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FINAL REPORT
SHASTA AND SCOTT RIVER
JUVENILE SALMONID OUTMIGRANT STUDY, 2010
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1.0 Abstract

The 2010 Juvenile Salmonid Outmigrant Study is part of the ongoing Anadromous Fisheries Resource Assessment and Monitoring Program (AFRAMP) study on the Shasta and Scott Rivers in Siskiyou County, California. Using rotary screw trapping methods, all age classes of outmigrating Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead trout (*Oncorhynchus mykiss*) were sampled from 12 February to 1 July of 2010. Using the Carlson method for mark and recapture of salmonids, trap efficiencies and population estimates were produced on a weekly basis, with some variation on this method for coho salmon. Fork lengths and scale samples were taken from a sub-sample of the daily catch. Established age-length cutoffs for each species were used to determine fish age. Otoliths were removed from any deceased salmonid. In-stream conditions such as flow and water temperature were also monitored in an attempt to identify a relationship between environmental factors and outmigration numbers and timing. Weekly estimates for the smolt class of all species were compared to show multi-year population trends. Using Shasta River multi-year seasonal production estimates for coho salmon and information on adult coho salmon returning to the Shasta River, survival and production per adult estimates were produced for Shasta River coho. It is estimated that for the period sampled in 2010 a total of 3,004,521 Chinook, 7,735 coho, and 66,557 steelhead emigrated from the Shasta and Scott Rivers, with fork lengths ranging from 33mm to 190 mm for Chinook, 32mm to 195mm for coho, and 24mm to 530mm for steelhead.

2.0 Introduction

For the past eleven years the Anadromous Fisheries Research Assessment and Monitoring Program has conducted rotary screw trapping of out migrating juvenile salmonids on the Shasta and Scott Rivers in Siskiyou County, California. Monitoring of salmonids on the Shasta River dates back to 1930 when returning adult Chinook salmon were first counted. Monitoring of juvenile salmonids on the Shasta River dates back to 1981 (KRIS). Juvenile salmonid monitoring initially began with the use of fyke nets and monitoring did not occur every year. However, in the year 2000 yearly monitoring began on the Shasta River using rotary screw traps. The use of screw traps allows the calculation of both trap efficiencies and corresponding juvenile production estimates. Juvenile salmonid migration was first monitored on the Scott River in the year 2000 and has continued since.

In the year 2002 the coho salmon Southern Oregon/Northern California Coast Evolutionary Significant Unit (SONCC ESU) was listed as a threatened species from the Oregon border to Punta Gorda, California under the California Endangered Species Act (CESU). In 2010 monitoring became even more important with the release of a California Department of Fish and Game report stating that two of the three coho cohorts on the Shasta River were “functionally extinct” with both population numbers and production rates in decline (Chesney 2009).

Juvenile salmonid out migration monitoring is necessary in order to continue to assess the populations of Chinook salmon, coho salmon, and steelhead trout in the Shasta and Scott Rivers.

2.1 Study Goals and Objectives

The two specific goals of the 2010 out migration monitoring were:

- To determine emigration abundance and timing of all age classes of juvenile salmonids exiting the Shasta and Scott Rivers between early February and early July of 2010.
- To investigate the relationships between in-stream conditions and emigration patterns of juvenile salmonids.

The specific objectives were:

- To estimate the weekly mean fork length at age of salmonids in the catch from a measured sub-sample.
- To estimate weekly rotary trap efficiencies for all age classes of Chinook, coho, and steelhead in the catch and produce weekly production estimates for each age class.
- To monitor stream flow and temperature at the traps.

This report explains the characteristics and estimations of the out migration of Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead trout (*Oncorhynchus mykiss*) from 12 February to 1 July, 2010 in the Shasta and Scott Rivers, Siskiyou County, California.

3.0 Shasta River Rotary Screw Trap Summary

3.1.0 Methods

The Shasta River was sampled with a modified five foot rotary screw trap manufactured by EG Solutions, Corvallis, Oregon. This trap contains a specially modified, extended livecar. The extended livecar's dimensions are 15' x 3'4" x 1'10". This is 66.67% larger than the livecar used in previous years. The trap operated six days per week, Sunday afternoon through Saturday morning, directly downstream of the Shasta River Fish Counting Facility at 041° 49' 46.38" N, 122° 35' 35.38" W, approximately 750 yards from the mouth of the river. The catch in the trap was processed daily at approximately 0800 hours. The trap was also checked at approximately 1700 hours daily and at 2200 hours as needed to monitor operation and remove algae and/ or debris. Sets were ended between 2200 and 2400 hours as necessary in response to high algae/debris accumulation.

During Julian weeks 11 – 14, a second rotary trap was installed next to the primary trap. The secondary trap was positioned in the thalweg in order to increase the trap efficiency for 1+, 2+, and 3+ smolts. The trap was equipped with large mesh screen in order to allow 0+ fish to escape. Any 0+ age fish that remained in this trap at the end of the set were released without processing. The primary screw trap sampled both 0+ and older aged fish.

After Julian week 14, the secondary screw trap discontinued fishing, and the initial screw trap continued to sample for the remainder of the trapping season. (A detailed explanation of the use of two traps can be found in the in section 3.3.1 of this report).

The velocity of the water entering the cone was measured at the beginning and end of each set with a flow meter manufactured by General Oceanics, model 2030R. The total volume of water, in million cubic feet (MCF), sampled by the trap was calculated for each set.

All vertebrates collected in the trap were identified and counted. Salmonids collected in the trap were classified by species, age, and life stage.

3.1.1 Bio-Sampling

A sub-sample of fish from each day's catch was processed for bio-data such as fork length, life stage, and age; scales were also collected. Up to 25 of each age class of steelhead and coho, 50 0+ Chinook, and 15 1+ Chinook were included in each day's sub-sample. This task involved anesthetizing the sub sample of fish in a water/CO₂ bath so the fish would be anesthetized within 45 seconds to 1 minute. The fish were measured, aged, attributed a life stage (Appendix 41), and scales were collected. After each fish was sampled it was placed into a well aerated recovery bucket containing a slime coat replacement/water conditioner to aid in the fish's recovery. Up to 10 scale samples of at least 12 scales per sample were collected from each age class of each species per week, with an attempt to collect from a variety of fork lengths within each age class. Scales were physically collected from the left side of the fish in a region known as the "scale pocket." The scale pocket is located between the dorsal fin and the adipose fin above the

lateral line. Once the scales were collected, they were then added to a multi-year scale collection library from which the age-length cutoffs are derived. In the event that a salmonid was deceased, it was collected so that its otolith could be removed and added to a multi-year otolith library for future micro-chemistry analysis.

Up to ten of each species of non-salmonids (Appendix 40) were measured on Saturdays.

3.1.2 Age Determination

Age-length cutoffs developed in 2007 were used to estimate age of salmonids in the catch (Appendix 35). These cutoffs were determined by calculating the ages of scales in the 2001-2007 collection. Individual scale samples were visually examined and categorized into brood years using scale age-estimation methods (Van Oosten 1957, Chilton and Beamish 1982, Casselman 1983). Fork length intervals for each age class were determined for appropriate time periods and updated throughout the season to create the age-length cutoffs used. These intervals are not absolutes and as a result of variable growth, some individuals may be older or younger than the cutoff fork lengths suggest.

3.1.3 Trap Efficiency Determinations and Production Estimates

Trap efficiency trials ran Monday through Saturday when sufficient fish were in the catch. Multiple trap efficiency trials were conducted to determine the mean weekly trap efficiency for 0+ Chinook, and 0+, 1+, 2+, and 3+ steelhead. For each trial, a known number of marked fish from each age class was taken three quarters of a mile upstream from the trap and released. Up to 500 0+ salmonids (depending on fish size, water temperature, and other stress factors) were dyed by placing them in a solution of 0.6 grams of Bismarck Brown Y mixed with 19 liters of water for 40 to 50 minutes. 1+, 2+, and 3+ aged fish were marked with a caudal fin margin clip. Three different caudal fin margin clips (upper caudal, lower caudal, upper caudal lower caudal) were used in a weekly rotation in order to determine if marked fish were being recaptured outside of the week in which they were marked. Fish marked in the morning processing were held in livecars until the afternoon in order to assess their condition prior to release. They were then transferred to automatic release boxes which were set to release after sunset.

For each species and age class, the number of fish recaptured during the week divided by the total number marked equals the estimated trap efficiency for the week. An estimate of the total number of outmigrants per week was determined using a stratified mark and recapture technique (Carlson 1998). Zero was used for the lower confidence limit if the calculated lower confidence limit for the estimate was negative. In weeks when marked fish were released but none were recaptured, the average trap efficiency for the season (the seasonal trap efficiency) was used to expand the number of fish trapped to develop an estimate of the total migrants for the week (ODFW Salmonid Lifecycle Monitoring Project). Single-trap seasonal efficiency was determined for Julian Weeks 7-10 and 15-26, when only one trap was fishing; and combined trap seasonal efficiency was determined for weeks 11-14. Since only one trap fished for 0+ fish throughout the entire trapping season, a single seasonal efficiency estimate was determined for 0+ aged fish based on mark/recapture trials from weeks 7-26.

The trap efficiency for 0+ and 1+ coho was calculated differently. Due to the low number of 0+ and 1+ coho projected for 2010, fish handling was minimized. In order to calculate the trap efficiency, data from years past, when coho numbers were sufficient, were correlated to the corresponding life stage of steelhead trout. 0+ coho were correlated to 0+ steelhead, and 1+ coho were correlated to 2+ steelhead. The correlation between 0+ steelhead and 0+ coho in 2005, 2006 and 2008 is expressed by the equation $y = 0.8224x + 0.0039$ (Figure 31). X represents the weekly efficiencies for 0+ steelhead from 2010, with y equaling the trap efficiency for 0+ coho. The correlation between the trap efficiency for 2+ steelhead smolts and 1+ coho smolts observed in 2004, 2005 and 2009 was used to estimate the number of coho smolts produced in 2010. The equation is expressed by $y = 0.7532x + 0.1485$ (Figure 32) where x is equal to 2+ steelhead efficiency and y is equal to 1+ coho efficiency.

We did not produce an estimate for 2+ coho due to the fact that there is a limited mark recapture history for this age class of coho.

3.1.4 Water Temperature and Flow Monitoring

Hourly water temperature was recorded with an Onset Optic StowAway® temperature logger attached to river left at the trap location. According to factory specifications, the thermal loggers are accurate to 0.2°C when in the -20°C to 50°C range (Onset). The thermal loggers are factory calibrated and then checked for accuracy before deployment by submerging them in a bucket of water for at least 24 hours and comparing the results. Two loggers are deployed at each site to ensure accuracy once deployed. The thermal loggers are deployed in January, before salmonid migration monitoring begins, and continue to collect data through Julian week 26, when salmonid migration monitoring ends. The thermal loggers are set to take temperature readings every hour.

Stream flow measurements were obtained from the United States Geological Survey (USGS) stream gauge number 11517500, Shasta River, Yreka (SRY) (Figure 26). This gauge is located approximately .75 miles upstream of the confluence with the Klamath River and records stream flow and gauge height every 15 minutes. Stream flow data presented in this report are preliminary.

3.1.5 Data Entry and Analysis

All data from field data forms were entered into Microsoft Access database software. Summary tables were then created in Access and exported to Microsoft Excel where they were broken down by species and age class. Temperature data were downloaded into HOBOWare Pro version 2.7.3 from the HOBO temperature loggers. These data were then exported to Excel for analysis.

3.2.0 Results

The Shasta River rotary trap began sampling six days per week on February 11, 2010. Trapping ended after 20 weeks on July 1, 2010. The trap fished 115 sets for a total of

2,355.57 hours. An estimated 216,809,778.9 cubic feet of water was sampled. During weeks 11 – 14 a secondary trap was also installed. This trap fished for 18 sets for a total of 319.16 hours. An estimated 34,742,884 cubic feet of water was sampled in this trap. The number of salmonids trapped, marked and recaptured by week was recorded, and weekly population estimates with a 95% Confidence Interval (CI) were produced (Appendices 2 – 9). Weekly mean fork lengths, sample size, and minimum and maximum size were also recorded with standard deviations (Appendices 18 – 26).

3.2.1 Chinook

Chinook 0+

An estimated 2,347,783 0+ Chinook (95% CI, 2,265,226 – 2,430,341) emigrated from the Shasta River during the period sampled (Figure 1). The greatest number of Chinook emigrated during Julian week 7 (441,313, 95% CI, 397,063 – 485,564). This is equal to 18.8% of the total estimate (Figure 2). A total of 425,662 Chinook 0+ were sampled (Figure 3, Appendix 1). The mean fork length for 0+ Chinook during Julian week 7 was 37 mm (Figure 7, Appendix 18).

Chinook 1+

An estimated 67 1+ Chinook (95% CI, 28 – 106) emigrated from the Shasta River during Julian weeks 7 through 15 (Figure 4). Only one of the efficiency trials resulted in recaptured fish. The greatest number of 1+ Chinook left during Julian week 12 (30, 95% CI, 0 - 60). This is equal to 44.7% of the total estimate (Figure 5). A total of 26 1+ Chinook were trapped in 2010 (Figure 6, Appendix 2). The mean fork length for 1+ Chinook during Julian week 12 was 135 mm (Figure 7, Appendix 19).

5148 0+ Chinook and 27 1+ Chinook were measured and aged in the sub-sample, with 42 scale samples taken and 169 otolith samples retrieved.

3.2.2 Coho

Coho 0+

An estimated 69 0+ coho emigrated from the Shasta River during Julian weeks 24 through 26 based on efficiencies compared to 0+ steelhead (Figure 8). The greatest number of coho, 51, left during Julian week 26. This is equal to 73.53% of the total estimate (Figure 9) and is based on the 0+ steelhead seasonal trap efficiency. A total of 13 0+ coho were trapped during sampling (Figure 10, Appendix 3). The mean fork length for 0+ coho during Julian week 26 was 70 mm (Figure 14, Appendix 20). No confidence intervals are given due to the fact that no efficiency trials were run. These estimations are based upon the efficiency of 0+ steelhead correlated from the 2005, 2006, and 2008 seasons (Figure 31).

Coho 1+

An estimated 169 1+ coho emigrated from the Shasta River from Julian week 13 through 20 (Figure 11). The greatest number of coho, 112, left in Julian week 16. This is equal

to 66.45% of the total estimate (Figure 12). A total of 35 1+ coho were trapped during sampling (Figure 13, Appendix 4). The mean fork length for 1+ coho during Julian week 16 was 148 mm (Figure 14, Appendix 21). No confidence intervals are available as this estimate is derived from the correlation of the observed trap efficiencies for 2+ steelhead and 1+ coho from the 2004, 2005 and 2009 seasons (Figure 32).

Coho 2+

At least 9 2+ coho emigrated from the Shasta River during Julian weeks 16 and 17, with 66.67% of total trapped 2+ coho leaving the river during Julian week 16. A total of 9 2+ coho were trapped in 2010 (Appendix 5). Due to the limited history of mark/recapture trials for 2+ coho, an accurate population estimate cannot be provided. The mean fork length for 2+ coho in Julian week 16 was 178 mm (Figure 14, Appendix 22).

Eleven (11) 0+ coho, 35 1+ coho, and 9 2+ coho were measured and aged in the sub-sample, with 47 scale samples taken and no otolith samples retrieved.

3.2.3 Steelhead

Steelhead 0+

An estimated 4,862 0+ steelhead (95% CI, 4,037 – 5,686) emigrated from the Shasta River during Julian weeks 12 – 26. The greatest number left during Julian week 26 (3,019, 95% CI, 2,245 – 3,792) (Figure 15). This is equal to 62.0% of the total estimate for the period sampled (Figure 16). Single trap seasonal efficiency of 27.55% was used to provide an estimate for Julian Weeks 13, 14, and 19 since no successful mark-recapture trials occurred. A total of 1,154 0+ steelhead were trapped in 2010 (Figure 17, Appendix 6). The mean fork length for 0+ steelhead during Julian week 26 was 85 mm (Figure 21, Appendix 23).

Steelhead 1+

An estimated 905 1+ steelhead (95% CI, 530 – 1280) emigrated from the Shasta River during Julian weeks 9-26 (Figure 18). The greatest number left during Julian week 22 (295, 95% CI, 11 – 578). This is equal to 32.6% of the total estimate for the period sampled (Figure 19). Single trap seasonal efficiency of 14.14% was used to provide an estimate for Julian weeks 9-10, 17-18, 20, and 23-24 since no successful mark-recapture trials occurred. A combined trap efficiency of 16.67% was used for Julian weeks 12-14. A total of 190 1+ steelhead were trapped in 2010 (Figure 20, Appendix 7). The mean fork length for 1+ steelhead during Julian week 22 was 165 mm (Figure 21, Appendix 24).

Steelhead 2+

An estimated 9,088 2+ steelhead (95% CI, 7,163 – 11,013) emigrated from the Shasta River during Julian weeks 7 through 26 (Figure 22). The greatest number left during Julian week 20 (2,221, 95% CI, 1,278 – 3,163). This is equal to 24.5% of the total estimate for the period sampled (Figure 23). Single trap seasonal efficiency of 11.06% was used to provide a population estimate for Julian Weeks 7-8, 10, 15, 17, and 23-26 since no successful mark-recapture trials occurred. A total of 1,115 steelhead 2+ were

trapped during sampling trials (Figure 24, Appendix 8). The mean fork length for 2+ steelhead during Julian week 20 was 189 mm (Figure 25, Appendix 25).

Steelhead 3+

At least 171 3+ steelhead emigrated from the Shasta River during Julian weeks 9-24. Ninety-three percent of total trapped 3+ steelhead left during Julian week 16 (Appendix 9). The mean fork length during Julian week 16 was 236 (Figure 25, Appendix 26). Due to the limited amount of successful mark/recapture trials for 3+ steelhead in 2010, an accurate population estimate cannot be provided.

265 0+ steelhead, 187 1+ steelhead, 769 2+ steelhead, and 156 3+ steelhead were measured and aged in the sub-sample, with 283 scale samples taken and 32 otolith samples retrieved.

3.2.4 Temperature

The Maximum Weekly Maximum Temperature (average of daily maximum temperatures for each week) occurred on Julian week 26 with an average maximum temperature of 25.95°C. The Maximum Weekly Average Temperature also occurred on Julian week 26 with a temperature of 22.593°C (Appendix 37). Water temperature was graphed by Julian week (Figure 27) and plotted to show variation by Julian week (Figure 28).

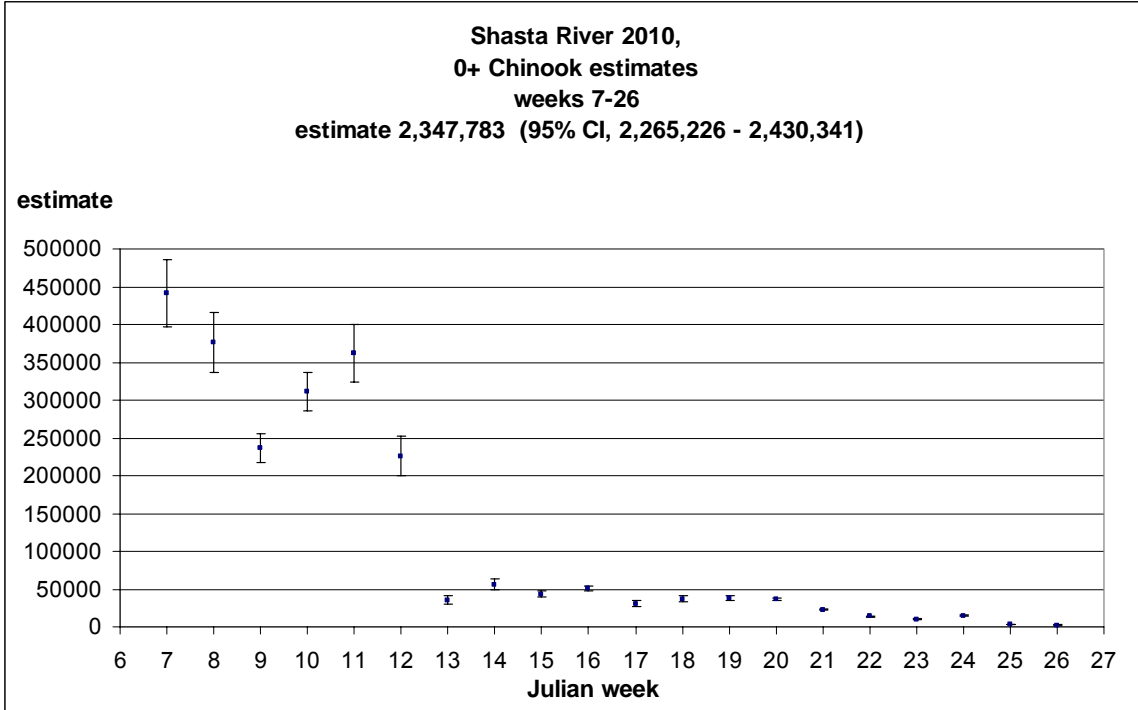


Figure 1. Shasta River 2010 0+ Chinook estimates weeks 7-26.

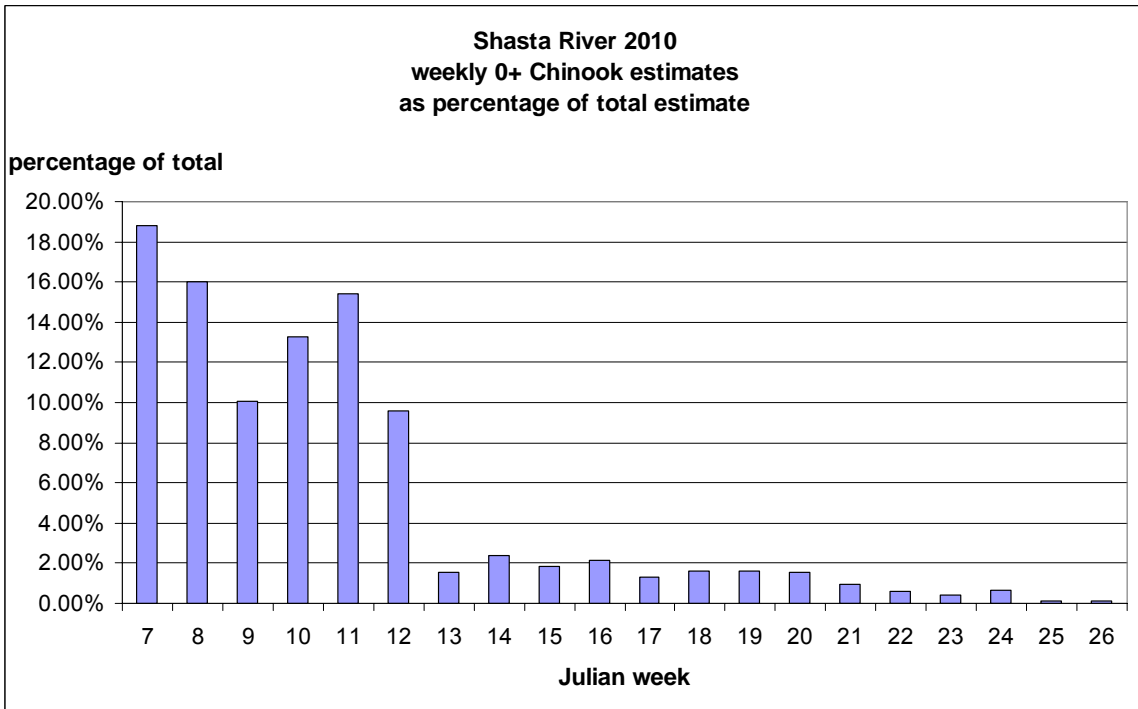


Figure 2. Shasta River 2010 0+ Chinook estimates as percentage of total.

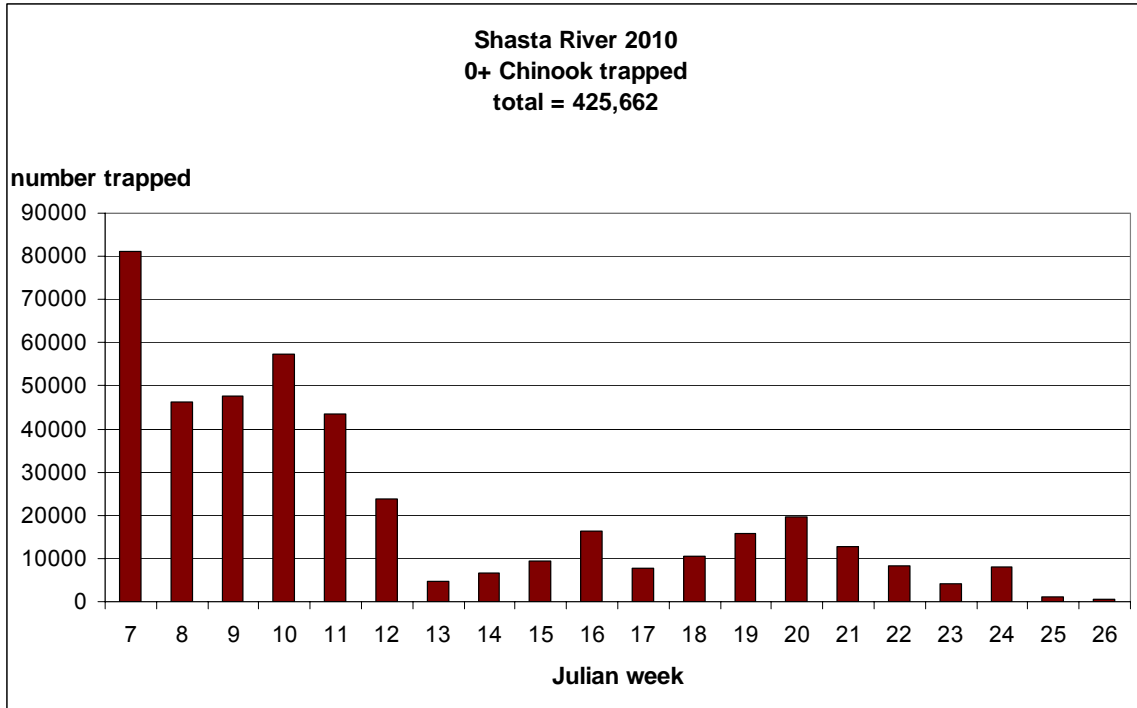


Figure 3. Shasta River 2010 0+ Chinook total trapped.

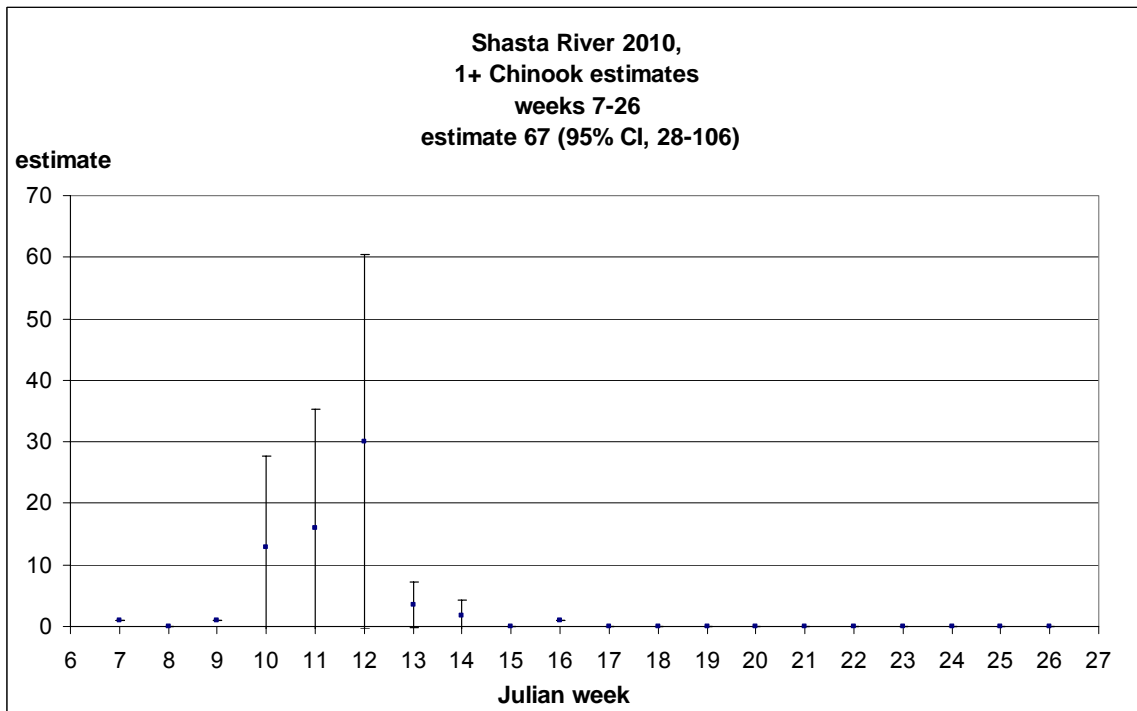


Figure 4. Shasta River 2010 1+ Chinook estimates weeks 7-26.

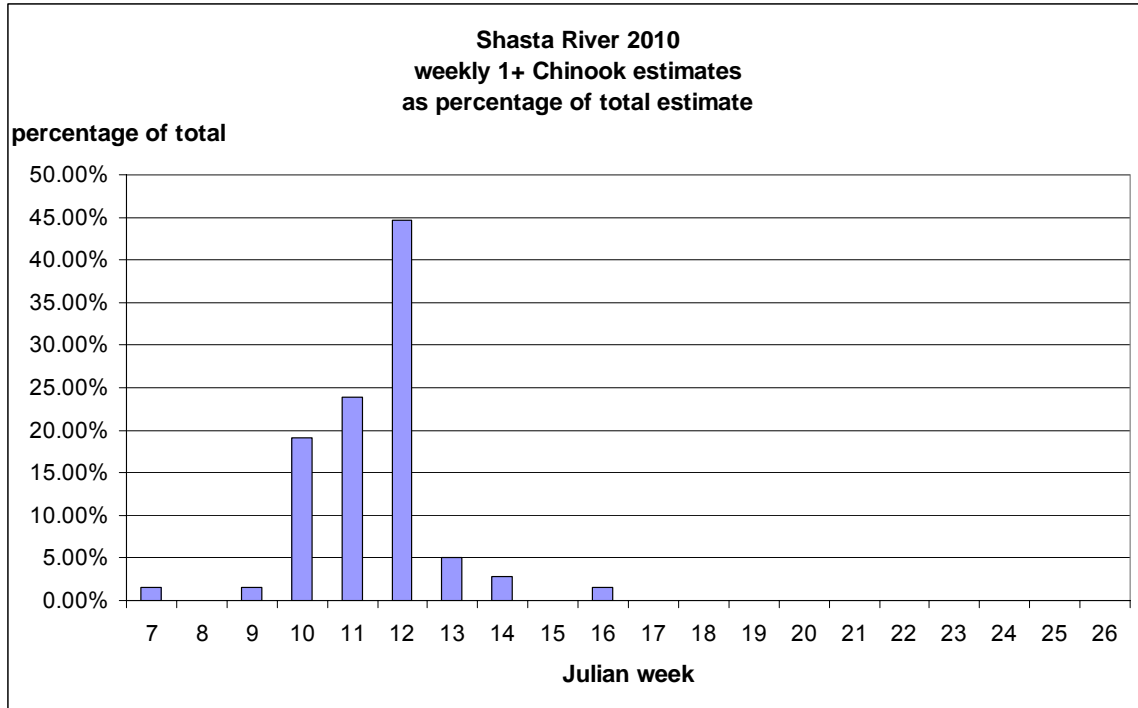


Figure 5. Shasta River 2010 1+ Chinook estimates as percentage of total.

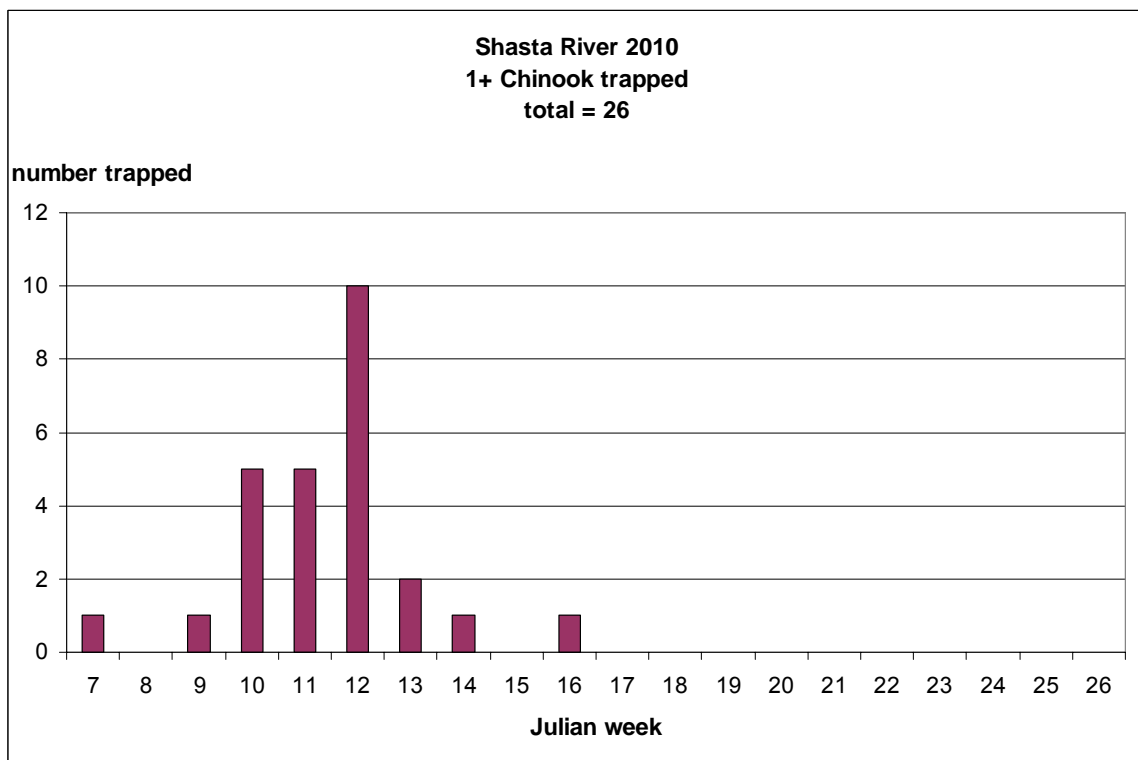


Figure 6. Shasta River 2010 1+ Chinook total trapped.

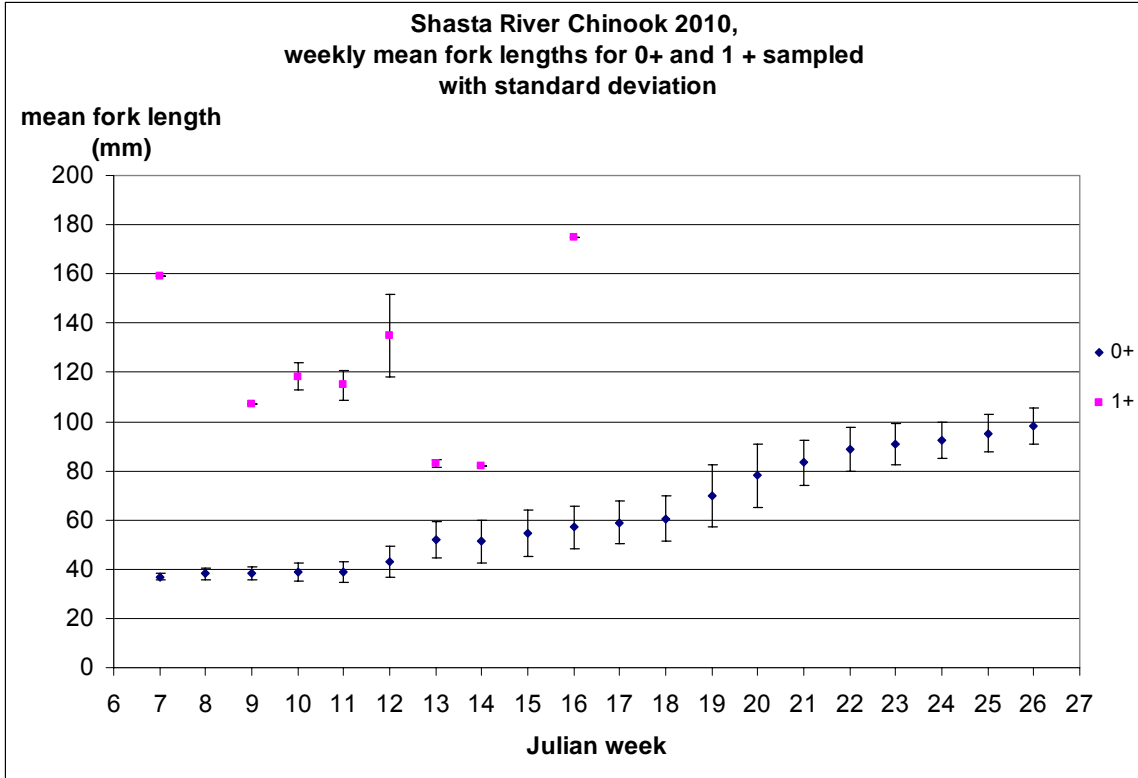


Figure 7. Shasta River 2010 weekly mean fork lengths for 0+ and 1+ Chinook sampled.

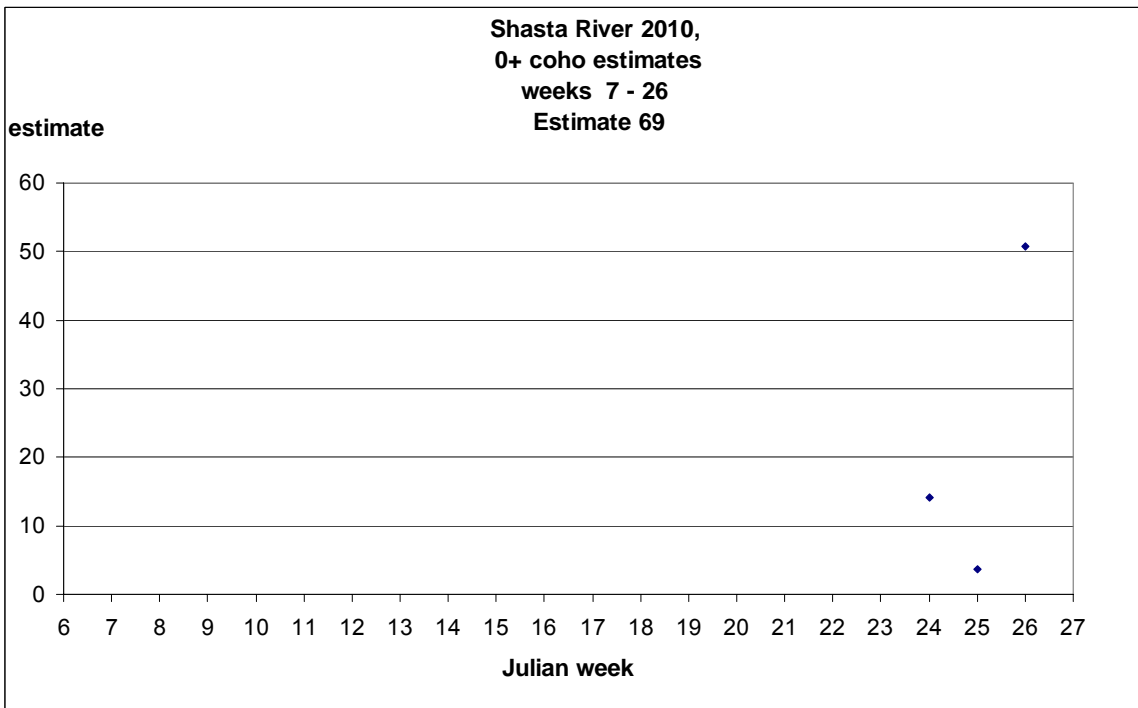


Figure 8. Shasta River 2010 0+ coho estimates weeks 7 – 26.

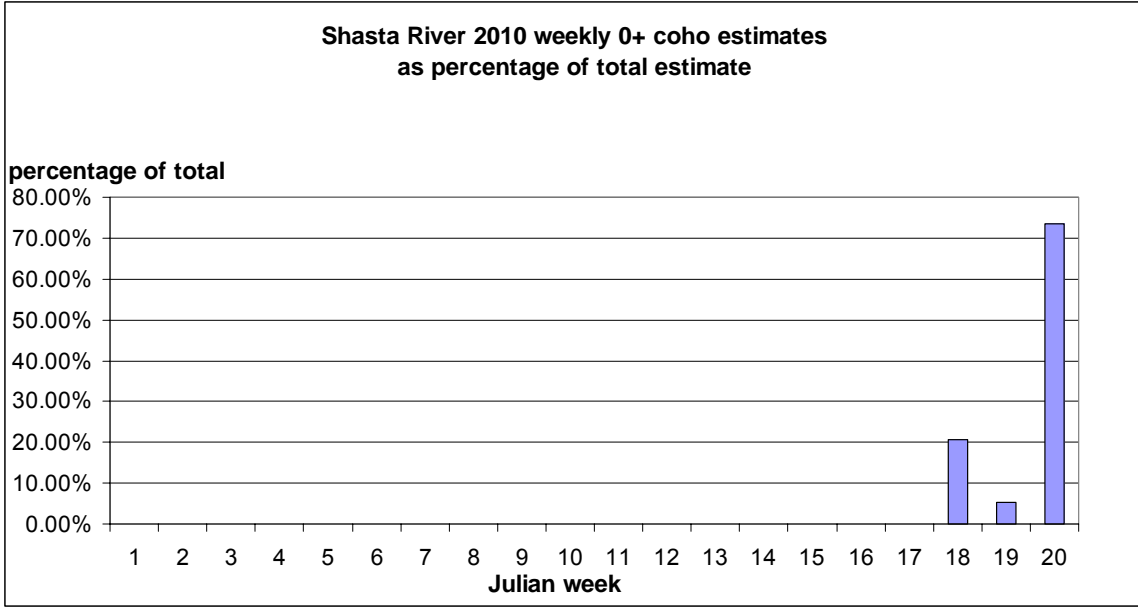


Figure 9. Shasta River 2010 0+ coho estimates as percentage of total.

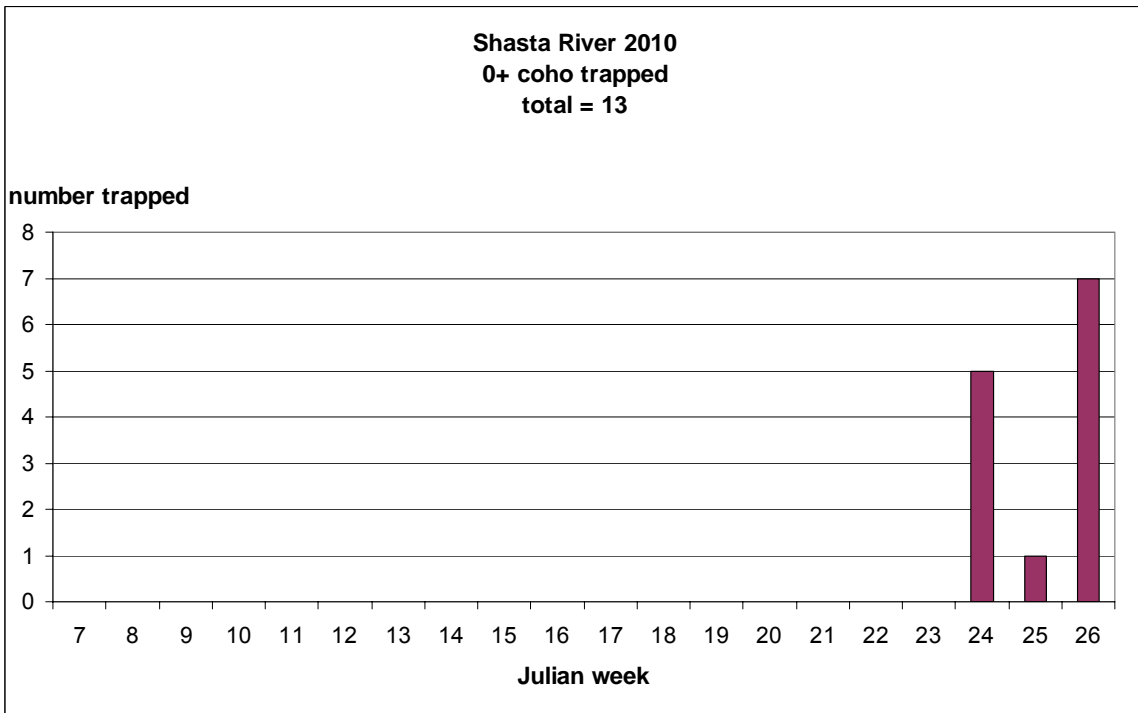


Figure 10. Shasta River 2010 0+ coho total trapped.

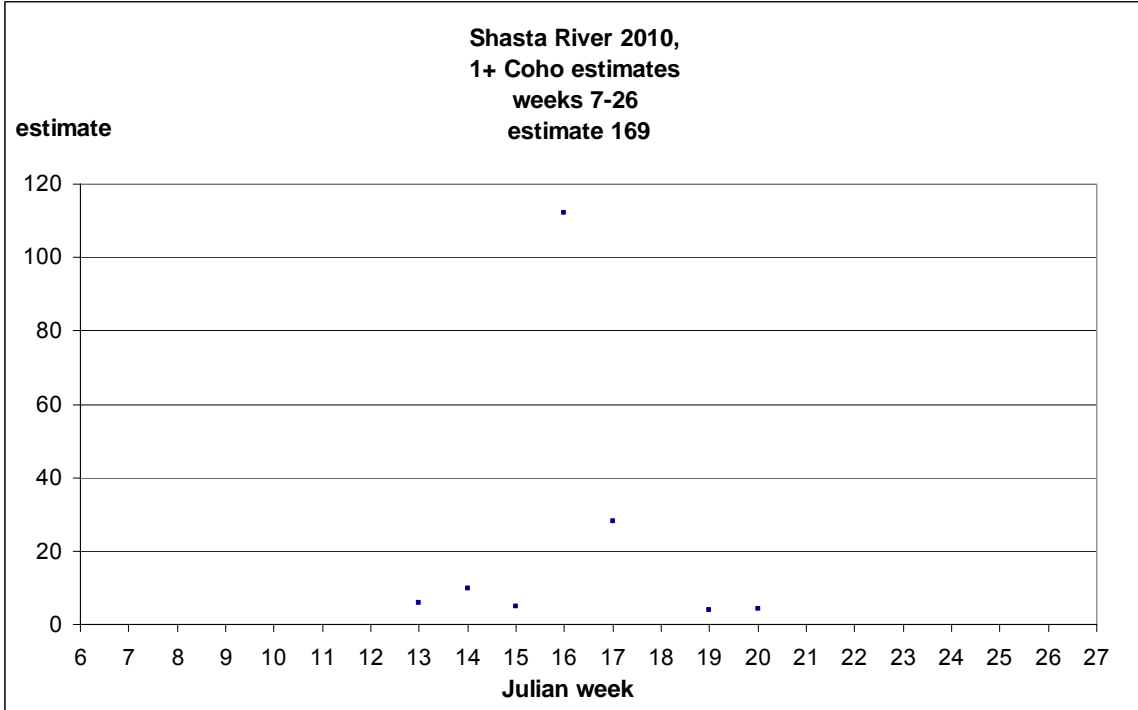


Figure 11. Shasta River 2010 1+ coho estimates weeks 7 – 26.

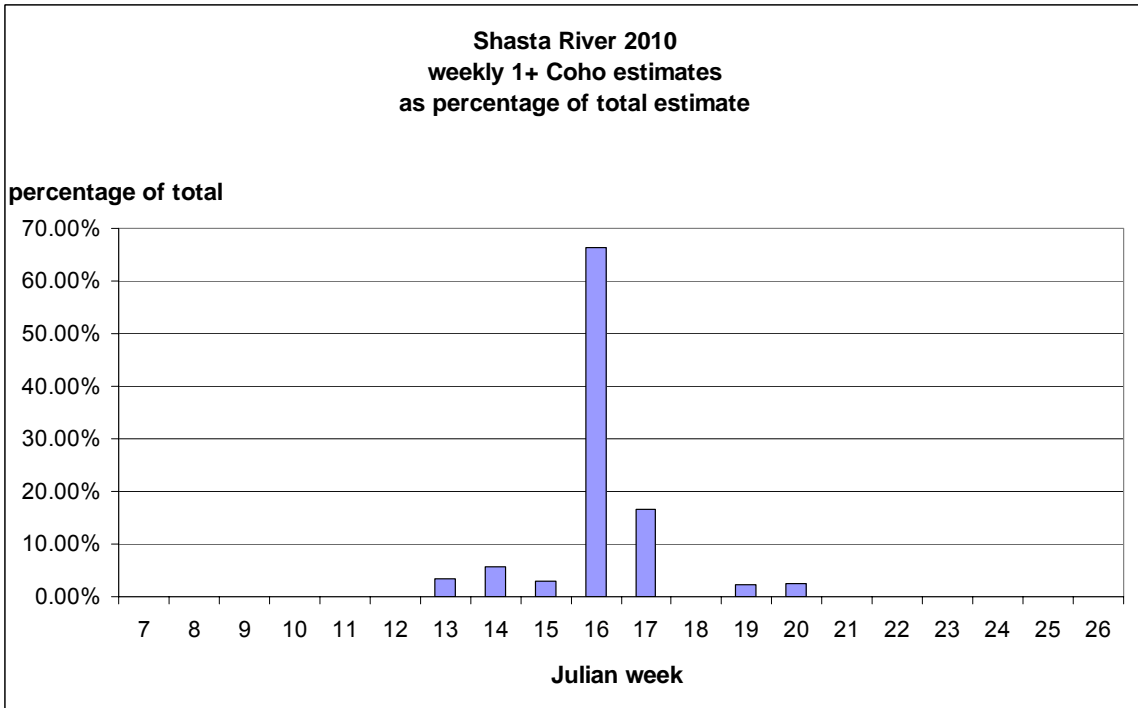


Figure 12. Shasta River 2010 1+ coho estimates as percentage of total.

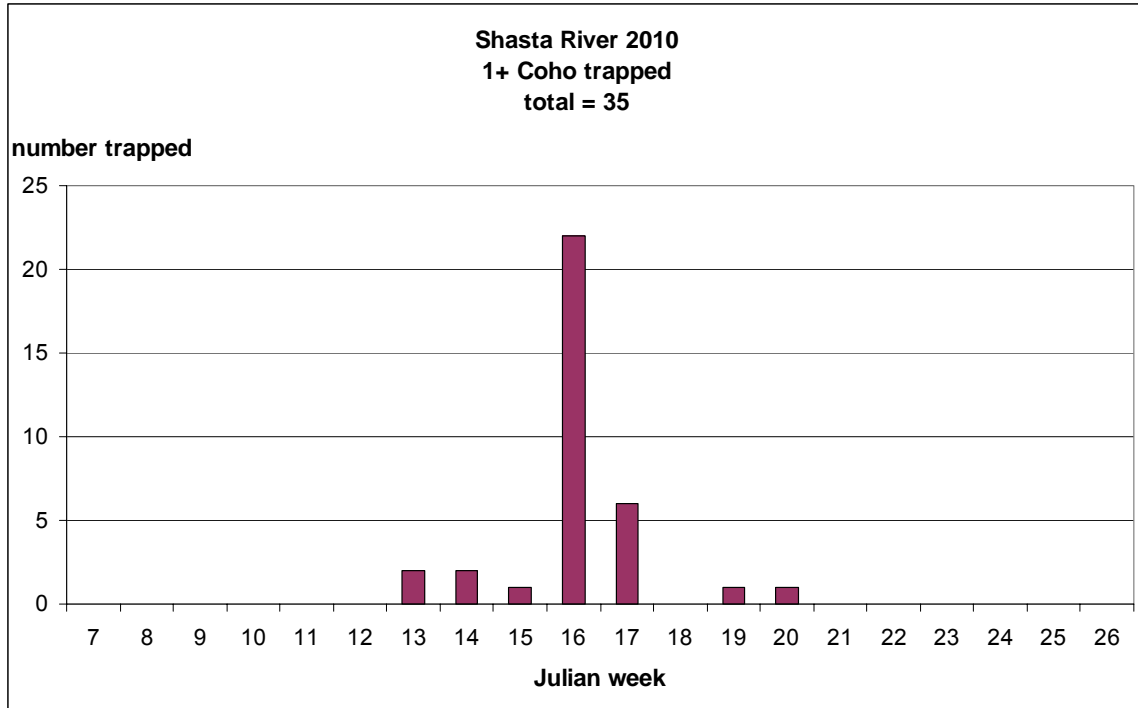


Figure 13. Shasta River 2010 1+ coho total trapped.

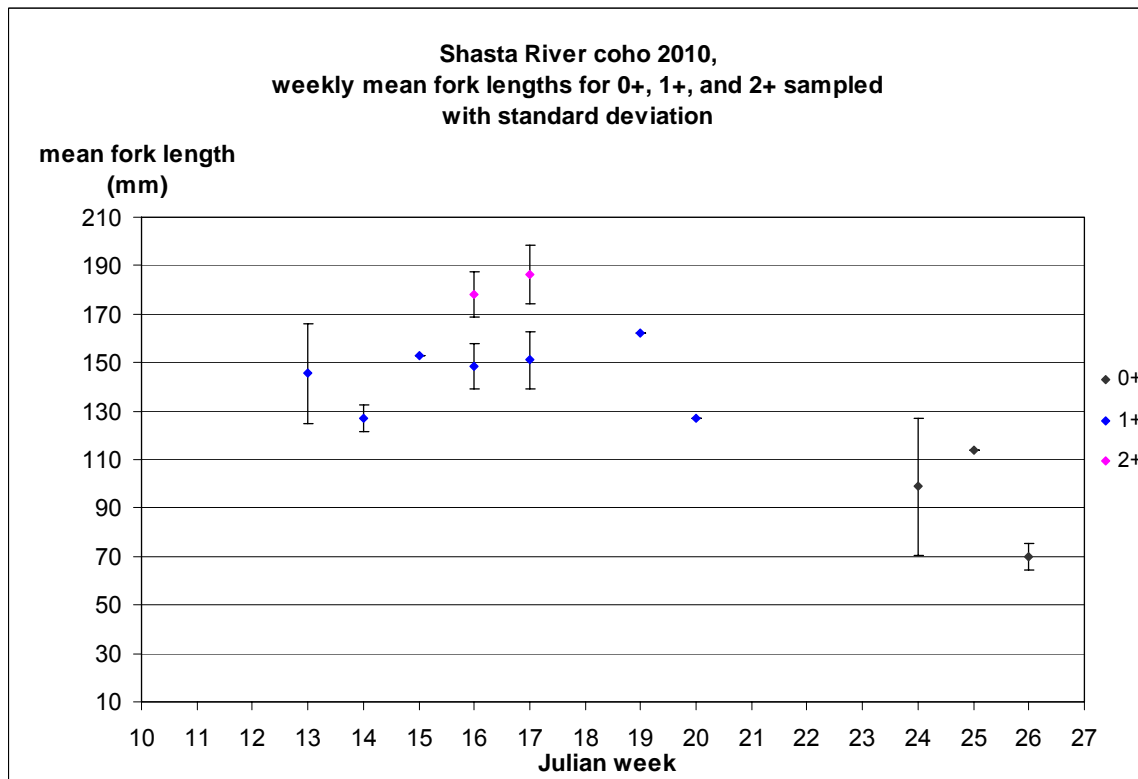


Figure 14. Shasta River 2010 weekly mean fork lengths for 0+, 1+, and 2+ coho sampled.

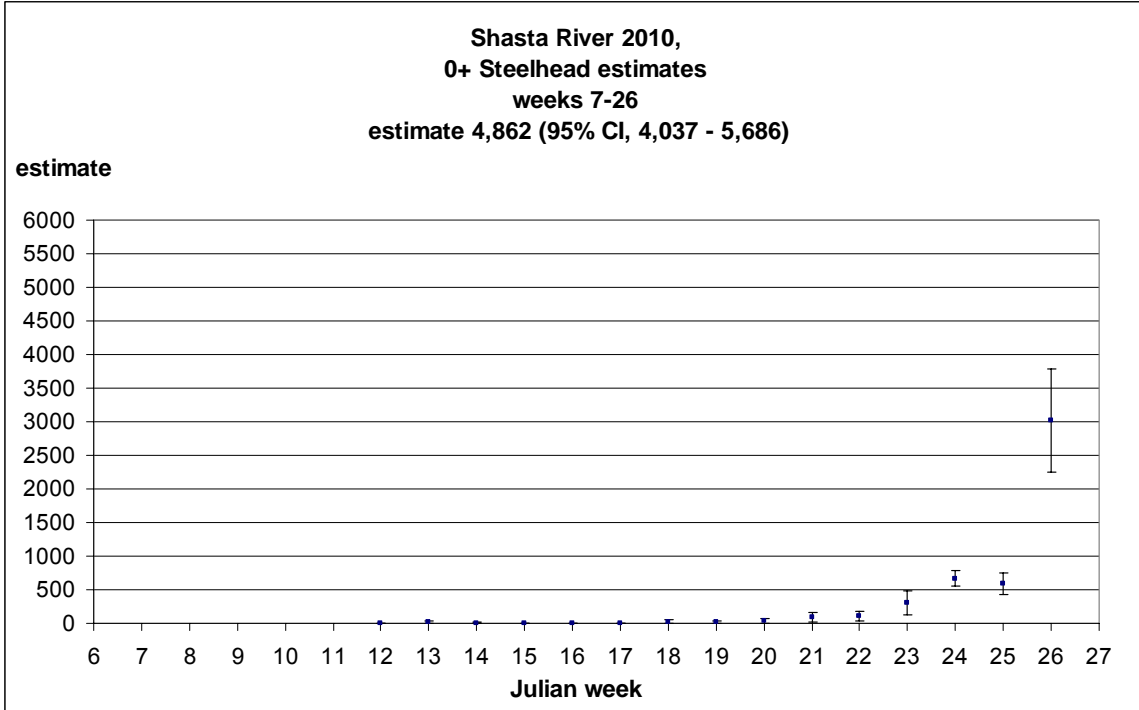


Figure 15. Shasta River 2010 0+ steelhead estimates weeks 7 – 26.

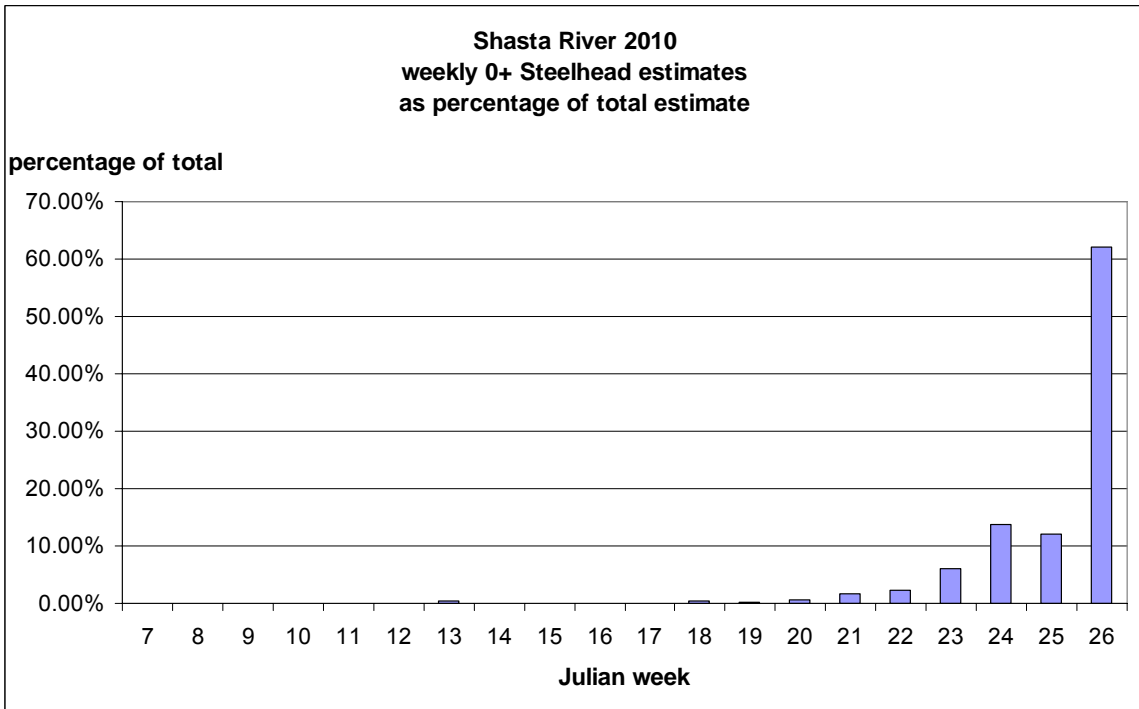


Figure 16. Shasta River 2010 0+ steelhead estimates as percentage of total.

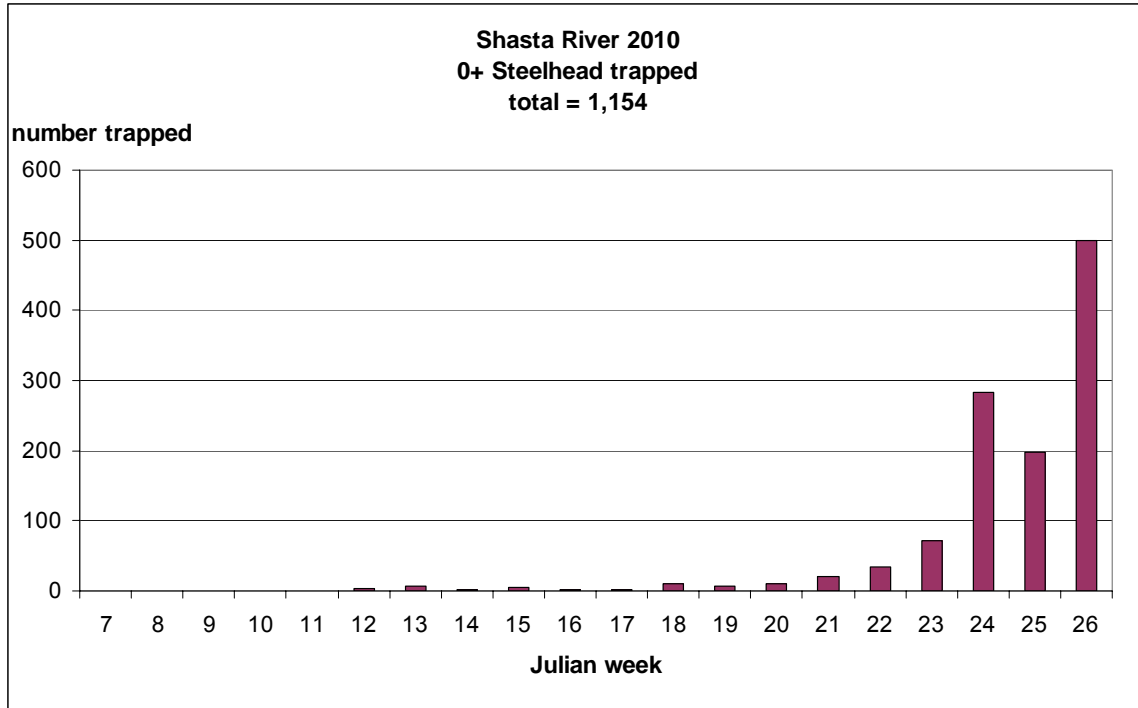


Figure 17. Shasta River 2010 0+ steelhead total trapped.

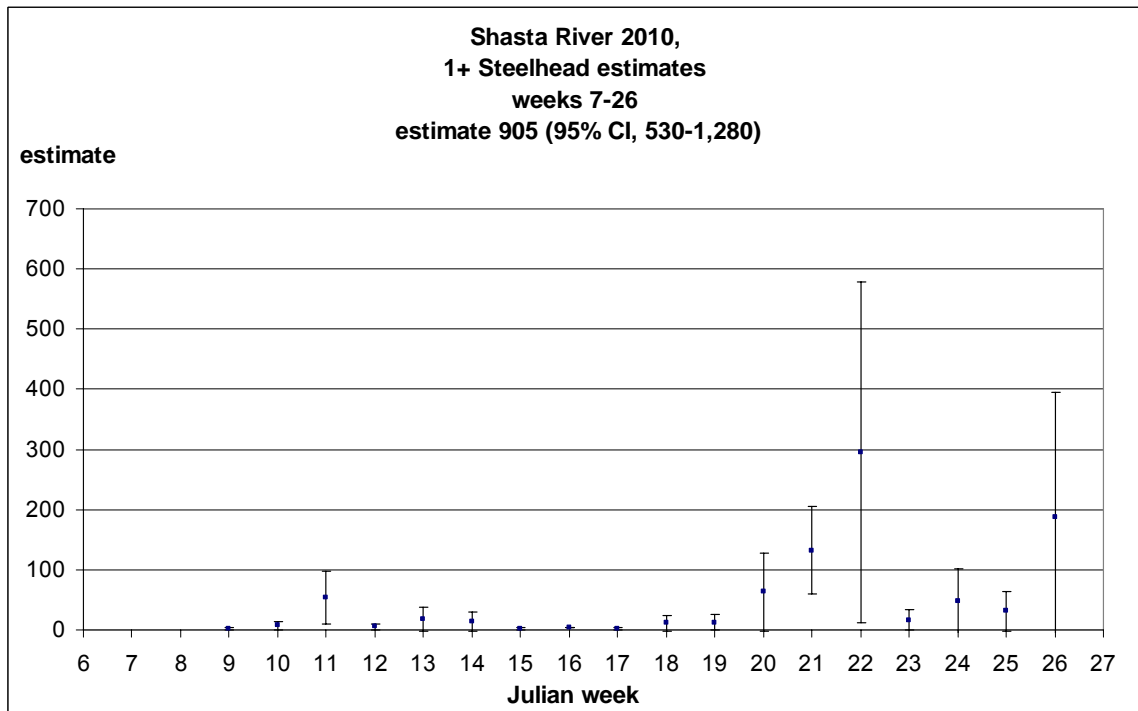


Figure 18. Shasta River 2010 1+ steelhead estimates weeks 7-26.

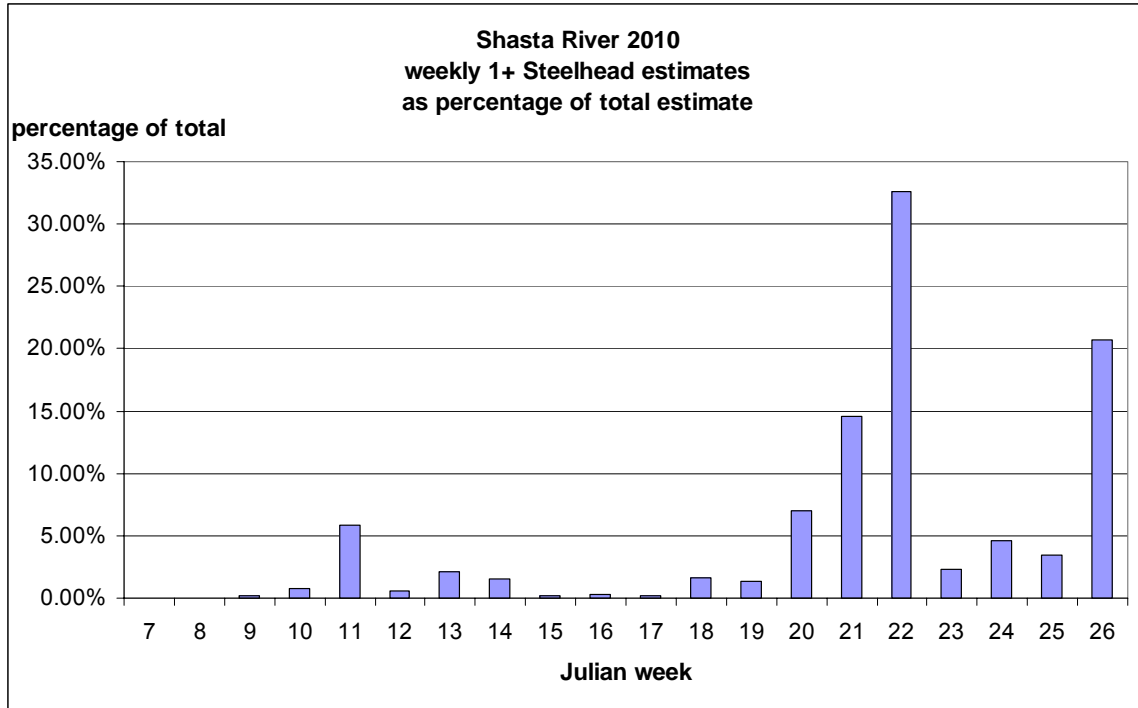


Figure 19. Shasta River 2010 1+ steelhead estimates as percentage of total.

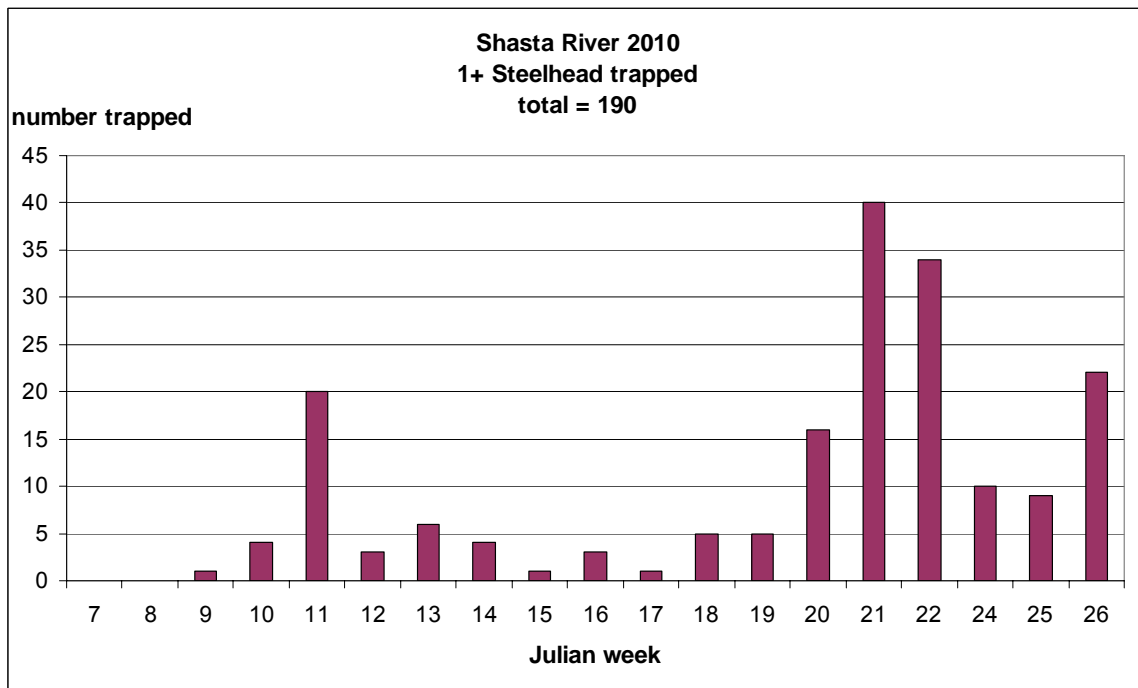


Figure 20. Shasta River 2010 1+ steelhead total trapped.

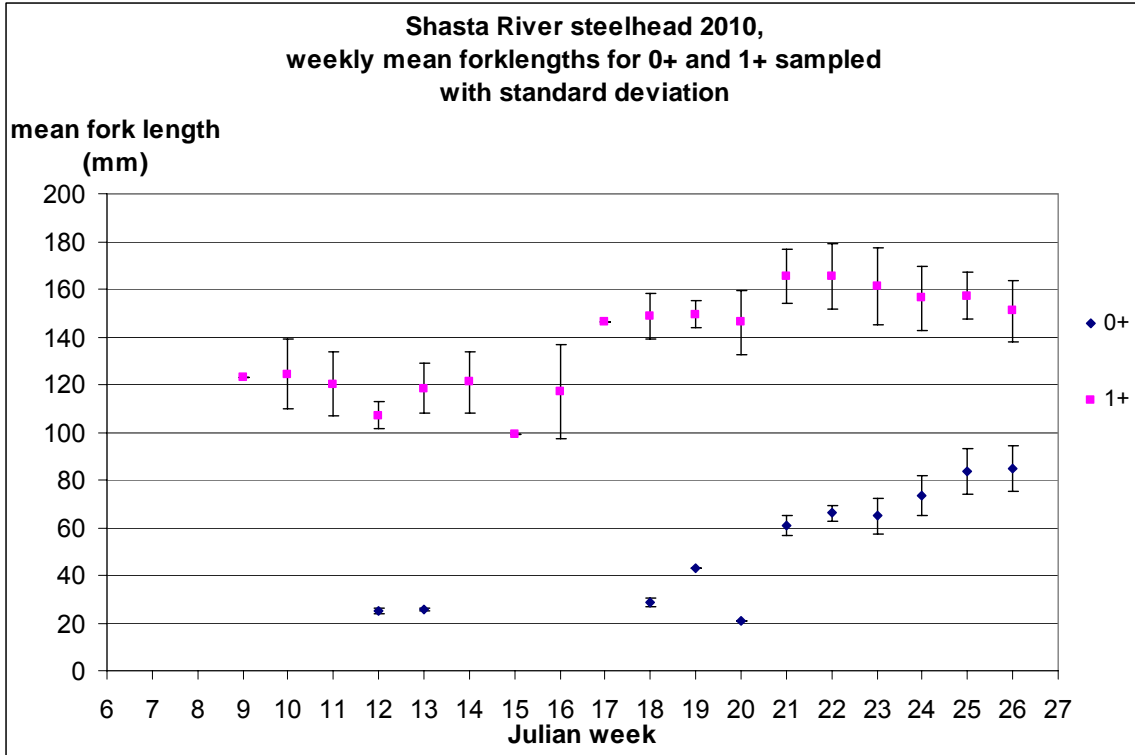


Figure 21. Shasta River 2010 weekly mean fork lengths for 0+ and 1+ steelhead sampled.

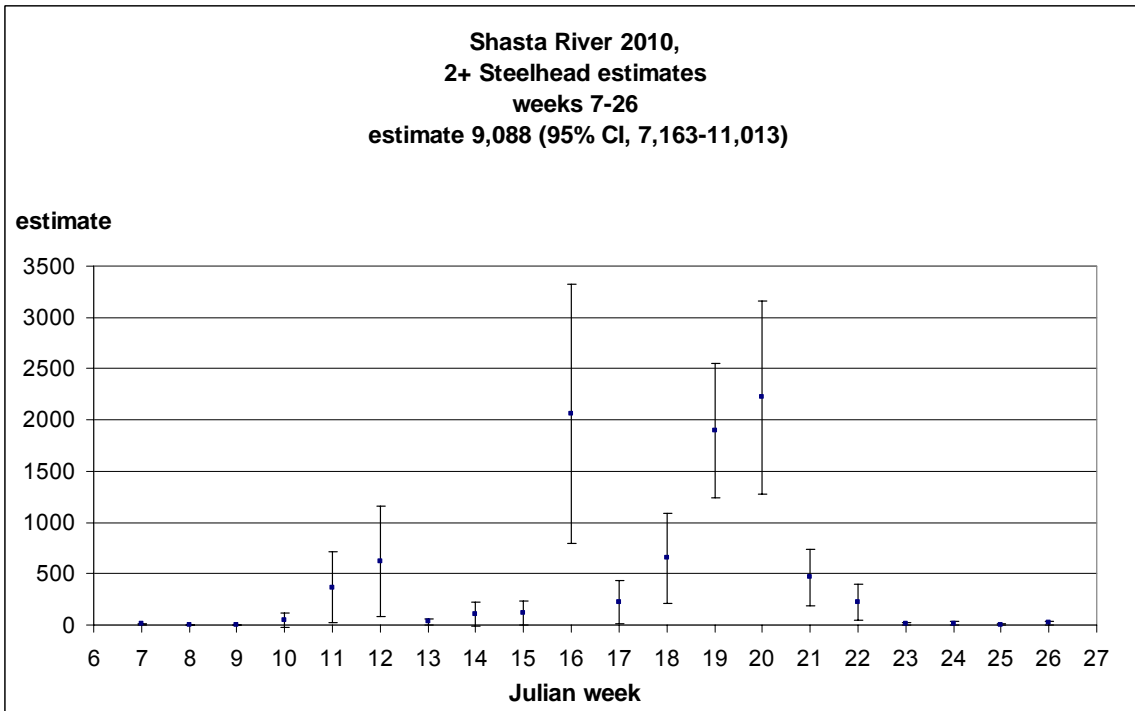


Figure 22. Shasta River 2010 2+ steelhead estimates weeks 7 – 26.

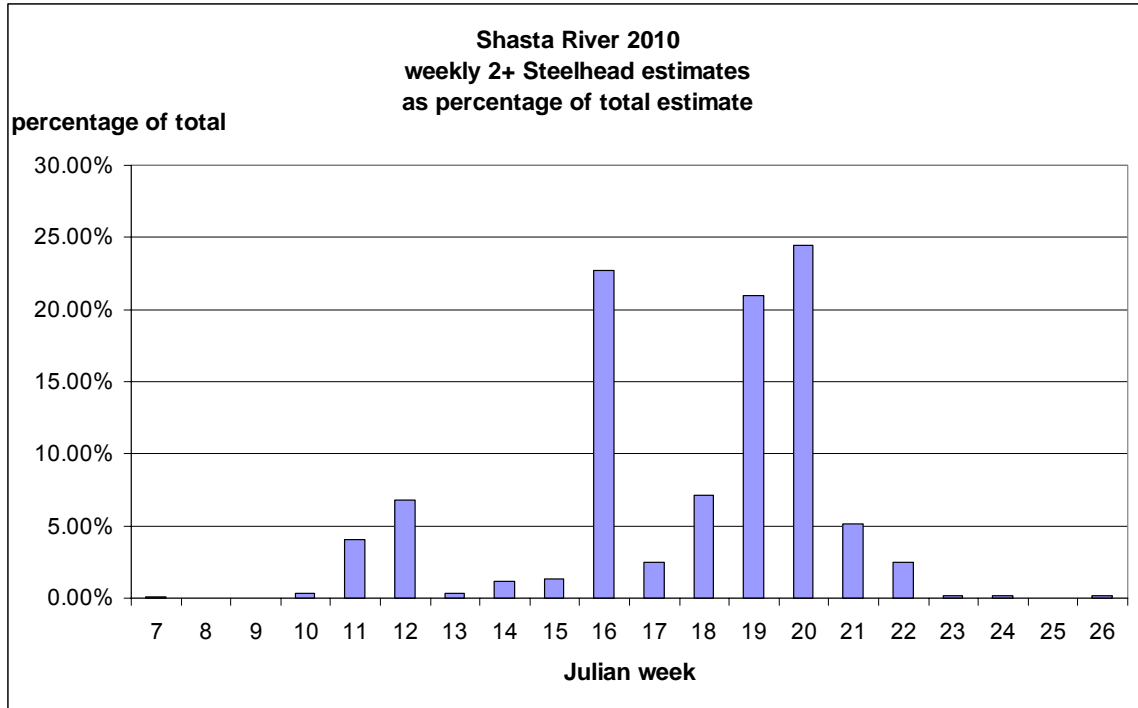


Figure 23. Shasta River 2010 2+ steelhead estimates as percentage of total.

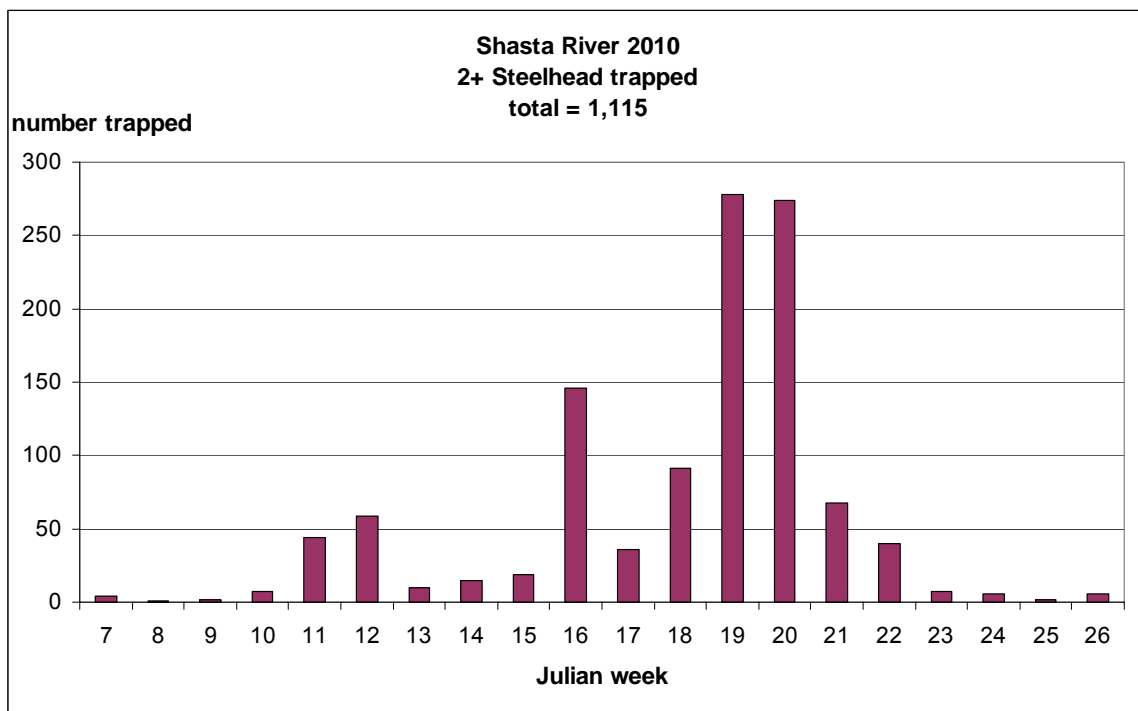


Figure 24. Shasta River 2010 2+ steelhead total trapped.

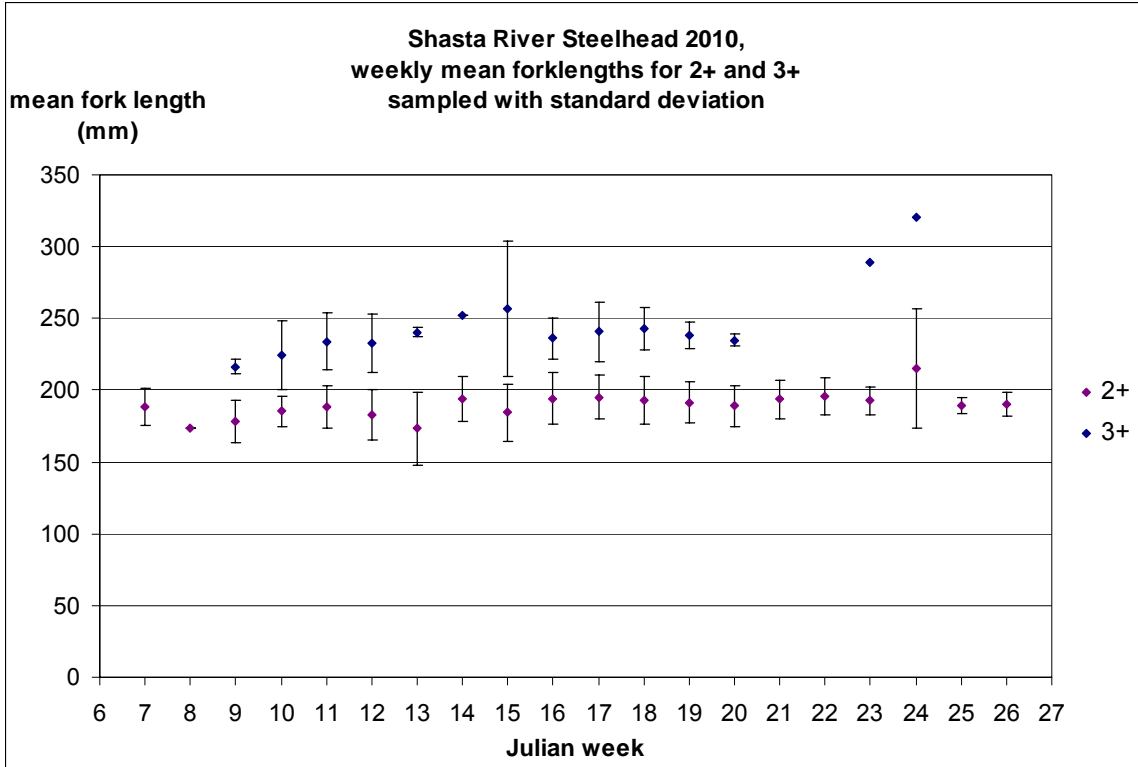
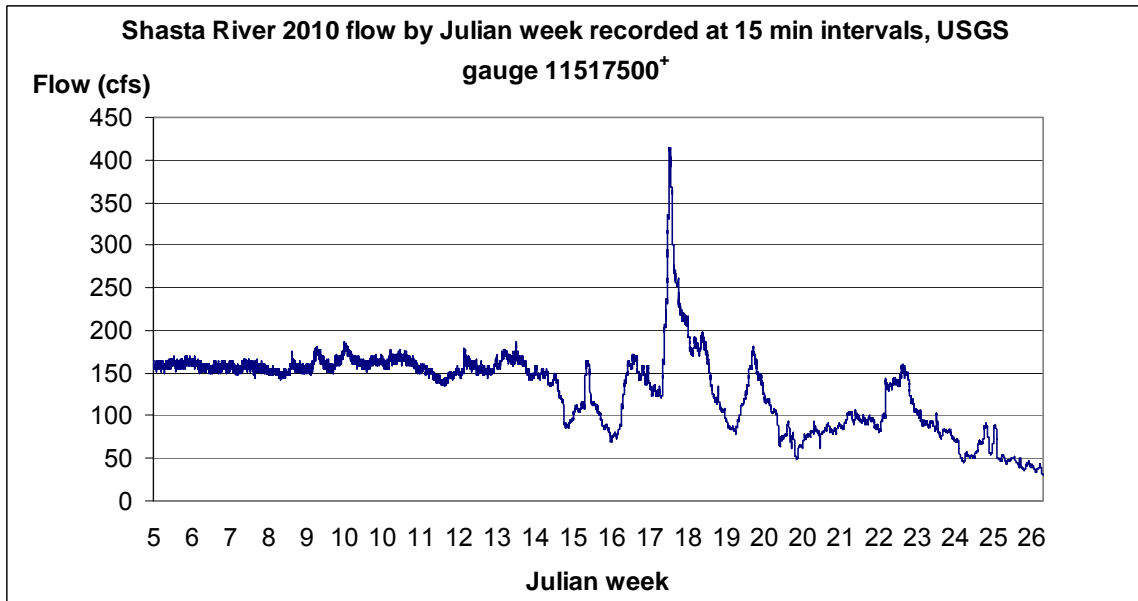


Figure 25. Shasta River 2010 weekly mean fork lengths for 2+ and 3+ steelhead sampled.



⁺ No flow values recorded between 17:15 on 6/3/2010 and 14:45 on 6/4/2010.

Figure 26. Shasta River 2010 flow by week.

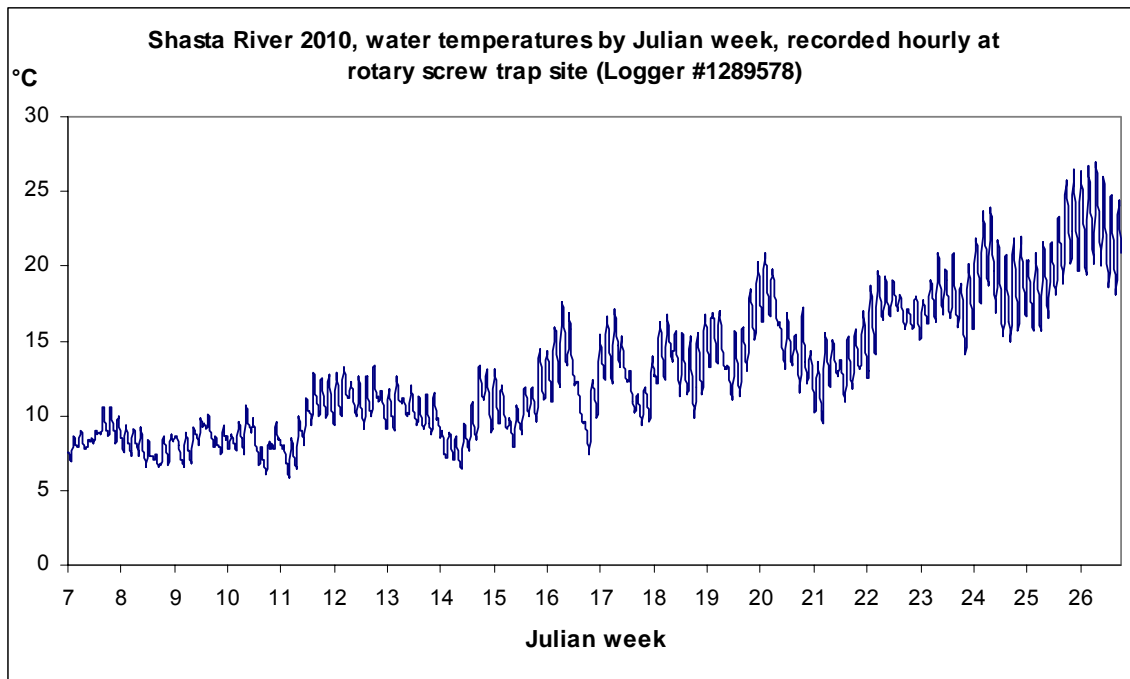


Figure 27. Shasta River 2010 water temperatures by week.

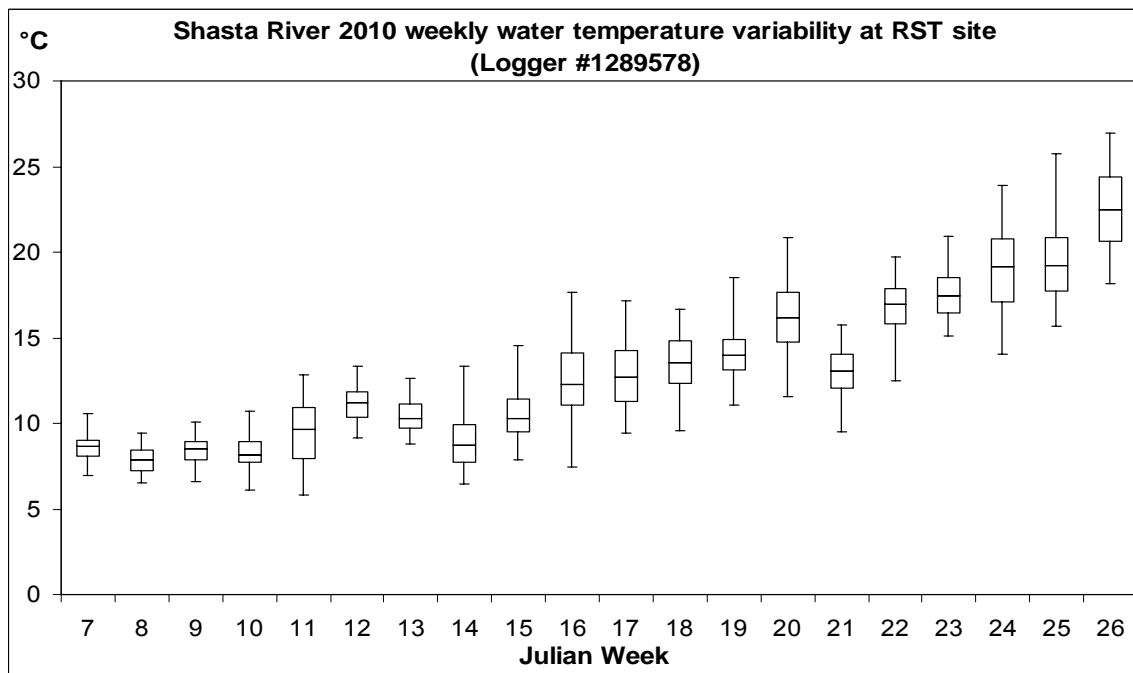


Figure 28. Shasta River 2010 weekly water temperature variability.

3.3.0 Discussion

3.3.1 Trap Operation

2010 was the first season that an extended livecar was used on the Shasta River screw trap. In years past large amounts of filamentous algae collected in the live car and increased the mortality rates for 0+ aged fish. The extended livecar was added to accommodate the large amounts of algae in addition to the catch. The new livecar's dimensions are 15' x 3'4" x 1'10"; this is 66.67% larger than the previous livecar used. To help in the flotation of this longer livecar, pontoons are attached to the side of the livecar itself. After a season of use it can be said that this extended livecar performed well. Under most conditions there was enough room in the new livecar to accumulate algae without stressing fish in the catch.

During the first few weeks of trapping, the weekly 0+ Chinook catch averaged between 40,000 and 80,000 fish with an average trap efficiency of 20%. These high trap efficiencies along with the production from a relatively large adult escapement in fall 2009 resulted in large daily catches of 0+ Chinook.

A trap efficiency of approximately 10% is preferred and allows weekly estimations of production with an acceptable confidence interval without trapping more fish than necessary. Trap efficiency can be reduced by moving the trap out of the thalweg so that less water is sampled. While this reduces the 0+ Chinook efficiency and catch, it also reduces the efficiency and catch of older age classes of fish, such as 2+ steelhead, resulting in estimates with unacceptably large confidence intervals.

In 2004 under similar conditions the need to reduce the 0+ catch of Chinook while maintaining adequate efficiencies for older age classes of steelhead was addressed by using two traps. The smolt trap was positioned to sample the fastest moving water in the thalweg and was fitted with large mesh screen in order to allow 0+ age classes to escape from the trap. A fry trap was positioned downstream in slower moving water near the channel margin and was positioned to average efficiency of 10% for 0+ salmonids.

In 2010 a similar approach was used. A secondary trap was placed next to the primary trap and contained side screens with 1cm x 2cm perforations for 0+ age fish to escape while still containing older aged fish. This secondary trap combined with the primary trap would then keep the older aged fish efficiencies up while keeping the 0+ fish efficiencies and trapping numbers down to a manageable level.

The primary and secondary trap positions were switched at the end of Julian week 14 due to high amounts of filamentous algae that clogged the perforation on the secondary trap not allowing the 0+ Chinook to escape. This led to a high mortality rate for 0+ Chinook in this trap. Because the primary trap has a 66.67% larger volume livecar it could now safely hold the entire sample since at this time the 0+ Chinook numbers were also on the decline. After switching positions the 0+ Chinook catch averaged around 10,000 until the

run dropped off drastically in Julian weeks 25 and 26. The secondary trap was not set again after the position switch in Julian week 14.

Throughout the season other steps were taken to keep the balance between efficiencies, catch totals, mortalities, and filamentous algae amounts. Dam boards were placed in the river upstream of the trap allowing for adjustments of flow into the trap. As the stream flow dropped, additional boards were placed in order to keep the cone spinning at a speed which would maintain trap efficiency. Dam boards were removed during periods of high flow in order to minimize fish mortality due to debris. The percent of the flow sampled by trap varied depending on total discharge of the river (Figure 29). When large amounts of algae were in the catch, it was necessary to raise the cone and end the set early to avoid impacts to fish in the catch (Figure 30). The cone was raised numerous times in 2010 due to large amounts of algae in the river. An example of this was in Julian week 17. During this week the trap only fished 4 sets for a total of 67 hours, sampling only 7.5 MCF when the average during the season was 12.5 MCF/week.

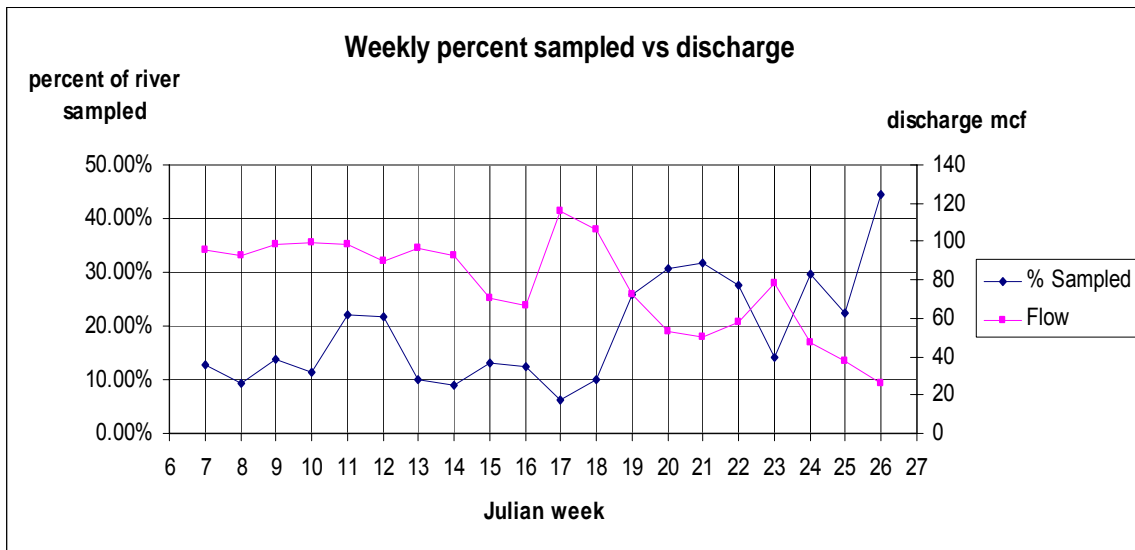


Figure 29. Shasta River weekly percent sampled vs. discharge.

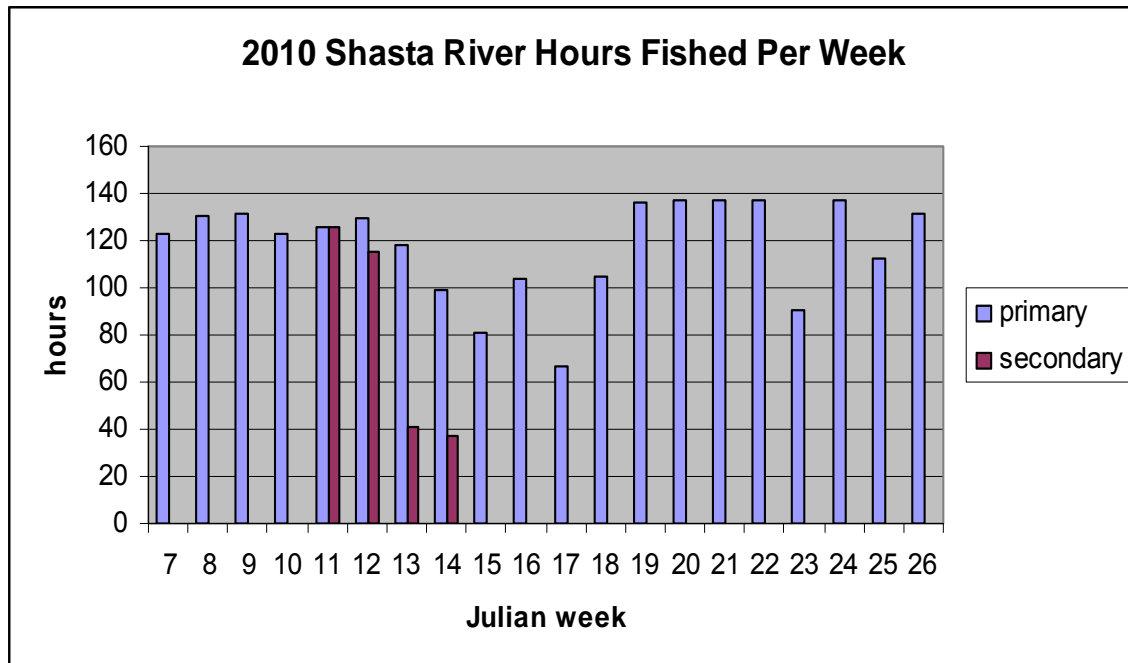


Figure 30. Shasta River hours fished per week.

3.3.2 Flow

Flow in the Shasta River in 2010 (Figure 26, Table 1) started the season below average for the months of February, March, April, and May. The percentile of the 10 year average for these months was: 57.04%, 64.67%, 90.62%, and 80.08%, respectively. The month of June was 106.67% of average, but the flow then dropped to 59.82% of average in the month of July. Even though the overall monthly flow was below average, the majority of the discharge came in pulses, such as in Julian week 17 when the flow went from 164 cfs on 4/27/10 at 11:00 am to a season peak of 415 cfs on 4/28 at 11:00 am. Within 24 hours the flow increased 151 cfs (Figure 26). Not all of these rapid spikes in flow were due to precipitation and are most likely explained by the fluctuations of upstream water diversions.

When compared to previous years the flow stayed higher longer in 2010, which helped contribute to the lower water temperatures than in previous years (Figures 31 and 32).

Table 1 2001 - 2010 Shasta River Flow Data

YEAR	2001 - 2010 Shasta River Flow Data During Months Sampled					
	Feb	Mar	Apr	May	Jun	Jul
2001	174.6	170.5	101.9	43.8	25.7	23.6
2002	215.1	170.2	98	105.9	44.3	24.2
2003	289.3	305.7	245.2	194.8	89	62.1
2004	333.9	296.1	130.5	108.7	62.3	37.8
2005	219.3	199.8	123.1	215.7	94.1	34.1
2006	629.1	443.7	418	288.2	152.4	86.8
2007	318.5	319.6	160.7	109	60	40.5
2008	258.9	225	125.1	94.8	75.2	20.6
2009	172	173.2	69.2	66.5	70.7	18.6
2010	158	159.1	146.8	106.5	80	22.2
Average	277	246	162	133	75	37
2010 percent of average	57.04%	64.67%	90.62%	80.08%	106.67%	59.82%

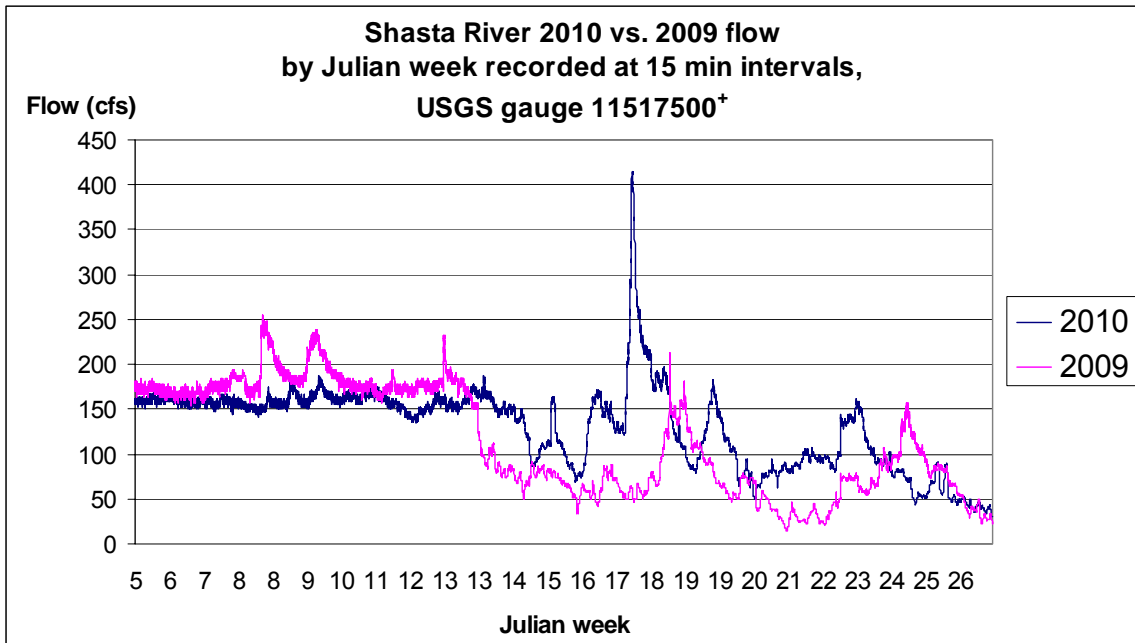


Figure 31. Shasta River 2010 vs. 2009 flow by week.

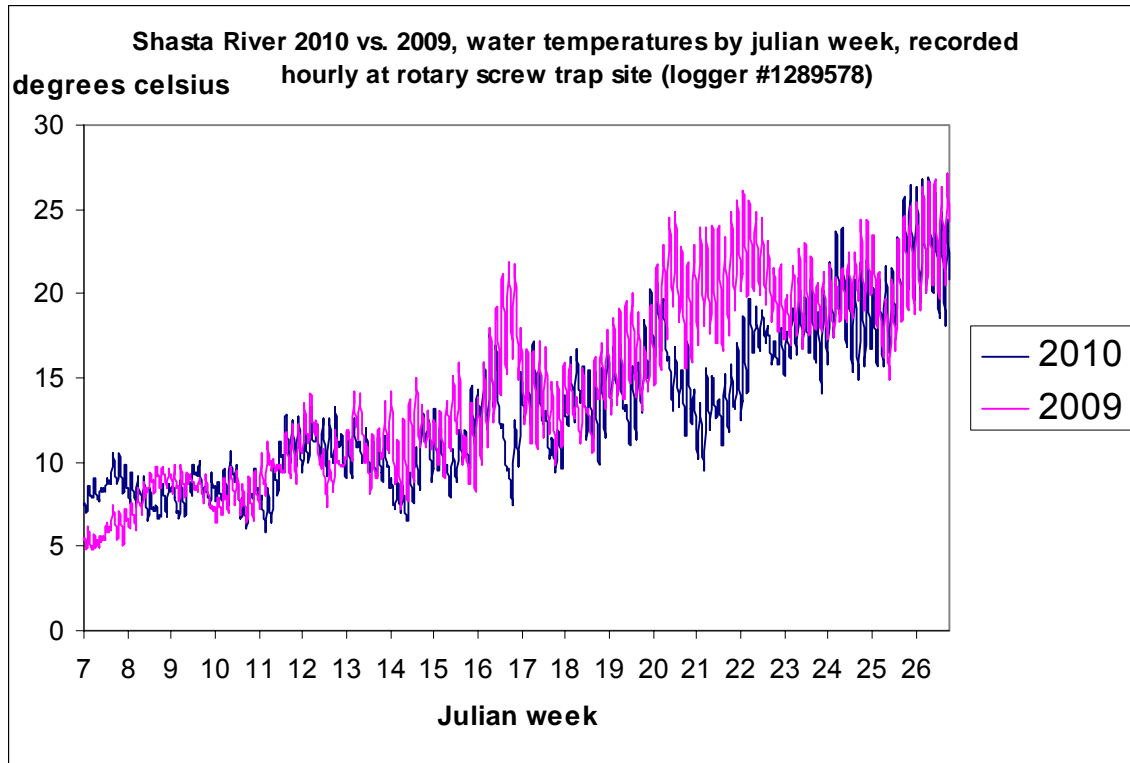


Figure 32. Shasta River 2010 vs. 2009 water temperatures by week.

3.3.3 Multi-Year Estimates

Annual estimates of the number of juvenile salmonids produced in the Shasta River began in the year 2000. The multi-year estimates listed below are limited to years in which the methods and the period sampled are comparable. The estimates were made using the methods as described on page 2 in this report. 95% confidence intervals are available for the weekly estimates with the exception of weeks without the recapture of marked fish. Estimates for these weeks were developed by expanding the catch by the seasonal trap efficiency.

An annual estimate for 1+ and 2+ steelhead was first possible in 2004 with the development of age length cutoffs (Appendix 37 and 38). Prior to 2004 combined estimates were produced for 1+ and 2+ steelhead. 2003 was the first year 0+ and 1+ coho were marked and an estimate produced.

3.3.4 Chinook

Both yearly and weekly estimates of the number of 0+ Chinook salmon produced from the Shasta River for 2010 were compared with the data from the previous nine years of sampling (Figure 33, Table 2). The estimate of 2,347,783 for 2010 was found to be the fourth largest in the ten years of trap operation.

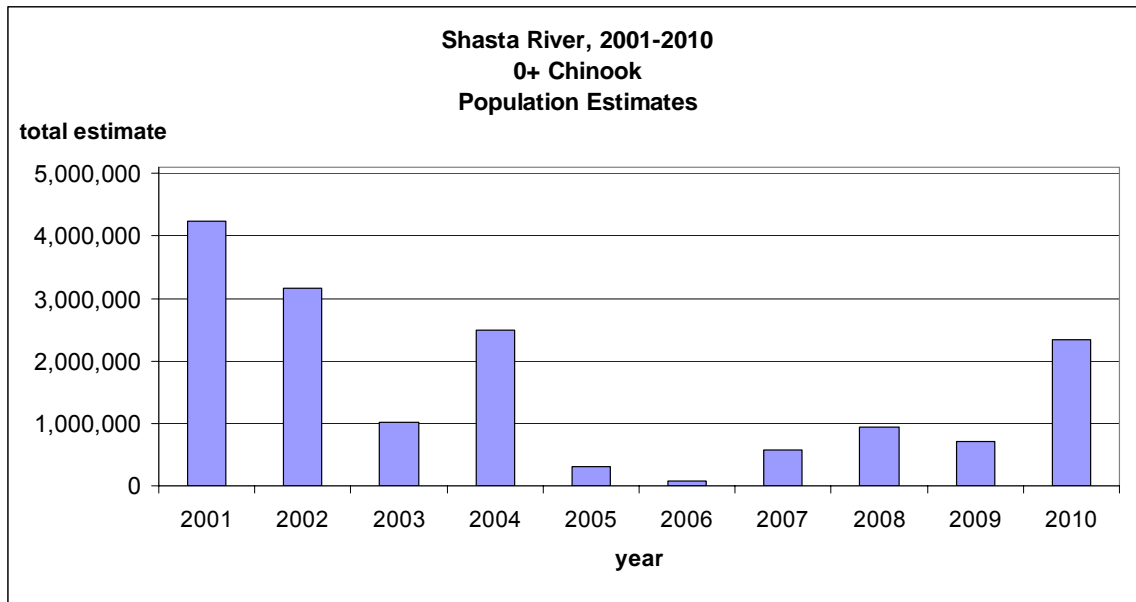


Figure 33. Shasta River 2001 – 2010 yearly 0+ Chinook population estimates.

Table 2
Shasta River 2001 - 2010 Weekly Population Estimates for 0+ Chinook Salmon

Julian Week	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
7	----	----	13,429	125,190	14,341	1,358	35,803	13,923	4,325	441,313
8	----	----	97,358	401,988	13,861	2,545	40,407	19,727	50,745	375,871
9	1,305,719	----	144,206	395,915	26,646	1,427	20,975	75,909	77,894	236,497
10	260,137	622,634	143,548	851,550	50,775	154	57,729	108,321	7,729	311,342
11	1,032,865	521,745	86,911	249,353	31,221	2,654	93,418	190,442	58,276	361,561
12	1,199,398	410,963	100,881	107,549	25,110	1,531	71,841	126,495	112,832	225,694
13	197,368	363,540	171,099	46,026	14,686	475	35,228	66,258	72,436	35,699
14	40,306	738,380	55,585	26,906	31,202	939	26,158	48,899	47,558	56,144
15	22,557	148,765	35,821	64,925	23,113	1,087	41,542	28,825	49,827	43,479
16	12,042	148,890	17,697	51,207	11,401	3,499	20,847	46,142	62,195	50,989
17	40,223	23,015	17,879	25,286	6,683	1,886	18,986	47,836	67,316	30,493
18	31,575	----	8,626	48,625	6,373	4,243	28,892	40,133	10,433	37,111
19	70,917	74,983	6,520	23,136	3,093	9,777	24,774	33,531	8,912	38,185
20	19,655	62,352	26,573	9,206	9,689	32,600	32,279	59,803	59,298	36,462
21	----	22,535	65,501	25,328	18,696	1,564	17,974	7,757	15,681	22,772
22	----	7,407	22,235	18,534	4,431	5,320	10,172	1,187	6,813	13,636
23	----	15,971	5,616	9,205	1,962	6,170	1,365	6,757	2,325	9,913
24	----	1,251	539	3,401	1,875	2,261	1,011	7,744	1,868	15,052
25	----	----	----	1,609	967	2,300	334	3,226	1,698	3,402
26	----	----	----	1,138	841	1,586	----	5,591	787	2,167
27	----	----	----	----	146	10	----	----	----	----
28	----	----	38	----	96	3	----	----	----	----
TOTAL	4,232,760	3,162,429	1,020,064	2,486,076	297,208	83,387	579,735	938,503	718,949	2,347,783

3.3.5 Coho

Both yearly and weekly estimates of the number of 1+ coho salmon produced from the Shasta River for 2010 were compared with data from the previous seven years of sampling (Figure 34, Table 3). The estimate of 169 for 2010 was found to be the smallest estimate in the eight years of 1+ coho population estimates.

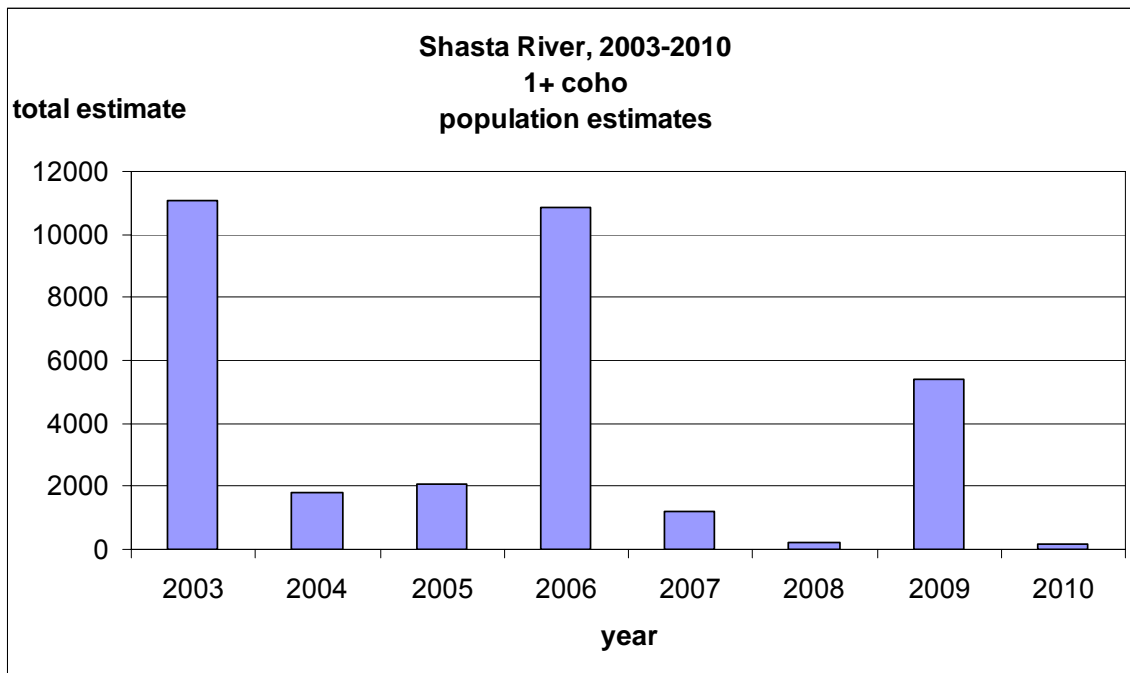


Figure 34. Shasta River 2003 – 2010 yearly 1+ coho population estimates.

Table 3
Shasta River 2003 - 2010 Weekly Population Estimates for 1+ Coho Salmon

Julian Week	2003	2004	2005	2006	2007	2008	2009	2010
7	21	-----	-----	60	-----	-----	-----	0
8	60	7	9	14	-----	-----	16	0
9	400	15	-----	-----	-----	-----	10	0
10	58	5	18	18	4	-----	18	0
11	100	78	46	85	-----	-----	20	0
12	386	135	25	55	12	-----	66	0
13	2,262	54	128	120	15	-----	381	6
14	2,937	261	117	173	326	-----	306	10
15	739	417	218	15	146	-----	1,246	5
16	1,762	337	266	226	232	-----	2,110	112
17	845	368	539	6,699	289	-----	681	28
18	950	98	222	2,048	63	-----	144	0
19	274	4	-----	1,104	53	-----	287	4
20	224	7	3	202	12	-----	75	4
21	29	-----	-----	-----	4	-----	21	0
22	4	-----	-----	8	12	-----	5	0
23	-----	-----	3	7	8	-----	10	0
24	-----	14	107	-----	4	-----	-----	0
25	-----	-----	129	-----	-----	-----	-----	0
26	-----	-----	224	-----	-----	-----	-----	0
27	-----	-----	-----	-----	-----	-----	-----	-----
28	-----	-----	-----	-----	-----	-----	-----	-----
TOTAL	11,052	1,799	2,054	10,833	1,178	208	5,396	169

In 2010, the emigrating 1+ coho smolts were again the progeny of what is one of the two weakest cohorts of Shasta River coho. Instead of the standard procedure of applying a caudal fin margin clip to a known number of the trapped coho and releasing them upstream of the trap to estimate efficiency, the fish were identified, counted and released. The correlation between the trap efficiency for 2+ steelhead smolts and 1+ coho smolts observed in 2004, 2005 and 2009 was used to estimate the number of coho smolts produced in 2010. The equation is expressed by $y = 0.7532x + 0.1485$ (Figure 36) where x is equal to 2+ steelhead efficiency and y is equal to 1+ coho efficiency.

3.3.6 Coho Smolt Production and Return Rate

We estimate that 5.45 smolts were produced per adult that returned in 2008 (Table 4) and that the average number of smolts per adult produced for brood years 2001 through 2008 has dropped to 18.38. The smolt to adult survival by year is shown for Shasta River coho 1+ in Table 5. Using the average survival of 2.8%, we project that 5 of the 169 1+ coho estimated to have emigrated in 2010 will return to spawn in 2011.

Table 4
Coho 1+ produced per returning adult

Brood year	Adults*	1+ produced in	Year	smolts per adult
2001	291	11052	2003	37.98
2002	86	1799	2004	20.92
2003	187	2054	2005	10.98
2004	373	10833	2006	29.04
2005	69	1178	2007	17.07
2006	47	208	2008	4.43
2007	255	5396	2009	21.16
2008	31	169	2010	5.45
2009	9	165	2011	18.38
2010	43**	788	2012	18.38

Projected production in 2011 and 2012 based on average production of 18.38% 1+ per adult observed for brood years 2001 – 2008

** All counts of returning adults are produced by the CDFG Klamath River Project, Shasta River Fish Counting Facility*

*** 2010 adult data are preliminary and subject to revision*

Table 5
Coho 1+ to adult survival

Brood year	Adults*	Emigration year	1+ produced	% return	Adults returning in	Brood year
2001	291	2003	11052	3.37%	373	2004
2002	86	2004	1799	3.84%	69	2005
2003	187	2005	2054	2.29%	47	2006
2004	373	2006	10833	2.35%	255	2007
2005	69	2007	1178	2.63%	31	2008
2006	47	2008	208	4.33%	9	2009
2007	255	2009	5396	0.79%	43	2010
2008	31	2010	169	2.80%	5	2011
2009	9	2011	165	2.80%	5	2012
2010	43**	2012	788	2.80%	22	2013

Projected 1+ estimate for 2011 and 2012 were made using the mean smolt per adult value (18.38%) from brood years 2001 through 2008.

Projected adult returns for 2010 - 2012 are based on the average 1+ smolt to adult survival rate for 2004 - 2008 (2.80%).

** All counts of returning adults are produced by the CDFG Klamath River Project, Shasta River Fish Counting Facility*

*** 2010 adult data are preliminary and subject to revision*

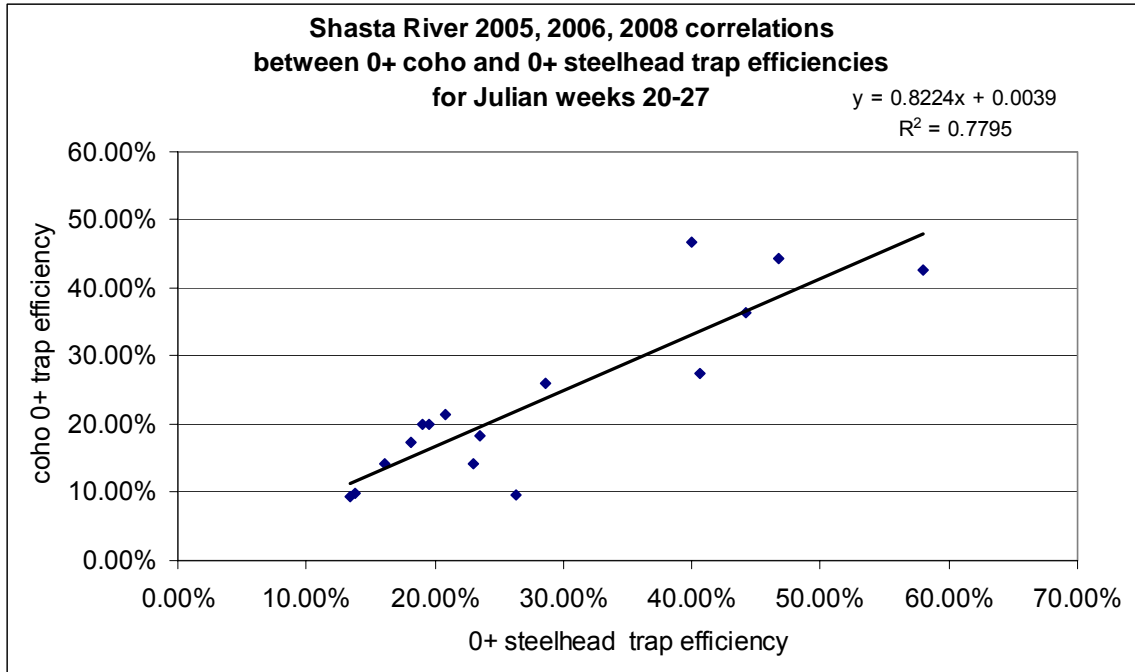


Figure 35. Shasta River 0+ coho/0+ steelhead trap efficiency correlations.

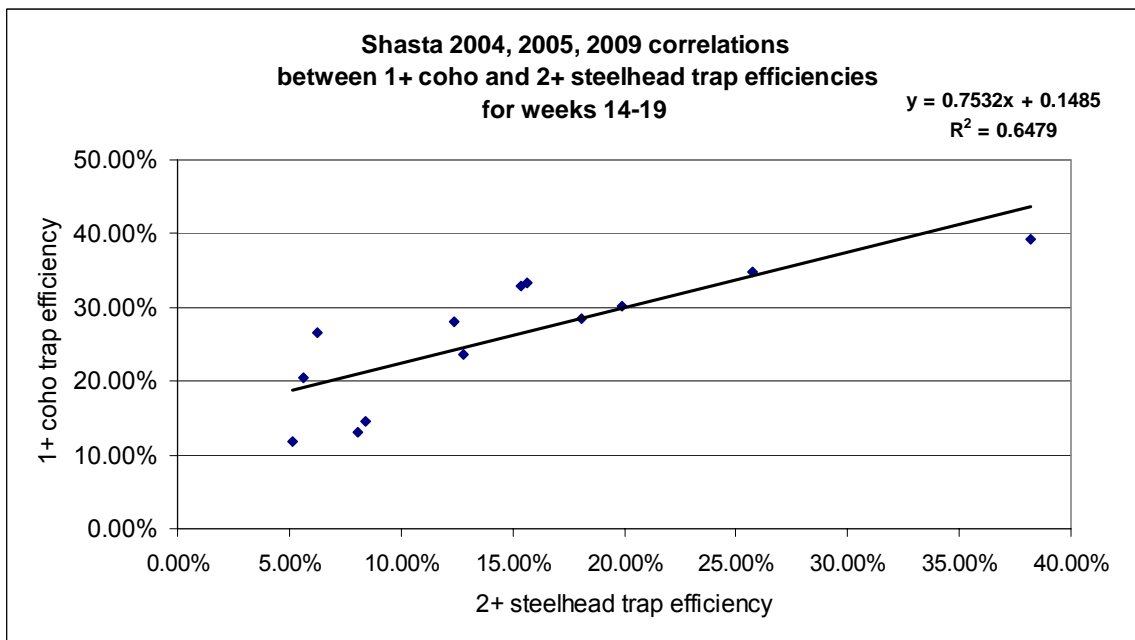


Figure 36. Shasta River 1+ coho/2+ steelhead trap efficiency correlations.

The trap efficiencies between coho and steelhead are believed to be well correlated because both species are at the same life stage and are responding similarly to environmental conditions. 0+ coho were correlated to 0+ steelhead and 1+ coho were correlated to 2+ steelhead (Figures 35, 36).

3.3.7 Steelhead

Both yearly and weekly estimates of the number of 2+ steelhead trout produced from the Shasta River for 2010 were compared with the data from the previous six years of sampling (Figure 37, Table 6). The estimate of 9,088 for 2010 was found to be the smallest estimation in the seven years of 2+ steelhead population estimates.

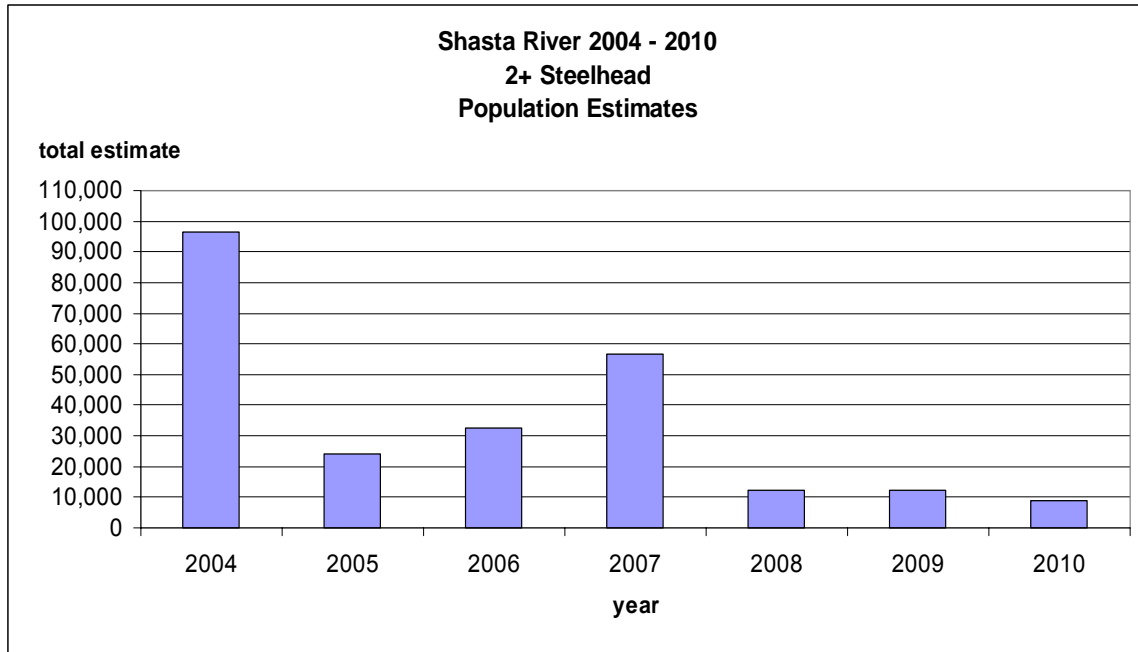


Figure 37. Shasta River 2004 – 2010 yearly 2+ steelhead population estimates.

Table 6**Shasta River 2004 - 2010 Weekly Population Estimates for 2+ Steelhead**

Julian Week	2004	2005	2006	2007	2008	2009	2010
7	-----	4	22	9	14	45	8
8	-----	-----	41	125	10	114	2
9	112	7	2	10	38	83	0
10	612	89	27	143	252	279	49
11	4,125	760	2	1,732	191	377	367
12	8,458	538	15	5,382	164	698	620
13	1,938	376	2	2,472	920	2806	30
14	5,962	1,043	6	2,626	1,901	1329	105
15	7,500	1,262	4	1,890	1,739	2989	120
16	15,893	763	94	2,616	857	10327	2060
17	27,048	3,278	2,391	7,637	1,731	3511	223
18	8,886	5,648	17,136	4,541	1,177	798	650
19	6,120	4,015	6,930	19,421	2,017	1595	1898
20	6,398	3,718	4,975	6,543	1,264	2134	2221
21	1,195	2,289	187	449	82	219	462
22	1,291	278	276	722	18	66	224
23	704	119	105	57	7	14	13
24	36	33	31	82	-----	2	15
25	150	17	251	28	-----	9	4
26	-----	-----	125	-----	5	-----	18
27	-----	-----	1	-----	-----	-----	-----
28	-----	-----	-----	-----	-----	-----	-----
TOTAL	96,426	24,235	32,621	56,483	12,386	27,395	9,088

4.0 Scott River Rotary Screw Trap Summary 2010

4.1.0 Methods

The Scott River was sampled with a five foot and an eight foot rotary screw trap manufactured by EG Solutions, Corvallis, Oregon. The traps were operated six days per week, Sunday afternoon through Saturday morning, at approximately 4.75 miles upstream of the confluence with the Klamath River at 041° 43' 34.87" N, 123° 00' 30.11" W. The catch in the trap was processed daily at approximately 0900 hrs. The velocity of the water was measured entering each cone at the beginning and end of each set with a flow meter manufactured by General Oceanics model 2030R and the total volume sampled was then calculated for each set.

All vertebrates collected in the trap were identified and counted. Salmonids collected in the trap were classified by species, age and life stage.

4.1.1 Bio-Sampling

The same bio-sampling methods as described in the Shasta River section on page 5 of this report were also used on the Scott River.

4.1.2 Age Determination

The same age-length cutoffs for salmonids that were developed for use in 2007 were used again this year (Appendix 36). These cutoffs were determined from fork length frequency distributions and by estimating the age of scales in the 2001-2007 collection. Individual scale samples were visually examined and categorized into brood years using scale age-estimation methods (Van Oosten 1957, Chilton and Beamish 1982, Casselman 1983). Fork length intervals for each age class were determined for appropriate time periods and updated throughout the season. The intervals are not absolutes and as a result of variable growth, some individuals may be larger or smaller than the cutoff fork length.

4.1.3 Trap Efficiency Determinations and Production Estimates

Trap efficiencies for Chinook and steelhead were calculated weekly using the same methods described in the Shasta River section on page 3 of this report. Weekly efficiency trials for all age classes of both Chinook and steelhead in the catch were conducted on the Scott River in 2010.

Prior to 2007, 1+ and 0+ coho were marked and released upstream of the rotary trap to produce weekly estimates of trap efficiency. Due to the low number of 0+ and 1+ coho projected for 2010, fish handling was minimized. In order to estimate population without actually marking the fish two methods were devised. For 0+ aged coho a correlation between 0+ coho and 0+ steelhead from the years 2005 and 2006 was used. This was different, however, for 1+ coho as no reasonable direct correlation could be found.

The correlation between 0+ steelhead and 0+ coho in 2005 and 2006 is expressed by the equation $y = 1.2666x + 0.0847$ (Figure 66). The weekly efficiencies for 0+ steelhead from 2010 were equal to x and with y equaling 0+ coho.

In 2010 the ratio between seasonal trap efficiencies for 2+ steelhead smolts and 1+ coho smolts observed in 2005, 2006, 2008 and 2009 was used to estimate the number of coho smolts produced in 2010. Seasonal trap efficiencies are developed by computing the percentage of total marked fish that were recaptured during the trapping season. For the years listed above it was possible to generate seasonal trap efficiencies. The situation encountered in 2010 is similar to that experienced in 2007 where no age 1+ coho salmon were subjected to mark/recapture treatments. An alternative method was devised to generate an appropriate estimate. Seasonal trap efficiencies for age 2+ steelhead and age 1+ coho salmon for years 2005 and 2006 were averaged to obtain an estimate for seasonal trap efficiency for 2007. Dividing the age 1+ coho salmon efficiency by the corresponding age 2+ steelhead efficiency yielded a ratio. This ratio was then multiplied by the actual, observed age 2+ steelhead seasonal trap efficiency for the year 2007. Thus from this is generated an estimate of the age 1+ coho salmon seasonal trap efficiency for 2007.

Age 1+ coho salmon encountered in 2010 were of the same cohort as those age 1+ fish captured in 2007. The same method used in 2007 was used again in 2010. Seasonal trap efficiencies for years 2005, 2006, 2008 and 2009 were averaged to develop estimated seasonal trap efficiencies for age 1+ coho salmon and age 2+ steelhead. The average values were then used to find the ratio of 2.10 (Table 7). Again, this ratio was multiplied by the observed age 2+ steelhead seasonal efficiency of 4.23%, which yielded an estimated seasonal efficiency for age 1+ coho salmon of 8.87%. When the observed catch of age 1+ coho salmon of 185 individuals was expanded using this efficiency estimate, an estimated population of 2,086 fish was developed. This number was used to produce a seasonal estimate of 1+ coho for the Scott River 2010 season with no confidence intervals. There is no correlation for 2+ coho due to the fact that there is a limited mark recapture history for this age class of coho.

Table 7
Seasonal trap efficiencies for 1+ coho and 2+ steelhead

	Seasonal trap efficiency 1+ coho	Seasonal trap efficiency 2+ steelhead	ratio of coho to steelhead efficiency
2005	7.54	5.23	1.44
2006	6.21	1.71	3.63
2008	6.14	3.91	1.57
2009	9.31	3.08	3.02
average seasonal efficiency	7.3	3.48	2.10

4.1.4 Water Temperature and Flow Monitoring

Stream flow measurements presented in this report were made using preliminary data from the United States Geological Survey (USGS) recorded at stream gauge number 11519500 (Figure 65). This gauge is located approximately 19.5 miles upstream of the trap. Several large tributaries without stream gauges and numerous small streams enter the Scott River between the gauge and the trap and are not included in the flow measurements.

Hourly water temperature was recorded using the same methods as described in the Shasta River section of this report on page 6

4.1.5 Data Entry and Analysis

The same data entry and analysis methods as described in the Shasta River section on page 7 of this report were also used with the data from the Scott River.

4.2.0 Results

The eight-foot Scott River rotary trap began sampling six days per week on February 15, 2010. Trapping ended after 19 weeks on July 1, 2010. The trap fished 92 sets for a total of 2,136.7 hours. An estimated 303,847,100.97 cubic feet of water was sampled. The five-foot Scott River rotary trap began sampling six days per week on February 12, 2010. After 19 weeks, trapping ended on July 1, 2010. The trap fished 76 sets for a total of 1,793.6 hours. An estimated 306,142,977.03 cubic feet of water was sampled during the season. The number of salmonids trapped, marked and recaptured by Julian week was recorded, and weekly population estimates with a 95% Confidence Interval (CI) were produced (Appendices 10 – 17). Weekly mean fork lengths, sample size, minimum and maximum size were also recorded with standard deviations (Appendices 27 – 34).

4.2.1 Chinook

Chinook 0+

An estimated 655,467 0+ Chinook (95% CI, 571,177 – 739,757) emigrated from the Scott River during the period sampled (Figure 38). The greatest number of Chinook emigrated during Julian week 19 (79,256, 95% CI, 38,882 – 119,630). This is equal to 12.1% of the total estimate (Figure 39). A total of 30,685 0+ Chinook were trapped during sampling (Figure 40, Appendix 10). The mean fork length for 0+ Chinook during Julian week 19 was 46 mm (Figure 44, Appendix 27).

Chinook 1+

An estimated 1,204 1+ Chinook (95% CI, 649 – 1,760) emigrated from the Scott River during the period sampled (Figure 41). The greatest number left during Julian week 9 (365 95% CI 0 – 776). This is equal to 30.3% of the total estimate (Figure 42). A total of 172 1+ Chinook were trapped during sampling (Figure 43, Appendix 11). The mean fork length for 1+ Chinook during Julian week 9 was 103 mm (Figure 44, Appendix 28).

In the sub-sample, 2304 0+ Chinook and 177 1+ Chinook were measured and aged, with 67 scale samples taken and 55 otolith samples retrieved.

4.2.2 Coho

Coho 0+

An estimated 5,314 0+ coho emigrated from the Scott River during Julian weeks 7 - 26 (Figure 45). The greatest number left during Julian week 15, which was a total of 2,001. This is equal to 37.64% of the total estimate (Figure 46). A total of 678 0+ coho were trapped during sampling (Figure 47, Appendix 12). The mean fork length for 0+ coho during Julian week 15 was 35 mm (Figure 49, Appendix 29). No confidence intervals were included due to no efficiency trial actually being run. These estimations are based

upon 0+ Steelhead trap efficiencies correlated to 0+ coho from the 2005 and 2006 seasons (Figure 64).

Coho 1+

An estimated 2,174 1+ coho emigrated from the Scott River during Julian weeks 7 – 22. The greatest number left during Julian week 19, a total of 38 trapped. A total of 185 1+ coho were trapped during sampling (Figure 48, Appendix 13). The mean fork length for 1+ coho during Julian week 19 was 121 mm (Figure 49, Appendix 30). No confidence intervals are included due to no efficiency trial actually being run. These estimations are based upon the ratio of 2+ steelhead trap efficiencies from the 2004 to 2009 season to 1+ coho seasonal trap efficiencies (see Trap Efficiency Determinations and Production Estimates above). No weekly estimates are provided because the efficiency derived is based upon whole season efficiencies, rather than individual weekly efficiencies.

Thirty-one (31) 0+ coho and 158 1+ coho were measured and aged in the sub-sample, with 10 scale samples taken and 16 otolith samples retrieved.

4.2.3 Steelhead

Steelhead 0+

An estimated 6,752 0+ steelhead (95% CI, 3,525 – 9,979) emigrated from the Scott River during Julian weeks 15 – 26 (Figure 50). The greatest number left during Julian week 22 (1,884, 95% CI, 83 – 3,684). This is equal to 27.90% of the total estimate for the period sampled (Figure 51). To minimize the handling of these fish, no fork lengths were taken during week 22. A total of 433 0+ steelhead were trapped during sampling (Figure 52, Appendix 14). In the last week of sampling, Julian week 26, the mean fork length was 57 mm (Figure 56, Appendix 31).

Steelhead 1+

An estimated 40,472 1+ steelhead (95% CI, 32,843 – 48,101) emigrated from the Scott River between Julian weeks 7 through 26 (Figure 53). The greatest number left during Julian week 12 (8,827 95% CI, 6,473 – 11,181). This is equal to 21.8% of the total estimate for the period sampled (Figure 54). A total of 2,958 1+ steelhead were captured during sampling (Figure 55, Appendix 15). The mean fork length for 1+ steelhead during Julian week 12 was 94 mm (Figure 56, Appendix 32).

Steelhead 2+

An estimated 4,299 2+ steelhead (95% CI, 2,591 – 6,008) emigrated from the Scott River in weeks 7 – 26 (Figure 57). The greatest number left during Julian week 12 (1,806 95% CI, 634– 2,978). This is equal to 42.0% of the total estimate for the period sampled (Figure 58). A total of 383 2+ steelhead were captured during sampling (Figure 59, Appendix 16). The mean fork length for 2+ steelhead during Julian week 12 was 135 mm (Figure 61, Appendix 33).

Steelhead 3+

A total of 6 3+ steelhead were captured during sampling (Figure 60, Appendix 17).

Seventy-two (72) 0+ steelhead, 2080 1+ steelhead, 383 2+ steelhead, and 5 3+ steelhead were measured and aged in the sub-sample, with 233 scale samples taken and 31 otolith samples retrieved.

4.2.4 Temperature Monitoring

The Maximum Weekly Maximum Temperature (average of daily maximum temperatures for each week) occurred on Julian week 26 with an average maximum temperature of 16.93°C. The Maximum Weekly Average Temperature also occurred on Julian week 26 with a temperature of 15.82°C (Appendix 39). Water temperature by Julian week was graphed (Figure 64) and water temperature variability by Julian week was plotted in a box and whisker plot (Figure 65).

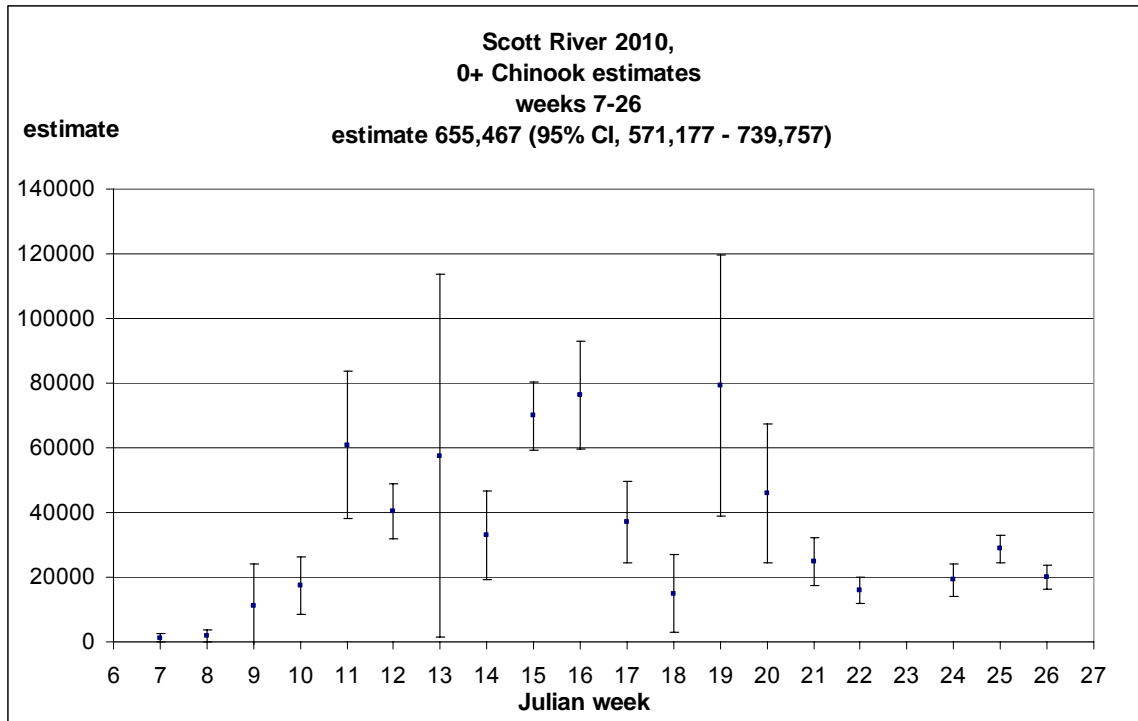


Figure 38. Scott River 2010 0+ Chinook estimates weeks 7 – 26.

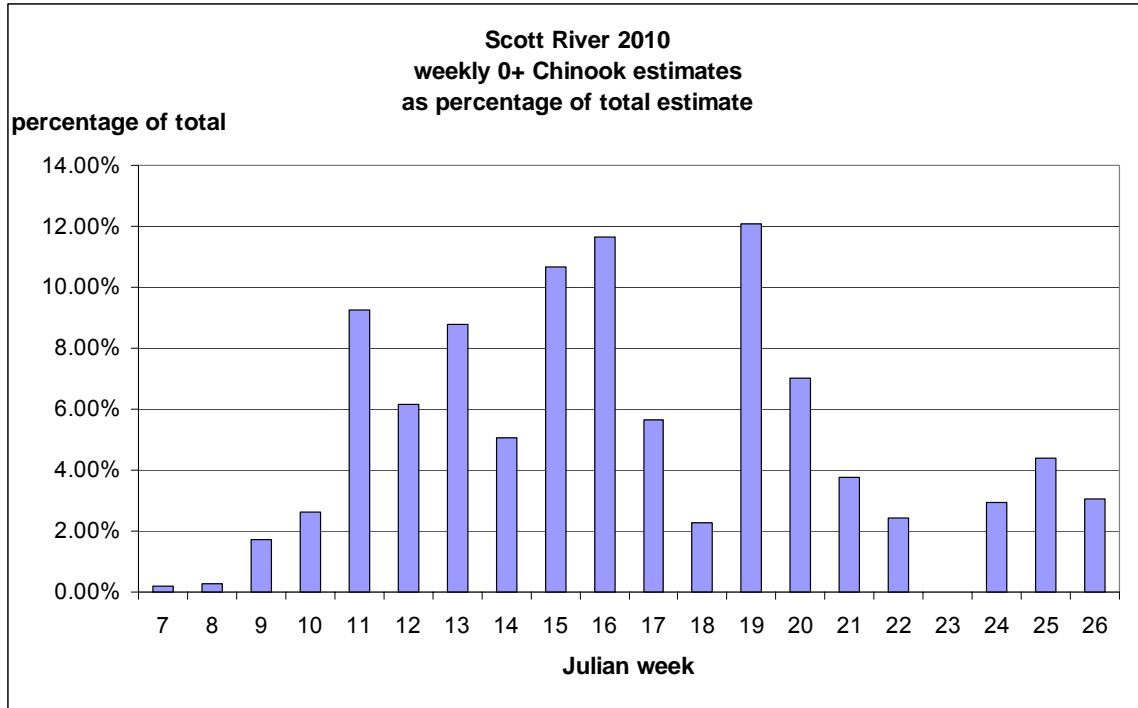


Figure 39. Scott River 2010 0+ Chinook estimates as percentage of total.

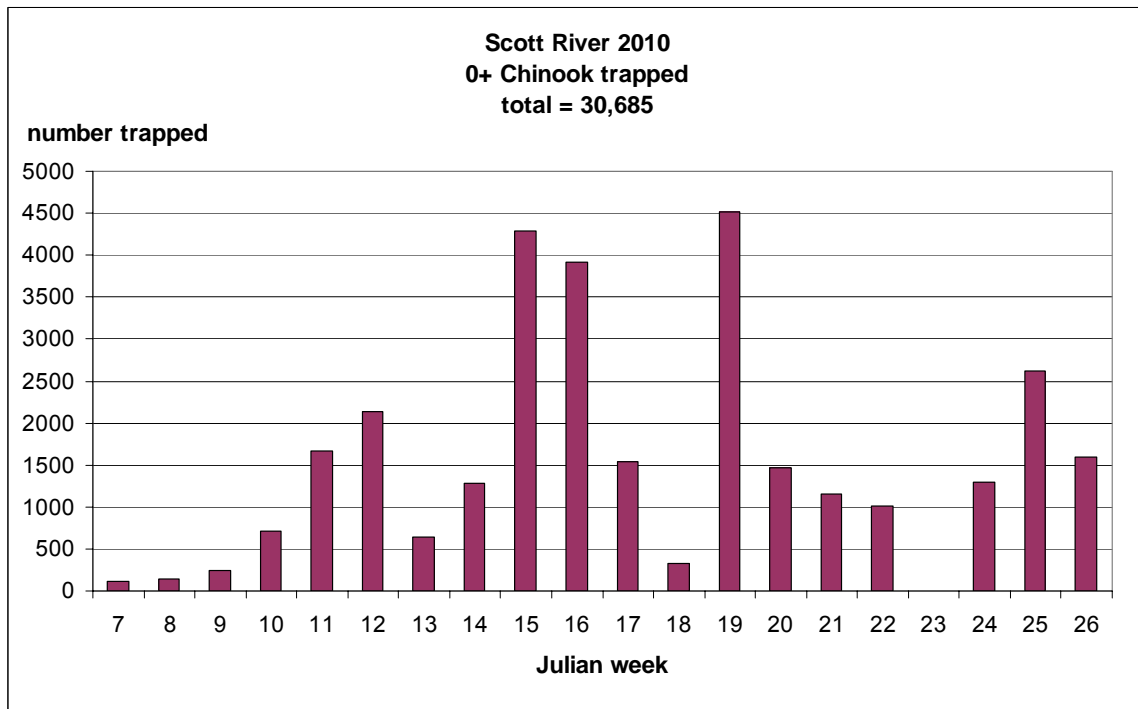


Figure 40. Scott River 2010 0+ Chinook total trapped.

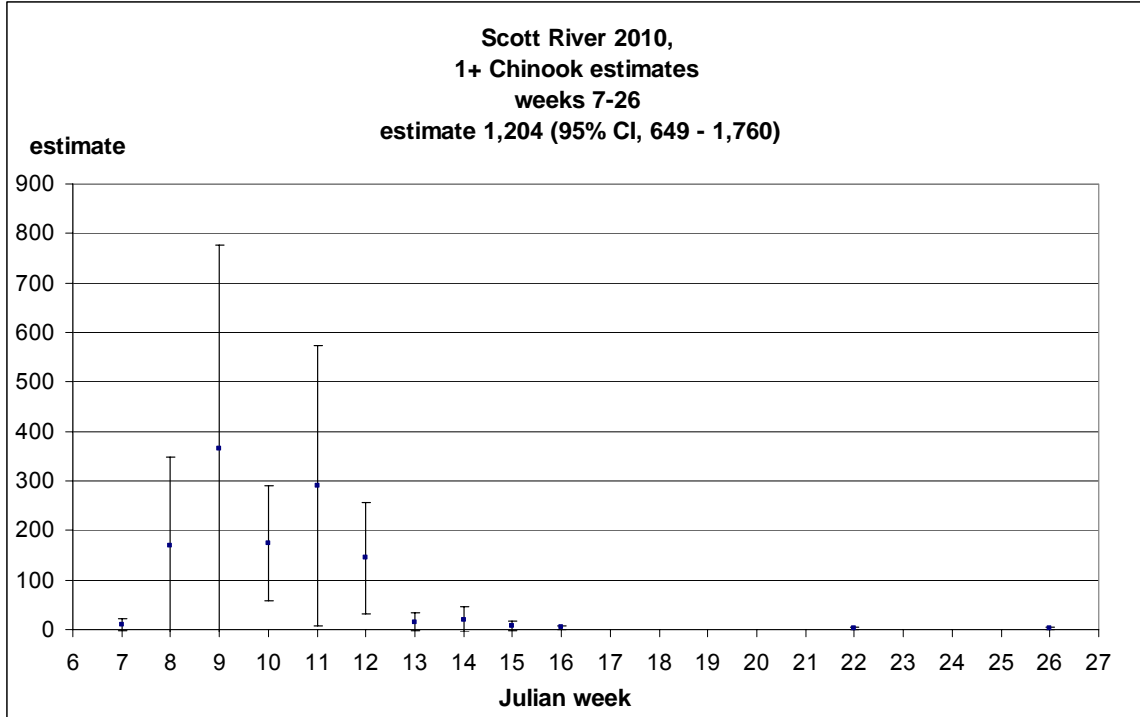


Figure 41. Scott River 2010 1+ Chinook estimates weeks 7 – 26.

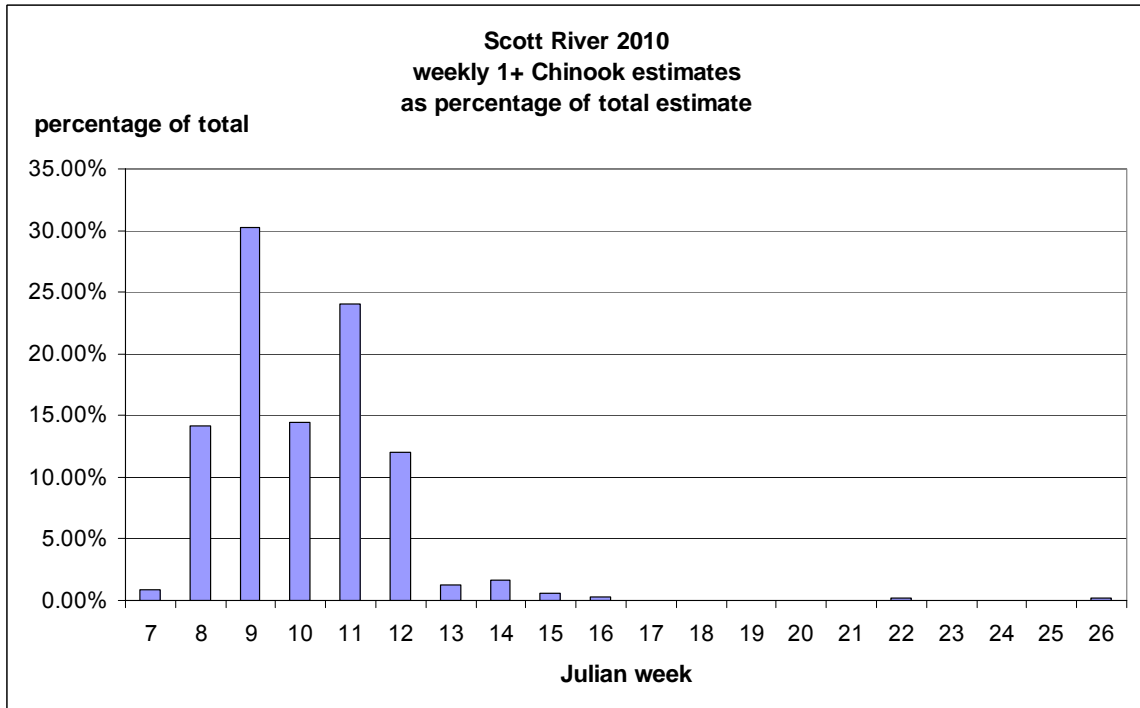


Figure 42. Scott River 2010 1+ Chinook estimates as percentage of total.

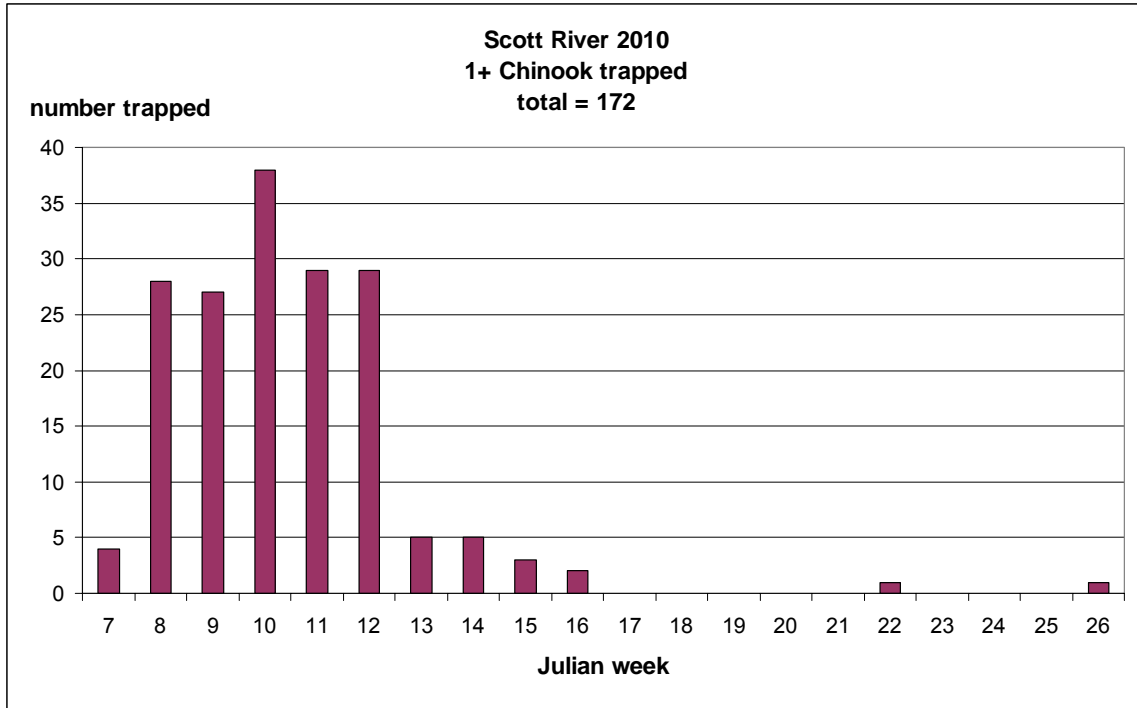


Figure 43. Scott River 2010 1+ Chinook total trapped.

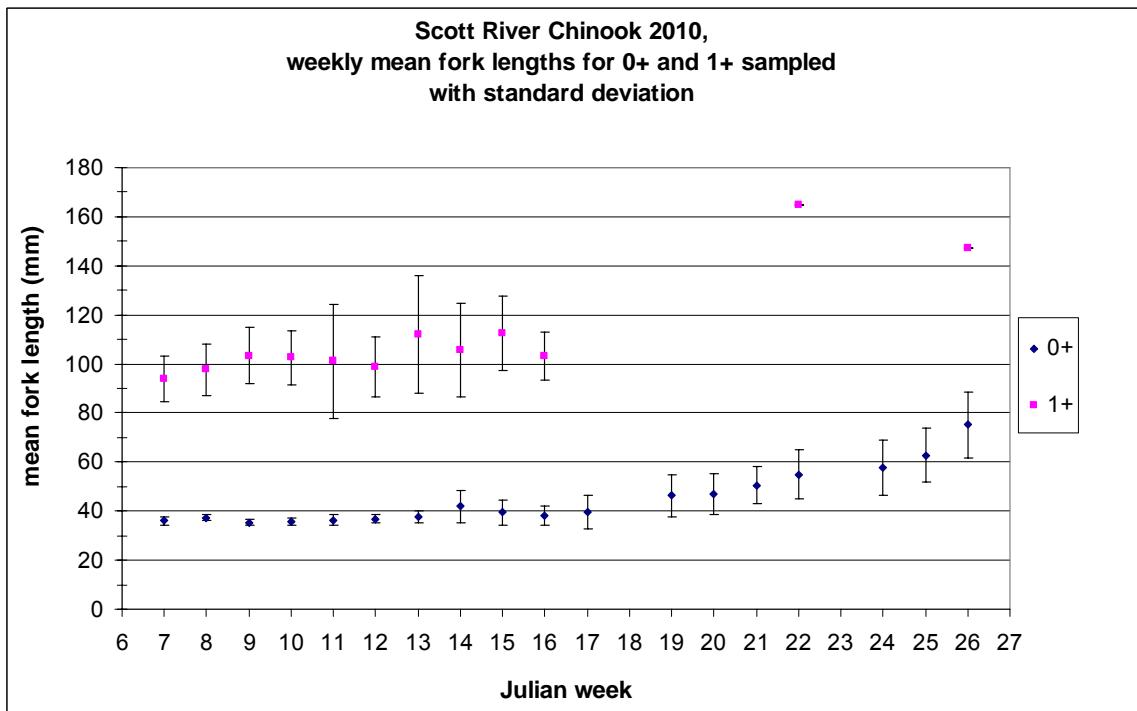


Figure 44. Scott River 2010 weekly mean fork lengths for 0+ and 1+ Chinook sampled.

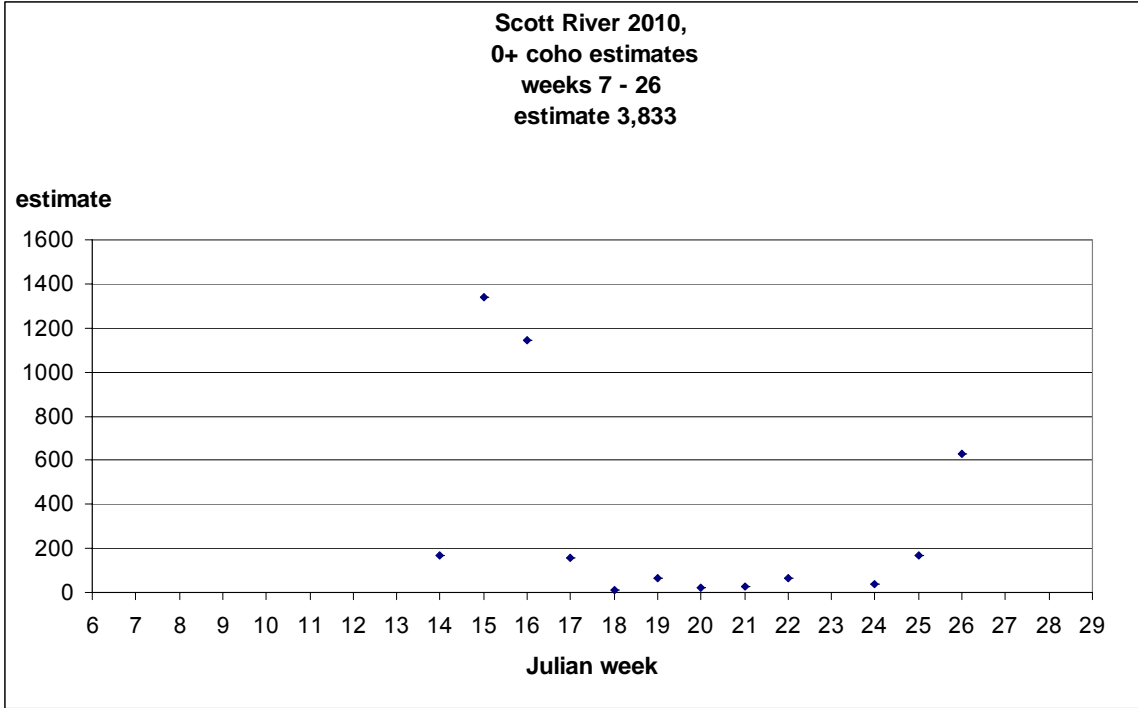


Figure 45. *Scott River 2010 0+ coho estimates weeks 7 – 26.*

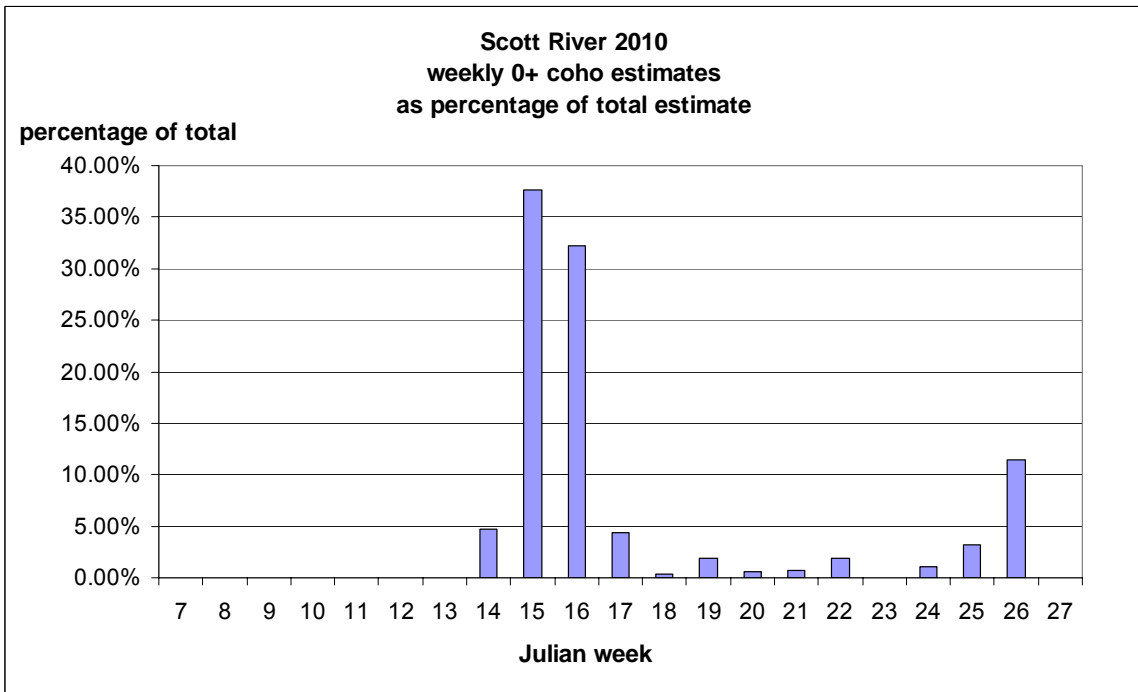


Figure 46. *Scott River 2010 0+ coho estimates as percentage of total.*

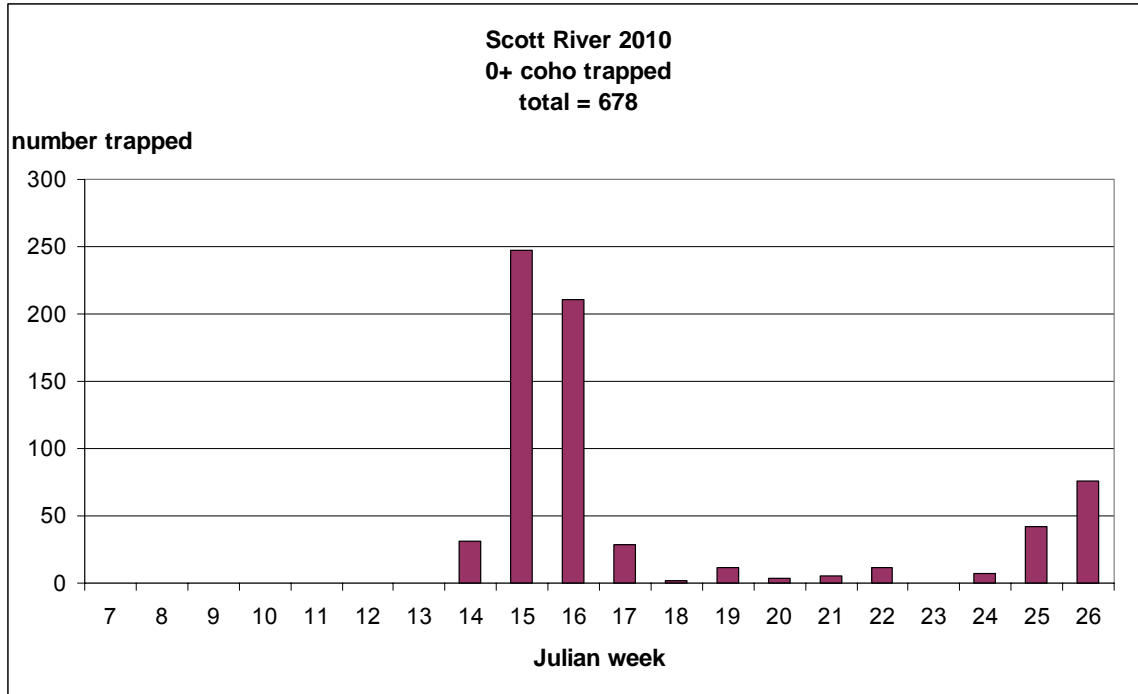


Figure 47. Scott River 2010 0+ coho total trapped.

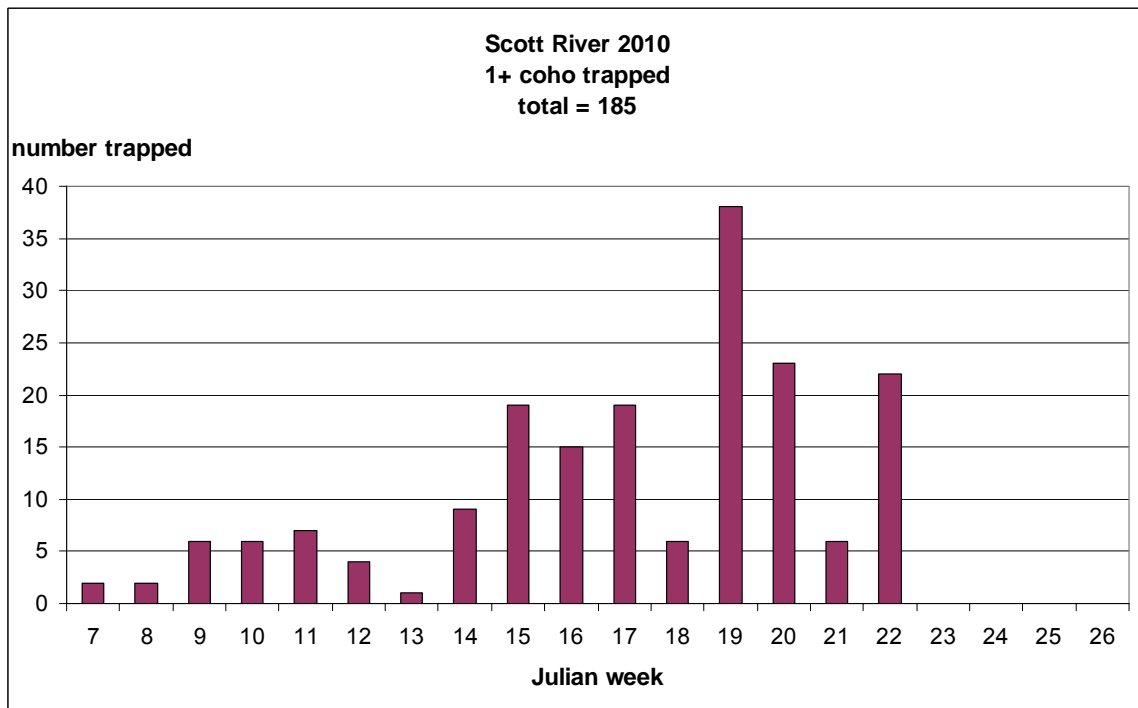
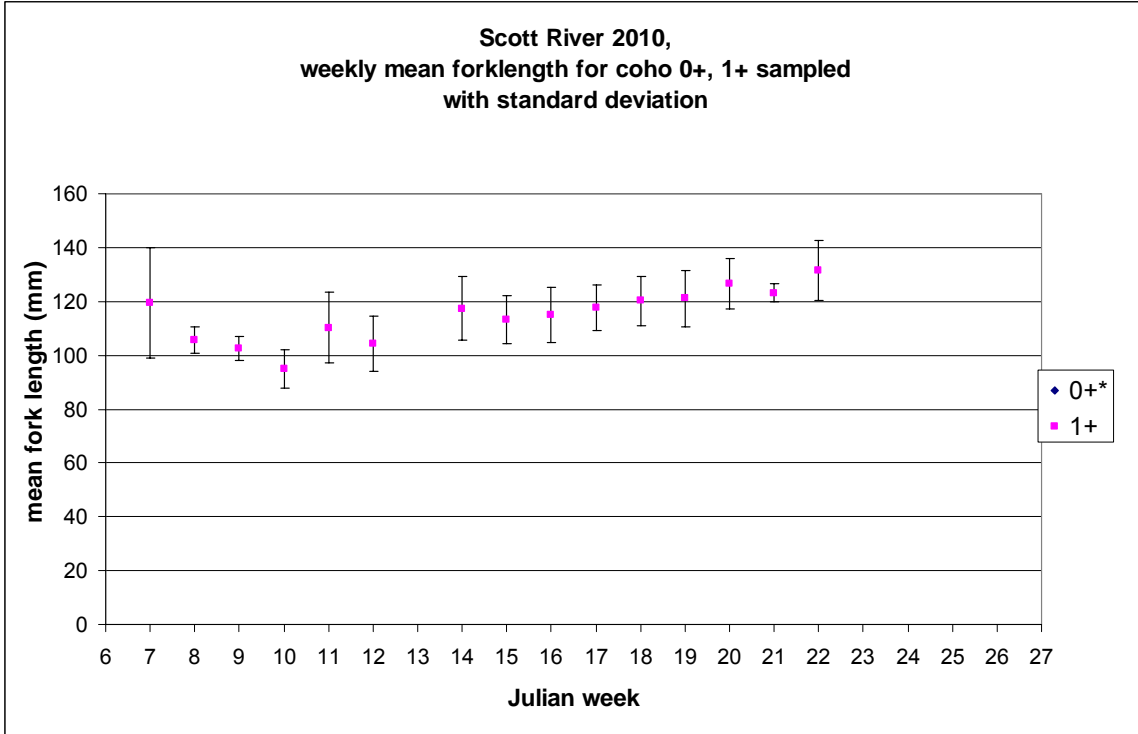


Figure 48. Scott River 2010 1+ coho total trapped.



*no 0+ coho were measured due to not wanting to over stress fish

Figure 49. Scott River 2010 weekly mean fork length for 0+ and 1+ coho sampled.

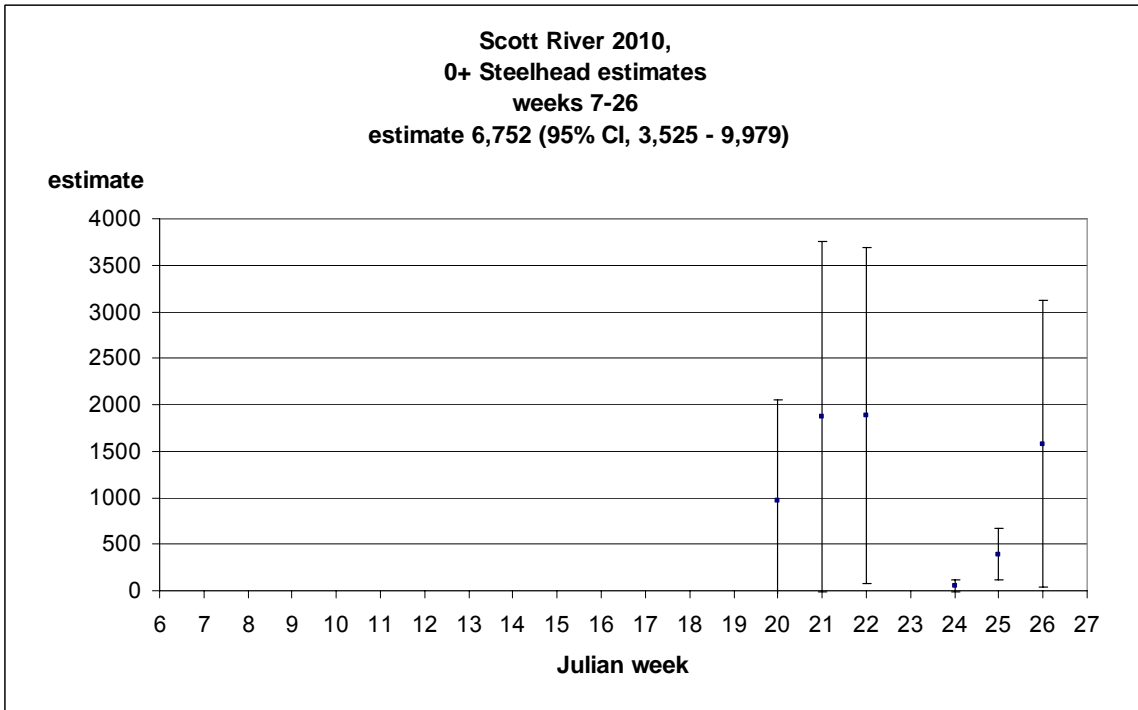


Figure 50. Scott River 2010 0+ steelhead estimates weeks 7 – 26.

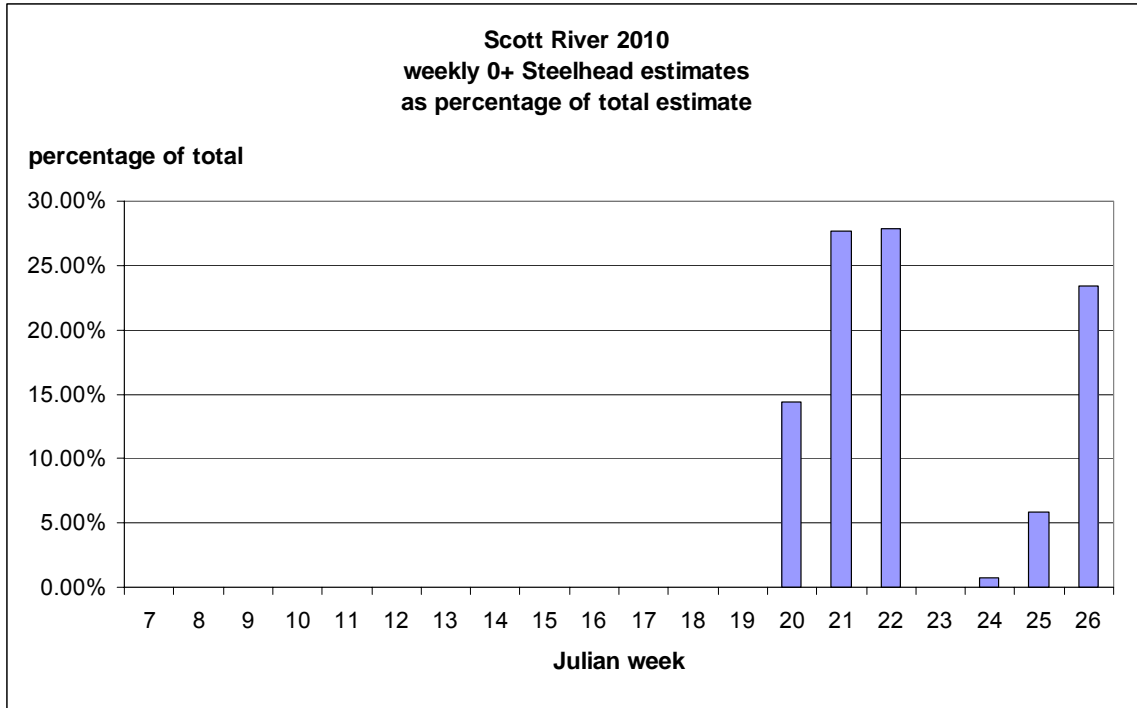


Figure 51. Scott River 2010 0+ steelhead estimates as percentage of total.

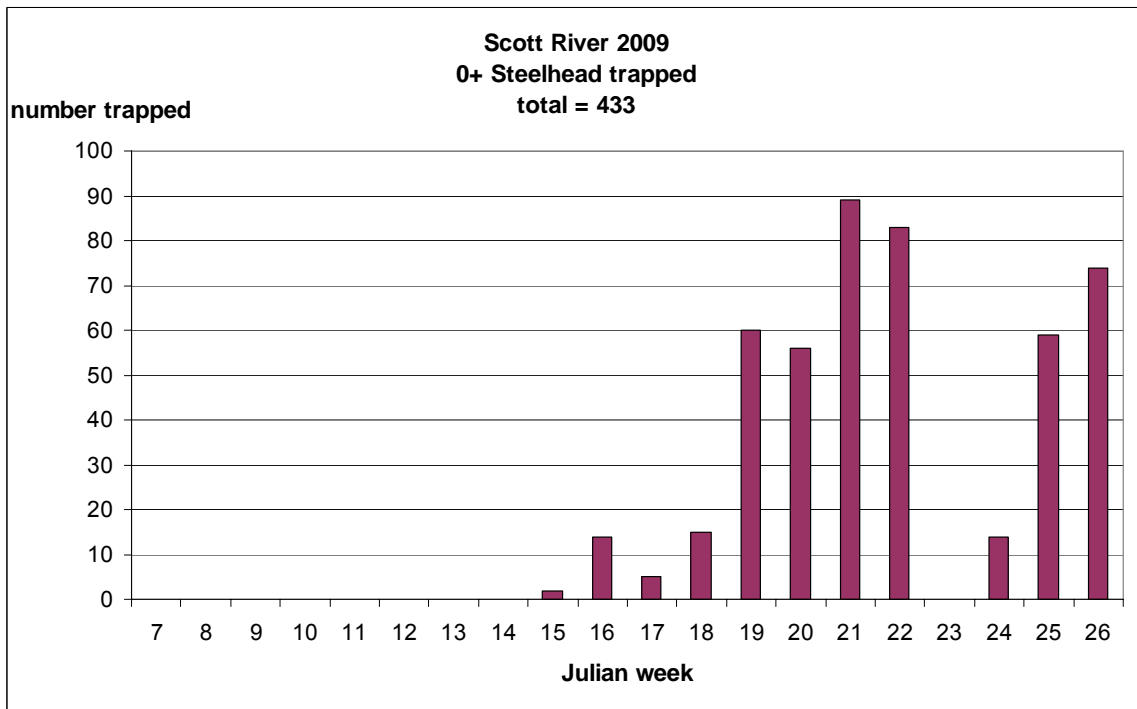


Figure 52. Scott River 2010 0+ steelhead total trapped.

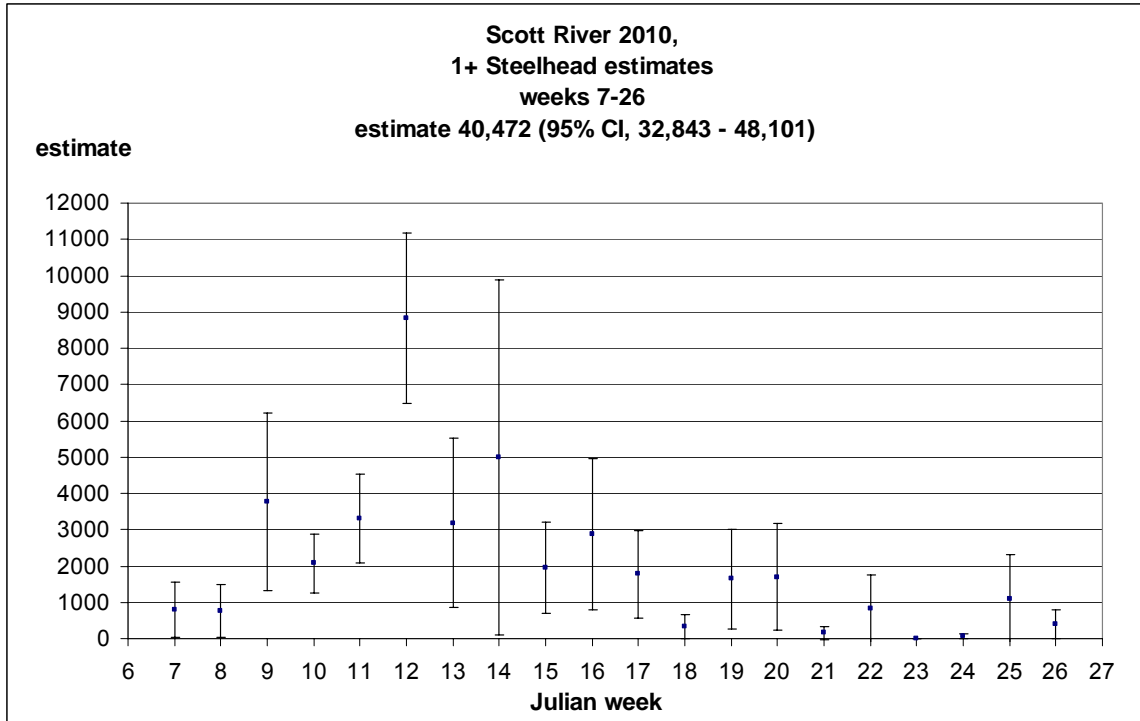


Figure 53. Scott River 2010 1+ steelhead estimates weeks 7 – 26.

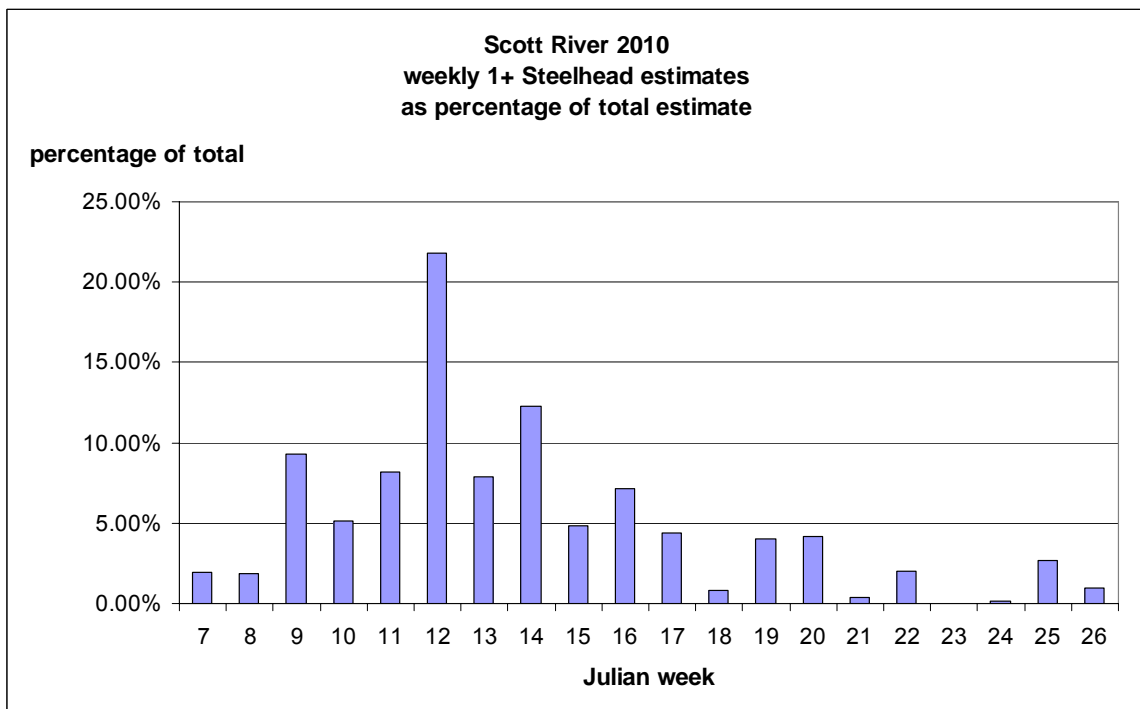


Figure 54. Scott River 2010 1+ steelhead estimates as percentage of total.

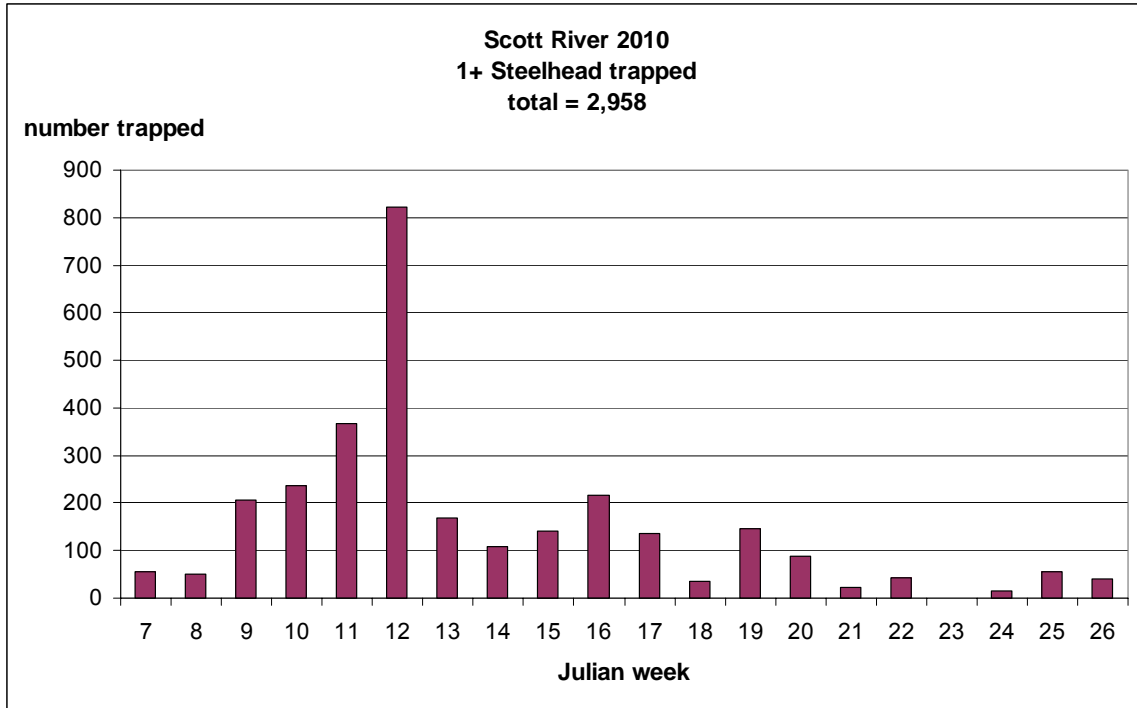


Figure 55. Scott River 2010 1+ steelhead total trapped.

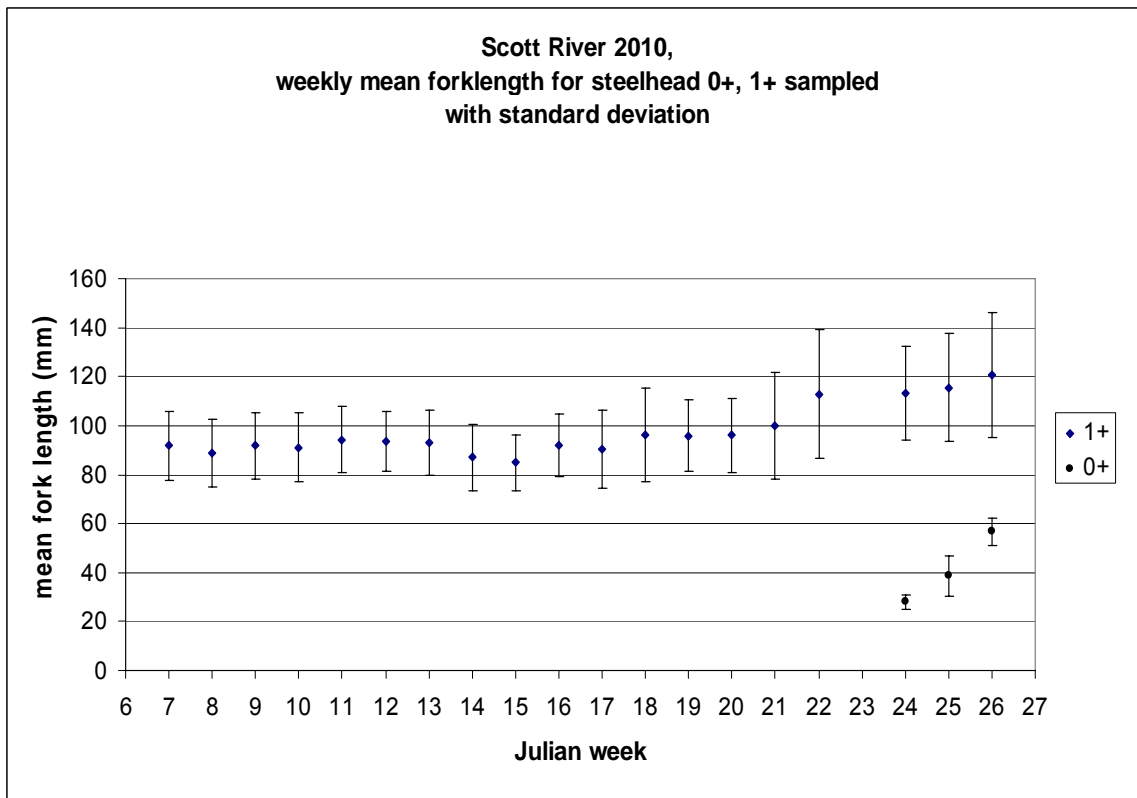


Figure 56. Scott River weekly mean fork length for 0+ and 1+ steelhead sampled.

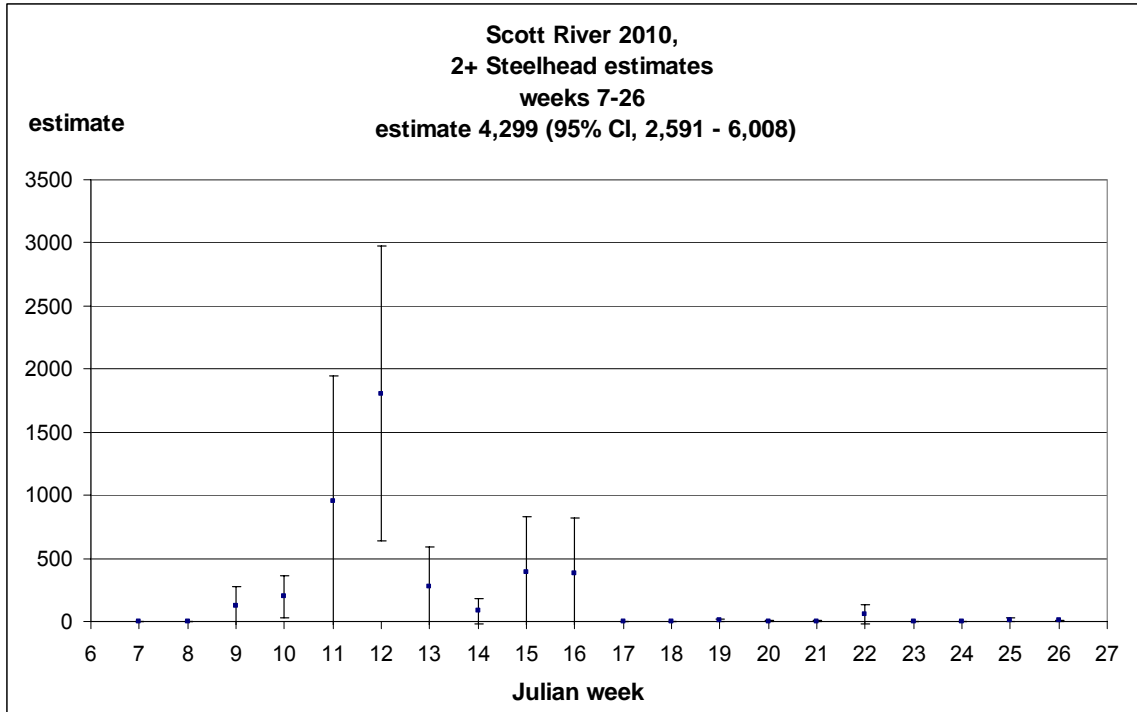


Figure 57. Scott River 2010 2+ steelhead estimates weeks 7 – 26.

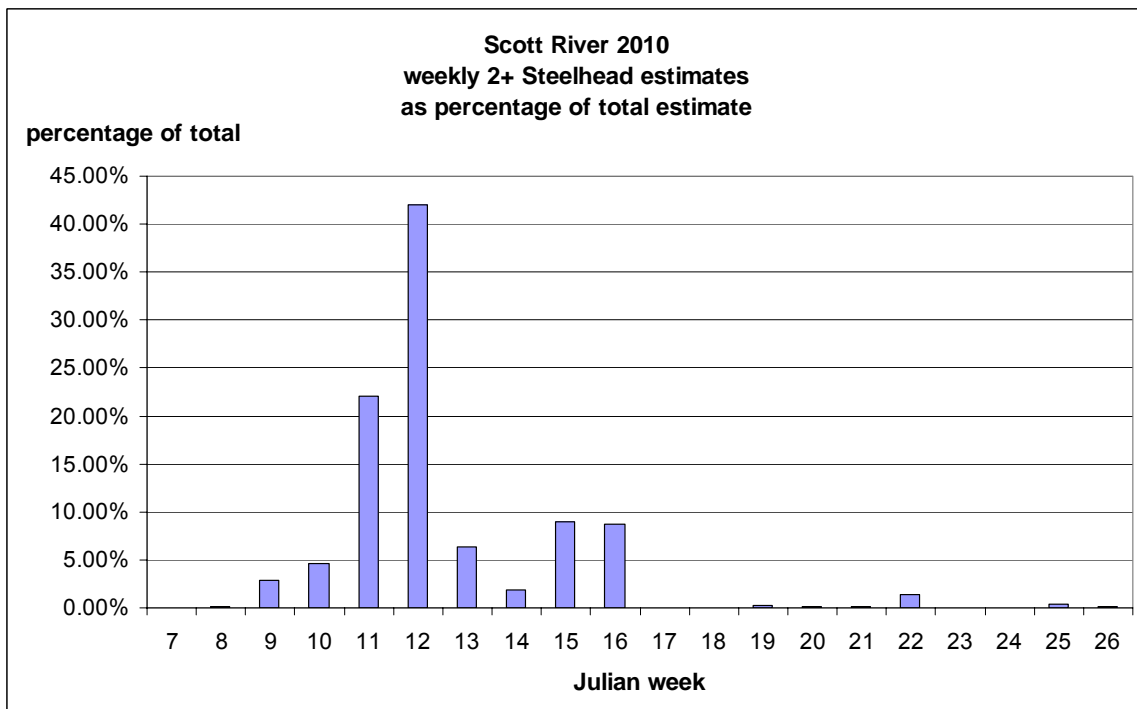


Figure 58. Scott river 2010 2+ steelhead estimates as percentage of total.

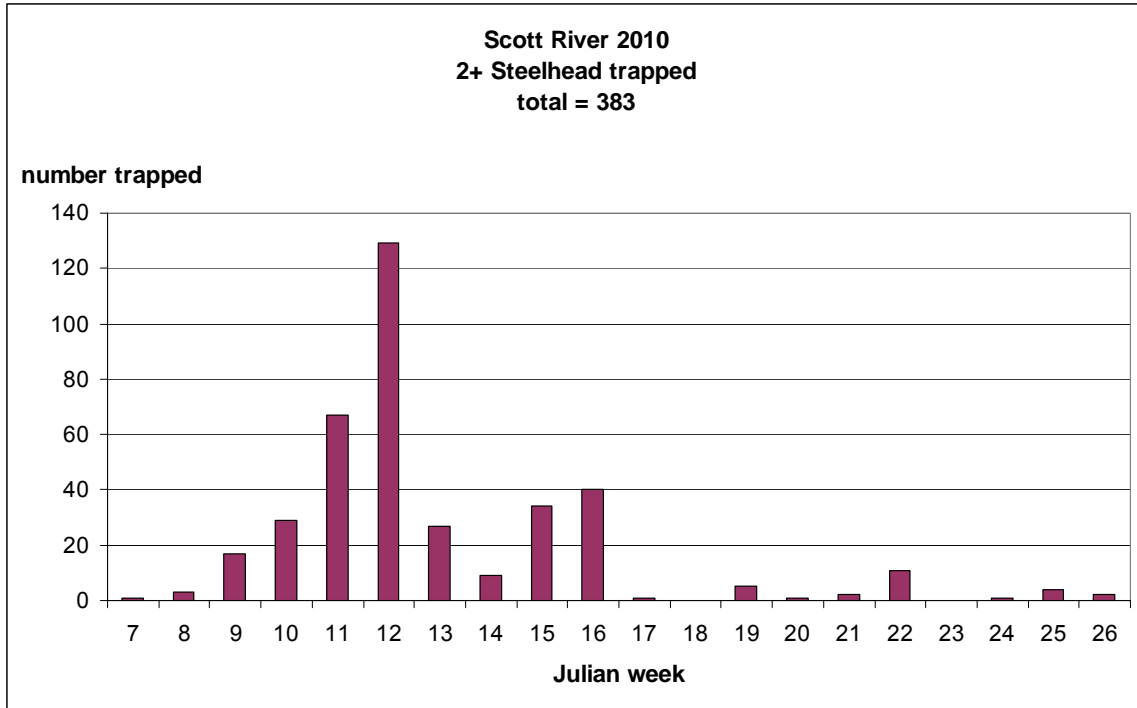


Figure 59. Scott River 2010 2+ steelhead total trapped.

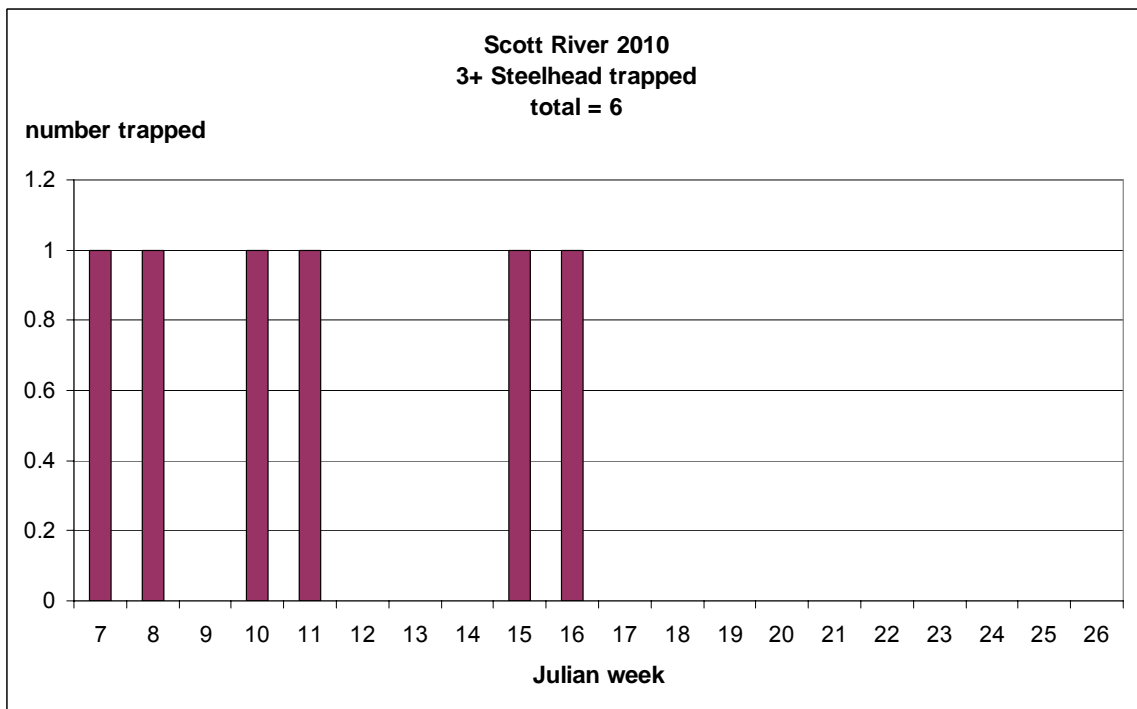


Figure 60. Scott River 2010 3+ steelhead total trapped.

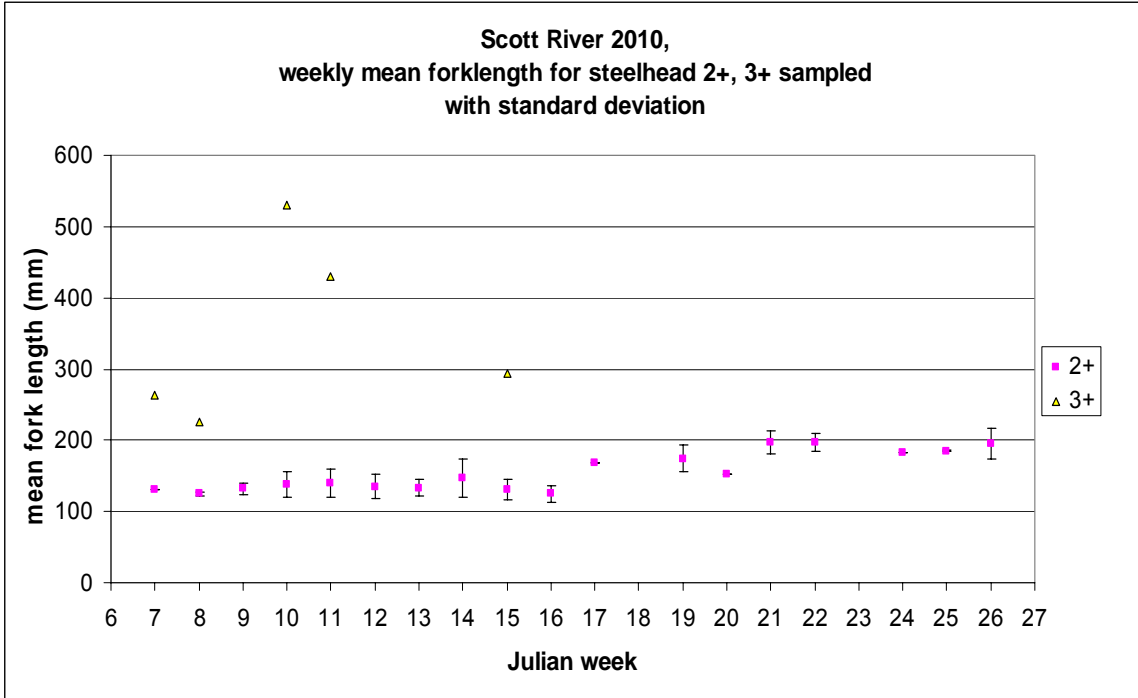


Figure 61. Scott River 2010 weekly mean fork lengths for 2+ and 3+ steelhead sampled.

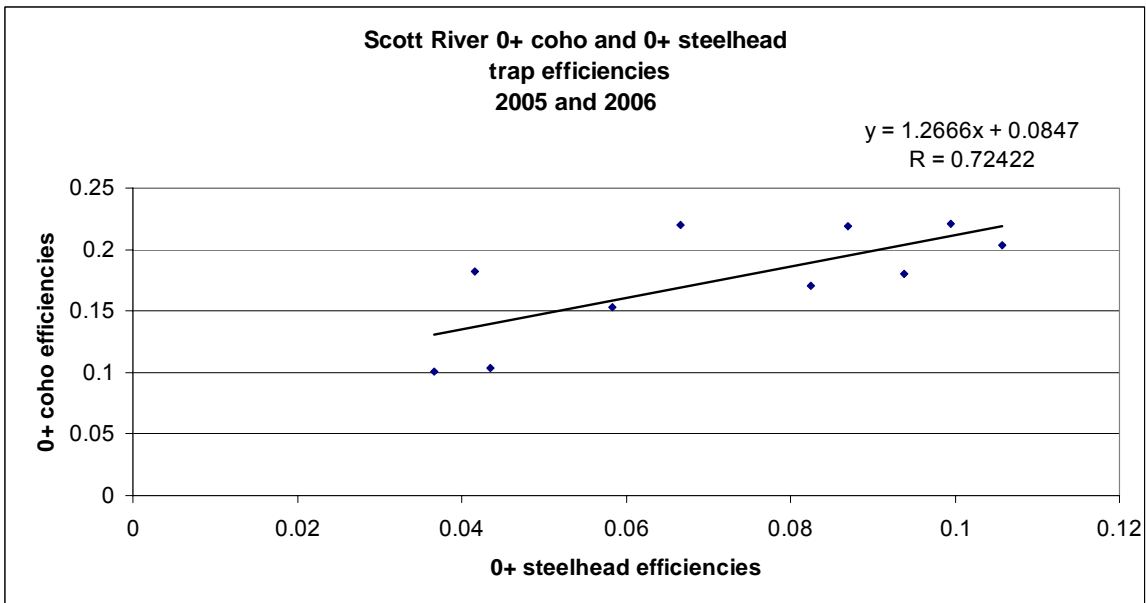


Figure 62. Scott River 2010 0+ coho/0+ steelhead efficiency correlation.

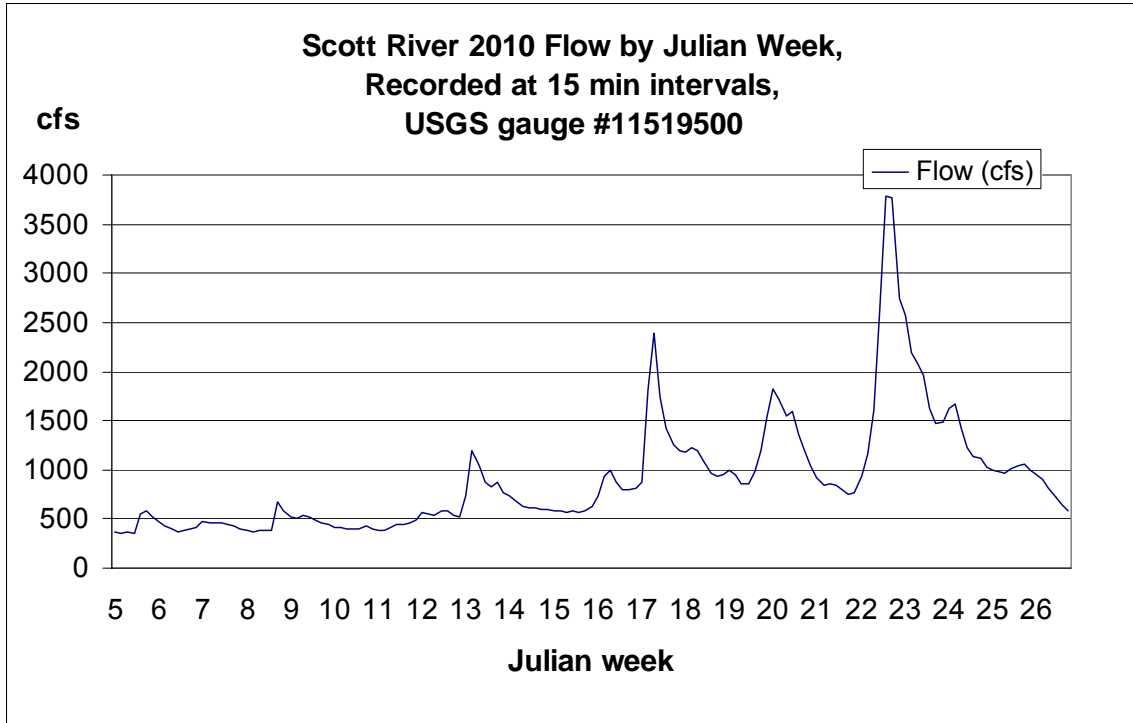


Figure 63. Scott River 2010 flow by week.

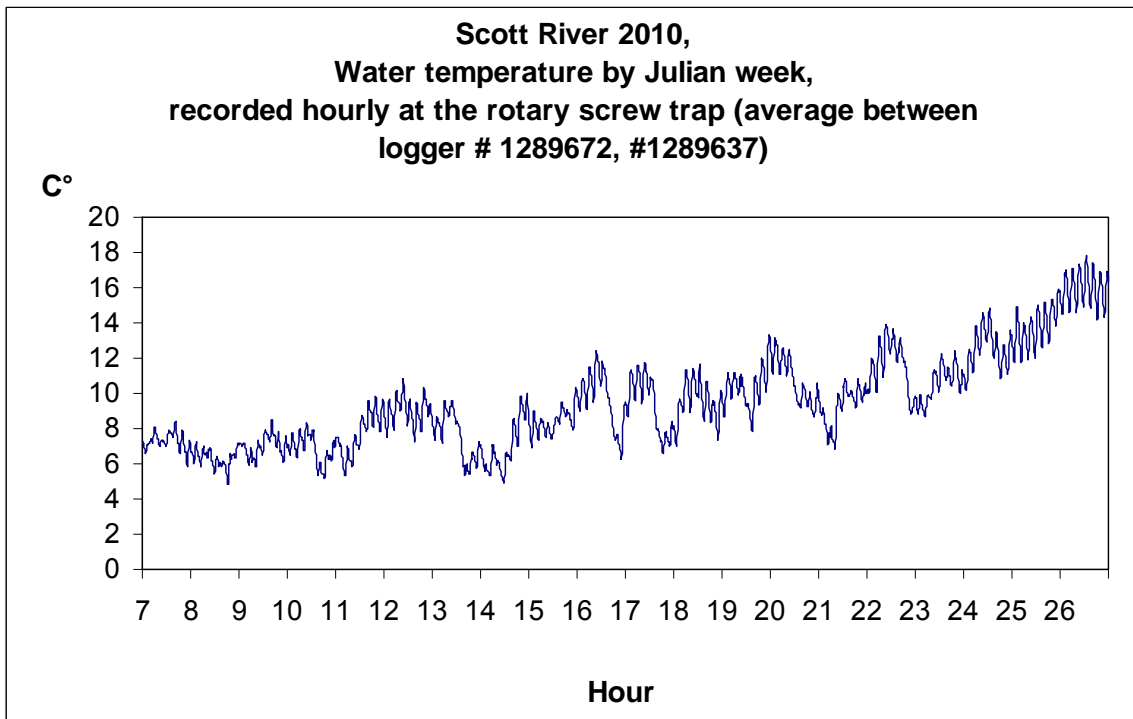


Figure 64. Scott River 2010 water temperatures by week.

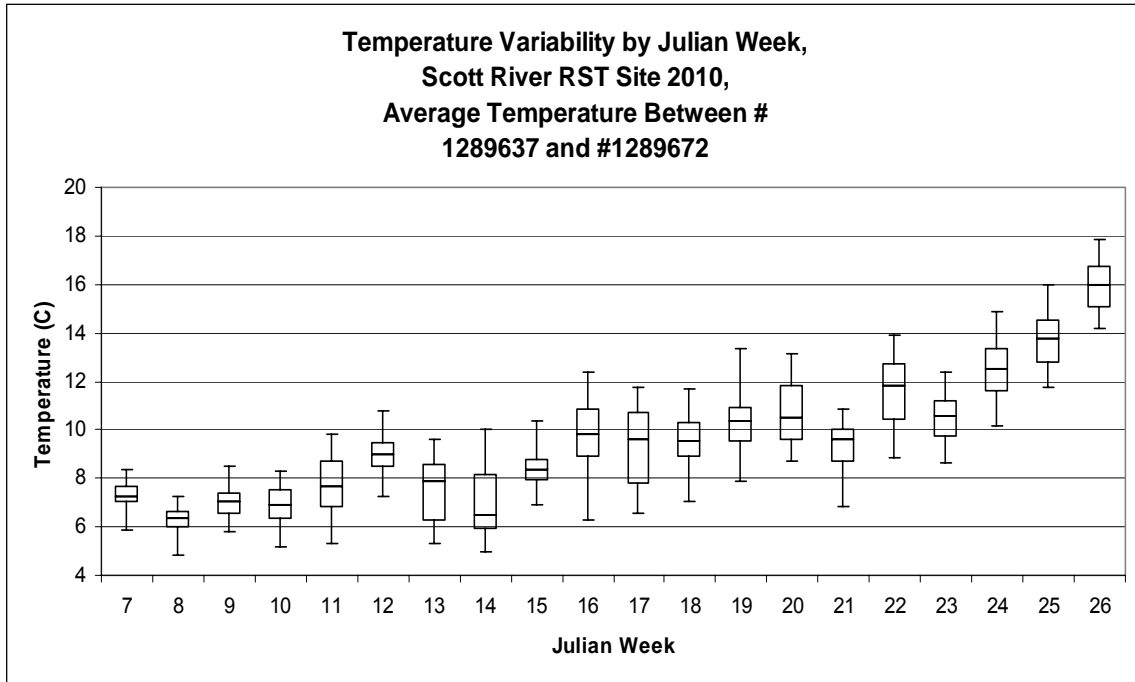


Figure 65. Scott River 2010 water temperature variability by week.

4.3.0 Discussion

4.3.1 Trap Operation

Trapping on the Scott River varies greatly as the flow can fluctuate considerably. Also having two traps in different locations creates more variability. The 8 foot trap is located in slower moving water on river left while the 5 foot trap is in swift moving water on river right. Even though the 5 foot trap is smaller than the 8 foot trap it consistently sampled more water than the 8 foot trap (Figure 66), all because of its position in the river.

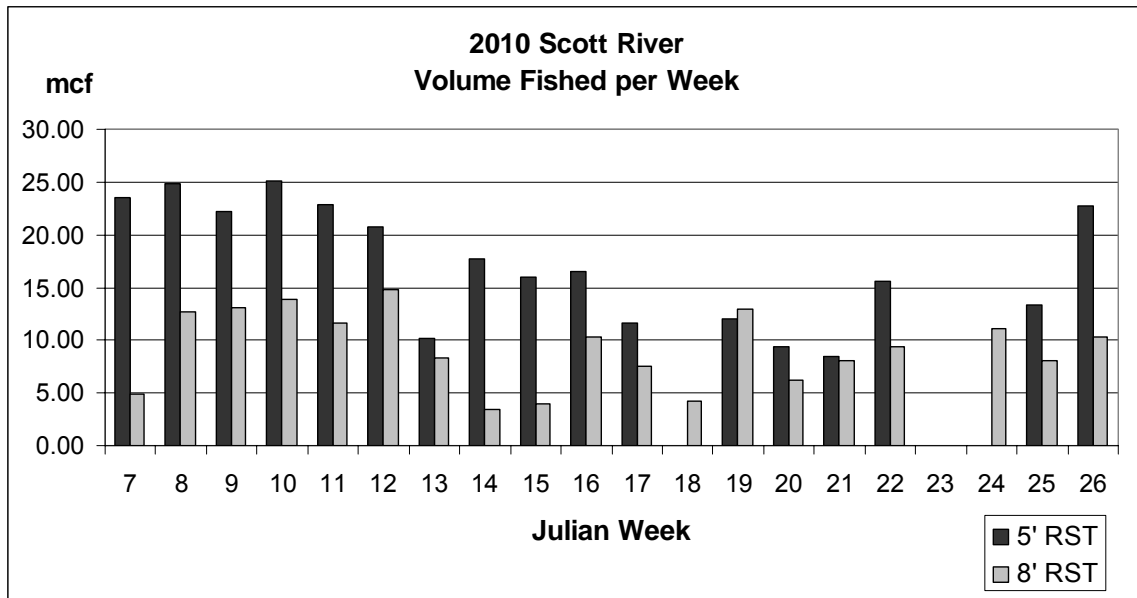


Figure 66. Scott River 2010 volume fished per week.

The hours and days fished per week on the Scott River also varied due to flow (Figure 67, Figure 68). When compared to the flow (Figure 63), it can be seen why the trapping varied. When the flow increases rapidly the traps can not be sampled for fear of mortalities or loss of equipment

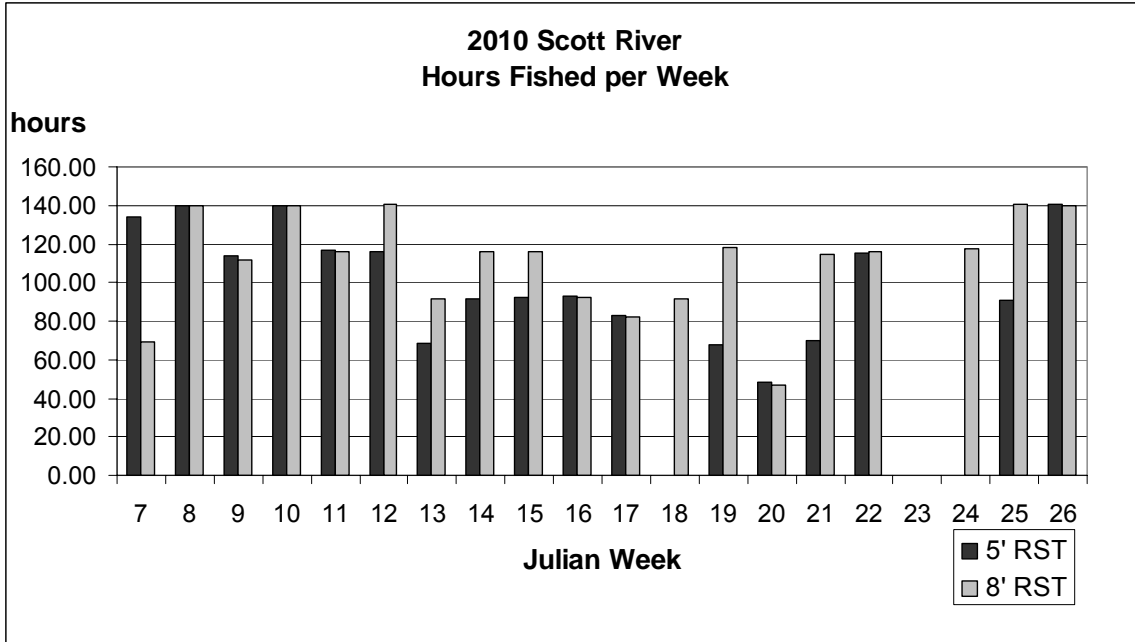


Figure 67. Scott River 2010 hours fished per week.

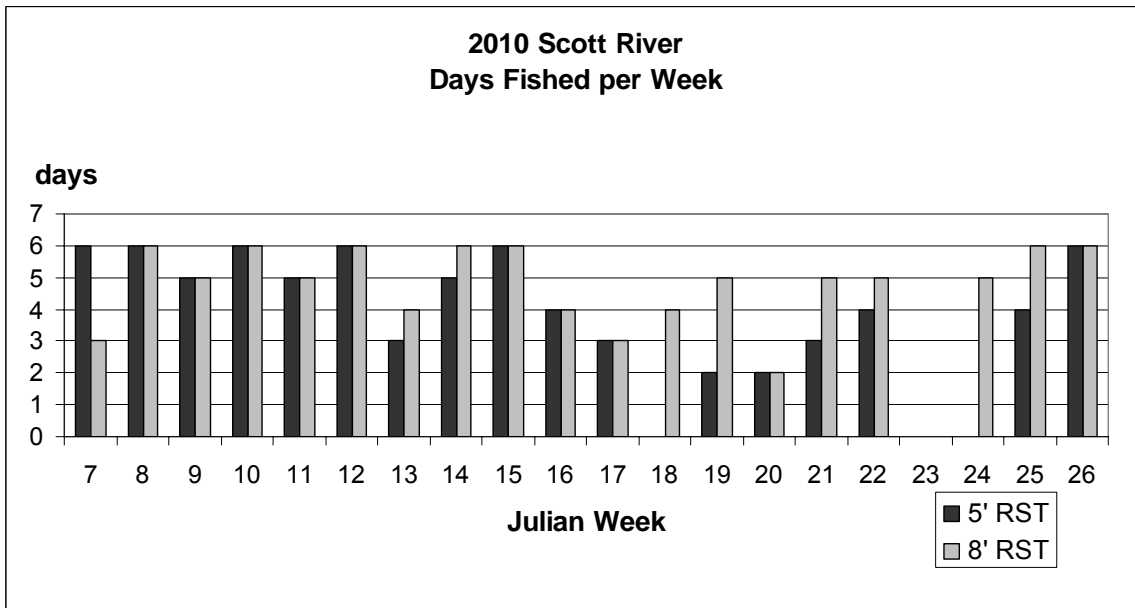


Figure 68. Scott River 2010 days fished per week.

During Julian week 17 the flow reached 1806 cfs at the gauge, a change of 932 cfs overnight. This caused the screens on the back of the 5 foot trap to be destroyed and allowed the catch to escape. The following Julian week (18) the 5 foot trap was not able to sample due to maintenance issues from the previous week's high flows. In Julian week 20 both traps only fished 2 days, as the average flow for the week was 1483 cfs. In Julian

week 23 neither trap was fished because the flow was the highest of the season, 3792 cfs at the beginning of the week receding to 1969 cfs by the end of the week.

4.3.2 Flow

All flow data in this report were obtained from the Scott River flow gauge (#11519500), which is located approximately 19.5 miles upstream of the trap. This gauge records flow and gauge height every 15 minutes. Several large tributaries without stream gauges and numerous small streams enter the Scott River between the gauge and the trap and are not included in the flow measurements.

Unfortunately there are very few means to manipulate the volume sampled on the Scott River as is done on the Shasta River. The only way to increase or decrease volume sampled is to move the traps either further out into the river or in toward the shore. This leads to more times when the traps can not sample due to flow being too high to work safely.

4.3.3 Multi-Year Estimates

Annual estimates of the number of juvenile salmonids produced in the Scott River began in 2000. The multi-year estimates listed below are limited to years in which the methods and the period sampled are comparable. The estimates were made using the same methods as described in this report. 95% confidence intervals are available for the weekly estimates with the exception of weeks without the recapture of marked fish. Estimates for these weeks were developed by expanding the catch by the seasonal trap efficiency.

Annual estimates for 1+ and 2+ steelhead were first possible beginning in 2004 with the development of age length cutoffs (Appendix 36). Prior to 2004, combined estimates were produced for 1+ and 2+ steelhead. 2003 was the first year 0+ and 1+ coho were marked and an estimate was produced.

4.3.4 Chinook

Both yearly and weekly estimates of the number of 0+ Chinook salmon produced from the Scott River for 2010 were compared with the data from the previous nine years of sampling (Figure 69, Table 8) The estimate of 655,437 for 2010 was found to be the third largest in the ten years of trap operation.

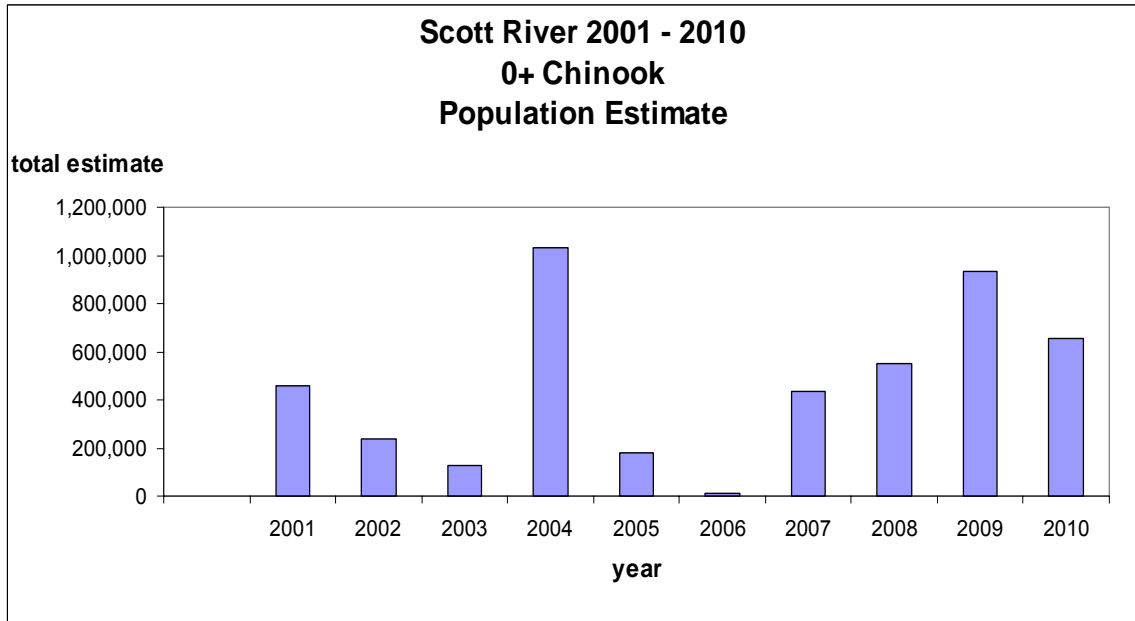


Figure 69. Scott River 2001 – 2010 yearly 0+ Chinook population estimates.

Table 8
Scott River 2001 – 2010 Weekly Population Estimates 0+ Chinook salmon

Julian Week	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
7	-----	-----	-----	5,481	-----	-----	454	242	-----	1111
8	-----	-----	-----	-----	-----	-----	1,661	150	456	1869
9	-----	-----	-----	12,739	-----	-----	710	3,477	-----	11270
10	-----	-----	-----	47,188	2,027	936	5,293	32,328	394	17331
11	6,206	-----	-----	83,499	9,898	54	418	10,634	8892	60754
12	23,734	-----	-----	89,822	12,142	88	13,422	12,371	27839	40399
13	4,871	-----	-----	137,491	3,936	52	10,690	30,274	74382	57542
14	16,111	35,654	-----	105,677	21,349	58	10,594	37,632	88192	33123
15	27,991	14,961	15,164	92,404	14,631	32	26,439	79,632	173797	69870
16	71,627	24,864	16,113	41,057	7,370	64	58,945	14,303	275700	76337
17	56,980	20,868	3,638	26,080	4,316	-----	12,274	32,757	82772	37065
18	48,857	32,824	-----	9,860	3,060	4	14,088	35,167	51991	14985
19	17,888	3,852	-----	16,935	3,987	53	5,154	20,304	-----	79256
20	10,236	5,192	-----	7,739	4,171	-----	12,732	5,197	37849	45904
21	143,777	3,680	-----	4,661	3,187	16	14,795	29,825	42249	24727
22	29,522	3,241	-----	5,650	6,006	24	3,838	52,534	12252	16036
23	-----	31,065	-----	15,028	10,498	-----	22,321	32,651	6014	-----
24	-----	63,282	-----	44,100	3,894	16	51,526	33,061	11171	19194
25	-----	-----	-----	230,377	2,436	19	117,746	36,622	20068	28713
26	-----	-----	14,050	50,803	16,578	2,624	52,180	53,310	16714	19980
27	-----	-----	34,802	3,107	42,808	4,961	-----	-----	-----	-----
28	-----	-----	42,142	-----	6,592	1,889	-----	-----	-----	-----
TOTAL	457,800	239,483	125,909	1,029,696	178,885	10,890	435,279	552,472	930,731	655,467

4.3.5 Coho

Both yearly and weekly estimates of the number of 1+ coho salmon produced from the Scott River for 2010 were compared with the data from the previous nine years of sampling (Figure 70, Table 9). The estimate of 2,174 for 2010 was found to be the fifth largest in the eight years of 1+ coho population estimates.

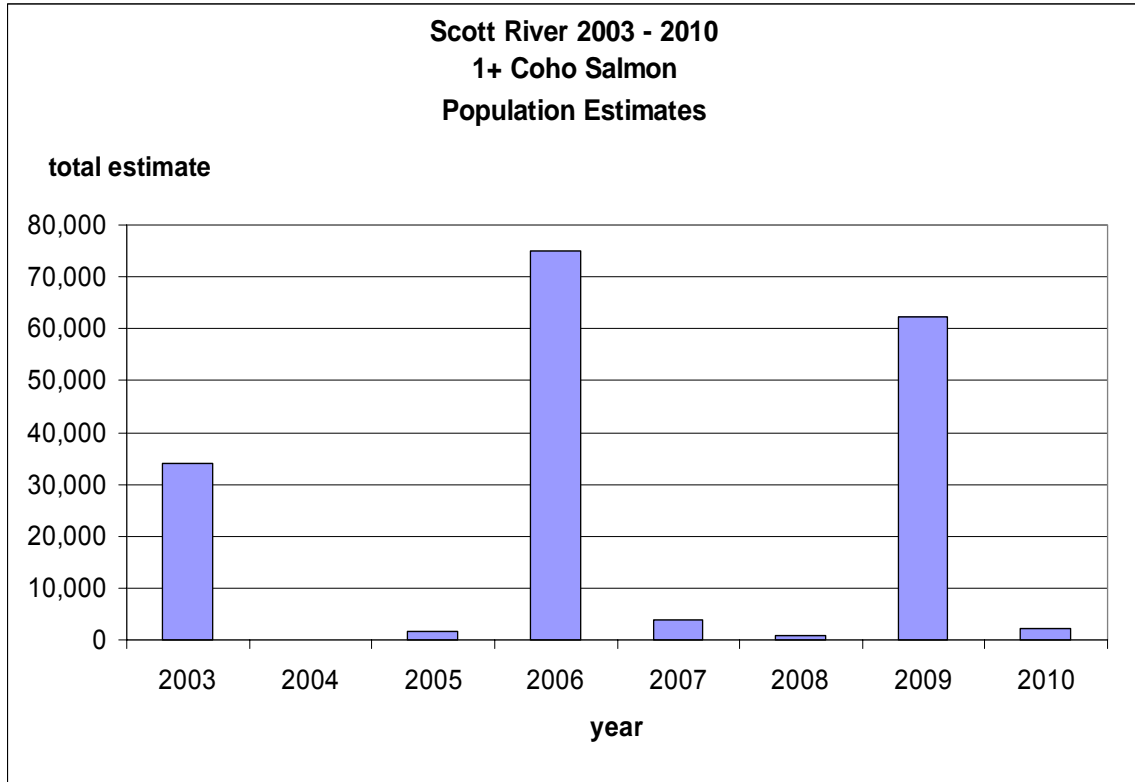


Figure 70. Scott River 2003 – 2010 yearly 1+ coho population estimates.

Table 9**Scott River 2003 – 2010 Weekly Population Estimates for 1+ Coho Salmon**

Julian Week	2003	2004	2005	2006	2007	2008	2009	2010
7	-----	-----	6	-----	-----	11	476	-----
8	-----	-----	10	329	-----	10	1,558	-----
9	489	-----	27	558	-----	5	4,805	-----
10	272	-----	43	277	-----	-----	13,029	-----
11	2,367	-----	162	1,230	-----	37	12,939	-----
12	10,136	-----	61	1,028	-----	28	6,510	-----
13	1,677	-----	91	2,914	-----	55	6,252	-----
14	3,600	-----	294	1,815	-----	179	2,866	-----
15	4,068	-----	268	2,166	-----	109	4,976	-----
16	1,338	-----	148	6,131	-----	150	4,389	-----
17	1,261	-----	181	6,107	-----	108	2,261	-----
18	771	-----	200	5,437	-----	158	1,553	-----
19	506	-----	48	9,935	-----	5	-----	-----
20	3,967	-----	100	4,148	-----	16	437	-----
21	800	-----	-----	7,436	-----	-----	48	-----
22	1,613	-----	21	16,486	-----	36	68	-----
23	961	-----	-----	2,548	-----	17	47	-----
24	312	-----	-----	3,538	-----	17	5	-----
25	11	-----	-----	1,875	-----	2	-----	-----
26	-----	-----	-----	1,072	-----	-----	-----	-----
27	-----	-----	-----	66	-----	-----	-----	-----
28	-----	-----	-----	-----	-----	-----	-----	-----
TOTAL	34,149	0	1,660	75,097	3,931	941	62,220	2,174

In 2010, the emigrating 1+ coho smolts were again the progeny of what is one of the two weakest cohorts of Scott River coho. Instead of the standard procedure of applying a caudal fin margin clip to a known number of the trapped coho and releasing them upstream of the trap to estimate efficiency, the fish were identified, counted and released. The observed ratio between the seasonal trap efficiency for 2+ steelhead smolts and 1+ coho smolts observed in 2004 through 2009 was used to estimate the number of coho smolts produced in 2010. The ratio of steelhead 2+ seasonal efficiencies to 1+ coho is 1:2.01. When the 2010 2+ steelhead efficiency of 4.23% was multiplied by this ratio it equaled an estimated 1+ coho seasonal efficiency of 8.51%. This number was used to produce the seasonal estimates of 1+ coho for the Scott River 2010 season. Because of the method used to estimate the population, no weekly estimates are available.

4.3.6 Steelhead

Both yearly and weekly estimates of the number of 2+ steelhead trout produced from the Scott River for 2010 were compared with the data from the previous nine years of sampling (Figure 71, Table 10). The estimate of 4,299 for 2010 was found to be the sixth largest in the seven years of 2+ steelhead population estimates.

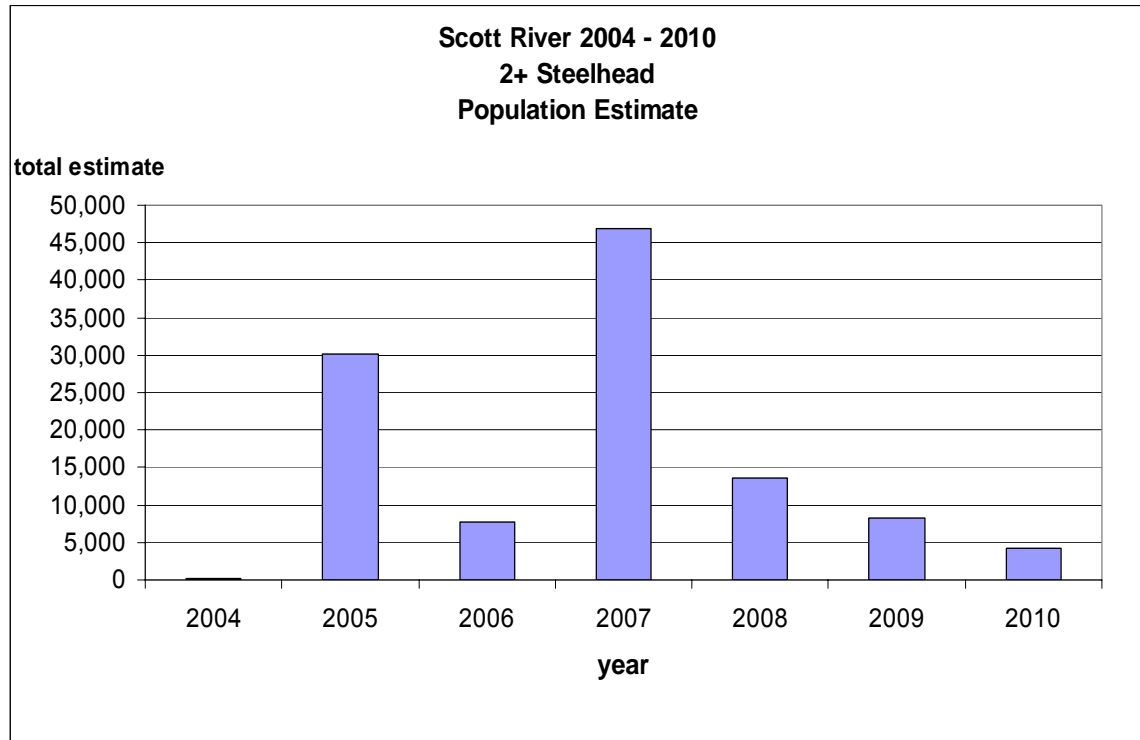


Figure 71. Scott River 2004 – 2010 yearly 2+ steelhead population estimates.

Table 10
Scott River 2004 – 2010 Weekly Population Estimates for 2+Steelhead

Julian Week	2004	2005	2006	2007	2008	2009	2010
7	3	82	120	309	68	31	1
8	3	79	110	104	17	99	3
9	3	744	64	-----	560	608	123
10	22	1,270	99	2,016	949	736	196
11	12	1,788	6	2,283	1,990	61	951
12	8	1,114	253	12,642	468	375	1806
13	5	1,588	510	4,946	1,213	1020	274
14	10	3,000	308	2,461	3,952	429	81
15	6	2,242	272	4,302	3,631	2423	387
16	23	4,988	6	1,554	616	2518	377
17	12	2,182	90	429	89	32	2
18	7	529	24	256	55	4	0
19	11	569	108	540	3	-----	10
20	26	132	522	11,100	-----	-----	3
21	23	51	3,519	2,875	8	-----	4
22	21	242	592	782	22	-----	61
23	21	1,353	210	86	6	-----	-----
24	22	1,426	255	61	22	-----	2
25	10	175	15	28	4	-----	14
26	6	41	112	35	0	-----	6
27	4	1,457	434	-----	-----	-----	-----
28	-----	5,022	-----	-----	-----	-----	-----
TOTAL	258	30,074	7,629	46,810	13,671	8,334	4,299

4.3.7 Temperature

When the data from the two thermal loggers were compared, despite calibrations, they were found to vary. A probability density function (Appendix 38) was created to depict the likelihood that the two thermal loggers were within the factory specified accuracy range; because two loggers were used the acceptable range of accuracy between the two loggers is 0.4°C. (this accounts for one logger being 0.2°C below actual temperature and the other logger being 0.2°C above actual temperature). It was found that the probability that the corresponding temperature readings between logger #1289672 and logger #1289637 had less than 0.4°C difference between them was 97.78%.

The corresponding temperatures between logger #1289672 and logger #1289637 were averaged to reconcile the difference between the two loggers. Water temperature by Julian week was then graphed (Figure 64). These temperatures were also plotted on a box and whisker diagram to show minimum, maximum, median, 25th percentile, and 75th percentile for Julian Weeks 7 – 26 (Figure 65).

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Literature Cited

- Carlson, S. R., L. G. Coggins Jr. and C. O. Swanton. 1998. A simple stratified design for mark-recapture estimation of salmon smolt abundance. *Alaska Fishery Research Bulletin* 5(2):88-102.
- Casselman, J.M. 1983. Age and growth assessment of fish from their calcified structures – Techniques and tools. In proceedings of the international workshop on age determination of oceanic pelagic fishes: Tunas, billfishes, sharks, ed. E. Prince and L. Pulos, pp. 1-17. NOAA Technical Report/National Marine Fisheries Service 8.
- Chesney, W. R., C. C. Adams , W. B. Crombie , H. D. Langendorf ,S. A. Stenhouse , and K. M. Kirkby 2010. Shasta River Juvenile Coho Habitat and Migration Study. California Department of Fish and Game.
- Chilton, D.E., and Beamish, R.J. 1982. Age determination methods for fishes studied by the groundfish program at the Pacific Biological Station. 102 pp. *Can. Spec. Publ. Fish. Aquat. Sci.* no. 60.
- KRIS 2010. KRIS Klamath Figure Page. http://krisweb.com/krisklamathtrinity/krisdb/webbuilder/sh_c11.htm
- KRIS 2010. Shasta River Infolinks <http://krisweb.com/krisklamathtrinity/krisdb/html/sh.htm#spawningreturns1>
- Onset. 2010. HOB0® Pro v2 Water Temperature Data Logger specification. http://www.onsetcomp.com/products/data-loggers/u22-001#tabsproduct_page_tabs1-2
- Oregon Department of Fish and Wildlife. Sampling protocols for downstream migrant fish traps. Salmonid Life-Cycle Monitoring Project. [online] Available at <http://oregonstate.edu/Dept/ODFW/life-cycle/TRPMETH3.HTM#trap%20efficiency>
- Van Oosten, J. 1957. The skin and scales. In *The physiology of fishes*, vol. 1, Metabolism, ed. M.E. Brown, pp. 207-244. New York: Academic Press.

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Appendix 1
Catch Table 0+ Chinook, Shasta River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	80,889	296	81,185	12.75	81,185	1,695	311	18.35%	441,313	397,063	485,564
8	46,109	254	46,363	8.72	46,363	2,496	307	12.30%	375,871	336,501	415,242
9	47,315	326	47,641	13.39	47,641	2,491	501	20.11%	236,497	217,930	255,063
10	55,969	1,423	57,392	11.40	57,392	2,489	458	18.40%	311,342	285,543	337,141
11	43,131	291	43,422	7.78	43,422	2,497	299	11.97%	361,561	323,113	400,008
12	23,307	436	23,743	6.83	23,743	2,499	262	10.48%	225,694	199,798	251,590
13	4,699	34	4,733	5.50	4,733	1,153	152	13.18%	35,699	30,363	41,034
14	6,542	24	6,566	4.33	6,566	2,188	255	11.65%	56,144	49,569	62,719
15	9,353	102	9,455	9.21	9,455	1,912	415	21.71%	43,479	39,707	47,251
16	16,146	120	16,266	8.41	16,266	1,698	541	31.86%	50,989	47,391	54,586
17	7,434	342	7,776	7.36	7,776	748	190	25.40%	30,493	26,725	34,262
18	10,454	116	10,570	10.47	10,570	796	226	28.39%	37,111	32,994	41,229
19	15,697	204	15,901	18.62	15,901	998	415	41.58%	38,185	35,349	41,022
20	19,535	45	19,580	16.14	19,580	999	536	53.65%	36,462	34,337	38,587
21	12,636	38	12,674	15.76	12,674	998	555	55.61%	22,772	21,485	24,059
22	8,200	20	8,220	16.01	8,220	500	301	60.20%	13,636	12,651	14,622
23	4,141	82	4,223	11.07	4,223	391	166	42.46%	9,913	8,755	11,071
24	8,051	68	8,119	13.87	8,119	494	266	53.85%	15,052	13,809	16,295
25	1,189	46	1,235	8.41	1,235	302	109	36.09%	3,402	2,875	3,929
26	579	19	598	11.41	598	278	76	27.34%	2,167	1,732	2,601
Totals	421,376	4,286	425,662	217.42	425,662	27,622	6,341	-----	2,347,783	2,265,226	2,430,341

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

Appendix 2
Catch Table 1+ Chinook Shasta River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	1	0	1	12.75	1	0	0	-----	1*	1	1
8	0	0	0	8.72	0	0	0	-----	-----	-----	-----
9	1	0	1	13.39	1	0	0	-----	1*	1	1
10	5	0	5	9.55	5	2	0	8.33%	13*	0	28
11	5	0	5	21.36	5	3	0	8.33%	16*	0	35
12	9	1	10	19.95	10	5	1	20.00%	30*	0	60
13	2	0	2	9.57	2	1	0	8.33%	3*	0	7
14	1	0	1	8.46	1	1	0	8.33%	2*	0	4
15	0	0	0	9.21	0	0	0	-----	-----	-----	-----
16	1	0	1	8.41	1	0	0	-----	1*	1	1
17	0	0	0	7.36	-----	-----	-----	-----	-----	-----	-----
18	0	0	0	10.47	-----	-----	-----	-----	-----	-----	-----
19	0	0	0	18.62	-----	-----	-----	-----	-----	-----	-----
20	0	0	0	16.14	-----	-----	-----	-----	-----	-----	-----
21	0	0	0	15.76	-----	-----	-----	-----	-----	-----	-----
22	0	0	0	16.01	-----	-----	-----	-----	-----	-----	-----
23	0	0	0	11.07	-----	-----	-----	-----	-----	-----	-----
24	0	0	0	13.87	-----	-----	-----	-----	-----	-----	-----
25	0	0	0	8.41	-----	-----	-----	-----	-----	-----	-----
26	0	0	0	11.41	-----	-----	-----	-----	-----	-----	-----
Totals	25	1	26	250.48	26	12	1	-----	67	28	106

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

*Population estimations based on seasonal efficiency of 8.33%.

Appendix 3

Catch Table 0+ Coho Shasta River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate
7	0	0	0	12.75	0	0	----	----	----
8	0	0	0	8.72	0	0	----	----	----
9	0	0	0	13.39	0	0	----	----	----
10	0	0	0	9.55	0	0	----	----	----
11	0	0	0	21.36	0	0	----	----	----
12	0	0	0	19.95	0	0	----	----	----
13	0	0	0	9.57	0	0	----	----	----
14	0	0	0	8.46	0	0	----	----	----
15	0	0	0	9.21	0	0	----	----	----
16	0	0	0	8.41	0	0	----	----	----
17	0	0	0	7.36	0	0	----	----	----
18	0	0	0	10.47	0	0	----	----	----
19	0	0	0	18.62	0	0	----	----	----
20	0	0	0	16.14	0	0	----	----	----
21	0	0	0	15.76	0	0	----	----	----
22	0	0	0	16.01	0	0	----	----	----
23	0	0	0	11.07	0	0	----	----	----
24	5	0	5	13.87	5	0	----	----	14*
25	1	0	1	8.41	1	0	----	----	4*
26	7	0	7	11.41	7	0	----	----	51*
Totals	13	0	13	240.01	13	0	----	----	69

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Numbers based upon steelhead 0+ efficiencies correlated to coho 0+ efficiencies

Appendix 4
Catch Table 1+ Coho, Shasta River 2010

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Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	12.75	0	----	----	----	0	0	0
8	0	0	0	8.72	0	----	----	----	0	0	0
9	0	0	0	13.39	0	----	----	----	0	0	0
10	0	0	0	9.55	0	----	----	----	0	0	0
11	0	0	0	21.36	0	----	----	----	0	0	0
12	0	0	0	19.95	0	----	----	----	0	0	0
13	0	0	0	9.57	0	----	----	----	6	0	0
14	0	0	0	8.46	0	----	----	----	10	0	0
15	1	0	1	9.21	1	----	----	----	5	0	0
16	22	0	22	8.41	22	----	----	----	112	0	0
17	6	0	6	7.36	6	----	----	----	29	0	0
18	0	0	0	10.47	0	----	----	----	0	0	0
19	1	0	1	18.62	1	----	----	----	4	0	0
20	1	0	1	16.14	1	----	----	----	4	0	0
21	0	0	0	15.76	0	----	----	----	0	0	0
22	0	0	0	16.01	0	----	----	----	0	0	0
23	0	0	0	11.07	0	----	----	----	0	0	0
24	0	0	0	13.87	0	----	----	----	0	0	0
25	0	0	0	8.41	0	----	----	----	0	0	0
26	0	0	0	11.41	0	----	----	----	0	0	0
Totals	31	0	31	250.48	31	0	0	----	169	0	0

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Numbers based upon steelhead 0+ efficiencies correlated to coho 0+ efficiencies

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Appendix 5

Catch Table 2+ Coho, Shasta River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency	Weekly population estimate
7	0	0	0	12.75	0	0	----	----	----
8	0	0	0	8.72	0	0	----	----	----
9	0	0	0	13.39	0	0	----	----	----
10	0	0	0	9.55	0	0	----	----	----
11	0	0	0	21.36	0	0	----	----	----
12	0	0	0	19.95	0	0	----	----	----
13	0	0	0	9.57	0	0	----	----	----
14	0	0	0	8.46	0	0	----	----	----
15	0	0	0	9.21	0	0	----	----	----
16	6	0	6	8.41	6	0	----	----	6
17	3	0	3	7.36	3	0	----	----	3
18	0	0	0	10.47	0	0	----	----	----
19	0	0	0	18.62	0	0	----	----	----
20	0	0	0	16.14	0	0	----	----	----
21	0	0	0	15.76	0	0	----	----	----
22	0	0	0	16.01	0	0	----	----	----
23	0	0	0	11.07	0	0	----	----	----
24	0	0	0	13.87	0	0	----	----	----
25	0	0	0	8.41	0	0	----	----	----
26	0	0	0	11.41	0	0	----	----	----
Totals	9	0	9	250.48	9	0	0	----	9

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

Catch Table Steelhead 0+ Shasta River 2010

¹ Does not include recaptured fish.

² Million cubic feet.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	12.75	0	0	0	-----	-----	-----	-----
8	0	0	0	8.72	0	0	0	-----	-----	-----	-----
9	0	0	0	13.39	0	0	0	-----	-----	-----	-----
10	0	0	0	11.4	0	0	0	-----	-----	-----	-----
11	0	0	0	7.78	0	0	0	-----	-----	-----	-----
12	4	0	4	6.83	4	0	0	-----	-----	-----	-----
13	6	1	7	5.50	7	3	0	27.55%*	15	1	30
14	2	0	2	4.33	2	3	0	27.55%*	4	0	10
15	5	0	5	9.21	5	0	0	-----	5	5	5
16	1	0	1	8.41	1	0	0	-----	1	1	1
17	1	0	1	7.36	1	0	0	-----	1	1	1
18	9	1	10	10.47	10	4	1	25.00%	25	1	49
19	6	0	6	18.62	6	5	0	27.55%*	15	0	30
20	10	1	11	16.14	11	8	2	25.00%	33	3	63
21	20	0	20	15.76	20	16	3	18.75%	85	14	156
22	34	0	34	16.01	34	21	6	28.57%	107	40	174
23	71	1	72	11.07	72	32	7	21.88%	297	119	475
24	280	3	283	13.87	283	241	102	42.32%	665	552	778
25	193	5	198	8.41	198	121	40	33.06%	589	430	749
26	491	9	500	11.41	500	319	52	16.30%	3019	2245	3792
Totals	1,133	21	1,154	217.43	1,154	773	213	-----	4,862	4037	5686

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

*Efficiency and population estimations based on seasonal single trap efficiency of 27.55%.

Catch Table Steelhead 1+ Shasta River 2010

Shasta and Scott River Juvenile Outmigrant Study, 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	12.75	0	0	0	----	-----	-----	-----
8	0	0	0	8.72	0	0	0	----	-----	-----	-----
9	1	0	1	13.39	1	1	0	14.14%**	2	0	5
10	4	0	4	9.55	4	1	0	14.14%**	8	0	17
11	20	0	20	21.36	20	7	2	28.57%	53	9	98
12	2	1	3	19.95	3	1	0	16.67%*	5	0	10
13	6	0	6	9.57	6	4	0	16.67%*	18	0	38
14	3	1	4	8.46	4	6	1	16.67%	14	0	30
15	1	0	1	9.21	1	1	0	16.67%*	2	0	4
16	3	0	3	8.41	3	2	2	100.00%	3	3	3
17	1	0	1	7.36	1	1	0	14.14%**	2	0	4
18	5	0	5	10.47	5	2	0	14.14%**	15	0	34
19	5	0	5	18.62	5	4	1	25.00%	13	0	25
20	16	0	16	16.14	16	7	0	14.14%**	63	0	128
21	40	0	40	15.76	40	32	9	28.13%	132	59	205
22	34	0	34	16.01	34	25	2	8.00%	295	11	578
23	5	1	6	11.07	6	5	0	14.14%**	17	0	34
24	10	0	10	13.87	10	8	0	14.14%**	48	0	101
25	9	0	9	8.41	9	6	1	16.67%	32	0	65
26	21	1	22	11.41	22	16	1	6.25%	187	0	395
Totals	186	4	190	250.48	190	129	19	-----	905	530	1,280

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

*Population estimations based on combined seasonal trap efficiency of 16.67%.

**Population estimates based on single trap seasonal efficiency of 14.14%.

Catch Table Steelhead 2+ Shasta River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	4	0	4	12.75	4	1	0	11.06%*	8	0	17
8	1	0	1	8.72	1	1	0	11.06%*	2	0	5
9	2	0	2	13.39	2	0	0	-----	0	0	0
10	7	0	7	9.55	7	6	0	11.06%*	49	-18	116
11	42	2	44	21.36	44	24	2	8.33%	367	18	715
12	58	1	59	19.95	59	41	3	7.32%	620	86	1153
13	10	0	10	9.57	10	8	2	25.00%	30	3	57
14	13	2	15	8.46	15	13	1	7.69%	105	0	222
15	19	0	19	9.21	19	18	0	11.06%*	120	4	235
16	146	0	146	8.41	146	126	8	6.35%	2060	792	3328
17	36	0	36	7.36	36	17	0	11.06%*	223	12	434
18	90	1	91	10.47	91	49	6	12.24%	650	217	1083
19	273	5	278	18.62	278	197	28	14.21%	1898	1239	2557
20	273	1	274	16.14	274	153	18	11.76%	2221	1278	3163
21	67	1	68	15.76	68	67	9	13.43%	462	192	733
22	40	0	40	16.01	40	27	4	14.81%	224	52	396
23	7	0	7	11.07	7	1	0	11.06%*	13	0	25
24	6	0	6	13.87	6	2	0	11.06%*	15	0	31
25	2	0	2	8.41	2	1	0	11.06%*	4	0	8
26	6	0	6	11.41	6	3	0	11.06%*	18	0	39
Totals	1,102	13	1,115	250.48	1,115	755	81	-----	9088	7163	11013

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

*Population estimates based on single trap seasonal efficiency of 11.06%.

Appendix 9

Catch Table 3+ Steelhead Shasta River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	12.75	0	0	0	-----	-----	-----	-----
8	0	0	0	8.72	0	0	0	-----	-----	-----	-----
9	2	0	2	13.39	2	1	0	0.00%	-----	-----	-----
10	4	0	4	9.55	4	3	0	0.00%	-----	-----	-----
11	22	0	22	21.36	22	11	1	9.09%	132	0	274
12	22	0	22	19.95	22	20	0	0.00%	-----	-----	-----
13	2	0	2	9.57	2	0	0	0.00%	-----	-----	-----
14	1	0	1	8.46	1	2	0	0.00%	-----	-----	-----
15	3	0	3	9.21	3	3	0	0.00%	-----	-----	-----
16	75	0	75	8.41	75	67	2	2.99%	1,700	39	3,361
17	13	0	13	7.36	13	4	0	0.00%	-----	-----	-----
18	6	0	6	10.47	6	4	0	0.00%	-----	-----	-----
19	17	0	17	18.62	17	10	0	0.00%	-----	-----	-----
20	2	0	2	16.14	2	1	0	0.00%	-----	-----	-----
21	0	0	0	15.76	0	0	0	-----	-----	-----	-----
22	0	0	0	16.01	0	0	0	-----	-----	-----	-----
23	1	0	1	11.07	1	0	0	-----	-----	-----	-----
24	1	0	1	13.87	1	1	0	0.00%	-----	-----	-----
25	0	0	0	8.41	0	0	0	-----	-----	-----	-----
26	0	0	0	11.41	0	0	0	-----	-----	-----	-----
Totals	171	0	171	250.48	171	127	3	-----	-----	-----	-----

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities, and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

Appendix 10

Catch Table 0+ Chinook, Scott River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	103	5	108	28.31	108	22	0	5.62%	1,111 **	-51	2,273
8	143	5	148	37.60	148	40	0	5.62%	1,867 **	145	3,588
9	229	16	245	35.32	245	91	1	1.10%	11,270	0	23,935
10	680	33	713	39.04	713	315	12	3.81%	17,331	8,361	26,302
11	1642	19	1661	34.45	1661	950	25	2.63%	60,754	37,977	83,532
12	1994	142	2136	39.71	2136	1531	80	5.23%	40,399	31,730	49,069
13	613	24	637	18.50	637	270	2	0.74%	57,542	1,332	113,753
14	1216	65	1,281	21.04	1281	542	20	3.69%	33,123	19,441	46,805
15	4158	136	4,294	30.92	4294	2635	161	6.11%	69,870	59,284	80,456
16	3372	544	3,916	26.86	3916	1500	76	5.07%	76,337	59,674	92,999
17	1484	48	1,532	19.17	1532	749	30	4.01%	37,065	24,364	49,765
18	326	7	333	4.29	333	224	4	1.79%	14,985	3,040	26,930
19	4463	56	4,519	25.03	4519	227	12	5.29%	79,256	38,882	119,630
20	1438	28	1,466	15.56	1466	500	15	3.00%	45,904	24,317	67,491
21	1152	4	1,156	16.45	1156	876	40	4.57%	24,727	17,297	32,157
22	1012	5	1,017	24.97	1017	882	55	6.24%	16,036	11,898	20,174
23*	0	0	0	0.00	0	0	0	-----	0	0	0
24	1288	3	1,291	11.14	1291	787	52	6.61%	19,194	14,150	24,239
25	2603	14	2,617	21.42	2617	1941	176	9.07%	28,713	24,558	32,868
26	1562	28	1,590	33.01	1590	1331	105	7.89%	19,980	16,229	23,731
Totals	29,478	1,182	30,660	482.79	30,660	15,413	866	-----	655,467	571,177	739,757

¹ Live fish trapped equals both marked and unmarked fish

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Did not fish Julian Week 23 due to high flows

** These numbers are based on seasonal trap efficiency of 5.62%

Appendix 11

Catch Table 1+ Chinook, Scott River 2010

Julian	Live	Mortalities	Total	Volume	Adjusted	Adjusted	Recaptured	Trap	Weekly	Lower	Upper
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week	fish trapped ¹			sampled, MCF ²	total trapped ³	marked & released ⁴		efficiency ⁵	population estimate	CI	CI
7	4	0	4	28.31	4	2	0	9.49%	10**	0	22
8	25	3	28	37.60	28	12	0	9.49%	170**	0	349
9	27	0	27	35.32	27	26	1	3.85%	365	0	776
10	38	0	38	39.04	38	31	6	19.35%	174	58	290
11	29	0	29	34.45	29	29	2	6.90%	290	7	573
12	29	0	29	39.71	29	24	4	16.67%	145	33	257
13	5	0	5	18.50	5	3	0	9.49%	16**	0	34
14	5	0	5	21.04	5	5	0	9.49%	20**	0	45
15	3	0	3	30.92	3	2	0	9.49%	8**	0	17
16	2	0	2	26.86	2	1	0	9.49%	4**	0	8
17	0	0	0	19.17	0	0	0	-----	0	0	0
18	0	0	0	4.29	0	0	0	-----	0	0	0
19	0	0	0	25.03	0	0	0	-----	0	0	0
20	0	0	0	15.56	0	0	0	-----	0	0	0
21	0	0	0	16.45	0	0	0	-----	0	0	0
22	1	0	1	24.97	1	1	0	9.49%	2**	0	4
23*	0	0	0	0.00	0	0	0	-----	0	0	0
24	0	0	0	11.14	0	0	0	-----	0	0	0
25	0	0	0	21.42	0	0	0	-----	0	0	0
26	1	0	1	33.01	1	1	0	9.49%	2**	0	4
Totals	169	3	172	482.79	172	137	13	-----	1204	649	1760

¹ Live fish trapped equals both marked and unmarked fish

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Did not fish Julian Week 23 due to high flows

** These numbers are based on seasonal trap efficiency of 9.49%

Appendix 12

Catch Table Coho 0+, Scott River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate*
7	0	0	0	28.31	0	0	0	-----	-----
8	0	0	0	37.60	0	0	0	-----	-----
9	0	0	0	35.32	0	0	0	-----	-----
10	0	0	0	39.04	0	0	0	-----	-----
11	0	0	0	34.45	0	0	0	-----	-----
12	0	0	0	39.71	0	0	0	-----	-----
13	0	0	0	18.50	0	0	0	-----	-----
14	30	1	31	21.04	31	0	0	12.35%	251
15	240	7	247	30.92	247	0	0	12.35%	2001
16	191	20	211	26.86	211	0	0	12.35%	1709
17	28	1	29	19.17	29	0	0	12.35%	235
18	2	0	2	4.29	2	0	0	12.35%	16
19	12	0	12	25.03	12	0	0	12.35%	97
20	4	0	4	15.56	4	0	0	12.35%	32
21	5	0	5	16.45	5	0	0	12.35%	40
22	12	0	12	24.97	12	0	0	12.35%	97
23*	0	0	0	0.00	0	0	0	12.35%	0
24	7	0	7	11.14	7	0	0	12.35%	57
25	41	1	42	21.42	42	0	0	24.71%	170
26	76	0	76	33.01	76	0	0	12.49%	608
Totals	648	30	678	482.79	678	0	0	-----	5314

¹ Live fish trapped equals both marked and unmarked fish

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ Efficiencies based on correlation ($y = 1.2666x + 0.0847$) where 0+ steelhead seasonal trap efficiency 3.06% equals x.

* Did not fish Julian Week 23 due to high flows

Appendix 13

Catch Table Coho 1+, Scott River 2010

Shasta and Scott River Juvenile Outmigrant Study, 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released	Recaptured	Trap efficiency	Weekly population estimate
7	2	0	2	28.31	2	0	0	-----	24
8	2	0	2	37.60	2	0	0	-----	24
9	6	0	6	35.32	6	0	0	-----	71
10	6	0	6	39.04	6	0	0	-----	71
11	7	0	7	34.45	7	0	0	-----	82
12	4	0	4	39.71	4	0	0	-----	47
13	1	0	1	18.50	1	0	0	-----	12
14	9	0	9	21.04	9	0	0	-----	106
15	19	0	19	30.92	19	0	0	-----	223
16	15	0	15	26.86	15	0	0	-----	176
17	18	1	19	19.17	19	0	0	-----	223
18	6	0	6	4.29	6	0	0	-----	71
19	38	0	38	25.03	38	0	0	-----	447
20	23	0	23	15.56	23	0	0	-----	270
21	6	0	6	16.45	6	0	0	-----	71
22	22	0	22	24.97	22	0	0	-----	259
23	0	0	0	0.00	0	0	0	-----	-----
24	0	0	0	11.14	0	0	0	-----	-----
25	0	0	0	21.42	0	0	0	-----	-----
26	0	0	0	33.01	0	0	0	-----	-----
Totals	184	1	185	482.79	185	0	0	-----	2,174**

¹ Live fish trapped equals both marked and unmarked fish

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

* Did not fish Julian Week 23 due to high flows

** Based on the ratio of 2+ steelhead seasonal efficiency.

Catch Table Steelhead 0+, Scott River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	Trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	28.31	0	0	0	-----	0	0	0
8	0	0	0	37.60	0	0	0	-----	0	0	0
9	0	0	0	35.32	0	0	0	-----	0	0	0
10	0	0	0	39.04	0	0	0	-----	0	0	0
11	0	0	0	34.45	0	0	0	-----	0	0	0
12	0	0	0	39.71	0	0	0	-----	0	0	0
13	0	0	0	18.50	0	0	0	-----	0	0	0
14	0	0	0	21.04	0	0	0	-----	0	0	0
15	2	0	2	30.92	2	0	0	-----	-----	-----	-----
16	10	4	14	26.86	14	0	0	-----	-----	-----	-----
17	5	0	5	19.17	5	0	0	-----	-----	-----	-----
18	15	0	15	4.29	15	0	0	-----	-----	-----	-----
19	49	11	60	25.03	60	0	0	-----	-----	-----	-----
20	44	12	56	15.56	56	35	0	3.06%	974**	0	2,051
21	86	3	89	16.45	89	56	0	3.06%	1,871**	0	3,756
22	78	5	83	24.97	83	71	0	3.06%	1,884**	83	3,684
23*	0	0	0	0.00	0	0	0	-----	0	0	0
24	14	0	14	11.14	14	3	0	3.06%	51**	0	113
25	57	2	59	21.42	59	39	5	12.82%	393	111	675
26	73	1	74	33.01	74	63	2	3.17%	1,579	38	3,119
Totals	433	38	471	482.79	471	267	7	-----	6,752	3,525	9,979

¹ Does not include recaptured fish.

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Did not fish Julian Week 23 due to high flows

** These numbers are based on seasonal trap efficiency of 3.06%

Appendix 15

Catch Table Steelhead 1+, Scott River 2010

Julian	Live fish	Mortality	Total	Volume	Adjusted	Adjusted	Recapture	Trap	Weekly	Lower CI	Upper CI
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week	trapped ¹	s		sampled, MCF ²	total trapped ³	marked & released ⁴	d	efficiency ⁵	populatio n estimate		
7	56	1	57	28.31	56	41	2	4.88%	784	24	1,544
8	49	0	49	37.6	51	43	2	4.65%	748	20	1,476
9	205	2	207	35.32	207	145	7	4.83%	3,778	1,332	6,223
10	234	5	239	39.04	237	200	22	11.00%	2,071	1,254	2,888
11	367	2	369	34.45	368	233	25	10.73%	3,312	2,093	4,531
12	808	15	823	39.71	823	546	50	9.16%	8,827	6,473	11,181
13	169	0	169	18.50	169	112	5	4.46%	3,183	848	5,518
14	107	2	109	21.04	109	136	2	1.47%	4,978	87	9,868
15	140	1	141	30.92	140	110	7	6.36%	1,943	686	3,199
16	215	1	216	26.86	216	79	5	6.33%	2,880	800	4,960
17	134	1	135	19.17	135	91	6	6.59%	1,774	562	2,986
18	35	0	35	4.29	35	25	0	6.90%	334 **	1	667
19	145	1	146	25.03	145	47	0	6.90%	1,640 **	280	3,000
20	88	1	89	15.56	89	75	3	4.00%	1,691	216	3,166
21	23	0	23	16.45	23	11	0	6.90%	157 **	0	334
22	42	1	43	24.97	43	37	1	2.70%	817	0	1,738
23*	0	0	0	0	0	0	0	-----	0	0	0
24	14	1	15	11.14	15	5	0	6.90%	67 **	0	146
25	54	2	56	21.42	56	38	1	2.63%	1,092	0	2,317
26	40	1	41	33.01	41	26	0	6.90%	396 **	6	786
Totals	2,925	37	2,962	482.79	2,958	2,000	138	-----	40,472	32,843	48,101

¹ Live fish trapped equals both marked and unmarked fish

² Million cubic feet.

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Did not fish Julian Week 23 due to high flows

** These numbers are based on seasonal trap efficiency of 6.90%

Appendix 16

Catch Table Steelhead 2+, Scott River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled,	Adjusted total	Adjusted marked &	Recaptured	Trap efficiency ⁵	Weekly population	Lower CI	Upper CI
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				MCF ²	trapped ³	released ⁴			estimate		
7	1	0	1	28.31	1	1	1	100.00%	1	1	1
8	3	0	3	37.6	3	0	0	-----	3	3	3
9	17	0	17	35.32	17	9	0	4.23%	123 **	0	274
10	29	0	29	39.04	29	26	3	11.54%	196	27	365
11	67	0	67	34.45	67	33	0	4.23%	951 **	0	1,943
12	129	0	129	39.71	129	111	7	6.31%	1,806	634	2,978
13	27	0	27	18.50	27	16	0	4.23%	274 **	0	595
14	8	1	9	21.04	9	13	0	4.23%	81 **	0	183
15	34	0	34	30.92	34	20	0	4.23%	387 **	0	827
16	40	0	40	26.86	40	14	0	4.23%	377 **	0	819
17	1	0	1	19.17	1	1	0	4.23%	2 **	0	5
18	0	0	0	4.29	0	0	0	-----	0	0	0
19	5	0	5	25.03	5	1	0	4.23%	10 **	0	20
20	1	0	1	15.56	1	2	0	4.23%	3 **	0	7
21	2	0	2	16.45	2	1	0	4.23%	4 **	0	8
22	11	0	11	24.97	11	6	0	4.23%	61 **	0	138
23*	0	0	0	0	0	0	0	-----	0	0	0
24	1	0	1	11.14	1	1	0	4.23%	2 **	0	5
25	3	1	4	21.42	4	3	0	4.23%	14 **	0	33
26	2	0	2	33.01	2	2	0	4.23%	6 **	0	13
Totals	381	2	383	482.79	383	260	11	-----	4,299	2,591	6,008

¹ Live fish trapped equals both marked and unmarked fish

² MCF = Million Cubic Feet

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

⁵ % trap efficiency equals # recaptured fish/# marked released.

* Did not fish Julian Week 23 due to high flows

** These numbers are based on seasonal trap efficiency of 4.23%

Appendix 17

Catch Table Steelhead 3+, Scott River 2010

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled,	Adjusted total	Adjusted marked &	Recaptured	Trap efficiency	Weekly population
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				MCF²	trapped³	released⁴			estimate
7	1	0	1	28.31	1	1	0	-----	2
8	1	0	1	37.6	1	0	0	-----	1
9	0	0	0	35.32	0	0	0	-----	0
10	1	0	1	39.04	1	0	0	-----	1
11	1	0	1	34.45	1	0	0	-----	1
12	0	0	0	39.71	0	0	0	-----	0
13	0	0	0	18.50	0	0	0	-----	0
14	0	0	0	21.04	0	0	0	-----	0
15	1	0	1	30.92	1	1	0	-----	2
16	1	0	1	26.86	1	0	0	-----	1
17	0	0	0	19.17	0	0	0	-----	0
18	0	0	0	4.29	0	0	0	-----	0
19	0	0	0	25.03	0	0	0	-----	0
20	0	0	0	15.56	0	0	0	-----	0
21	0	0	0	16.45	0	0	0	-----	0
22	0	0	0	24.97	0	0	0	-----	0
23	0	0	0	0	0	0	0	-----	0
24	0	0	0	11.14	0	0	0	-----	0
25	0	0	0	21.42	0	0	0	-----	0
26	0	0	0	33.01	0	0	0	-----	0
Totals	6	0	6	482.79	6	2	0	-----	8

¹ Live fish trapped equals both marked and unmarked fish

² MCF = Million Cubic Feet

³ Adjusted total trapped includes live fish, mortalities and marked fish. Does not include recaptured or marked fish caught after the end of the Julian week.

⁴ Adjusted marked & released includes fish marked during the week minus marked fish caught after the end of the week.

Appendix 18

Shasta River 2010 average fork length by Julian week for Chinook 0+.

Julian week	average	s.d.	n	min	max
7	37.00	1.40	300	33	44
8	38.07	2.27	300	34	52
9	38.21	2.67	300	34	49
10	38.8	3.68	300	34	54
11	38.89	4.10	300	34	58
12	43.10	6.43	300	34	68
13	52.02	7.16	164	36	68
14	51.28	8.60	248	35	74
15	54.42	9.39	250	35	85
16	56.97	8.82	300	38	84
17	58.96	8.9	150	42	87
18	60.63	9.26	250	40	94
19	69.81	12.59	300	48	100
20	78.00	12.66	274	51	105
21	83.22	9.03	300	53	110
22	88.63	8.84	289	62	109
23	90.72	8.34	190	66	112
24	92.42	7.52	300	68	114
25	95.10	7.56	209	58	120
26	98.31	7.49	124	82	118

Appendix 19

Shasta River 2010 average fork length by Julian week for Chinook 1+.

Julian week	average	s.d.	n	min	max
7	159	-----	1	159	159
8	-----	-----	-----	-----	-----
9	107	-----	1	107	107
10	118.2	5.45	5	111	126
11	114.8	6.06	5	108	124
12	134.9	16.72	10	115	161
13	83	1.41	2	82	84
14	82	-----	1	82	82
15	-----	-----	-----	-----	-----
16	175	-----	1	175	175
17	-----	-----	-----	-----	-----
18	-----	-----	-----	-----	-----
19	-----	-----	-----	-----	-----
20	-----	-----	-----	-----	-----
21	-----	-----	-----	-----	-----
22	-----	-----	-----	-----	-----
23	-----	-----	-----	-----	-----
24	-----	-----	-----	-----	-----
25	-----	-----	-----	-----	-----
26	-----	-----	-----	-----	-----

Appendix 20

Shasta River 2010 average fork length by Julian week for coho 0+.

Julian week	average	s.d.	n	min	max
7	-----	-----	-----	-----	-----
8	-----	-----	-----	-----	-----
9	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----
11	-----	-----	-----	-----	-----
12	-----	-----	-----	-----	-----
13	-----	-----	-----	-----	-----
14	-----	-----	-----	-----	-----
15	-----	-----	-----	-----	-----
16	-----	-----	-----	-----	-----
17	-----	-----	-----	-----	-----
18	-----	-----	-----	-----	-----
19	-----	-----	-----	-----	-----
20	-----	-----	-----	-----	-----
21	-----	-----	-----	-----	-----
22	-----	-----	-----	-----	-----
23	-----	-----	-----	-----	-----
24	98.80	28.09	5	49	115
25	114	-----	1	114	114
26	69.86	5.55	7	62	76

Appendix 21

Shasta River 2010 average fork length by Julian week for coho 1+.

Julian Week	average	s.d.	n	min	max
7	-----	-----	-----	-----	-----
8	-----	-----	-----	-----	-----
9	-----	-----	-----	-----	-----
10	-----	-----	-----	-----	-----
11	-----	-----	-----	-----	-----
12	-----	-----	-----	-----	-----
13	145.50	20.51	2	131	160
14	127	5.66	2	123	131
15	153	-----	1	153	153
16	148.23	9.33	22	130	159
17	151.17	11.82	6	140	165
18	162	-----	1	162	162
19	127	-----	1	127	127
20	-----	-----	-----	-----	-----
21	-----	-----	-----	-----	-----
22	-----	-----	-----	-----	-----
23	-----	-----	-----	-----	-----
24	-----	-----	-----	-----	-----
26	-----	-----	-----	-----	-----

Appendix 22

Shasta River 2010 average fork length by Julian week for coho 2+

Shasta River 2010 - average fork length by Julian Week - Coho 2+					
Julian Week	average	s.d.	n	min	max
7	----	----	----	----	----
8	----	----	----	----	----
9	----	----	----	----	----
10	----	----	----	----	----
11	----	----	----	----	----
12	----	----	----	----	----
13	----	----	----	----	----
14	----	----	----	----	----
16	178.17	9.58	6	164	191
17	186.50	12.02	2	178	195
18	----	----	----	----	----
19	----	----	----	----	----
20	----	----	----	----	----
21	----	----	----	----	----
22	----	----	----	----	----
23	----	----	----	----	----
24	----	----	----	----	----
25	----	----	----	----	----
26	----	----	----	----	----

Appendix 23

Shasta River 2010 average fork length by Julian week for steelhead 0+.

Julian week	average	s.d.	n	min	max
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	25.25	1.26	4	24	27
13	25.50	0.71	2	25	26
14	---	---	---	---	---
15	---	---	---	---	---
16	---	---	---	---	---
17	---	---	---	---	---
18	28.80	1.92	5	27	32
19	43	---	1	43	43
20	21	---	1	21	21
21	61	4.18	5	55	66
22	66	3.39	5	62	70
23	64.88	7.61	26	53	79
24	73.28	8.29	86	52	91
25	83.83	9.51	29	65	106
26	84.50	9.57	101	64	108

Appendix 24

Shasta River 2010 average fork length by Julian week for steelhead 1+.

Julian week	average	s.d.	n	min	max
7	-----	-----	-----	-----	-----
8	-----	-----	-----	-----	-----
9	123	-----	1	123	123
10	124.25	14.59	4	106	137
11	120.28	13.38	18	91	135
12	107	5.66	2	103	111
13	118.50	10.60	6	101	130
14	121	12.68	4	105	136
15	99	-----	1	99	99
16	117	19.47	3	102	139
17	146	-----	1	146	146
18	148.6	9.61	5	133	159
19	149.4	5.73	5	140	154
20	146	13.50	16	116	159
21	165.56	11.36	41	125	179
22	165.37	13.99	35	120	179
23	161.2	16.27	5	138	179
24	156.22	13.58	9	141	175
25	157.3	9.70	10	143	170
26	150.76	12.92	21	125	171

Appendix 25

Shasta River 2010 average fork length by Julian week for steelhead 2+.

Julian week	average	s.d.	n	min	max
7	188.25	12.66	4	176	206
8	174.00	-----	1	174	174
9	178.50	14.85	2	168	189
10	185.29	10.92	7	168	200
11	187.58	16.36	45	140	209
12	182.71	17.34	58	140	209
13	173.30	25.18	10	143	214
14	193.73	15.96	15	171	217
15	184.53	20.00	19	150	214
16	193.60	18.34	73	140	219
17	195.25	15.22	36	170	225
18	193.36	16.57	90	160	228
19	191.05	14.31	150	164	228
20	188.93	14.66	131	161	228
21	194.13	13.63	67	180	260
22	195.27	12.96	41	180	233
23	192.71	9.46	7	180	204
24	215.60	41.57	5	181	262
25	189.00	5.66	2	185	193
26	190.17	8.50	6	180	200

Appendix 26

Shasta River 2010 average fork length by Julian week for steelhead 3+.

Julian week	average	s.d.	n	min	max
7	---	---	---	---	---
8	---	---	---	---	---
9	216.5	4.95	2	213	220
10	224.5	24.34	4	235	287
11	233.91	20.00	22	210	299
12	232.86	20.06	22	210	277
13	240.5	3.54	2	238	243
14	252	---	1	252	252
15	257	47.09	3	220	310
16	236.04	14.46	56	220	276
17	240.85	20.67	13	230	305
18	243	14.91	6	230	268
19	238.31	9.02	16	230	262
20	235	4.24	2	232	238
23	289	---	1	289	289
24	320	---	1	320	320
25	---	---	---	---	---
26	---	---	---	---	---

Appendix 27

Scott River 2010 average fork length by Julian week for Chinook 0+.

Julian week	average	s.d.	n	min	max
7	36	1.87	5	34	39
8	37	1.29	12	35	40
9	35	1.08	59	33	38
10	36	1.38	95	32	39
11	36	2.10	100	33	48
12	37	1.73	100	34	35
13	38	2	184	32	48
14	42	6.67	53	34	65
15	39	5.15	200	33	59
16	38	3.91	345	32	68
17	40	6.95	100	34	95
18	-----	-----	-----	-----	-----
19	46	8.45	349	32	79
20	47	8.55	150	33	81
21	51	7.58	50	38	69
22	55	9.95	150	37	85
23	-----	-----	-----	-----	-----
24	58	11.06	50	38	84
25	63	10.91	100	41	90
26	75	13.41	200	46	100

Appendix 28

Scott River 2010 Average fork length by Julian week for Chinook 1+

Julian week	average	s.d.	n	min	max
7	94	9.22	4	81	101

8	98	10.39	24	76	117
9	103	11.61	28	73	128
10	103	10.88	44	76	132
11	101	23.08	29	78	190
12	99	12.15	31	81	135
13	112	24	5	88	150
14	106	19.20	5	85	125
15	113	15.37	4	91	125
16	103	9.81	3	92	109
17	----	----	----	----	----
18	----	----	----	----	----
19	----	----	----	----	----
20	----	----	----	----	----
21	----	----	----	----	----
22	165	----	1	165	165
23	----	----	----	----	----
24	----	----	----	----	----
25	----	----	----	----	----
26	147	----	1	147	147

Appendix 29

Scott River 2010 Average fork length by Julian week for Coho 0+

Julian week	average	s.d.	n	min	max
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	---	---	---	---	---
14	35	---	1	35	35
15	36	3.21	3	32	38
16	---	---	---	---	---
17	---	---	---	---	---
18	---	---	---	---	---
19	40	---	1	40	40
20	---	---	---	---	---
21	---	---	---	---	---
22	54	---	1	54	54
23	---	---	---	---	---
24	63	2.12	2	61	64
25	58	10.61	2	50	65
26	67	7.61	21	56	80

Appendix 30

Scott River 2010 Average fork length by Julian week for Coho 1+

Julian week	average	s.d.	n	min	max
-------------	---------	------	---	-----	-----

7	105	---	1	105	105
8	106	4.95	2	102	109
9	103	4.59	6	97	108
10	95	7.07	2	90	100
11	110	13.05	4	95	125
12	104	10.21	3	97	116
13	113	---	1	113	113
14	117	11.72	5	99	129
15	113	8.79	19	96	133
16	115	10.25	15	95	129
17	118	8.28	19	105	130
18	120	9.24	6	103	129
19	121	10.33	36	105	153
20	126	9.42	9	117	147
21	123	3.43	6	120	128
22	132	10.94	22	117	160
23	---	---	---	---	---
24	---	---	---	---	---
25	---	---	---	---	---
26	---	---	---	---	---

Appendix 31

Scott River 2010 Average fork length by Julian week for Steelhead 0+

Julian week	average	s.d.	n	min	max
7	----	----	----	----	----
8	----	----	----	----	----
9	----	----	----	----	----
10	----	----	----	----	----
11	----	----	----	----	----
12	----	----	----	----	----
13	-----	-----	-----	-----	-----
14	-----	-----	-----	-----	-----
15	-----	-----	-----	-----	-----
16	-----	-----	-----	-----	-----
17	-----	-----	-----	-----	-----
18	-----	-----	-----	-----	-----
19	-----	-----	-----	-----	-----
20	-----	-----	-----	-----	-----
21	-----	-----	-----	-----	-----
22	----	----	----	----	----
23	----	----	----	----	----
24	28	3.08	5	25	32
25	39	8.25	10	28	53
26	57	5.81	16	47	70

Appendix 32

Scott River 2010 Average fork length by Julian week for Steelhead 1+

Julian week	average	s.d.	n	min	max
7	92	14.02	57	66	119
8	89	13.79	49	65	119
9	92	13.65	187	63	120
10	91	14.11	239	62	119
11	94	13.32	232	64	119
12	94	12.20	300	68	119
13	93	13.37	118	65	119
14	87	13.69	106	62	119
15	85	11.52	122	60	109
16	92	12.74	25	68	107
17	90	16.07	109	62	145
18	96	19.14	36	66	142
19	96	14.57	133	66	133
20	96	14.93	86	70	146
21	100	21.79	24	70	172
22	113	26.17	43	69	175
23	----	----	----	----	----
24	113	19.22	14	83	151
25	115	22.15	55	81	178
26	121	25.56	39	86	172

Appendix 33

Scott River 2010 Average fork length by Julian week for Steelhead 2+

Julian week	average	s.d.	n	min	max
7	131	----	1	131	131
8	125	2.89	3	123	128
9	132	7.59	16	122	147
10	138	17.84	31	120	193
11	140	19.74	67	120	220
12	135	16.46	129	120	210
13	133	11.20	27	121	160
14	147	26.37	8	123	185
15	131	14.34	34	110	174
16	125	11.69	14	111	151
17	169	----	1	169	169
18	----	----	----	----	----
19	175	19	5	151	202
20	152	----	1	152	152
21	197	16.26	2	185	208
22	197	12.49	11	181	220
23	----	----	----	----	----
24	183	----	1	183	183
25	185	1.53	3	184	187
26	195	21.21	2	180	210

Appendix 34

Scott River 2010 Average fork length by Julian week for Steelhead 3+

Julian week	average	s.d.	n	min	max
7	263	----	1	263	263
8	226	----	1	226	226
9	----	----	----	----	----
10	530	----	1	530	530
11	430	----	1	430	430
12	----	----	----	----	----
13	----	----	----	----	----
14	----	----	----	----	----
15	294	----	1	294	294
16	----	----	----	----	----
17	----	----	----	----	----
18	----	----	----	----	----
19	----	----	----	----	----
20	----	----	----	----	----
21	----	----	----	----	----
22	----	----	----	----	----
23	----	----	----	----	----
24	----	----	----	----	----
25	----	----	----	----	----
26	----	----	----	----	----

Appendix 35

Age Length cut-offs for Shasta River juvenile salmonids

Shasta River Steelhead age-length cut-offs for Julian weeks 7-28 based on 2006 scale ageing data

Julian Weeks	Age-Length Cut-offs				n
	Age 0+	Age 1+	Age 2+	Age 3+	
7 - 8	≤ 49	50 - 139	140 - 259	≥ 260	13
9 - 10	≤ 49	50 - 169	170 - 209	≥ 210	16
11 - 12	≤ 49	50 - 149	150 - 189	≥ 190	6
13 - 14	≤ 49	50 - 149	150 - 259	≥ 260	7
15 - 16	≤ 49	50 - 129	130 - 219	≥ 220	13
17 - 18	≤ 79	80 - 149	150 - 229	≥ 230	28
19 - 20	≤ 79	80 - 119	120 - 229	≥ 230	26
21 - 22	≤ 89	90 - 189	190 - 219	≥ 220	22
23 - 24	≤ 119	120 - 179	180 - 239	≥ 240	28
25 - 26	≤ 99	100 - 169	170 - 259	≥ 260	30
27 - 28	≤ 109	110 - 169	170 - 269	≥ 270	17

Shasta River Coho salmon age-length cut-offs for Julian weeks 7-28 based on 2006 scale ageing data

Julian Weeks	Age-Length Cut-offs			n
	Age 0+	Age 1+	Age 2+	
7 - 8	≤ 79	80 - 149	≥ 150	14
9 - 12	≤ 99	100 - 159	≥ 160	34
13 - 14	≤ 59	60 - 189	≥ 170	33
15 - 16	≤ 99	100 - 159	≥ 160	14
17 - 20	≤ 89	90 - 169	≥ 170	35
21 - 28	≤ 119	120 - 149	≥ 150	49

Shasta River Chinook salmon age-length cut-offs for Julian weeks 7-28 based on 2006 scale ageing data

Julian Weeks	Age-Length Cut-offs		n
	Age 0+	Age 1+	
7 - 8	≤ 50	≥ 110	1
9 - 12	≤ 79	≥ 80	16
13 - 14	≤ 79	≥ 80	14
15 - 16	≤ 89	≥ 90	18
17 - 20	≤ 119	≥ 120	20
21 - 28	≤ 159	≥ 160	36

Appendix 36

Age Length cut-offs for Scott River juvenile salmonids

Scott River Steelhead age-length cut-offs for Julian weeks 7-28 based on 2000 - 2006 scale ageing data

Julian Weeks	Age-Length Cut-offs				n
	Age 0+	Age 1+	Age 2+	Age 3+	
7 - 8	≤ 59	60 - 119	120 - 189	≥ 190	61
9 - 12	≤ 49	50 - 119	120 - 229	≥ 230	162
13 - 14	≤ 49	50 - 119	120 - 259	≥ 260	86
15 - 16	≤ 59	60 - 109	110 - 219	≥ 220	70
17 - 20	≤ 59	60 - 149	150 - 229	≥ 230	199
21 - 28	≤ 79	80 - 179	180 - 229	≥ 230	224

Scott River Coho salmon age-length cut-offs for Julian weeks 7-28 based on 2000 - 2006 scale ageing data

Julian Weeks	Age-Length Cut-offs			n
	Age 0+	Age 1+	Age 2+	
7 - 8	≤ 49	50 - 119	≥ 120	24
9 - 12	≤ 49	50 - 149	≥ 150	49
13 - 14	≤ 59	60 - 149	≥ 150	20
15 - 16	≤ 69	70 - 149	≥ 150	22
17 - 20	≤ 69	70 - 159	≥ 160	31

21 - 28	≤ 109	110 - 159	≥ 160	96
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Scott River Chinook salmon age-length cut-offs for Julian weeks 7-28 based on 2000 - 2006 scale ageing data

Julian Weeks	Age-Length Cut-offs		n
	Age 0+	Age 1+	
7 - 8	≤ 99	≥ 100	0
9 - 12	≤ 129	≥ 130	1
13 - 14	≤ 99	≥ 100	0
15 - 16	≤ 69	≥ 70	1
17 - 20	≤ 119	≥ 120	4
21 - 28	≤ 129	≥ 130	27

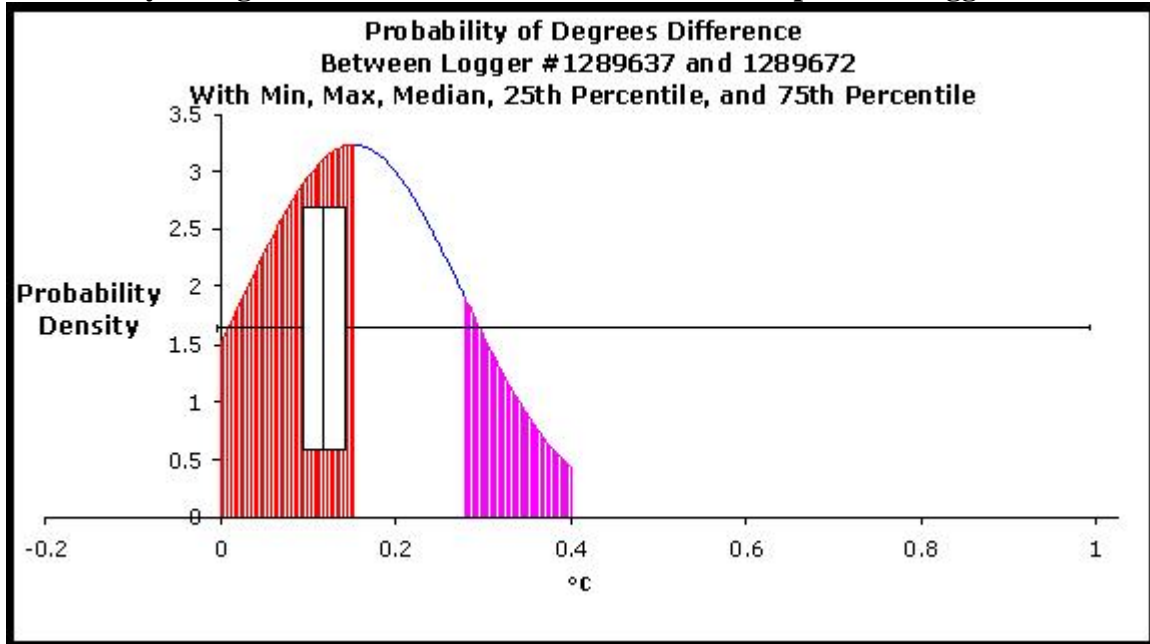
Appendix 37

Weekly statistics for Shasta River temperature

Weekly Temperature Statistics for Shasta River						
JW	Maximum	Avg. Max	Average	Avg. Min	Minimum	Max ΔT
7	10.57	9.45	8.66	8.04	6.97	1.90
8	9.41	8.71	7.84	6.97	6.51	2.08
9	10.10	9.27	8.40	7.57	6.61	2.52
10	10.69	9.25	8.29	7.35	6.08	3.24
11	12.85	10.88	9.42	8.09	5.85	3.46
12	13.31	12.66	11.18	10.00	9.14	3.49
13	12.61	11.71	10.42	9.36	8.79	3.57
14	13.35	10.59	9.14	7.94	6.48	4.96
15	14.51	12.07	10.49	9.09	7.85	4.87
16	17.63	14.64	12.52	10.72	7.44	5.68
17	17.15	14.44	12.82	11.27	9.41	5.59
18	16.70	15.59	13.39	11.46	9.58	5.73
19	18.49	16.44	14.29	12.30	11.03	5.49
20	20.87	18.35	16.26	14.39	11.59	5.64
21	15.77	14.75	12.98	11.32	9.53	6.00
22	19.70	18.42	16.64	15.09	12.46	6.21
23	20.94	19.32	17.61	16.07	15.10	4.62
24	23.91	22.02	18.96	16.15	14.07	7.00
25	25.77	22.22	19.42	16.73	15.65	6.97
26	26.92	25.94	22.59	19.47	18.13	7.26
		25.94	22.59			
		MWMT	MWAT			

Appendix 38

Probability of degrees difference between Scott River temperature loggers



Statistical values of probability density for Scott River temperature loggers

$\Pr(x < 0)$	0.00%
$\Pr(x > 0.4)$	2.22%
$\Pr(0 < x < 0.4)$	97.78%
Mean	0.152107
StDev	0.12334
Median	0.123
Q1	0.1
Q3	0.149
Minimum	0
Maximum	1.025

Appendix 39

Weekly Statistics of Scott River Temperature

Weekly Statistics						
JW	Maximum	Avg. Max	Average	Avg. Min	Minimum	Max ΔT
7	8.32	7.72	7.24	6.78	5.82	1.45
8	7.19	6.73	6.25	5.71	4.77	1.74
9	8.42	7.54	6.94	6.36	5.75	1.52
10	8.30	7.52	6.77	6.08	5.10	1.72
11	9.78	8.57	7.64	6.74	5.23	2.01
12	10.81	9.95	8.94	7.90	7.17	2.55
13	9.63	8.36	7.49	6.72	5.23	2.54
14	9.83	7.85	6.89	6.09	4.97	2.67
15	10.17	8.96	8.35	7.69	6.89	2.25
16	12.12	10.71	9.65	8.66	6.46	2.83
17	11.54	10.22	9.24	8.36	6.51	2.98
18	11.61	10.63	9.48	8.34	6.97	2.81
19	13.23	11.37	10.27	9.15	7.85	3.16
20	13.09	11.51	10.68	9.88	8.64	2.16
21	10.81	9.99	9.19	8.47	6.79	3.14
22	13.83	12.50	11.55	10.46	8.79	3.18
23	12.36	11.26	10.46	9.71	8.57	2.12
24	14.70	13.53	12.45	11.46	10.08	2.59
25	15.75	14.84	13.66	12.36	11.69	3.20
26	17.56	16.93	15.82	14.59	14.29	2.65
		MWMT	MWAT			
		16.93	15.82			

Appendix 40

Additional fish species collected in the Shasta and Scott River rotary traps in 2010.

Shasta River rotary trap, 2010.

Ammocoete	family <i>Petromyzontidae</i>	70
Bluegill	<i>Lepomis macrochirus</i>	6
Brown Bullhead	<i>Ameiurus nebulosus</i>	19
Bull Frog	<i>Pyxicephalus edulis</i>	1
Crayfish	family <i>Astacidae</i>	1
Fathead Minnow	<i>Pimephales promelas</i>	3
Golden Shiner	<i>Notemigonus crysoleucas</i>	10
Green Sunfish	<i>Lepomis cyanellus</i>	31
Japanese Smelt	<i>Hypomesus nipponensis</i>	28
Klamath Large Scale Sucker	<i>Catostomus snyderi</i>	1
Klamath River Lamprey	<i>Lampetra similis</i>	96
Klamath Small Scale Sucker	<i>Catostomus rimiculus</i>	745
Large Mouth Bass	<i>Micropterus salmoides</i>	2
Marbled Sculpin	<i>Cottus klamathensis</i>	50
Mesquito Fish	genus <i>Gambusia</i>	15
Pacific Lamprey	<i>Lampetra tridentata</i>	1414
Pumpkin Seed	<i>Lepomis gibbosus</i>	29
River Lamprey	<i>Lampetra fluviatilis</i>	23
Speckled Dace	<i>Rhinichthys osculus</i>	108
Tui Chub	<i>Gila bicolor</i>	5
Unknown Fish	----	8
Yellow Bullhead	<i>Ameiurus natalis</i>	134

Scott River rotary traps, 2010.

Common Name	Scientific Name	Count
Ammocoete	family <i>Petromyzontidae</i>	9,673
Bluegill	<i>Lepomis macrochirus</i>	1
Brook Stickleback	<i>Culaea inconstans</i>	145
Brown Bullhead	<i>Ameiurus nebulosus</i>	1
Bull Frog	<i>Pyxicephalus edulis</i>	3
Bull Frog Tadpole	<i>Pyxicephalus edulis</i>	146
Crayfish	family Astacidae	22
Fathead Minnow	<i>Pimephales promelas</i>	10
Golden Shiner	<i>Notemigonus crysoleucas</i>	3
Green Sunfish	<i>Lepomis cyanellus</i>	6
Klamath River Lamprey	<i>Lampetra similis</i>	39
Klamath Small Scale Sucker	<i>Catostomus rimiculus</i>	5,457
Large Mouth Bass	<i>Micropterus salmoides</i>	10
Marbled Sculpin	<i>Cottus klamathensis</i>	12
Mesquito Fish	genus <i>Gambusia</i>	2
Miller Lake Lamprey	<i>Lampetra (Entosphenus) minima</i>	1
Pacific Lamprey	<i>Lampetra tridentata</i>	811
Pacific Salamander	<i>Dicamptodon tenebrosus</i>	2
Speckled Dace	<i>Rhinichthys osculus</i>	1,015
Tui Chub	<i>Gila bicolor</i>	3
Unknown Fish	-----	1
Western Toad	<i>Anaxyrus boreas</i>	1

Appendix 41

Life stages*

Sac Fry – A fry whose yolk sack has yet to be fully absorbed

Fry – Stage between sac fry and parr. Parr marks are not yet visible (it is assumed in this study that anything that is not a sac fry, yet under a 55 mm fork length is a fry).

Parr – Parr marks are visible on the fish.

Silvery Parr – Parr that has commenced smoltification. Scales are silvery and loose, yet parr marks are still visible.

Smolt – Silver scales with no parr marks visible.

Rosy Post Smolt – A colorful fish larger than the usual smolt size; possibly a resident.

Adult – A sexually mature fish.

*Some of the life stages are subjective depending on how the sampler of a specific fish interprets the visible characteristics of that fish

Appendix 42

List of Julian weeks and calendar equivalents

<u>Julian Week #</u>	<u>Inclusive Dates</u>
<u>1</u>	<u>1/1 - 1/7</u>
<u>2</u>	<u>1/8 - 1/14</u>
<u>3</u>	<u>1/15 - 1/21</u>
<u>4</u>	<u>1/22 - 1/28</u>
<u>5</u>	<u>1/29 - 2/4</u>
<u>6</u>	<u>2/5 - 2/11</u>
<u>7</u>	<u>2/12 - 2/18</u>
<u>8</u>	<u>2/19 - 2/25</u>
<u>9</u>	<u>2/26 - 3/4*</u>
<u>10</u>	<u>3/5 - 3/11</u>
<u>11</u>	<u>3/12 - 3/18</u>
<u>12</u>	<u>3/19 - 3/25</u>
<u>13</u>	<u>3/26 - 4/1</u>
<u>14</u>	<u>4/2 - 4/8</u>
<u>15</u>	<u>4/9 - 4/15</u>
<u>16</u>	<u>4/16 - 4/22</u>
<u>17</u>	<u>4/23 - 4/29</u>
<u>18</u>	<u>4/30 - 5/6</u>
<u>19</u>	<u>5/7 - 5/13</u>
<u>20</u>	<u>5/14 - 5/20</u>
<u>21</u>	<u>5/21 - 5/27</u>
<u>22</u>	<u>5/28 - 6/3</u>
<u>23</u>	<u>6/4 - 6/10</u>
<u>24</u>	<u>6/11 - 6/17</u>
<u>25</u>	<u>6/18 - 6/24</u>
<u>26</u>	<u>6/25 - 7/1</u>

<u>Julian Week #</u>	<u>Inclusive Dates</u>
<u>27</u>	<u>7/2 - 7/8</u>
<u>28</u>	<u>7/9 - 7/15</u>
<u>29</u>	<u>7/16 - 7/22</u>
<u>30</u>	<u>7/23 - 7/29</u>
<u>31</u>	<u>7/30 - 8/5</u>
<u>32</u>	<u>8/6 - 8/12</u>
<u>33</u>	<u>8/13 - 8/19</u>
<u>34</u>	<u>8/20 - 8/26</u>
<u>35</u>	<u>8/27 - 9/2</u>
<u>36</u>	<u>9/3 - 9/9</u>
<u>37</u>	<u>9/10 - 9/16</u>
<u>38</u>	<u>9/17 - 9/23</u>
<u>39</u>	<u>9/24 - 9/30</u>
<u>40</u>	<u>10/1 - 10/7</u>
<u>41</u>	<u>10/8 - 10/14</u>
<u>42</u>	<u>10/15 - 10/21</u>
<u>43</u>	<u>10/22 - 10/28</u>
<u>44</u>	<u>10/29 - 11/4</u>
<u>45</u>	<u>11/5 - 11/11</u>
<u>46</u>	<u>11/12 - 11/18</u>
<u>47</u>	<u>11/19 - 11/25</u>
<u>48</u>	<u>11/26 - 12/02</u>
<u>49</u>	<u>12/03 - 12/09</u>
<u>50</u>	<u>12/10 - 12/16</u>
<u>51</u>	<u>12/17 - 12/23</u>
<u>52</u>	<u>12/24 - 12/31**</u>

* = eight days only during leap years

** = eight day Julian week