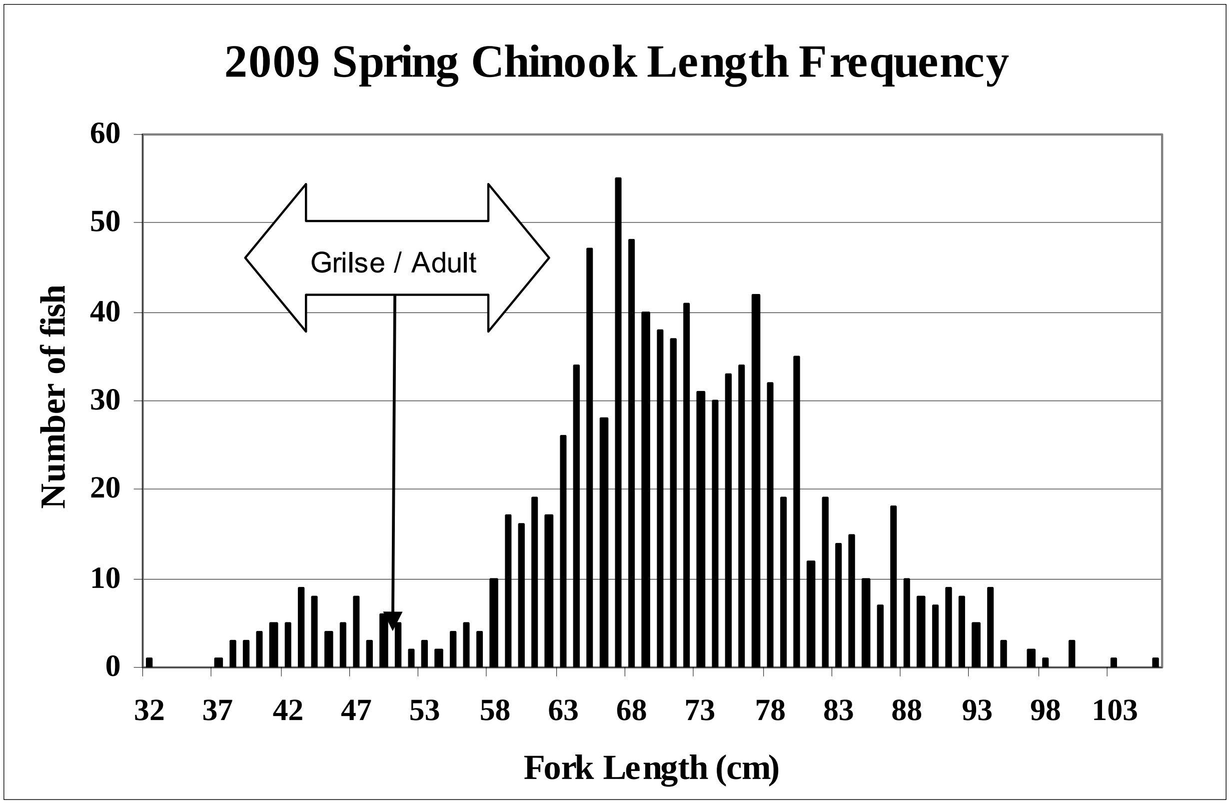


Figure 4. Length frequency for all condition-1 and -2 spring Chinook measured during the 2009 main stem Trinity River spawner survey.

Fall Chinook Salmon

Fork lengths obtained from fall Chinook (n = 2,164) averaged 72.5 cm and ranged between 32-111 cm. (Figure 5). Grilse (FL <55 cm) accounted for 5.36% (116/2,164) of measured fall Chinook.

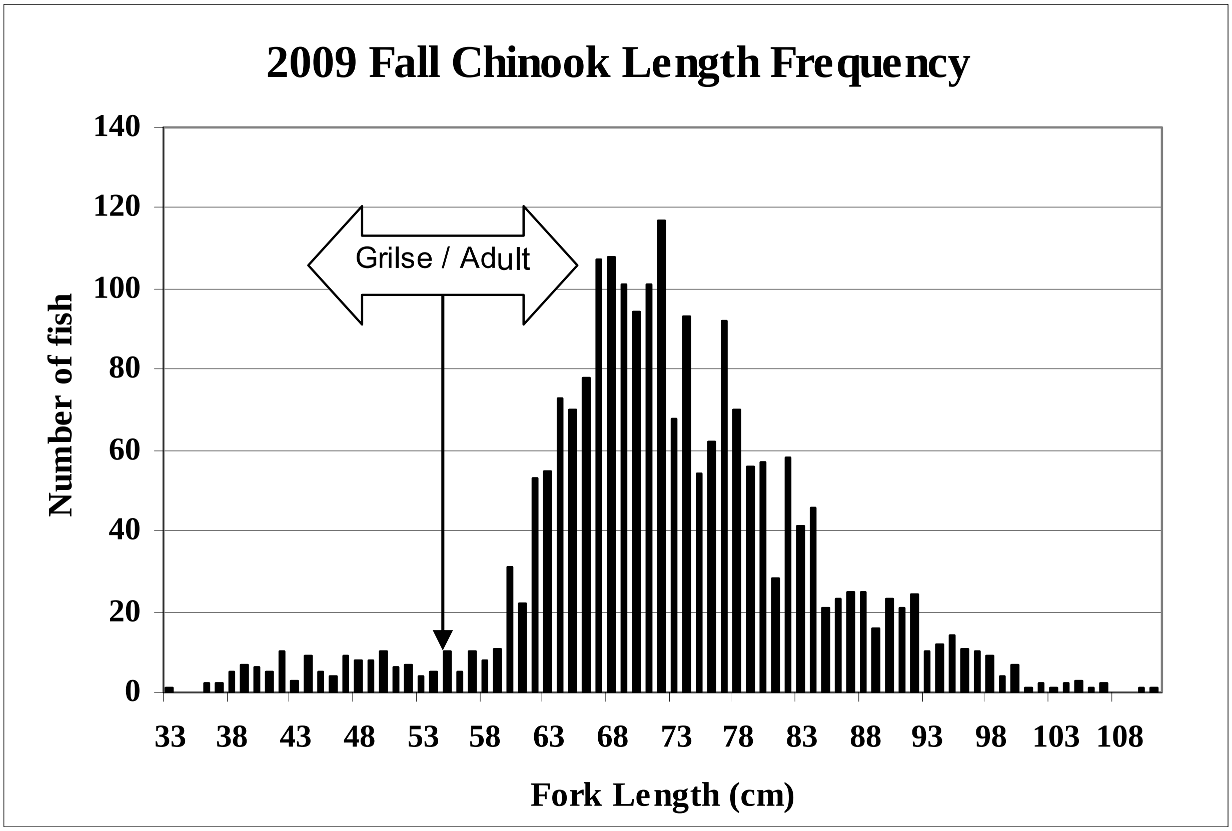


Figure 5. Length frequency for all condition-1 and -2 fall Chinook measured during the 2009 main stem Trinity spawner survey.

Coho Salmon
Fork lengths of measured coho salmon (n = 162) averaged 64.7 cm and ranged from 32-81 cm. (Figure 6). Grilse (FL < 54 cm) accounted for 7.41% (12/162) of measured coho salmon.

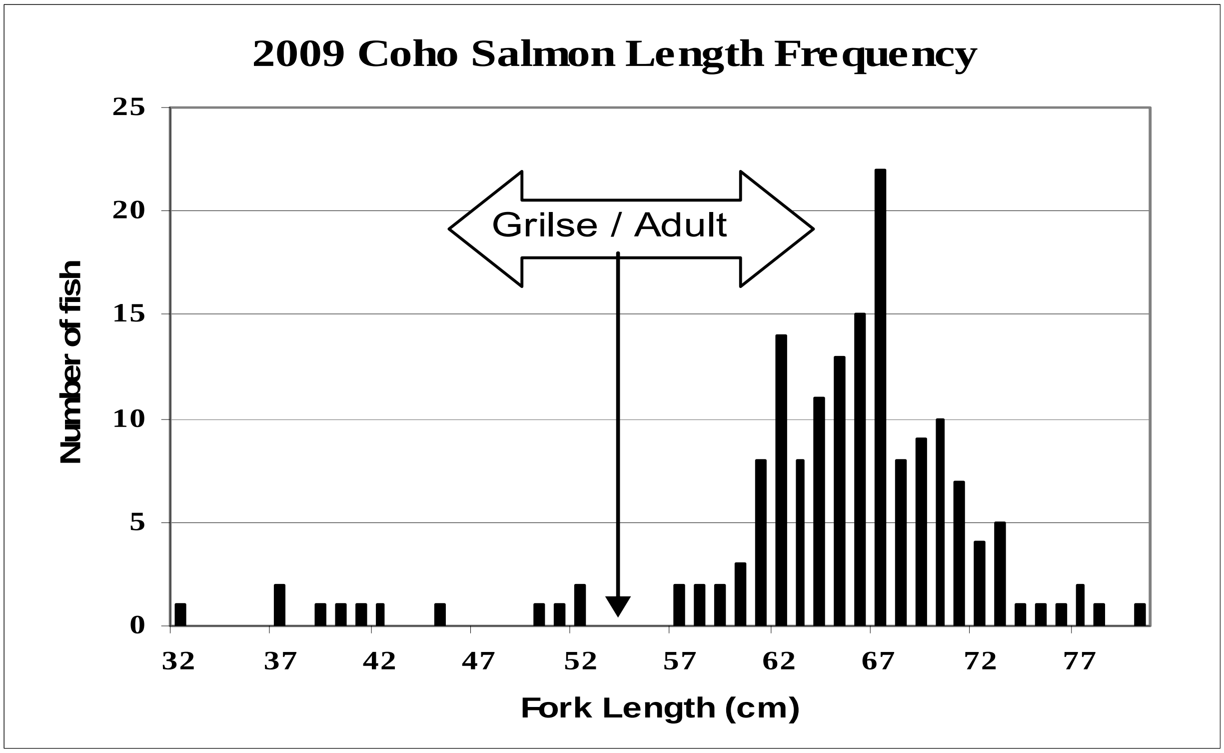


Figure 6. Length frequency for all condition-1 and -2 coho salmon measured during the 2009 main stem Trinity River spawner survey.

Adult Sex Composition and Female Pre-Spawn Mortality

Spring Chinook Salmon

Of the spring Chinook recovered that were sexed; 363 were sexed as males and 626 as females, a male to female ratio of 0.58:1 (Table 8). Gender was indiscernible on 51 fish due to advanced decomposition. Thirty four (5.43%) of the 626 female spring Chinook carcasses evaluated were determined to be pre-spawn mortalities.

Table 8. Male to female ratio and prespawn mortality of spring Chinook during 2009 main stem Trinity River spawner survey

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	137	30	103	7	4	0.29	6.80%
2	129	36	92	7	1	0.39	7.61%
3	235	78	143	10	14	0.55	6.99%
4	187	71	98	4	18	0.72	4.08%
5	90	27	57	2	6	0.47	3.51%
6	131	60	67	1	4	0.90	1.49%
7	81	46	33	3	2	1.39	9.09%
8	0	0	0	0	0	0.00	0.00%
9	48	15	31	0	2	0.48	0.00%
10	0	0	0	0	0	0.00	0.00%
12	0	0	0	0	0	0.00	0.00%
13	2	0	2	0	0	0.00	0.00%
14	0	0	0	0	0	0.00	0.00%
Total	1,040	363	626	34	51	0.58	5.43%

Fall Chinook Salmon

Of the fall Chinook recovered that were sexed; 796 were sexed as males and 1,343 were sexed as females, for a male: female ratio of 0.59:1 (Table 9). Gender was indiscernible on 229 fish due to advanced decomposition. Sixty six (4.91%) of the 1,343 adult female fall Chinook carcasses examined were determined to be pre-spawn mortalities.

Table 9. Male to Female Ratio and Prespawn Mortality of fall Chinook during 2009 main stem Trinity River spawner survey by reach.

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	925	262	631	11	32	0.42	1.74%
2	547	225	264	7	58	0.85	2.65%
3	249	97	127	5	25	0.76	3.94%
4	155	55	71	4	29	0.77	5.63%
5	78	19	50	0	9	0.38	0.00%
6	83	17	43	6	23	0.40	13.95%
7	86	25	39	3	11	0.64	7.69%
8	12	7	3	0	2	2.33	0.00%
9	93	22	45	14	26	0.49	31.11%
10	58	24	24	3	10	1.00	12.50%
12	42	20	18	10	4	1.11	55.56%
13	39	15	24	2	0	0.63	8.33%
14	12	8	4	1	0	2.00	25.00%
Total	2,379	796	1,343	66	229	0.59	4.91%

Coho Salmon

Of the 169 coho salmon recovered that were sexed; 67 were sexed as males and 95 were sexed as females, for a male: female ratio of 0.71: 1 (Table 10). Grisle have been included in number of males, and gender was indiscernible on 7 fish due to advanced decomposition. Fifteen (15.79%) of 95 female coho salmon carcasses examined were determined to be pre-spawn mortalities.

Table 10. Male to female ratio and prespawn mortality of all coho salmon during 2009 main stem Trinity River spawner survey by reach.

Reach	Total Coho	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	81	31	48	6	2	0.65	12.50%
2	52	22	25	3	5	0.88	12.00%
3	21	7	14	2	0	0.50	14.29%
4	5	2	3	2	0	0.67	66.67%
5	2	1	1	0	0	1.00	0.00%
6	0	0	0	0	0	0.00	0.00%
7	2	2	0	0	0	0.00	0.00%
8	0	0	0	0	0	0.00	0.00%
9	4	2	2	1	0	1.00	50.00%
10	1	0	1	0	0	0.00	0.00%
12	0	0	0	0	0	0.00	0.00%
13	0	0	0	0	0	0.00	0.00%
14	1	0	1	1	0	0.00	100.00%
Total	169	67	95	15	7	0.71	15.79%

Incidence of Hatchery Produced Chinook and Coho Salmon

Spring Chinook Salmon

During the spring-run period, 2.70 % (n = 10) of condition-one and 2.30% (n = 24) of all spring Chinook bore Ad-clips. One hundred percent of all ad-clipped spring Chinook were recovered in reaches 1 and 2. CWTs were recovered from 23 Chinook encountered during the spring Chinook recovery period, all of which were spring-run fish. During the period associated with the spring-run, 1 ad-clipped Chinook was recovered in which no CWTs was found. The majority of CWTs were represented by the 2006 spring-run yearling release group (n=6, 26.09%) and 2005 spring-run fingerling release group (n=6, 26.09%). All other CWTs were represented by 2004 brood year spring-run fingerling (n=4, 17.39%), 2004 spring-run yearling (n=3, 13.04%), and 2006 brood year fingerling release groups (n=1, 4.35%).

Based on expansion of all CWT codes recovered during the spring period, an estimated 87 (8.34%) of the total 1,040 fish recovered were of TRH origin (Table 4). 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 34.46% age 5, 28.45% age 4, and 37.19% age 3 (Table 11).

Table 11. Release and recovery data for coded-were tagged, Trinity River Hatchery produced Chinook salmon, recovered during 2009 Trinity River spawner survey.

Release data					Recovery data				
			Release	Production	Recovery period3				Expanded
CWT Code	Brood year	Age	type1	multiplier2	Spring	Fall	Total	% of subtotal	total
Spring Chinook									
65319	2004	5	Sf	4.20282	2		2	8.33	8.406
65321	2004	5	Sf	4.48686	2		2	8.33	8.974
65326	2004	5	Sy	4.14173	3		3	12.5	12.425
65333	2005	4	Sf	4.04924	3		3	12.5	12.148
65334	2005	4	Sf	4.07323	2		2	8.33	8.146
65335	2005	4	Sf	4.38751	1		1	4.17	4.388
65347	2006	3	Sf	4.18636	1		1	4.17	4.186
65360	2006	3	Sy	4.01047	6	1	7	29.17	28.073
No CWT recovered4					3		3	11.54	
	Total recovered spring Chinook:				23	1	24		86.746
Fall Chinook									
65322	2004	5	Ff	4.10472		1	1	1.3	4.105
65329	2004	5	Ff	4.20297		1	1	1.3	4.203
65336	2005	4	Ff	4.7081		3	3	3.9	14.124
65337	2005	4	Ff	4.03683		2	2	2.6	8.074
65338	2005	4	Ff	4.25156		2	2	2.6	8.503
65339	2005	4	Ff	4.02679		2	2	2.6	8.054
65341	2005	4	Fy	4.17253		7	7	9.09	29.208
65350	2006	3	Ff	4.2354		4	4	5.19	16.942
65351	2006	3	Ff	4.20807		6	6	7.79	25.248
65352	2006	3	Ff	4.18405		7	7	9.09	29.288
65353	2006	3	Ff	3.98763		4	4	5.19	15.951
65361	2006	3	Fy	4.05413		25	25	32.47	101.353
No CWT recovered4						13	13	16.88	
	Total recovered fall Chinook:				0	77	77		265.052
	Total recovered adipose clipped Chinook:				23	78	101		351.798

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.

Fall Chinook Salmon

During the fall-run period 8.15% (n = 30) of the condition-1 and 3.49% (n = 83) of all fall Chinook bore ad-clips (Table 5). Observed ad-clip rates in reach 1 and 2 for fall Chinook were 7.34% (n=27; condition-1) and 3.49% (n=83; all carcasses) respectively. In reach 3, fall Chinook ad-clip rates of 0.82% (n=3; condition-1) and 0.39% (n=9; all carcasses) were observed. No CWTs were found in reaches 4 through 14. CWTs were recovered from 83 of the total Chinook encountered during the fall Chinook recovery period; all but one of which were fall Chinook. During the period associated with the fall-run, 18 ad-clipped Chinook were recovered in which no CWTs were found. The majority of CWTs during the fall-run recovery period were represented by 2006 fall fingerling releases (n=25; 30.48%). All other CWTs were represented by the following brood year groups; 2004 fall brood year fingerlings (n=2, 2.44%), 2005 fall brood year fingerlings (n=9, 11.0%), 2005 fall brood year yearling (n=7, 9.0%), 2006 fall brood year fingerlings (n=21, 24.61%), and 2006 spring brood year yearling (n=1, 1.22%).

Based on expansion of all CWT codes recovered during the fall-run period, an estimated 265 (11.14%) of the total 2,379 fish recovered were of TRH origin (Table 5). Based on expansions of all fall CWT groups, the estimated age structure of TRH fall Chinook recovered in the main stem Trinity River spawner survey was 3.13% age 5, 25.64% age 4, and 71.22% age 3. (Table 11).

Coho Salmon

During the course of the survey, 71.43% (n = 25) of condition-1 and 62.72% (n = 106) of all coho salmon recovered bore right maxillary (RM) clips (Table 6). Coho RM clip rates for condition-1 carcasses were highest in reach one. Based on a 100% clip rate of Trinity River Hatchery (TRH) produced juvenile coho salmon, an estimated 62.72% 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 4). Nine of these were recovered on condition-1 carcasses. No spring Chinook Project tags were found on carcasses in reaches 8 through 14. During the course of the survey, 10 tags from the Junction City weir and 7 tags from the Willow Creek weir were recovered prior to Julian week 44. All spaghetti tags were found above reach 5 (Table 4).

Fall Chinook Salmon

A total of 65 Project tags applied at Junction City and Willow Creek weirs were recovered during the survey (Table 5). Fifteen of these were recovered on condition-1 carcasses. During the course of the survey, 62 tags from the Willow Creek weir and 3 tags from the Junction City weir were recovered after Julian week 43. Spaghetti tags were found in all reaches except 8, 9, 12, 13, and 14, and 56.92% were found in reaches 1 and 2 (Table 5).

Coho salmon

A total of 4 Project tags applied at the Willow Creek weir were recovered during the survey (Table 6). All of these were recovered in reaches 2 and 3 during Julian weeks 45 through 49.

Steelhead/Rainbow trout

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

Brown Trout

One Project tag was found on a brown trout carcass during this survey in reach 5 during Julian week 49.

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 12, 13, &14). Mark-recapture techniques were historically used on the Trinity, and were recently reintroduced during the carcass survey in 2005. During the 2009 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 ninety one (20.21%) of Chinook were marked, and two hundred thirty five (34.0%) of those fish were subsequently recaptured (Appendix 6). The upper reaches (reaches 1-5) had a lower marking rate of 16.32% and a slightly higher recapture rate of 42.15% than the survey in its entirety (Appendices 5&6). The lower reaches (reaches 6-10) had a marking rate of 35.66%, and a recapture rate of 19.18% (Appendix 6). Estimates could not be made for spring-run in the lower reaches due to low numbers of recaptures (6 recaptures). All estimators used in this report require at least 25 recaptures to produce reliable results.

Table 12. In-river escapement estimates for Chinook collected during 2009 Trinity River spawner survey.

Estimator	Reaches 1-5	Reaches 1-14	Reaches 1-5 (95% CI)
Peterson	6,463	10,027	675
Weekly Stratified Peterson	8,754	13,372	1,115
Schaefer	8,389	9,590	697
Schaefer with Law's adjustment	7,797	8,899	697

The different estimators produced estimates which range from 8,899 to 13,372 Chinook for the entire survey, and from 6,463 to 8,754 for the upper reaches 1-5 (Table 13). Adding in the 95% Confidence interval, the estimates ranged from 8,026 to 15,075 for the entire survey, and from 5,788 to 9,869 for the upper reaches. These results indicate there is a 5% chance that the true estimate falls outside of the confidence intervals.

Table 13. In-river escapement estimates for spring and fall Chinook collected during 2009 Trinity River spawner survey above Junction City.

Above J.C. (reach 1-5)	Spring	Fall	Ratio of spring to fall Chinook
Petersen	1,840	4,622	
Weekly stratified Petersen	2,493	6,261	0.398:1
Schaefer	2,389	6,000	
Schaefer w/ Law's adjustment	2,220	5,577	

Estimates for the different runs in the entire survey ranged from 2,707 to 4,068 for spring Chinook and 6,192 to 9,304 for fall Chinook (Table 14). The estimates for the upper reaches ranged from 1,840 to 2,493 for spring Chinook and 4,622 to 6,261 for fall Chinook (Table 13). The results of the carcass survey indicate spring to fall Chinook ratios of 0.437:1 for the entire survey and 0.398:1 for the upper reaches (Tables 13 & 14).

Table 14. In-river escapement estimates for spring and fall Chinook collected during 2009 Trinity River spawner survey in all reaches.

Entire survey (reach 1-14)	Spring	Fall	Ratio of spring to fall Chinook
Petersen	3,050	6,977	
Weekly stratified Petersen	4,068	9,304	0.437:1
Schaefer	2,917	6,673	
Schaefer w/ Law's adjustment	2,707	6,192	

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 2009 season, crews recovered slightly more total Chinook than during the 2008 field season (Appendix 1). Coho salmon carcass numbers were the lowest since they began being enumerated during the 2000 field season. 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 first time with spring Chinook and not for fall Chinook. This year, reach 3 has the greatest percentage of spring Chinook (235/1040; 22.60%) than any other reach, and reach 9 produced the highest numbers of spring (n=48) ever observed. This deviation may be due to decreased hatchery contribution to the spring run (Table 15). This decrease has resulted in more naturally spawning spring Chinook in the Trinity River which may be due to restoration activities.

Table 15. 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%

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: 0.58:1 for spring Chinook and 0.59:1 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 5.43 % for spring Chinook and 4.91% 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 15.8%. 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 (15.47%) were classified as condition-1 than spring Chinook carcasses (35.67%) (Tables 4 and 5). This accounts for the different marking rates between spring and fall Chinook. Therefore, due to the higher marking rates for spring Chinook, the estimates may be more efficient for spring Chinook than fall Chinook due to the higher marking rate.

Weather is an uncontrollable factor, which most likely has a great affect 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 2009 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.) Redd survey protocols and datasheets should be simplified, in order to concentrate crew efforts on carcass and redd detection.

5.) 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.

6.) More research into carcass deterioration rate differences between spring-run and fall-run Chinook.

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APPENDICES

Appendix 1. Total spring Chinook carcasses recoverd by reach during the main stem Trinity River spawner survey 2000-2009.

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

Appendix 2. Total fall Chinook carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2009.

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

Appendix 3. Total coho salmon carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2009.

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

Appendix 4. Salmon female prespawn mortality rates observed in the Trinity River spawner survey 1955 through 2009.

Study	Literature	Spring-run Chinook			Fall-run Chinook			Total Chinook			Coho salmon		
Year	Source	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	1138	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	1180	70	5.6	1,604	110	6.4	154	22	12.5
2009	Current study	626	34	5.3	1,343	66	4.9	1,969	100	5.1	95	15	15.8

Appendix 5. Carcass mark recapture statistics and estimates observed on main stem Trinity River spawner surveys 2005 to 2009.

2005	Captured	Marked	Recaptured	Marking Rate	Recapture Rate	Petersen	Stratified Petersen	Schaefer	Schaefer w/ Law's
Spring	1,385	533	143	38.40%	26.80%	3,158	3,539	3,256	2,855
Fall	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	1,311	520	116	39.70%	22.30%	3,567	3,958	4,039	3,661
Fall	3,462	832	390	24.00%	46.90%	9,172	10,176	10,386	9,412
Both	4,772	1,352	506	28.30%	37.40%	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

Appendix 6. Trinity River upper (reaches 1-5) and lower (reaches 6-14) reaches expansion matrix for Chinook mark-recapture estimators during 2009 survey.

Upper Reaches (1-5)	Captured	Marked	Recaptured	Marking Rate	Recapture Rate	Petersen	Stratified Petersen	Schaefer	Schaefer w/ Law's adjustment
Spring	778	218	33	28.02%	15.14%	1,840	2,493	2,389	2,220
Fall	1,954	228	155	11.67%	67.98%	4,622	6,261	6,000	5,577
Both	2,732	446	188	16.33%	42.15%	6,463	8,754	8,389	7,797
Lower Reaches (6-14)									
Spring	262	140	6	53.44%	4.29%	a/	a/	a/	a/
Fall	425	105	41	24.70%	39.05%	b/	b/	b/	b/
Both	687	245	47	35.66%	19.18%	b/	b/	b/	b/

a/ These estimates were made in violation of the rule requiring at lest 25 recaptures for each on of these estimators.

b/ Valid estimates could not be made.

ANNUAL REPORT
KLAMATH RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2009-10 SEASON

ANGLER CREEL SURVEYS IN THE LOWER KLAMATH RIVER

By

Sara Borok

ABSTRACT

During August 6, 2009 through November 4, 2009 a creel census was conducted in the lower (Ocean to Hwy 96 Bridge in Weitchpec) Klamath River to determine numbers of upstream migrating Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) harvested by sport anglers. A total of 5,133 (3,197 adults and 1,936 grilse) Chinook salmon and 200 (192 adults and 8 half-pounders) steelhead were harvested. Chinook salmon caught before August 15, 2009 were considered spring-run Chinook salmon. Forty-nine spring-run Chinook (38 adults and 11 grilse) salmon were harvested in 2009. A total of 5,084 fall-run Chinook (3,159 adult and 1,926 grilse) salmon were harvested by sport anglers. The 2009 in-river sport quota was 30,800 adult Chinook salmon. Seasonal summaries and comparisons of angler effort and catch, catch timing, length frequencies, species composition, hatchery fin clips and tag recoveries are presented.

INTRODUCTION

The Klamath River basin is the second largest river system in California (the Sacramento system is the largest). It drains over 40,000 sq km in northern California and southern Oregon. The Trinity River is its largest tributary and empties into the Klamath River at Weitchpec (river kilometer (rkm) 68.8). Other major tributaries of the Klamath River are the Salmon River (rkm 105.6), the Scott River (rkm 228.8) and the Shasta River (rkm 283.2).

The upper limit of anadromy in the main Klamath River is Iron Gate Dam (rkm 304.2). Iron Gate Hatchery, at the base of the dam, mitigates for loss of historic anadromous fish habitat above the dam. The upper limit of anadromy in the Trinity River is at Lewiston Dam (rkm 177.8). Trinity River Hatchery is located at the base of Lewiston Dam and mitigates for loss of historic anadromous fish habitat above the dam. Both hatcheries are operated by California Department of Fish and Game (CDFG).
The Klamath River system is one of the state's primary producers of Chinook salmon and steelhead trout. These two species support popular sport fisheries throughout the

Klamath River system with most of the concentrated effort and catch occurring in the lower 50 kilometers of the main stem Klamath River.

Although sport angling has been popular throughout the Klamath River for many decades, angler harvest data of anadromous salmonids within the Klamath River system prior to 1978 is limited. The earliest report found mentioning angling in the Klamath River is by Snyder (1931) where he briefly describes methods, mean length and sex of a two day creel sample at the mouth of the Klamath River in August of 1921. Coots (1952) reports on angler harvest of anadromous salmonids during a year long creel census from the mouth of Salmon River (rkm 105.6) to Copco Dam (rkm 314) during 1949 and 1950. Gibbs and Kimsey (1955) provide angler effort and harvest estimates for the boat fishery in the Klamath River estuary during 1951. Bailey (1952) reported on a creel census of the fishery in the lower Klamath River above the Highway 101 Bridge conducted during the fall 1951 adult steelhead and Chinook salmon immigration period.

Other earlier creel census reports on the main stem Klamath River conducted upstream of the Salmon River (rkm 105.6) deal with angler catches during the summer trout season. Some adult steelhead and juvenile coho salmon are reported in the catch reports (Coots 1950, 1951, 1953, 1954; Wales 1948; Wales and Coots 1949). More harvest data was reported by Lanse (1970) in an area of the upper Klamath River between Dutch Creek (rkm 147) to Iron Gate (rkm 304) and by Miller (1971) working in an area of the middle Klamath River from Johnson's (rkm 40) to the Salmon River (105.6 rkm). Steelhead comprised the majority of the sampled catches.

Creel census studies prior to 1978 consisted primarily of angler effort, species composition and catch per unit effort (CPUE) information. Some provided harvest and effort estimates within the sampled area. However, not until 1978 was an attempt made to estimate Chinook harvest by anglers throughout the Klamath River basin (Boydstun, 1979).

The Fishery and Conservation Management Act of 1976 established a 200-mile fishery conservation zone and created eight regional Fisheries Management Councils, one of which is the Pacific Fisheries Management Council (PFMC), the purpose of which was to develop and implement a Fishery Management Plan (FMP) for commercial and recreational salmon fisheries off the coasts of Washington, Oregon and California. All inland waters and those ocean waters out to the 3 mile mark are managed by the individual adjoining states, those waters off California are managed by CDFG.

The Klamath River is regarded as one of the more important producers of fall-run (fall) Chinook salmon in California's commercial and sport fisheries. PFMC management objectives include measures to rebuild and protect depressed Klamath River fall Chinook stocks (PFMC 1983). PFMC management practices have focused on harvest restrictions for commercial and recreational fisheries that were impacting Klamath River Chinook stocks. The California Fish and Game Commission (Commission), with management jurisdiction of fisheries in coastal waters from shore out 5 kilometers (3 miles) and in-river sport fisheries, has implemented Chinook salmon management practices and regulations supporting PFMC objectives. Thus, Klamath River adult fall Chinook run-size data has been a critical management component of the fall Chinook resource and its fisheries in northern California and southern Oregon.

The number of fall Chinook salmon entering the Klamath Basin (run-size) is determined by summarizing the number harvested in-river (both sport and tribal), the number returning to the two basin hatcheries, natural spawning escapement (fish spawning in natural areas) and drop-off net and angler mortaility. Angler harvest of Klamath River fall Chinook salmon has been monitored by CDFG to provide data for fall Chinook salmon run-size estimates since 1978. Annual reports summarizing these activities have been written through the 2008 season (Boydstun 1979, 1980; Lee 1984a, 1984b, 1985, Lau 1992-1997; Pisano 1998; Borok 1999-2004, Hanson 2005-2008).

This report covers the period from July 1, 2009 through June 30, 2010. It provides data and a description of the CDFG fall Chinook salmon angler harvest monitoring program in the main stem Klamath River from the mouth of the Klamath River to the Highway (Hwy) 96 Bridge at Weitchpec (rkm 68.8) excluding the Trinity River.

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 Hwy 101 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 adult Chinook salmon. This report covers the lower 2 sections of the Klamath River from the ocean to the Hwy 96 Bridge in Weitchpec.

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 and upper Klamath River (17%) (rkm 68.8 to rkm 306) and the Trinity River (33%). CDFG monitors or models each of the areas for the fall 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 2009 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, 2009 in the Lower Klamath River and September 1, 2009 in the Trinity River and the Klamath River above the Hwy 96 Bridge in Weitchepec. The limit of hatchery steelhead for the Trinity River (only) was increased to two per day and four in possession. Regulations stated one “hatchery” trout or one “hatchery” steelhead could be harvested, which eliminated the cutthroat trout fishery in the Klamath basin. No harvest of coho salmon was permitted in the entire Klamath Basin. Adult Chinook are defined in the regulations as Chinook 22 inches (56 cm) total length or greater. Grilse or jacks are the Chinook under 22 inches (<55cm).

METHODS

Description of the Fishery and Creel Sample Area

To estimate angler catch and effort, CDFG divides the main stem Klamath River from the mouth to Iron Gate Dam into three areas. The mouth of the river to the Hwy 96 Bridge in Weitchpec (Areas 1 and 2) are included in this report. The area upstream of the Hwy 96 Bridge in Weitchpec to Iron Gate Dam (Area 3) was 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 consisted of 4.5 rkm (2.8 mi) of river from the mouth of the Klamath to the Hwy 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 2009. 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 2009 season fishing the mouth was not closed at any time. If 15% of the lower river quota had been caught below the Hwy 101 Bridge (3,375 adult fall 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 extended from the Hwy 101 Bridge at Klamath (rkm 5) to the Hwy 96 Bridge (rkm 68) in Weitchpec. 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 riffles (Lower Klamath Glen and Blake's) located in the lower 5 km of this area easily accessed by shore anglers. One former resort boat dock (Klamath Glen) and a public boat launch (Roy Rook), also located in this section 5 km, 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 were 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 were 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 was 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.

Creel Census Methods

Study methods and procedures used in Areas 1 and 2 during the 2009 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; for weeks that were sampled other than that, 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. 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 weather 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 was stratified for each creel census location by Julian week (Appendix 1). Angler catch and effort estimates are calculated for each week. The catch-effort estimate formula used was:

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

where: Estimate total = estimates of catch or effort
Daily total = Daily counts of catch or effort
N = Number of fishing days in week
n = number of sample days
I = boat sampling ratio

Area 2: Harvest estimates for the area above Highway 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 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:

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

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 Indian 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 computed 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.

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.

The creel census for the lower Klamath River began on August 6 and ran through November 4 (JW 32 through 44) of 2009.   Chinook salmon harvested in the lower Klamath fishery ranged in size from 36 to 107 cm in fork length (Figure 1). The adult portion of Chinook harvested ranged in size from 59 to 107 cm FL and averaged 73.4 cm FL. The grilse component of the angler harvest ranged in size from 36 to 58 cm FL and averaged 48.4 cm FL. The shift in size for adults from the stated size in the regulations is based on the fork length distribution below.

Harvested steelhead ranged in size from 34 to 79 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.

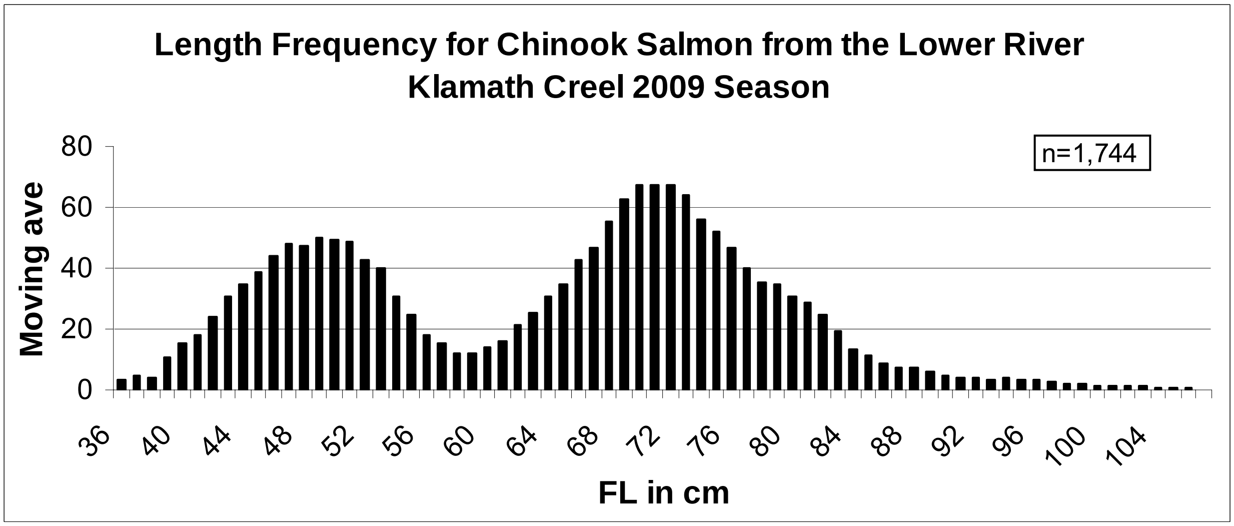

Figure 1. Fork length frequency of Chinook salmon harvested in the lower Klamath River during the 2009 season.

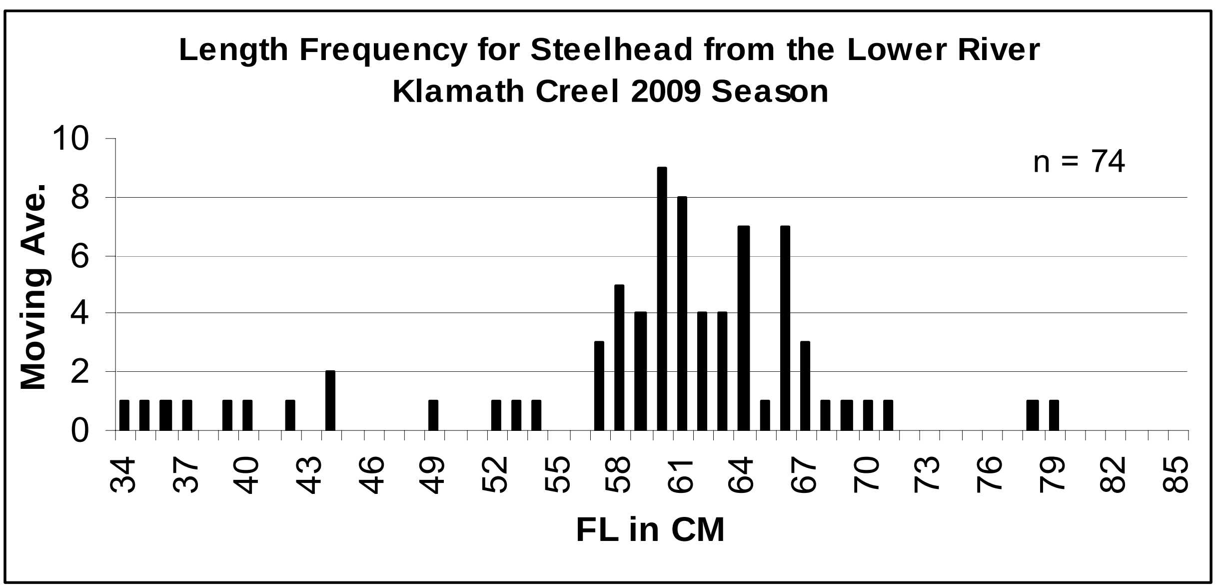

Figure 2. Fork length frequency of steelhead harvested in the lower Klamath River during the 2009 season.

Estimated Angler Effort and Harvest

During the 2009 season, CDFG estimate that anglers made a total of 14,736 trips in Areas 1 and 2 combined. Of the 14,736 trips; 6,627 were in Area 1, and 8,109 were in Area 2 (Table 1). These trips resulted in a total effort of 67,160 fishing hours. As in previous seasons, boat anglers out-numbered shore anglers in both Areas (Table 1).

A total of 5,133 (3,197 adults and 1,936 grilse) Chinook salmon and 200 (192 adults and 8 half-pounders) steelhead were harvested (Table 1). During Julian weeks 32 and 33, 49 (38 adult and 11 grisle) spring-run Chinook salmon were harvested. The total of fall Chinook harvested was 5,084(3,159 adults and 1,925 grilse) fish. Eleven adult coho salmon were estimated harvested this season.

Table 1. Summary of estimated angler effort and harvest during the 2009 lower Klamath River creel census.

Site	Angler		Steelhead		Chinook Salmon	
Location	Trips	Hours	½ lbers	Adults	Grilse	Adults
Area 1 -Mouth to Highway 101 Bridge						
Shore	2,183	7,256	4	2	37	408
Boats	4,444	14,243	0	39	412	673
Total	6,627	21,499	4	41	449	1,081
Area 2 - Highway 101 to Hwy 96						
Shore	1,548	4,883	2	25	36	109
Boats	6,561	40,778	2	126	1,452	2,006
Total	8,109	45,661	4	151	1,487	2,115
Grand Total	14,736	67,160	8	192	1,936	3,197
2008	10,827	56,005	2	56	3,947	1,056
2007	13,913	64,101	7	767	255	3,388

2009 Harvest and Effort Patterns

The average trip length during the 2009 season was 4.6 hours (Table 2) and was consistent with years 2002-2007. Average trip length over the previous 17 years (1992-2008) was 4.0 hours per trip. The 2008 season was an anomaly; anglers fished longer trips, caught fewer adult fish, but caught 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 eighteen seasons, 1992-2009.

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

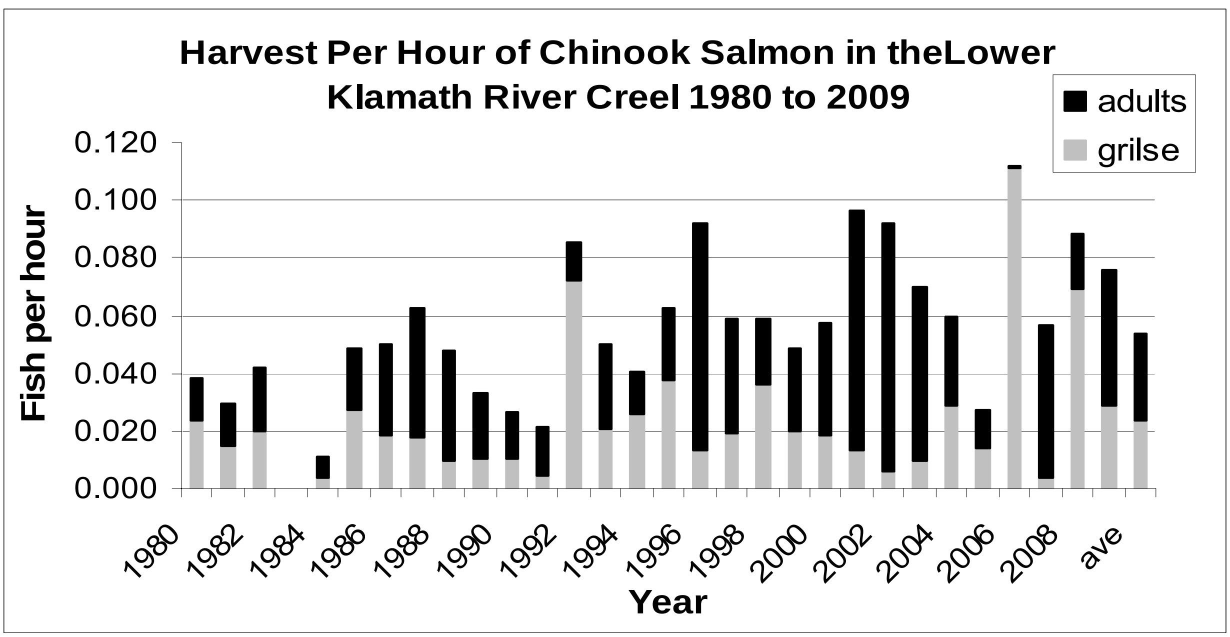

Figure 3. Harvest per hour of Chinook salmon from the sport fishery during the lower Klamath River creel survey, 1980 – 2009.

Catch and Release

Catch and release data were recorded as part of the creel interview. 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 924 half-pounders, 485 adult steelhead, 338 grilse, and 292 adult Chinook salmon (Tables 3 and 4). In addition an estimated 5 grilse and 34 adult coho salmon were released this season. The majority of coho salmon harvested 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. The quota was not met during the 2009 season.

Table 3 Estimated number of Chinook and coho salmon and steelhead caught and released from the lower Klamath River, 1994-2009.

Year	Chinook		Steelhead		Coho	
	Grilse	Adults	<42	>41	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

Table 4. Creel survey estimates of Chinook salmon and steelhead caught and released in the lower Klamath River, 2009 season.

Site Location		Angler Trips	Angler Hours	Steelhead 1/2 lbers	Steelhead Adults	Chinook Salmon Grilse	Chinook Salmon Adults
Area 1 - Mouth to Highway 101 Bridge							
Shore		2183	7256	8	9	7	26
Boats		4,444	14,243	43	34	66	28
Total		6,627	21,499	51	44	73	53
Area 2 - Highway 101 to HWY 96							
Shore		1,548	4,883	438	111	32	24
Boats		6,561	40,778	485	330	233	215
Total		8,109	45,661	924	441	265	239
Grand Total		14,736	67,160	975	485	338	292
2008		10,827	56,005	7	767	255	3,388
2007		13,913	64,101	23	231	4,626	53

Harvest Timing

Angler effort and Chinook harvest peaked in Julian week 37 for both grilse and adults (Figure 4 and 5). Harvest of adult steelhead peaked in Julian week 36 (Figure 6), while the peak week of half pounder catch and release fishing was JW 32 (Figure 7). Very few half-pounders (7) were harvested this season.

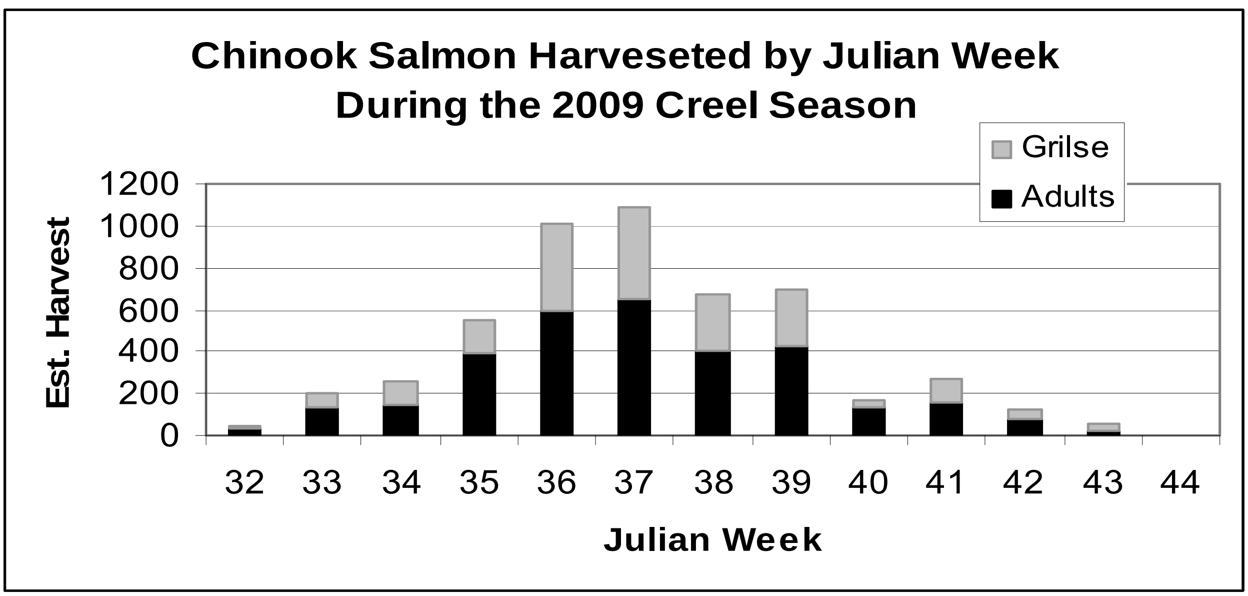

Figure 4. Estimated harvest of Chinook salmon by Julian week in the lower Klamath River during the 2009 creel survey.

Table 5. Angler effort, fish harvested and fish released by Julian week during the 2009 lower Klamath River creel census.

Julian	Angler		Chinook Harvested		Steelhead Harvesetd		Chinook Released		Steelhead Released	
Week	Trips	Hours	Grilse	Adults	1/2 lbers	Adults	Grilse	Adults	1/2 lbers	Adults
32	719	2,244	11	37	0	21	4	7	266	70
33	876	2,944	65	132	0	36	12	12	311	102
34	1,344	4,725	109	147	4	16	37	19	98	26
35	1,576	6,578	146	397	0	8	14	11	16	7
36	2,382	10,964	411	595	2	13	64	40	46	25
37	2,667	12,973	432	656	0	37	55	30	37	84
38	2,095	10,746	272	406	0	35	77	82	23	77
39	1,558	7,834	275	423	0	20	28	48	51	28
40	739	4,039	33	137	0	2	14	23	42	21
41	387	2,209	110	158	0	2	28	5	51	35
42	237	1,142	47	79	2	0	7	11	14	4
43	140	692	26	26	0	0	0	5	19	5
44	16	71	0	0	0	0	0	0	0	2
Total	14,736	67,160	1936	3194	7	192	338	292	975	485

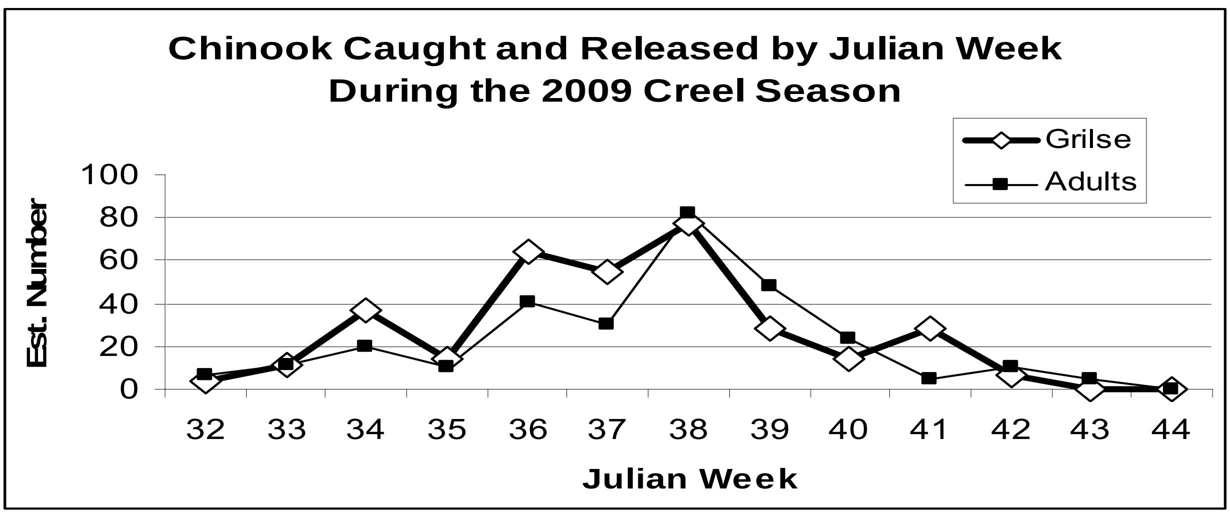

Figure 5. Estimated Chinook salmon caught and released by Julian week during the 2009 lower Klamath River creel season.

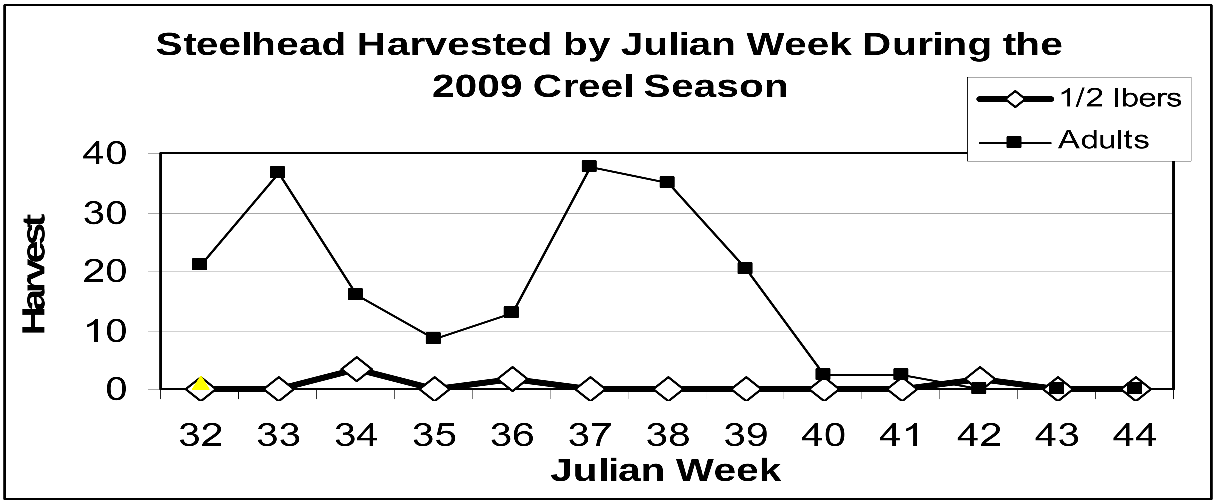

Figure 6. Estimated steelhead harvested by Julian week in the lower Klamath River for the 2009 creel season.

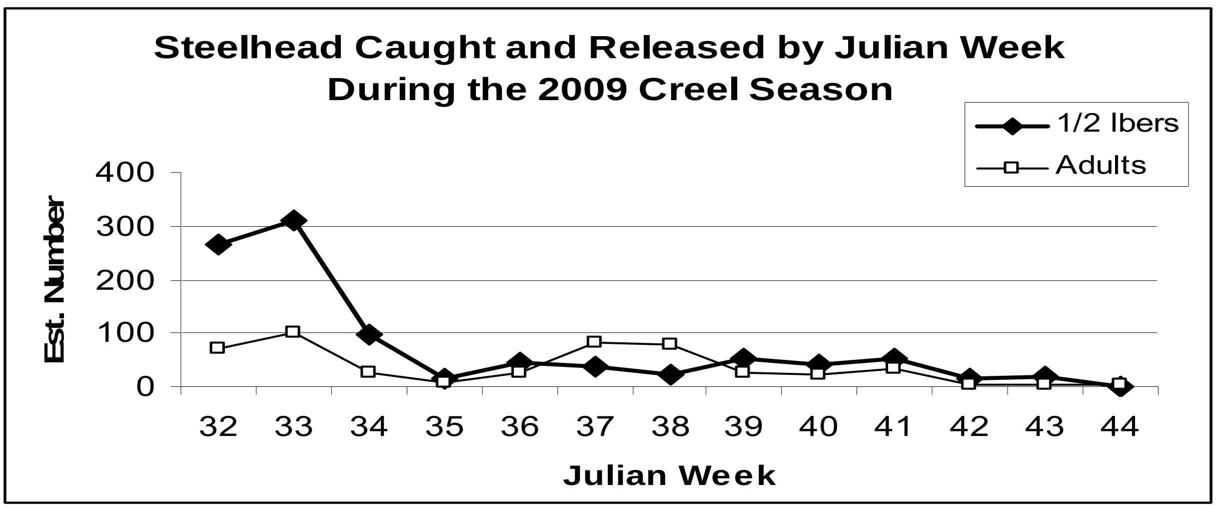

Figure 7. Estimated steelhead caught and released, by Julian week, during the 2009 lower Klamath River 2009 creel season.

Coded-Wire Tag Recovery

KRP personnel recovered the heads of 78 adipose fin-clipped and coded-wire-tagged (Ad+CWT) Chinook salmon during Julian weeks 33 through 42 of the 2009 season. There were four 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 eight heads. This left 66 tags to decode. Of these 66 heads, 18 were adult salmon while 48 were grilse salmon.

No Trinity River Hatchery spring Chinook heads were recovered. Recoveries of adipose fin-clipped fall Chinook salmon adults ranged in size from 64 to 87 cm. Grilse ranged in size from 52 cm to 81 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 3.02 % (66/2,185) 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 1,013 hatchery fish were harvested (Table 7). Hatchery fish represented an estimated 19.74% (1,013/5,130) of the entire sport harvest in the lower Klamath River. All 66 randomly recovered tags were from Klamath and Trinity Basin origin Chinook salmon.

<u>Iron Gate Hatchery Origin Chinook Salmon</u>
CDFG decoded 18 random recovered tags from Klamath River origin Chinook. These Chinook salmon represent 9 different tag codes; 2 from the 2005 Brood Year, 5 from the 2006 Brood Year and 2 from the 2007 Brood Year at Iron Gate Hatchery (Table 6). When expanded for creel sampling and hatchery production multipliers for each tag group, Iron Gate Hatchery origin fish account for 9.45% (485/5,130) of the total sport harvest (Table 7). The Iron Gate Hatchery origin Chinook were harvested between Julian Weeks 33 to 39 (Figure 8).

<u>Trinity River Hatchery Origin Chinook Salmon</u>
CDFG decoded a total of 48 randomly recovered tags of Trinity River Hatchery fall Chinook origin. These Chinook salmon represent 7 different tag codes; 2 from the 2006 Brood Year and 5 from the 2007 Brood Year at Trinity River Hatchery (Table 6). Trinity River origin fish represented 10.29% (528/5,130) of the total sport harvest (Table 7). Trinity River Hatchery origin Chinook were harvested between Julian Weeks 36 to 42 (Figure 8).

During the 2009 season, sport in-river harvest by stock can be described as follows: The tail end of the Trinity River Hatchery spring-run Chinook salmon made up the majority of harvest up to Julian week 33 (assumed from past seasons), then Iron Gate Hatchery fall Chinook salmon were present and peaked at Julian week 36. The bulk of the Trinity River fall tags were collected during Julian weeks 37 and 39. No additional 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, 2009 season.

		Julian Week											
CWT Code	Brood Year	32	33	34	35	36	37	38	39	40	41	42	Total
Trinity River Hatchery Fall													
65338	2006					1							1
65341	2006					1							1
65351	2007									1			1
65353	2007						1		1				2
65361	2007					6	12	5	10	1	5	1	40
68804	2007					1							1
68809	2007						1		1				2
Iron Gate Hatchery													
601020602	2005			1									1
601020607	2005		1										1
601020608	2006					1							1
601020609	2006		1	1	1								3
601020702	2006					1		1					2
601020703	2006				1	1							2
601020704	2006					2	1	2	1				6
608020002	2007					1							1
608020003	2007					1							1
100000				1	2		3	1	1				8
200000						1							1
300000													0
400000						1	1	1					3
Total		0	2	3	4	18	19	10	14	2	5	1	78

Table 7. Fall Chinook salmon harvest proportioned by hatchery origin of the 2009 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	% Hatchery
Grilse	1,936		49	509	558	28.82%
Adults	3,194		436	19	455	14.25%
	5,130		485	528	1,013	

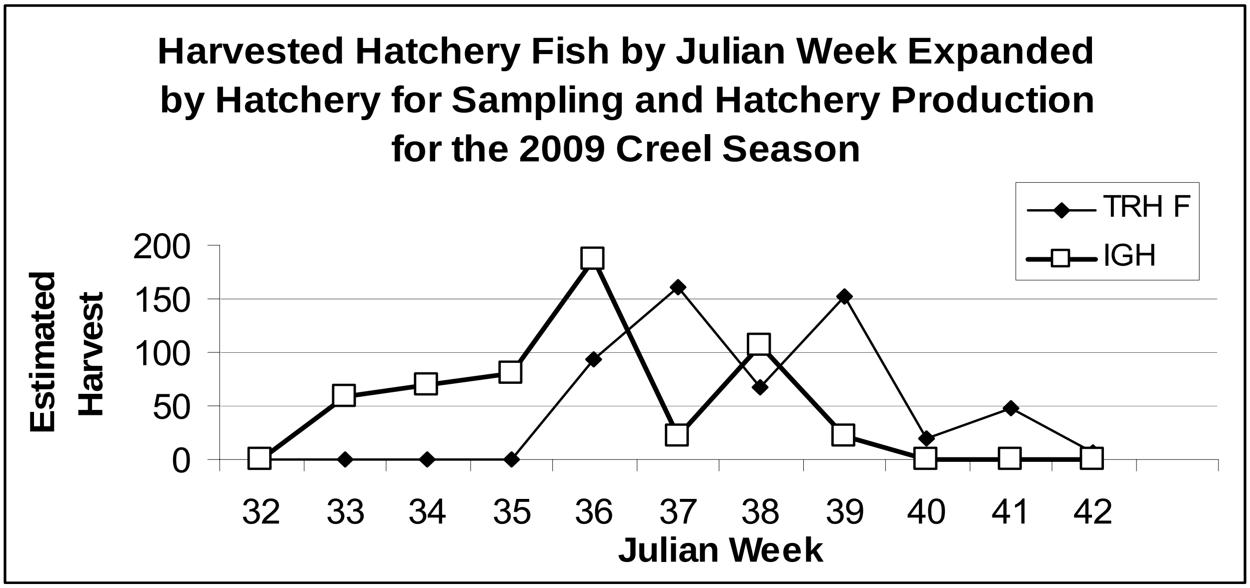

Figure 8. Estimated harvest of hatchery produced fall Chinook salmon by Julian week in the lower Klamath River, 2009 season.

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DISCUSSION

During the 2008 creel census 3,879 grisle salmon were harvested.. A large run of two year old fish one season usually indicates there will be a large number of three year old fish in the system the following season. Anglers did catch more adult Chinook salmon in 2009 but not in the numbers anticipated considering the 2008 grilse predictions. Basin wide, anglers only harvested 18.3% (5,651/30,800) of their quota

Anglers are aware that the tribal commercial harvest is usually over after the Labor Day weekend. This season the peak in effort occurred the week following that holiday weekend. There has been a slight shift in effort patterns, in previous seasons the peak in effort was Labor Day weekend.

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

ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2009-2010 SEASON

TASK VI
JUVENILE COHO SALMON SUMMER DISTRIBUTION IN THE UPPER TRINITY RIVER

by

John Hileman

ABSTRACT

Habitat use along the upper part of the Trinity River below Lewiston Dam by juvenile coho salmon (*Oncorhynchus kisutch*) is essential data in the evaluation of the potential effects of restoration activities on the Trinity River. Coho salmon are a Federal and State listed species. The upper 30.4 kilometers (Rkm) of the main stem Trinity River were surveyed for juvenile (post fry, >50 mm) coho presence using snorkel apparatus. The flow discharge from Lewiston Dam at the time the surveys were conducted in August 2009 was at the base-flow of 450 cubic feet per second (cfs). A total of 5,551 juvenile coho salmon were counted across 226 point observations. The bulk of both the point observations and high density point observations were recorded from Old Lewiston Bridge, to Grass Valley Creek.

INTRODUCTION

Summer juvenile coho salmon distribution in the upper Trinity River is highly clustered around slower backwater areas that have non-rooted aquatic vegetation. Large wood debris is a primary cover type preferred by juvenile coho (Garrison, 2008). Large woody debris cover is now infrequent in the upper Trinity River due to the loss of recruitment from damming of the river and loss of streamside mature forest from past logging and urban development. The intent of this study is to generate a generalized synoptic view of the abundance and distribution of juvenile coho salmon in the upper river basin during summertime base flows of 450cfs, as a means of gauging and monitoring the TRRP mechanical and flow based habitat modification efforts.

Coho salmon populations are currently listed as a State and Federal threatened species in the Southern Oregon- Northern California (SONC) Evolutionary Significant Unit (ESU). Information generated in Tasks I and III of this report document annual adult returns of hatchery and in-river compositions of the population.

The Trinity River Restoration Program (TRRP) is a consortium of agencies, tribes, and stakeholders. TRRP formed as a result of the 2000 Trinity River Record of Decision (ROD) (USDOI 2000). The ROD authorized increased flow regimes based on water year types, and recommended a Restoration and Implementation Group (RIG), and a Technical Management and Assessment Group (TMAG).

The 2008 run-size estimate for natural escapement of coho salmon in the main stem Trinity River above Willow Creek Weir was 4,794 individuals. An estimated 80.3% were of hatchery origin and marked with a right maxillary clip (RM) (Sinnen, et al., 2010). Carcass surveys in the fall of 2008 counted a total of 318 coho carcasses in the upper Trinity River, 91.82% of which were observed from Lewiston Dam to below Indian Creek (Hill, 2010). Based on a Generalized Additive Model (GAM), in the fall of 2008 an estimated 565.5 coho salmon redds occurred from Lewiston Dam to just downstream of Weaver Creek (Chamberlin, 2010). Trinity River Hatchery (TRH) in Lewiston, CA has an annual production goal of releasing 500,000 yearling hatchery-produced coho salmon by volitional release on or about March 15 each year. Between March 16, 2009 and March 23, 2009, 457,478 brood-year 2007 hatchery raised yearling coho salmon were volitionally released into the Trinity River (Sinnen, et al., 2010).

Naturally produced juvenile coho salmon utilize the upper main stem Trinity River and associated peripheral habitats for hatching out and rearing. During the summer base flows juvenile coho prefer habitats that provide flow and predator cover that is most frequently observed in off-channel areas, particularly side channels and backwaters that contain non-emergent vegetative cover or small woody debris (Garrison and Sinnen, 2008). The study design precludes any data information regarding juvenile coho salmon utilizing river side channels. Such information will be included in a separate report.

This study is limited to the presence / absence and enumeration of juvenile coho salmon in the upper main stem Trinity River from Lewiston Dam to the confluence of Indian Creek during the summer of 2009. At the time of this study in August 2009, post fry (>50mm) juvenile coho salmon in the study area were naturally produced from the brood-year 2008 cohort.

METHODS

Study area and survey period

The snorkel surveys for this study were conducted in August 2009 across two survey days in Julian week 31 and three survey days in Julian week 32. The study site included the upper 30.4 kilometers of the main stem Trinity River, from Lewiston Dam downstream to Indian Creek. Flow discharge rates during the study period were at the base flow release out of Lewiston Dam at 450 cfs. The study area has a temperature regime (Figure 1) that supports juvenile coho salmon and encompasses a large section that is undergoing mechanical restoration (Garrison and Sinnen, 2008).

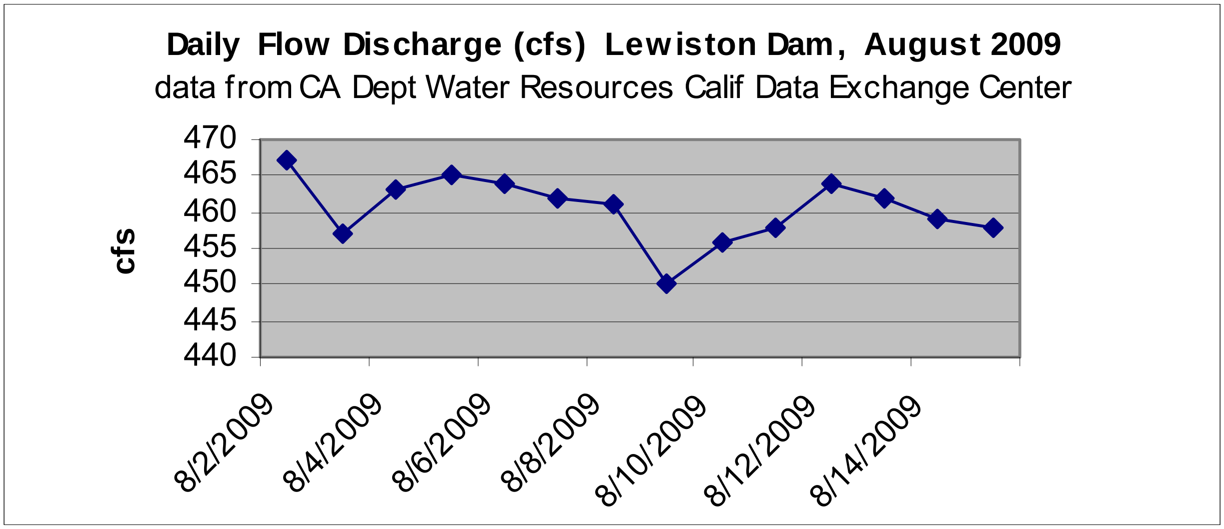

Figure 1. Lewiston Dam (Upper Trinity River) discharge (cfs) August 2009.

Direct observation methods

Juvenile coho salmon point observations were made by two to three divers outfitted in a wet or dry suit using snorkel apparatus. The divers were accompanied by a raft and rower/data recorder. The river was surveyed in a downstream fashion. At each observation point the raft was anchored or beached until all the observation data was recorded (Appendix 1).

Data Collection, Storage and Transfer

Each point observation was recorded on a field data sheet that included RKm, a GPS waypoint, right or left bank, number of juvenile coho salmon observed and comments. Observations were recorded to the nearest .01 RKm, based on interpretation of aerial photos over-laid with a coordinate grid. GPS waypoints observations were recorded using a Garmin 12 XL GPS unit, rated for <3 meter accuracy. Waypoints were marked in decimal degrees, using WGS 84 map datum. Data were downloaded as a Microsoft Excel spreadsheet file from the GPS unit to a desktop computer. Files were converted into a GIS layer for use by TRRP.

RESULTS

A total of 226 juvenile coho point observations were made from Lewiston Dam to Indian Creek. A total of 5,551 individuals were counted within these 226 point observations (Table 1). Densities of juvenile coho were neither uniform within nor across snorkel survey sections (Figure 2).

Distribution of juvenile coho within the upper river was clustered with highest densities observed just above the confluence of Rush Creek (Figure 3). The total number of point observations was highest in the section from Rush Creek to Bucktail, and lowest in the section from Poker Bar to Steelbridge. The total number of individual juvenile coho observations was highest in the section from Rush Creek to Bucktail and lowest in the section between Steelbridge to Indian Creek (Figures 4-6).

Table 1. Snorkel survey summary, upper Trinity River, August 2009.

Snorkel Section	Date Snorkeled	Distance (RKm)	Point Observations	Juvenile Coho Observed
Lewiston Dam to Rush Creek	8/3/2009	5.43	41	1391
Rush Creek to Bucktail	8/4/2009	4.84	71	2322
Bucktail to Poker Bar	8/10/2009	4.93	54	1256
Poker Bar to Steelbridge	8/11/2009	5.97	29	318
Steelbridge to Indian Creek	8/12/2009	9.23	31	264
Total	-	30.40	226	5551

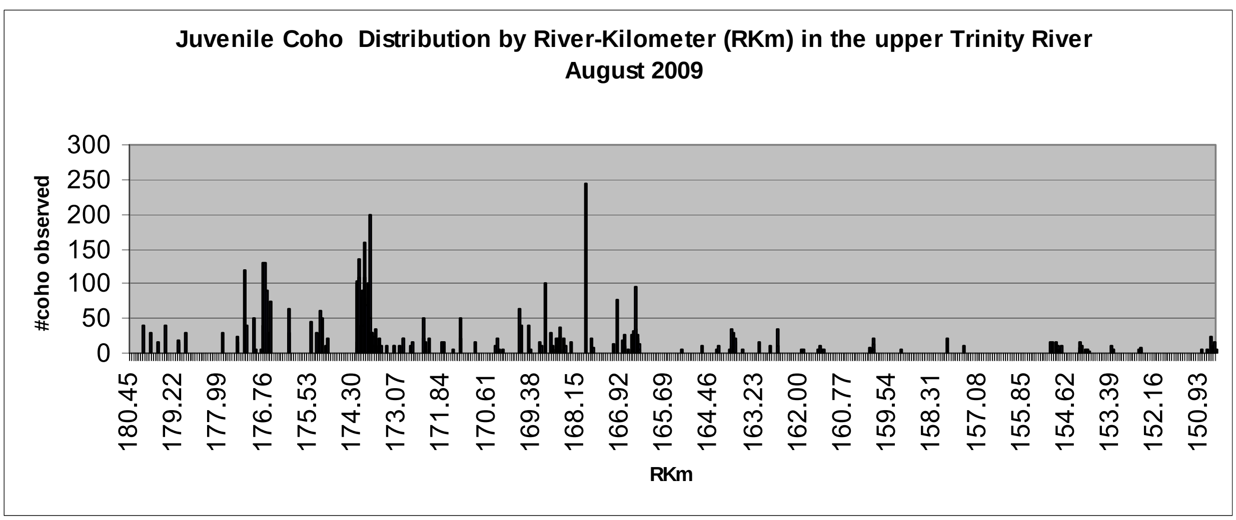

Figure 2. Juvenile coho distribution observed during snorkel surveys from Lewiston Dam to Indian Creek, August 2009.

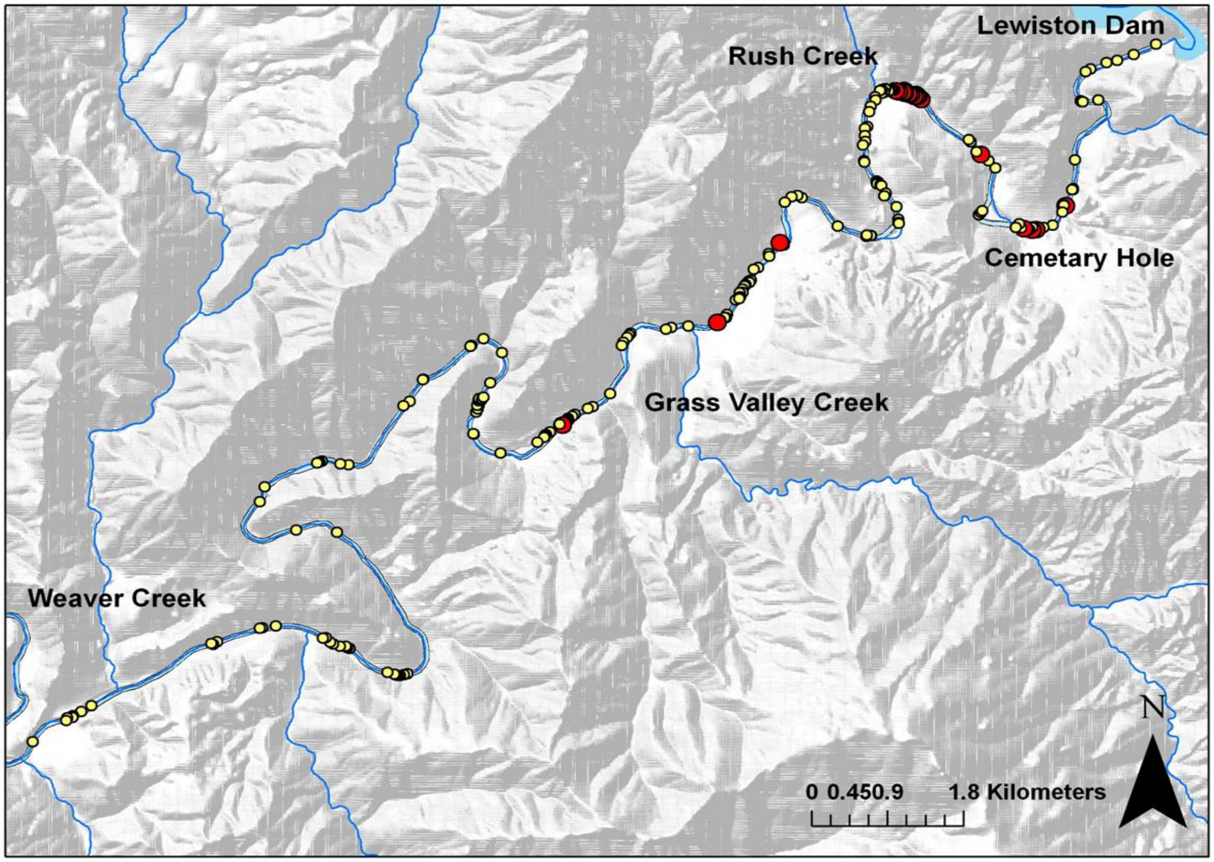

Figure 3. Juvenile coho point observations in the upper Trinity River, August 2009. Points in yellow indicate observations of 1 to 55 juvenile coho. Points in bolded red indicate observations of 56 to 214 juvenile coho.

Figure 4. Aerial photograph of Trinity River, Lewiston CA, in vicinity of Old Lewiston Bridge. Overlay points in yellow indicate observations of 1 to 55 juvenile coho. Overlay points in bolded red indicate observations of 56 to 214 juvenile coho.

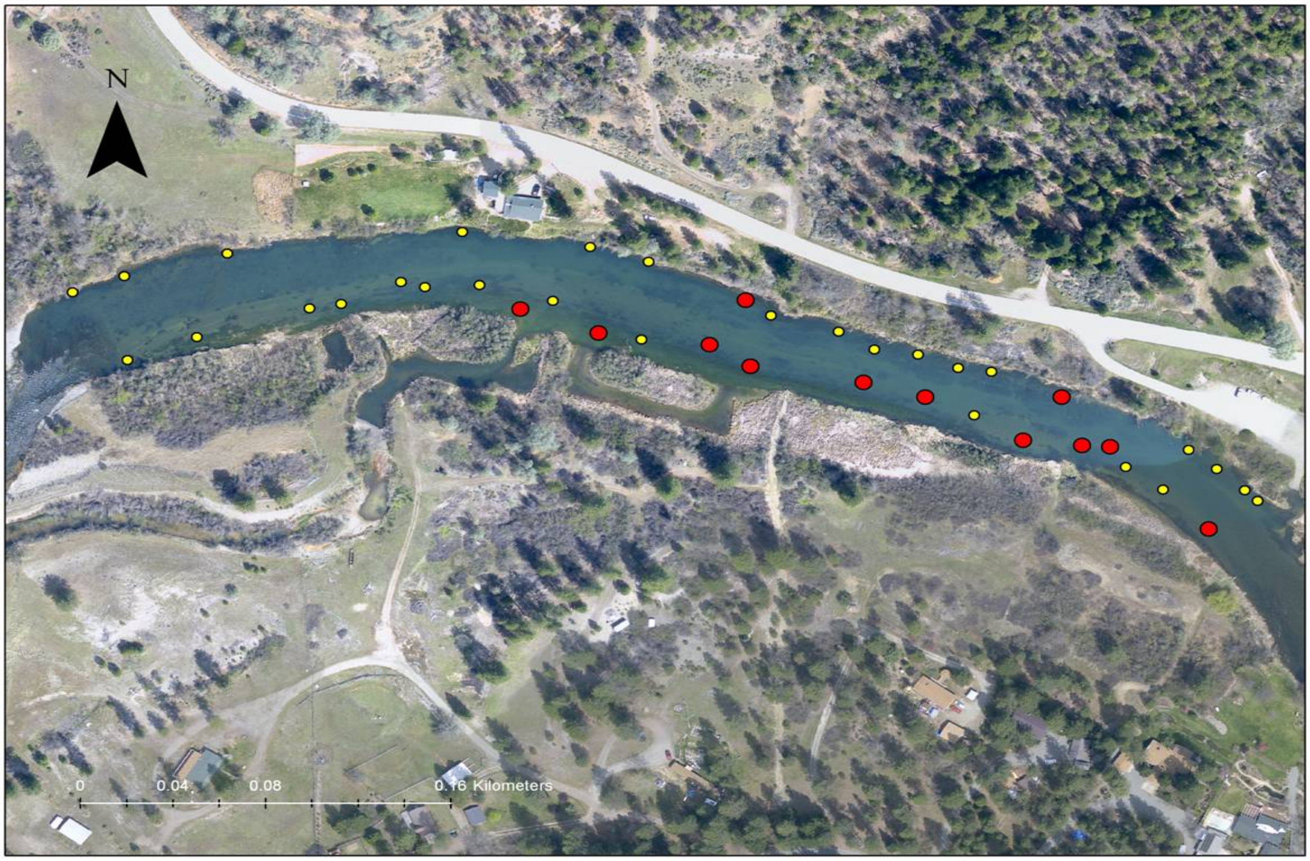

Figure 5. Aerial photograph of Trinity River, Lewiston, CA in vicinity of the confluence with Rush Creek. Overlay points in yellow indicate observations of 1 to 55 juvenile coho. Overlay points in bolded red indicate observations of 56 to 214 juvenile coho.

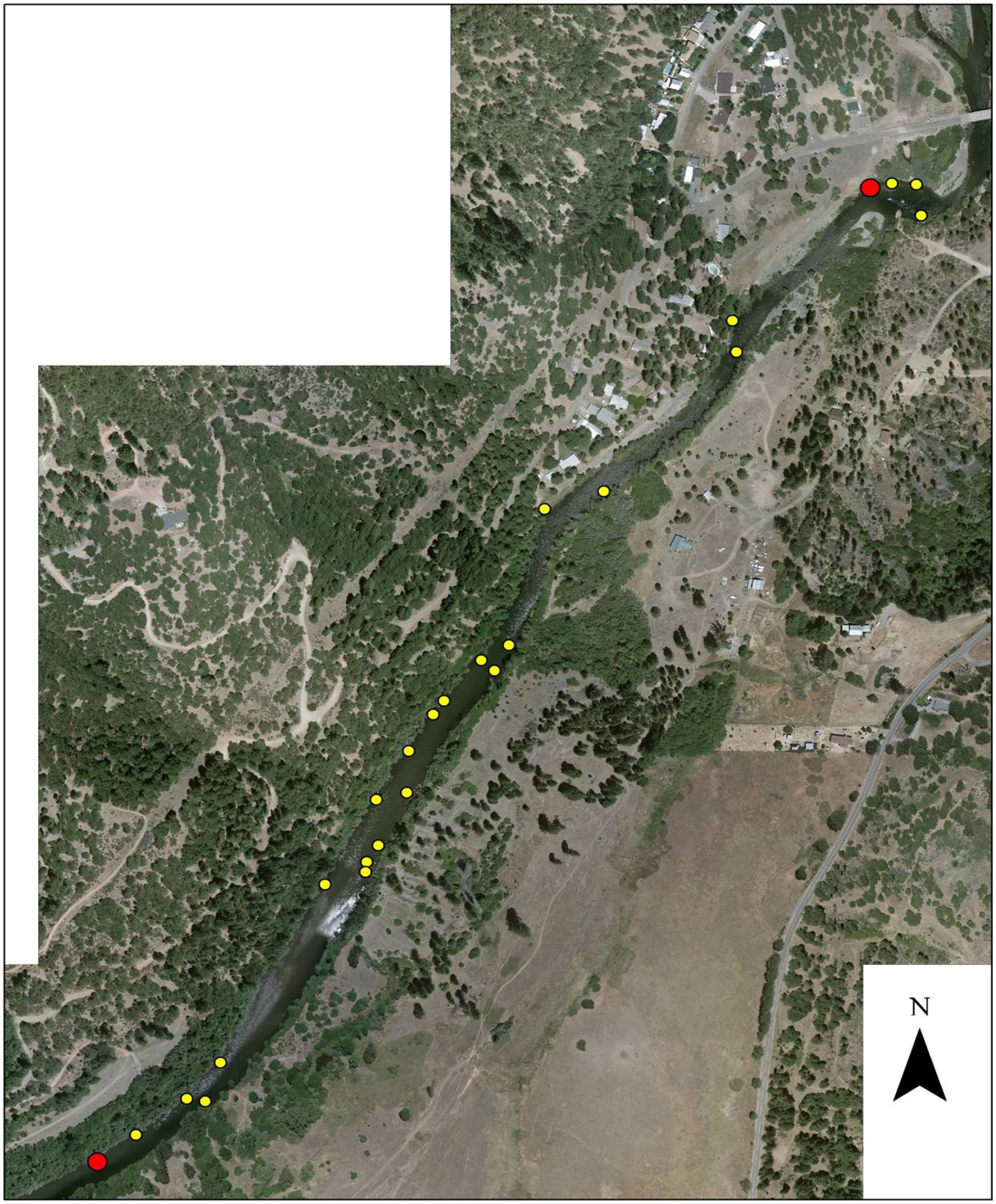

Figure 6. Aerial photograph of Trinity River, Lewiston, CA in vicinity of Salt Flat to Grass Valley Creek. Overlay points in yellow indicate observations of 1 to 55 juvenile coho. Overlay points in bolded red indicate observations of 56 to 214 juvenile coho.

The distribution of juvenile coho observations was not uniform across the survey sections. Empirically the largest numbers of juvenile coho were observed from Rush Creek to Bucktail (Figure 7). The largest numbers of point observations were also observed from Rush Creek to Bucktail (Figure 8), however the section of the river just upstream of Rush Creek had several clustered “hot spots”. The highest density of juvenile coho per point observation per RKm was observed in the reach from Lewiston Dam to Rush Creek (Figure 9). This is most likely to the high density point observations from in the vicinity of Cemetery Hole and just upstream from Rush Creek, as those areas have habitat and flows suitable for juvenile coho rearing.

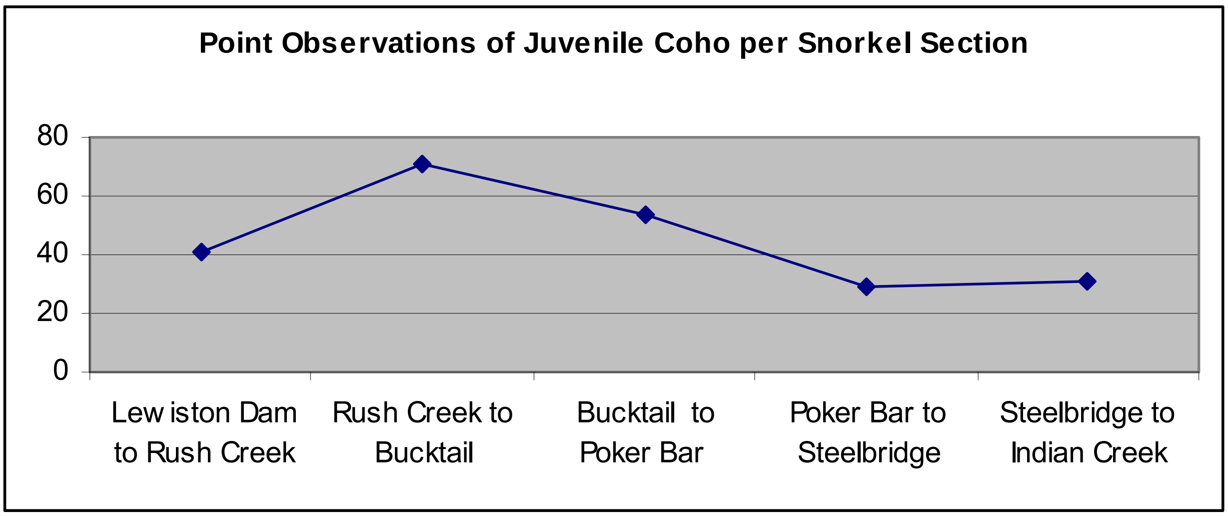

Figure 7. Point observations of juvenile coho per snorkel section in the upper Trinity River, August 2009.

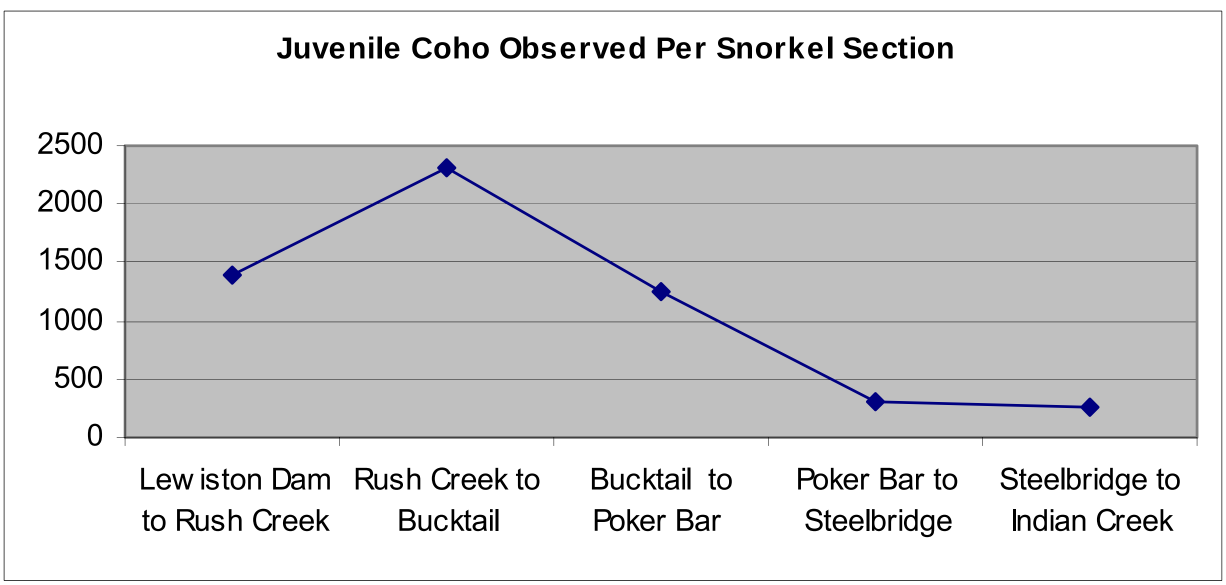

Figure 8. Number of juvenile coho observed per snorkel section in the upper Trinity River, August 2009.

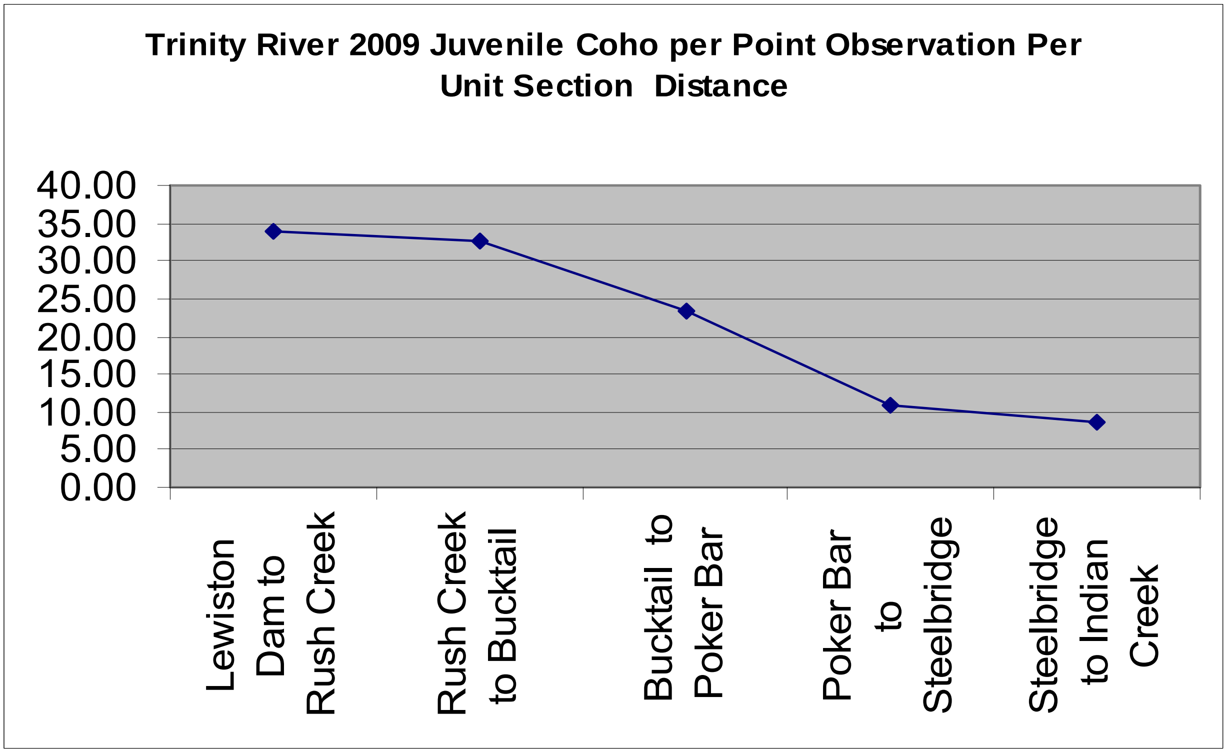

Figure 9. Ratio of juvenile coho per point observation per RKm in the upper Trinity River in August 2009.

Although the study design was limited in both scope and context, in a generalized sense the number of juvenile coho observed in August 2009 compared to coho carcasses found on the carcass surveys of fall of 2008 demonstrates an offset positive correlation (Table 2, Figure 10). Most carcasses were observed in the section from Lewiston Dam to Old Bridge. However the most juveniles in 2009 were located in the carcass section from Old Bridge to Bucktail, which includes the slow water Rush Creek “hot spots”. (Figure 11).

Coho redd estimates for the fall of 2008, were highest in proximity to Lewiston Dam. (Chamberlin, 2010) (Table 3). However, the ratio of estimated redds in 2008 to observed juvenile coho was highest in proximity to Rush Creek (Figure 12). This is completely consistent with juvenile coho rearing habitat preference.

Table 2. Empirical counts of fall 2008 coho carcasses and summer 2009 juvenile coho observations per carcass survey reach in the upper Trinity River.

Carcass Reach	2008 Carcasses	2009 Juv Coho	2009 Juv /2008 Carcass
1	154	482	3.13
2	103	3206	31.13
3	27	1535	56.85
4	8	259	32.38

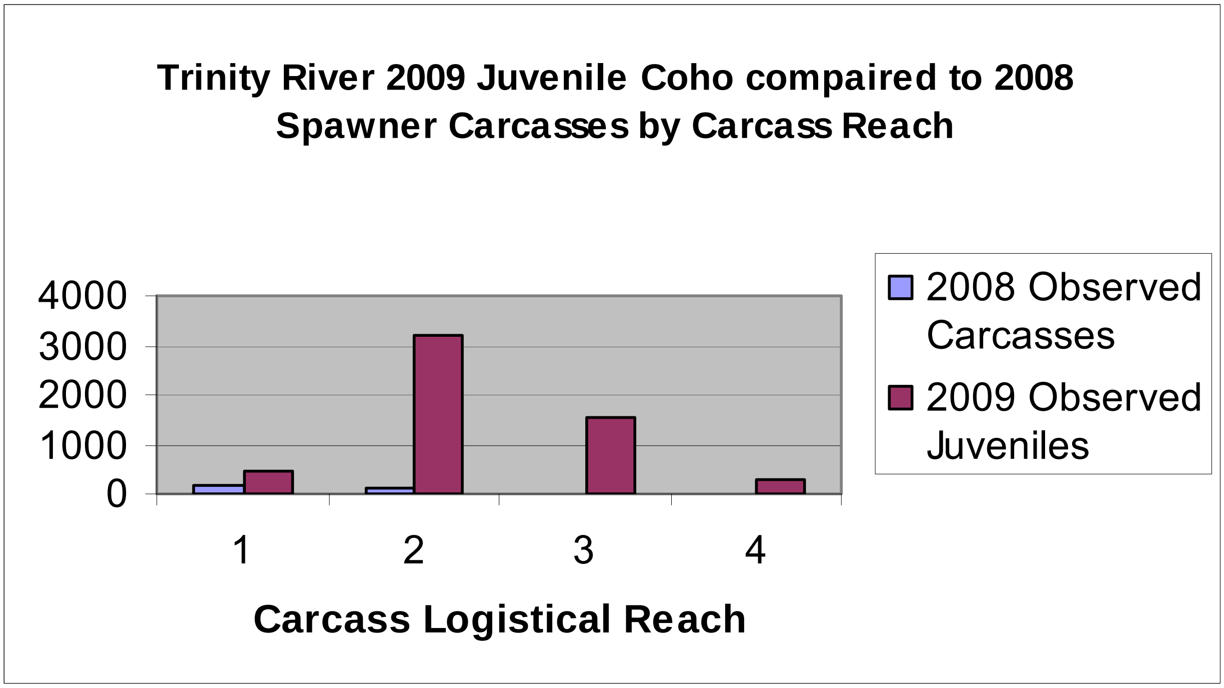

Figure 10. Comparison of 2008 adult coho carcasses observed in fall 2008 with juvenile coho observed in summer 2009 by carcass survey logistical reach in the upper Trinity River.

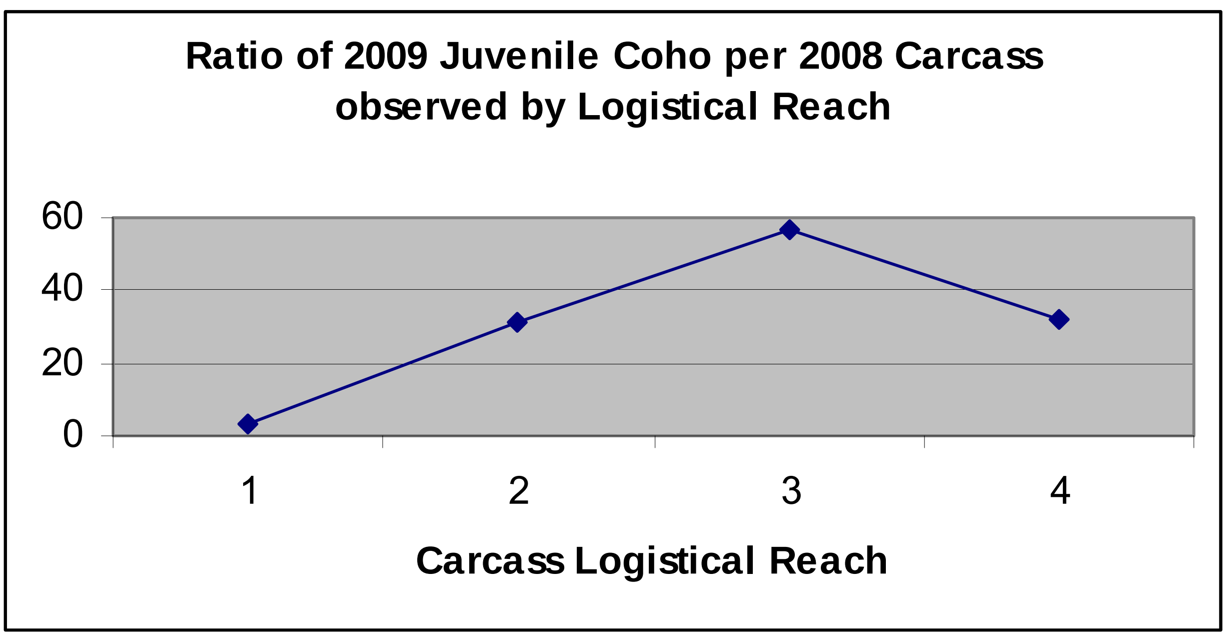

Figure 11. Ratio of 2008 adult carcasses observed in fall 2008 to juvenile coho observed in summer 2009 by carcass logistical reach in the upper Trinity River.

Table 3. Comparison of estimated coho redds in fall 2008 with observed juvenile coho in summer 2009 by redd survey reach in the upper Trinity River.

Reach	Estimated 2008 Coho Redds	2009 Juv Coho
Lewiston Dam - Sawmill	323.1	1221
Sawmill- Bucktail	90.9	2427
Bucktail - Salt Flat	60.4	1246
Salt Flat-Limekiln	36.7	271
Limekiln- "Notches"	32.5	88
"Notches"-Douglas City	21.9	229

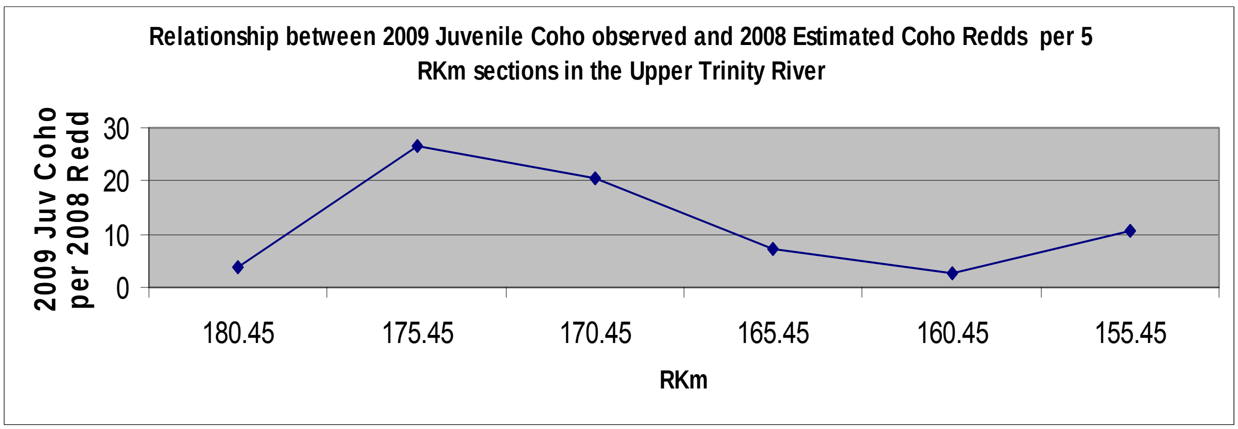

Figure 12. Ratio of estimated coho redds in fall 2008 with observed juvenile coho in summer 2009 by redd survey reach in the upper Trinity River.

DISCUSSION

The highest density point observations were recorded from Old Lewiston Bridge, to Grass Valley Creek. This is completely consistent with junvenile coho summer rearing habitat preference. This stretch of the Trinity River has reaches of slow water and has areas of non-rooted aquatic vegetation as well as relatively cool water summer temperatures. Additionally, although outside the scope of the study design, this reach of the Trinity River has several side channels and peripheral habitat.

The number of juvenile coho observed in summer 2009 compared with adult coho carcasses observed in fall 2008 is relatively low in the section closest to Lewiston Dam and peaked in the third section downstream of Lewiston Dam. This is consistent with juvenile habitat preference as there is minimal summer rearing habitat in close proximity to the dam. The highest ratio of the 2009 juveniles : 2008 carcasses was observed in the third carcass section. This is also consistant with juvenile habitat preference as there is suitable summer rearing habitat in the third carcass section.

The lack of juvenile coho salmon in suitable habitats whenever brown trout were present has been demonstrated in controlled experiments (Bugert and Bjornn 1991) and may explain why the number of coho observations decreased in the lower part of our study section, an area where brown trout become more common.

RECOMMENDATIONS

Reconnect peripheral areas in the upper main stem Trinity River to provide essential winter habitat and/or flood protection habitat. Several studies have demonstrated the importance of off-channel habitat for winter rearing and flooding episodes. (Bell et al 2001, Beechie et al 1994, Swales and Levings 1989). Since the upper Trinity River is now managed for spring peak releases of up to 12,000 cfs, it may be vitally important that juvenile coho in the upper Trinity River have refugal areas during the high flow release period, which generally coincides with their emergence timing (March through May). Mechanical reconnections of side channel and peripheral juvenile coho habitat may be a good approach.

Evaluate the difference between several small patches of juvenile coho summer rearing habitat or a few large patches of habitat. Depending upon the intent of restoration efforts, it might be better to have several smaller patches of juvenile coho summer rearing habitat versus isolated pockets of high density juvenile coho summer rearing habitat.

Maintain the monitoring of “wild” to “hatchery” ratios in natural escapement estimates. Although 5,550 juvenile coho were observed in the survey, it is likely that upwards of 80% of these are from hatchery genetic stocks. A reduction of the TRH production goal of releasing 500,000 yearling coho annually may potentially reduce future natural escapement of hatchery stocks.   Designing and implementing a molecular genetic sampling protocol to evaluate naturally produced juvenile coho for stock heredity, may be a valuable tool in managing this issue (i.e. determine what percentage of naturally produced juvenile coho are from hatchery stocks versus wild stocks).

Design and implement a method of evaluating, enumerating or monitoring brown trout abundance and impact on the juvenile coho populations in the upper river. As of current there is no way of numerically discerning what effects predatory brown trout have on juvenile coho populations and densities. Brown trout prey upon juvenile coho and are distributed in the upper river.

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Appendix 1. GPS waypoints for juvenile coho observations August 2009

DATE	WYPT	N	W	R Km	JUV COHO
8/3/09	001	40.7267985	122.7954154	180.45	1
8/3/09	002	40.7256237	122.7985160	180.10	40
8/3/09	003	40.7248942	122.8008441	179.90	30
8/3/09	004	40.7246259	122.8023837	179.70	15
8/3/09	005	40.7238803	122.8045724	179.55	1
8/3/09	006	40.7235745	122.8052430	179.50	40
8/3/09	007	40.7201842	122.8059135	179.15	12
8/3/09	008	40.7201091	122.8057848	179.14	18
8/3/09	009	40.7200823	122.8056131	179.13	15
8/3/09	010	40.7203129	122.8034727	178.92	30
8/3/09	011	40.7134250	122.8066431	177.93	30
8/3/09	012	40.7100937	122.8068737	177.50	15
8/3/09	013	40.7100025	122.8068952	177.49	10
8/3/09	014	40.7100079	122.8070132	177.49	15
8/3/09	015	40.7081196	122.8078715	177.30	100
8/3/09	016	40.7082376	122.8081237	177.30	20
8/3/09	017	40.7081733	122.8081666	177.29	50
8/3/09	018	40.7073901	122.8083436	177.25	40
8/3/09	019	40.7058558	122.8096740	177.05	50
8/3/09	020	40.7056252	122.8109775	177.00	4
8/3/09	021	40.7056091	122.8117339	176.82	5
8/3/09	022	40.7053569	122.8119807	176.80	80
8/3/09	023	40.7055662	122.8121792	176.80	50
8/3/09	024	40.7053677	122.8122167	176.78	40
8/3/09	025	40.7053087	122.8125654	176.75	100
8/3/09	026	40.7055930	122.8125654	176.75	30
8/3/09	027	40.7053516	122.8129140	176.70	15
8/3/09	028	40.7054911	122.8134720	176.68	30
8/3/09	029	40.7054481	122.8136812	176.67	90
8/3/09	030	40.7055447	122.8140835	176.65	30
8/3/09	031	40.7060275	122.8143786	176.57	45
8/3/09	032	40.7056037	122.8148721	176.57	30
8/3/09	033	40.7070199	122.8200541	176.10	30
8/3/09	034	40.7072399	122.8197591	176.08	50
8/3/09	035	40.7074437	122.8195981	176.08	15
8/3/09	036	40.7123843	122.8178172	175.45	45
8/3/09	037	40.7132319	122.8187828	175.30	30
8/3/09	038	40.7139507	122.8198342	175.20	60
8/3/09	039	40.7142511	122.8205101	175.18	50
8/3/09	040	40.7153884	122.8212987	175.05	10
8/3/09	041	40.7156244	122.8215937	175.02	20
8/4/09	042	40.7203129	122.8280632	174.20	3
8/4/09	043	40.7203612	122.8281276	174.19	15
8/4/09	044	40.7201842	122.8283100	174.20	100
8/4/09	045	40.7204578	122.8282724	174.18	9
8/4/09	046	40.7205436	122.8284173	174.17	50
8/4/09	047	40.7203612	122.8285460	174.17	50
8/4/09	048	40.7204631	122.8287391	174.16	50
8/4/09	049	40.7205543	122.8288196	174.15	80
8/4/09	050	40.7207796	122.8290717	174.14	75
8/4/09	051	40.7205597	122.8289644	174.14	80
8/4/09	052	40.7208923	122.8294310	174.13	50
8/4/09	053	40.7209084	122.8296028	174.10	20

Appendix 1 (continued). GPS waypoints for juvenile coho observations August 2009

8/4/09	054	40.7205812	122.8292648	174.13	60
8/4/09	055	40.7206938	122.8295170	174.10	20
8/4/09	056	40.7209674	122.8298066	174.05	40
8/4/09	057	40.7209889	122.8300319	174.04	30
8/4/09	058	40.7207743	122.8297691	174.06	90
8/4/09	059	40.7210693	122.8302143	174.02	40
8/4/09	060	40.7208387	122.8300856	174.01	160
8/4/09	061	40.7211391	122.8305630	173.97	20
8/4/09	062	40.7212088	122.8306918	173.94	60
8/4/09	063	40.7209084	122.8306649	173.97	90
8/4/09	064	40.7213805	122.8311907	173.90	30
8/4/09	065	40.7210049	122.8308742	173.93	70
8/4/09	066	40.7210264	122.8312228	173.90	50
8/4/09	067	40.7210532	122.8314428	173.88	70
8/4/09	068	40.7214448	122.8314911	173.88	30
8/4/09	069	40.7211981	122.8316788	173.85	50
8/4/09	070	40.7215092	122.8321455	178.83	50
8/4/09	071	40.7211605	122.8318451	173.85	150
8/4/09	072	40.7212678	122.8320543	173.80	30
8/4/09	073	40.7212571	122.8323333	173.79	30
8/4/09	074	40.7212785	122.8324567	173.78	30
8/4/09	075	40.7211766	122.8327624	173.77	20
8/4/09	076	40.7211552	122.8329234	173.76	25
8/4/09	077	40.7214019	122.8333472	173.75	10
8/4/09	078	40.7210210	122.8334974	173.70	35
8/4/09	079	40.7209138	122.8338514	173.71	10
8/4/09	080	40.7212946	122.8338729	173.67	20
8/4/09	081	40.7212195	122.8341357	173.57	20
8/4/09	082	40.7204470	122.8347955	173.54	10
8/4/09	083	40.7201145	122.8347365	173.39	10
8/4/09	084	40.7193581	122.8353803	173.37	5
8/4/09	085	40.7187787	122.8356002	173.18	10
8/4/09	086	40.7170353	122.8358631	173.17	10
8/4/09	087	40.7168153	122.8362010	173.00	10
8/4/09	088	40.7159946	122.8361903	172.93	20
8/4/09	089	40.7153455	122.8360776	172.92	20
8/4/09	090	40.7148895	122.8363941	172.70	10
8/4/09	091	40.7131139	122.8362708	172.69	15
8/4/09	092	40.7129208	122.8362171	172.35	20
8/4/09	093	40.7107857	122.8344683	172.34	15
8/4/09	094	40.7106677	122.8342752	172.34	30
8/4/09	095	40.7104639	122.8343986	172.34	5
8/4/09	096	40.7103727	122.8339319	172.32	15
8/4/09	097	40.7102654	122.8337870	172.31	5
8/4/09	098	40.7093803	122.8331272	172.20	5
8/4/09	099	40.7090584	122.8333632	172.20	5
8/4/09	100	40.7078729	122.8316359	172.00	10
8/4/09	101	40.7063976	122.8313677	171.83	15
8/4/09	102	40.7060275	122.8313194	171.80	10
8/4/09	103	40.7059363	122.8312550	171.79	15
8/4/09	104	40.7045255	122.8351550	171.53	5
8/4/09	105	40.7045308	122.8352032	171.35	10

Appendix 1 (continuted). GPS waypoints for juvenile coho observations August 2009

8/4/09	106	40.7043753	122.8357933	171.34	40
8/4/09	107	40.7045791	122.8357290	171.34	20
8/4/09	108	40.7055662	122.8398649	170.92	15
8/4/09	109	40.7088063	122.8449558	170.39	10
8/4/09	110	40.7090638	122.8455190	170.35	20
8/4/09	111	40.7088653	122.8463398	170.30	5
8/4/09	112	40.7082484	122.8473161	170.18	5
8/10/09	113	40.7035974	122.8474073	169.60	40
8/10/09	114	40.7035974	122.8474073	169.70	24
8/10/09	115	40.7033077	122.8473483	169.70	40
8/10/09	116	40.7036081	122.8476862	169.40	5
8/10/09	117	40.7023046	122.8494780	169.00	70
8/10/09	118	40.7020095	122.8494297	169.45	40
8/10/09	119	40.7006899	122.8509210	169.15	15
8/10/09	120	40.7005182	122.8515915	169.10	10
8/10/09	121	40.6992361	122.8519831	169.00	30
8/10/09	122	40.6990913	122.8522943	168.85	10
8/10/09	123	40.6989947	122.8521441	168.85	20
8/10/09	124	40.6987051	122.8527127	168.80	5
8/10/09	125	40.6985763	122.8528361	168.78	10
8/10/09	126	40.6982330	122.8531097	168.70	5
8/10/09	127	40.6978414	122.8531258	168.68	20
8/10/09	128	40.6977717	122.8534691	168.65	10
8/10/09	129	40.6973425	122.8534422	168.65	10
8/10/09	130	40.6971869	122.8535710	168.62	25
8/10/09	131	40.6969724	122.8540431	168.60	10
8/10/09	132	40.6970904	122.8535871	168.60	16
8/10/09	133	40.6952879	122.8552125	168.60	10
8/10/09	134	40.6949231	122.8553788	168.58	5
8/10/09	135	40.6949446	122.8555880	168.50	20
8/10/09	136	40.6946013	122.8561620	168.47	10
8/10/09	137	40.6943438	122.8565965	168.30	15
8/10/09	138	40.6938825	122.8606520	167.90	244
8/10/09	139	40.6937054	122.8630231	167.75	20
8/10/09	140	40.6934962	122.8638063	167.70	8
8/10/09	141	40.6930295	122.8687738	167.10	13
8/10/09	142	40.6928096	122.8689937	167.00	5
8/10/09	143	40.6925574	122.8692566	167.00	23
8/10/09	144	40.6919727	122.8697501	167.00	50
8/10/09	145	40.6919566	122.8697662	166.90	19
8/10/09	146	40.6916240	122.8699754	166.90	2
8/10/09	147	40.6860719	122.8715525	165.90	23
8/10/09	148	40.6845484	122.8739451	165.85	18
8/10/09	149	40.6842909	122.8746156	165.84	15
8/10/09	150	40.6836042	122.8764610	165.84	11
8/10/09	151	40.6833896	122.8768365	165.82	9
8/10/09	152	40.6833950	122.8768365	165.80	11
8/10/09	153	40.6831429	122.8773944	165.70	6
8/10/09	154	40.6829337	122.8773193	165.60	8
8/10/09	155	40.6828478	122.8775231	165.60	19
8/10/09	156	40.6828103	122.8778450	165.58	13

Appendix 1 (continuted). GPS waypoints for juvenile coho observations August 2009

8/10/09	157	40.6827513	122.8777431	165.56	32
8/10/09	158	40.6826547	122.8779094	165.54	13
8/10/09	159	40.6826011	122.8781293	165.52	34
8/10/09	160	40.6823758	122.8781293	165.50	96
8/10/09	161	40.6824455	122.8785746	165.48	18
8/10/09	162	40.6815818	122.8798781	165.45	26
8/10/09	163	40.6812600	122.8804575	165.44	22
8/10/09	164	40.6811098	122.8806345	165.43	13
8/10/09	165	40.6809488	122.8807311	165.42	4
8/10/09	166	40.6803963	122.8816913	165.25	6
8/11/09	167	40.6790874	122.8868358	164.70	10
8/11/09	168	40.6812278	122.8905909	164.25	5
8/11/09	169	40.6813083	122.8906713	164.23	10
8/11/09	170	40.6837705	122.8902851	163.92	5
8/11/09	171	40.6841514	122.8900866	163.89	10
8/11/09	172	40.6845537	122.8899471	163.86	10
8/11/09	173	40.6845645	122.8901831	163.86	25
8/11/09	174	40.6850902	122.8899579	163.82	10
8/11/09	175	40.6851921	122.8899471	163.81	5
8/11/09	176	40.6851384	122.8896145	163.80	10
8/11/09	177	40.6853530	122.8898667	163.80	20
8/11/09	178	40.6852779	122.8895126	163.79	15
8/11/09	179	40.6854979	122.8893034	163.77	20
8/11/09	180	40.6871608	122.8883754	163.57	5
8/11/09	181	40.6906209	122.8867499	163.09	15
8/11/09	182	40.6922463	122.8893463	162.80	10
8/11/09	183	40.6914416	122.8910629	162.62	35
8/11/09	184	40.6913397	122.8911809	162.60	10
8/11/09	185	40.6874881	122.8977524	161.92	5
8/11/09	186	40.6874344	122.8978382	161.90	5
8/11/09	187	40.6849400	122.8996192	161.50	5
8/11/09	188	40.6844196	122.9005043	161.45	10
8/11/09	189	40.6775532	122.9080789	160.40	5
8/11/09	190	40.6776765	122.9092322	160.30	5
8/11/09	191	40.6779823	122.9118393	160.05	7
8/11/09	192	40.6778589	122.9121665	159.98	6
8/11/09	193	40.6778214	122.9123810	159.96	20
8/11/09	194	40.6777677	122.9125206	159.95	14
8/11/09	195	40.6749514	122.9198269	159.28	6
8/12/09	196	40.6732187	122.9204814	159.20	5
8/12/09	197	40.6700269	122.9153584	157.92	20
8/12/09	198	40.6698016	122.9096292	157.44	10
8/12/09	199	40.6536118	122.8995709	155.05	17
8/12/09	200	40.6535045	122.8999947	155.00	15
8/12/09	201	40.6533972	122.9005740	154.90	15
8/12/09	202	40.6533596	122.9008584	154.85	10
8/12/09	203	40.6534240	122.9011158	154.81	5
8/12/09	204	40.6535206	122.9013733	154.79	5
8/12/09	205	40.6537351	122.9023228	154.76	10
8/12/09	206	40.6564281	122.9077141	154.25	2
8/12/09	207	40.6565515	122.9080413	154.24	7

Appendix 1 (continuted). GPS waypoints for juvenile coho observations August 2009

8/12/09	208	40.6566963	122.9082183	154.23	15
8/12/09	209	40.6566909	122.9090230	154.20	10
8/12/09	210	40.6569323	122.9099940	154.12	5
8/12/09	211	40.6571255	122.9104446	154.10	2
8/12/09	212	40.6576512	122.9110132	154.04	5
8/12/09	213	40.6575761	122.9114477	154.00	3
8/12/09	214	40.6589601	122.9180835	153.38	10
8/12/09	215	40.6587241	122.9199503	153.35	5
8/12/09	216	40.6586811	122.9202990	153.34	5
8/12/09	217	40.6570504	122.9262428	152.62	5
8/12/09	218	40.6567392	122.9268221	152.60	9
8/12/09	219	40.6568358	122.9270743	152.59	4
8/12/09	220	40.6495509	122.9437737	150.92	5
8/12/09	221	40.6488750	122.9452060	150.72	5
8/12/09	222	40.6483815	122.9463862	150.65	5
8/12/09	223	40.6482152	122.9464344	150.65	20
8/12/09	224	40.6481401	122.9471533	150.60	10
8/12/09	225	40.6478450	122.9472874	150.56	15
8/12/09	226	40.6453506	122.9519544	150.05	5