

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

FINAL ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD
MONITORING PROJECT
2008-2009 SEASON



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December 2010

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In Memory of Michael Allan
(1947 – 2008)



Mike Allan was a scientific technician for the Department from 1984 through 2008. Mike was an essential team member on many field projects the Department operated in the upper Trinity River. He took pride and ownership of the projects he worked on and spent many hours, often times in difficult circumstances, making sure projects ran smoothly. The Junction City weir, pictured above, was his favorite project and he spent numerous hours at all times of the day and night guiding its operation and maintenance. Though Mike had a demeanor that may have appeared gruff to some, those that knew him would all tell you he had a heart of gold. Mike had a love of the outdoors and he, along with wife Linda, maintained two “off” the grid homes in the French and Mill Creek drainages within the Trinity Basin. Mike was an avid Dodgers fan, loved to hang out with close friends, and was particularly concerned with the health of the Trinity River and the fisheries resources he spent so many years to help monitor. Mike’s mentorship to younger staff, his professional behavior, and his dedication and pride will be missed by all that knew him.

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Foreword

This is the twentieth annual report to the United States Bureau of Reclamation (USBOR). This year's activities were conducted under terms of Cooperative Agreement Number 02FG200027, and cover the period October 1, 2008 through September 30, 2009 (FFY 2008). 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 2008. 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 five separate projects (Tasks) performed on the lower Klamath River, mainstem 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

We would like to sincerely thank the following CDFG technicians who made possible our field seasons: Linda Allan, Linda Battin, Burt Blank, Jason Coburn, Kyle DeJuilio, Becky Dutra, Melissa Gordon, Mark Kerr, Amanda Lindley, Carl Meredith, Todd Newhouse, Justin Pabich, Roddy Park, Melissa Reneski, Guy Smith, Ron Smith, Cindy Walker and Eileen Williams. A special thanks for the office support from Brenda Tuel.

We are grateful for the help of many biologists, technicians, crew, staff, and volunteers from HVTF, YTFP, USFWS, USFS, and other CDFG projects, who worked cooperatively with us during everything from single days to whole seasons on our field projects.

We also appreciate the cooperation of the CDFG Trinity River Hatchery staff during processing of returning salmonids, and the following landowners: Doris Chase, Tom O'Gorman, Pierre LeFuel (and Karen and Mark), the Bureau of Land Management and 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 Doug Schleusner and the TRRP staff for their input and effort administering our projects and contracts.

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Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

Table of Contents

Foreword/Acknowledgments	i
Table of Contents	iii
List of Tables	iii - vii
List of Figures	vii - x
List of Appendices	x - xiii
 Task 1. Annual Run-size, Harvest, and Spawner Escapement Estimates for Trinity River Basin Chinook and Coho Salmon and Steelhead	 1
 Task 2. Survival and Contributions to the Fisheries and Spawner Escapements Made by Chinook Salmon Produced at Trinity River Hatchery.....	 75
 Task 3. Survival and Spawner Escapements Made by Coho Salmon Produced at Trinity River Hatchery.....	 96
 Task 4. Salmon Spawner Surveys in the Upper Trinity River	 109
 Task 5. Angler Creel Surveys in the Lower Klamath River	 143

List of Tables

Task 1. Annual Run-size, Harvest, and Spawner Escapement Estimates for Trinity River Basin Chinook and Coho Salmon and Steelhead.

Table 1. Weekly summary of spring Chinook trapped in the Trinity River at Junction City weir during 2008	15
Table 2. Weekly summary of Chinook trapped in the Trinity River at Willow Creek weir during 2008.....	16
Table 3. Release data and recoveries of coded-wire tagged (CWT) and maxillary clipped salmon trapped in the Trinity River at Willow Creek and Junction City weirs, and subsequently recovered at Trinity River Hatchery during the 2008-09 season	21
Table 4. Weekly summary of coho trapped in the Trinity River at Willow Creek weir during 2008	24
Table 5. Weekly summary of fall-run steelhead trapped at Junction City weir during 2008	27

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Tables (continued)

Table 6. Weekly summary of fall-run steelhead trapped in the Trinity River at Willow Creek weir during 2008.....	28
Table 7. Weekly summary of brown trout trapped in the Trinity River at Junction City weir during 2008	31
Table 8. Fork length frequency of brown trout trapped by Julian week at Junction City weir during 2008	32
Table 9. Recoveries at Trinity River Hatchery of coded-wire tagged spring Chinook during the 2008-09 season	37
Table 10. Total number and numbers of Project-tagged Chinook and coho salmon that entered Trinity River Hatchery (TRH) during the 2008-09 season	38
Table 11. Recoveries of Trinity River Hatchery origin fall Chinook by coded-wire tag (CWT) group during the 2008-09 season.....	39
Table 12. Total number of coho by brood year and clip, that returned to Trinity River Hatchery by Julian week, during the 2008-09 season.....	41
Table 13. Total number of adult steelhead entering Trinity River Hatchery (TRH) and number recovered that were tagged at Willow Creek weir (WCW) during the 2008-09 season	42
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 2008-09 season.....	44
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 2008-09 season	45

Task 2. Survival and Contributions to the Fisheries and Spawner Escapements Made by Chinook Salmon Produced at Trinity River Hatchery

Table 1. Release and recovery data for adipose fin-clipped Chinook recovered at Trinity River Hatchery (TRH) during the 2008-09 season.....	79
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 2008-09 season	81

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Tables (continued)

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 2005 through 2008	82
---	----

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 2005 through 2008	85
---	----

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 2008-09 season.....	88
--	----

Task 3. Survival and Contributions to the In-river Sport Fisheries and Spawner Escapements Made by Coho Salmon Produced at Trinity River Hatchery

Table 1. Production, marking totals, and quality control data for 2007 brood year coho salmon reared at Trinity River Hatchery and released March 16 through March 23, 2009	100
---	-----

Table 2. Run-size, in-river sport catch, and spawner escapement estimates for for naturally- and Trinity River Hatchery- produced coho salmon, upstream of Willow Creek weir for the 2008-09 return year	101
--	-----

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 Willow Creek weir during the period 2007 through 2008.....	102
---	-----

Task 4. Salmon Spawner Surveys in the Upper Trinity River

Table 1. Main stem Trinity River spawner survey reach descriptions.....	111
---	-----

Table 2. Recovery of all Chinook salmon by Julian week and section during the 2008 main stem Trinity River spawner survey	116
---	-----

Table 3. Summary of weekly redd enumeration from the main stem 2008 Trinity River spawner survey	117
--	-----

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Tables (continued)

Table 4. Number, density, incidence of ad-clips, project tags, and condition of spring Chinook recovered during the 2008 main stem Trinity River spawner survey	118
Table 5. Number, density, incidence of ad-clips, project tags, and condition of fall Chinook recovered during the 2008 main stem Trinity River spawner survey	119
Table 6. Number, density, incidence of RM clips, project tags, and condition of coho salmon recovered during the 2008 main stem Trinity River spawner survey	120
Table 7. Number, density, incidence of adipose clips, and project tags recovered from steelhead and brown trout during the 2008 main stem Trinity River spawner survey	121
Table 8. Male to female ratio and pre-spawn mortality of spring Chinook during the 2008 main stem Trinity River spawner survey by reach	125
Table 9. Male to female ratio and pre-spawn mortality of fall Chinook during the 2008 main stem Trinity River spawner survey by reach	125
Table 10. Male to female ratio and pre-spawn mortality of coho salmon during the 2008 main stem Trinity River spawner survey by reach	126
Table 11. Release and recovery data for coded-wire tagged, Trinity River Hatchery-produced Chinook salmon recovered during the 2008 Trinity River spawner survey	128
Table 12. In-river escapement estimates for Chinook collected during the 2008 Trinity River spawner survey	130
Table 13. In-river escapement estimates for spring and fall Chinook collected during the 2008 Trinity River spawner survey above Junction City	130
Table 14. In-river escapement estimates for spring and fall Chinook collected during the entire 2008 Trinity River spawner survey	131

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Tables (continued)

Task 5. Angler Creel Surveys in the Lower Klamath River

Table 1. Summary of estimated angler effort and harvest during the 2008 lower Klamath River creel census.....	151
Table 2. Number of angler trips, hours, and average length of trip in the lower Klamath River sport fishery for the last seventeen seasons, 1992-2008.....	152
Table 3. Number of estimated Chinook and coho salmon and steelhead caught and released from the lower Klamath River creel survey, 1994-2008	153
Table 4. Summary of estimated catch and release during the 2008 lower Klamath River creel census by species and area.....	153
Table 5. Harvest, release and angler effort by Julian week during the 2008 lower Klamath River creel census	155
Table 6. Actual coded-wire-tag recoveries by Julian week of Iron Gate Hatchery (IGH) and Trinity River Hatchery (TRH) for Chinook salmon obtained from the lower Klamath River creel 2008 season	158
Table 7. Fall Chinook salmon harvest in the 2008 lower Klamath River, proportioned by hatchery origin and expanded from creel sampling and hatchery production multiplier	159

List of Figures

Task 1. Annual Run-size, Harvest, and Spawner Escapement Estimates for Trinity River Basin Chinook and Coho Salmon and Steelhead.

Figure 1. Location of trapping/tagging weirs for anadromous salmonids near Willow Creek and Junction City in the main stem Trinity River, 2008 season	4
Figure 2-3. Photographs of Alaskan style weir tripods and boat gate	5
Figure 4. Photograph of Alaskan style weir showing trap boxes on upstream side	6
Figure 5. Percent recovery of Junction City and Willow Creek weir marked Chinook at Trinity River Hatchery during the 2008 season	14

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Figures (continued)

Figure 6. Mean catch of spring and fall Chinook in the Trinity River at Junction City weir during 2008	15
Figure 7. Mean catch of spring and fall Chinook in the Trinity River at Willow Creek weir during 2008	16
Figure 8. Spring Chinook fork lengths (cm) observed at Junction City weir Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2008-09 season.....	17
Figure 9. Fall Chinook fork lengths (cm) observed at Junction City weir Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2008-09 season	18
Figure 10. Mean catch of coho salmon trapped in the Trinity River at Willow Creek weir during 2008.....	24
Figure 11. Coho salmon fork lengths (cm) observed at Willow Creek weir Trinity River Hatchery and both sites combined during the 2008-09 season.....	25
Figure 12. Mean catch of fall-run steelhead in the Trinity River at Junction City weir during 2008.....	27
Figure 13. Mean catch of fall-run steelhead in the Trinity River at Willow Creek weir during 2008.....	28
Figure 14. Steelhead fork lengths (cm) observed at Junction City weir, Willow Creek weir and Trinity River Hatchery and all three sites combined during the 2008-09 season.....	29
Figure 15. Mean catch of brown trout in the Trinity River at Junction City weir during 2008.....	31
Figure 16. Fork length distribution of brown trout trapped at Junction City weir during 2008.....	32
Figure 17. Estimated numbers of spring and fall Chinook that entered Trinity River Hatchery during the 2008-09 season, based on expansion of coded-wire tagged fish	36

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Figures (continued)

Task 4. Salmon Spawner Surveys in the Upper Trinity River

Figure 1. Survey reaches for 2008 Trinity River main stem spawner survey	112
Figure 2. Weekly recoveries of coded-wire tagged spring and fall Chinook observed in the 2008 Trinity River spawner survey	115
Figure 3. Chinook and coho salmon carcasses collected by Julian week during the 2008 Trinity River main stem spawner survey	116
Figure 4. Length frequency for all condition 1 and 2 spring Chinook measured during the 2008 main stem Trinity River spawner survey	122
Figure 5. Length frequency for all condition 1 and 2 fall Chinook measured during the 2008 main stem Trinity River spawner survey	123
Figure 6. Length frequency for all condition 1 and 2 coho salmon measured during the 2008 main stem Trinity River spawner survey	124

Task 5. Angler Creel Surveys in the Lower Klamath River

Figure 1. Fork length frequency of Chinook salmon harvested in the lower Klamath River creel during the 2008 season	150
Figure 2. Fork length frequency of steelhead harvested in the lower Klamath River creel during the 2008 season	150
Figure 3. Harvest per hour of Chinook salmon from the sport harvest on the lower Klamath River creel census 1980 to 2008	152
Figure 4. Estimated harvest of Chinook by Julian week in the 2008 lower Klamath River creel season	154
Figure 5. Estimated Chinook released by Julian week during the 2008 lower Klamath River creel season	155
Figure 6. Estimated steelhead harvested during the 2008 lower Klamath River creel season, by Julian week	156

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Figures (continued)

Figure 7. Estimated steelhead released week during the 2008 lower Klamath River creel season, by Julian week	156
Figure 8. Coded wire tagged Chinook recovered during the 2008 lower Klamath River creel census, expanded for sampling and by individual tag code	159

List of Appendices

Task 1. Annual Run-size, Harvest, and Spawner Escapement Estimates for Trinity River Basin Chinook and Coho Salmon and Steelhead.

Appendix 1. List of Julian weeks and their calendar date equivalents.....	54
Appendix 2. Fork length (FL) distribution of coded-wire-tagged, Trinity River Hatchery-produced spring Chinook recovered at Trinity River Hatchery during the 2008-09 season.....	55
Appendix 3. Fork length (FL) distribution of coded-wire-tagged, Trinity River Hatchery-produced, fall Chinook recovered at Trinity River Hatchery during the 2008-09 season.....	56
Appendix 4. Fork length (FL) distribution of spring Chinook trapped and tagged in the Trinity River at Willow Creek and Junction City weirs during the 2008-09 season	57
Appendix 5. Fork length (FL) distribution of fall Chinook trapped and tagged in the Trinity River at Willow Creek and Junction City weirs during the 2008-09 season	58
Appendix 6. Fork length (FL) distribution of coho salmon trapped in the Trinity River at Willow Creek weir and Trinity River Hatchery during the 2008-09 season	59
Appendix 7. Fork length (FL) distribution of steelhead trapped in the Trinity River at Willow Creek weir and Trinity River Hatchery (TRH) during the 2008-09 season	60
Appendix 8. Fork length distribution of spring Chinook tagged at Junction City weir and subsequently recovered during the 2008-09 season	61

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Appendices (continued)

Appendix 9. Fork length distribution of fall Chinook tagged at Willow Creek weir and subsequently recovered during the 2008-09 season	62
Appendix 10. Fork length distribution of coho tagged at Willow Creek weir and subsequently recovered during the 2008-09 season.....	63
Appendix 11. Fork length distribution of fall-run steelhead tagged at Willow Creek Weir and subsequently recovered during the 2008-09 season	64
Appendix 12. Spring Chinook run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Junction City weir from 1977 through 2008	65
Appendix 13. Fall Chinook run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2008	67
Appendix 14. Coho salmon run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2008	69
Appendix 15. Fall-run adult steelhead run-size, spawner escapement and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2008	71
Appendix 16. Daily mean flow (CFS) recorded at the USGS gauge (11526250) on the Trinity River in Junction City and stream temperature recorded at Junction City weir, 2008	73
Appendix 18. Daily mean flow (CFS) recorded at the USGS gauge (11530000) on the Trinity River in Hoopa and stream temperature recorded at Willow Creek weir, 2008.....	74

Task 2. Survival and Contributions to the In-river Sport Fisheries and Spawner Escapements Made by Spring- and Fall-run Chinook Salmon Produced at Trinity River Hatchery

Appendix 1. Percent return of Trinity River Hatchery-produced, coded-wire tagged, spring-run Chinook salmon, brood years 1986-2003.....	92
Appendix 2. Percent return of Trinity River Hatchery-produced, coded-wire tagged, fall-run Chinook salmon, brood years 1986-2003.....	93

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Appendices (continued)

Appendix 3. Estimated contributions of Trinity River Hatchery-produced, spring-run Chinook salmon to total estimated run-size above Junction City weir, 1991 – 2008 seasons	94
---	----

Appendix 4. Estimated contributions of Trinity River hatchery-produced, fall-run Chinook salmon to total estimated run-size above of Willow Creek weir, 1991 – 2008 seasons	94
---	----

Task 3. Survival and Contributions to the In-river Sport Fisheries and Spawner Escapements Made by Coho Salmon Produced at Trinity River Hatchery

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 1994-2005	106
--	-----

Appendix 2. Naturally and Trinity River Hatchery-produced coho salmon run-size, in-river angler harvest and spawner escapement estimates for the Trinity River upstream of Willow Creek weir for 1997-2008	107
--	-----

Task 4. Salmon Spawner Surveys in the Upper Trinity River

Appendix 1. Total spring Chinook carcasses recovered by reach during the main stem Trinity River spawner survey, 2000 through 2008	137
--	-----

Appendix 2. Total fall Chinook carcasses recovered by reach during the main stem Trinity River spawner survey, 2000 through 2008	137
--	-----

Appendix 3. Total coho salmon carcasses recovered by reach during the main stem Trinity River spawner survey, 2000 through 2008	138
---	-----

Appendix 4. Salmon female pre-spawn mortality rates observed in the Trinity River spawner survey, 1955 through 2008	139
---	-----

Appendix 5. Carcass mark-recapture statistics and estimates observed on main Stem Trinity River spawner surveys 2005 - 2008	140
---	-----

Appendix 6. Trinity River upper (reaches 1-5) and lower (reaches 6-14) reaches expansion matrix for Chinook mark-recapture estimators during 2008 survey	141
--	-----

Trinity River Basin Salmon and Steelhead Monitoring Project
2008 - 2009 Season

List of Appendices (continued)

Task 5. Angler Creel Surveys in the Lower Klamath River

Appendix 1. List of Julian weeks and their calendar date equivalents.....	164
---	-----

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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2008-09 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 and Wade Sinnen

ABSTRACT

The California Department of Fish and Game's Trinity River Project (TRP) conducted tagging and recapture operations from July 2008 through March 2009 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 (HVT). Two main stem weirs were placed in the Trinity River near the towns of Junction City and Willow Creek, and trapped 2,343 Chinook salmon, 449 coho salmon, 957 fall steelhead and 101 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 10,283 spring Chinook migrated into the Trinity River basin upstream of Junction City weir (JCW). An estimated 306 spring Chinook were caught by anglers, leaving 9,977 fish as potential spawners. An estimated 22,997 fall Chinook migrated past Willow Creek weir (WCW), of which an estimated 475 were caught by anglers, leaving 22,521 potential spawners.

The coho salmon (coho) run in the Trinity River basin upstream of WCW was estimated at 9,982 fish. Zero adult coho were estimated as harvested by anglers, leaving all 9,982 as potential spawners.

An estimated 15,015 (5,477 naturally produced and 9,538 hatchery produced) adult fall steelhead returned to the Trinity River basin upstream of WCW. Anglers harvested an estimated 424 adult fall steelhead above the WCW, leaving 14,590 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 HVT 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 (DFG) (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), and Sinnen and Kier (2009).

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 tributaries (Moffett and Smith (1950); Gibbs (1956); LaFaunce (1965a, 1965b, 1967);

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.

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.

METHODS

Trapping and Tagging

Trapping Locations and Periods

Trapping and tagging operations were conducted by TRP and HVT personnel from July through late November 2008 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 (40° 58' 29.85" N, 123° 38' 8.61" W). The upstream site, JCW, was located 132.7 km upstream from the Klamath River confluence (40° 41' 5.51" N, 123° 01' 35.55" W) (Figure 1). In general, prior to 1995, JCW was operated from May through November. From 1995 through 2008 JCW was operated from late-June or mid-July 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 from July 15 through September 24, 2008, and the WCW was operated from August 20 through November 25, 2008. At both weir sites, trapping was attempted during a five day period beginning around dusk on Sunday and ending Friday afternoon. Each trapping day the weir was opened for at least five hours to allow fish to pass unimpeded through the weir site, and it was 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 22° Celsius.

Weir and Trap Design

Since 1989, a Bertoni (Alaskan) weir design has been used at both sites (Figures 2-4). The weir is supported by wooden tripods set 2.5 m apart. Weir panels consisted of 3.0 m x 1.9 cm (10 ft x 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

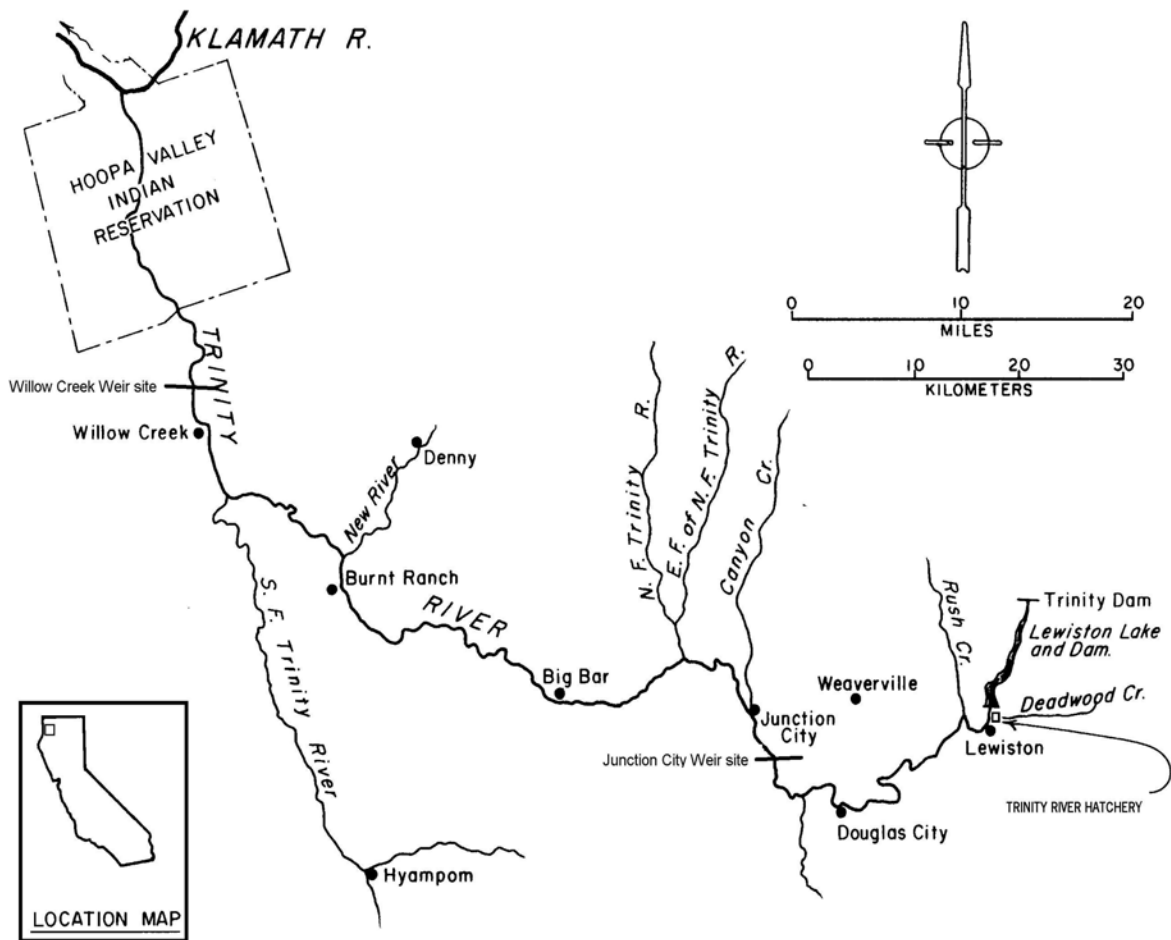


Figure 1. Location of trapping/tagging weirs for anadromous salmonids near Willow Creek and Junction City in the main stem Trinity River, 2008 season.

bottom. The weir panels are angled at roughly a 45° angle, with the top of the weir standing 1.8 m above the river bottom.

The traps are made of 1.9 cm electrical conduit spaced 2.5 cm apart and welded into panels. The panels are wired together at the corners to produce a 2.4 m square box which is bolted to a plywood floor and covered with a plywood lid to prevent fish from jumping out. A fyke, also made of conduit panels, is installed 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.



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



Figure 3. Photo (from downstream) of Willow Creek weir. Note the open boat gate (right side of picture).



Figure 4. Photograph of Alaskan-style weir showing the trapping boxes on upstream side of 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 $\frac{1}{4}$ the length of the dorsal fin, anterior of the posterior edge of the dorsal fin. At both weirs one-third of the Chinook received \$10-reward tags, while the remaining two-thirds received non-reward tags. At WCW one-half of the steelhead received reward tags while the remaining fish received non-reward tags, while all the steelhead at JCW were tagged with non-reward tags. Coho were tagged with non-reward tags at WCW, though none were tagged (or trapped) at JCW. At JCW, brown trout were tagged with serially numbered (Floy) FD-94 anchor tags, but at WCW any brown trout were tagged with FT-4 spaghetti non-reward tags.

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.

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 (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.

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, 118,575 fall Chinook of CWT group 06-53-50 plus 383,638 unmarked fall Chinook were released from TRH in June of 2006. The expanded estimate for each return of this group is 4.235 ($118,575 + 383,638 / 118,575$). 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 $\geq 90\%$ of the Chinook could be designated as either spring run or fall run as explained by the expansion of CWTs.

Coho salmon do not receive CWTs, 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

Weir Recovery

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

Tagging Mortalities

Tagged salmonids recovered dead at the weir, in spawning surveys, or reported dead by anglers were considered tagging mortalities if there was no evidence they had spawned and they were recovered dead ≤ 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.

Angler Tag Returns

All the tags placed on fish at the weirs were inscribed with the TRP Arcata field office address and the word RETURN. The information from returned Project-tags by anglers and river enthusiasts allowed for estimation of angler harvest and catch and release rates for all species marked. All anglers that returned tags were sent questionnaires asking the date and location of their catch and whether they harvested (kept) or released their catch. The questionnaire informed them of the fish's tagging date and location.

Tags returned to the TRP Arcata field office through June 12, 2009 were included in assessing harvest and catch and release rates. Tags returned after that date were processed for payment but not used for analysis.

Trinity River Hatchery Returns

The TRH fish ladder was open September 08 through October 09, 2008 and October 24, 2008 through March 11, 2009. TRH closed the fish ladder from October 10 to October 24 (parts or all of JWs 41-43) 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 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 date-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 salmon, coho salmon 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):

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

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 $\pm 10\%$ of the run-size estimate. The confidence interval estimator is selected using criteria established by Chapman (1948). Estimates for spring Chinook and coho

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).

were not stratified into grilse and adult salmon this season because there were not sufficient grilse and adult salmon recovered to obtain 95% confidence of $\pm 10\%$ of each of the stratified portions of the run. Estimates for fall Chinook above the WCW were stratified this year due to the unusually large discrepancy between the number of grilse and adults seen at WCW versus seen anywhere else in the Trinity system. To estimate the number of grilse and adult coho above the WCW the proportions of grilse and adults observed at WCW and TRH were combined and were applied to the run-size estimate. To estimate the number of grilse and adult spring Chinook above the JCW the proportions of grilse and adults observed at JCW and TRH were combined and were applied to the run-size estimate.

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 race 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 race 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 and 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 recoveries 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. In 2008 spring Chinook was the only race of Chinook trapped at JCW throughout the entire trapping period (Figure 5). At JCW spring Chinook peaked during JW 31 at 14.2 fish per night. The last two Julian weeks of trapping (JW 38 and 39) combined (with 6 nights of trapping total) yielded 13% of the catch for the season with 4.3 Chinook per night (Table 1, Figure 6).

At WCW in 2008, the first two weeks of trapping, JW 34 and JW 35, spring Chinook dominated the catch. It wasn't until JW 36 that the proportion of fall Chinook tagged at WCW exceeded spring Chinook (Figure 5), therefore, all Chinook captured prior to JW 36 were considered spring Chinook, while those captured after JW 35 were considered fall Chinook (Figure 7). Fall Chinook daily catch peaked during the second week of the fall period (JW 37) at 90.6 fish per night and decreased thereafter. A storm-event during JW 44 coincided with an increased number of fish moving through the system (32.3 Chinook per night) but also meant we had to stop trapping for nearly two weeks. When we were able to resume trapping we had little success, averaging three Chinook per night in JW 46 and only two per night in JW 47 (Table 2, Figure 7). We removed the weir from the river, for the season, on 25 November.

Size of Trapped Fish

Spring Chinook trapped at JCW, WCW and TRH averaged 66.3, 58.1 and 71.6 cm FL, respectively, with a combined average of the three sites of 70.1 cm FL (Figure 8, Appendix 4). The nadir between grilse and adult spring Chinook indicated a maximum grilse size of 54 cm FL. Data from known age, hatchery-marked spring Chinook that entered TRH reinforced a minimum adult fork length of 55 cm. There was some overlap between sizes of age 2 and age 3 fish (Appendix 2). Applying the minimum adult size of 55 cm FL to observed populations of Chinook, an estimated 21.6% of the spring Chinook observed were grilse at JCW, and 8.7% at TRH. Spring Chinook age composition at TRH based on CWT analysis alone was 27.5%, 15.8%, 53.7%, and 3.0% age 2, 3, 4 and 5 year old fish, respectively. 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 61.3 and 71.7 cm FL, respectively, with a combined average FL of 69.1 cm. (Figure 9). The nadir between grilse and adult fall Chinook indicated a maximum grilse size of 57 cm FL. Data from known age,

hatchery marked fall Chinook entering TRH supported this separation between grilse and adults; there was little overlap between sizes of age 2 and age 3 fish (Appendix 3).

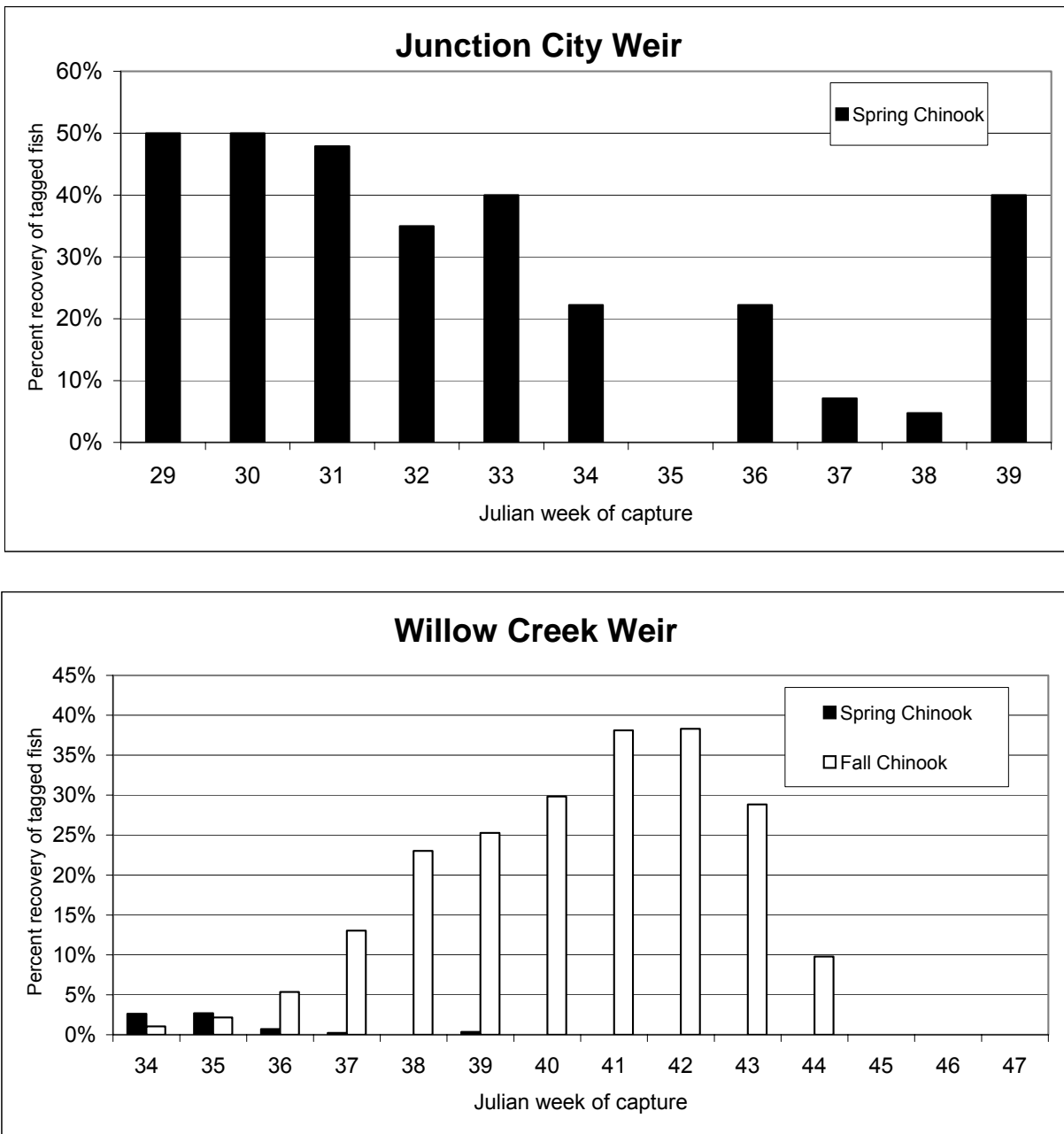


Figure 5. Percent recovery of Junction City weir and Willow Creek weir marked Chinook at Trinity River Hatchery during the 2008 season.

Table 1. Weekly summary of spring Chinook trapped in the Trinity River at Junction City weir during 2008. ^a

Julian week	Inclusive dates	Nights Trapped	Number trapped						Fish/night
			Grilse ^b	Ad-clips	Adults	Ad-clips ^c	Total	Ad-clip total	
29	16-Jul - 22-Jul	2	0	0	26	1	26	1	13.0
30	23-Jul - 29-Jul	5	1	0	5	0	6	0	1.2
31	30-Jul - 5-Aug	5	9	0	62	14	71	14	14.2
32	6-Aug - 12-Aug	5	5	0	15	1	20	1	4.0
33	13-Aug - 19-Aug	5	3	0	17	1	20	1	4.0
34	20-Aug - 26-Aug	5	3	0	6	1	9	1	1.8
35	27-Aug - 2-Sep	4	2	0	1	0	3	0	0.8
36	3-Sep - 9-Sep	5	3	0	6	1	9	1	1.8
37	10-Sep - 16-Sep	5	7	0	7	1	14	1	2.8
38	17-Sep - 23-Sep	5	9	0	12	1	21	1	4.2
39	24-Sep - 30-Sep	1	2	0	3	1	5	1	5.0
Total:		47	44	0	160	22	204	22	
Mean:									4.3

a/ Trapping at Junction City weir took place July 15 - September 24, 2008 (Julian weeks 28-39).

b/ Spring Chinook <55 cm FL were considered grilse in 2008.

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

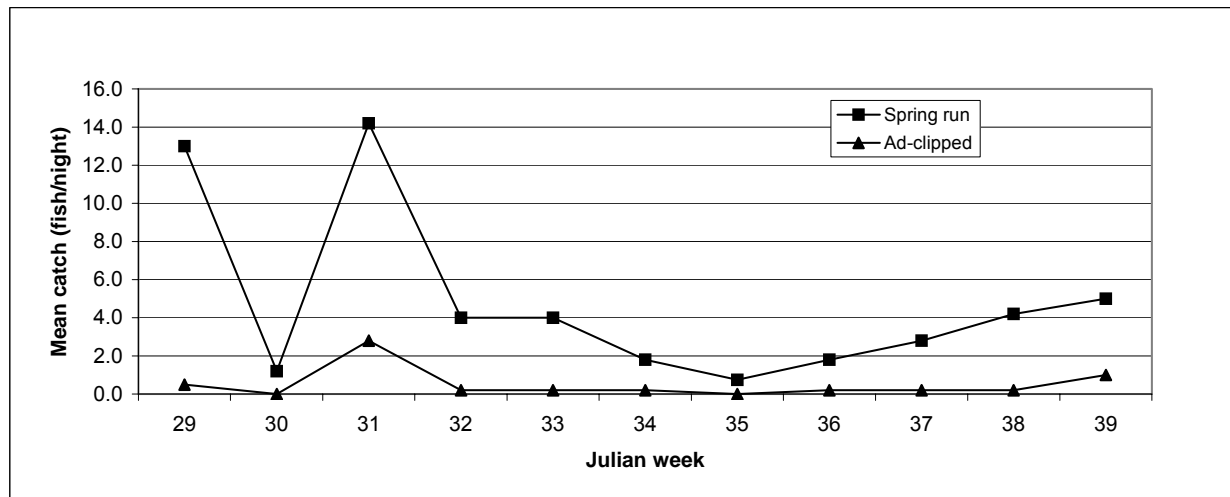


Figure 6. Mean catch of spring Chinook in the Trinity River at Junction City weir during 2008.

Table 2. Weekly summary of Chinook trapped in the Trinity River at Willow Creek weir during 2008. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped				Total	Ad-clip total	Fish/night
			Grilse ^b	Ad-clips	Adults	Ad-clips ^c			
Spring Chinook									
34	20-Aug - 26-Aug	4	112	1	89	4	201	5	50.3
35	27-Aug - 2-Sep	5	130	1	66	2	196	3	39.2
	Sub total:	9	242	2	155	6	397	8	
	Sub mean:								44.1
Fall Chinook									
36	3-Sep - 9-Sep	5	209	4	82	3	291	7	58.2
37	10-Sep - 16-Sep	5	290	9	163	14	453	23	90.6
38	17-Sep - 23-Sep	5	131	5	117	12	248	17	49.6
39	24-Sep - 30-Sep	5	145	8	141	25	286	33	57.2
40	1-Oct - 7-Oct	5	42	4	74	12	116	16	23.2
41	8-Oct - 14-Oct	5	17	1	47	6	64	7	12.8
42	15-Oct - 21-Oct	5	27	2	84	14	111	16	22.2
43	22-Oct - 28-Oct	5	18		38	4	56	4	11.2
44	29-Oct - 4-Nov	3	9		88	15	97	15	32.3
45	5-Nov - 11-Nov	0	0		0		--	--	--
46	12-Nov - 18-Nov	2	6		0		6	0	3.0
47	19-Nov - 25-Nov	7	11		3		14	0	2.0
	Sub-total:	52	905	33	837	105	1,742	138	
	Sub-mean:								33.5
	Grand total:	61	1,147	35	992	111	2,139	146	
	Grand mean:								35.1

a/ Trapping at Willow Creek weir took place August 20 - November 25, 2008 (Julian weeks 34-47).

b/ Spring Chinook <55 cm FL, and fall Chinook <58 cm FL were considered grilse in 2008.

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

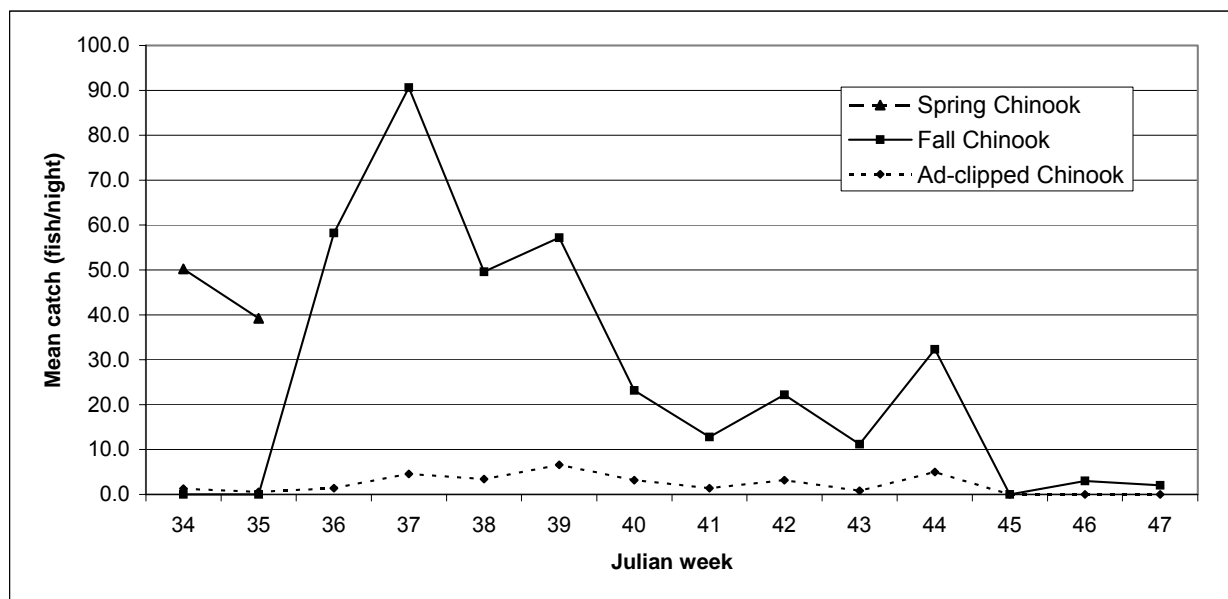


Figure 7. Mean catch of spring and fall Chinook at Willow Creek weir, 2008.

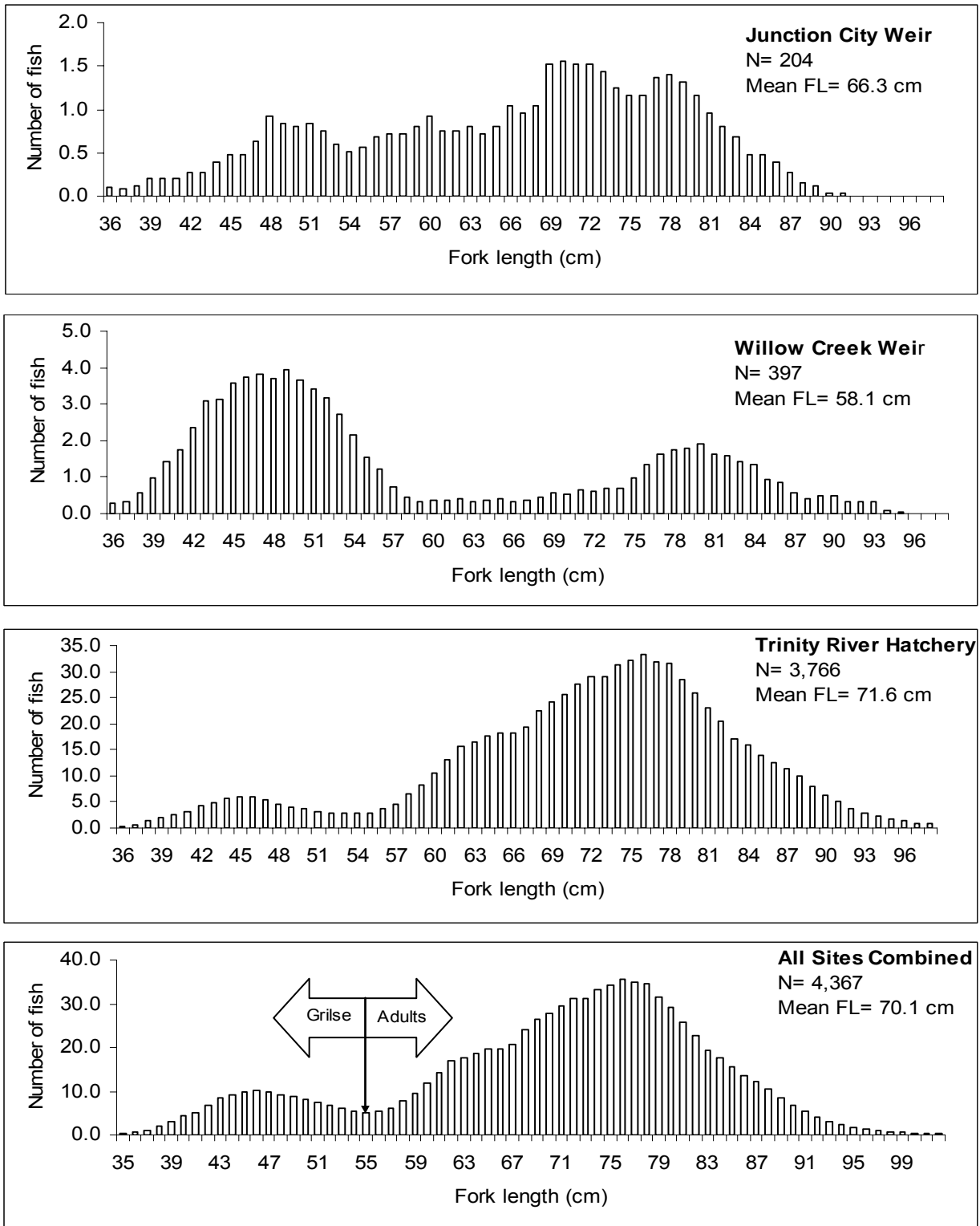


Figure 8. Spring Chinook fork lengths (cm) observed at Junction City weir, Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2008-09 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

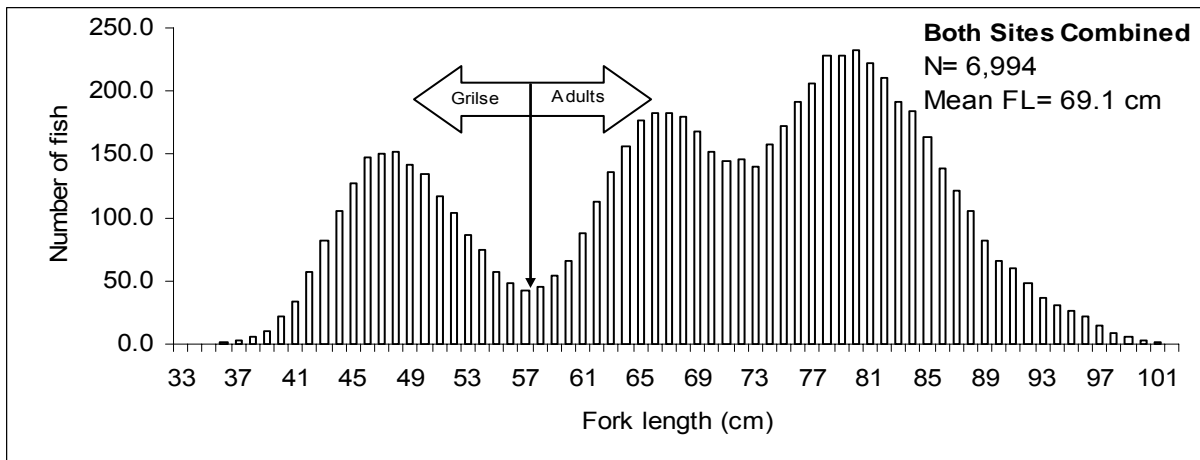
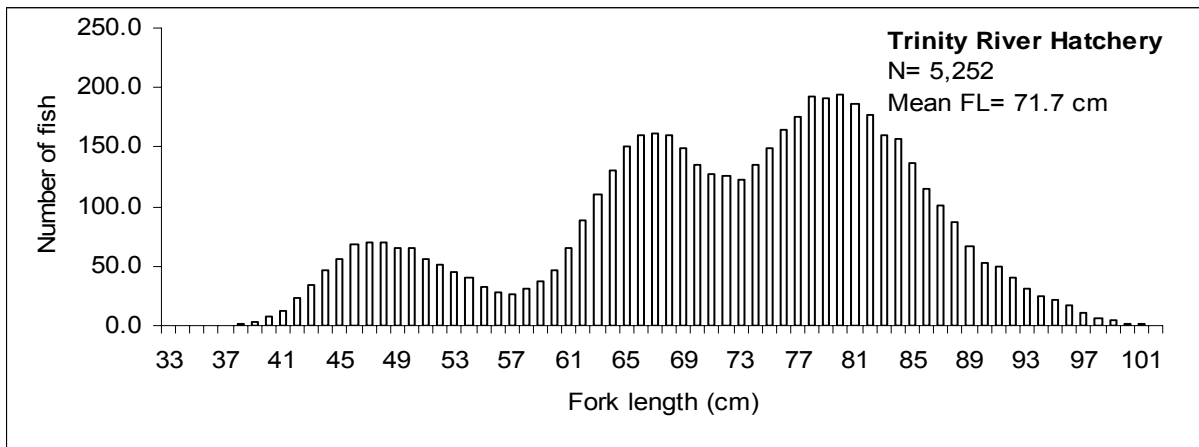
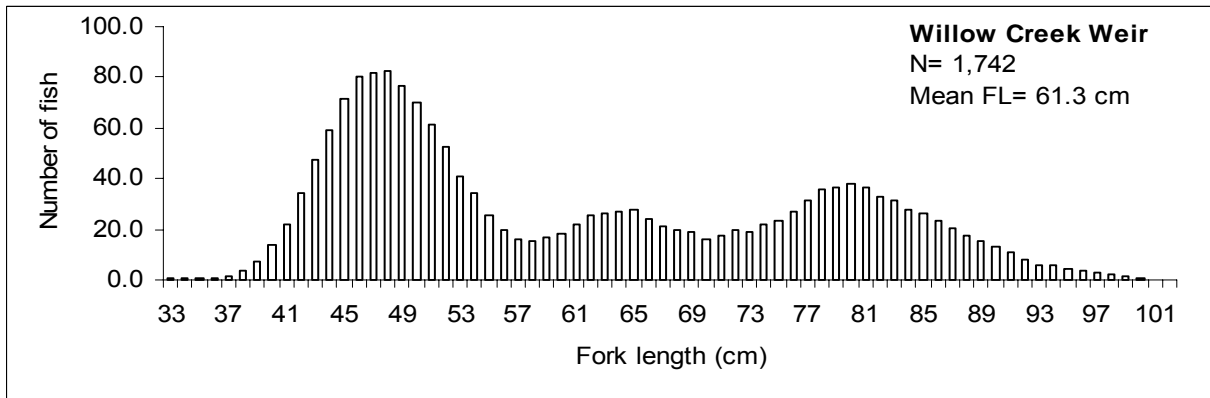


Figure 9. Fall Chinook fork lengths (cm) observed at Willow Creek weir and Trinity River Hatchery and both sites combined during the 2008-09 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

Using the maximum grilse size of 57 cm, fall Chinook grilse comprised 51.9% and 15.3% of the run observed at WCW and TRH respectively. Fall Chinook age composition at TRH based on CWT analysis alone was 24.7%, 19.9%, 54.3%, and 1.1% age 2, 3, 4, and 5 year old fish, respectively. The maximum grilse FL averages 54 cm over the 33 year period of record.

Effectively Tagged Fish

A total of 204 spring Chinook were trapped at JCW, of which 201 (43 grilse and 158 adults) were effectively tagged (Appendix 4). There were two tagging mortalities detected and one caught and released spring Chinook, from which anglers reported removing tags (Appendix 8). A total of 67 (33.3 %) spring Chinook were tagged with reward tags (15 grilse and 52 adults); the remaining fish received non-reward tags.

Of the 397 spring Chinook trapped at WCW, 375 (233 grilse and 142 adults) were effectively tagged. A total of 1,742 fall Chinook were trapped at WCW, of which 1,690 were tagged (the other 52 were in poor condition and not tagged). Of those 1,690 tagged fish (877 grilse and 813 adults), 1,666 of them (861 grilse and 805 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 four adult and one grilse tagging mortalities detected and 19 (15 grilse, 4 adult) caught and released fall Chinook from which anglers reported removing tags (Appendix 9). Reward tags were placed on 563 (292 grilse and 271 adults), or 33.8%, of the fall Chinook trapped at WCW, non-reward tags on the remaining fish (585 grilse and 542 adults).

Incidence of Tags and Fin Clips

Three of the spring Chinook tagged at WCW were subsequently recaptured at JCW this year. Ad-clipped fish comprised 10.78% of the spring Chinook captured (22 of 204) at JCW (Appendix 4). Fourteen of the 22 (63.6%) ad-clipped spring Chinook tagged at JCW were subsequently recovered at TRH (Table 3).

Ad-clipped fish comprised 2.0% (8/397) of the spring Chinook (Appendix 4) and 7.9% (138/1,742) of the fall Chinook trapped at WCW (Appendix 5). Three (37.5%) of the eight ad-clipped spring Chinook and 78 (56.5%) of the 138 ad-clipped fall Chinook tagged at WCW were recovered at TRH (Table 3). Of these 138, the vast majority (25) were three year old fall Chinook released from TRH as yearlings in October of 2006, while 12 were four year olds released as yearlings in October 2005.

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

Seventeen (8.3%) of the 204 spring Chinook trapped at JCW had gill net wounds. Crews also noted one old hooking scar, four wounds of unknown origin and three predator wounds on spring Chinook at JCW.

Forty one (10.3%) spring and 157 (9.0%) fall Chinook trapped at WCW had gill net wounds. The WCW crew also noted one spring and zero fall Chinook with old hook scars; one spring and nine fall Chinook with fresh hook wounds; 10 spring and 30 fall

Chinook with unknown wounds; and 14 spring and 82 fall Chinook with predator wounds.

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 2008-09 season.

CWT and release type ^a	Species	Race	Brood year	Date	Number of fish	Origination Site	Number recovered from tagging site:	
							WCW	JCW
SPRING CHINOOK								
065326-y	Chinook	spring	2004	10/03-11/2005	104,478	TRH	1	11
065332-y	Chinook	spring	2005	10/02-16/2006	11,959	TRH		1
065334-f	Chinook	spring	2005	06/01-07/2006	95,152	TRH	1	
065335-f	Chinook	spring	2005	06/01-07/2006	74,036	TRH		1
065347-f	Chinook	spring	2006	06/01-08/2007	65,914	TRH	1	
shed tag ^b	Chinook	spring						1
Total spring Chinook:							3	14
FALL CHINOOK								
065322-f	Chinook	fall	2004	06/01-08/2005	123,231	TRH	1	
065323-f	Chinook	fall	2004	06/01-08/2005	120,440	TRH	10	
065325-f	Chinook	fall	2004	06/01-08/2005	120,518	TRH	2	
065329-f	Chinook	fall	2004	06/01-08/2005	5,917	TRH	1	
065327-y	Chinook	fall	2004	10/03-11/2005	218,386	TRH	12	
065336-f	Chinook	fall	2005	06/07-07/2006	104,760	TRH	2	
065338-f	Chinook	fall	2005	06/07-07/2006	119,293	TRH	1	
065339-f	Chinook	fall	2005	06/07-07/2006	127,742	TRH	2	
065340-f	Chinook	fall	2005	06/07-07/2006	10,267	TRH	1	
065341-y	Chinook	fall	2005	10/02-16/2006	227,903	TRH	25	
065350-f	Chinook	fall	2006	06/01-08/2007	118,575	TRH	3	
065351-f	Chinook	fall	2006	06/01-08/2007	119,712	TRH	3	
065353-f	Chinook	fall	2006	06/01-08/2007	126,470	TRH	1	
065361-y	Chinook	fall	2006	10/01-10/2007	238,156	TRH	7	
shed tag ^b	Chinook	fall					7	
Total fall Chinook:							78	0

Table 3 (continued). 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 2008-09 season.

COHO						
RM ^c	coho	2005	03/15-20/2007	511,961	TRH	45
RM ^c	coho	2006	03/17-25/2008	455,557	TRH	171
Total coho:						216
						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 < 53 cm FL were classified as brood year 2006 and coho >52 cm FL were classified as brood year 2005. Age cutoff based on fork length distribution.

Coho Salmon

Run timing

No coho salmon were trapped at JCW in 2008. Four weeks into trapping at WCW we had only caught four coho, trapping week five (JW 38) we got 13, 53 were caught the following week, 117 the week after that, and the run peaked in JW 41 with 148 coho (29.6 fish per night) trapped (Table 4, Figure 10). A total of 449 coho salmon were trapped (107 grilse and 342 adults) at WCW during the 2008 season.

Size of Trapped Fish

Coho trapped at WCW and TRH average FL was 59.9 and 65.0cm respectively (Figure 11, Appendix 6). The size separating grilse and adult was based on the combined fork length data from coho salmon trapped at WCW and those that entered TRH (Figure 11). This year all coho salmon ≤ 53 cm FL were considered grilse. Grilse comprised 23.8% and 12.5% of the coho salmon trapped at WCW and TRH respectively.

Effectively Tagged Fish

A total of 449 coho were trapped at WCW, of which 430 (101 grilse and 329 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 five 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

Three hundred ninety of the 449 (86.9%) coho trapped at WCW (103 grilse and 287 adults) bore right maxillary (RM) clips (Appendix 6). Two hundred twenty three of the WCW Project-tagged coho, 216 of them RM-clipped, were recovered at TRH (Table 3).

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

Of the 449 coho trapped at WCW, 43 had gill net wounds. The crew also noted 32 with predator wounds, one with a fresh hook scar, and nine with wounds of unknown origin.

Table 4. Weekly summary of coho trapped at Willow Creek weir during 2008.^a

Julian week	Inclusive dates	Nights trapped	Number trapped						Fish / night
			Grilse ^b	Grilse w/ RM clips ^c	Adults	Adults w/ RM clips	Total trapped	Total RM clips	
34	20-Aug - 26-Aug	4	1	1			1	1	0.3
35	27-Aug - 2-Sep	5	0	0	2	2	2	2	0.4
36	3-Sep - 9-Sep	5	0	0	0	0	0	0	0.0
37	10-Sep - 16-Sep	5	0	0	1	1	1	1	0.2
38	17-Sep - 23-Sep	5	4	3	9	8	13	11	2.6
39	24-Sep - 30-Sep	5	18	17	35	32	53	49	10.6
40	1-Oct - 7-Oct	5	34	34	83	75	117	109	23.4
41	8-Oct - 14-Oct	5	21	20	127	104	148	124	29.6
42	15-Oct - 21-Oct	5	19	18	47	39	66	57	13.2
43	22-Oct - 28-Oct	5	7	7	32	22	39	29	7.8
44	29-Oct - 4-Nov	3	3	3	5	4	8	7	2.7
45	5-Nov - 11-Nov	0			0		0	0	--
46	12-Nov - 18-Nov	2			0		0	0	0.0
46	19-Nov - 25-Nov	7			1		1	0	0.1
Total		61	107	103	342	287	449	390	
Mean:									7.4

a/ Trapping at Willow Creek weir took place from August 20 - November 25, 2008 (Julian weeks 34-47).

b/ Coho <53 cm FL were considered grilse.

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

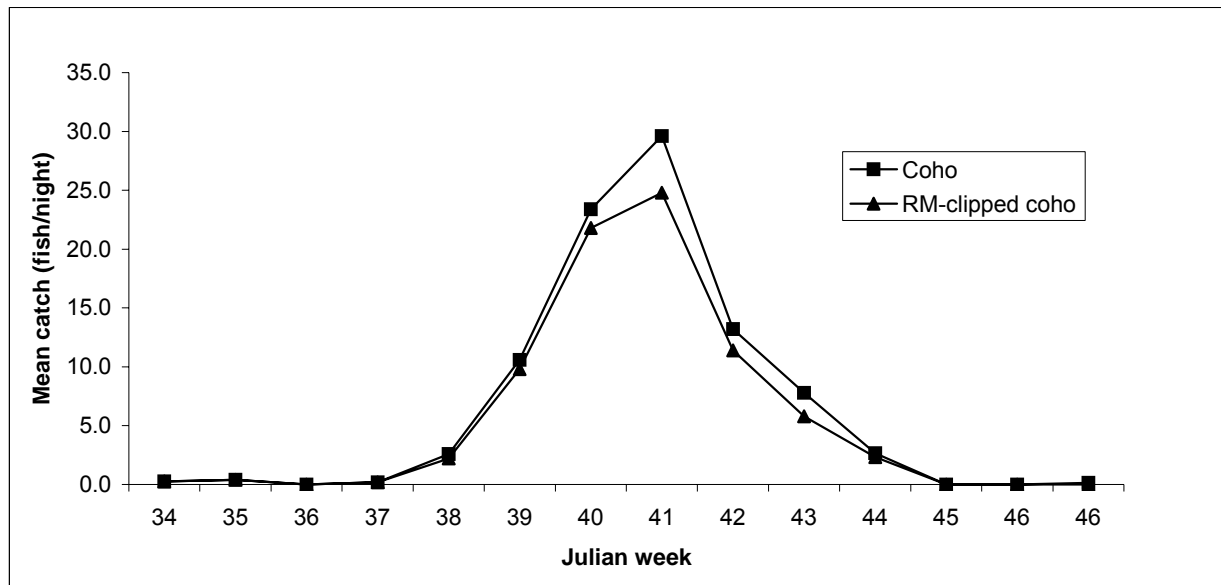


Figure 10. Mean catch of coho trapped at Willow Creek weir during 2008.

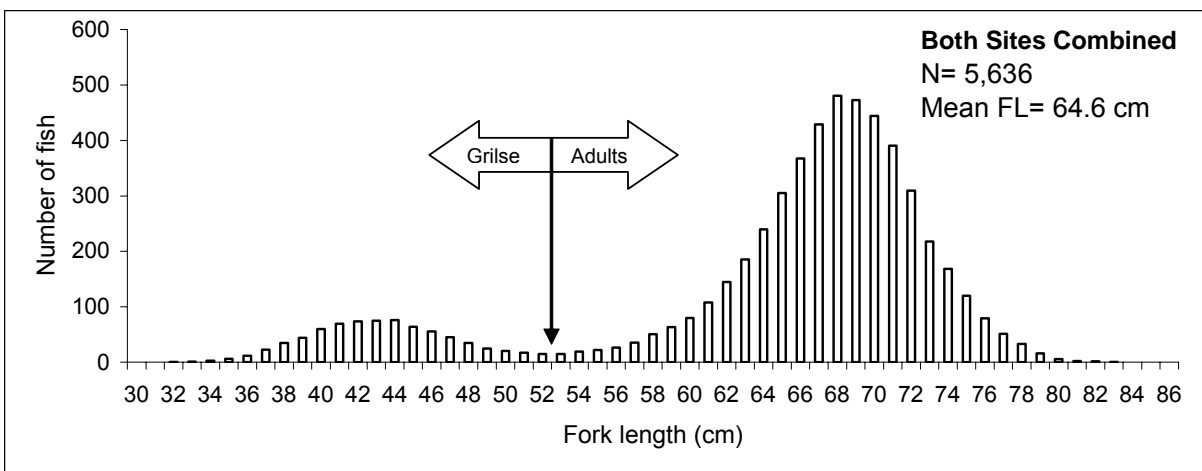
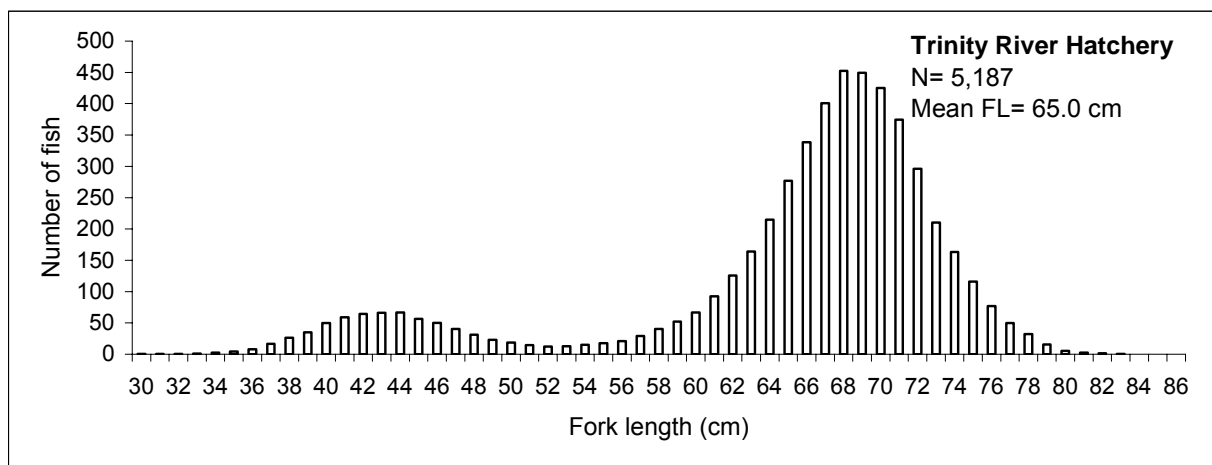
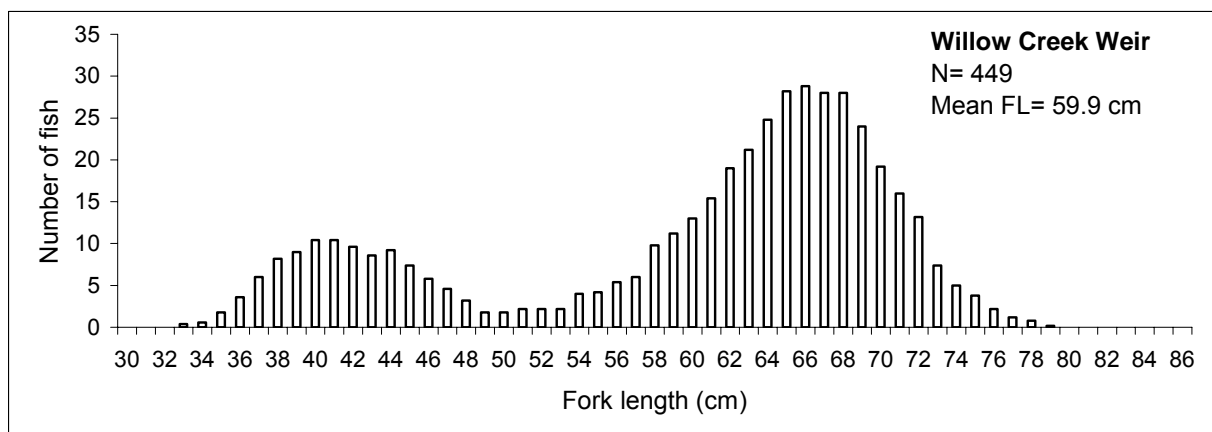


Figure 11. Coho salmon fork lengths (cm) observed at Willow Creek Weir and Trinity River Hatchery and both sites combined during the 2008-09 season. The number of fish shown at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate grilse and adults for analysis.

Fall Steelhead

Run Timing

At JCW, only 42 (41 adult and one half-pounder) steelhead were trapped all season, of which 30 adults, and the one half-pounder, had ad-clips. Julian weeks 31 and 32 (with 5 trap nights per week) yielded the highest numbers of fish trapped (eight), averaging 1.6 per night, though JW 29 saw five adults trapped in two nights of trapping (Table 5, Figure 12). Adipose fin-clipped steelhead were tagged at JCW in 2008, though no run estimates were attempted. The results of the tagging are purely qualitative in nature. Of the 31 tagged fish, nine were recovered at TRH.

Nine hundred fifteen fall steelhead were trapped at WCW in 2008 (Table 6, Figure 13), 46 half-pounders (<42 cm FL) and 869 adults. The peak of the run was during JW 40 with an average of 58.8 fish per night trapped. Julian week 44 yielded a mere 1.7 fish/night.

Size of Fish Trapped

Steelhead caught at JCW, WCW, and TRH averaged 62.1, 62.3 and 64.8 cm FL, respectively (Figure 14). Adult steelhead (> 41 cm FL) made up 97.6% and 95.0% of the steelhead trapped at JCW, and WCW, respectively.

Effectively Tagged Fish

A total of 869 adult steelhead were trapped at WCW in 2008, and 855 of those were tagged (Appendix 7). Only adult fish were tagged. Six adult fish were not tagged due to poor condition. Six fish 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) and anglers reported removing tags from 85 caught and released fish, leaving 775 effectively tagged adult steelhead. Eight of the adult steelhead trapped wore Project tags from previous years. Of the 855 newly tagged fish, reward-tags were attached to 426 while the remainder (429) received non-reward tags.

Incidence of Tags and Fin Clips

Ad-clips were found on 31 (73.8%) of the steelhead at JCW, 584 (63.8%) at WCW and 2,527 (98.8%) at TRH (Appendix 7). Steelhead trapped at WCW had various other clips as well: 1-left maxillary; 1-left maxillary plus ad-clip; and 1-right maxillary 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 one predator wound were noted on steelhead in 2008. On the 915 steelhead trapped at WCW we noted the following: 18 gill-net wounds; eight fresh hooking wounds; 30 unknown wounds or scars; and 72 predator wounds.

Table 5. Weekly summary of fall-run steelhead trapped at the Junction City weir during 2008. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped					Fish / night
			Half pounders ^b	Ad-clips	Adults	Ad-clips ^c	Ad-clip total	
29	16-Jul - 22-Jul	2	0	0	5	4	4	2.5
30	23-Jul - 29-Jul	5	0	0	4	2	2	0.8
31	30-Jul - 5-Aug	5	0	0	8	4	4	1.6
32	6-Aug - 12-Aug	5	0	0	8	6	6	1.6
33	13-Aug - 19-Aug	5	0	0	3	3	3	0.6
34	20-Aug - 26-Aug	5	0	0	2	2	2	0.4
35	27-Aug - 2-Sep	4	0	0	2	2	2	0.5
36	3-Sep - 9-Sep	5	0	0	3	1	1	0.6
37	10-Sep - 16-Sep	5	0	0	2	2	2	0.4
38	17-Sep - 23-Sep	5	1	1	4	4	5	1.0
39	24-Sep - 30-Sep	1	0	0	0	0	0	0.0
Total:		47	1	1	41	30	42	
Mean:							31	0.9

a/ Trapping at Junction City weir took place July 16 - September 24, 2008 (Julian weeks 29 - 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.

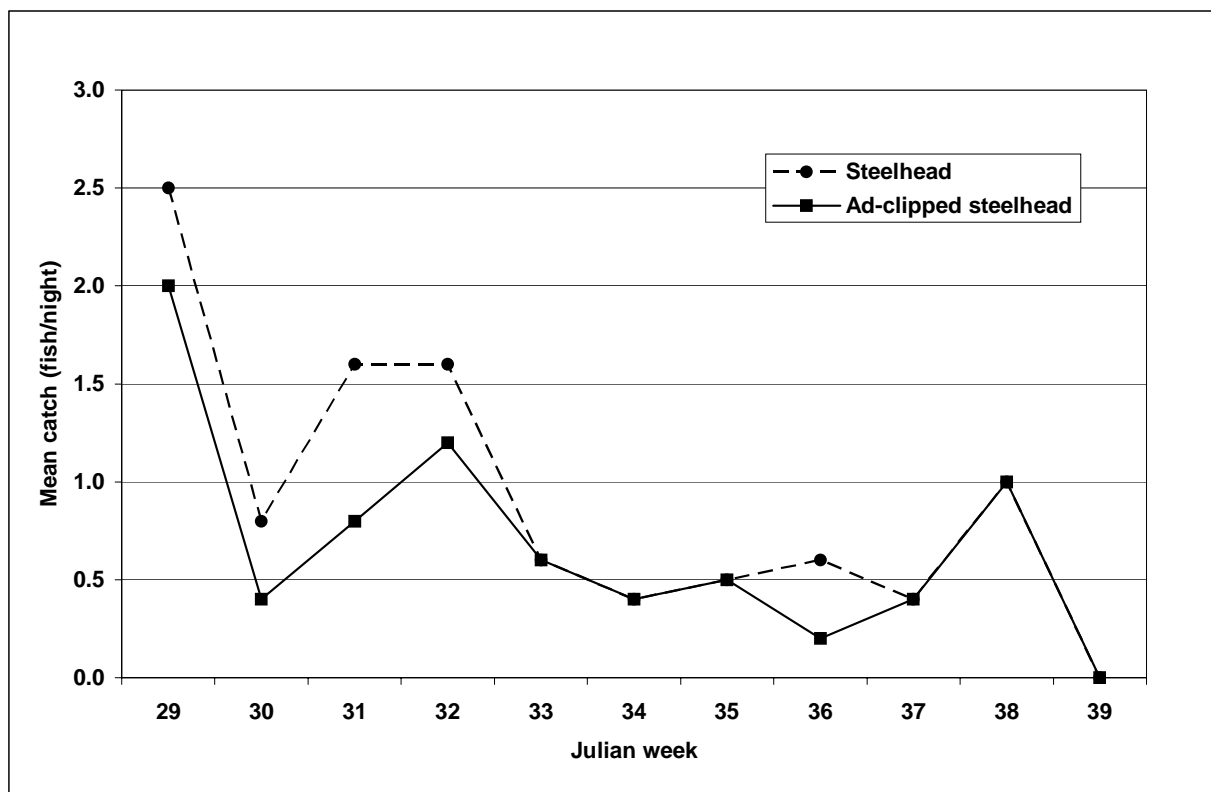


Figure 12. Mean catch of fall-run steelhead at Junction City weir during 2008.

Table 6. Weekly summary of fall-run steelhead trapped at the Willow Creek weir during 2008. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped					Fish/night
			Half pounders ^b	Ad-clips ^c	Adults	Ad-clips	Total	
34	20-Aug - 26-Aug	4	5	2	114	56	119	29.8
35	27-Aug - 2-Sep	5	3	2	61	28	64	12.8
36	3-Sep - 9-Sep	5	1	1	39	23	40	8.0
37	10-Sep - 16-Sep	5	2	1	35	22	37	7.4
38	17-Sep - 23-Sep	5	4	3	39	30	43	8.6
39	24-Sep - 30-Sep	5	4	4	106	77	110	22.0
40	1-Oct - 7-Oct	5	21	14	273	192	294	58.8
41	8-Oct - 14-Oct	5	2	2	136	90	138	27.6
42	15-Oct - 21-Oct	5	1	1	34	23	35	7.0
43	22-Oct - 28-Oct	5	1	1	11	6	12	2.4
44	29-Oct - 4-Nov	3	0	0	5	4	5	1.7
45	5-Nov - 11-Nov	0	0	0	0	0	0	--
46	12-Nov - 18-Nov	2	0	0	5	1	5	2.5
47	19-Nov - 25-Nov	7	2	1	11	0	13	1.9
Total:		61	46	32	869	552	915	584
Mean:								15.0

a/ Trapping at Willow Creek weir took place August 20 - November 25, 2008 (Julian weeks 34 - 47).

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.

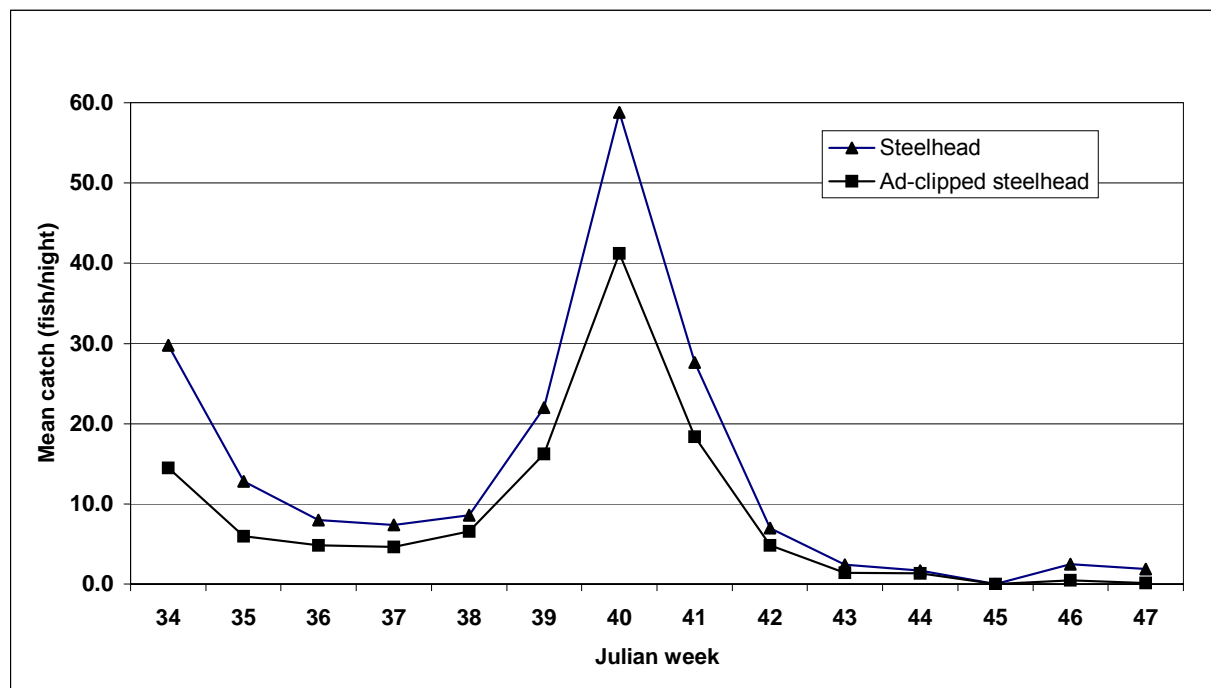


Figure 13. Mean catch of fall-run steelhead at Willow Creek weir during 2008.

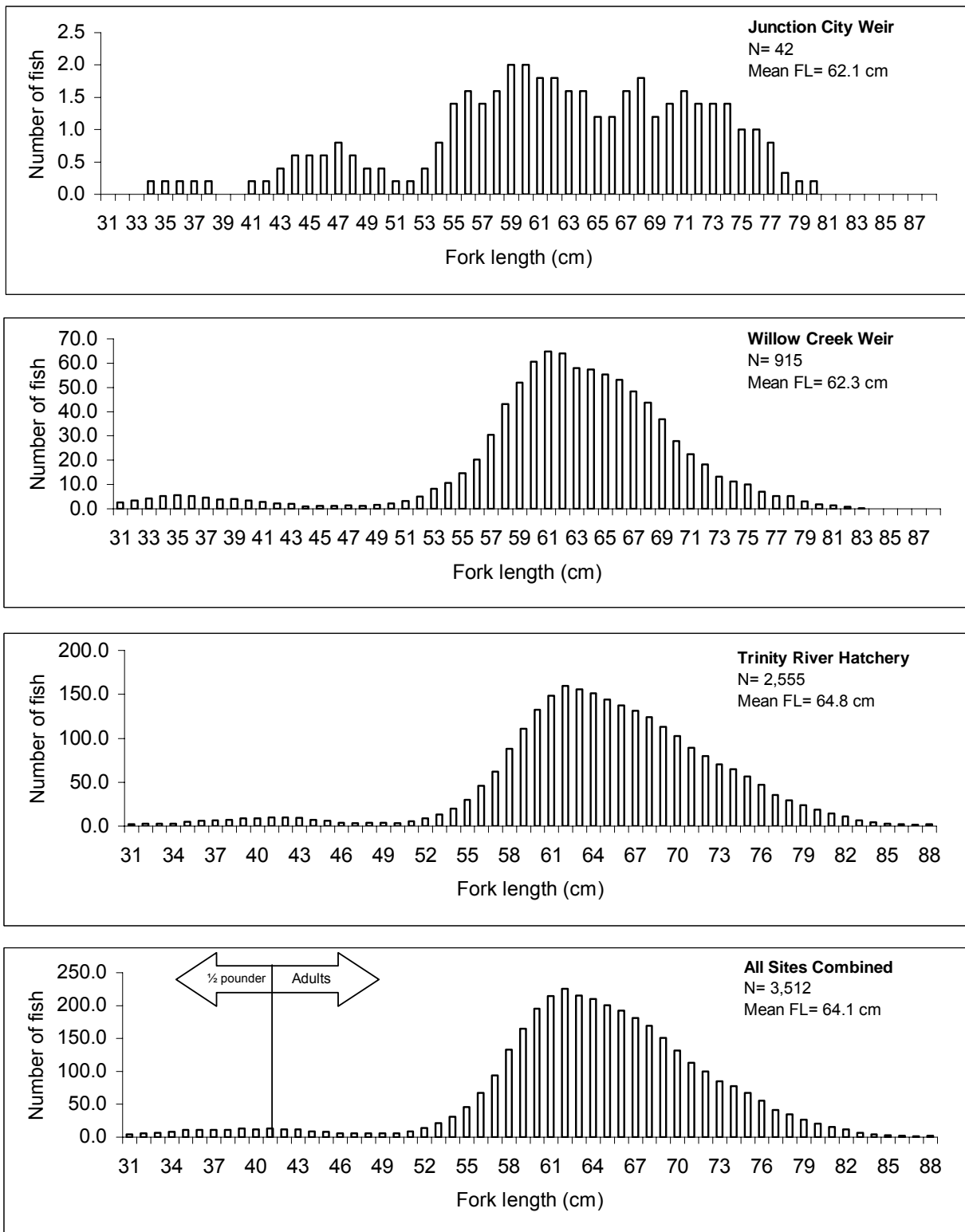


Figure 14. Steelhead fork lengths (cm) observed at Junction City weir, Willow Creek weir, Trinity River Hatchery and all three sites combined during the 2008-09 season. The number of fish at each fork length is shown as a moving average of five, 1-cm increments. The arrow denotes the size used to separate 1/2 pounders (sub-adults) and adults for analysis.

Brown Trout

Capture Timing

During the 2008 trapping season, 101 brown trout were captured during 47 nights of trapping at JCW (Table 7, Figure 15). The highest catch occurred in the fourth week of trapping (JW 32) with a mean fish/night rate of 5.2. No brown trout were trapped at WCW during 2008.

Size of Trapped Fish

Brown trout captured this season ranged in size from 32 to 62 cm FL (Table 8, Figure 16). Four brown trout tagged in previous years were recaptured at JCW in 2008, one tagged in 2005 (tagged at 46cm FL, recaptured at 53cm FL) and three browns tagged in 2007 (which averaged an increase of 3.3cm growth from the previous year).

Effectively Tagged Fish

Of the 101 brown trout tagged at JCW in 2008, two were reported as caught/released by anglers, leaving 99 effective tags. No Project-tagged brown trout were reported as harvested. All of the brown trout at JCW were tagged with non-reward tags.

Table 7. Weekly summary of brown trout trapped in the Trinity River at Junction City weir during 2008. ^a

Julian week	Inclusive dates	Nights trapped	Number trapped	
			Total	Fish/night
29	16-Jul - 22-Jul	2	10	5.0
30	23-Jul - 29-Jul	5	5	1.0
31	30-Jul - 5-Aug	5	22	4.4
32	6-Aug - 12-Aug	5	26	5.2
33	13-Aug - 19-Aug	5	13	2.6
34	20-Aug - 26-Aug	5	12	2.4
35	27-Aug - 2-Sep	4	4	1.0
36	3-Sep - 9-Sep	5	3	0.6
37	10-Sep - 16-Sep	5	1	0.2
38	17-Sep - 23-Sep	5	3	0.6
39	24-Sep - 30-Sep	1	2	2.0
Total:		47	101	
Mean:				2.1

a/ Trapping at Junction City weir took place July 16 - September 24, 2008 (Julian weeks 28 - 39).

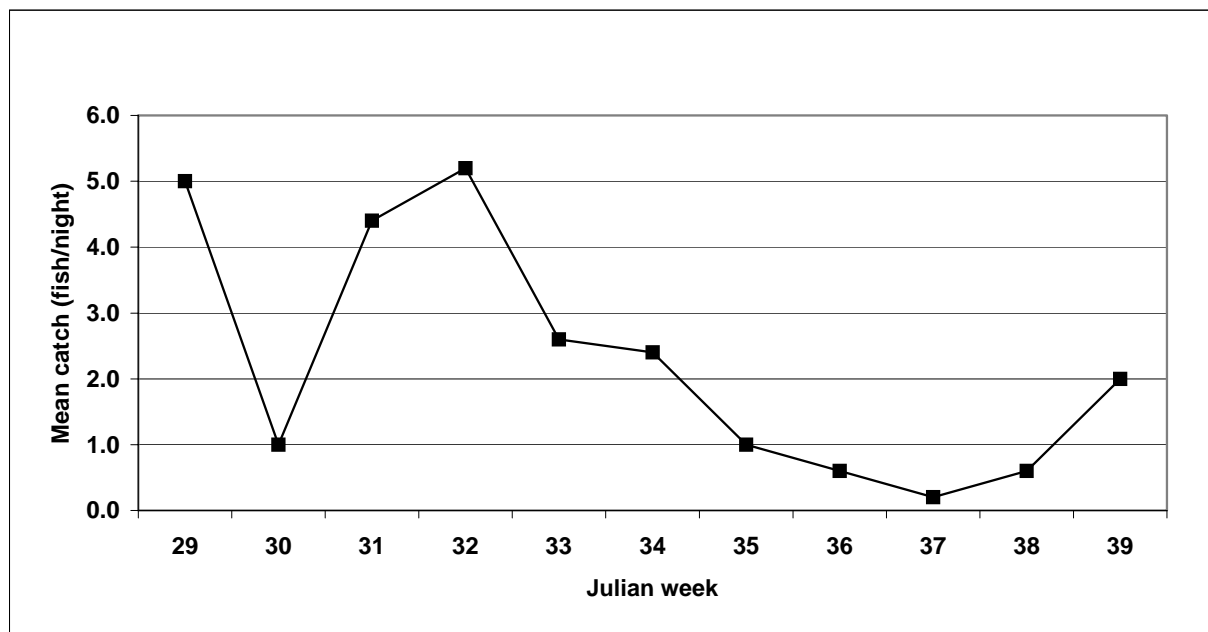


Figure 15. Mean catch of brown trout (fish/night) at Junction City weir, by Julian week, during 2008.

Table 8. Summary of brown trout trapped by Julian week at Junction City weir during 2008.^a

Fork length (cm)	29	30	31	32	33	34	35	36	37	38	39	Totals
32										1		1
33										0		0
34										0		0
35										0		0
36										0		0
37										0		0
38				1						0		1
39				2		1				0		3
40			1	1		2				0		4
41			1	1	1	1				0		4
42		1	2	1	2	0				0		6
43		1	0	1	2	2			1	0		7
44		0	0	3	2	2		2		0	1	10
45		0	1	1	2	1		0		0	1	6
46		0	3	1	0	0	1	0		0		5
47	1	0	0	2	1	1	1	0		0		6
48	0	1	2	1	0	0	0	0		1		5
49	0	0	2	1	0	1	0	0		0		4
50	1	1	1	0	1	0	0	0		1		5
51	0	0	1	2	1	0	1	0				5
52	1	0	2	1	1	1	0	1				7
53	2	0	0	1			0					3
54	0	0	2	1			0					3
55	2	1	3	1			0					7
56	1		1	0			0					2
57	0			2			0					2
58	1			2			1					4
59	0											0
60	0											0
61	0											0
62	1											1
Totals:	10	5	22	26	13	12	4	3	1	3	2	101
Mean FL:	54.1	47.6	48.9	47.8	45.3	43.9	50.5	46.7	43.0	43.3	44.5	47.7

a/ Trapping at Junction City weir took place July 15 - September 24, 2008 (Julian weeks 29 - 39).

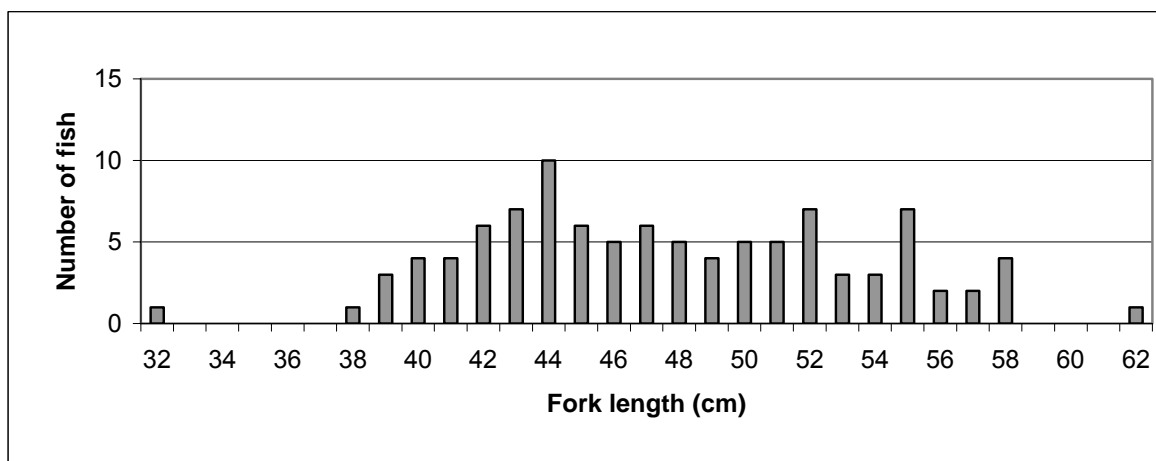


Figure 16. Fork length distribution of brown trout trapped at Junction City weir during 2008.

Recovery of Tagged Fish

Total Recoveries

Fish tagged at JCW and WCW were recovered from four different sources: Angler tag 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 204 tagged spring Chinook at JCW 45.1% were recovered, whereas 25.9% of the 1,742 tagged WCW fall Chinook were recovered. Of the 435 coho tagged at WCW, 55.4% were recovered, as were 27.3% of the 863 adult fall steelhead recovered throughout the Trinity basin. The highest percentage of all recoveries for all species occurred at TRH.

Tag Returns by Anglers

The number of fish available each year to sport fishers is determined by DFG and published in the annual fishing regulations. In 2008 the fall Chinook sport quota for the Klamath River basin season was 20,500, split between the lower (below the Highway 96 Bridge in Weitchpec) and upper basins. Anglers were allowed to retain one ad-clipped steelhead, although the take of coho was prohibited.

Sport (and tribal) fishers remove Project tags from harvested and caught and released fish and return the tags to the DFG address imprinted on the tags. Tags are also returned by river enthusiasts and agency personnel who happen upon them (either attached to dead fish or laying on the river bar unattached) during the course of their river activities.

Spring Chinook

Four tags from adult spring Chinook tagged at JCW (three from harvested fish, one from a caught and released fish) were returned. Additionally, tags from two JCW grilse (one harvested, one found unattached) were returned (Appendix 8). Harvest rate of JCW-tagged grilse Chinook was estimated at 2.3%, while the harvest rate of JCW tagged adults was 1.9% (with one reward and two non-reward tags returned). The catch and release rate for adults was estimated at 0.6% by averaging tag returns from reward (zero) and non-reward (one tag) marked fish. There were no tags returned from caught/released grilse.

Fall Chinook

Anglers returned 12 reward tags (seven grilse/five adult) and nine non-reward tags (four grilse/five adult) from harvested fall Chinook tagged at WCW. Based on those tag returns, the estimated harvest rate of Project-tagged fall Chinook upstream of WCW was 1.3% for grilse and 1.2% for adults. Anglers reported the catch and release of 15 grilse (seven reward and eight non-reward tagged) and four adult fall Chinook (two with reward tags, two with non-reward tags) from WCW (Appendix 9). Using those numbers, the catch and release rates for fall Chinook upstream of the WCW were estimated at 1.7% of the tagged grilse and 0.5% 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 five tags from grilse coho that were caught and released (Appendix 10). Catch and release rates for coho salmon above the WCW were estimated at 1.5% for grilse and 0% for adults based on that return.

Fall Steelhead

Anglers returned 102 tags from steelhead tagged at WCW. Of those 102 tags, 73 were from ad-clipped fish. Anglers returned 82 tags from steelhead reported as caught/released, 53 of those ad-clipped fish (Appendix 11). Based on tag return, an estimated 9.6% of the tagged steelhead migrating upstream of WCW were caught and released.

Brown Trout

All brown trout tagged at JCW received non-reward tags during 2008. Anglers returned two tags from caught and released brown trout tagged during the season, and one tag was recovered in the upper mainstem spawner surveys.

Spawner Surveys

Main stem Trinity spawner surveys were conducted from September 16, 2008 to December 19, 2008 from TRH to Cedar Flat. During the spawner surveys 11 spring Chinook tagged at JCW (Appendix 8), 16 spring Chinook tagged at WCW and 74 fall Chinook tagged at WCW (Appendix 9) were recovered. Thirteen coho salmon tagged at WCW were also recovered (Appendix 10). There were no steelhead recovered in the spawner survey in 2008 (Appendix 11). For additional information on the 2008 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 09, 2008 (JW 36) through March 11, 2009 (JW 10). The ladder and trap were closed October 10, and not reopened until October 23 (most of JW 41, all of JW 42 and some of JW 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 44 (Figure 17, Table 9). Recovery of spring Chinook peaked during JW 39 when 238 fish entered the facility and decreased thereafter with only one fish in JW 44. Based upon CWT expansion, an estimated 3,745 spring Chinook entered TRH (Figure 17).

Of the 204 spring Chinook tagged at JCW, 73 (35.8%) were recovered at TRH. The mean FL for effectively tagged JCW spring Chinook was 66.3 cm, whereas the spring Chinook recovered at TRH averaged 71.6 cm FL (Figure 8, Appendix 4). Sixteen of the 397 (4.0%) spring Chinook tagged at WCW were recovered at TRH. The mean FL for effectively tagged WCW spring Chinook was 58.1 cm.

A total of 3,766 spring Chinook were recovered at TRH, from which 741 CWTs were recovered (Table 9). Spring Chinook age composition at TRH based on CWT analysis was 8.4%, 22.6%, 68.7%, and 0.3% 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 40 of 2008 (Figure 17, Table 11). The fall run peaked during JW 45 when an estimated 1,677 Chinook entered the facility, decreasing thereafter until the last Chinook entered during JW 2 of 2009. Using CWT expansions, an estimated 5,271 fall Chinook entered TRH.

There were not any fall Chinook tagged at JCW in 2008 (they were all spring run). Of the 1,742 tagged fall Chinook from WCW, 323 (18.5%) were recovered at TRH. The mean FL for effectively tagged WCW fall Chinook was 61.3 cm while the mean FL for fall Chinook trapped at TRH was 71.7cm (Figure 9). A total of 1,163 ad-clipped fall Chinook were recovered at TRH, from which 1,064 CWTs were recovered (Table 11). Fall Chinook age composition at TRH based on CWT analysis was 14.0%, 32.0%, 54.0%, and 0% age 2, 3, 4, and 5 year old fish, respectively.

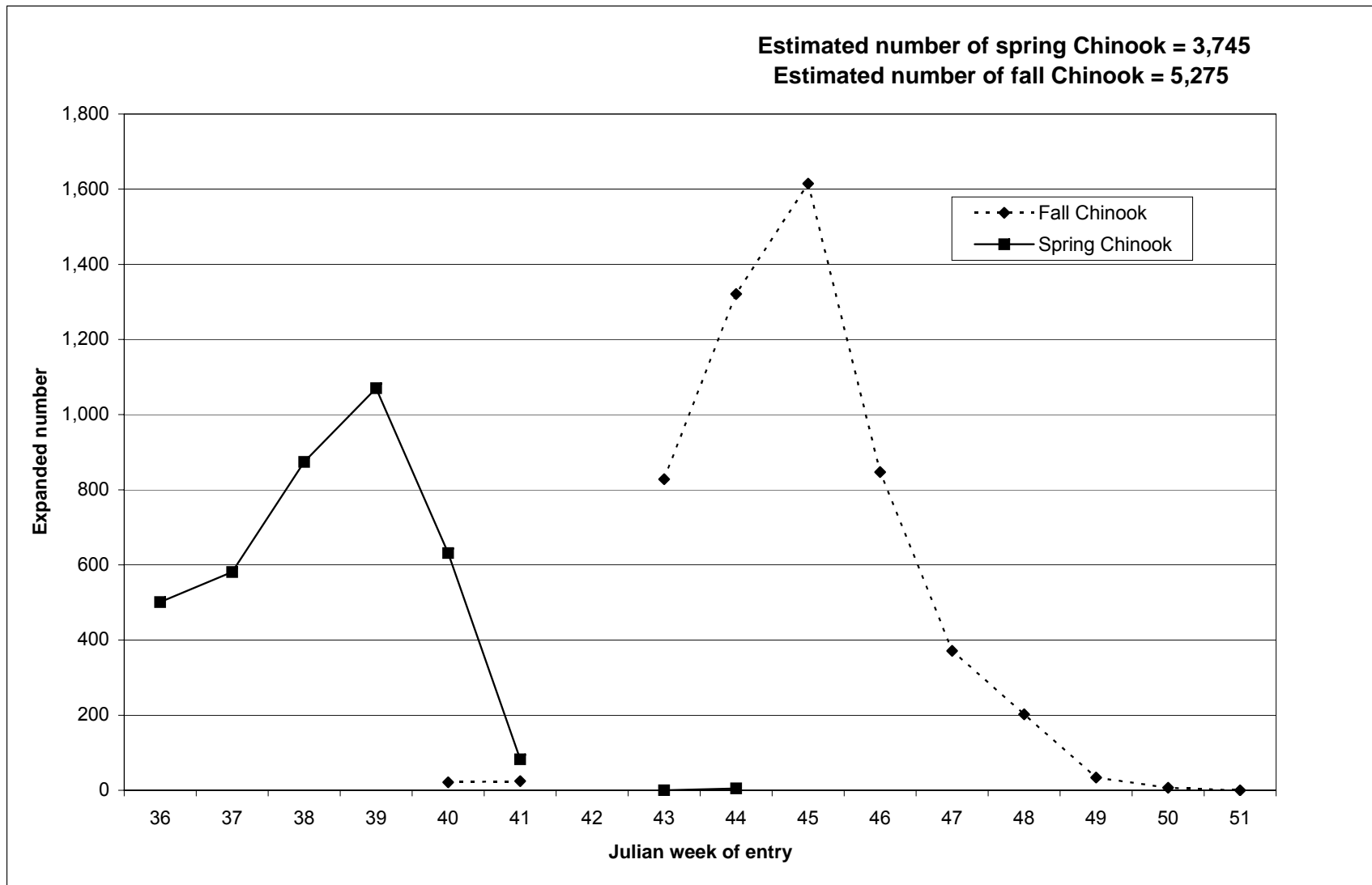


Figure 17. Estimated numbers of spring and fall Chinook that entered Trinity River Hatchery during the 2008-2009 season, based on expansion of coded-wire tagged fish (showing the fish ladder closure/spawning break during all or parts of JWs 41-43).

Table 9. Recoveries at Trinity River Hatchery of coded-wire tagged, spring Chinook during the 2008-09 season.^a

Coded-wire tag number and release type ^c	Brood year	Number of chinook entering TRH, by Julian week ^b											Totals
		36	37	38	39	40	41	42 ^d	43	44	45	46	
065311-f	2003		1										1
065312-f	2003					1							1
065319-f	2004	11	14	5	2								32
065320-f	2004	4	11	9	9								33
065321-f	2004	1	8	12	17	5	1						44
065326-y	2004	57	50	92	131	58	13	0	0	1			402
065330-y	2005		1		1		1						3
065331-y	2005	1											1
065332-y	2005			2									2
065333-f	2005	12	9	11	7	3							42
065334-f	2005	2	9	11	14	4							40
065335-f	2005	8	6	14	21	6	1						56
065342-y	2005		1	1	5	2							9
065343-y	2005			1	4								5
065344-y	2005				1								1
065345-y	2005				1	1							2
065346-y	2005		4	1	6	2							13
065347-f	2006		2	2	2	3							9
065348-f	2006		1	1	4	3							9
065349-f	2006			1	2	3							6
065360-y	2006	2	11	10	6	1							30
No CWT ^e		4	2	12	5	9	1						33
Weekly totals:		102	130	185	238	101	17	0	0	1	0	0	0
Grand Total:													774

a/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 41-43).

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

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

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

e/ No CWT's were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after October 14, 2008 (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 2008-09 season.^a

Julian week of entry ^b	Inclusive dates	Chinook					Coho		
		Total entering TRH	Spring run tagging site		Fall run tagging site		Total entering TRH	Tagging site	
			WCW	JCW	WCW	JCW		WCW	JCW
36	3-Sep - 9-Sep	164		11					
37	10-Sep - 16-Sep	337		3					
38	17-Sep - 23-Sep	722	2	21					
39	24-Sep - 30-Sep	1,376	3	23					
40	1-Oct - 7-Oct	1,060	4	13	2		5		
41	8-Oct - 14-Oct	107	1	2	2		5	1	
42	15-Oct - 21-Oct	0	0		0		0	0	
43	22-Oct - 28-Oct	466	3		80		403	14	
44	29-Oct - 4-Nov	852	2		83		207	13	
45	5-Nov - 11-Nov	1,677	0		104		348	22	
46	12-Nov - 18-Nov	1,638	0		41		2,375	123	
47	19-Nov - 25-Nov	371	1		10		706	23	
48	26-Nov - 2-Dec	202			5		604	17	
49	3-Dec - 9-Dec	34					298	3	
50	10-Dec - 16-Dec	7					139	5	
51	17-Dec - 23-Dec	4					61	1	
52	24-Dec - 31-Dec	0					33	1	
1	1-Jan - 7-Jan	1					3		
2	8-Jan - 14-Jan								
3	15-Jan - 21-Jan								
4	22-Jan - 28-Jan								
5	29-Jan - 4-Feb								
6	5-Feb - 11-Feb								
7	12-Feb - 18-Feb								
8	19-Feb - 25-Feb								
9	26-Feb - 4-Mar								
10	5-Mar - 11-Mar								
Totals:		9,018	16	73	327	0	5,187	223	0

a/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 41-43).

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

Table 11. Recoveries of Trinity River Hatchery-origin fall Chinook by coded-wire tag (CWT) group during the 2008-09 season.

CWT number and release type ^c	Brood year	Julian week of entry ^{a,b}																			Totals
		36	37	38	39	40	41	42 ^d	43	44	45	46	47	48	49	50	51	52	1	2	
065322-f	2004						1		12	15	16	1	1								46
065323-f	2004								8	11	23	8	3								53
065324-f	2004								2	16	20	7	1	1							47
065325-f	2004								5	9	17	16	3	2							52
065328-f	2004									1	1	1									3
065329-f	2004										1										1
065327-y	2004						2		42	73	97	81	47	24	6	1					373
065336-f	2005					1			1		5	1									8
065337-f	2005					1			3	8	8	6									26
065338-f	2005						1		3	4	3	2	1								14
065339-f	2005								1	5	6	5	1								18
065340-f	2005									1	2		1								4
065341-y	2005					1			37	59	86	54	20	11	2						270
065350-f	2006								13	10	9	2									34
065351-f	2006								8	12	8	1									29
065352-f	2006								5	7	6	1									19
065353-f	2006								5	10	7	1									23
065361-y	2006						1		10	15	13	4			1						44
No CWT ^e									27	26	23	11	5	4	3						99
Weekly totals:		0	0	0	0	3	5	0	182	282	351	202	83	42	12	1	0	0	0	0	1,163

a/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 41-43).

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

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

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

e/ No CWTs were recovered from these ad-clipped fish. Chinook with shed or lost tags recovered after October 21, 2008 (JW 42) were considered fall Chinook.

Coho Salmon

The first coho entered TRH during JW 40 OF 2008. The coho run peaked during JW 46 and the last three coho entered TRH during JW 1 of 2009 (Table 12). A total of 5,182 coho (4,539 adults and 648 grilse) were recovered at TRH the season. Two hundred twenty three WCW tagged coho salmon (43 grilse and 180 adults) were recovered at TRH (51.9 % of those effectively tagged). The mean FL of effectively tagged coho salmon at WCW was 60.1 cm and the mean FL of all coho salmon recovered at TRH was 65.0 cm (Appendix 6).

Of the 5,182 coho recovered at TRH, 4,819 (92.9%) were observed to have right maxillary (RM) clips, indicating they were of TRH origin, while 368 (7.1%) 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 ≤ 52 cm FL were considered grilse (age 2) from the 2006 brood year and accounted for 13.3% (642/4,819) of the total, while the remaining 4,177 were considered adults (age 3) from the 2005 brood year. The 368 non RM clipped coho salmon 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 November (Table 13). A total of 2,557 adult steelhead (>41 cm, FL) entered TRH during the season. Of the 775 adult fall steelhead effectively tagged at WCW, 128 were recovered at TRH (Table 13, Appendix 7). The mean FL of effectively tagged steelhead at WCW was 63.6 cm and the mean FL of all adult steelhead recovered at TRH was 64.7 cm

Ad-clipped adults composed 98.8% (2,527/2,557) 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 2008-09 season. ^a

Julian Week of Entry ^c	Inclusive Dates	Brood Year and Clip ^b				Total
		2005		2006		
		No Clip	RM	No Clip	RM	
40	1-Oct - 7-Oct		3		2	
41	8-Oct - 14-Oct		1		4	5
42	15-Oct - 21-Oct		0		0	0
43	22-Oct - 28-Oct	6	149	3	245	403
44	29-Oct - 4-Nov	12	24	1	170	207
45	5-Nov - 11-Nov	41	185	1	121	348
46	12-Nov - 18-Nov	75	2228	1	71	2,375
47	19-Nov - 25-Nov	56	638		12	706
48	26-Nov - 2-Dec	81	514		9	604
49	3-Dec - 9-Dec	51	243		4	298
50	10-Dec - 16-Dec	26	109		4	139
51	17-Dec - 23-Dec	5	56			61
52	24-Dec - 31-Dec	8	25			33
1	1-Jan - 7-Jan	1	2			3
	Totals:	362	4,177	6	642	5,182

a/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 41-43).

b/ Coho <53 cm FL were considered of the 2006 brood year, and coho > 52 cm FL were considered of the 2005 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 2008-09 season.^b

Julian Week of Entry ^c	Inclusive Dates	Number Entering TRH	Recoveries from WCW
38	17-Sep - 23-Sep	1	0
39	24-Sep - 30-Sep	3	0
40	1-Oct - 7-Oct	8	0
41	8-Oct - 14-Oct	9	0
42	15-Oct - 21-Oct	0	0
43	22-Oct - 28-Oct	5	0
44	29-Oct - 4-Nov	14	0
45	5-Nov - 11-Nov	70	1
46	12-Nov - 18-Nov	108	6
47	19-Nov - 25-Nov	114	7
48	26-Nov - 2-Dec	138	11
49	3-Dec - 9-Dec	87	3
50	10-Dec - 16-Dec	50	1
51	17-Dec - 23-Dec	58	4
52	24-Dec - 31-Dec	122	3
1	1-Jan - 7-Jan	114	6
2	8-Jan - 14-Jan	269	19
3	15-Jan - 21-Jan	270	20
4	22-Jan - 28-Jan	231	13
5	29-Jan - 4-Feb	247	11
6	5-Feb - 11-Feb	165	6
7	12-Feb - 18-Feb	101	3
8	19-Feb - 25-Feb	143	3
9	26-Feb - 4-Mar	132	8
10	5-Mar - 11-Mar	36	3
Totals:		2,495	128

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

b/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all 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 10,238 (8,065 adults and 2,218 grilse) spring Chinook migrated into the Trinity River basin upstream of JCW. Based on the Poisson Approximation, the 95% confidence interval for the spring Chinook run-size estimate was 8,255-13,054 (Table 14). Spawning escapement above JCW was estimated at 9,977 adult fish, including 3,766 spring Chinook that entered TRH (Table 15). This year's run-size estimate is 57.4% of the 30 year average spring Chinook run-size of 17,902. 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 158 adults and 148 grilse from the spring run (Table 15).

Fall Chinook Salmon

An estimated 22,997 (15,141 adults and 7,856 grilse) fall Chinook migrated into the Trinity River basin upstream of WCW. Based on the Normal (Stratified) Approximation, the 95% confidence interval for the fall Chinook run-size estimate upstream of WCW was 13,323-17,075 adults and 6,388-9,489 grilse (Table 14). Trinity River fall Chinook spawner escapement, upstream of WCW, was estimated at 15,141 adult fish, including 4,451 adult fall Chinook that entered TRH (Table 15). Harvest rates generated from tags applied at WCW were used to estimate 194 grilse and 281 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 22,997 fish is 54.2% of the 42,416 fish mean run-size for all the years since 1977.

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 2008-2009 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum ^a	Number effectively tagged ^b	Trinity River Hatchery recoveries		Run-size estimate ^d	Confidence limits 1-p= 0.95	Confidence limit estimator
				Number examined for tags ^c	Number of tags in sample			
Spring Chinook	Upstream of Junction City weir	Grilse	43	329	3	2,218	8,255 - 13,054	Poisson Approximation
		Adults	158	3,437	70	8,065		
		Total	201	3,766	73	10,283		
Fall Chinook	Upstream of Willow Creek weir	Grilse	861	801	87	7,856	6,388 - 9,489 13,323 - 17,075	Normal, Stratified Approximation
		Adults	805	4,451	236	15,141		
		Total	1,666	5,252	323	22,997		
Coho	Upstream of Willow Creek weir	Grilse	101	648	47	2,379	8,775 - 11,408	Poisson Approximation
		Adults	329	4,539	176	7,603		
		Total	430	5,187	223	9,982		
Fall run steelhead	Upstream of Willow Creek weir	Adults	775	2,495	128	15,015	12,598 - 17,646	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 and TRH numbers combined. Run-size estimates for grilse and adult fall Chinook were based on stratified Peterson estimator (due to proportion of grilse to adults observed at the Willow Creek weir, but not observed likewise anywhere else in the basin, except in the lower Klamath River creel census).

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 2008-2009 season.

Species/ race	Area of Trinity River basin for run-size estimate	Stratum ^a	Run-size estimate	Angler Harvest		Spawner Escapement		
				Harvest rate ^b	Number of fish ^c	Natural area spawners ^d	Trinity River Hatchery	Total
Spring Chinook	Upstream of Junction City weir	Grilse	2,218	0.067	148	1,741	329	2,070
		Adults	8,065	0.020	158	4,470	3,437	7,907
		Total	10,283		306	6,211	3,766	9,977
Fall Chinook	Upstream of Willow Creek weir	Grilse	7,856	2.470	194	6,861	801	7,662
		Adults	15,141	1.859	281	10,408	4,451	14,859
		Total	22,997		475	17,269	5,252	22,521
Coho	Upstream of Willow Creek weir	Grilse	2,379	0.000	0	1,730	649	2,379
		Adults	7,603	0.000	0	3,064	4,539	7,603
		Total	9,982		0	4,794	5,188	9,982
Fall-run adult steelhead	Upstream of Willow Creek weir	Natural	5,477	0.007	38	5,415	24	5,439
		Hatchery	9,538	0.004	386	6,680	2,471	9,151
		Total	15,015		424	12,095	2,495	14,590

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.

Coho Salmon

An estimated 9,982 (7,603 adults and 2,379 grilse) coho migrated into the Trinity River basin upstream of the WCW in 2008. Based on the Poisson Approximation, the 95% confidence interval for the coho run-size estimate upstream of WCW was 8,775 – 11,408 fish (Table 14). Of those estimated 9,982 fish, 4,539 adults are estimated to have entered TRH (Table 15). Estimated coho salmon run-size, upstream of WCW, has ranged from 852 fish in 1994 to 59,079 fish in 1987 (Appendix 14). This year's run-size estimate was 56.5% of the 17,657 fish 32-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 15,015 adult fall steelhead migrated upstream of WCW this season. The 95% confidence interval for the estimate, based on the Normal Approximation, was 12,598 – 17,646 adult steelhead (Table 14). The run was estimated to be composed of 5,477 natural and 9,538 TRH origin fish. Of those 15,015 fish an estimated 38 wild and 386 TRH produced steelhead were harvested by anglers above WCW (Table 15). The estimated 14,590 fish spawner escapement was comprised of 12,095 natural spawners (5,415 natural origin and 6,680 TRH origin fish) in addition to the 2,495 steelhead that entered TRH. In the 25 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 14,810 fish. This year's run was 101.4% of the average.

DISCUSSION

It was a tough sampling year in 2008. The regulated river flows were not diminished sufficiently to get the JCW into the river until 15 July, and because of numerous long-burning lightning-ignited forest fires the air was quite smoky, and the sky increasingly darker throughout the summer. Due to the combination of high flows and fire evacuations JCW only operated 47 days, compared to 70 trapping days in 2007. Down river the fires had less effect...the fires burned all summer and fall, and the smoke and haze hung in the air, but WCW did not suffer any fire evacuations. A storm in late October demanded the cessation of trapping for nearly two weeks but when the high flows receded we were able to sample again for an additional nine nights. With another storm looming on the horizon and reduced catch of all target species, we pulled the weir November 25, 2008.

The estimated spring Chinook salmon, fall Chinook salmon, and coho salmon runs were all in the 50-60% of average range, while the steelhead run was slightly above average in 2008. Most of the salmon and steelhead runs had passed the WCW by the third week of October so the Halloween storm is not thought to have kept us from sampling any major component of any of the species/races. The very strong grilse component

detected at the weirs of both the spring and fall Chinook runs will hopefully translate to a strong three-year old Chinook cohort in 2009.

The number of grilse seemed out of proportion to adults at the Willow Creek weir, compared to other recovery areas in the basin. Why that same grilse to adult proportion was not seen at TRH could not be easily explained. Because we trapped salmonids from 32 cm to 102 cm FL (and, anecdotally, large numbers of Klamath suckers smaller than 32 cm in length) we assume we were not selecting for grilse. It seems likely those large number of grilse must have ended up elsewhere in the system, but we have no monitoring on the South Fork of the Trinity (nor any of the other major tributaries in the upper basin) so that will have to remain a supposition.

Too few grilse spring Chinook or grilse coho salmon were tagged to generate independent estimates for adults and grilse, therefore we used numbers of adults and grilse combined to generate the total tagged, total recaptured and total recovered fish when calculating spawning escapement and run-size estimates for each species or race. We trapped sufficient fall Chinook salmon (grilse and adult) to run stratified population estimates for that race/species. The run-size estimate for coho salmon was separated into grilse and adults by the ratio of grilse and adults observed at the WCW and TRH combined. For spring Chinook, the total run-size estimate was stratified based on the ratio of adults and grilse observed at JCW only. The steelhead estimates above WCW are for adults only.

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 one coho in the two final weeks of sampling. Slightly more than half of all WCW-tagged coho were eventually recovered at TRH, and only six of the 223 were not RM-clipped (hatchery-origin) fish. There were no WCW-tagged coho trapped at TRH after JW 1, nor were there any other coho recovered at TRH after that, indicating all of the coho run passed WCW while it was installed.

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, if they have already spawned, and trapping is suspended if water temperatures exceed 21°C. We identified 25 total tagging mortalities resulting from our project at both the WCW and JCW combined. At

less than 1% of the 3,850 total fish that went through those two weirs we consider that mortality rate to be pretty good, but we would like to bring it down even further.

At the current JCW location the trap is unable to be installed prior to mid June or July, (depending upon the water year classification and resulting flow regime) when Lewiston Dam releases allow the Trinity River main stem flows to recede below 800cfs in Junction City. Historically, JCW was installed in the beginning of May and peak numbers of spring Chinook ran in late May and early June; at the time, however, spring flow releases from Lewiston Dam were much lower than under the current flow schedule.

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 Junction City.
2. An alternate weir site for the Junction City area really should be identified if possible. The current site does not allow for trapping at flows that exceed approximately 800 cfs, which means a mid-June or July put-in, after much of the spring Chinook have migrated. Ideally, trapping should commence in mid May. If an alternate site that would meet the available flow regime is not available then perhaps modification to a resistance board weir (or other potentially more effective or flexible weir design) should be researched. The advantages to maintaining the monitoring sites at both Willow Creek and Junction City are many (access, land owner cooperation etc); the flow limitations at each site make them less than perfect. Perhaps with a modified weir type the sampling season could be extended, or the loss of trapping days during moderate storm events decreased
3. Funding for re-instated monitoring of the South Fork Trinity River should be sought/identified/acquired. The information gleaned about such an important tributary would be quite useful, especially in a year such as this when the ratio of fish age classes at the different trapping locales did not mesh.

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

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

* Eight day Julian week only during leap years

**Eight day Julian week every year

Appendix 2. Fork length distribution of coded-wire tagged, Trinity River Hatchery-produced, spring Chinook recovered at TRH during the 2008-09 season.^a

FL (cm)	Brood Years (by coded-wire tag number and type) ^b																		20
	2003		2004				2005												
	065311-f	065312-f	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	06348-f
38																			
39																			
40																			
41																			
42																			
43																			
44																			1
45																	1	1	
46																	0	0	
47																	1	2	
48																	2	1	
49																	2	1	
50																	0	0	
51																	2	1	
52																	0	0	
53											1						0	1	
54											0						0	0	
55						1					0						0	0	
56						0					0						0	0	
57						2			1	2		2	1				0		
58						0			0	0	2	1	0				0		1
59			1			0		1	0	3	2	0	1				1	0	
60			0	1		1	1		0	4	2	2	1	1			1	0	
61			0	0		1	0		0	0	1	3	0	0	1		1	0	
62			0	0		2	0		0	5	1	5	1	1		1	2	1	
63			0	0		2	0		0	5	2	3	0	0		0	0		
64			0	0		3	2		0	2	4	2	0	1		0	1		
65			1	0		2			0	2	3	2	0	0		0	2		
66			0	0		4			0	3	3	2	1	1		0	0		
67			3	0		9			0	3	0	5	2	0		0	1		
68			2	1	1	12			0	2	1	1	0	0		0	1		
69			1	0	1	16		1	1	1	3	4	0	0		0	0		
70			4	4	2	20			0	3	4	0		1		1	0		
71			1	2	2	22			0	2	6	0					0		
72			0	0	2	18			2	3	2	1					0		
73			1	1	3	17			1	1	0	0					1		
74			2	2	0	19			0	0	2	0					0		
75			1	3	5	16			2	3	1	0					0		
76			4	1	6	30			1	0	3	0					1		
77			2	3	2	24			1	0	1	0					0		
78			2	1	2	26			2	1	0	0					0		
79			1	2	3	17			1	0	3	0					0		
80			3	1	3	27				1	1	0					0		
81			0	2	0	11				1		0					0		
82			0	1	4	13				0		0					0		
83			2	1	1	16				1		0					0		
84			0	1	2	10						0					0		
85			0	0	1	13						0					1		
86			0	1	1	13						0							
87			1	0	1	6						0							
88		1		1	1	8						0							
89				2	1	10						0							
90				0		3						0							
91				0		2						0							
92				1		1						1							
93				0		3													
94				0		1													
95				0		1													
96				0															
97				0															
98				0															
99				1															
100	1																		
Totals:	1	1	32	33	44	402	3	1	2	42	40	56	9	5	1	2	13	9	9
Mean	100.0	88.0	73.8	78.0	77.6	76.8	62.7	59.0	63.0	66.0	67.9	67.7	66.9	64.4	61.0	66.0	66.7	50.0	49.0

a/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 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 2008-09 season.^a

FL (cm)	Brood Years (by coded-wire tag number and type) ^b																		Total
	2004							2005							2006				
	065322-f	065323-f	065324-f	065325-f	065328-f	065329-f	065327-y	065336-f	065337-f	065338-f	065339-f	065340-f	065341-y	065350-f	065351-f	065352-f	065353-f	065361-y	
38																		1	1
39																	1	0	1
40																	0	0	0
41																1	0	0	1
42															0	1	1	0	1
43															0	1	3	4	
44														2	1	0	9	12	
45														3	3	1	0	3	10
46														2	5	0	4	5	16
47														2	2	3	0	5	12
48														3	5	2	3	6	19
49														3	2	1	4	3	13
50														4	2	0	1	2	9
51														2	2	2	1	2	9
52														2	1	6	0	4	13
53														3	3	0	2	1	9
54														2	1	1	3	7	
55												1		1	0	2	0	4	
56												0		1	1	0	1	3	
57												0		1		1	0	2	
58												1		2			0	3	
59								1				0		1		1		3	
60				1				1			1	11						15	
61		1		0			1	2		2	0	9						15	
62		0		0			1	0		1	2	13						18	
63		0		1			1	2		2	4	11						23	
64		0		0			1	0		2	2	0	0					26	
65		0		1	0		0	1		3	0	2	0					31	
66		0		0	0		0	0		4	1	1	0					32	
67		1		0	0		5	1		1	3	1	1					26	
68		0		1	0		1	0		2	1	2		2				25	
69		0		0	0		3	1		3	1	0						24	
70	1	0		0	2		2			0	0	3						21	
71	0	1		2	1		3			1	0	1						7	
72	1	1		0	1		8			0	1	0						14	
73	0	0		0	2		10			2	0	0						6	
74	5	0		4	2		12			1	0	1						5	
75	0	3		3	1		17				1	1						1	
76	3	4		3	1		24				1							2	
77	4	0		1	7		15											3	
78	2	3		2	5	1	27											3	
79	4	5		3	5	0	23											1	
80	3	6		7	1	0	26											0	
81	2	5		4	3	0	19											0	
82	4	4		4	4	1	23											1	
83	4	5		0	1	0	23											0	
84	0	4		3	2	0	17											0	
85	2	0		4	1	0	21											1	
86	3	3		1	3	0	24												
87	3	1		1	2	0	15												
88	1	3		0	3	0	3												
89	2	0		2	2	0	9												
90	0	1		0	0	0	10												
91	0	0		0	0	0	10												
92	1	1		0	0	0	2												
93	0	0		1	0	0	3												
94	1	0		0	1		5												
95		0		0			2												
96		0		0			3												
97		1		0			3												
98				0			0												
99				1			1												
Totals:	46	53	47	52	3	1	373	8	26	14	18	4	270	34	29	19	23	44	1064
Mean	80.9	80.8	79.6	79.5	84.7	83.0	81.1	63.6	66.0	66.5	67.5	66.3	67.1	50.5	48.4	50.8	49.2	46.8	71.9

a/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 41-43).

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

Appendix 4. Fork length (FL) distribution of spring Chinook trapped and tagged at Willow Creek (WCW) and Junction City (JCW) weirs during the 2008-09 season.^a

FL (cm)	WCW			JCW		
	Total Trapped	Ad-clips ^b	Effective Tags ^c	Total Trapped	Ad-clips ^b	Effective Tags ^c
35	1		1			
36	0		0			
37	1		1			
38	4		4	2		2
39	2		2	0		0
40	7		6	1		1
41	10		10	2		2
42	13		13	0		0
43	12		12	2		2
44	17		14	2		2
45	25		25	1		0
46	11		11	5		5
47	24		23	2		2
48	17	1	16	2		2
49	19	0	17	6		6
50	21	0	20	8		8
51	18	0	18	3		3
52	16	0	16	1		1
53	11	1	11	3		3
54	13	0	13	4		4
55	10	0	10	4	1	4
56	4	0	4	1	0	0
57	1	0	1	2	1	2
58	2	0	2	6	1	6
59	1	0	1	5	0	5
60	3	0	2	4	0	4
61	1	0	1	3	1	3
62	2	1	2	5	1	5
63	2	0	2	2	0	2
64	2	0	2	5	0	5
65	1	1	1	5	2	5
66	2	0	2	1	0	1
67	3	0	3	7	2	7
68	0	0	0	8	1	8
69	3	0	3	3	1	3
70	3	0	2	7	1	7
71	5	1	5	13	1	13
72	2	0	2	8	1	8
73	3	0	2	7	0	7
74	2	0	2	3	1	3
75	5	1	5	5	1	5
76	5	0	5	8	2	8
77	9	1	9	6	0	6
78	13	0	12	7	0	7
79	9	0	8	8	1	8
80	8	0	6	6	1	5
81	6	0	5	6	0	6
82	12	0	9	2	0	2
83	6	0	6	2	0	2
84	8	1	8	4	0	4
85	4		3	3	2	3
86	4		3	1		1
87	1		1	2		2
88	4		4	0		0
89	1		1	1		1
90	0		0			
91	6		6			
92	1		1			
93	0		0			
94	1		1			
Totals:	397	8	375	204	22	201
Mean FL:	58.2	66.9	57.8	66.3	69.9	66.3
Total grilse: ^d	242	2	233	44	0	43
Total adults:	155	6	142	160	22	158

a/ Trapping at JCW took place July 15 - September 24, 2008 (Julian weeks 28 - 39). All Chinook trapped at JCW were considered spring Chinook. Trapping at WCW took place August 20 - November 25, 2008 (Julian weeks 34-47). Chinook trapped prior to Julian week 36 at WCW were considered spring Chinook.

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).

Appendix 5. Fork length (FL) distribution of fall Chinook trapped and tagged at Willow Creek weir (WCW) during the 2008-09 season.^a

FL (cm)	WCW		
	Total Trapped	Ad-clips ^b	Effective Tags ^c
35	2		2
36	0		0
37	0		0
38	2	1	2
39	5	0	5
40	13	0	12
41	17	0	15
42	33	1	31
43	40	2	36
44	68	4	64
45	80	4	75
46	73	4	69
47	95	2	92
48	84	4	81
49	77	1	73
50	82	1	76
51	47	2	46
52	60	3	60
53	39	1	37
54	34	2	32
55	26	1	26
56	11	0	11
57	17	0	16
58	12	0	11
59	13	0	13
60	23	3	23
61	18	3	17
62	27	4	27
63	28	2	27
64	30	6	29
65	28	9	28
66	22	4	21
67	29	5	29
68	10	3	10
69	17	4	17
70	20	4	18
71	19	3	19
72	13	0	13
73	20	2	18
74	27	4	26
75	16	4	14
76	34	7	34
77	21	1	20
78	37	4	36
79	48	8	45
80	39	6	38
81	38	5	37
82	26	3	26
83	30	3	29
84	33	0	28
85	29	2	27
86	19	0	19
87	22	1	22
88	13	1	13
89	19	0	19
90	15	1	14
91	6	1	6
92	11	0	10
93	4	0	4
94	4	0	3
95	5	2	5
96	4		3
97	6		6
98	1		0
99	0		0
100	0		0
101	0		0
102	1		1
Totals:	1,742	138	1,666
Mean FL:	61.3	66.9	61.3
Total grilse: ^d	905	33	861
Total adults:	837	105	805

a/ Trapping at WCW took place August 20 - November 25, 2008 (Julian weeks 34-47). Only those Chinook trapped after Julian week 35 at WCW were considered fall Chinook. There were no fall Chinook trapped at Junction City weir this season.

b/ Ad-clip = Adipose fin clipped fish.

Appendix 6. Fork length (FL) distribution of coho salmon trapped at Willow Creek weir (WCW), and recovered at Trinity River Hatchery (TRH) during the 2008-09 season.^a

FL (cm)	WCW			TRH		
	Total Trapped	RM-clips ^b	Effective Tags ^c	WCW tags recovered at TRH	Total Trapped	RM-clips ^b
30					1	1
31					1	1
32					0	0
33					0	0
34					0	0
35	2	1	1		2	2
36	1	1	1		7	7
37	6	5	6	2	13	13
38	9	9	9	5	18	18
39	12	11	11	6	43	43
40	13	13	12	6	51	51
41	5	5	5	3	51	51
42	13	13	12	7	86	85
43	9	9	8	2	63	62
44	8	8	8	5	70	67
45	8	8	8	2	60	60
46	8	8	7	4	54	54
47	4	3	4	1	36	35
48	1	1	1	0	30	30
49	2	2	2	2	22	22
50	1	1	1	0	15	15
51	1	1	1	0	12	12
52	4	4	4	2	13	13
53	3	3	3	2	11	11
54	2	2	2	2	11	10
55	1	1	1	0	16	16
56	10	9	9	5	24	24
57	5	5	5	3	26	26
58	9	9	8	7	28	27
59	5	5	5	2	53	52
60	20	19	17	11	72	70
61	17	16	17	8	82	78
62	14	13	13	5	98	95
63	21	18	20	12	157	155
64	23	19	21	11	219	209
65	31	25	30	16	264	249
66	35	29	35	20	336	319
67	31	25	31	17	409	383
68	24	19	23	15	465	431
69	19	15	18	8	530	493
70	31	25	31	14	522	467
71	15	12	15	8	320	288
72	7	5	7	2	288	251
73	8	6	7	4	211	186
74	5	3	5	1	140	120
75	2	2	2	1	93	81
76	3	1	3	1	84	65
77	1	1	1	1	52	47
78					16	14
79					4	4
80					5	5
81					2	0
82					0	0
83					0	0
84					0	0
85					0	0
86					1	1
Totals:	449	390	430	223	5,187	4,819
Mean FL:	59.9	59.0	60.1	60.3	65.0	64.7
Total grilse: ^d	107	103	101	43	648	642
Total adults:	342	287	329	180	4,539	4,177

a/ Trapping at WCW took place August 20 - November 25, 2008 (Julian weeks 34-47). The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 41-43). There were no coho trapped at Junction City weir in 2008.

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 53 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 2008-09 season.^a

FL (cm)	Willow Creek weir			Trinity River Hatchery		
	Total Trapped	Ad-clips ^{bc}	Effective Tags ^d	WCW tags recovered at TRH	Total Trapped	Ad-clips ^b
31					2	1
32	2				2	2
33	6	2			2	1
34	6	6			5	4
35	7	6			2	1
36	5	3			4	3
37	4	3			12	12
38	4	3			7	7
39	3	3			7	7
40	3	2			7	6
41	6	4			12	12
42	1	1			11	11
43	1	1	1		13	13
44	0	0	0		6	6
45	2	1	2		4	4
46	1	0	1		2	2
47	2	0	2		6	6
48	1	0	1		2	2
49	1	0	1		4	4
50	1	0	1		5	5
51	3	0	3		2	2
52	5	1	4		5	5
53	6	1	6		11	11
54	10	3	9	1	20	20
55	17	5	15	1	28	27
56	15	11	13	3	35	34
57	25	14	20	2	56	54
58	34	21	31	5	90	89
59	61	34	57	8	100	100
60	81	51	69	16	159	156
61	59	38	54	13	149	149
62	68	46	60	7	164	162
63	55	35	47	12	169	167
64	57	36	53	7	157	155
65	51	27	49	8	139	138
66	56	39	49	4	128	126
67	58	33	53	14	127	127
68	44	34	40	7	137	136
69	33	19	32	4	126	123
70	28	24	24	1	102	101
71	22	16	19	3	72	72
72	12	9	11	3	75	75
73	17	16	15	2	72	72
74	12	10	9	1	79	78
75	3	3	2	0	53	52
76	12	11	8	3	45	45
77	6	5	6	0	34	34
78	2	2	2	2	25	25
79	3	3	3	0	21	21
80	3	2	2	1	22	22
81	1		1		16	16
82					9	9
83					4	4
84					4	4
85					1	1
86					4	4
87					1	1
88					1	1
Totals:	915	584	775	128	2,557	2,527
Mean FL:	62.3	62.9	63.6	64.1	64.7	64.8
Total 1/2 pounders: ^e	46	32	0	0	62	56
Total adults:	869	552	775	128	2,495	2,471

^a Trapping at WCW took place August 20 - November 25, 2008 (Julian weeks 34-47). The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 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 spring Chinook tagged at Junction City weir and subsequently recovered during the 2008-09 season. ^a

FL (cm)	Total Tagged	Recoveries					Angler Found Tags ^g	Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass ^c Recoveries	TRH ^d Recoveries	Angler Released ^e	Angler Harvest ^f			
38	2							0	0.0
39	0							0	—
40	1							0	0.0
41	2			2				2	100.0
42	0			0				0	—
43	2			0				0	0.0
44	2			0				0	0.0
45	1	1		0				1	100.0
46	5			0				0	0.0
47	2			0				0	0.0
48	2			0				0	0.0
49	6			1		1		2	33.3
50	8			0				0	0.0
51	3			0			1	1	33.3
52	1			0				0	0.0
53	3			0				0	0.0
54	4			0				0	0.0
55	4		1	1				2	50.0
56	1	1	0	0				1	100.0
57	2		0	0				0	0.0
58	6		0	2				2	33.3
59	5		0	4				4	80.0
60	4		0	2				2	50.0
61	3		0	1				1	33.3
62	5		0	2				2	40.0
63	2		0	1				1	50.0
64	5		0	4				4	80.0
65	5		0	2				2	40.0
66	1		0	1				1	100.0
67	7		0	5				5	71.4
68	8		1	4		1		6	75.0
69	3		0	1				1	33.3
70	7		2	3				5	71.4
71	13		1	5				6	46.2
72	8		1	3		1		5	62.5
73	7		1	4				5	71.4
74	3		0	1				1	33.3
75	5		0	1				1	20.0
76	8		2	5				7	87.5
77	6		0	3				3	50.0
78	7		2	2				4	57.1
79	8			5				5	62.5
80	6			3	1			4	66.7
81	6			4				4	66.7
82	2			0				0	0.0
83	2			0				0	0.0
84	4			0				0	0.0
85	3			1				1	33.3
86	1							0	0.0
87	2					1		1	50.0
88	0							0	—
89	1							0	0.0
Grilse: ^h	44	1	0	3	0	1	1	6	13.6
Adults:	160	1	11	70	1	3	0	86	53.8
Total:	204	2	11	73	1	4	1	92	45.1

a/ Trapping at Junction City took place July 15 - September 24, 2008 (Julian weeks 28-39). All Chinook trapped at JCW in 2008 were considered spring

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, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JW's 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 <55 cm FL were considered grilse.

Appendix 9. Fork length (FL) distribution of fall Chinook tagged at Willow Creek weir and subsequently recovered during the 2008-09 season.^a

FL (cm)	Total Tagged	Recoveries						Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass Recoveries ^c	TRH Recoveries ^d	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g		
35	2							0	0.0
36	0							0	--
37	0							0	--
38	2			1				1	50.0
39	5			0				0	0.0
40	13			0				0	0.0
41	17			0	1		1	2	11.8
42	33		2	4	2		0	8	24.2
43	40		1	3	0		0	4	10.0
44	68		0	9	1		0	10	14.7
45	80		6	13	2		0	21	26.3
46	73	1	1	11	1	1	0	15	20.5
47	95	0	2	7	1	0	1	11	11.6
48	84	0	0	7	1	0	0	8	9.5
49	77	0	1	5	2	0	1	9	11.7
50	82	0	2	9	3	0	1	15	18.3
51	47	0	0	5	0	0	0	5	10.6
52	60	0	0	4	0	0	0	4	6.7
53	39	0	0	2	0	0	0	2	5.1
54	34	0	1	2	1	0	1	5	14.7
55	26	0	0	3	0	1	0	4	15.4
56	11	0	0	1	0	0	0	1	9.1
57	17	0	2	1	0	2	0	5	29.4
58	12	0	1	1	0	0	0	2	16.7
59	13	0	0	2	0	1	0	3	23.1
60	23	0	1	6	0	1	0	8	34.8
61	18	0	1	4	1	2	0	8	44.4
62	27	0	5	7	0	0	1	13	48.1
63	28	0	0	9	0	0	0	9	32.1
64	30	0	3	14	0	2	0	19	63.3
65	28	0	2	17	0	0	0	19	67.9
66	22	0	1	11	0	0	0	12	54.5
67	29	0	1	14	0	1	0	16	55.2
68	10	0	0	6	0	0	0	6	60.0
69	17	0	0	9	0	0	0	9	52.9
70	20	0	0	11	0	0	0	11	55.0
71	19	0	3	8	0	0	0	11	57.9
72	13	0	0	4	0	1	0	5	38.5
73	20	1	1	3	0	2	0	7	35.0
74	27	0	4	4	0	0	0	8	29.6
75	16	0	1	8	0	0	0	9	56.3
76	34	0	6	5	0	0	0	11	32.4
77	21	0	1	6	0	1	0	8	38.1
78	37	0	0	8	1	0	1	10	27.0
79	48	1	3	18	1	0	1	24	50.0
80	39	0	5	12	1	0	1	19	48.7
81	38	0	5	6		0	0	11	28.9
82	26	0	1	6		0	0	7	26.9
83	30	0	3	6		1	0	10	33.3
84	33	1	4	6		0	0	11	33.3
85	29	0	1	4		0	1	6	20.7
86	19	0	1	2		0		3	15.8
87	22	0	0	2		0		2	9.1
88	13	0	0	1		0		1	7.7
89	19	0	1	6		1		8	42.1
90	15	0	1	4		0		5	33.3
91	6	0		3		0		3	50.0
92	11	1		2		0		3	27.3
93	4			0		0		0	0.0
94	4			1		1		2	50.0
95	5					0		0	0.0
96	4					1		1	25.0
97	6					0		0	0.0
98	1					1		1	100.0
99	0					0		0	--
100	0					1		1	--
101	0							0	--
102	1							0	0.0
Grilse: ^h	905	1	18	87	15	4	5	130	14.4
Adults:	837	4	56	236	4	17	5	322	38.5
Total:	1,742	5	74	323	19	21	10	452	25.9

a/ Trapping at Willow Creek took place August 20 - November 25, 2008 (Julian weeks 34-47). Chinook trapped after Julian week 35 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, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 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 <58 cm FL were considered grilse.

Appendix 10. Fork length (FL) distribution of coho tagged at Willow Creek weir and subsequently recovered during the 2008-09 season.^a

FL (cm)	Total Tagged	Recoveries						Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass Recoveries ^c	TRH Recoveries ^d	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g		
35	1							0	0.0
36	1							0	0.0
37	6			2				2	33.3
38	9			5				5	55.6
39	11			6				6	54.5
40	12			6				6	50.0
41	5			3				3	60.0
42	12			7				7	58.3
43	8			2				2	25.0
44	8			5				5	62.5
45	8		2	2				4	50.0
46	7		0	4				4	57.1
47	4		0	1				1	25.0
48	1		0	0				0	0.0
49	2		0	2				2	100.0
50	1		0	0				0	0.0
51	1		0	0				0	0.0
52	4		0	2				2	50.0
53	3		0	2				2	66.7
54	2		0	2				2	100.0
55	1		0	0				0	0.0
56	9		0	5				5	55.6
57	5		0	3				3	60.0
58	8		0	7				7	87.5
59	5		0	2				2	40.0
60	20		0	11	3			14	70.0
61	17		1	8	0			9	52.9
62	13		1	5	0			6	46.2
63	20		1	12	0			13	65.0
64	21		0	11	0			11	52.4
65	30		0	16	0			16	53.3
66	35		0	20	0			20	57.1
67	31		2	17	0			19	61.3
68	24		0	15	1			16	66.7
69	18		0	8	0			8	44.4
70	31		3	14	0			17	54.8
71	15		1	8	0			9	60.0
72	7		1	2	0			3	42.9
73	8		1	4	1			6	75.0
74	5			1				1	20.0
75	2			1				1	50.0
76	3			1				1	33.3
77	1			1				1	100.0
Grilse: ^h	101	0	2	47	0	0	0	49	48.5
Adults:	334	0	11	176	5	0	0	192	57.5
Total:	435	0	13	223	5	0	0	241	55.4

a/ Trapping at Willow Creek took place from August 20 - November 25, 2008 (Julian weeks 34-47).

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, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 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 <53 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 2008-09 season. ^a

FL (cm)	Total Tagged	Recoveries						Total Recoveries	% Recoveries
		Tag Morts ^b	Carcass Recoveries ^c	TRH Recoveries ^d	Angler Released ^e	Angler Harvest ^f	Angler Found Tags ^g		
43	1							0	0.0
44	0							0	--
45	2							0	0.0
46	1							0	0.0
47	2							0	0.0
48	1							0	0.0
49	1							0	0.0
50	1							0	0.0
51	3							0	0.0
52	5				1			1	20.0
53	6				0			0	0.0
54	10			1	1			2	20.0
55	17			1	2			3	17.6
56	15			3	2			5	33.3
57	24	1		2	3	2		8	33.3
58	34	0		5	3	1		9	26.5
59	61	1		8	4	1		14	23.0
60	80	1		16	10	2		29	36.3
61	59	1		13	4	1		19	32.2
62	68	0		7	7	2	1	17	25.0
63	55	1		12	7	0	1	21	38.2
64	57	0		7	4	1		12	21.1
65	51	0		8	2	1		11	21.6
66	55	0		4	6	3		13	23.6
67	57	0		14	4	0		18	31.6
68	44	0		7	4	2		13	29.5
69	33	0		4	1	0		5	15.2
70	28	0		1	4	0		5	17.9
71	22	0		3	3	0		6	27.3
72	11	0		3	0	0		3	27.3
73	17	0		2	2	1		5	29.4
74	12	0		1	3	0		4	33.3
75	3	0		0	1	0		1	33.3
76	12	1		3	3	0		7	58.3
77	6			0	0	1		1	16.7
78	2			2	0			2	100.0
79	3			0	0			0	0.0
80	3			1	1			2	66.7
81	1							0	0.0
Totals:	863	6	0	128	82	18	2	236	27.3

a/ Trapping at Willow Creek took place August 20 - November 25, 2008 (Julian weeks 34-47).

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

c/ Fish recovered in upper Trinity River spawner surveys. There were no Project-tagged fish recovered in the 2008 carcass surveys.

d/ The fish ladder was open September 08, 2008 - March 11, 2009 (Julian weeks 36-10; closed parts or all of JWs 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 2008.

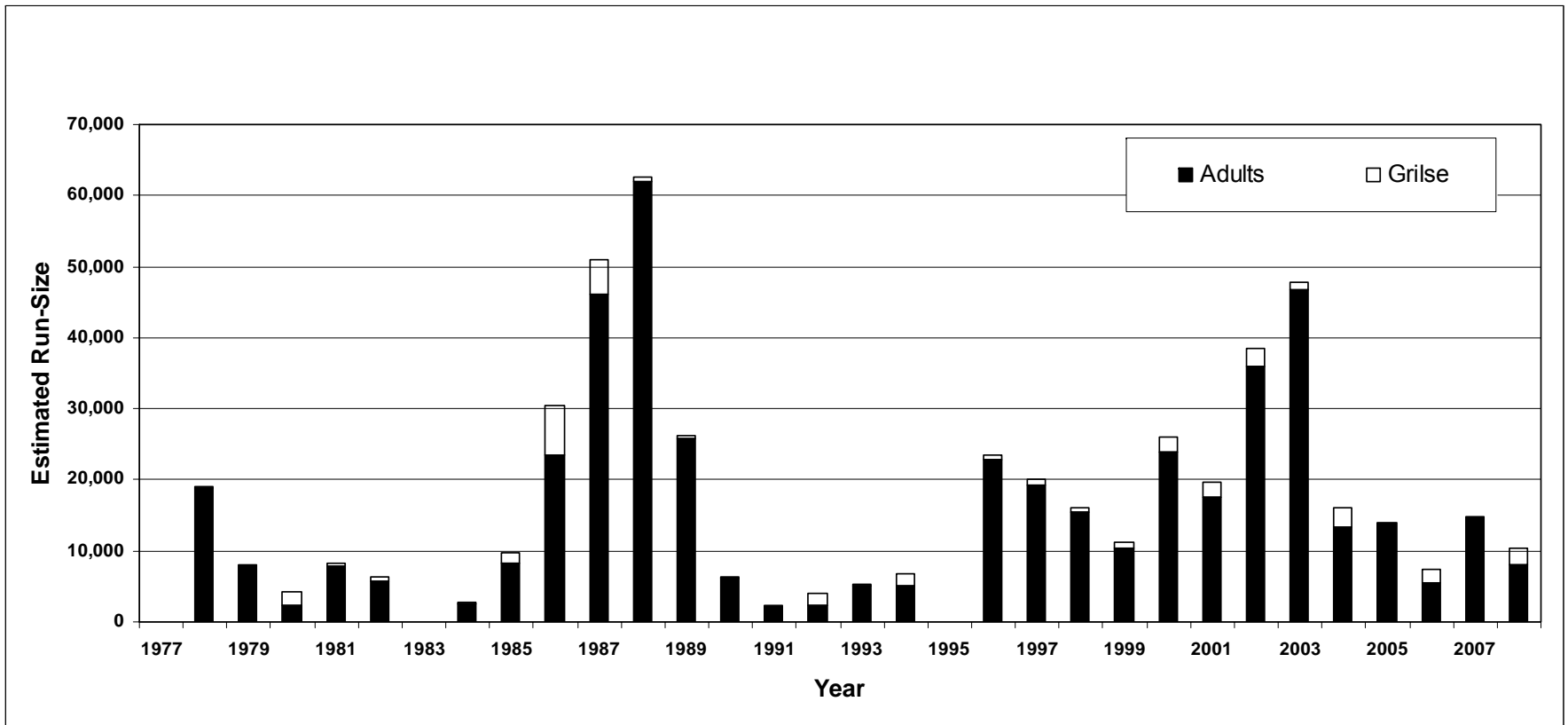
Year	Run-size estimate					Spawner escapements						Angler harvest			
	Grilse		Adults		Total	Natural Area Spawners ^a			Trinity River Hatchery			Grilse	Adults	Total	
	Number	Percent	Number	Percent		Grilse	Adults	Total	Grilse	Adults	Total				
1977			no estimates				no estimates			385	1,124	1,509	no estimates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

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 2008.



Appendix 13. Fall Chinook run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2008.

Year	Run-size estimate					Spawner escapements						Angler harvest	
	Grilse			Adults		Natural Area Spawners ^a			Trinity River Hatchery			Grilse	Adults
	Number	Percent	Number	Percent	Total	Grilse	Adults	Total	Grilse	Adults	Total		
1977	14,318	43.5	18,596	56.5	32,914	9,737	13,501	23,238	2,177	2,035	4,212	2,404	3,060
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/
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
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
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
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
1983	1,240	4.7	25,138	95.3	26,378	853	17,284	18,137	271	5,494	5,765	116	2,360
1984	4,575	34.8	8,556	65.2	13,131	3,416	5,654	9,070	766	2,166	2,932	393	736
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/
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
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
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
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
1990	634	6.3	9,358	93.7	9,992	241	7,682	7,923	371	1,348	1,719	22	328
1991	681	7.4	8,526	92.6	9,207	382	4,867	5,249	205	2,482	2,687	94	1,177
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/
1993	3,381	32.2	7,104	67.8	10,485	2,473	5,898	8,371	736	815	1,551	172	391 c/
1994	7,494	34.2	14,430	65.8	21,924	2,505	10,906	13,411	4,442	3,264	7,706	547	260 c/
1995	9,892	9.4	95,833	90.6	105,725	9,262	77,876	87,138	76	15,178	15,254	554	2,779 c/
1996	5,072	9.1	50,574	90.9	55,646	4,478	42,646	47,124	249	6,411	6,660	345	1,517 c/
1997	3,767	17.6	17,580	82.4	21,347	2,845	11,507	14,352	820	5,387	6,207	102	686 c/
1998	2,307	5.3	40,882	94.7	43,189	1,974	24,460	26,434	192	14,296	14,488	141	2,126 c/
1999	6,583	35.6	11,933	64.4	18,516	4,154	6,753	10,907	2,027	5,037	7,064	402	143 d/
2000	3,163	5.7	52,310	94.3	55,473	1,964	24,880	26,844	1,028	26,018	27,046	171	1,412 d/
2001	1,214	2.1	55,895	97.9	57,109	914	36,152	37,066	204	17,971	18,175	96	1,772 d/
2002	3,812	21.0	14,344	79.0	18,156	2,566	10,310	12,876	1,078	3,475	4,553	168	559 d/
2003	1,547	2.4	62,815	97.6	64,362	758	31,195	31,953	634	29,752	30,386	155	1,867 d/
2004	5,224	17.7	24,310	82.3	29,534	3,839	11,545	15,384	1,059	12,384	13,443	327	381 d/
2005	899	3.2	27,332	96.8	28,231	751	12,717	13,468	48	13,758	13,806	100	856 d/
2006	12,290	35.2	22,622	64.8	34,912	8,228	14,566	22,794	3,938	8,056	11,994	124	0 d/
2007	886	1.5	57,987	98.5	58,873	765	38,967	39,732	33	18,081	18,114	89	939 d/
2008	7,856	34.2	15,141	65.8	22,997	6,861	10,408	17,269	801	4,451	5,252	194	281 d/

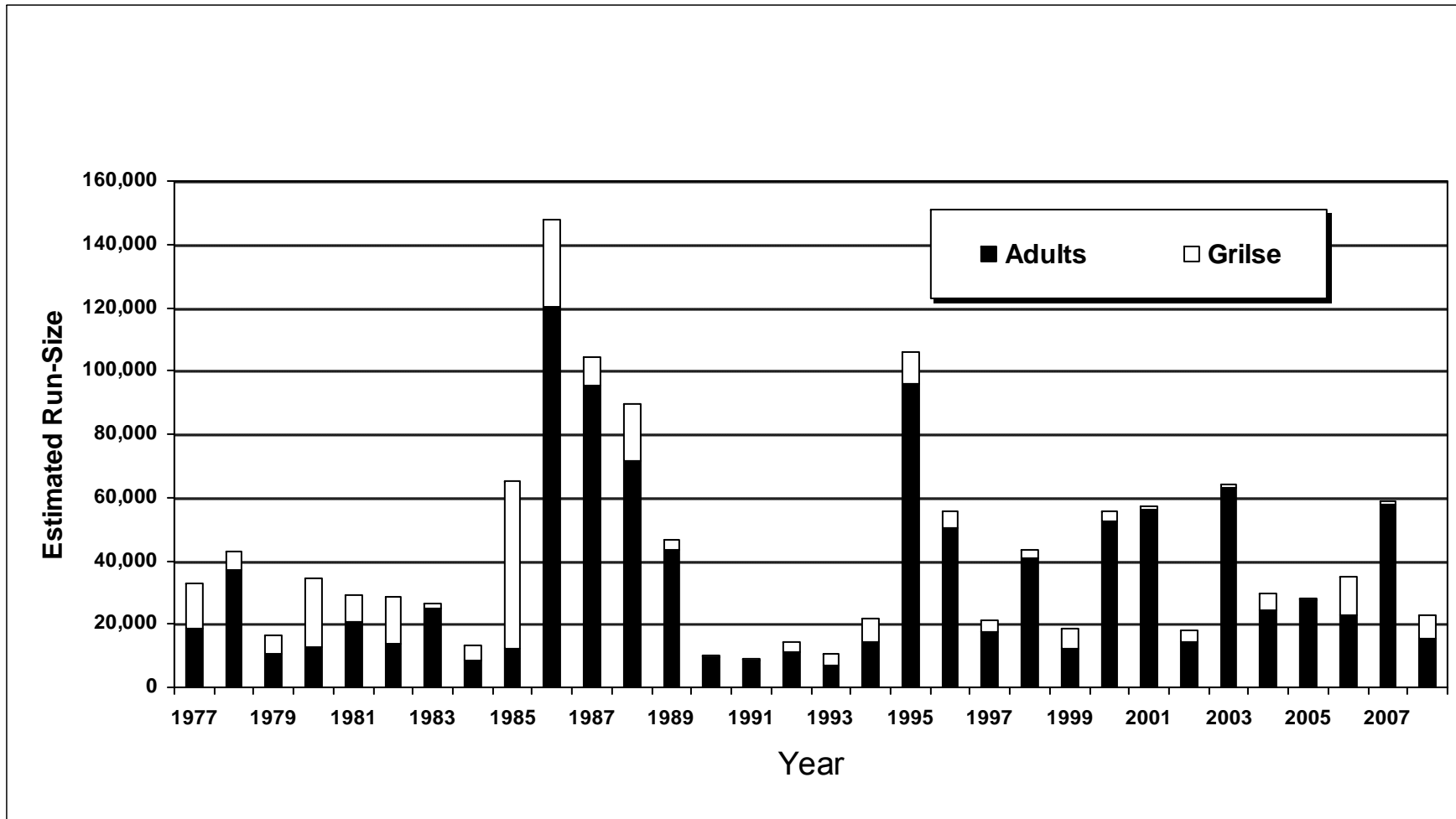
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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

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

d/ The 1999-2008 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 2005, zero in 2006, 10,600 in 2007, and 20,500 in 2008.

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 2008.



Appendix 14. Coho salmon run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2008.

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

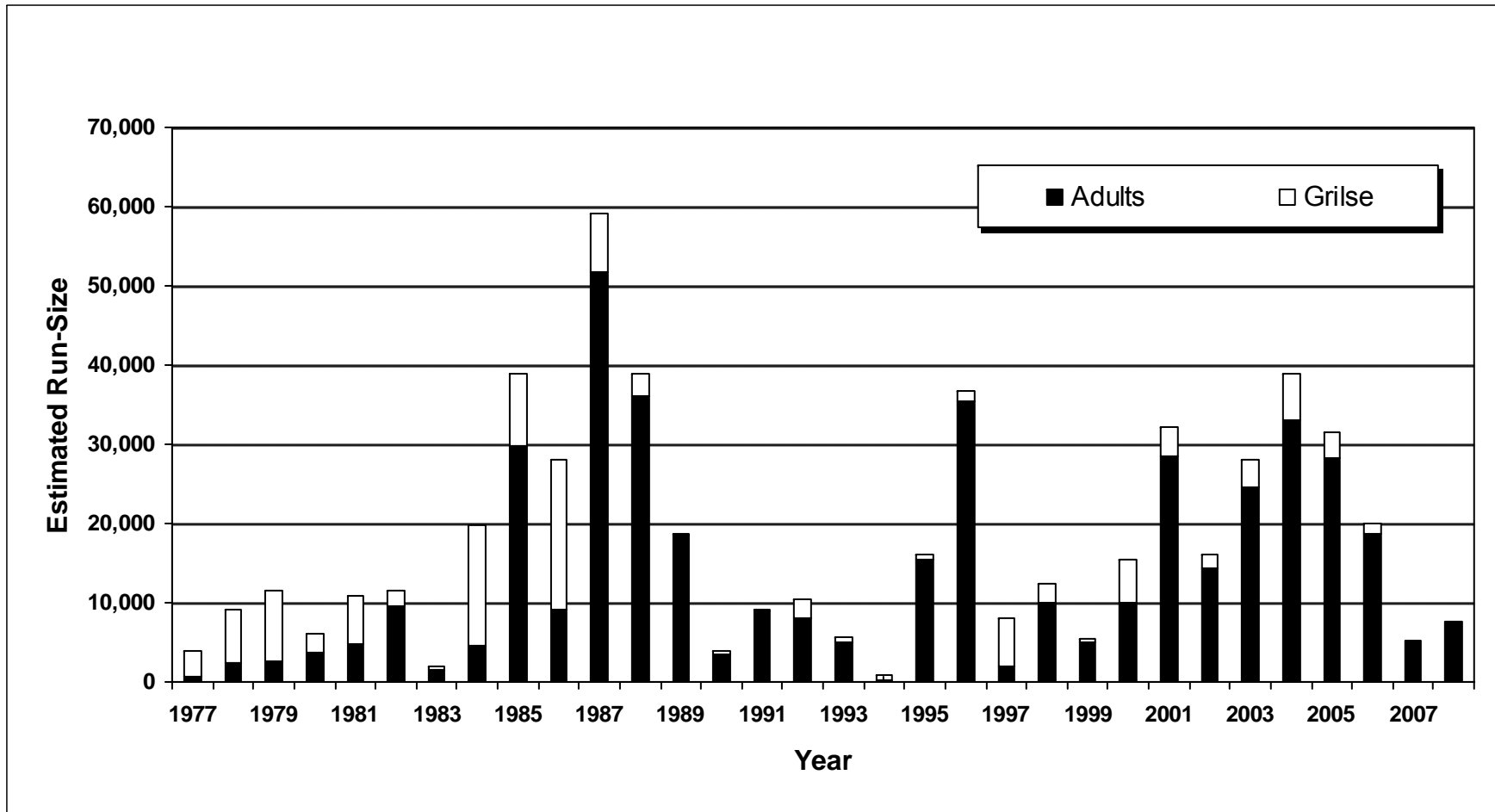
a/ Natural area spawners includes both wild and hatchery fish that spawn in areas outside Trinity River Hatchery.

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 1996-2008 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 2008.



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 2008.

1977 through 2008:

Year	Run-size estimate					Spawner escapement						Angler harvest		
	Hatchery ^b		Wild ^c		Total	Natural Area Spawners ^a			Trinity River Hatchery			Hatchery	Wild	Total
						Hatchery	Wild	Total	Hatchery	Wild	Total			
	Number	Percent	Number	Percent										
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			"					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

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

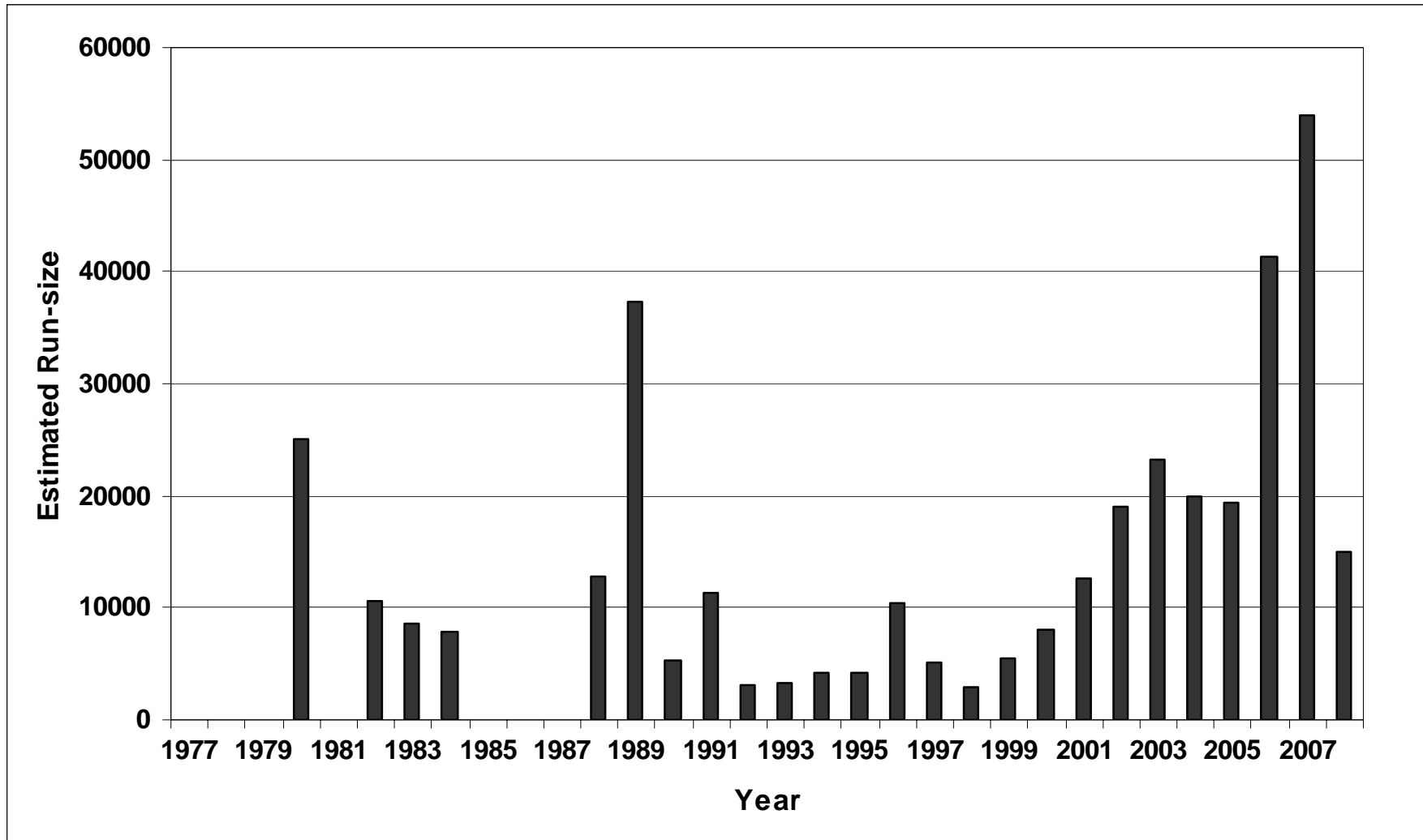
b/ Trinity River Hatchery-produced steelhead.

c/ Naturally produced steelhead.

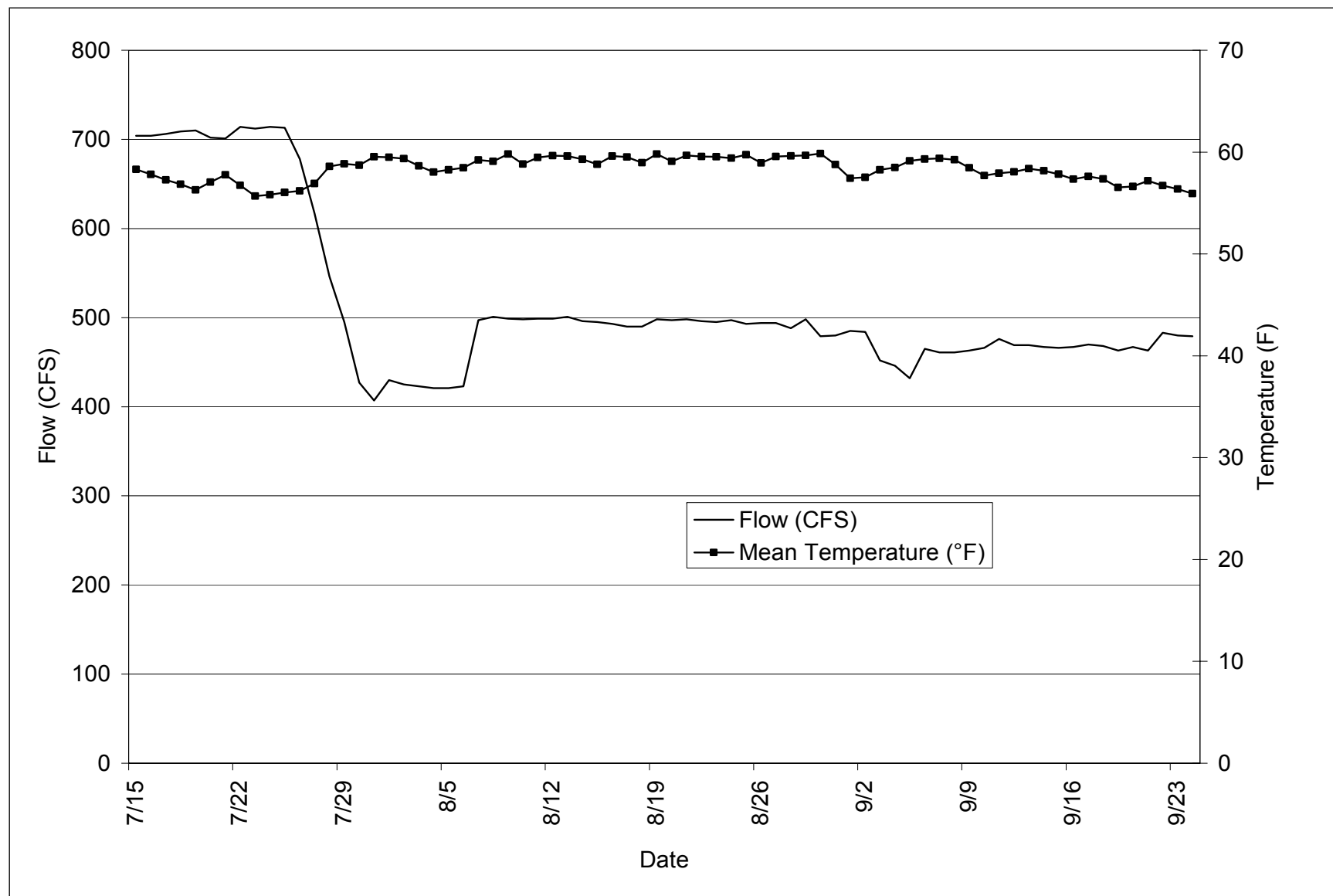
d/ The natural spawner escapement reflects an overestimate due to the unknown number of fish harvested by anglers upstream of Willow Creek Weir.

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

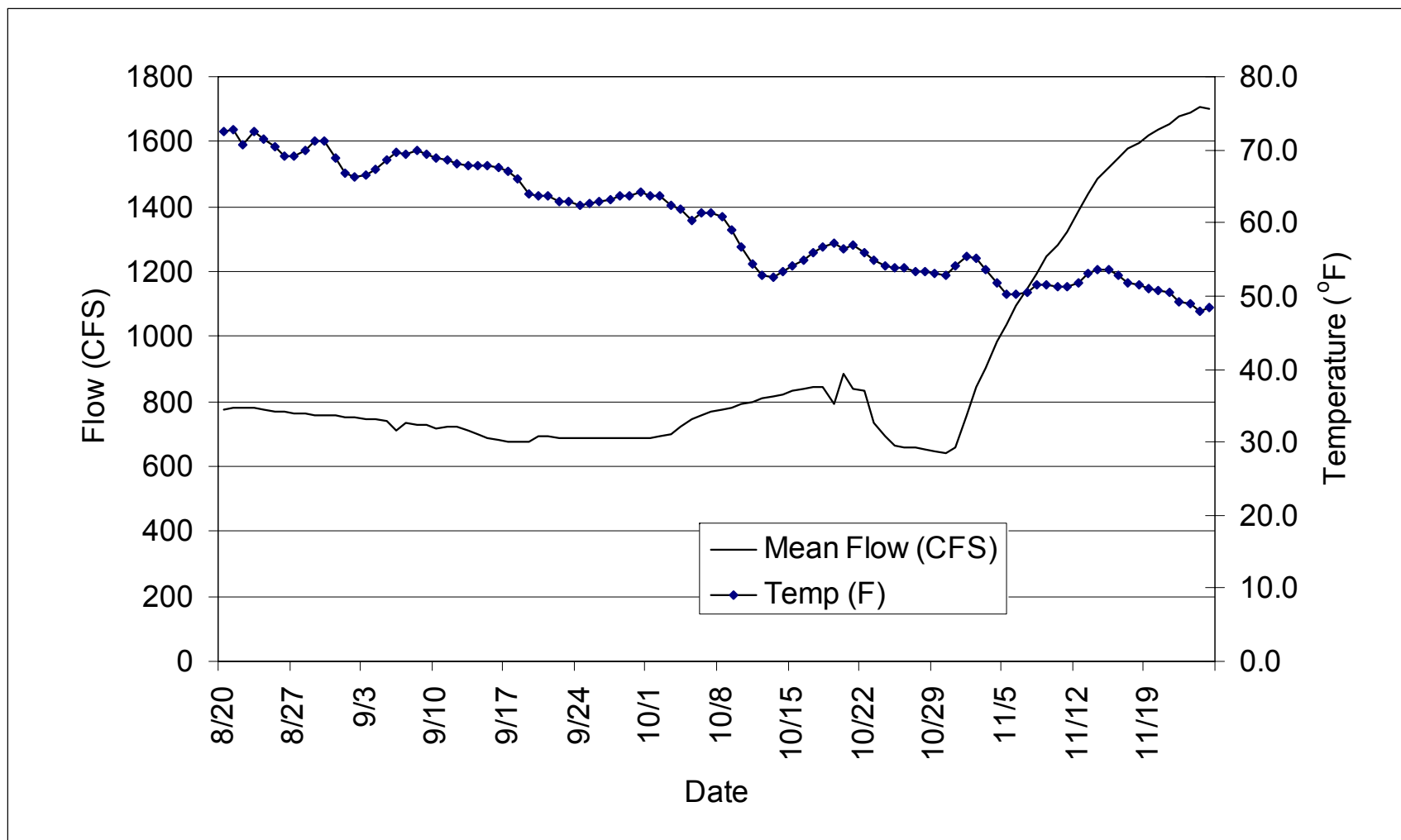
Appendix 15 (continued). Fall-run adult steelhead (>41cm FL) run-size, spawner escapement, and angler harvest estimates for the Trinity River upstream of Willow Creek weir from 1977 through 2008.



Appendix 16. Daily mean flow (CFS) and stream temperature at Junction City weir, 2008.



Appendix 17. Daily mean flow (CFS) and stream temperature at Willow Creek weir, 2008.



**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2008-09 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, 2008 and March 11, 2009. Of the 9,018 Chinook salmon that entered TRH, we recovered 1,945 adipose fin-clipped (AD) Chinook salmon, 21.6 % of the total. Of these, coded-wire tags (CWT) were recovered from 741 spring Chinook and 1,064 fall Chinook salmon.

We estimated that 1,102 marked (AD+CWT) spring Chinook returned to the Trinity River upstream of the Junction City weir (JCW) and 2,045 marked fall Chinook returned to the Trinity River upstream of the Willow Creek weir (WCW) during the 2008-09 season.

Estimated in-river run-size, angler harvest, and spawner escapements of marked TRH spring and fall Chinook salmon for the 2003 through 2006 brood years (BY's) are presented. Complete returns are only available for both runs of fish from the 2003 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 2003 BY ranged from 0.085% to 0.156% for spring Chinook fingerling CWT groups and 0.026% to 0.085% for fall Chinook fingerlings. Returns of spring Chinook released as yearlings was estimated at 0.323%, while fall Chinook yearlings returned at a rate of 0.418%.

Total spring Chinook run-size, upstream of Junction City Weir, was estimated to be composed of 4,577 (44.5%) Trinity River Hatchery produced fish and 5,706 naturally produced fish. Similar estimates for fall Chinook, upstream of Willow Creek Weir, were 8,585 (37.3%) hatchery produced fish and 14,412 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 September 18, 2008 through March 11, 2009, the California Department of Fish and Game's (CDFG) Trinity River Project recaptured Chinook salmon returning to 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 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

We examined all salmon entering TRH for fin-clips and Project tags (also part of Task 1). The heads from AD-clipped salmon were retained for later coded-wire tag removal and decoding. CWTs that were lost or un-readable were apportioned to all groups recovered on a weekly basis. Heads from AD-clipped salmon which did not contain a CWT were considered to have shed their tags and were accounted for in the quality control process prior to their release from TRH as juveniles.

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:

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

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

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

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

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

where, $N_{\text{CWT natural escapement}}$ = 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.

Run-size 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.

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 9,018 Chinook salmon at TRH this season, of which 1,945 (21.6%) bore AD-clips. We recovered CWTs from 741 known spring Chinook and 1,064 known fall Chinook (Table 1). The remaining 140 AD-clipped fish had either shed their CWT (114) or the CWT was lost or unreadable (26). Chinook without CWTs were classified as either spring- or fall-run based on their date of entry into TRH.

Table 1. Release and recovery data for adipose fin-clipped chinook recovered at Trinity River Hatchery (TRH) during the 2008-09 season.

Release data							Recovery data				
CWT a/ code	Egg source	Brood year	Date	Number	Size (No./lb)	Site	Males		Females		Total
							No.	FL b/	No.	FL b/	
Spring-run chinook salmon											
065310	TRH	2003	06/4-10/04	94,182	54.0	TRH	0	----	0	----	0
065311	TRH	2003	06/4-10/04	78,663	54.0	TRH	1	100.0	0	----	1
065312	TRH	2003	06/4-10/04	92,711	60.0	TRH	1	88.0	0	----	1
065317	TRH	2003	10/20/04	104,974	11.4	TRH	0	----	0	----	0
065319	TRH	2004	06/1-8/05	91,301	38.0	TRH	7	78.9	25	72.4	32
065320	TRH	2004	06/1-8/05	90,290	38.0	TRH	12	84.9	21	74.0	33
065321	TRH	2004	06/1-8/05	72,239	48.0	TRH	11	84.0	33	75.5	44
065326	TRH	2004	10/3-11/05	104,478	9.9	TRH	175	80.7	227	73.9	402
065330	TRH	2005	10/2-16/06	11,265	13.3	TRH	2	62.0	1	64.0	3
065331	TRH	2005	10/2-16/06	11,247	13.3	TRH	1	59.0	0	----	1
065332	TRH	2005	10/2-16/06	11,959	13.3	TRH	1	57.0	1	69.0	2
065333	TRH	2005	06/1-7/06	93,920	56.0	TRH	23	68.0	19	63.7	42
065334	TRH	2005	06/1-7/06	95,152	56.0	TRH	22	70.2	18	65.1	40
065335	TRH	2005	06/1-7/06	74,036	54.5	TRH	36	68.9	20	65.6	56
065342	TRH	2005	10/2-16/06	11,382	13.3	TRH	4	74.3	5	61.0	9
065343	TRH	2005	10/2-16/06	11,510	13.3	TRH	2	65.0	3	64.0	5
065344	TRH	2005	10/2-16/06	11,766	13.3	TRH	0	----	1	61.0	1
065345	TRH	2005	10/2-16/06	11,169	13.3	TRH	1	70.0	1	62.0	2
065346	TRH	2005	10/2-16/06	27,309	13.3	TRH	8	66.5	5	67.0	13
065347	TRH	2006	06/1-08/07	65,914	64.2	TRH	8	48.5	1	62.0	9
065348	TRH	2006	06/1-08/07	86,088	76.2	TRH	9	49.0	0	----	9
065349	TRH	2006	06/1-08/07	74,456	76.2	TRH	5	49.6	1	53.0	6
065360	TRH	2006	10/1-10/07	74,456	11.7	TRH	30	43.6	0	----	30
Lost CWT c/ e/							5	76.2	6	70.8	11
No CWT d/ e/							16	70.0	14	69.9	30
Spring-run chinook salmon totals:							380		402		782
Fall-run chinook salmon											
065293	TRH	2003	06/4-10/04	11,342	130.0	TRH	0	----	0	----	0
065294	TRH	2003	06/4-10/04	5,230	130.0	TRH	0	----	0	----	0
065313	TRH	2003	06/4-10/04	125,073	99.0	TRH	0	----	0	----	0
065314	TRH	2003	06/4-10/04	132,044	99.0	TRH	0	----	0	----	0
065315	TRH	2003	06/4-10/04	131,548	105.0	TRH	0	----	0	----	0
065316	TRH	2003	06/4-10/04	128,982	105.0	TRH	0	----	0	----	0
065318	TRH	2003	10/20/04	225,798	16.0	TRH	0	----	0	----	0
065322	TRH	2004	06/4-10/05	123,231	66.0	TRH	10	84.9	36	79.8	46
065323	TRH	2004	06/4-10/05	120,440	73.0	TRH	13	84.1	40	79.7	53
065324	TRH	2004	06/4-10/05	122,180	82.0	TRH	9	82.4	38	79.0	47
065325	TRH	2004	06/4-10/05	120,518	78.0	TRH	14	84	38	77.9	52
065328	TRH	2004	06/4-10/05	8,110	110.0	TRH	2	88	1	78.0	3
065329	TRH	2004	06/4-10/05	5,917	110.0	TRH	0	----	1	83.0	1
065327	TRH	2004	10/20/05	218,386	14.3	TRH	140	85.4	233	78.5	373
065336	TRH	2005	06/1-7/06	104,760	101.1	TRH	4	62.3	4	65	8
065337	TRH	2005	06/1-7/06	126,404	101.1	TRH	11	67.4	15	64.9	26
065338	TRH	2005	06/1-7/06	119,293	108.8	TRH	8	67.5	6	65.2	14
065339	TRH	2005	06/1-7/06	127,742	108.8	TRH	12	68.4	6	65.7	18
065340	TRH	2005	06/1-7/06	10,267	157.0	TRH	3	65.7	1	68	4
065341	TRH	2005	10/2-16/06	227,903	19.8	TRH	152	68.1	118	65.8	270
065350	TRH	2006	06/1-8/07	118,575	110.0	TRH	34	50.5	0	----	34
065351	TRH	2006	06/1-8/07	119,712	110.0	TRH	29	48.5	0	----	29
065352	TRH	2006	06/1-8/07	122,076	134.3	TRH	19	50.8	0	----	19
065353	TRH	2006	06/1-8/07	126,470	134.3	TRH	23	49.2	0	----	23
065361	TRH	2006	10/1-10/07	238,156	19.5	TRH	44	46.8	0	----	44
Lost CWT c/ e/							6	59.0	9	70.2	15
No CWT d/ e/							40	70.3	44	73.8	84
Fall-run chinook salmon totals:							573		590		1,163

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.

Spring Chinook CWTs were represented by 21 release groups from the 2003 through 2006 BY's. Fall Chinook CWTs were composed of 18 groups representing the 2004 through 2006 BY's (Table 1). We did not recover any known age five fish from fall Chinook this year at TRH.

Run-Size, Angler Harvest, and Escapement of Coded-Wire Tagged Salmon

Spring Chinook Salmon

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 1,102 (92 grilse and 1,010 adults) CWTed spring Chinook salmon returned to the Trinity River above JCW during the 2008 season.

In 2008 none of the grilse spring Chinook at JCW were observed to have an AD-clip, thus we used a surrogate AD-clip rate of .0455 for estimates above the weir. We felt this rate reasonably approximated the number of grilse which entered TRH and accounted for angler harvest and natural area spawners of hatchery origin.

An estimated 120 adult and 6 grilse CWTed fish were harvested by anglers during the season. Escapement of CWTed spring Chinook was divided between 741 fish recovered at TRH and 335 estimated to have spawned in natural areas (Table 2). The year's run of known aged CWTd spring Chinook was composed of the following: 92 (8.3%) age 2; 256 (23.2%) age 3; 751 (68.2%) age 4; and 2 (0.2%) age 5 fish (Table 2).

2003 Brood Year

Four spring Chinook CWT groups from the 2003 BY completed their life cycle this season, having reached the age of five. Cumulative age two through five in-river return rates, expressed as a percentage of the number of returns divided by the number released, ranged from 0.085% to 0.156% for fingerling release groups. The one yearling release group, 065317, experienced a return rate of 0.323% (Table 3). Thus, yearlings returned at a rate approximately twice that of their fingerling released cohorts. All release types experienced their highest returns as age four fish.

2004 Brood Year

Spring Chinook from the 2004 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 fair returns (ranging from 0.68% to 1.17%), which is approximately 4 to 7 times better than the completed 2003 BY returns (Table 3). Both the fingerling and yearling groups had their highest returns as age three fish.

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 2008-09 season.

Run-size estimates	Run Size estimate		Harvest rates		TRH Ads With CWTs	% weir Ad clips		Ad+CWT Run-size estimates		
	Grilse	Adults	Grilse	Adults		Grilse	Adults	Grilse	Adults	Total
Sp. Chinook (JCW)	2,218	8,065	6.7%	2.0%	0.911	4.55%	13.75%	92	1,010	1,102
Fall Chinook (WCW)	7,856	15,141	2.5%	1.9%	0.931	3.76%	12.55%	275	1,770	2,045

CWT code	BY	Age	TRH Total No.	% of Total	Run-size	Angler harvest	Spawning escapement		
							TRH	Natural	Total
Spring-run chinook salmon									
Adults									
065311	03	5	1	0.1%	1	0	1	0	1
065312	03	5	1	0.1%	1	0	1	0	1
065319	04	4	32	4.7%	47	1	32	14	46
065320	04	4	33	4.8%	49	1	33	15	48
065321	04	4	44	6.4%	65	1	44	19	63
065326	04	4	402	58.5%	591	12	402	178	580
065330	05	3	3	0.4%	4	0	3	1	4
065331	05	3	1	0.1%	1	0	1	0	1
065332	05	3	2	0.3%	3	0	2	1	3
065333	05	3	42	6.1%	62	1	42	19	61
065334	05	3	40	5.8%	59	1	40	18	58
065335	05	3	56	8.2%	82	2	56	25	81
065342	05	3	9	1.3%	13	0	9	4	13
065343	05	3	5	0.7%	7	0	5	2	7
065344	05	3	1	0.1%	1	0	1	0	1
065345	05	3	2	0.3%	3	0	2	1	3
065346	05	3	13	1.9%	19	0	13	6	19
Totals:			687	1	1,010	20	687	303	990
Grilse									
065347	06	2	9	16.7%	15	1	9	5	14
065348	06	2	9	16.7%	15	1	9	5	14
065349	06	2	6	11.1%	10	1	6	4	10
065360	06	2	30	55.6%	51	3	30	18	48
Totals:			54	1	92	6	54	32	86

Fall-run chinook salmon

Adults									
065322	04	4	46	5.0%	89	2	46	41	87
065323	04	4	53	5.8%	103	2	53	48	101
065324	04	4	47	5.1%	91	2	47	42	89
065325	04	4	52	5.7%	101	2	52	47	99
065327	04	4	373	40.8%	721	13	373	335	708
065328	04	4	3	0.3%	6	0	3	3	6
065329	04	4	1	0.1%	2	0	1	1	2
065336	05	3	8	0.9%	15	0	8	7	15
065337	05	3	26	2.8%	50	1	26	23	49
065338	05	3	14	1.5%	27	1	14	13	27
065339	05	3	18	2.0%	35	1	18	16	34
065340	05	3	4	0.4%	8	0	4	4	8
065341	05	3	270	29.5%	522	10	270	243	513
Totals:			915	1	1,770	33	915	822	1,737
Grilse									
065350	06	2	34	22.8%	63	2	34	27	61
065351	06	2	29	19.5%	53	1	29	23	52
065352	06	2	19	12.8%	35	1	19	15	34
065353	06	2	23	15.4%	42	1	23	18	41
065361	06	2	44	29.5%	81	2	44	35	79
Totals:			149	1	275	7	149	119	268

Table 3. Run-size, percent return, in-river sport catch and spawner escapement estimates for Trinity River Hatchery-produced coded-wire-tagged spring Chinook salmon returning to the Trinity River upstream of Junction City Weir during the period 2005 through 2008.

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
065310	2003	06/4-10/04	94,182	TRH	2	4	0.004	0	2	2	4
					3	23	0.024	0	18	5	23
					4	81	0.086	3	35	43	78
					5	0	0.000	0	0	0	0
					Totals: d/		108	0.115	3	55	105
					Total adults: e/		104	0.110	3	53	101
065311	2003	06/4-10/04	78,663	TRH	2	9	0.011	0	5	4	9
					3	49	0.062	0	39	10	49
					4	64	0.081	2	27	34	61
					5	1	0.001	0	1	0	1
					Totals: d/		123	0.156	2	72	120
					Total adults: e/		114	0.145	2	67	111
065312	2003	06/4-10/04	92,711	TRH	2	2	0.002	0	1	1	2
					3	14	0.015	0	11	3	14
					4	62	0.067	2	26	33	59
					5	1	0.001	0	1	0	1
					Totals: d/		79	0.085	2	39	76
					Total adults: e/		77	0.083	2	38	74
065317	2003	10/20/04	104,974	TRH	2	2	0.002	0	1	1	2
					3	54	0.051	0	43	11	54
					4	283	0.270	11	121	152	273
					5	0	0.000	0	0	0	0
					Totals: d/		339	0.323	11	165	329
					Total adults: e/		337	0.321	11	164	327
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
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
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
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
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
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

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 3 (continued). Run-size, percent return, in-river sport catch and spawner escapement estimates for Trinity River Hatchery-produced coded-wire-tagged spring Chinook salmon returning to the Trinity River upstream of Junction City Weir during the period 2005 through 2008.

065332	2005	10/2-16/06	11,959	TRH	2 3	0 3	0.000 0.025	0 0	0 2	0 1	0 3
065333	2005	06/1-7/06	93,920	TRH	2 3	6 62	0.006 0.066	0 1	5 42	0 19	5 61
065334	2005	06/1-7/06	95,152	TRH	2 3	7 59	0.007 0.062	0 1	6 40	0 18	6 58
065335	2005	06/1-7/06	74,036	TRH	2 3	5 82	0.007 0.111	0 2	4 56	0 25	4 81
065342	2005	10/2-16/06	11,382	TRH	2 3	0 13	0.000 0.114	0 0	0 9	0 4	0 13
065343	2005	10/2-16/06	11,510	TRH	2 3	0 7	0.000 0.061	0 0	0 5	0 2	0 7
065344	2005	10/2-16/06	11,766	TRH	2 3	0 1	0.000 0.008	0 0	0 1	0 0	0 1
065345	2005	10/2-16/06	11,169	TRH	2 3	0 3	0.000 0.027	0 0	0 2	0 1	0 3
065346	2005	10/2-16/06	27,309	TRH	2 3	1 19	0.004 0.070	0 0	1 13	0 6	1 19
065347	2006	06/1-08/07	65,914	TRH	2	15	0.023	1	9	5	14
065348	2006	06/1-08/07	86,088	TRH	2	15	0.017	1	9	5	14
065349	2006	06/1-08/07	74,456	TRH	2	10	0.013	1	6	4	10
065360	2006	10/1-10/07	104,019	TRH	2	51	0.049	3	30	18	48

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.

2005 Brood Year

Spring Chinook from the 2005 brood year have returned as age two and three thus far. Returns to date indicate that this brood is doing poorly. Only 273 fish have returned as two and three-year-olds for all groups combined (Table 3). However, some cohorts in the past have contributed most returns as age four fish. This brood will return as four and five-year-old fish in the next two seasons.

2006 Brood Year

Four 2006 BY release groups (3 fingerling and 1 yearling) returned as two-year-olds this season. Thus far, the fingerling CWT group, 065360, 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.

Fall 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 CWT fish at TRH, we estimated that 2,045 CWTed fall Chinook salmon returned to the Trinity River above WCW during the 2008-09 season. We estimated that anglers harvested 7 grilse and 33 adult CWTed fall Chinook. Escapement of CWTed fall Chinook was divided between 1,064 fish recovered at TRH and 941 estimated to have spawned in natural areas this season (Table 2).

The fall Chinook CWT run was composed of 275 (13.4%) age 2 fish, 658 (32.2%) age 3 fish, 1,112 (54.4%) age 4 fish, and no age five fish (Table 2).

2003 Brood Year

The BY 2003 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 0.026% and 0.085%. The lone yearling group, 065318, returned at a rate of .418%, which is approximately 10 times that of the mean fingerling group return rates (Table 4). All Chinook from the 2003 BY experienced their highest returns as three-year-old fish (Table 4).

2004 Brood Year

The 2004 BY is represented by seven CWT groups, of which six are fingerling groups and one a yearling group. In contrast to the poor returns of the 2003 BY releases, fall Chinook from the 2004 BY are returning at a much higher rate. Through age four returns, all fingerling groups have returned at rates exceeding 0.4% (table 4). The lone yearling group, 065327, is approaching a 1.8% return, approximately four times

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 2005 through 2008.

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
065293	2003	06/4-10/04	11,342	TRH	2	0	0.000	0	0	0	0
					3	2	0.018	0	1	1	2
					4	1	0.009	0	1	0	1
					5	0	0.000	0	0	0	0
					Totals: d/	3	0.026	0	2	1	3
					Total adults: e/	3	0.026	0	2	1	3
065294	2003	06/4-10/04	5,230	TRH	2	0	0.000	0	0	0	0
					3	2	0.038	0	1	1	2
					4	0	0.000	0	0	0	0
					5	0	0.000	0	0	0	0
					Totals: d/	2	0.038	0	1	1	2
					Total adults: e/	2	0.038	0	1	1	2
065313	2003	06/4-10/04	125,073	TRH	2	0	0.000	0	0	0	0
					3	100	0.080	0	42	58	100
					4	6	0.005	0	4	2	6
					5	0	0.000	0	0	0	0
					Totals: d/	106	0.085	0	46	60	106
					Total adults: e/	106	0.085	0	46	60	106
065314	2003	06/4-10/04	132,044	TRH	2	2	0.002	0	1	1	2
					3	53	0.040	0	22	31	53
					4	12	0.009	0	8	4	12
					5	0	0.000	0	0	0	0
					Totals: d/	67	0.051	0	31	36	67
					Total adults: e/	65	0.049	0	30	35	65
065315	2003	06/4-10/04	131,548	TRH	2	0	0.000	0	0	0	0
					3	53	0.040	0	22	31	53
					4	6	0.005	0	4	2	6
					5	0	0.000	0	0	0	0
					Totals: d/	59	0.045	0	26	33	59
					Total adults: e/	59	0.045	0	26	33	59
065316	2003	06/4-10/04	128,982	TRH	2	0	0.000	0	0	0	0
					3	43	0.033	0	18	25	43
					4	9	0.007	0	6	3	9
					5	0	0.000	0	0	0	0
					Totals: d/	52	0.040	0	24	28	52
					Total adults: e/	52	0.040	0	24	28	52
065318	2003	10/20/04	225,798	TRH	2	3	0.001	0	2	1	3
					3	810	0.359	0	339	471	810
					4	131	0.058	2	89	40	129
					5	0	0.000	0	0	0	0
					Totals: d/	944	0.418	2	430	512	942
					Total adults: e/	941	0.417	2	428	511	939

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 2005 through 2008.

Release data					Estimated returns						
CWT a/ code	Brood year	Date b/ Date	Number	Site	Age	Run- size	% of release	River harvest	Spawning escapement		
									TRH c/	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
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
065324	2004	06/4-10/05	122,180		2	204	0.167	2	132	70	202
					3	566	0.463	9	383	174	557
					4	91	0.074	2	47	42	89
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
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	2973
					4	721	0.330	13	373	335	708
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
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
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
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
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
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
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
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
065350	2006	06/1-8/07	118,575	TRH	2	63	0.053	2	34	27	61
065351	2006	06/1-8/07	119,712	TRH	2	53	0.044	1	29	23	52
065352	2006	06/1-8/07	122,076	TRH	2	35	0.029	1	19	15	34
065353	2006	06/1-8/07	126,470	TRH	2	42	0.033	1	23	18	41
065361	2006	10/1-10/07	238,156	TRH	2	81	0.034	2	44	35	79

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.

that of the yearling group from the 2003 brood (Table 4).of less than 0.1%, while the yearling group, 065318 has returned at a rate of approximately 0.42% (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 2009 season.

2005 Brood Year

Six release groups (5 fingerling and 1 yearling) have returned to date as two- and three-year-old fish (Table 4). The yearling group, 065327, has experienced the best returns to date, surpassing 0.23% through age 3. Fish from both release groups should return as four and five-year-olds in 2009 and 2010, respectively. No age two returns were estimated for any of the fingerling release groups and only 16 were estimated for the yearling group (Table 4).

2006 Brood Year

Five CWT groups (4 fingerling and 1 yearling) from the 2006 BY returned as two-year-olds during the 2008 season (Table 4). Age two return rates have been average so far, surpassing 2003 and 2005 returns for age two, but considerably less than 2004 returns through age two. Adult returns from these groups will occur over the next three years.

The 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 2008-09 run of spring Chinook was composed of 4,577 (372 grilse and 4,205 adult) fish of TRH origin. This represents 16.8% (372/2,218) of the grilse, 52.1% (4,205/8,065) of the adult run, and 44.5% (4,577/10,283) of the total run estimated upstream of JCW.

The fall run, upstream of WCW, was estimated to be composed of 8,585 (1,133 grilse and 7,452 adults) TRH-produced Chinook, which represents 37.3% (8,585/22,997) of the total estimated run. Hatchery produced fall Chinook were estimated to contribute 14.4% (1,133/7,856) of the two-year-olds (grilse) and 49.2% (7,452/15,141) of the adult run this season.

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 CWTd fish estimated to have spawned naturally are the remaining estimated number of fish after hatchery CWTs and estimated angler harvest are

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 2008-09 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													
065310	03	5	4.00	0	0	0	0	0	0	0	0	0	0
065311	03	5	4.03	1	4	0	0	1	4	0	0	1	4
065312	03	5	4.05	1	4	0	0	1	4	0	0	1	4
065317	03	5	4.16	0	0	0	0	0	0	0	0	0	0
065319	04	4	4.20	47	197	1	4	32	134	14	59	46	193
065320	04	4	4.20	49	206	1	4	33	139	15	63	48	202
065321	04	4	4.49	65	292	1	4	44	198	20	90	64	287
065326	04	4	4.14	591	2,447	12	50	402	1,664	177	733	579	2,397
065330	05	3	4.00	4	16	0	0	3	12	1	4	4	16
065331	05	3	4.00	1	4	0	0	1	4	0	0	1	4
065332	05	3	4.00	3	12	0	0	2	8	1	4	3	12
065333	05	3	4.05	62	251	1	4	42	170	19	77	61	247
065334	05	3	4.07	59	240	1	4	40	163	18	73	58	236
065335	05	3	4.39	82	360	2	9	56	246	24	105	80	351
065342	05	3	4.00	13	52	0	0	9	36	4	16	13	52
065343	05	3	4.00	7	28	0	0	5	20	2	8	7	28
065344	05	3	4.00	1	4	0	0	1	4	0	0	1	4
065345	05	3	4.00	3	12	0	0	2	8	1	4	3	12
065346	05	3	4.00	19	76	0	0	13	52	6	24	19	76
Total adults:				1,008	4,205	19	79	687	2,866	302	1,260	989	4,126
Grilse													
065347	06	2	4.19	15	63	1	4	9	38	5	21	14	59
065348	06	2	4.23	15	63	1	4	9	38	5	21	14	59
065349	06	2	4.13	10	41	1	4	6	25	3	12	9	37
065360	06	2	4.01	51	205	3	12	30	120	18	72	48	192
Total grilse:				91	372	6	25	54	221	31	127	85	348
Fall-run chinook salmon													
Adults													
065293	03	5	4.07	0	0	0	0	0	0	0	0	0	0
065294	03	5	4.07	0	0	0	0	0	0	0	0	0	0
065313	03	5	4.08	0	0	0	0	0	0	0	0	0	0
065314	03	5	4.01	0	0	0	0	0	0	0	0	0	0
065315	03	5	4.00	0	0	0	0	0	0	0	0	0	0
065316	03	5	4.00	0	0	0	0	0	0	0	0	0	0
065318	03	5	4.01	0	0	0	0	0	0	0	0	0	0
065322	04	4	4.10	89	365	2	8	46	189	41	168	87	357
065323	04	4	4.06	103	418	2	8	53	215	48	195	101	410
065324	04	4	4.05	91	369	2	8	47	190	42	170	89	360
065325	04	4	4.14	101	418	2	8	52	215	47	195	99	410
065327	04	4	4.31	721	3,108	13	56	373	1,608	335	1,444	708	3,051
065328	04	4	4.20	6	25	0	0	3	13	3	13	6	25
065329	04	4	4.20	2	8	0	0	1	4	1	4	2	8.4
065336	05	3	4.71	15	71	0	0	8	38	7	33	15	71
065337	05	3	4.04	50	202	1	4	26	105	23	93	49	198
065338	05	3	4.25	27	115	1	4	14	60	12	51	26	111
065339	05	3	4.03	35	141	1	4	18	73	16	64	34	137
065340	05	3	4.44	8	36	0	0	4	18	4	18	8	36
065341	05	3	4.17	522	2,177	10	42	270	1,126	242	1,009	512	2,135
Total adults:				1,770	7,452	34	143	915	3,852	821	3,457	1,736	7,309
Grilse													
065350	06	2	4.24	63	267	2	8	34	144	27	114	61	259
065351	06	2	4.21	53	223	1	4	29	122	23	97	52	219
065352	06	2	4.18	35	146	1	4	19	79	15	63	34	142
065353	06	2	4.00	42	168	1	4	23	92	18	72	41	164
065361	06	2	4.05	81	328	2	8	44	178	35	142	79	320
Total grilse:				274	1,133	7	29	149	616	118	488	267	1,104

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.

subtracted from the overall CWT estimate. Return rates are also affected by ocean and in-river harvest below the weir sites, which is not included in our estimates. Thus, harvest rates in these sectors can greatly affect river returns upstream of respective weir sites in any given year.

Two other potential biases that could distort our CWT run-size estimates are vulnerability of capture and run-timing. 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.

In-river spring Chinook return rates of fingerling releases for the 2003 BY were approximately 25% of the 18 year average (0.12% vs. 0.54%) and the fifth lowest observed in our data set (Appendix 1). Spring Chinook yearling releases for the same 2003 BY returned at rate one third of the long term average (0.32% vs. 1.11%), but more than double the rate estimated for fingerling release types (Appendix 1).

Fall Chinook 2003 BY releases experienced similar patterns of return as their spring Chinook counterparts. Fall Chinook yearling releases returned at a rate almost ten times (0.42% vs. 0.05%) their fingerling released siblings (Appendix 2). Return rates for both fingerling and yearling releases were substantially less than the long term averages (Appendix 2).

The contribution of hatchery-produced Chinook to total run-size was an estimated 44.5% of the spring Chinook run upstream of Junction City weir (Appendix 3), the fourth lowest since 1991. The contribution of hatchery-produced fall Chinook to total run-size, upstream of Willow Creek weir, was estimated at 37.3% (Appendix 4), the third lowest observed 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 obviously either hatchery fish performed poorly or wild fish survived reasonably well, compared to their hatchery counterparts.

Run-size estimates may have potential bias (see Task I), 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 2009-10.
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 IV) in the upper Trinity River to evaluate straying of TRH produced fish.

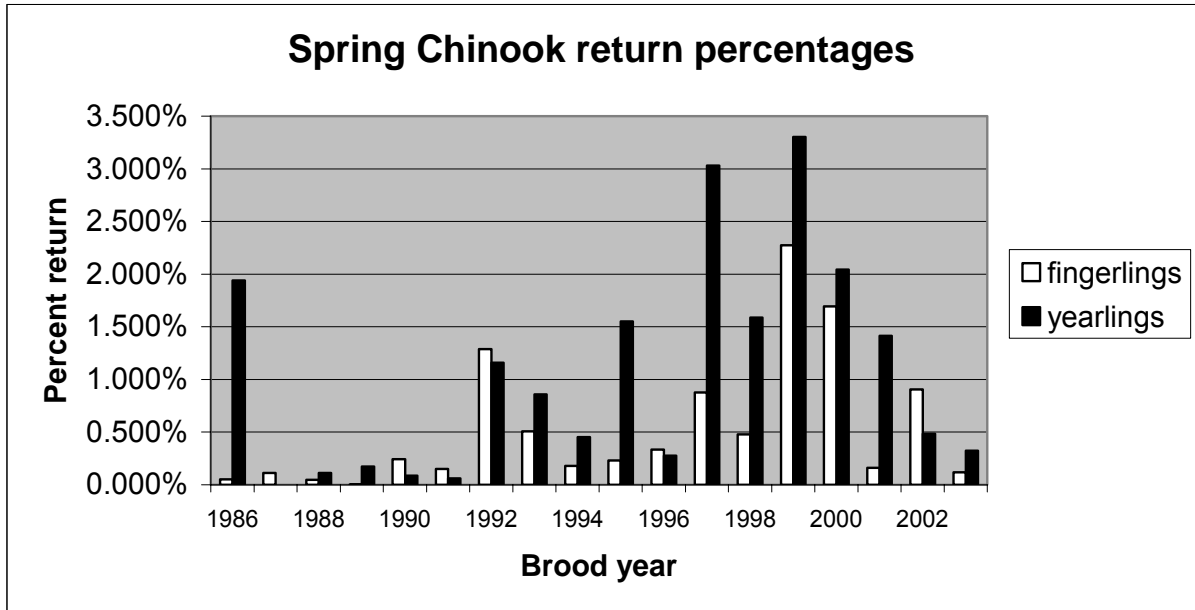
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Appendix 1. Percent return of Trinity River Hatchery produced, coded-wire tagged, spring-run Chinook salmon, brood years 1986-2003. a/

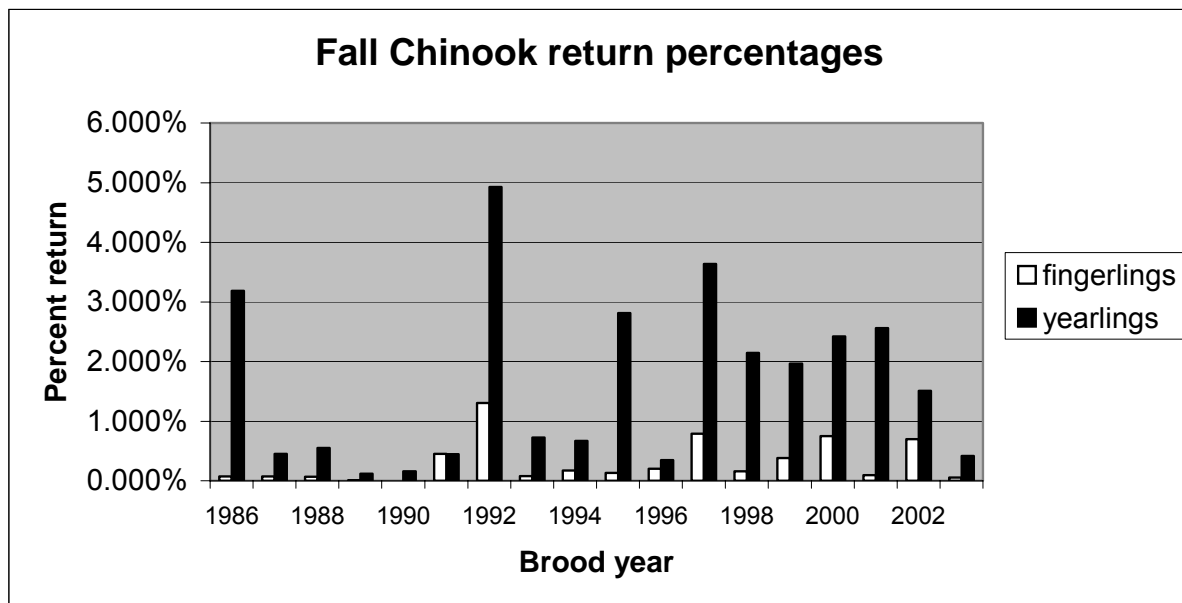
Brood year	Fingerling releases			Yearling releases		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	197,113	103	0.052%	101,030	1,960	1.940%
1987	185,718	208	0.112%	---	---	---
1988	181,698	84	0.046%	98,820	112	0.113%
1989	186,413	7	0.004%	102,555	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%
Means:	204,160	1,104	0.54%	111,011	1,314	1.11%



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 or in-river harvest below Junction City Weir.

Appendix 2. Percent return of Trinity River Hatchery produced, coded-wire tagged, fall-run Chinook salmon, brood years 1986-2003. a/

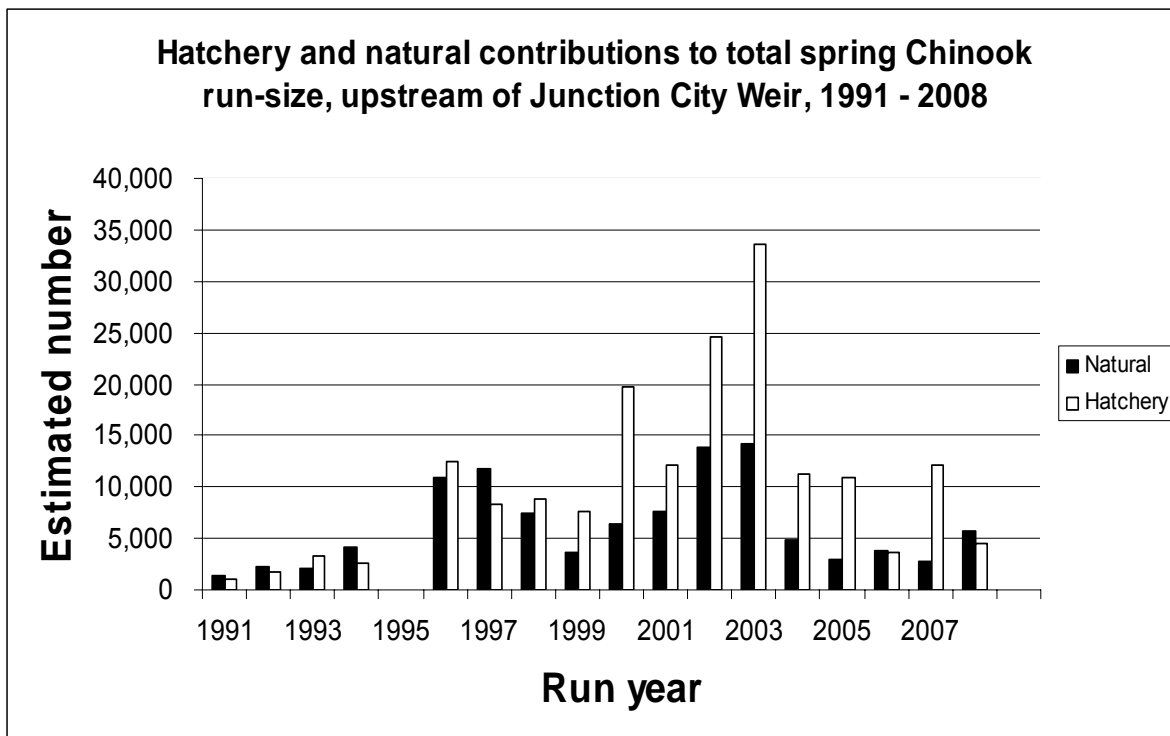
Brood year	Fingerling releases			Yearling releases		
	Number released	Number of returns	Percent return	Number released	Number of returns	Percent return
1986	393,955	292	0.074%	153,700	4,899	3.187%
1987	172,980	129	0.075%	92,300	418	0.453%
1988	194,197	138	0.071%	143,934	796	0.553%
1989	201,622	21	0.010%	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%
Means:	285,947	954	0.32%	175,619	3,191	1.61%



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

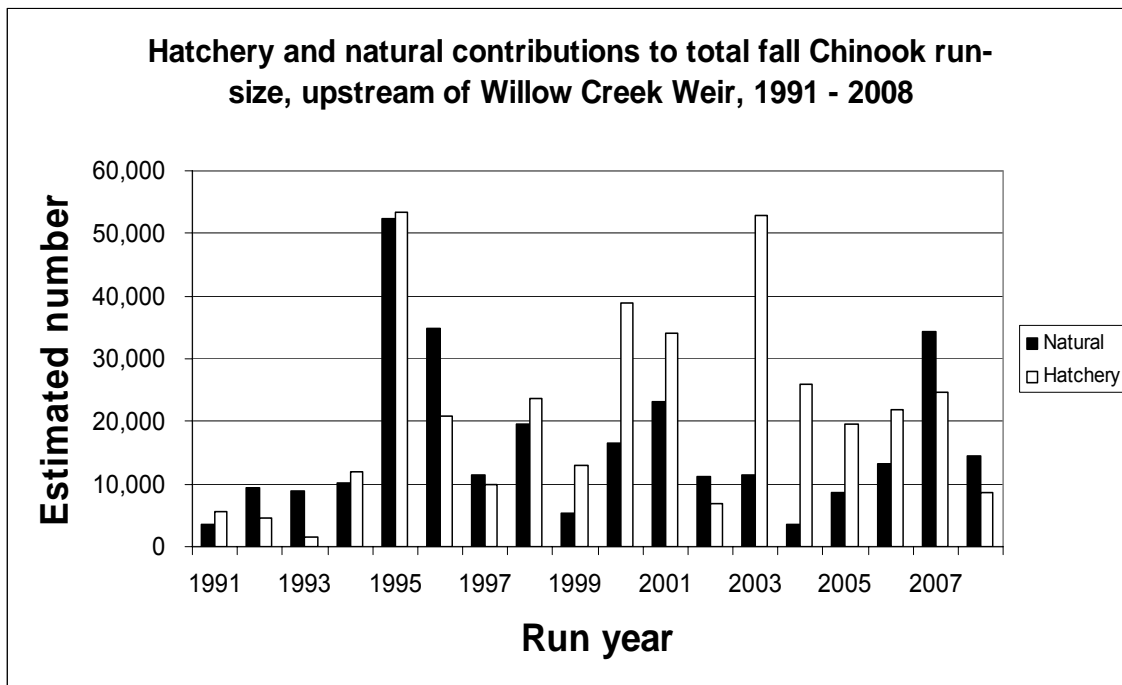
Appendix 3. Estimated contributions of Trinity River Hatchery-produced, spring-run chinook salmon, to total estimated run-size above Junction City weir, 1991-2008 seasons.

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	
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%
Means:	16,710	10,496	6,214	58.8%



Appendix 4. Estimated contributions of Trinity River Hatchery-produced, fall-run chinook salmon, to total estimated run-size above Willow Creek weir, 1991-2008 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%
Means:	37,214	20,979	16,235	53.9%



**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2008-2009 SEASON**

**TASK 3
SURVIVAL AND SPAWNER ESCAPEMENTS MADE BY COHO
SALMON PRODUCED AT TRINITY RIVER HATCHERY**

by

Wade Sinnen and John Hileman

ABSTRACT

Project personnel effectively marked 457,478 yearling coho salmon (*Oncorhynchus kisutch*) from the 2007 brood year (BY) with a right maxillary (RM) clip prior to their release from Trinity River Hatchery (TRH) in March of 2009. These fish are expected to return as two and three-year-old fish during the 2009-10 and 2010-11 seasons respectively.

An estimated 9,983 coho salmon returned to the Trinity River, upstream of the Willow Creek Weir (WCW), during the 2008-09 season. We estimated the TRH-produced component (86.9%) of this run to be 8,671 fish. Spawning escapement of TRH-produced coho was divided between 4,820 fish which entered TRH and 3,851 fish estimated to have spawned outside of the hatchery facility.

TRH-produced coho from the 2005 brood year (age 3) are considered to have completed their life cycle this year. An estimated 6,884 grilse and adult coho from the 2005 brood year returned to the Trinity River basin, upstream of Willow Creek weir, the past two seasons. This represents 1.34% of the 511,961 marked coho yearlings released from TRH in March of 2006 (BY 2005). Estimated TRH-produced coho returns from the 2006 brood year are complete for age two returns only. An estimated 2,290 coho have returned thus far, representing 0.50% 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 a 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:

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

where, N_N = 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:

$$N_{\text{Escapement}} = N_{\text{Cohorun}} - H_{\text{coho}}$$

where, H_{coho} = 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:

$$N_{\text{Naturalescapement}} = N_{\text{Escapement}} - N_{\text{TRHescapement}}$$

where $N_{\text{Naturalescapement}}$ = the estimated number of coho salmon above Willow Creek weir estimated to have spawned in natural areas; and

$N_{\text{TRHescapement}}$ = 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

Staff personnel marked (RM clips) approximately 457,478 2007 BY coho, representing the 99.9% of the entire production at TRH. We began marking coho in late December, 2008 and finished in early March, 2009.

We performed a quality control check to determine our clipping effectiveness for coho in each raceway on March 10-12, 2009. We measured and examined approximately 2% of the coho in each raceway. The percentage of coho with proper clips ranged from 99.8% to 100% and averaged 99.9% for the 10,065 fish examined. We also recorded 2,141 post-clip mortalities. Based on these data we estimate that 457,478 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 156 to 163 mm, FL. We estimate that 462 unmarked coho were released for a total release number of 457,940 fish. All BY 2007 coho were volitionally released from TRH March 16 - 23, 2009.

Table 1. Production, marking totals, and quality control data for 2007 brood year coho salmon reared at Trinity River Hatchery and released March 16 through March 23, 2009.

	Hatchery raceway							Totals
	G3-4	H1-2	H3-4	I1-2	I3-4	J1-2	J3-4	
Marking totals								
Number clipped	64,756	64,496	64,478	66,386	66,729	68,675	64,099	459,619
Post-clip mortalities	302	300	300	309	311	320	299	2,141
Total marked	64,454	64,196	64,178	66,077	66,418	68,355	63,800	457,478
Quality control parameters								
Number examined	1,365	1,324	1,312	1,365	1,368	1,830	1,501	10,065
Number without clips	1	2	3	0	1	1	2	10
Un-clipped ratio	0.000733	0.001511	0.002287	0.000000	0.000731	0.000546	0.001332	0.000994
Mean fork length (mm)	157.9	161.2	156.2	156.6	160.7	158.8	162.9	159.0
Fork length range (mm)	101-289	103-281	105-281	81-302	119-297	95-292	111-334	81-334
Release totals								
Clipped releases	64,454	64,196	64,178	66,077	66,418	68,355	63,800	457,478
Un-clipped releases	47	97	147	0	49	37	85	462
Percentage clipped	99.9%	99.8%	99.8%	100.0%	99.9%	99.9%	99.9%	99.9%
Total release	64,501	61,293	64,325	66,077	66,467	68,392	63,885	454,940

Contribution of TRH-produced coho to escapement and in-river sport fisheries

Total (natural and TRH-produced) coho run-size for the 2008-09 season, above WCW, was estimated at 9,983 fish (Task 1), of which 2,379 were grilse (age 2) and 7,604 were adults (age 3). Age classes were determined using length frequency analysis. The size separating grilse and adults was 52 cm FL (Task 1). Therefore all coho < 52 cm, FL were considered grilse and larger fish as adults.

The percentage of right maxillary-clipped (RM) coho observed at WCW was 96% (103/107) for grilse salmon and 84% (287/342) for adults. Based on this information the overall marked coho total observed at WCW for the 2007-08 season was 87% (390/449). Based on RM-clipped coho at WCW and recovery of Project-marked coho at TRH, we estimate that the 2008-09 coho run was composed of 1,312 naturally-produced fish and 8,671 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. Five tags were returned from coho caught by anglers reported as caught and released.

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 2008-09 return year.

					Spawning escapement	
Strata	BY ^{a/}	Age ^{b/}	Run-size	Angler harvest	TRH ^{c/}	Natural
Naturally	06	2	89	0	6	83
Produced	05	3	1,223	0	362	861
		Totals:	1,312	0	368	944
TRH	06	2	2,290	0	643	1,647
Produced	05	3	6,381	0	4,177	2,204
		Totals:	8,671	0	4,820	3,851
Grand totals:			9,983	0	5,188	4,795

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 2005, TRH-produced coho was

1.34% (Table 3). Coho from the 2005 BY have reached three years of age and are considered to have completed their life cycle. The estimated return of two-year-old 2006 BY coho was 0.50%. These fish will return during the 2009-10 season as three-year-olds.

Spawning escapement of 2005 BY, TRH-produced coho consisted of 4,447 (64.6%) fish that entered TRH and 2,437 (35.4%) fish estimated to have spawned in natural areas (Table 3).

Estimated escapement in 2008-09 of TRH-produced, two-year-old coho from the 2006 BY was 643 (28.1%) hatchery spawners and 1,647 (71.9%) 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 Willow Creek weir during the period 2007 through 2008.

Release Data						Estimated Returns					
Clip a/	Brood Year	Date	Number b/	Site	Age c/	Run-size	% of release	River harvest	Spawning Escapement		
									TRH d/	Natural	Total
RM	05	3/15- 20/07	511,961	TRH	2	503	0.098	0	270	233	503
					3	6,381	1.25	0	4,177	2,204	6,381
					Totals:	6,884	1.34	0	4,447	2,437	6,884
RM	06	3/16- 20/08	455,623	TRH	2	2,290	0.50	0	643	1,647	2,290

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 did trap trapped 449 coho, of which we effectively tagged 430 coho. The total coho run-size estimate of 9,982 fish, produced under Task 1 of this report, had confidence intervals (1-p=0.95) within 12 - 14% of the point estimate, which is one of the tightest estimates for our coho run

estimates. 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 in late November. However, we only trapped one coho the last week of operation and the catch curve was normally distributed through our trapping period. 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.

The percent return of 2005 BY coho, estimated at 1.34%, is the third lowest in-river return rate over the last twelve coho cohort cycles (Appendix 1). Return rates have ranged from a low of 0.98% for BY 2004 coho to a high of 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 318 coho in the main stem Trinity River (Task 4). Of these, 165 (51.9%) 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. The past twelve seasons of trapping data (years in which all TRH-produced coho have been 100% marked) have consistently shown that the marked percentage of coho observed at the weir has been substantial, 77 to 94% of the total observed (Appendix 2). This season we estimated that approximately 87% of the run was composed of TRH-produced coho.

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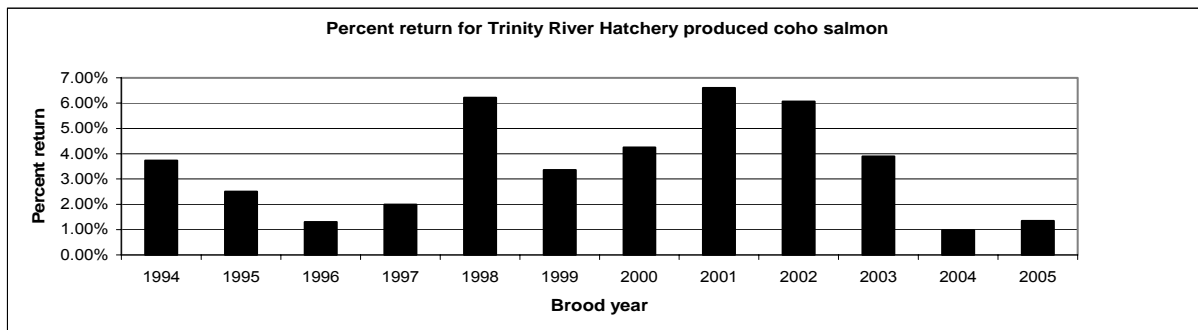
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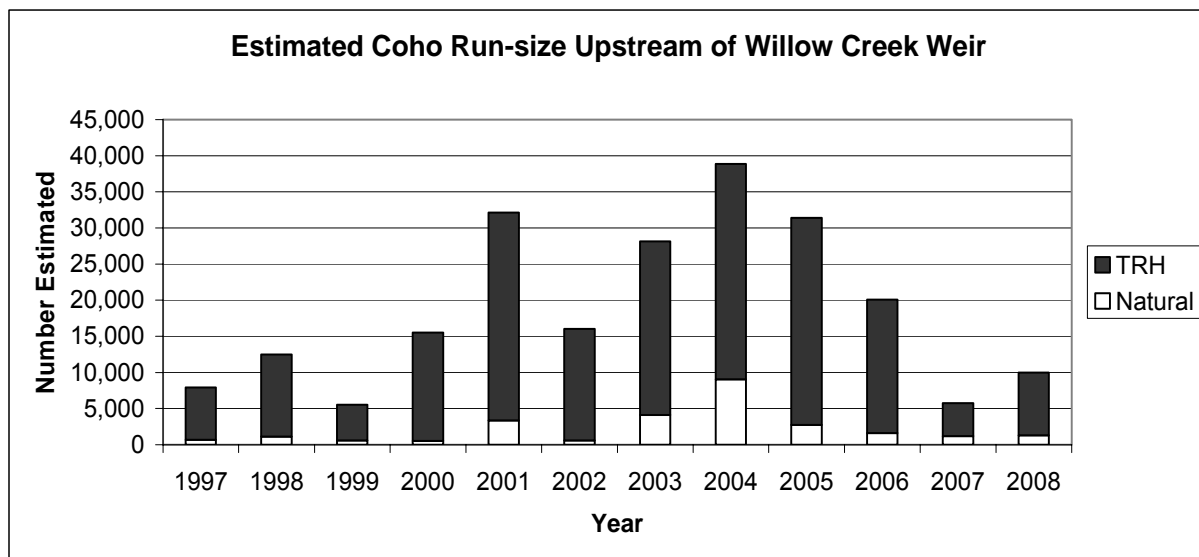
Appendix 1. Run-size, harvest and spawner escapement estimates for right maxillary clipped, Trinity River Hatchery-produced coho salmon returning to the Trinity River, upstream of Willow Creek weir, brood years 1994-2005.

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



Appendix 2. Naturally and Trinity River Hatchery-produced coho salmon run-size, in-river angler harvest and spawner escapement estimates for the Trinity River upstream of Willow Creek Weir for 1997-2008.

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



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**ANNUAL REPORT
TRINITY RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2008-09 SEASON**

**TASK 4
SALMON SPAWNER SURVEYS IN THE 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 16, 2008 to December 19, 2008. 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, 3,564 Chinook salmon (*Oncorhynchus tshawytscha*), 318 coho salmon (*Oncorhynchus kisutch*), 32 steelhead (*Oncorhynchus mykiss*), and 90 brown trout (*Salmo trutta*) were recovered.

This survey is focused on Chinook carcasses recovered throughout the spawning season included both spring-run (spring) and fall-run (fall) Chinook. Coded wire tag (cwt) recoveries from adipose-fin clipped Chinook indicate spring Chinook carcasses outnumbered fall carcasses until after Julian week 44 (ending November 3, 2008). With this Julian week separation, 993 spring Chinook carcasses were recovered and 2,571 fall Chinook carcasses were recovered. CWT recoveries also allow separation of two year old grilse from adults (greater than two years old), so 78.88% spring Chinook and 83.56% of the fall Chinook were adults. The recovery of these adipose-fin clipped Chinook carcasses indicated 10.27% of the spring and 11.12% of the fall carcasses observed in the main stem surveys were of hatchery origin. A Petersen mark-recapture model estimates the lowest in-river escapement of 11,002 Chinook salmon (3,065 spring and 7,937 fall). The Schaefer model provides the highest estimate of 13,885 Chinook salmon (3,869 spring and 10,016 fall).

The recovery of hatchery clipped coho salmon and adipose-clipped steelhead carcasses indicated 51.89% of recovered coho salmon carcasses and 31.25% steelhead carcasses were of hatchery origin. Adult coho salmon represented 96.45% 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 (USFWS) conducted a carcass and redd survey in the main stem Trinity River. The survey was funded through the Trinity River Restoration Program (TRRP). The U.S. Forest Service (USFS) also participated in the survey using internal funding. USFS participation was limited to enumerating redds in the uppermost reach (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 compare estimated in-river spawning from year to year.

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 16, 2008 and December 19, 2008. Two rafting teams consisting of CDFG and YTFP 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 107.7)
9	Big Flat Launch (RKM 107.7)	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 (RKM 41.7)
13	Camp Kimtu (RKM 41.7)	Rolands Bar (RKM 20.6)
14	Rolands Bar (RKM 20.6)	Weitchpec (Trinity mouth RKM 0)

Surveys were conducted using 12-ft NRS™ Otter and 12-ft Maravia™ 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.

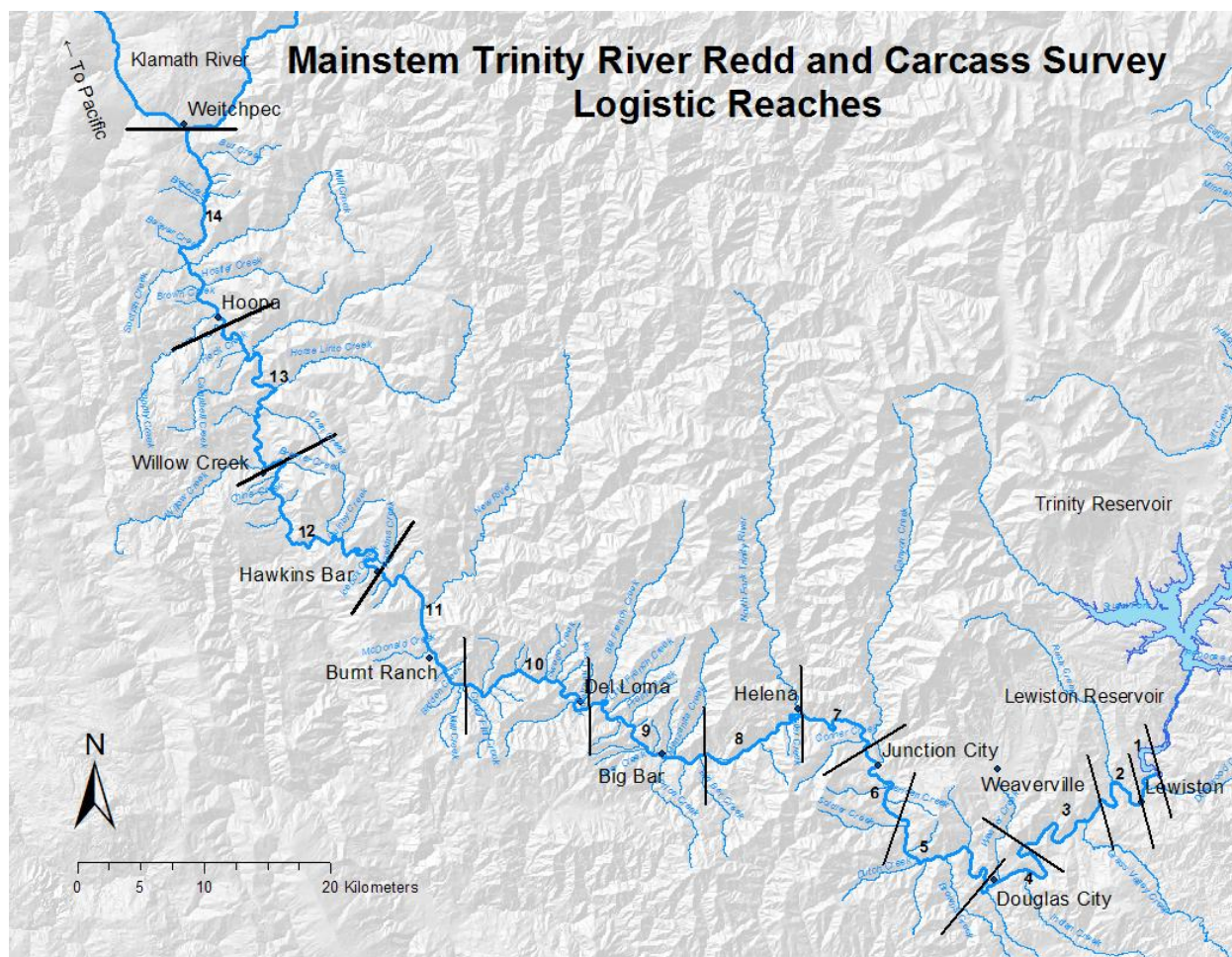


Figure 1. Survey reaches for 2008 Trinity River main stem spawner survey. Map courtesy of USFWS.

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 run timing, a date separating the two races is determined based on two factors. First, some of the Chinook carcasses recovered during the survey contain 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. Second, a portion of the carcasses recovered have been marked with spaghetti tags at CDFG fish trapping weirs located near the towns of Junction City and Willow Creek. Race was assigned to each spaghetti tagged fish based on the time they were captured and tagged at the weirs. The week separating spring and fall Chinook runs was established when the percentage of fall Chinook recoveries (based on CWT and tags from weir recaptures) 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 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 tag 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 project tags (spaghetti and floy 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 CWT's 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 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):

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

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

RESULTS

Spring/ Fall Chinook Separation

From CWT extraction of adipose-fin clipped carcasses, the only overlap of spring and fall Chinook runs occurred during Julian week 45. Spring Chinook carcasses were predominant through Julian week 43 (October 21, 2008 to October 27, 2008), 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).

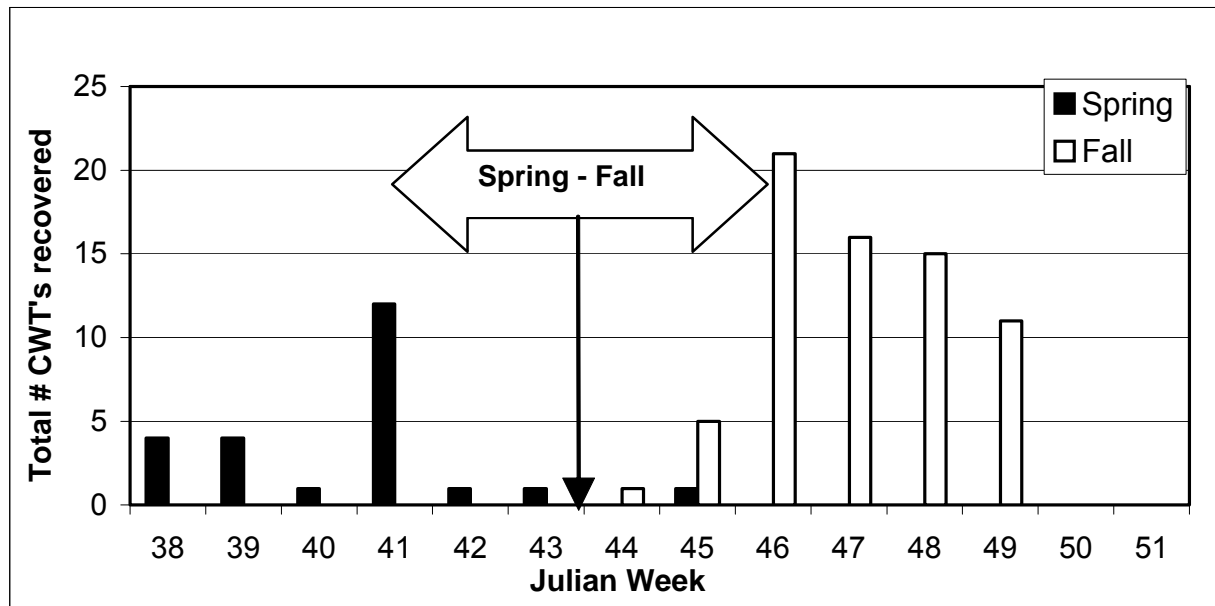


Figure 2. Weekly recoveries of coded-wire tagged spring and fall Chinook recovered in 2008 Trinity River spawner survey.

Temporal Carcass Distribution

A total of 3,564 Chinook carcasses were encountered during the survey. Recovery of Chinook carcasses peaked during Julian week 46 (November 11, 2008 to November 17, 2008) where 511 carcasses were counted. The first coho salmon carcass was recovered during Julian week 39 (September 23, 2008 to September 29, 2008). A total of 318 coho salmon carcasses were recovered during the survey with peak recovery number of 97 during Julian week 49 (December 2, 2008 to December 8, 2008) (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.

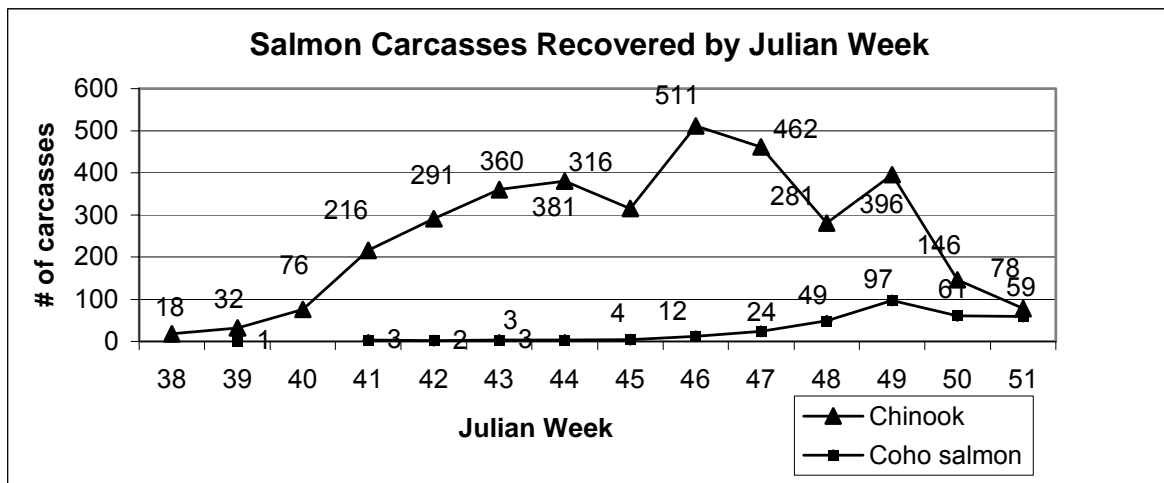


Figure 3. Chinook and coho salmon carcasses collected by Julian week during the 2008 Trinity River main stem spawner survey.

Carcass Distribution

A total of 3,564 Chinook carcasses were recovered during Julian weeks 38 to 51 (September 16, 2008 to December 19, 2008) in the 14 survey sections (Table 2). Of the 3,564 Chinook carcasses encountered, 1,775 (49.80%) were recovered in sections 1 and 2, 30.58% of the carcasses were recovered in reach 1 alone. Reach 8 had the fewest carcasses (17) and 25.11% of encountered carcasses were downstream of reach 5 (Table 2).

Table 2. Recovery of all Chinook salmon by Julian week and section during 2008 main stem Trinity River spawner survey.

Section	Number of surveys	Julian week of Chinook recovery														Section Totals
		38	39	40	41	42	43	44	45	46	47	48	49	50	51	
1	14	5	11	26	82	50	53	51	78	224	180	136	120	53	21	1090
2	13	5	7	15	51	59	44	72	76	138	101	60	47	ns	10	685
3	13	3	7	14	38	25	45	48	35	ns	31	16	24	22	7	315
4	13	3	4	13	25	49	55	64	55	48	14	0	11	14	0	355
5	11	1	1	3	19	34	41	51	25	20	11	0	18	0	0	224
6	13	1	0	4	0	56	88	24	33	21	23	8	3	0	0	261
7	13	0	0	1	0	12	29	25	9	30	0	23	0	3	0	132
8	8	0	0	0	0	1	1	5	0	0	0	7	0	3	0	17
9	7	0	0	0	0	3	0	20	0	16	23	0	0	19	0	81
10	7	0	0	0	0	2	0	21	0	10	0	30	0	14	0	77
12	9	0	0	0	0	0	0	0	5	4	47	0	76	18	0	150
13	7	0	2	0	1	0	2	0	0	0	23	0	85	0	28	141
14	7	0	0	0	0	0	2	0	0	0	9	1	12	0	12	36
Totals	135	18	32	76	216	291	360	381	316	511	462	281	396	146	78	3,564

Redd Distribution

Similar to carcass recovery, Chinook redds were encountered most frequently in section 1 with a total of 4,116 redds enumerated during the 2008 survey (Table 3). A total of 1,412 redds were enumerated in section 1, approximately half (34.31%) of the total (1,412/4,116) for all sections combined. The fewest redds (19) were observed in section 8. Peak redd enumeration occurred during Julian week 47 when 504 redds were counted.

Table 3. Summary of weekly redd enumeration from main stem Trinity River 2008 survey. a/

Julian Week																Grand Total
Reach	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
01	20	58	118	143	75	50	85	111	178	167	160	149	53	28	17	1,412
02			14	21	12	70	25	25	24	52	53	39	49		15	399
03		2	10	21	64	38	30	45	20		37	54	43	30		394
04		3	15	4	82	37	45	41	29	33	7		22	37		355
05			3	27	56	42	42	56	10	18	6		24			284
06			2	27		67	26	4	19							145
07				14		32	36	22	2	5						111
08						12		15		2						29
09				1		59		56		14	5			7		142
10				1		35		42		10		10		2		100
11																
12							12	5	14	41	125		65	42		304
13							3	6		59	77	50	53	27	62	337
14							2	4			34	15	31	10	8	104
Grand Total	20	63	162	259	289	442	306	432	296	401	504	317	340	183	102	4,116

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

Spring Chinook

A total of 993 Chinook carcasses were classified as spring-run during the survey, of which 403 were classified as condition-one (Table 4). Spring Chinook carcass recovery by reach ranged from 227 in reach 1 to zero in reach 12. Spring Chinook carcass density was greatest in reach 1 at 68.79 fish/km and dropped considerably to 25.49 fish/km in reach 2.

Table 4. Number, density, incidence of ad-clips, project tags, and condition of spring Chinook recovered during the 2008 main stem Trinity River spawner survey. 1/

Reach	Length (km)	Number observed	Density (fish/km)	C-1 ₂	C-2 ₃	Adipose Clips		Project tags	
						Total ₅	C-1 ₂	Total ₄	C1
1	3.3	227	68.79	80	140	19	12	1	1
2	7.1	181	25.49	58	117	4	3	3	1
3	10.9	132	12.11	50	69	1	1	3	1
4	10.8	149	13.80	56	87	2	1	1	0
5	14.7	99	6.73	44	54	0	0	3	2
6	8.6	149	17.33	76	72	0	0	2	1
7	8.9	42	4.72	28	14	0	0	1	1
8	10.8	2	0.19	2	0	0	0	0	0
9	13.8	3	0.22	2	1	0	0	0	0
10	14.7	2	0.14	2	0	0	0	0	0
12	22.4	0	0.00	0	0	0	0	0	0
13	21.1	5	0.24	3	2	0	0	1	1
14	21.3	2	0.09	2	0	0	0	0	0
Total	103.6	993	9.58	403	556	26	17	15	8

1/All Chinook recovered prior to Julian week 44 (Oct.28 – Nov.3) were considered spring Chinook.

2/Condition-1 fish are those with at least one clear eye and considered to have died within one week.

3/Condition-2 fish are those with both eyes cloudy and considered to have died more than one week prior to recovery.

4/Adipose clipped Chinook salmon presumed to contain CWT.

5/Spaghetti tags applied at Willow Creek and Junction City weirs.

Fall Chinook

A total of 2,571 Chinook carcasses were classified as fall-run during the survey, of which 558 were classified as condition-one (Table 5). Fall Chinook carcass recovery by reach ranged from 863 in reach 1 to 15 in reach 8. Fall Chinook carcass density was greatest in reach 1 at 261.52 fish/km and dropped considerably to 70.99 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 2008 main stem Trinity River spawner survey. 1/

Reach	Length (km)	Number observed	Density (fish/km)			Adipose Clips		Project tags	
				C-1 ₂	C-2 ₃	Total ₄	C1 ₂	Total ₅	C1 ₂
1	3.3	863	261.52	188	597	71	29	38	13
2	7.1	504	70.99	66	374	14	4	16	0
3	10.9	183	16.79	34	117	3	2	4	2
4	10.8	206	19.07	41	136	1	1	8	2
5	14.7	125	8.50	32	81	0	0	11	3
6	8.6	112	13.02	36	53	0	0	4	1
7	8.9	90	10.11	36	46	0	0	3	2
8	10.8	15	1.39	5	2	0	0	2	0
9	13.8	78	5.65	20	34	0	0	3	0
10	14.7	75	5.10	26	48	0	0	2	1
12	22.4	150	6.70	36	111	0	0	2	2
13	21.1	136	6.45	22	112	0	0	0	0
14	21.3	34	1.60	16	17	0	0	0	0
Total	168.4	2,571	15.27	558	1,728	89	36	93	26

1/All Chinook recovered after to Julian week 45 (Nov.4 – Nov.10) were considered fall Chinook.

2/Condition-1 fish are those with at least one clear eye and considered to have died within one week.

3/Condition-2 fish are those with both eyes cloudy and considered to have died more than one week prior to recovery.

4/Adipose clipped Chinook salmon presumed to contain CWT.

5/Spaghetti tags applied at Willow Creek and Juntion City weirs.

Coho salmon

A total of 318 coho salmon carcasses were recovered during the survey, of which 94 were classified as condition-one (Table 6). The first coho was recovered during Julian week 39 with peak recovery during Julian week 49 (December 2, 2008 to December 8, 2008). Coho carcass recovery by reach ranged from 154 (48.43%) in reach 1 to zero in reaches 10 and 14. Coho salmon carcass density was greatest in reach 1 (46.67 fish/km) and dropped considerably to 14.51 fish/km in reach 2. Coho salmon carcass density downstream from reach 3 was less than 3 fish per kilometer.

Table 6. Number, density, incidence of right maxillary (RM) clips, project tags, and condition of coho salmon recovered during the 2008 main stem Trinity River spawner survey.

Reach	Length (km)	Number observed	Density (fish/km)	C-1 ₁	C-2	Right Max Clip		Project tags	
						Total ₃	C1 ₁	Total ₄	C1 ₁
1	3.3	154	46.67	44	109	97	19	4	3
2	7.1	103	14.51	21	76	48	8	3	1
3	10.9	27	2.48	10	14	16	5	2	1
4	10.8	8	0.74	5	3	3	1	0	0
5	14.7	4	0.27	2	2	1	0	0	0
6	8.6	8	0.93	4	4	0	0	0	0
7	8.9	4	0.45	2	2	0	0	0	0
8	10.8	1	0.09	0	1	0	0	0	0
9	13.8	5	0.36	2	3	0	0	0	0
10	14.7	0	0.00	0	0	0	0	0	0
12	22.4	1	0.04	1	0	0	0	0	0
13	21.1	3	0.14	3	0	0	0	0	0
14	21.3	0	0.00	0	0	0	0	0	0
Total	168.4	318	66.69	94	214	165	33	9	5

1/Condition-1 fish are those with at least one clear eye and considered to have died within one week.

2/Condition-2 fish are those with both eyes cloudy and considered to have died more than one week prior to recovery.

3/ Right maxillary (RM) clipped coho salmon

4/Spaghetti tags applied at Willow Creek and Junction City weirs.

Steelhead and Brown Trout

A total of 32 steelhead carcasses and 90 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 reaches 2, 3 and 4, and project tags only turned up in reaches 5 and 6. For the first time a brown trout was observed in reach 1.

Table 7. Number, density, incidence of adipose clips, and project tags recovered during the 2008 main stem Trinity River spawner survey.

Reach	Length (km)	Steelhead				Brown Trout		
		Number Observed	Density (fish/km)	Adipose Clip ₁	Project Tags ₂	Number Observed	Density (fish/km)	Project Tags ₂
1	3.3	11	3.33	7	0	1	0.3	0
2	7.1	1	0.14	0	0	17	2.39	0
3	10.9	0	0	0	0	29	2.66	0
4	10.8	1	0.09	1	0	11	1.02	0
5	14.7	3	0.2	0	0	14	0.95	1
6	8.6	8	0.93	2	0	3	0.35	1
7	8.9	3	0.34	0	0	8	0.9	0
8	10.8	2	0.19	0	0	3	0.28	0
9	13.8	0	0	0	0	2	0.14	0
10	14.7	0	0	0	0	1	0.07	0
12	22.4	2	0.09	0	0	0	0	0
13	21.1	0	0	0	0	1	0.05	0
14	21.3	1	0.05	0	0	0	0	0
Total	168.4	32	0.19	10	0	90	0.53	2

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 that were measured are 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 and fall Chinook and coho salmon was determined using length frequency analysis of fish trapped at WCW, JCW and TRH. For additional information regarding grilse and adult fork length separation see Task 1 of this report.

Spring Chinook

Fork lengths of spring Chinook (n = 961 averaged 74.7 cm. and ranged between 34-120 cm (Figure 4). Grilse (FL < 55 cm) accounted for 12.12% (203/961) of the measured spring Chinook.

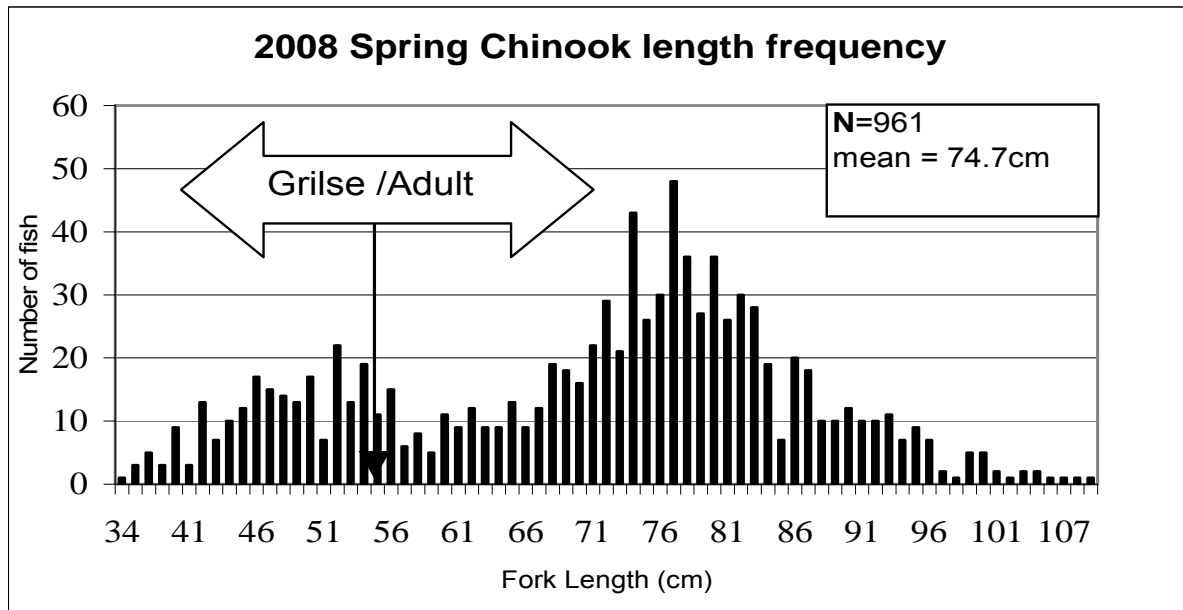


Figure 4. Length frequency histogram for all condition 1 and 2 spring Chinook measured during the 2008 main stem Trinity spawner survey.

Fall Chinook

Fork lengths obtained from fall Chinook ($n = 2,323$) averaged 74.5 cm and ranged between 33-113 cm (Figure 5). Grilse (FL <58 cm) accounted for 16.44% (382/2,323) of measured fall Chinook.

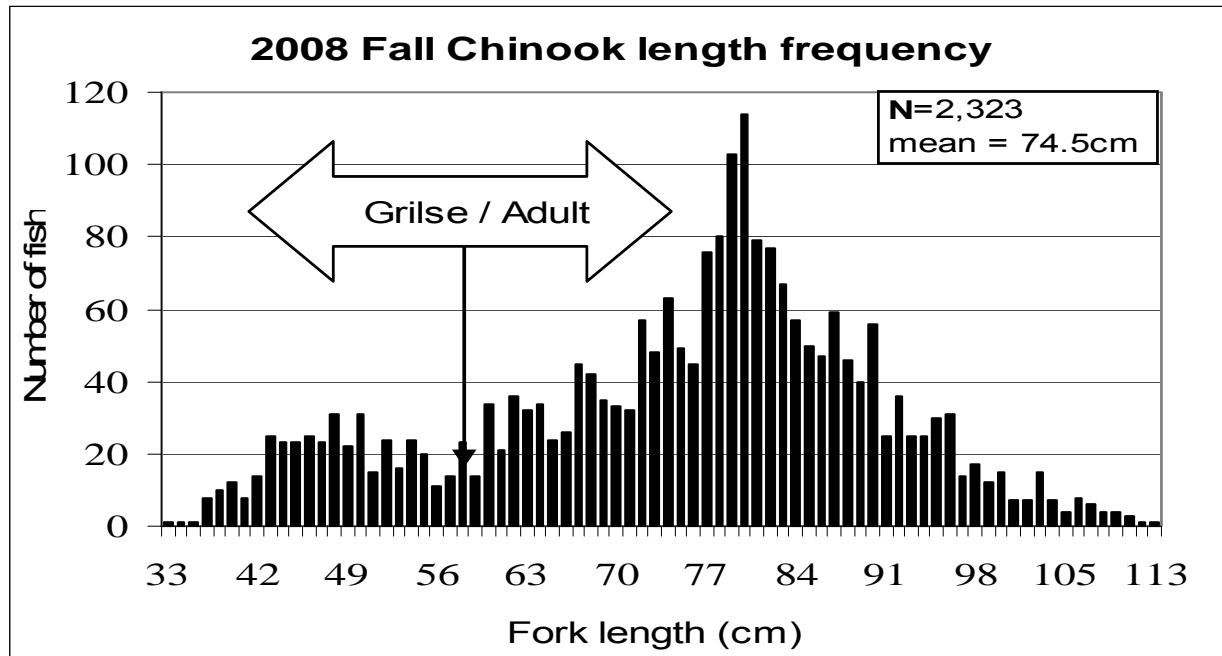


Figure 5. Length frequency histogram for all condition 1 and 2 fall Chinook measured during the 2008 main stem Trinity River spawner survey.

Coho salmon

Fork lengths of coho salmon (n = 310) averaged 67.7 cm and ranged from 33-92 cm. (Figure 6). Grilse (FL < 52 cm) accounted for 3.55% (11/318) of measured coho salmon.

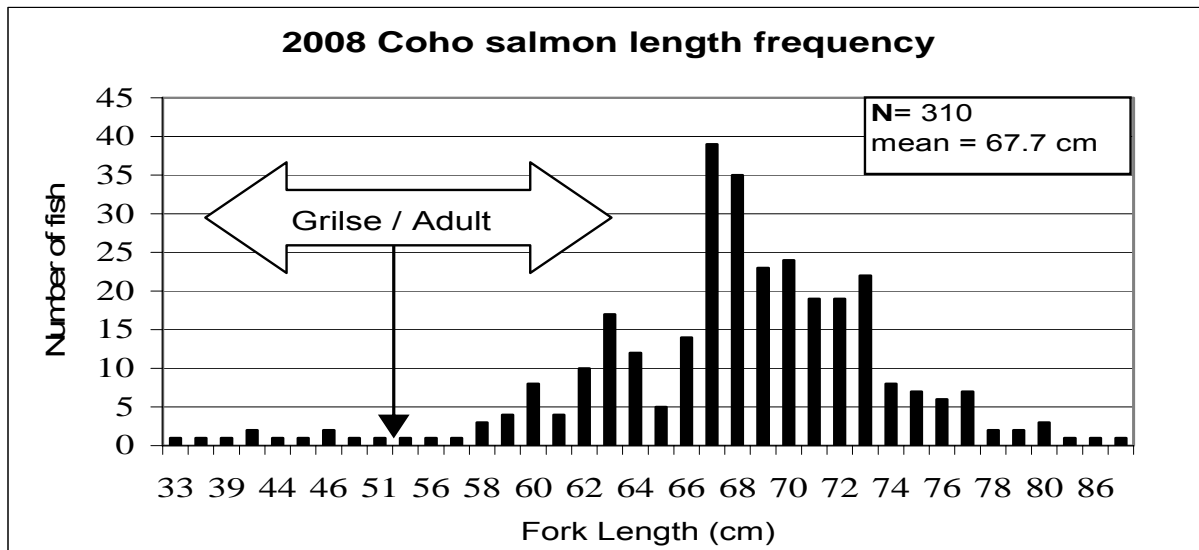


Figure 6. Length frequency histogram for all condition 1 and 2 coho salmon measured during the 2008 main stem Trinity River spawner survey.

Adult Sex Composition and Female Pre-Spawn Mortality

Spring Chinook

Of the spring Chinook recovered that were sexed 510 were sexed as males and 464 as females, a male to female ratio of 1.10:1 (Table 8). Gender was indiscernible on 40 fish due to advanced decomposition. Forty (8.62%) of the 464 female spring Chinook carcasses evaluated were determined to be pre-spawn mortalities. Grilse were included from these totals.

Table 8. Male to Female Ratio and Prespawn Mortality of spring Chinook during 2008 main stem Trinity River spawner survey by reach.

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	227	84	139	17	4	0.60	12.23%
2	181	92	86	13	3	1.07	15.12%
3	132	74	57	2	1	1.30	3.51%
4	149	84	63	3	2	1.33	4.76%
5	99	56	43	2	0	1.30	4.65%
6	149	84	57	0	8	1.47	0.00%
7	42	32	10	0	0	3.20	0.00%
8	2	1	1	0	0	1.00	0.00%
9	3	0	3	0	0	0.00	0.00%
10	2	2	0	0	0	0.00	0.00%
12	0	0	0	0	0	0.00	0.00%
13	5	1	3	2	1	0.33	66.67%
14	2	0	2	1	0	0.00	50.00%
Total	993	510	464	40	19	1.10	8.62%

Fall Chinook

Of the 2,571 Chinook that were sexed; 1,141 were sexed as males and 1,256 were sexed as females, for a male: female ratio of 0.91:1 (Table 9). Gender was indiscernible on 174 fish due to advanced decomposition. Seventy (5.57%) of the 1,256 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 2008 main stem Trinity River spawner survey by reach.

Reach	Total Chinook	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	863	298	535	16	30	0.56	2.99%
2	504	278	195	10	31	1.43	5.13%
3	183	99	67	4	17	1.48	5.97%
4	206	103	92	4	11	1.12	4.35%
5	125	66	55	2	4	1.20	3.64%
6	112	37	43	5	32	0.86	11.63%
7	90	35	42	2	13	0.83	4.76%
8	15	5	5	2	5	1.00	40.00%
9	78	28	30	9	20	0.93	30.00%
10	75	36	33	10	6	1.09	30.30%
12	150	71	77	4	2	0.92	5.19%
13	136	64	69	1	3	0.93	1.45%
14	34	21	13	1	0	1.62	7.69%
Total	2,571	1,141	1,256	70	174	0.91	5.57%

Coho salmon

Of the 318 coho salmon that were sexed; 126 were sexed as males and 176 were sexed as females, for a male: female ratio of 0.72: 1 (Table 10). Gender was indiscernible on 16 fish due to advanced decomposition. Twenty two (12.50%) of 176 female coho salmon carcasses examined were determined to be pre-spawn mortalities.

Table 10. Male to female ratio and prespawn mortality of coho salmon during 2008 main stem Trinity River spawner survey by reach.

Reach	Total Coho	Males	Females	Unspawned Females	Unknown Gender	Males per Female	Prespawn Mortality (Females)
1	154	57	96	10	1	0.59	10.42%
2	103	42	56	5	5	0.75	8.93%
3	27	11	13	2	3	0.85	15.38%
4	8	3	5	1	0	0.60	20.00%
5	4	2	2	1	0	1.00	50.00%
6	8	6	0	0	2	0.00	0.00%
7	4	3	0	0	1	0.00	0.00%
8	1	0	1	1	0	0.00	100.00%
9	5	2	3	2	0	0.67	66.67%
10	0	0	0	0	0	0.00	0.00%
12	1	0	0	0	1	0.00	0.00%
13	3	0	0	0	3	0.00	0.00%
14	0	0	0	0	0	0.00	0.00%
Total	318	126	176	22	16	0.72	12.50%

Incidence of Hatchery Produced Chinook and Coho Salmon

Spring Chinook

During the spring-run period, 4.22% (17/403) of condition-one and 2.62% (26/993) of all spring Chinook bore ad-clips. Observed ad-clip rates in reaches 1 and 2 for spring Chinook were 3.72% (15/405; condition 1) and 2.32% (23/993; all carcasses). Downstream of reach 2 ad-clip rates were 0.74% (3/403; condition 1) and 0.20% (2/993; all carcasses) (Table 4). Coded wire tags were recovered from 24 of the 26 ad-clipped Chinook encountered during the spring Chinook recovery period, of which all but one were actually spring-run fish. During the period associated with the spring-run, 2 ad-clipped Chinook were recovered in which no CWTs were found. The majority of CWTs were represented by the 2004 spring-run fingerling release group (n=11, 47.83%). All other CWTs were represented by 2004 brood year spring-run yearling (n=7, 30.43%) 2005 brood year spring-run fingerling (n=4, 17.39%), and 2003 brood year yearling release groups (n=1, 4.35%).

Based on expansion of all CWT codes recovered during the spring period, an estimated 102 (10.27%) of the total 993 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 79.4% age 4, 16.5% age 3, and 4.1% age 5 (Table 11).

Fall Chinook

During the fall-run period, 6.45% (36/558) of the condition one and 3.46% (89/2,571) of all fall Chinook bore ad-clips (Table 5). Observed ad-clip rates in reach 1 and 2 for fall Chinook were 12.99% (33/558; condition 1) and 6.22% (85/2,571; all carcasses). CWT's were observed in only two other reaches, reaches three and four where ad-clip rates of 0.54% (3/558; condition 1) and 0.29% (4/993; all carcasses) were observed. No CWT's were observed in reaches 5 through 14. Coded wire tags were recovered from 89 of the total Chinook encountered during the fall Chinook recovery period; all of which were fall Chinook. During the period associated with the fall-run, 20 ad-clipped Chinook were recovered in which no CWTs were found. The majority of CWTs during the fall-run recovery period were represented by age four, 2004 brood year fingerling releases (n=50; 72.46%). All other CWTs were represented by the following brood year groups; 2005 brood year yearlings (n=7, 10.15%), 2005 brood year fingerlings (n=6, 8.70%), 2006 brood year fingerling (n=3, 4.35%), and 2003 brood year fingerlings (n=1, 1.44%).

Based on expansion of all CWT codes recovered during the fall-run period, an estimated 286 (11.12%) of the total 2,571 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 5.7% age 2, 20.4% age 3, 72.5% age 4, and 1.4% age 5 (Table 11).

Coho salmon

During the course of the survey, 35.11% (n = 33) of condition-1 and 51.89% (n = 165) 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 51.890% of adult coho salmon recovered during the survey were of TRH origin.

Table 11. Release and recovery data for coded-were tagged, Trinity River Hatchery produced Chinook salmon, recovered during 2008 Trinity River spawner survey.

Release data					Recovery data				
			Release	Production	Recovery period				Expanded
CWT Code	Brood year	Age	type ₁	multiplier ₂	Spring	Fall	Total	% of subtotal	total
Spring Chinook									
65317	2003	5	Sy	4.1616	1		1	3.85	4.162
65319	2004	4	Sf	4.20282	2		2	7.69	8.406
65320	2004	4	Sf	4.2008	2		2	7.69	8.402
65321	2004	4	Sf	4.48686	7		7	26.92	31.408
65326	2004	4	Sy	4.14173	7	1	8	30.77	33.134
65333	2005	3	Sf	4.04924	1		1	3.85	4.049
65334	2005	3	Sf	4.07323	1		1	3.85	4.073
65335	2005	3	Sf	4.38751	2		2	7.69	8.775
No CWT recovered ₄					2		2	7.69	
				Subtotal:	25	1	26		102.408
65315	2003	5	Ff	4.00115		1	1	1.12	4.001
65322	2004	4	Ff	4.10472		11	11	12.36	45.152
65323	2004	4	Ff	4.05842		6	6	6.74	24.351
65324	2004	4	Ff	4.05173		5	5	5.62	20.259
65325	2004	4	Ff	4.13755		7	7	7.87	28.963
65327	2004	4	Ff	4.20284		21	21	23.60	88.260
65336	2005	3	Ff	4.70810		1	1	1.12	4.708
65337	2005	3	Ff	4.03683		4	4	4.49	16.147
65338	2005	3	Ff	4.25156		1	1	1.12	4.252
65339	2005	3	Ff	4.02679		1	1	1.12	4.027
65341	2005	3	Fy	4.17253		7	7	7.87	29.208
65351	2006	2	Ff	4.20807		1	1	1.12	4.208
65353	2006	2	Ff	3.98763		3	3	3.37	11.963
No CWT recovered ₄						20	20	22.47	
				Subtotal:	0	89	89		285.497
				Grand Totals:	25	90	115		387.905

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

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

3/ Spring Chinook recovery period was September 16, 2008 to October 27, 2008. Later recoveries were all considered Fall Chinook.

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

Incidence of Program Marked Salmon

Spring Chinook

A total of 15 project tags applied at the Junction City and Willow Creek weirs were recovered in survey reaches 1 through 14 (Table 4). This indicates that project tags were recovered on 1.51% (15/993) of all spring Chinook carcasses. No spring Chinook project tags were found on carcasses in reaches 4, 8 through 12, and reach 14. During the course of the survey, seven tags from the Junction City Weir and eight 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

A total of 93 project tags applied at Junction City and Willow Creek weirs were recovered during the survey (Table 5). This indicates that project tags were recovered on 3.62% (93/2571) of all fall Chinook carcasses. During the course of the survey, 89 tags from the Willow Creek Weir and 4 tags from the Junction City Weir were recovered after Julian week 43. Spaghetti tags were found in all reaches except 13 and 14, and 58% were found in reaches 1 and 2 (Table 5).

Coho Salmon

A total of nine project tags applied at the Willow Creek weir were recovered during the survey (Table 6). This indicates that project tags were recovered on 2.83% of all coho salmon observed. All of these were recovered above reach 4 during Julian weeks 47 through 51 with none found during Julian week 50.

Steelhead/Rainbow Trout

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

Brown Trout

Two project tags were found on brown trout carcasses during this survey, one found in reach 5 during Julian week 41, and one found in reach 6 during Julian week 48.

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 2008 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, 25.0% of Chinook were marked, and 32.3% of those fish were subsequently recaptured (Appendix 5). The upper section (reaches 1-5) had a slightly higher recapture rate (39.2%) than the survey as a whole (32.3%) (Appendices 5 & 6). The lower section (reaches 6-10) had a recapture rate of 18.7% that included 56 recovered carcasses (Appendix 6). Estimates could not be made for spring-run in the lower reaches due to low numbers of recaptures (nine 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 2008 Trinity River spawner survey.

Estimator	Reaches 1-5	Reaches 1-14	Reaches 1-5 (95% CI)	Reaches 1-14 (95% CI)
Peterson	6,794	11,002	650	1,001
Weekly Stratified Peterson	7,105	11,167	601	1,038
Schaefer	9,701	13,885	710	1,383
Schaefer with Law's adjustment	9,112	12,997	710	1,383

The different estimators produced estimates which range from 11,002 to 13,885 Chinook for the entire survey, and from 6,794 to 9,701 for the upper reaches 1-5 (Tables 12&13). Adding in the 95% confidence interval, the estimates ranged from 10,001 to 15,268 for the entire survey, and from 6,144 to 10,411 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 2008 Trinity River spawner survey above Junction City.

Above J.C. (reach 1-5)	Spring	Fall	Ratio of Spring to Fall Chinook
Petersen	2,006	4,788	0.419:1
Weekly stratified Petersen	2,098	5,007	
Schaefer	2,864	6,837	
Schaefer w/ Law's adjustment	2,690	6,421	

Estimates for the different runs in the entire survey ranged from 3,065 to 3,869 for spring Chinook and 7,937 to 10,016 for fall Chinook (Table 14). The estimates for the upper reaches ranged from 2,006 to 2,864 for spring Chinook and 4,288 to 6,837 for fall Chinook (Table 13). The results of the carcass survey indicate spring to fall Chinook ratios of 0.39:1 for the entire survey and 0.42:1 for the upper reaches (Tables 13 & 14).

Table 14. In-river escapement estimates for spring and fall Chinook collected during the entire 2008 Trinity River spawner survey.

Entire survey (reach 1-10)	Spring	Fall	Ratio of Spring to Fall Chinook
Petersen	3,065	7,937	0.386:1
Weekly stratified Petersen	3,111	8,056	
Schaefer	3,869	10,016	
Schaefer w/ Law's adjustment	3,621	9,375	

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 2008 season, crews recovered approximately the same number of total Chinook as fall Chinook alone during the 2007 season (Appendix 1). Coho salmon carcass numbers were also slightly lower than the 2005 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 declined downstream (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.

Adult Sex Composition and Female Pre-Spawn Mortality

For all races and species of salmon carcasses recovered on the upper Trinity, female adults outnumbered 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 are as follows: 1.10:1 for spring Chinook and 0.91:1 for fall Chinook.

Trinity River Chinook salmon pre-spawn mortalities for years when more than 100 females were examined have ranged from 1.0 to 63% for spring Chinook, and 0.7 to 43.7% for fall Chinook (Appendix 4). Pre-spawn mortality rates observed this year were 8.62 % for spring Chinook and 5.57 % 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 12.50%. 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; however, its use in this study showed it to be even more positively biased than the pooled Petersen as seen in tables 12 and 13.

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 one 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

(21.70%) were classified as condition one than spring Chinook carcasses (40.58%) (Tables 4 & 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 2008 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 CWT's 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 recovered by reach during the main stem Trinity River spawner survey 2000-2008.

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

Appendix 2. Total fall Chinook carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2008.

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

Appendix 3. Total coho salmon carcasses recovered by reach during the main stem Trinity River spawner survey 2000-2008.

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

Appendix 4. Salmon female prespawn mortality rates observed in the Trinity River spawner survey 1955 through 2008.

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	1,138	11	1.0	1,619	48	3.0	288	31	9.7
2007	Hill (2008)	915	74	7.5	2,158	185	7.9	3,073	259	7.8	97	11	10.2
2008	Current study	424	40	8.6	1,180	70	5.6	1,604	110	6.4	154	22	12.5

Appendix 5. Carcass mark recapture statistics and estimates observed on main stem Trinity River spawner surveys 2005 to 2008.

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

Appendix 6. Trinity River upper (reaches 1-5) and lower (reaches 6-14) reaches expansion matrix for Chinook mark-recapture estimators during 2008 survey.

Upper Reaches (1-5)	Captured	Marked	Recaptured	Marking Rate	Recapture Rate	Petersen	Stratified Petersen	Schaefer	Schaefer w/ Law's
Spring	788	269	60	34.14%	22.30%	2,006	2,098	2,864	2,690
Fall	1881	323	172	17.17%	53.25%	4,788	5,007	6,837	6,421
Both	2669	592	232	22.18%	39.19%	6,794	7,105	9,701	9,112
Lower Reaches (6-10)									
Spring	205	115	9	56.10%	7.83%	/b	/b	/b	/b
Fall	690	184	47	26.67%	25.54%	3,635	1,810	2,616	2,500
Both	895	299	56	33.41%	18.73%	4,715	2,349	3,393	3,243

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

b/ Estimates could not be made because of the inadequate number of recaptures.

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**ANNUAL REPORT
KLAMATH RIVER BASIN SALMON AND STEELHEAD MONITORING PROJECT
2008-09 SEASON**

ANGLER CREEL SURVEYS IN THE LOWER KLAMATH RIVER

By

Sara Borok

ABSTRACT

During August 6, 2008 through November 4, 2008 a creel census was conducted in the lower (Pacific 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 4,916 (1,037 adults and 3,879 grilse) Chinook salmon and 58 (56 adults and 2 half-pounders) steelhead were harvested. Chinook salmon caught before August 15, 2008 were considered spring-run (spring) Chinook salmon. Eighty-seven spring Chinook (18 adults and 69 grilse) salmon were harvested in 2008. The 2008 in-river sport quota was 22,500 adult fall-run (fall) 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 that mentions 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) and Iron Gate (rkm 304) and by Miller (1971) working in an area of the middle Klamath River from Johnson's (rkm 40) to 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 (Boydston, 1979).

The Fishery Conservation and 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 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 and natural spawning escapement (fish spawning in natural areas). 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 2007 season (Boydston 1979, 1980; Lee 1984a, 1984b, 1985, Lau 1992-1998; Borok 1999-2010).

This report covers the period from July 1, 2008 through June 30, 2009. 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 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 Highway (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). We determine angling effort and harvest by area. The CDFG uses this information to determine in real time when sport anglers have reached the in-river sport harvest sub-quota for each section of fall-run adult Chinook salmon. This report covers the lower 2 sample reach sections, the Klamath River from the ocean to the Hwy 96 Bridge at Weitchpec.

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

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

Starting in 1999 CDFG implemented an “impact quota” for the Klamath and Trinity Rivers. From this impact quota a ten percent hooking mortality factor was accounted for within the quota and this number was used as the trigger quota. 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 2008 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, 2008 in the Lower Klamath River and September 1, 2008 in the Trinity River and the Klamath River above the Hwy 96 Bridge in Weitchep. The limit of hatchery steelhead, in the Trinity River only, was increased to two per day and four in possession. No harvest of coho salmon was permitted. Regulations stated: One “hatchery” trout or one “hatchery” steelhead could be harvested, which eliminated the cutthroat trout fishery in the lower river.

METHODS

Description of the Fishery and Creel Sample Area

To estimate angler catch and effort, CDFG divides the main stem Klamath River from the mouth to Iron Gate Dam into three areas. The mouth of the river to the Hwy 96 Bridge in Weitchep (Areas 1 and 2) are included in this report. From upstream of the Hwy 96 bridge in Weitchep to Iron Gate Dam (Area 3) was not surveyed by CDFG this season.

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 2008. 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 2008 season fishing the mouth was not closed at any time. The 15% of the basin quota caught below the Hwy 101 Bridge (3,375 adult fall-run Chinook salmon) which could have closed the spit to fishing was not met.

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 river mouth access were sampled this season for angler effort and catch.

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

Creel Census Methods

Study methods and procedures used in Areas 1 and 2 during the 2008 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 above, the data is expanded accordingly. Each angling access site is sampled throughout the day to account for total catch and effort for that particular site. Scientific aids interviewed anglers as they departed the fishing site and recorded the following information:

- 1) Was the angler finished fishing for the day at this time?
- 2) Total hours spent fishing (to the nearest half hour).
- 3) The first three numbers of their Zip Code (to find their general area of residence).
- 4) Fish harvested are identified to species, fork length is measured and they are inspected for marks, external tags and unusual conditions. Also a scale sample was collected.
- 5) For Chinook salmon missing an adipose fin, (possessed a CWT) the head was removed and retained by staff.

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

Harvest and Effort Estimating Procedures

Data 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:

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

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

Area 2: Harvest estimates for the area above 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:

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

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

same between both the unsampled and sampled docks. It is also assumed that the effort and catch are equal between the non-sampled boats and sampled boats.

A boat count is made every day Area 1 is sampled. This count excludes all boats used in the 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 thought it necessary to compute harvest and effort estimates daily (real time) as we neared the quota to help prevent any over-harvesting. In addition, CDFG estimated one, two, and three day harvest projections to allow lead time of any adult Chinook salmon fishery closures.

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 2008. Chinook salmon harvested in the creel fishery ranged in size from 33 to 100 cm in fork length (Figure 1). The adult portion of Chinook harvested ranged in size from 51 to 100 cm FL and averaged 67.3 cm FL. The grilse component of the angler harvest ranged in size from 33 to 50 cm FL and averaged 43.8 cm FL.

Steelhead harvested ranged in size from 37 to 75 cm FL and averaged 63 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 23 cm FL are considered resident trout and not anadromous. Half-pounder steelhead ranged in size from 37 to 41 cm FL and the adult steelhead ranged in size from 42 to 75 cm FL.

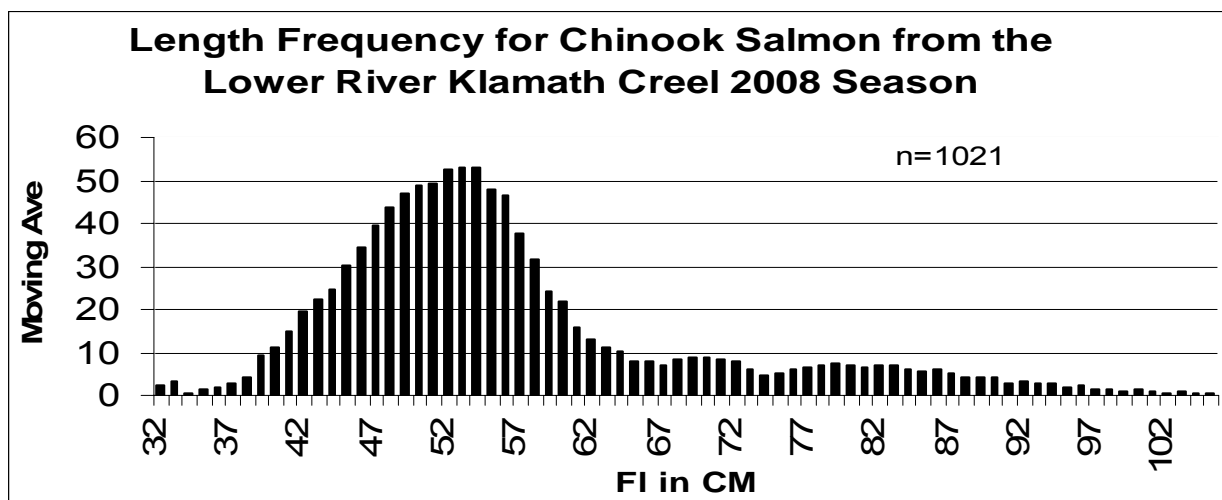


Figure 1. Fork length frequency of Chinook salmon harvested in the lower Klamath River creel during the 2008 season.

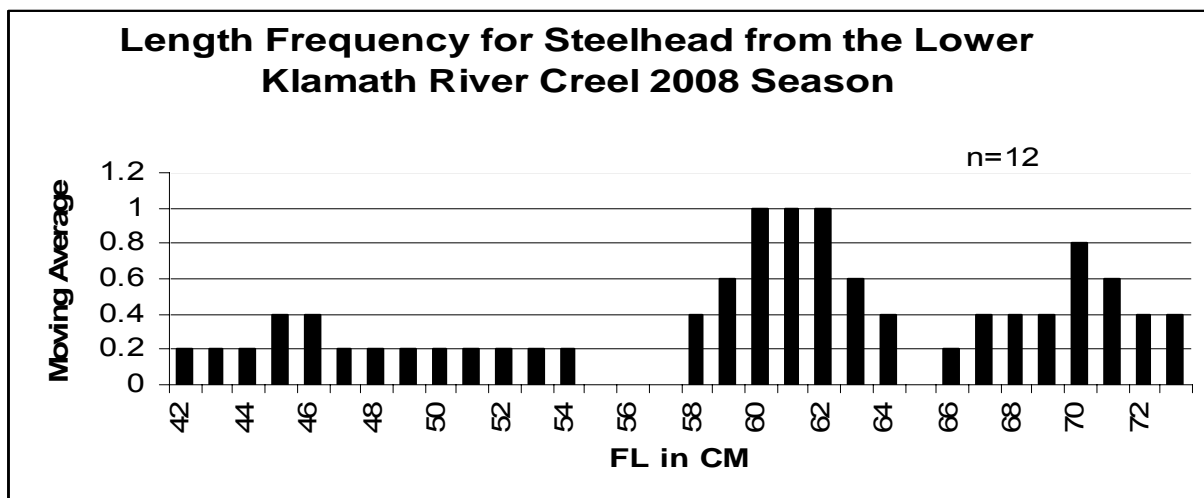


Figure 2. Fork length frequency of steelhead harvested in the lower Klamath River creel during the 2008 season.

Estimated Angler Effort and Harvest

During the 2008 season, anglers made an estimated total of 10,827 trips in Areas 1 and 2 combined. Of the 10,827 trips; 4,128 were in Area 1, and 6,699 were in Area 2 (Table 1). These trips resulted in a total effort of 56,005 fishing hours. As in previous seasons, boat anglers out-numbered shore anglers in both Areas (Table 1).

A total of 3,947 (1,056 adults and 3,426 grilse) Chinook salmon and 58 (56 adults and 2 half-pounders) steelhead were harvested (Table 1). During Julian weeks 32 and 33,

237 (50 adult and 187 grilse) spring Chinook salmon were harvested. The total of fall Chinook harvested was 3,710 (1,006 adults and 3,239 grilse) fish. Nine adult coho salmon were harvested this season.

Table 1. Summary of estimated angler effort and harvest during the 2008 lower Klamath River creel census.

Site	Angler		Steelhead		Chinook salmon	
Location	Trips	Hours	½ lbers	Adults	Grilse	Adults
Area 1 -Mouth to Hwy 101 Bridge						
Shore	1,445	5,177	0	2	161	44
Boats	2,683	10,462	0	10	359	97
Total	4,128	15,639	0	12	521	141
Area 2 - Hwy 101 Bridge to Hwy 96 Bridge						
Shore	1,049	3,816	0	2	159	42
Boats	5,651	36,550	2	41	3,267	872
Total	6,699	40,366	2	43	3426	915
Grand Total	10,827	56,005	2	56	3,947	1,056
2007	13,913	64,101	7	767	255	3,388
2006	8,920	41,792	23	231	4,626	53

2008 Harvest and Effort Patterns

The average length during the 2008 season was 5.2 hours (Table 2) and was longest trip length of this data set. Average trip length over the 17 years was 4.0 hours per trip.

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 624 half-pounders, 296 adult steelhead, 1,379 grilse, and 243 adult Chinook salmon (Tables 3 and 4). In addition an estimated 13 grilse and 58 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.

Table 2. Number of angler trips, hours, and average length of trip in the lower Klamath River sport fishery for the last seventeen seasons, 1992-2008.

Year	Total Angler		Average Hours/Trip
	Trips	Hours	
1992	11,190	33,080	3.0
1993	16,081	51,889	3.2
1994	15,100	54,748	3.6
1995	19,881	63,369	3.6
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

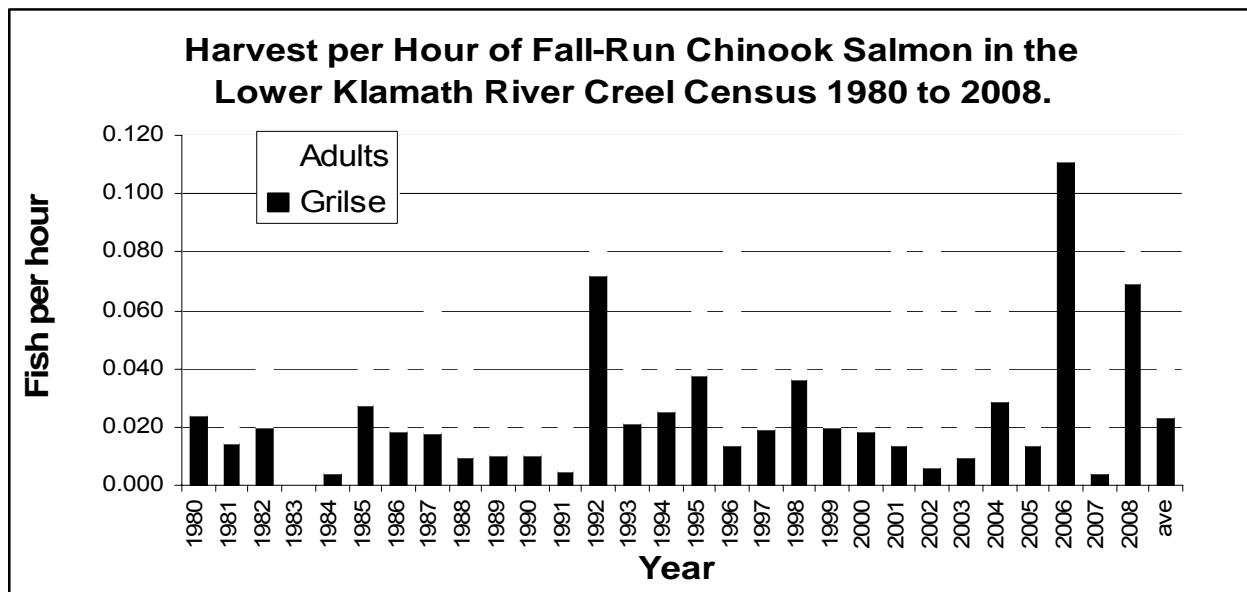


Figure 3. Harvest per hour of Chinook salmon from the sport harvest on the lower Klamath River creel census 1980 to 2008.

Table 3 Number of estimated Chinook and coho salmon and steelhead caught and released from the lower Klamath River creel surveys 1994-2008.

Year	Chinook		Steelhead		Coho	
	Grilse	Adults	<42cm FL	>41cm FL	Grilse	Adults
1994	290	2,571	4,044	198	0	0
1995	175	14,408	1,049	259	0	33
1996	521	1,438	1,944	256	7	11
1997	34	1,015	1,479	516	0	0
1998	330	1,317	1,738	460	10	19
1999	1,897	1,164	1,189	346	2	5
2000	757	6,253	8,103	1,129	17	43
2001	464	1,720	11,892	2,997	12	242
2002	405	2,985	4,783	6,036	12	243
2003	303	3,970	3,791	1,553	4	130
2004	509	688	6,223	1,577	29	135
2005	657	1,394	3,678	1,159	11	157
2006	3,758	2,922	1,030	1,129	12	91
2007	162	1,407	1,416	1,050	11	21
2008	1,379	243	624	296	13	58

Table 4. Summary of estimated catch and releases during the 2008 lower Klamath River creel census by species and area.

Site	Angler		Steelhead		Chinook salmon	
Location	Trips	Hours	½ lbers	Adults	Grilse	Adults
Area 1 -Mouth to Hwy 101 Bridge						
Shore	1,445	5,177	26	14	16	2
Boats	2,683	10,462	10	15	44	0
Total	4,128	15,639	35	29	60	2
Area 2 - Hwy 101 Bridge to HYW 96 Bridge						
Shore	1,049	3,816	868	54	59	2
Boats	5,651	36,550	476	161	505	291
Total	6,699	40,366	1,344	214	564	294
Grand Total	10,827	56,005	1,379	243	624	296
2007	13,913	64,101	1,416	1,050	162	1,407
2006	8,920	41,792	1,030	1,129	3,758	2,922

Harvest Timing

Julian week 37 was the week with the most Chinook harvested, both grilse and adults (Figure 4). In Julian week 35 a large peak of Chinook released was recorded due to a fishing derby by the American Fishing Foundation (Figure 5).

Fewer steelhead (58) were harvested than in the last three seasons (774 in 2007, 278 in 2006 and 152, in 2005). Julian week 36 was the peak harvest of adult steelhead (Figure 6), while Julian week 32 had the highest released half pounders (Figure 7). Very few half-pounders (2) were harvested this season.

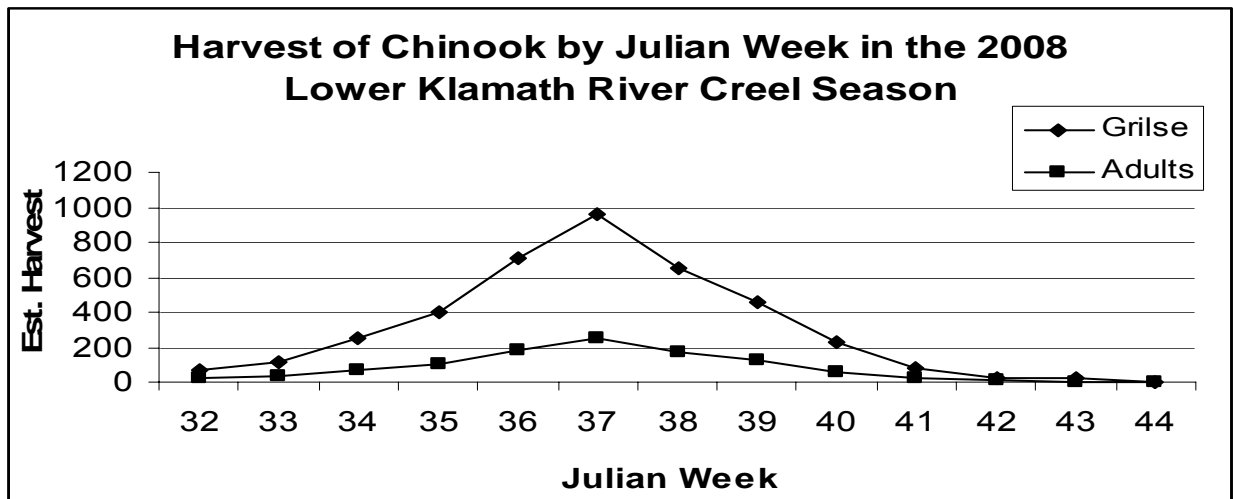


Figure 4. Estimated harvest of Chinook by Julian week in the 2008 lower Klamath River creel season.

Table 5. Harvest, release and angler effort by Julian week (JW) during the 2008 lower Klamath River creel census.

	Angler		Harvest				Released			
			Steelhead		Chinook		Steelhead		Chinook	
JW	Trips	Hours	½ lber	Adult	Grilse	Adult	½ lber	Adult	Grilse	Adult
32	613	2,444	0	7	69	18	515	28	112	14
33	584	2,374	0	5	118	32	403	36	42	5
34	1,094	4,306	0	5	249	66	124	49	2	0
35	1,377	6,553	2	2	401	107	37	16	287	189
36	1,873	9,476	0	15	703	188	84	30	40	14
37	1,851	10,232	0	7	958	256	16	20	60	7
38	1,234	6,986	0	0	650	174	21	9	9	12
39	993	6,666	0	9	454	121	54	26	35	42
40	560	3,279	0	2	227	61	40	16	12	7
41	274	1,754	0	4	78	21	6	0	7	7
42	243	1,329	0	0	21	6	42	5	7	0
43	119	585	0	0	18	5	28	7	12	0
44	11	21	0	0	0	0	11	0	0	0
Total	10,827	56,005	2	56	3,947	1,056	1,379	243	624	296

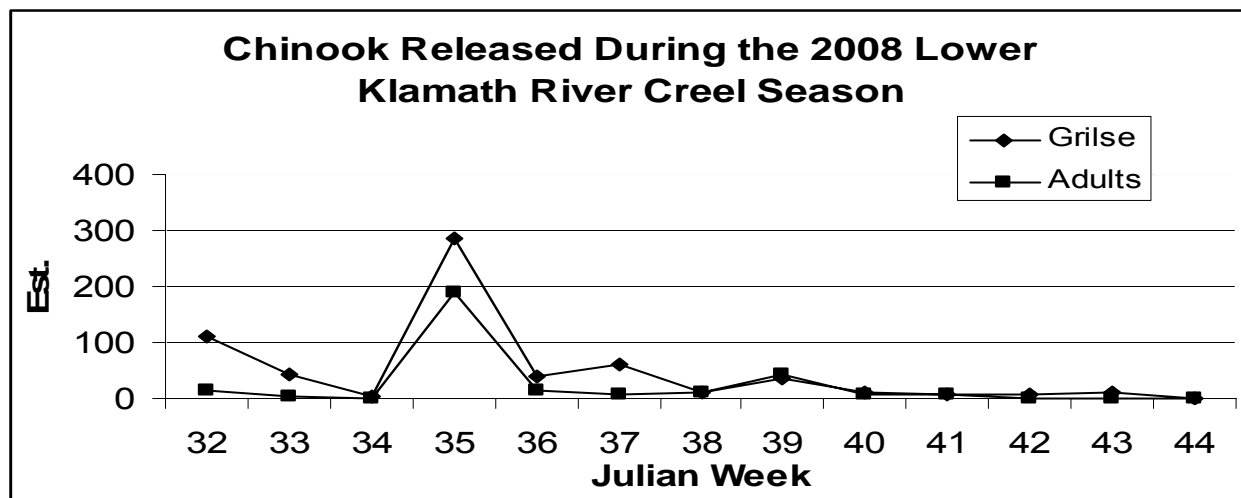


Figure 5. Estimated Chinook released by Julian week during the 2008 lower Klamath River creel season.

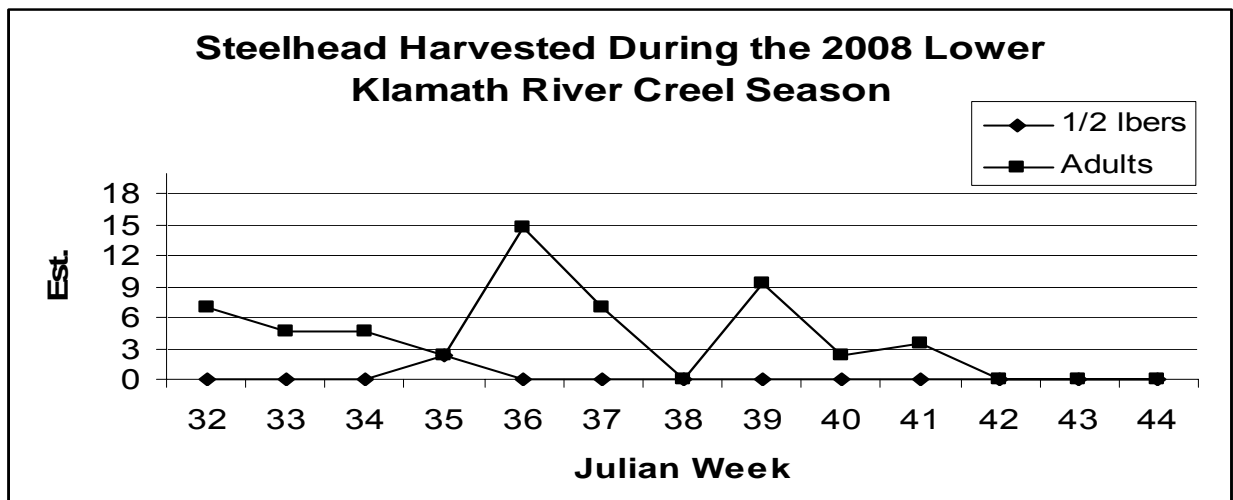


Figure 6. Estimated steelhead harvested during the 2008 lower Klamath River creel season, by Julian week.

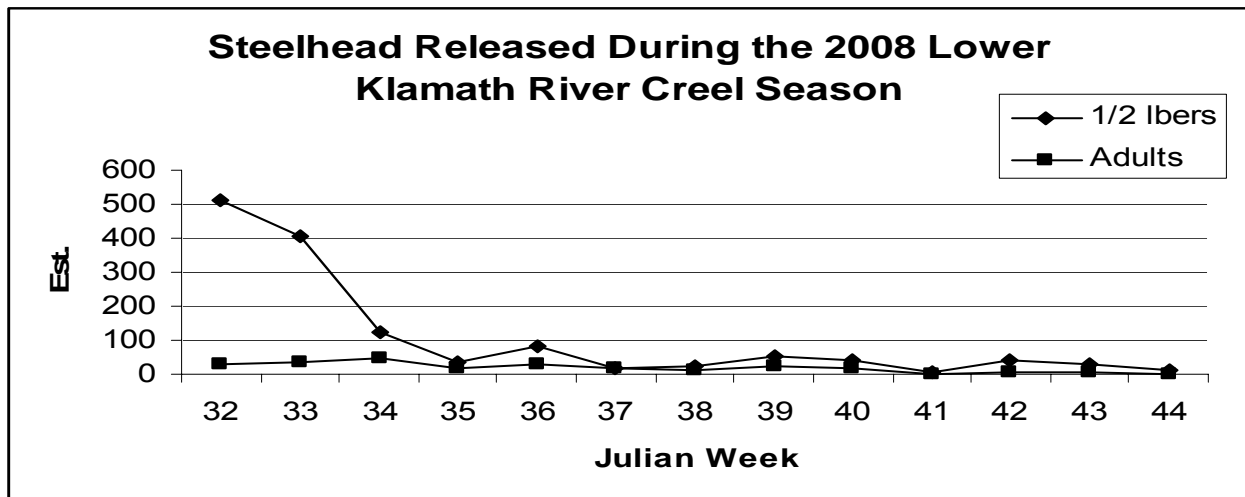


Figure 7. Estimated steelhead released during the 2008 lower Klamath River creel season, by Julian week.

Coded-Wire Tag Recovery

KRP personnel recovered the heads of 42 adipose fin-clipped and coded-wire-tagged (Ad+CWT) Chinook salmon during Julian weeks 33 through 39 of the 2008 season. There was one non-random recovery (NRR), wherein anglers and or resort owners saved their fish head for our personnel. These NRRs are not used to estimate the harvest of marked hatchery origin (Ad+CWT) Chinook salmon (Table 6), however, they are used to calculate harvest timing (Figure 8). CWTs were not recovered from seven

heads and four hatchery fish were recorded but the heads were not received for processing. This left 30 tags to decode. Of these 30 heads, 17 were adult salmon while 13 were grilse salmon.

No Trinity River Hatchery spring Chinook heads were recovered during the creel census. Fin-clipped fall-run adult Chinook recovered ranged in size from 60 to 90 cm and grilse ranged in size from 38 cm to 66 cm. Heads from all fin-clipped fish collected 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 2.03 % (41/2,012) of the actual Chinook salmon harvested. With expansions made from creel sampling and hatchery production multipliers for each tag group, CDFG estimated 794 hatchery fish were harvested (Table 7). Hatchery fish represented an estimated 15.8% (794/5,003) of the entire sport harvest in the lower Klamath River. All 30 random recovered heads that had tags which could be read were from Klamath and Trinity basin origin Chinook salmon.

Iron Gate Hatchery Origin Chinook Salmon

CDFG decoded 19 randomly recovered tags from Klamath River origin Chinook. These Chinook salmon represent 11 different tag codes; two from the 2004 brood year, two from the 2005 brood year and seven from the 2006 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 13.6% (679/5,003) of the total sport harvest (Table 7). The Klamath River origin Chinook were harvested between Julian weeks 35 to 39 (Figure 8).

Trinity River Hatchery Origin Chinook Salmon

CDFG decoded a total of 11 randomly recovered tags from Trinity River Hatchery fall-run origin Chinook. These Chinook represent five different tag codes; one from the 2004 brood year, one from the 2005 brood year and three from the 2006 brood year at Trinity River Hatchery (Table 6). Trinity River origin fish represented 2.3% (115/5,003) of the total sport harvest (Table 7). Trinity River origin Chinook were harvested between Julian weeks 34 to 38 (Figure 8).

During the 2008 season, sport in-river harvest by stock can be described as follows: the tail-end of the Trinity River Hatchery spring Chinook salmon made up the majority of harvest up to Julian week 33 (based on past data), next Iron Gate Hatchery fall-run Chinook salmon were present and peaked at Julian week 36. The bulk of the Trinity

River fall-run tags were collected during Julian weeks 37 and 38, no more coded-wire tagged Chinook salmon were recovered after Julian week 39 (Figure 8).

Table 6. Actual coded-wire-tag recoveries by Julian week of Iron Gate Hatchery (IGH) and Trinity River Hatchery (TRH) Chinook salmon obtained from the lower Klamath River creel, 2008 season.

		Julian Week											
CWT Code	Brood Year	32	33	34	35	36	37	38	39	40	41	42	Total
Trinity River Hatchery Fall													
65327	2004			1				2					3
65341	2005						2	2					4
65350	2006					1	1						2
65351	2006				1								1
65361	2006					1							1
Iron Gate Hatchery													
601020506	2004				1			1					2
601020508	2004					1							1
601020606	2005						1						1
601020607	2005				1		4		1				6
601020608	2006					1			1				2
601020609	2006					1							1
601020700	2006					1	1						2
601020701	2006						1						1
601020702	2006				1								1
601020703	2006						1						1
601020704	2006					1							1
100000						2	5						7
300000			1			1	2						4
Total		0	1	1	4	10	18	5	2	0	0	0	41

Table 7. Fall Chinook salmon harvest in the 2008 lower Klamath River sport harvest proportioned by hatchery origin and expanded for creel sampling and hatchery production multiplier.

Total Fall Chinook Salmon		IGH Expanded	TRH Expanded	Estimated Total Hatchery	% Hatchery
Grilse	3947	354	38	392	9.93%
Adults	1056	325	77	402	38.07%
Total	5003	679	115	794	48.00%

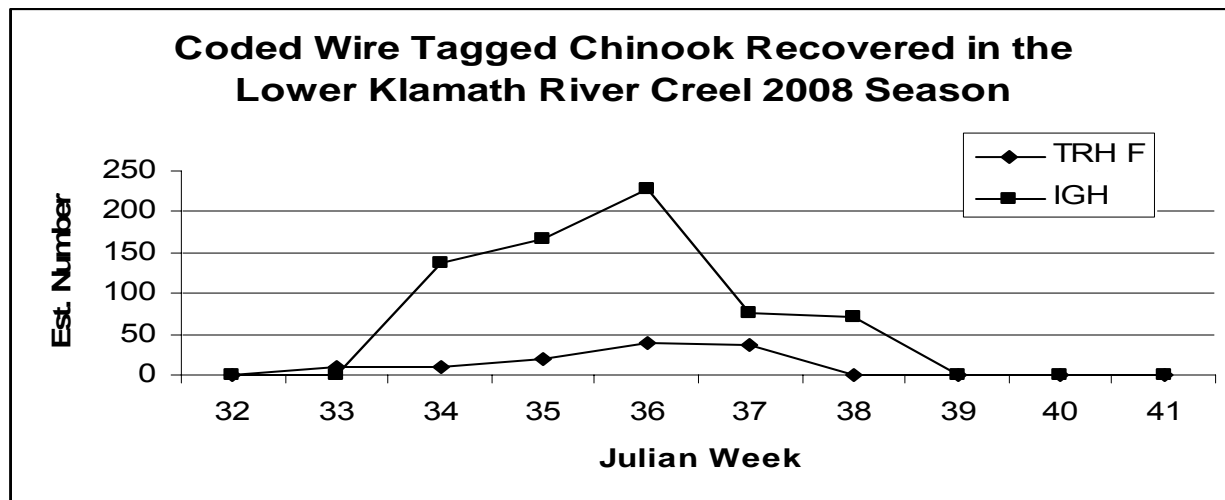


Figure 8. Coded wire tagged Chinook recovered during the 2008 lower Klamath River creel census, expanded for sampling and by individual tag code

DISCUSSION

More grilse salmon were harvested and released this season. This bodes well for future salmon fishing seasons in the basin if ocean conditions are favorable. Regulations were similar to past seasons and could not account for the higher returns from the 2006 brood year.

CONCLUSION

The size of the quota affects the economy of this area and should be taken into consideration in the allocation process each year.

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

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

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

b/ Eight-day week every year.