State of California
The Resources Agency
DEPARTMENT OF FISH AND WILDLIFE

REPORT
SHASTA AND SCOTT RIVER
JUVENILE SALMONID OUTMIGRANT STUDY, 2016

Prepared by

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1.0 Abstract

The 2016 Juvenile Salmonid Outmigrant Study is part of the ongoing work conducted annually by the California Department of Fish and Wildlife, Yreka Fisheries Program on the Shasta and Scott rivers in Siskiyou County, California. Using rotary screw traps, all age classes of outmigrating Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead trout (*Oncorhynchus mykiss*) were sampled from 29 January to 1 July of 2016. Mark and recapture trials were conducted multiple times per week to determine trap efficiencies and weekly population estimates. Established age-length cutoffs for each species were used to determine the age of the fish captured. In-stream conditions such as flow and water temperature were also monitored. Weekly estimates for the smolt class of all species were compared to show multi-year population trends. Using multi-year seasonal production estimates and coho salmon returns to the Shasta River, adult survival and smolt production estimates were calculated for Shasta River coho. It was estimated that for the period sampled in 2016, a total of 2,757,850 0+ Chinook, 164 1+ Chinook, 480 0+ coho, 229 1+ coho, 3 (actual number caught) 2+ coho, 11,749 0+ steelhead, 1,665 1+ steelhead, 30,501 2+ steelhead, and 6,045 3+ steelhead emigrated from the Shasta River. It was estimated for this same sample period, 56,634 0+ Chinook, 28 (actual number caught) 1+ Chinook, 14 (actual number caught) 0+ coho, 2,411 1+ coho, 1 (actual number caught) 2+ coho, 97 (actual number caught) 0+ steelhead, 73,540 1+ steelhead, and 44 (actual number caught) 2+ steelhead emigrated from the Scott River.

2.0 Introduction

Since 2000, we have operated rotary screw traps on the Shasta and Scott rivers in order to produce weekly estimates of the number of emigrating juvenile salmonids. Monitoring of salmonids on the Shasta River dates back to 1930 when returning adult Chinook salmon were first counted (Brown 1937). Monitoring of juvenile salmonids on the Shasta River dates back to 1981 (KRIS, 2010). This monitoring initially began with the use of fyke nets and did not occur every year. However, in 2000, annual monitoring began on the Shasta River using rotary screw traps. The use of screw traps allows the calculation of trap efficiencies and corresponding juvenile production estimates. Monitoring of juvenile salmonid migration in the Scott River also began in 2000 and has continued since.

In 2002, coho salmon of the Southern Oregon/Northern California Coast Evolutionary Significant Unit (SONCC ESU) were listed as a threatened species from the Oregon border to Punta Gorda, California under the California Endangered Species Act (CESA). 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 populations and production rates in decline (Chesney 2010).

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

2.1 Study Goals and Objectives

The specific goals of the 2016 out migration monitoring were:

- To determine emigration abundance and timing of all age classes of juvenile salmonids in the Shasta and Scott Rivers between late January and early July 2016.

- To estimate the weekly mean fork lengths and ages 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 includes estimates of the number of emigrating Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead trout (*Oncorhynchus mykiss*) from 29 January to 1 July, 2016 in the Shasta River, and 5 February to 3 June 2016 in the Scott River, 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). The trap was fitted with a specially modified, extended live car. The extended live car dimensions are 15’ x 3’4” x 1’10”. The trap operated six days per week, Sunday afternoon through Saturday morning. It was located at 041º 49' 46.38" N, 122º 35' 35.38" W (WGS 84), directly downstream of the Shasta River Fish Counting Facility, and 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 1600 hours to monitor operation and remove debris as necessary.

The velocity of the water entering the cone was measured at the beginning and end of each set using a model 2030R flow meter manufactured by General Oceanics (Miami, Florida). Velocity measurements were used to calculate the total volume of water sampled, in million cubic feet (MCF), 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 was processed daily for bio-data which consisted of fork length, life stage, and age. Scales were also collected from some selected fish. Up to 25 individuals of each age class of steelhead and coho, as well as 50 0+ Chinook, and 15 1+ Chinook were sampled daily. This task involved anesthetizing the sub-sample of fish in a CO_2 water bath. The fish would be anesthetized within 45 seconds to 1 minute. The fish were measured, aged, attributed a life stage, and scales were collected. After each fish was sampled it was placed into a well aerated recovery bucket containing Stress Coat® Water Conditioner by Mars Fishcare North America, Inc. (Chalont, Pennsylvania), to aid quick recovery. Every week up to 25 scale samples of each age class were taken. At least 12 scales per fish were collected. Attempts were made to collect scales from fish representing a range of fork lengths within each age class. Scales were taken from the left side of the fish in a region known as the “scale pocket” (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 were derived. Otoliths were

removed from deceased salmon and added to a multi-year otolith library for future micro-chemistry analyses.

Non-salmonid species were counted and are reported in Appendices 35 and 36.

3.1.2 Age Determination

Age–length cutoffs developed in 2007 were used to estimate ages of salmonids in the catches (Appendix 33). 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+ and 1+ Chinook, 0+ and 1+ coho, and 0+, 1+, 2+, and 3+ steelhead. For each trial, a known number of marked fish from each age class were taken three quarters of a mile upstream from the trap, and released. The number of marked fish in the following day's catch, divided by the total number marked on the day prior, produced the trap efficiency. The goal of the study was to maintain a minimum 10% recapture rate. However, in practice this proved to be difficult.

For each efficiency trial, up to 500 0+ salmonids were dyed in a solution of 0.6 – 1.2 grams of Bismarck Brown Y (Alfa Aesar, Ward Hill, Massachusetts). The number of fish marked in this manner depended on fish size, water temperature, and other stress factors. As these factors increased we reduced the number of fish selected for marking. Age 0 coho were marked with Bismark Brown. 1+, 2+, and 3+ aged fish were marked with a caudal fin margin clip. Age 1+ coho caudal clippings were retained as tissue samples and dried on blotter paper to be kept for future genetic analyses. Three different caudal fin margin clips were used in a weekly rotation in order to only count recaptured fish from the week they were marked. The three caudal clips used were upper caudal, lower caudal, and upper/lower caudal. Fish marked in the morning were transferred to automatic release boxes set to release after sunset.

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 fish were captured or mark-released but none were recaptured, the average trap efficiency for the season (the seasonal trap efficiency) was used as described in the Oregon Department of Fish and Wildlife's website (ODFW Salmonid Lifecycle Monitoring Project). A confidence interval for the seasonal population estimate cannot be calculated when using this method within a species and age class.

3.1.4 Water Temperature and Flow Monitoring

Hourly water temperatures were recorded using a waterproof temperature logger (Model U22-001, Onset Computer Corporation, Bourne, Massachusetts) attached on river right near the trap location. The logger was deployed in January, before salmonid out migration monitoring began, and continued to collect data through Julian week 26, when the season ended.

Stream flow measurements were obtained from a United States Geological Survey (USGS) stream gauge, number 11517500, Shasta River, Yreka (SRY). This gauge is located approximately 0.75 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 and subject to revision.

3.1.5 Data Entry and Analysis

All data from field forms were entered into Microsoft Access database software. Summary tables were created in Access and exported to Microsoft Excel, where data were broken down by species and age class. Temperature data were downloaded in the field and then uploaded into HOBOware Pro version 2.7.3 (Onset Corp.). 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 January 29, 2016. Trapping ended after 22 weeks on July 1, 2016. The trap fished for a total of 2,663.3 hours. An estimated 361,985,478.8 cubic feet of water was sampled during weeks 5 through 26. When the cone was partially raised due to low flows, flow was still measured. The week in which this occurred was Julian Week 24. Volume sampled for this week is an estimate.

The number of salmonids trapped, marked and recaptured by week (Tuesday through Saturday) was recorded, and weekly population estimates with 95% confidence intervals were produced (Appendices 1 – 8). Weekly mean fork lengths with standard deviation, sample size, as well as minimum and maximum sizes were also recorded (Appendices 16 – 24).

3.2.1 Chinook

Chinook 0+

An estimated 2,757,850 0+ Chinook (95% CI, 2,661,219 – 2,854,481) emigrated from the Shasta River during weeks 5 through 26 (Figure 1). The greatest number of Chinook emigrated during Julian week 7 (569,484, 95% CI, 515,546 – 623,421). This was equal to 20.65% of the total estimate (Figure 2). The mean fork length for 0+ Chinook during Julian week 7 was 38 mm (Appendix 16). A total of 428,614 Chinook 0+ were sampled during the trapping season (Figure 3, Appendix 1).

Chinook 1+

An estimated 164 1+ Chinook emigrated from the Shasta River during Julian weeks 5-18 (Figure 4). The greatest number of 1+ Chinook emigrated during Julian week 13 (44, 95% CI, 3 - 85).

This is equal to 29.91% of the total estimate (Figure 5). The mean fork length for 1+ Chinook during Julian week 13 was 130 mm (Appendix 17). A total of 41 Chinook 1+ were trapped (Figure 6, Appendix 2).

5,081 0+ Chinook and 46 1+ Chinook were measured and aged in the sub-sample (Figure 7); 15 otolith samples were taken from 0+ Chinook and 2 were taken from 1+ Chinook; 16 scale samples were taken from 0+ Chinook and 34 scale samples were taken from 1+ Chinook.

3.2.2 Coho

Coho 0+

An estimated 480 0+ coho emigrated from the Shasta River during Julian weeks 12 through 26 (Figure 8). The greatest number of coho: 191 (95% CI, 7 - 374), left during Julian week 22. This is equal to 39.75% of the total estimate (Figure 9). The mean fork length for 0+ coho during Julian week 25 was 91 mm (Appendix 18). A total of 94 0+ coho were trapped during sampling (Figure 10, Appendix 3).

Coho 1+

An estimated 229 1+ coho emigrated from the Shasta River from Julian weeks 5 through 17 (Figure 11). The greatest number of 1+ coho left in Julian week 15 (114, (95% CI, 0 – 238). This is equal to 49.78% of the total estimate (Figure 12). The mean fork length for 1+ coho during Julian week 15 was 143 mm (Appendix 19). A total of 49 1+ coho were trapped during sampling (Figure 13, Appendix 4).

Coho 2+

A total of 3 2+ coho were captured during sampling (Figure 14) in Julian week 16. There were no recaptures out of the 3 marked trials. The mean fork length for 2+ coho during Julian week 16 was 202 mm (Appendix 20).

Iron Gate Hatchery Coho

A total of 14 1+ coho with left maxillary clips were caught during the 2016 season, indicating they originated from Iron Gate Hatchery (IGH). The greatest number caught (4) occurred in Julian weeks 14 and 18. All IGH fish were identified and released off the trap; they were not used in our population estimates.

A total of 11 0+ coho, 50 1+ coho, and 3 2+ coho were measured and aged in the sub-sample (Figure 15); 5 otolith samples and 1 tissue sample were taken from 0+ coho; 13 scale and 31 tissue samples were taken from 1+ coho; 2 scale and 6 tissue samples were taken from 2+ coho.

3.2.3 Steelhead

Steelhead 0+

An estimated 11,749 0+ steelhead emigrated from the Shasta River during Julian weeks 11 through 26 (Figure 16). The greatest number left during Julian week 22 (3,649, 95% CI, 2,983 – 4,316). This is equal to 31.06% of the total estimate for the period sampled (Figure 17). The average fork lengths for 0+ steelhead during Julian week 23 was 76 mm (Appendix 21). A total of 3,472 0+ steelhead were trapped in 2016 (Figure 17, Appendix 5).

Steelhead 1+

An estimated 1,665 1+ steelhead emigrated from the Shasta River during Julian weeks 5 through 26 (Figure 19). The greatest number left during Julian week 22 (555). This is equal to 33.33% of the total estimate for the period sampled (Figure 20). The mean fork length for 1+ steelhead during Julian week 22 was 156 mm (Appendix 22). A total of 178 1+ steelhead were trapped in 2016 (Figure 21, Appendix 6).

Steelhead 2+

An estimated 30,501 2+ steelhead emigrated from the Shasta River during Julian weeks 5 through 26 (Figure 23). The greatest number left during Julian week 19 (7,151 95% CI, 4,040 – 10,263). This is equal to 23.45% of the total estimate for the period sampled (Figure 24). The mean fork length for 2+ steelhead during Julian week 19 was 193 mm (Appendix 23). A total of 2,131 2+ steelhead were trapped during sampling trials (Figure 25, Appendix 7).

Steelhead 3+

An estimated 6,045 3+ steelhead emigrated from the Shasta River during Julian weeks 5 through 20 (Figure 26). The greatest number left during Julian week 15 (2,359). This is equal to 39.02% of the total estimate for the period sampled (Figure 27). The mean fork length for 3+ steelhead during Julian week 15 was 248 mm (Appendix 24). A total of 231 3+ steelhead were trapped during sampling trials (Figure 28, Appendix 8).

A total of 421 0+ steelhead, 178 1+ steelhead, 1,071 2+ steelhead, and 226 3+ steelhead were measured and aged in the sub-sample (Figure 22, Figure 29); 2 scale samples were taken from 0+ steelhead; 60 scale and 1 otolith samples were taken from 1+ steelhead; 113 scale and 2 otolith samples were taken from 2+ steelhead; and 59 scale and 1 otolith samples were taken from 3+ steelhead.

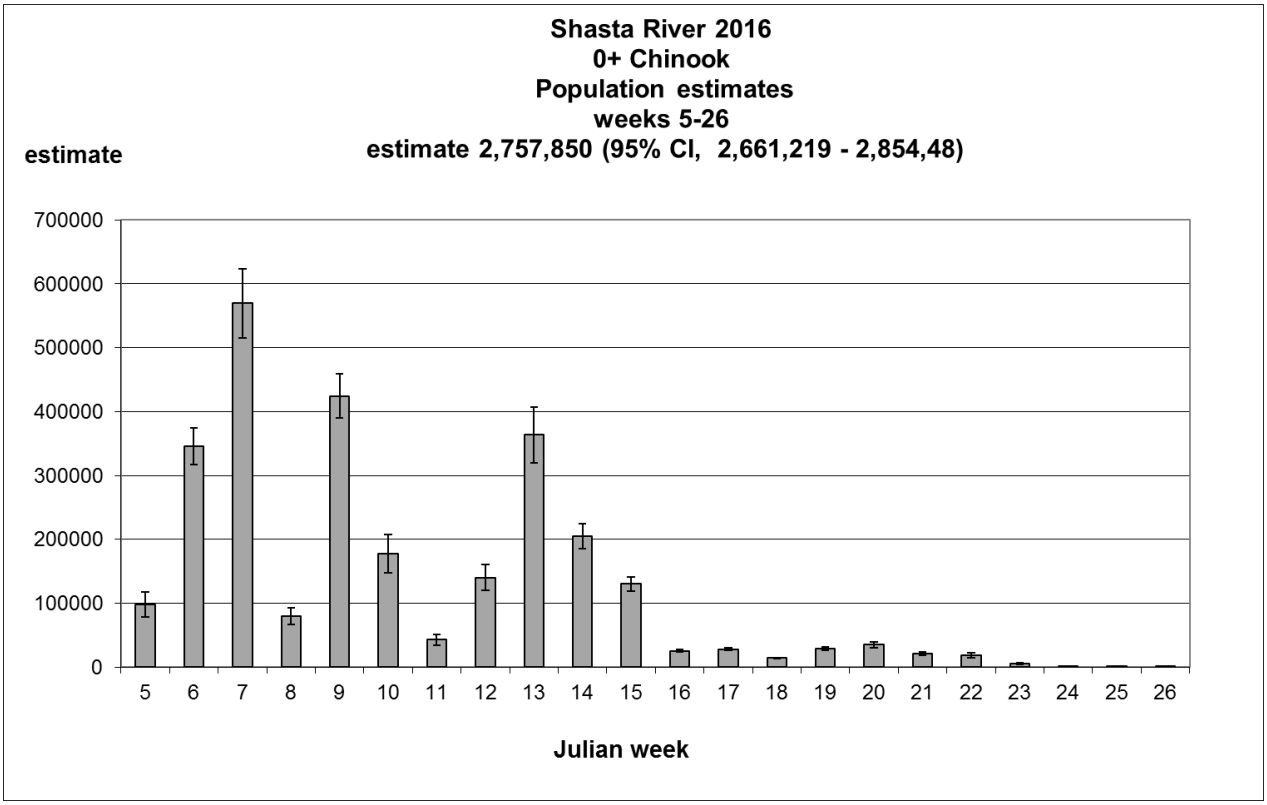

Figure 1. *Shasta River 0+ Chinook estimates, 2016*

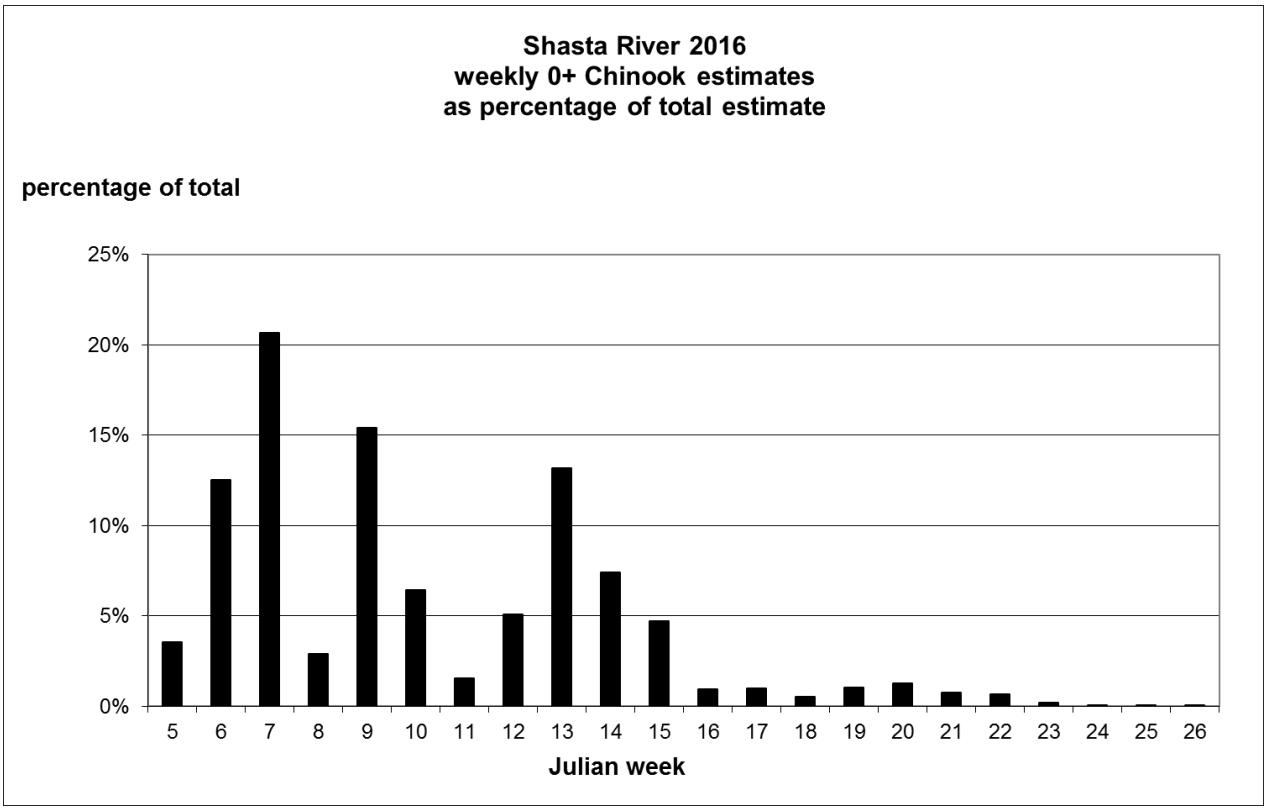

Figure 2. *Shasta River 0+ Chinook estimates, as percentage of total estimate, 2015*

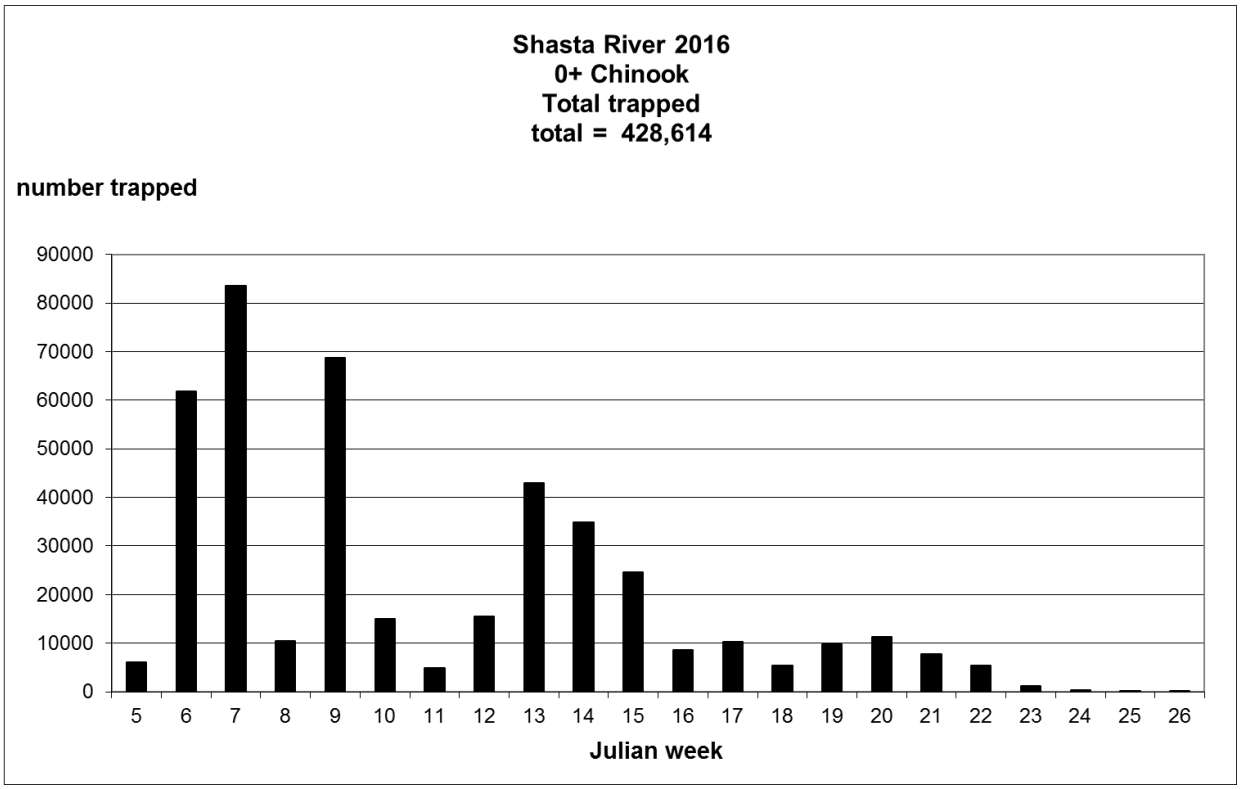

Figure 3. *Shasta River 0+ Chinook total trapped, 2016*

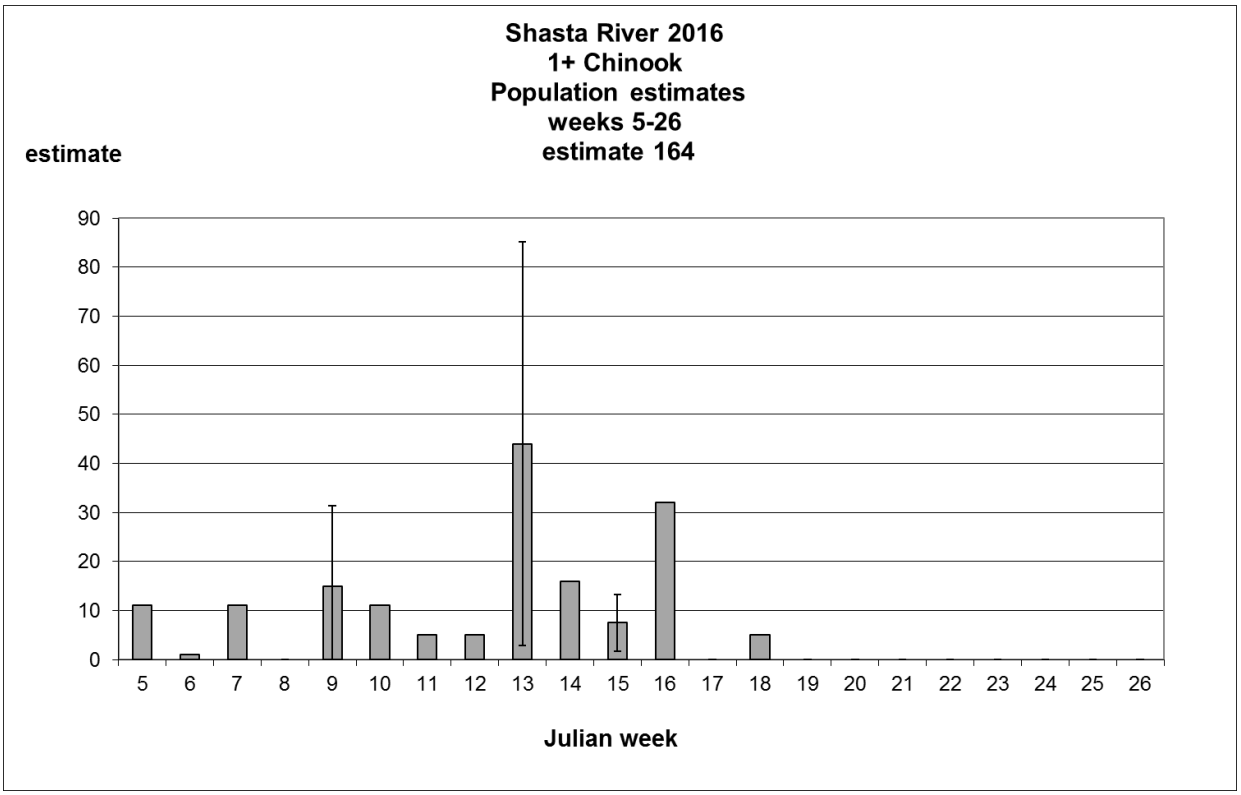

Figure 4*. Shasta River 1+ Chinook estimates, 2016*

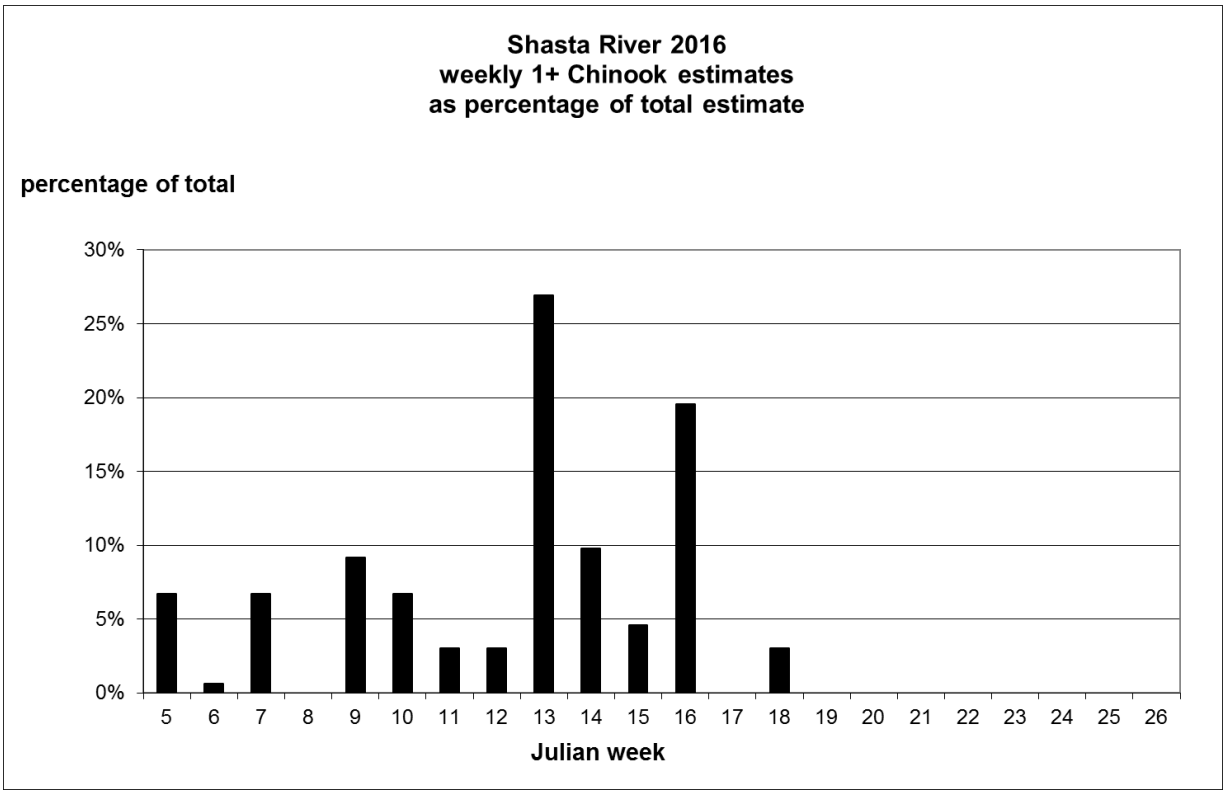

Figure 5. *Shasta River 0+ Chinook estimates, as percentage of total estimate, 2016*

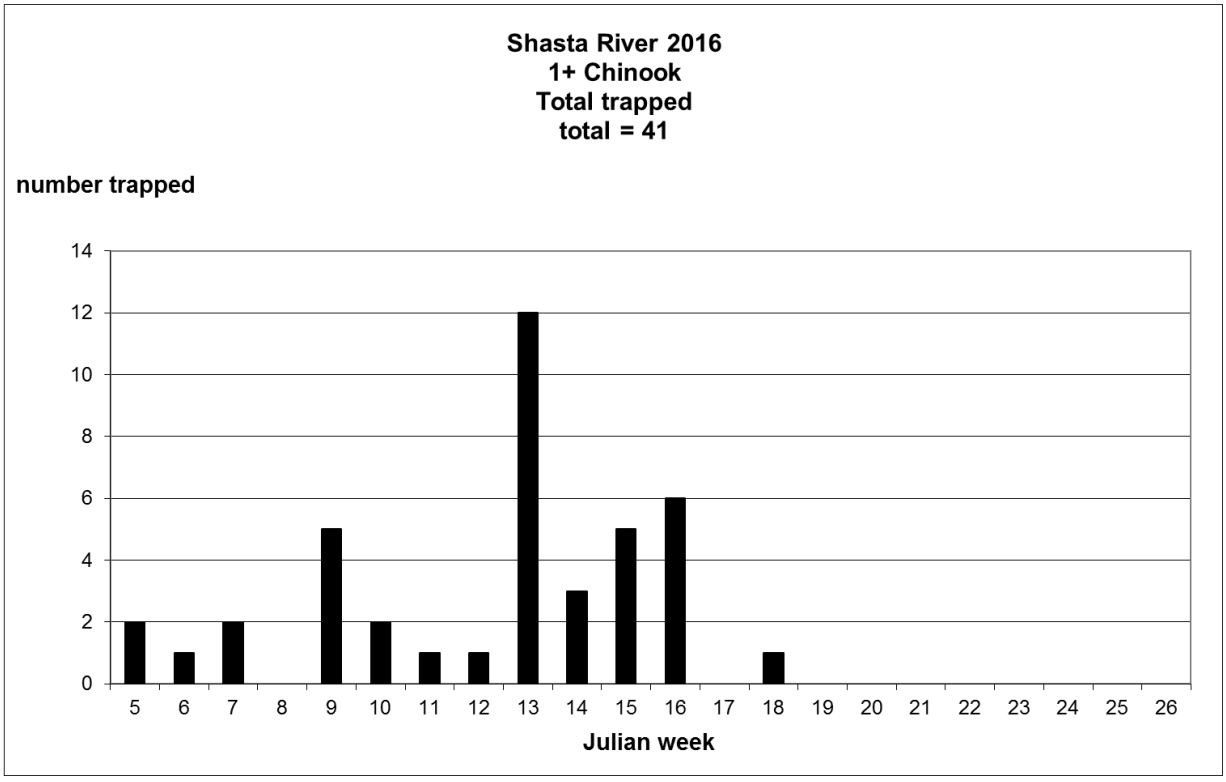

Figure 6. *Shasta River 1+ Chinook total trapped, 2016*

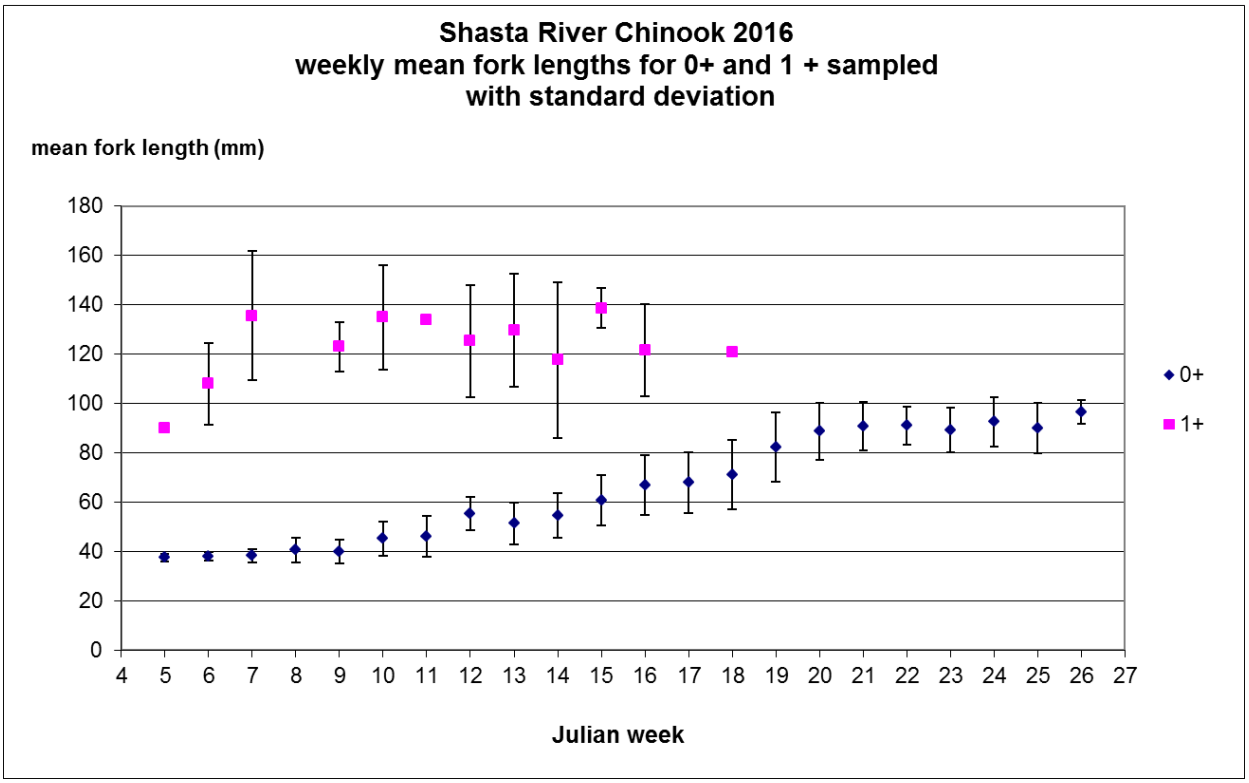

Figure 7. *Shasta River 0+, 1+ Chinook weekly mean fork lengths, 2016*

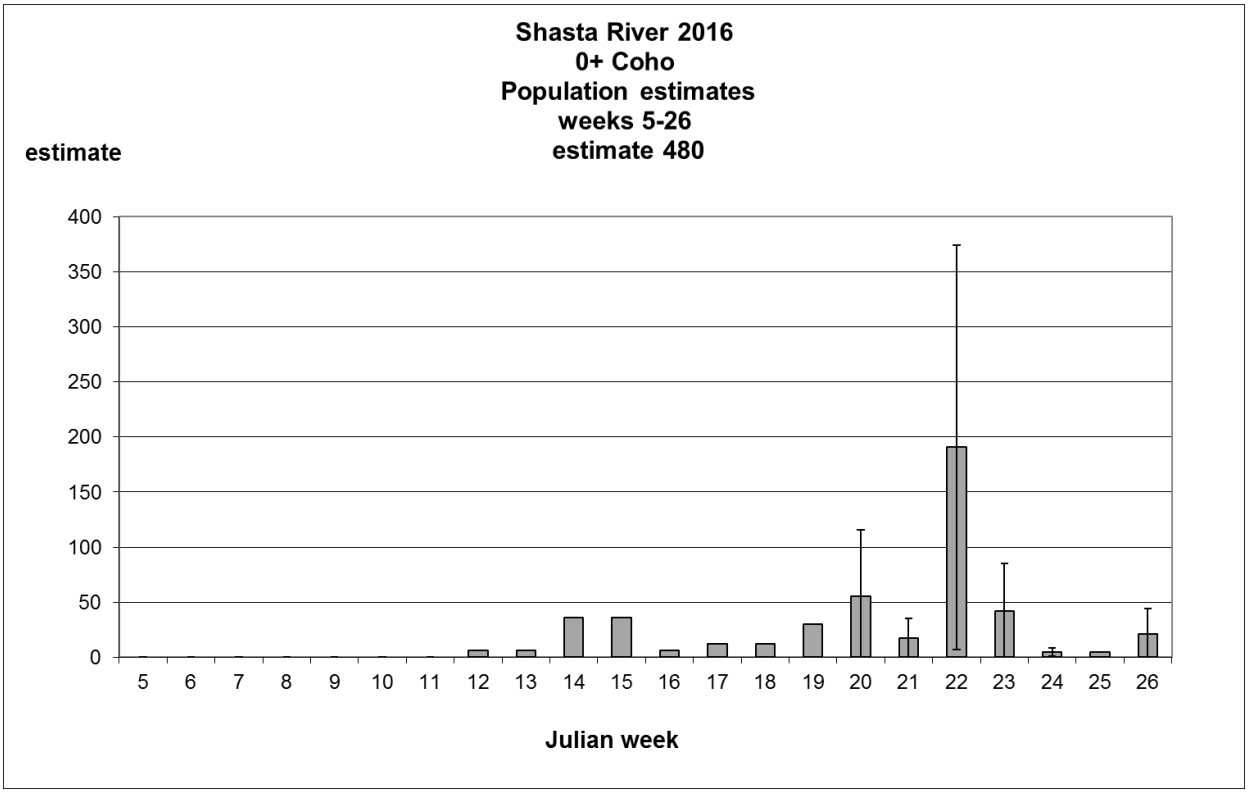

Figure 8. *Shasta River 0+ coho estimates, 2016*

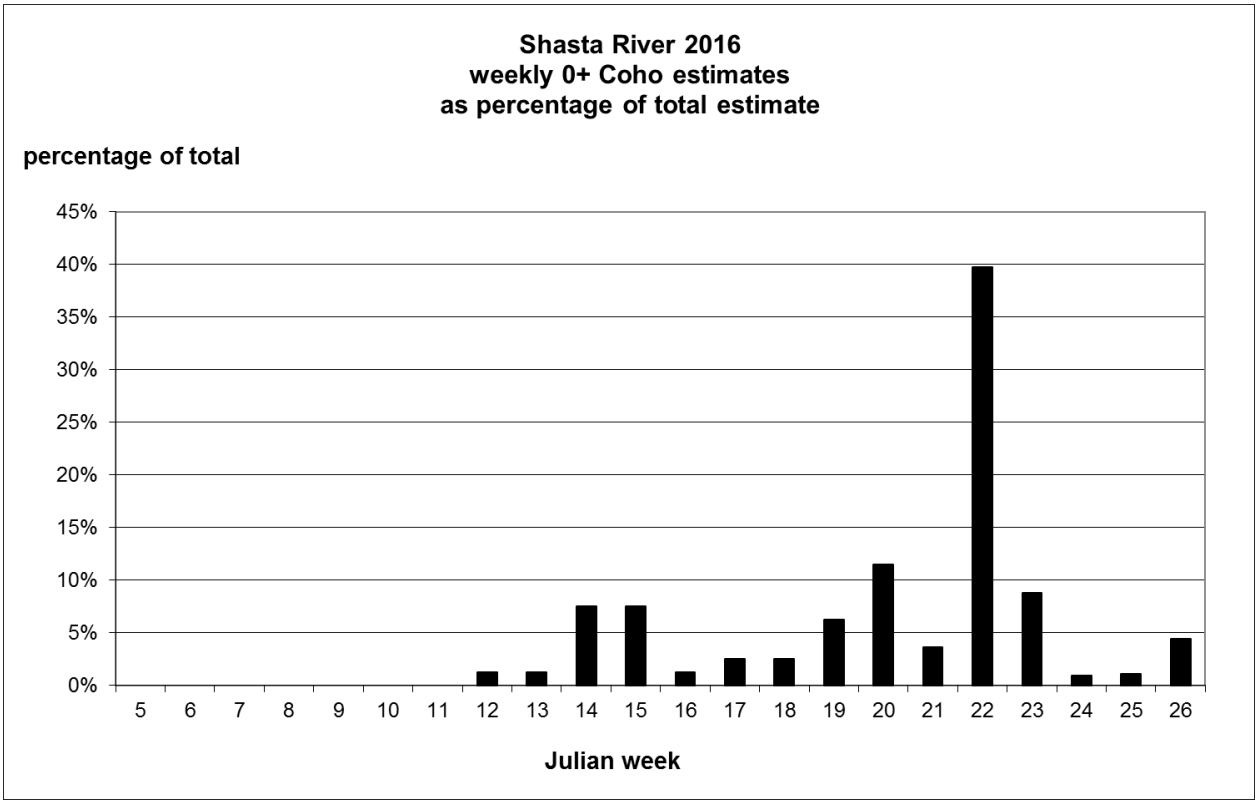

Figure 9. *Shasta River 0+ coho estimates, as percentage of total estimate, 2016*

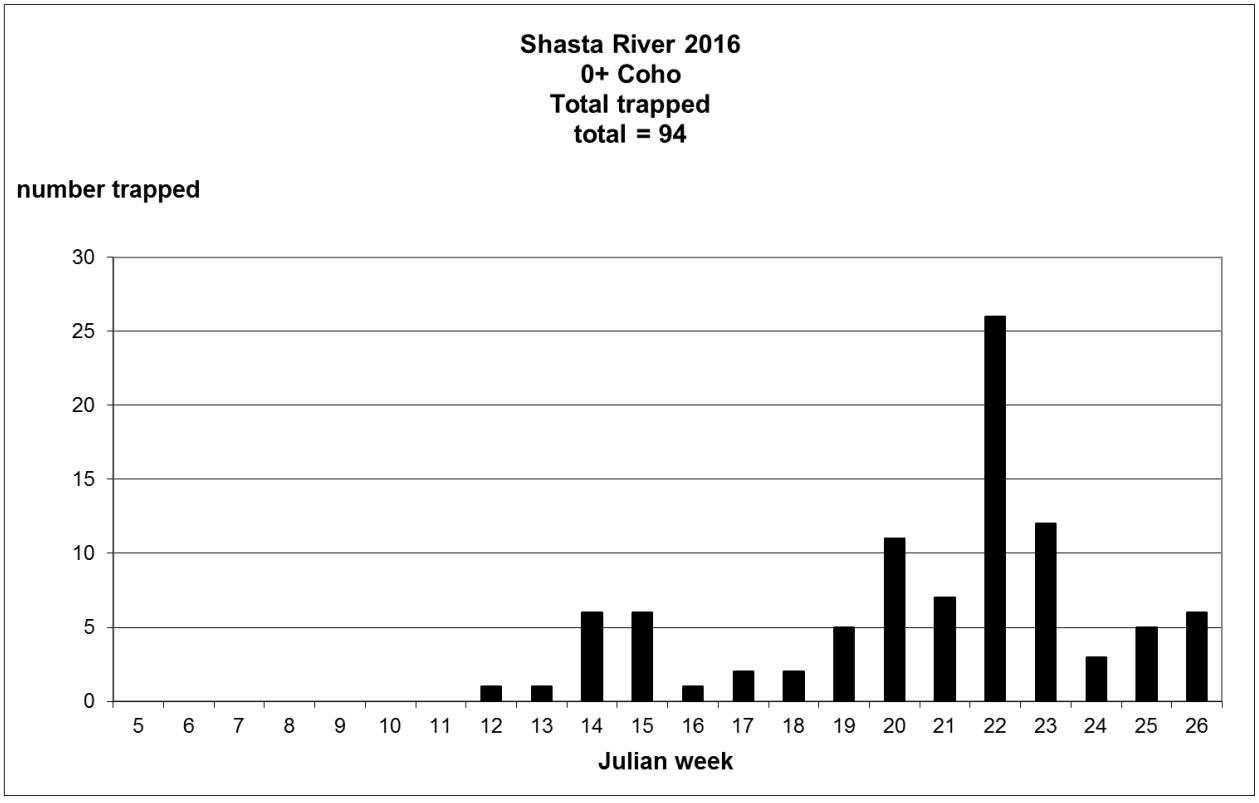

Figure 10. *Shasta River 0+ coho total trapped, 2016*

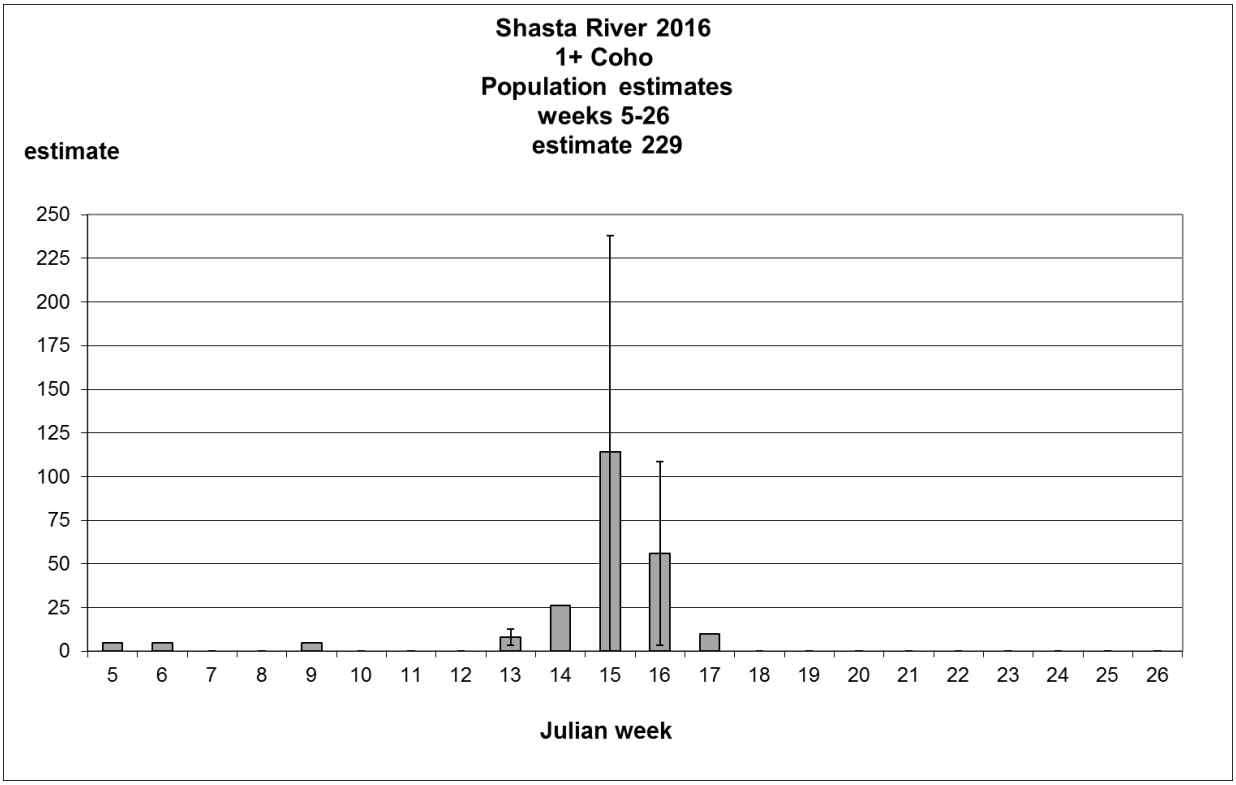

Figure 11. *Shasta River 1+ coho estimates, 2016*

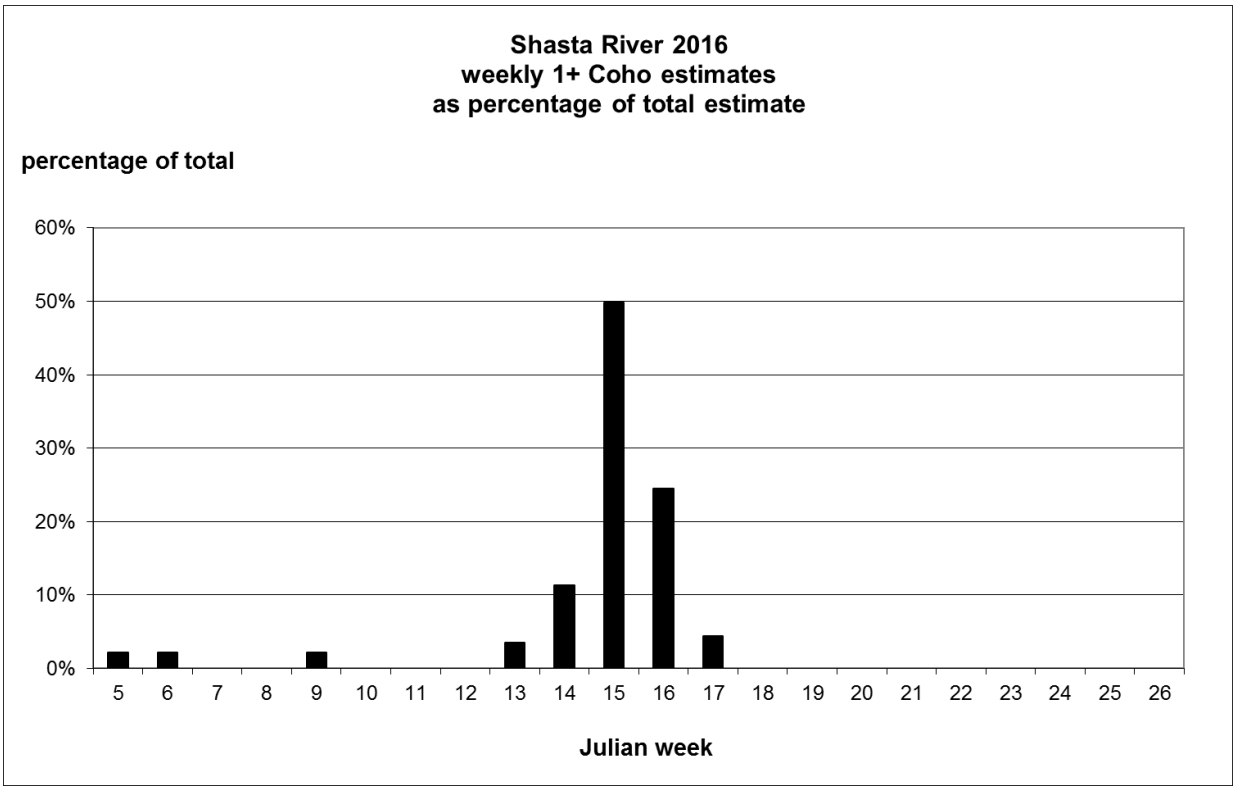

Figure 12*. Shasta River 1+ coho estimates, as percentage of total estimate, 2016*

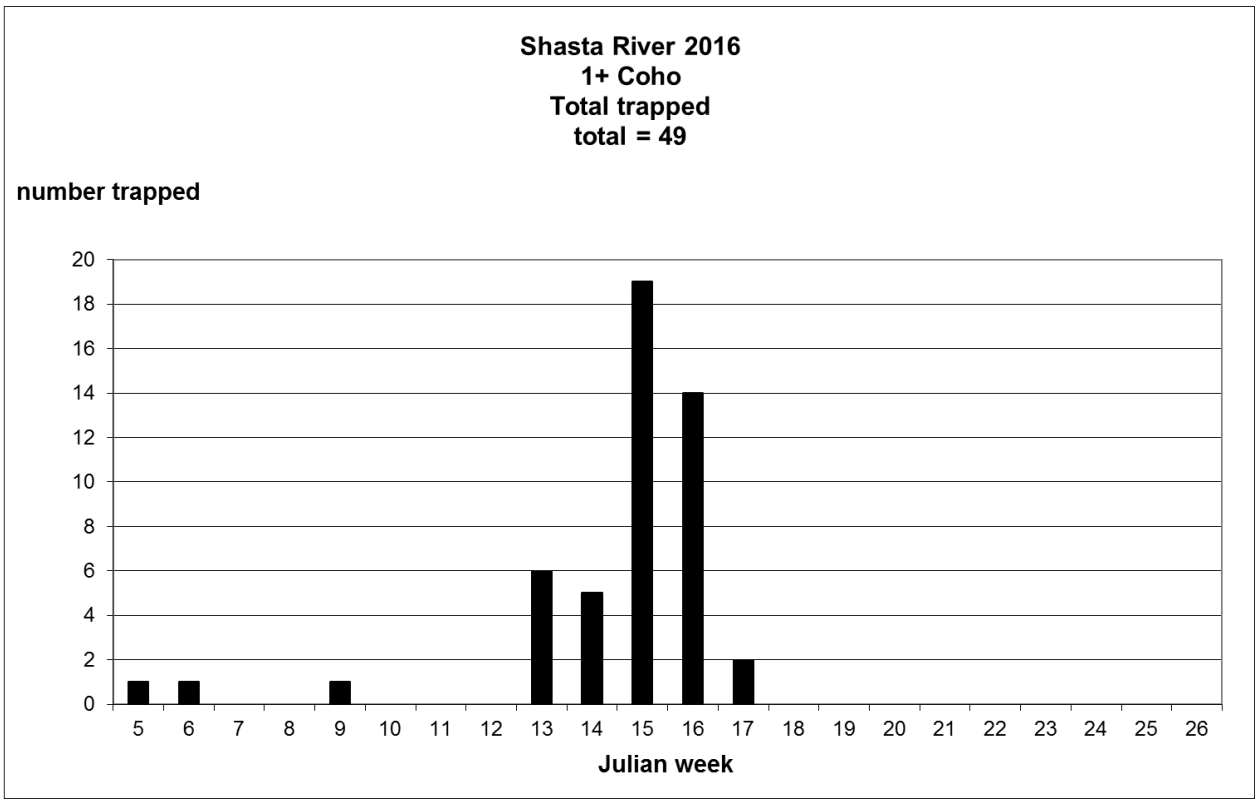

Figure 13. *Shasta River 1+ coho total trapped, 2016*

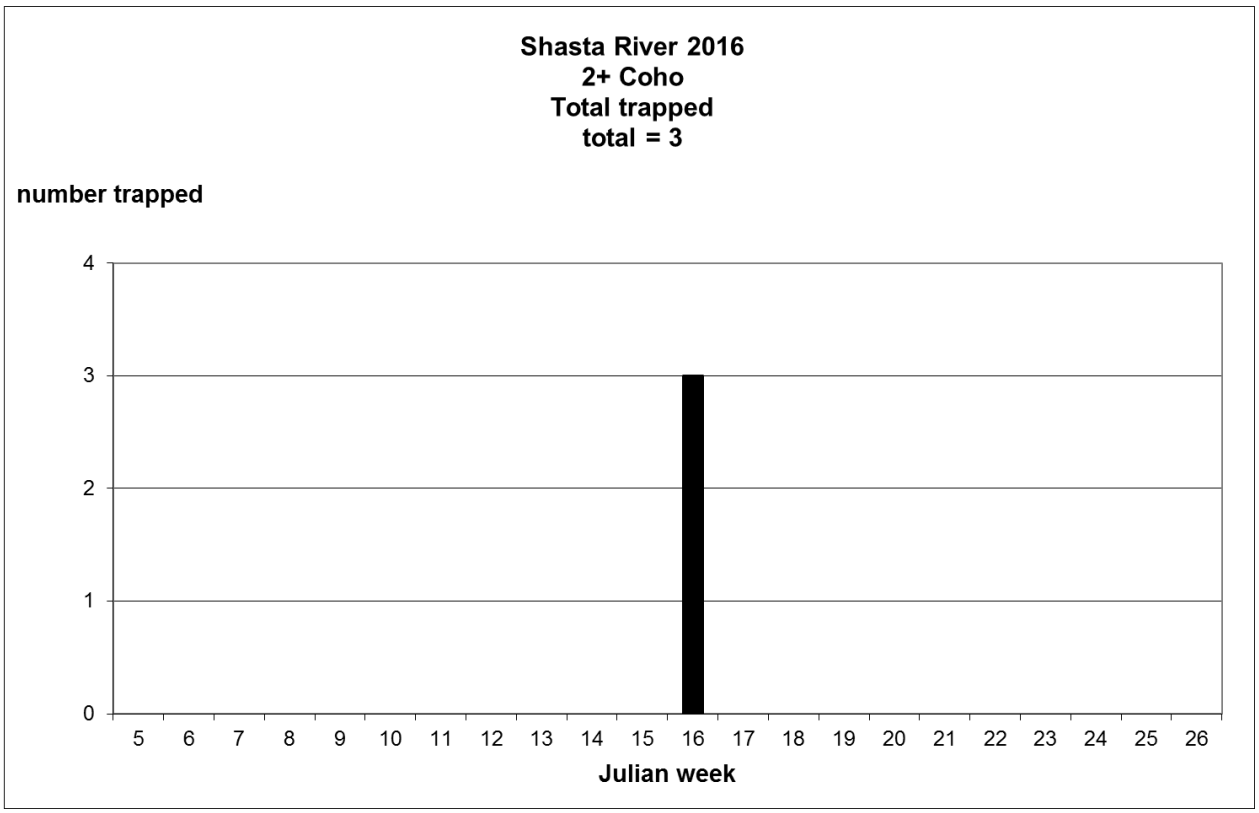

Figure 14. *Shasta River 2+ coho total trapped, 2016*

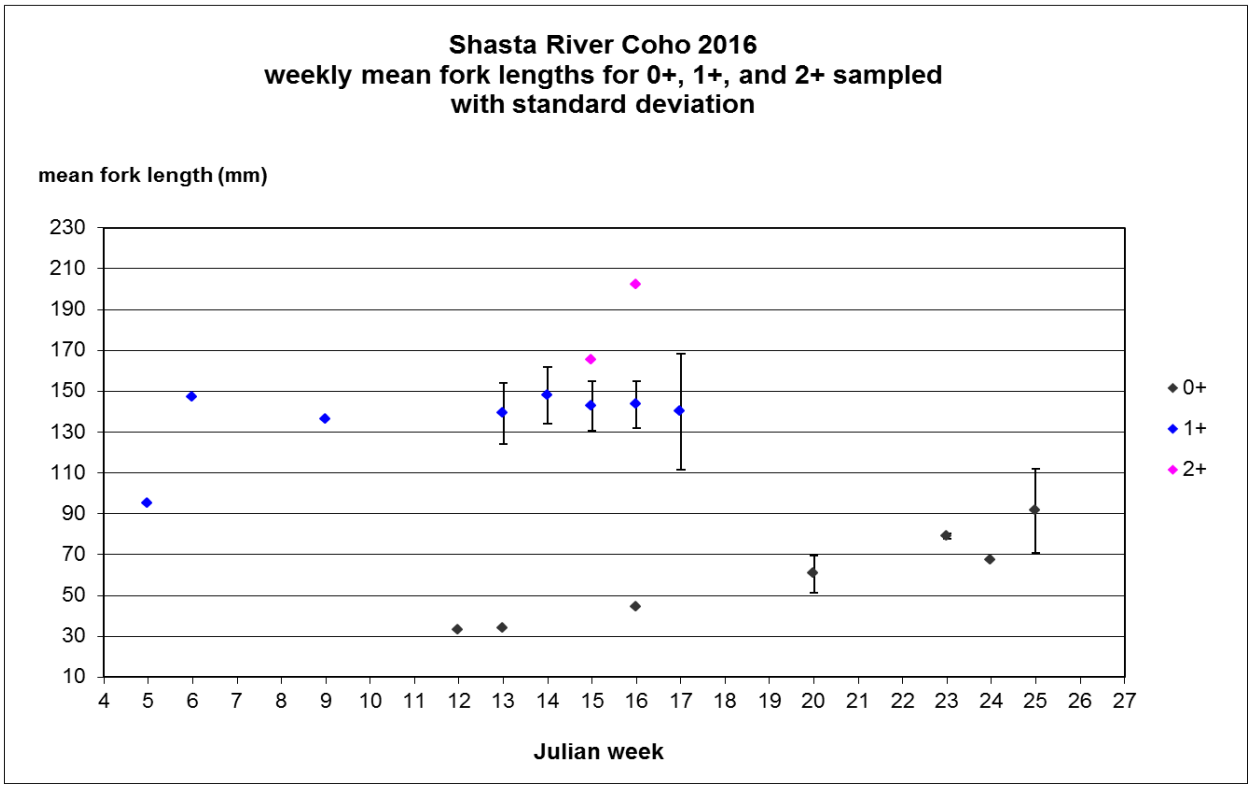

Figure 15. *Shasta River 0+, 1+, 2+ coho weekly mean fork lengths, 2016*

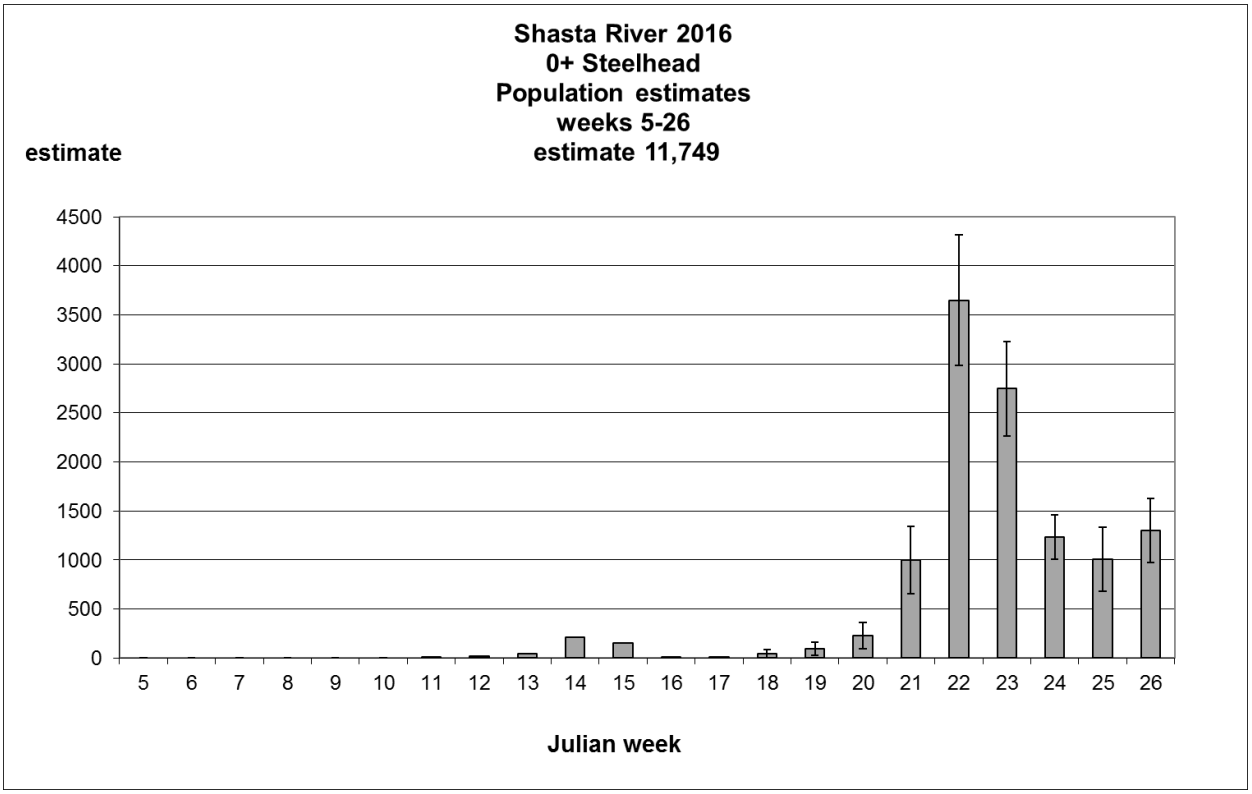

Figure 16. *Shasta River 0+ steelhead estimates, 2016*

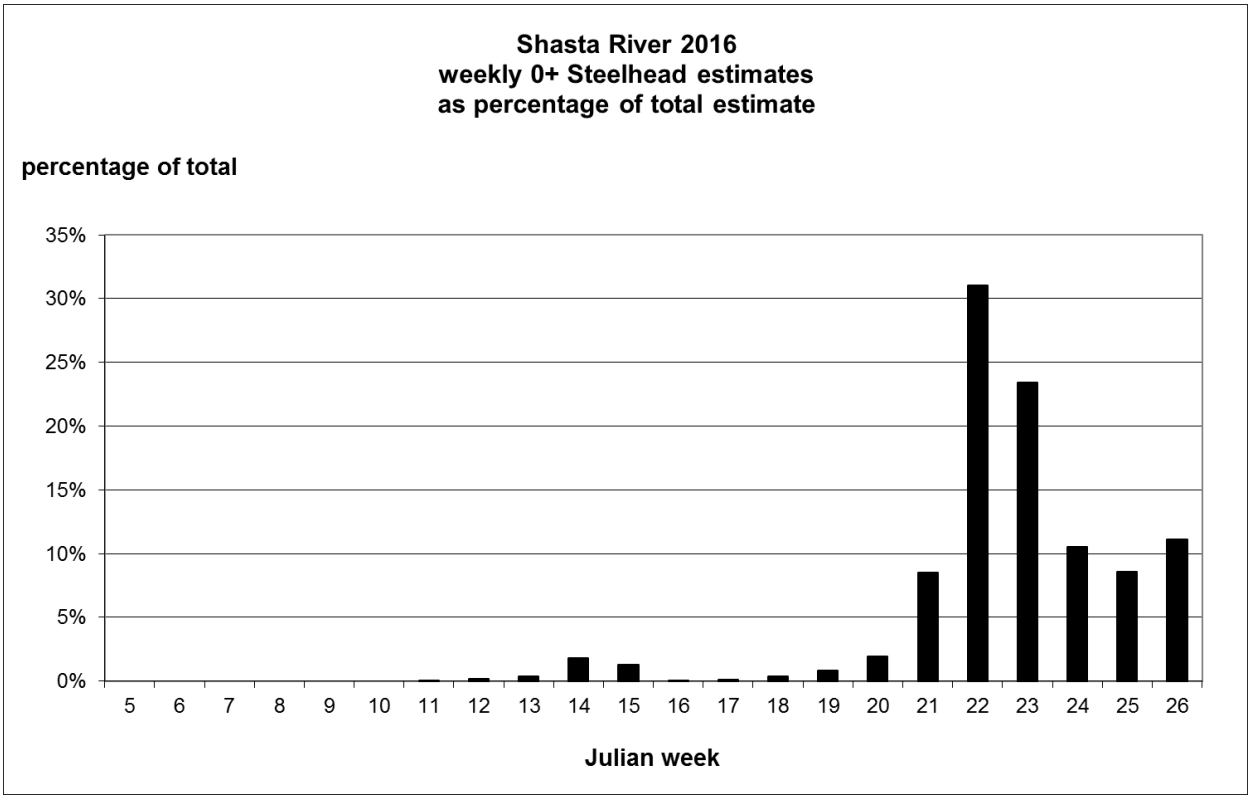

Figure 17. *Shasta River 0+ steelhead estimates, as percentage of total estimate, 2016*

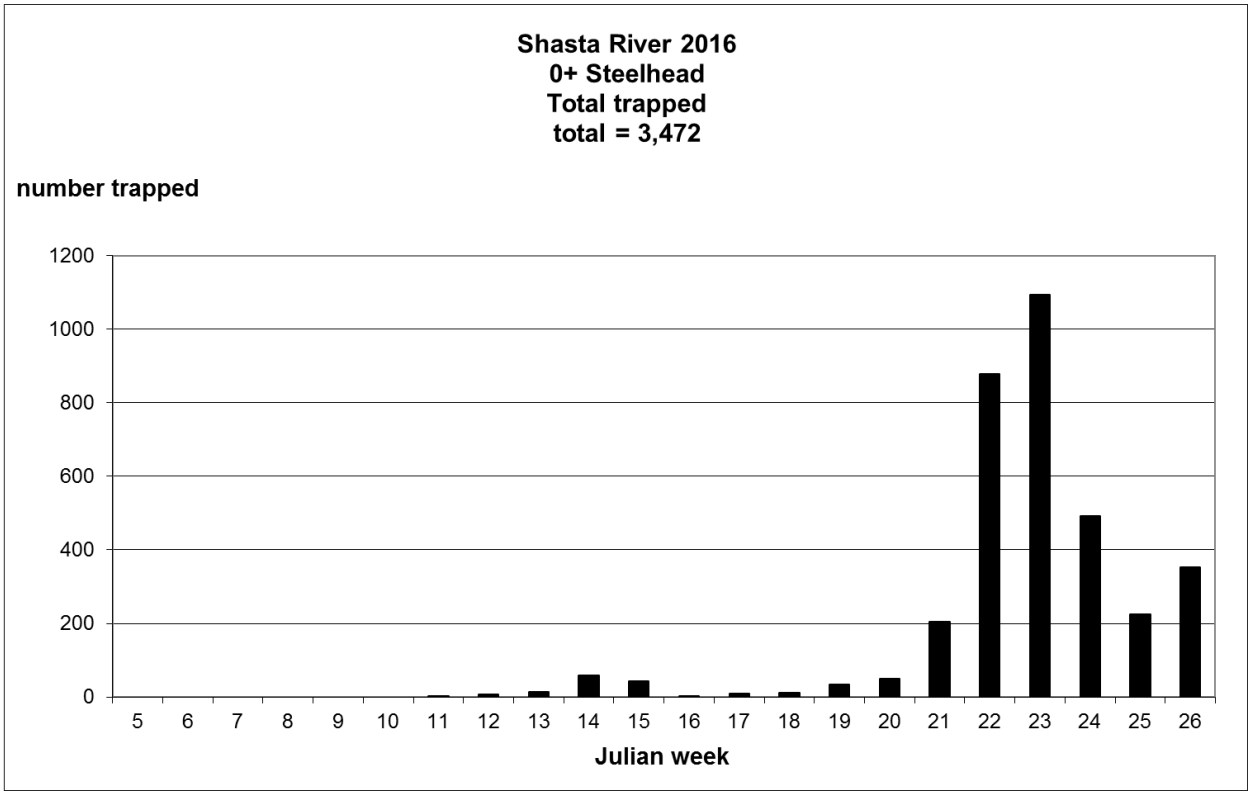

Figure 18. *Shasta River 0+ steelhead total trapped, 2016*

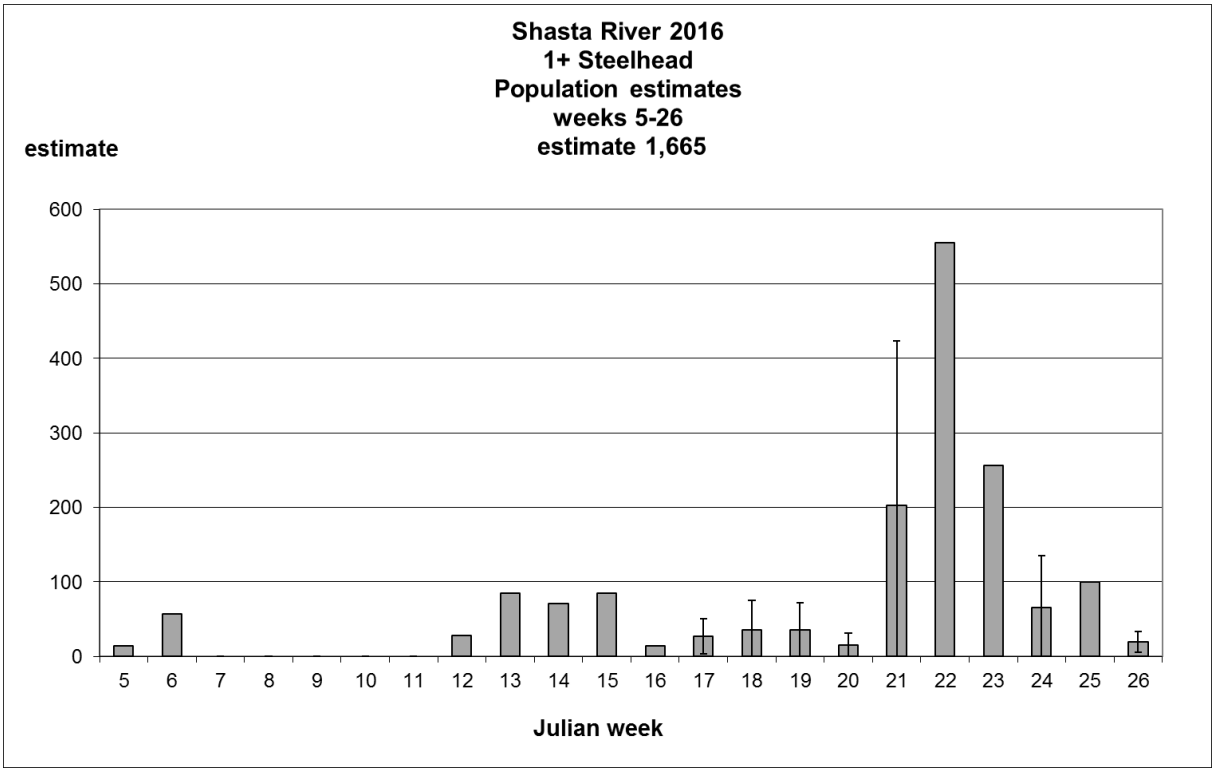

Figure 19. *Shasta River 1+ steelhead estimates, 2016*

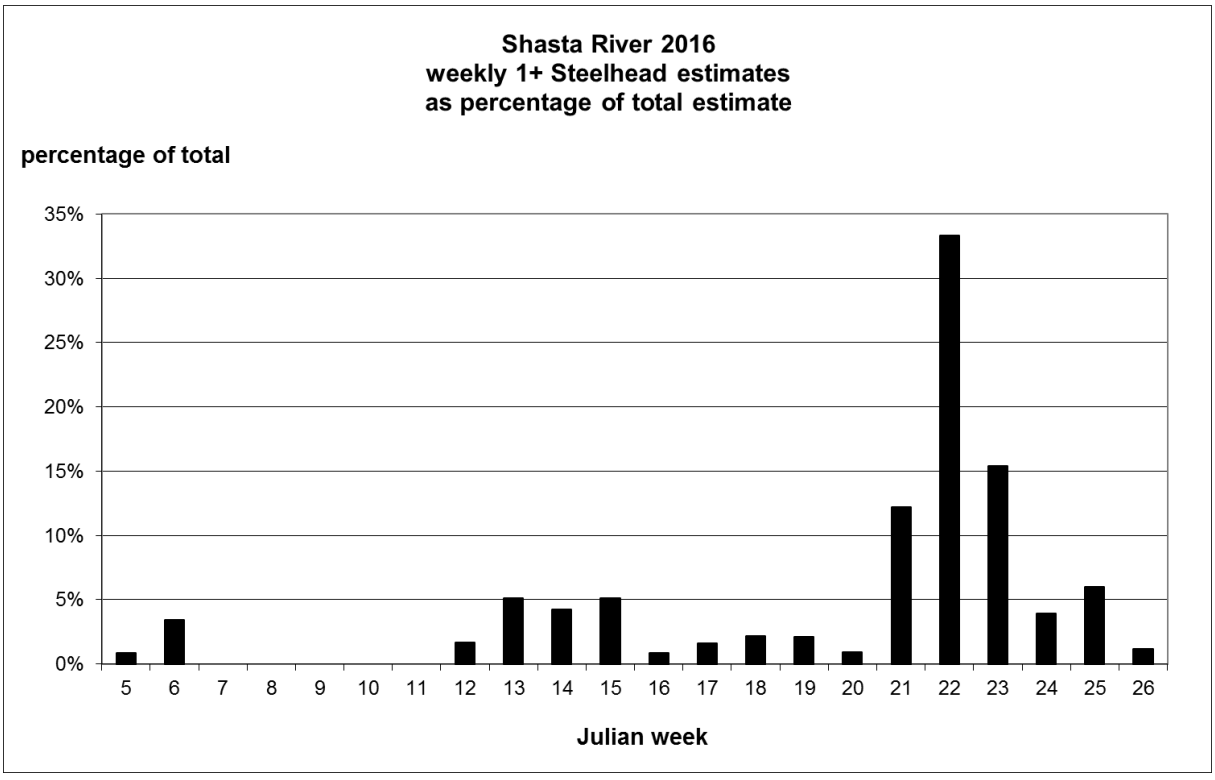

Figure 20*. Shasta River 1+ steelhead estimates, as percentage of total estimate, 2016*

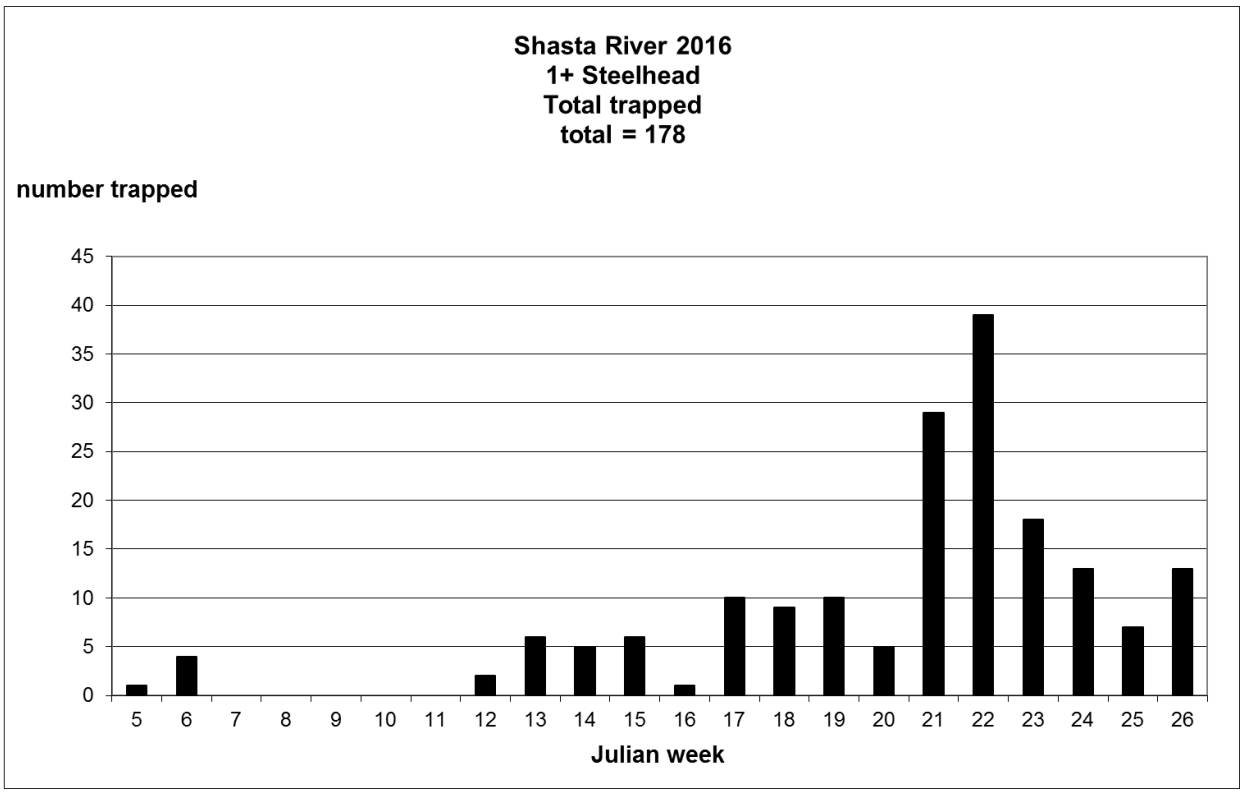

Figure 21. *Shasta River 1+ steelhead total trapped, 2016*

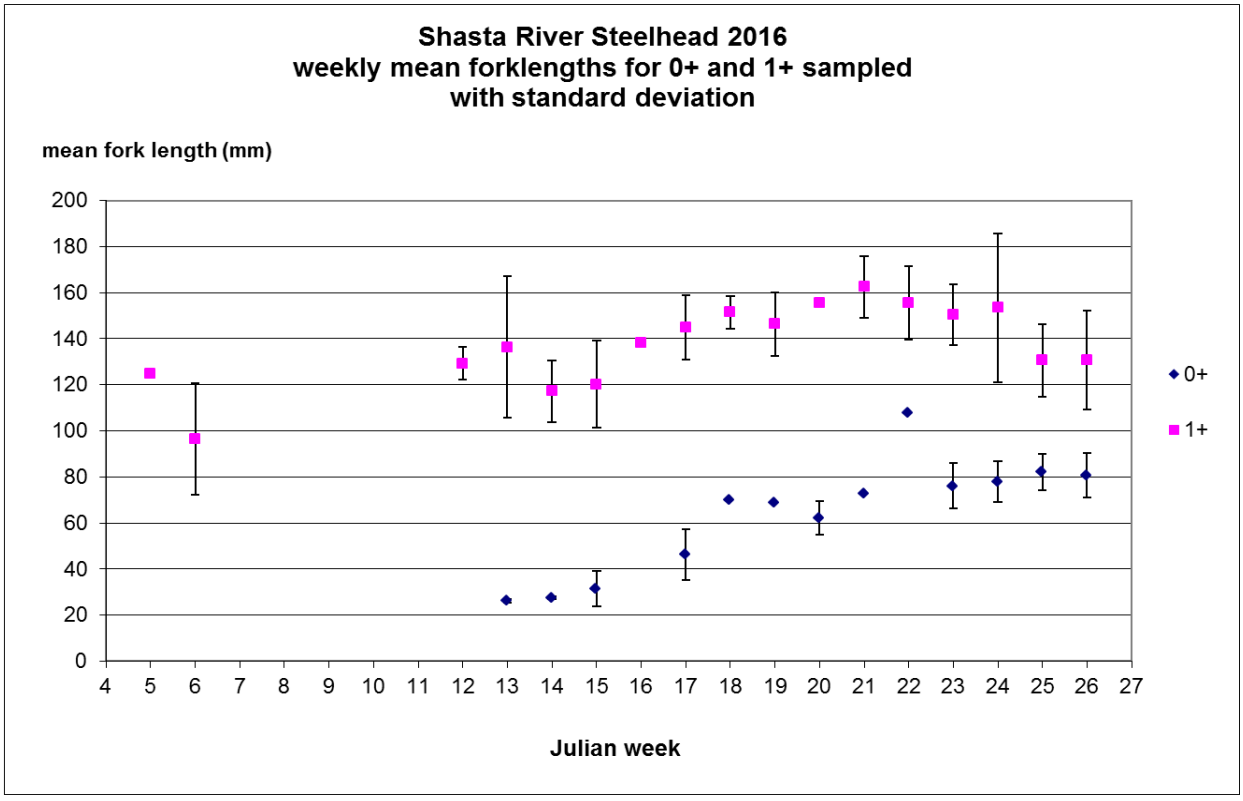

Figure 22. *Shasta River 0+, 1+ steelhead weekly mean fork lengths, 2016*

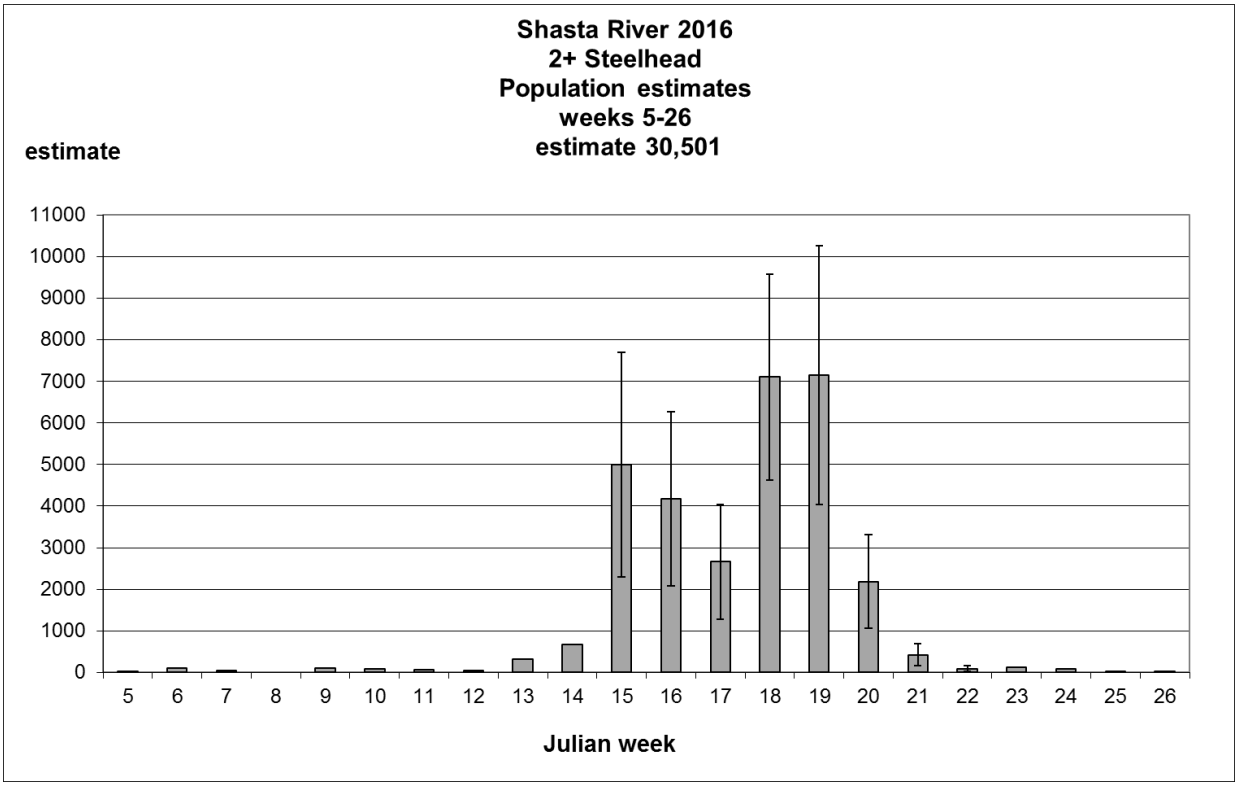

Figure 23. *Shasta River 2+ steelhead estimates, 2016*

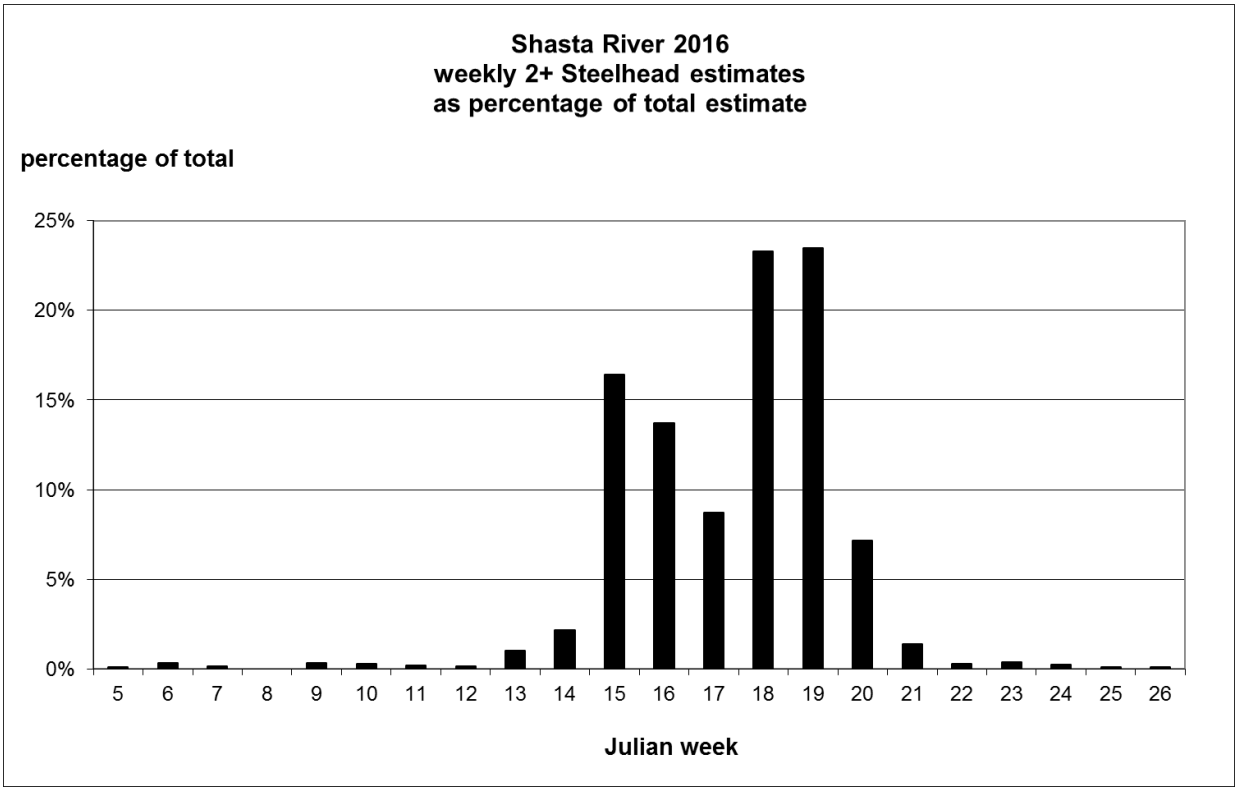

Figure 24. *Shasta River 2+ steelhead estimates, as percentage of total estimate, 2016*

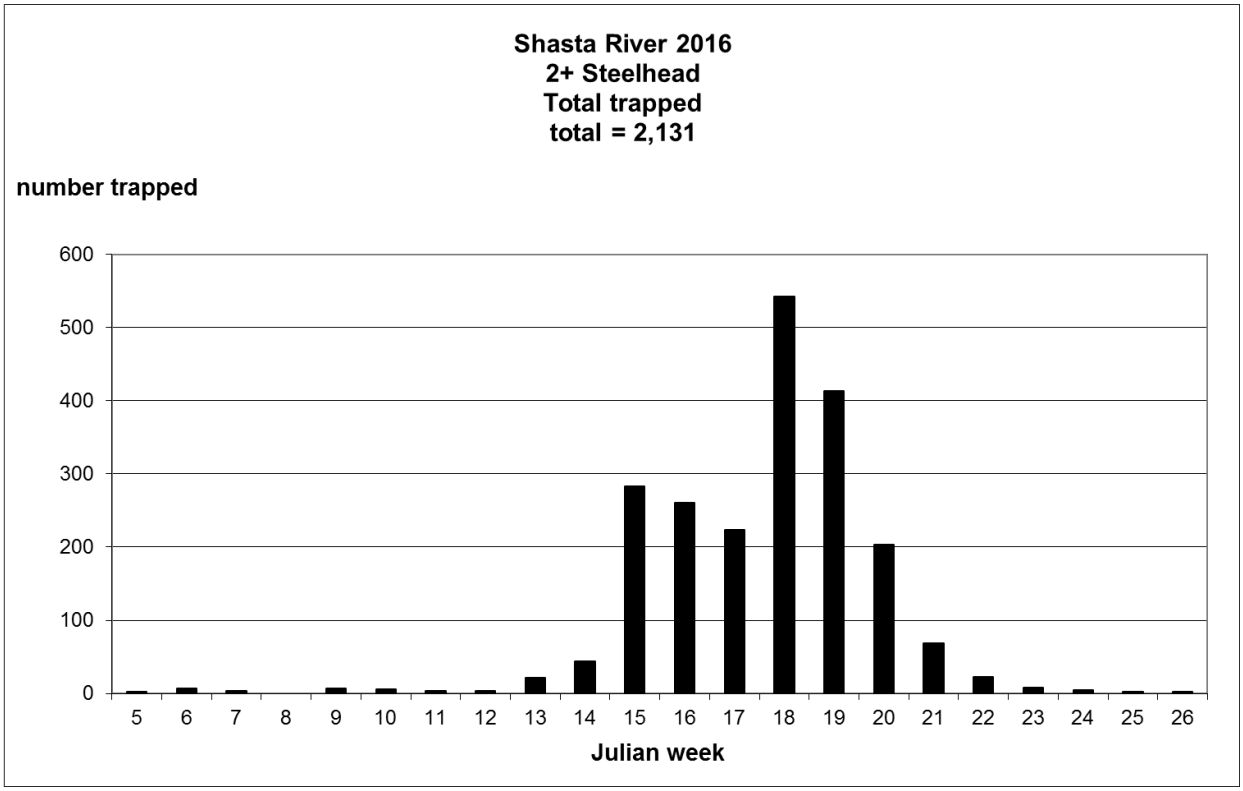

Figure 25. *Shasta River 2+ steelhead total trapped, 2016*

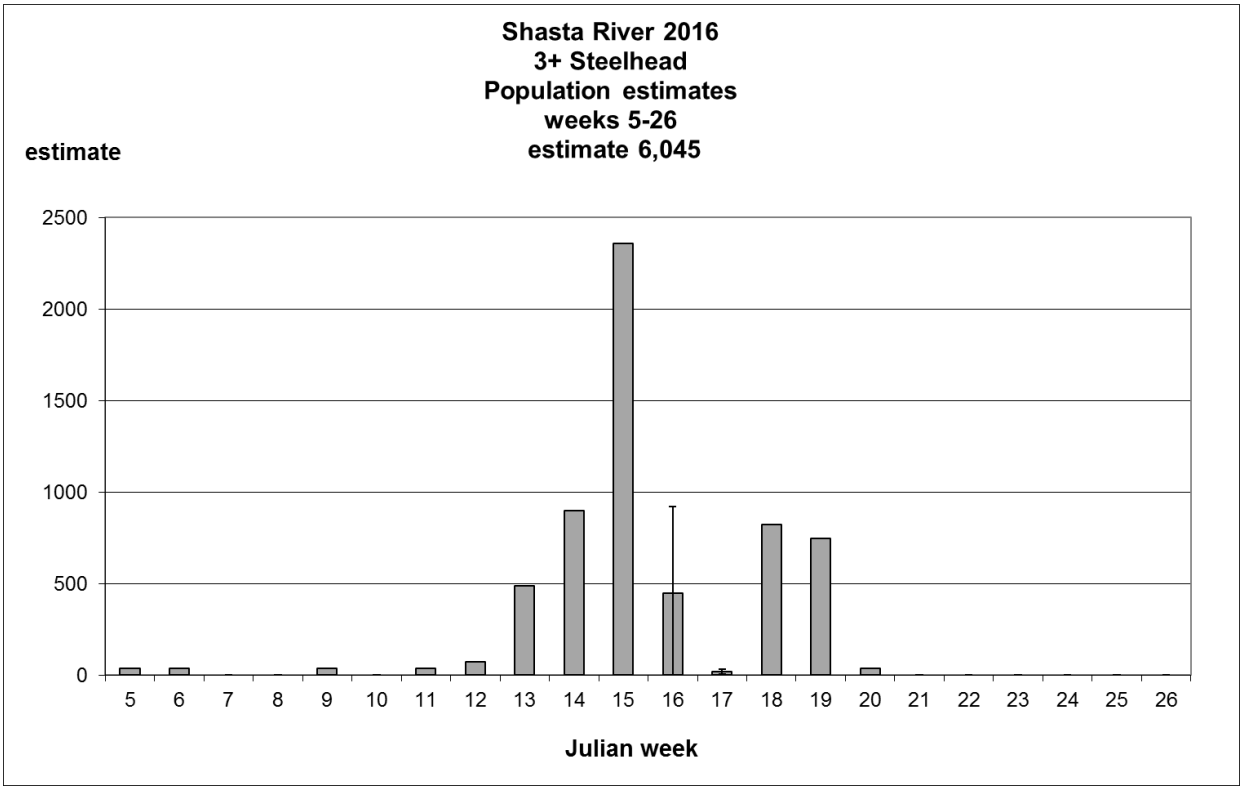

Figure 26. *Shasta River 3+ steelhead estimates, 2016*

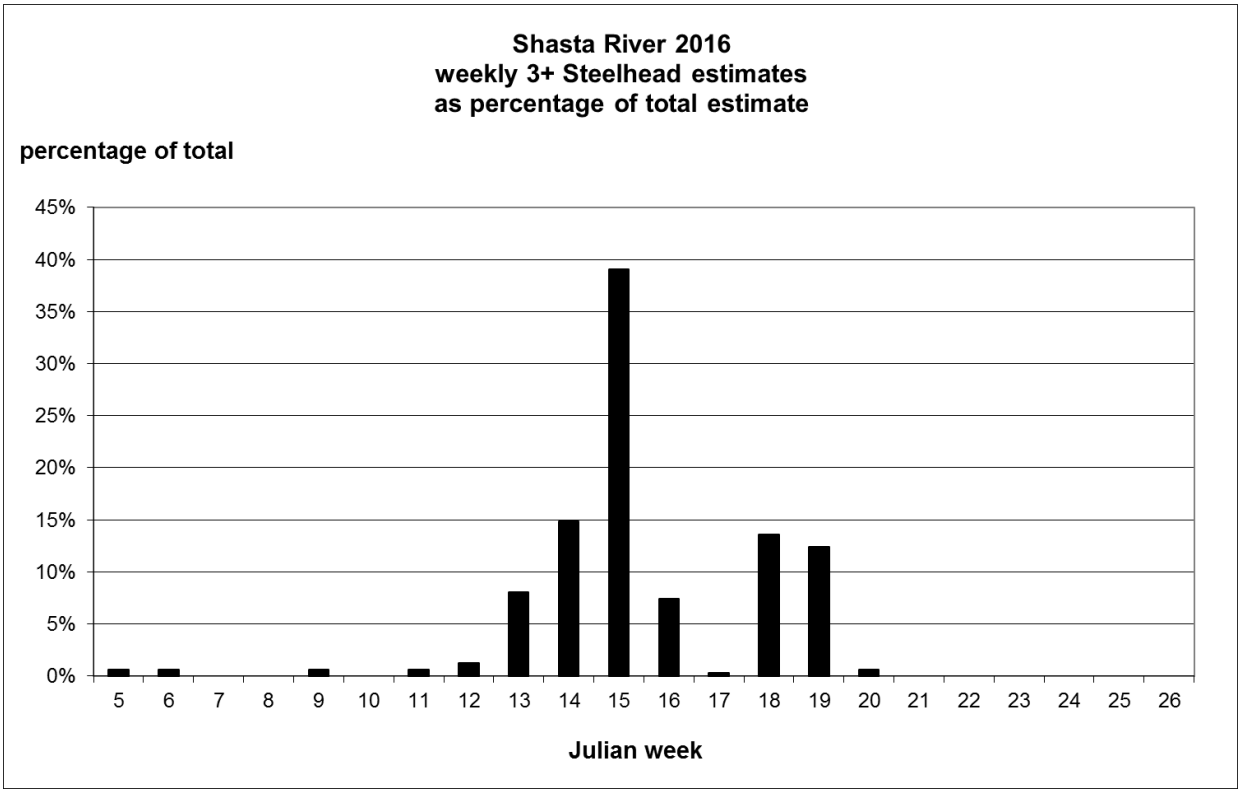

Figure 27*. Shasta River 3+ steelhead estimates, as percentage of total estimate, 2016*

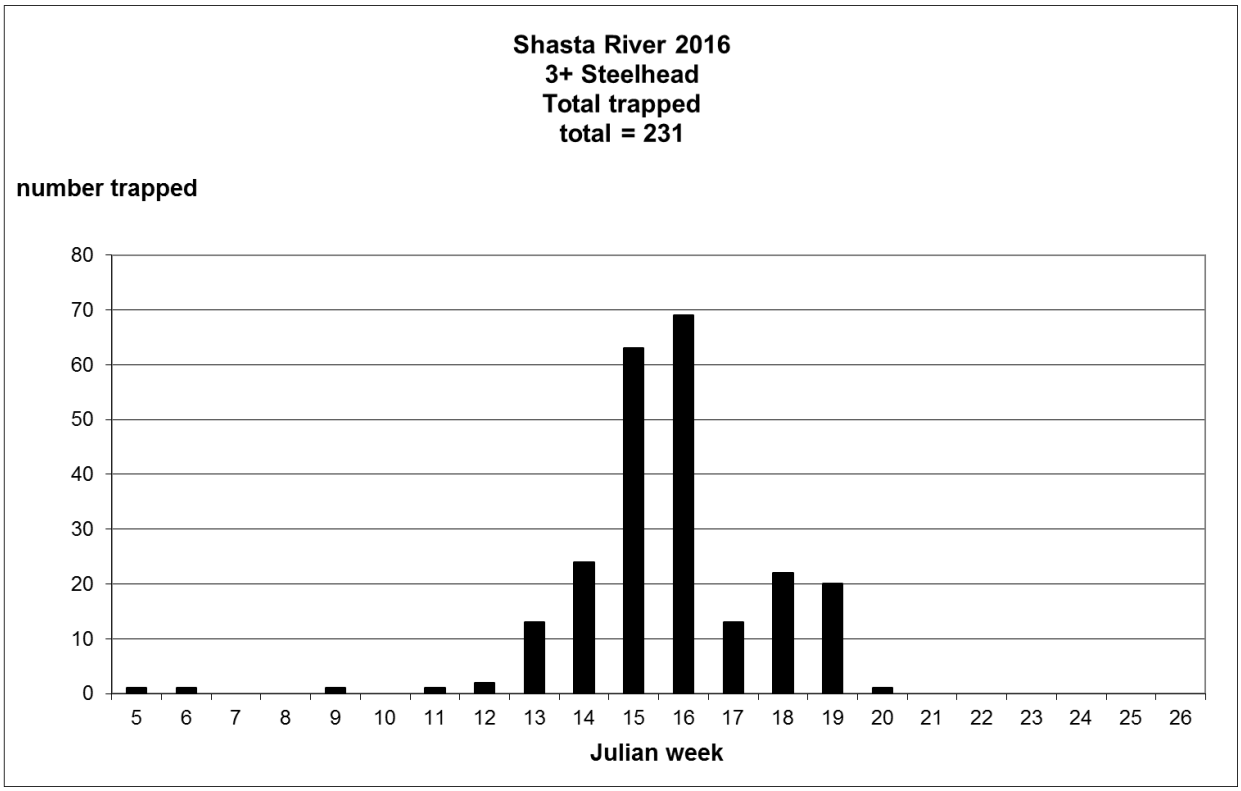

Figure 28. *Shasta River 3+ steelhead total trapped, 2016*

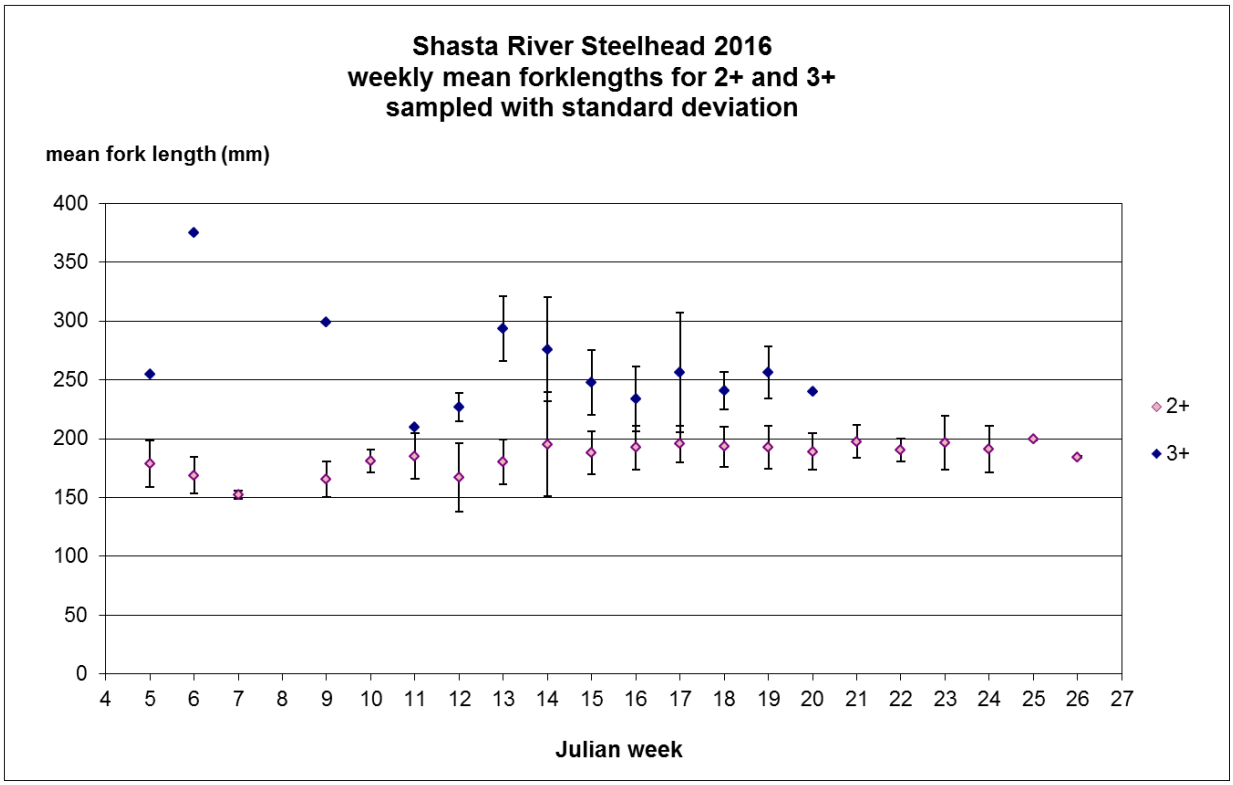

Figure 29. *Shasta River 2+, 3+ steelhead weekly mean fork lengths, 2016*

3.2.4 Temperature

The Maximum Weekly Maximum Temperature (maximum average of daily maximum temperatures for each week) occurred during Julian week 26 and was 25.70°C. The Maximum Weekly Average Temperature also occurred during Julian week 26 with a temperature of 22.71°C. The seasonal maximum temperature was 27.04°C and occurred June 29st at 17:00. Temperature logging occurred from January 1st to July 1st. Hourly water temperatures were graphed in Figure 30. It is worth noting that diurnal temperature fluctuations became greater especially after the start of the irrigation season in the beginning of April.

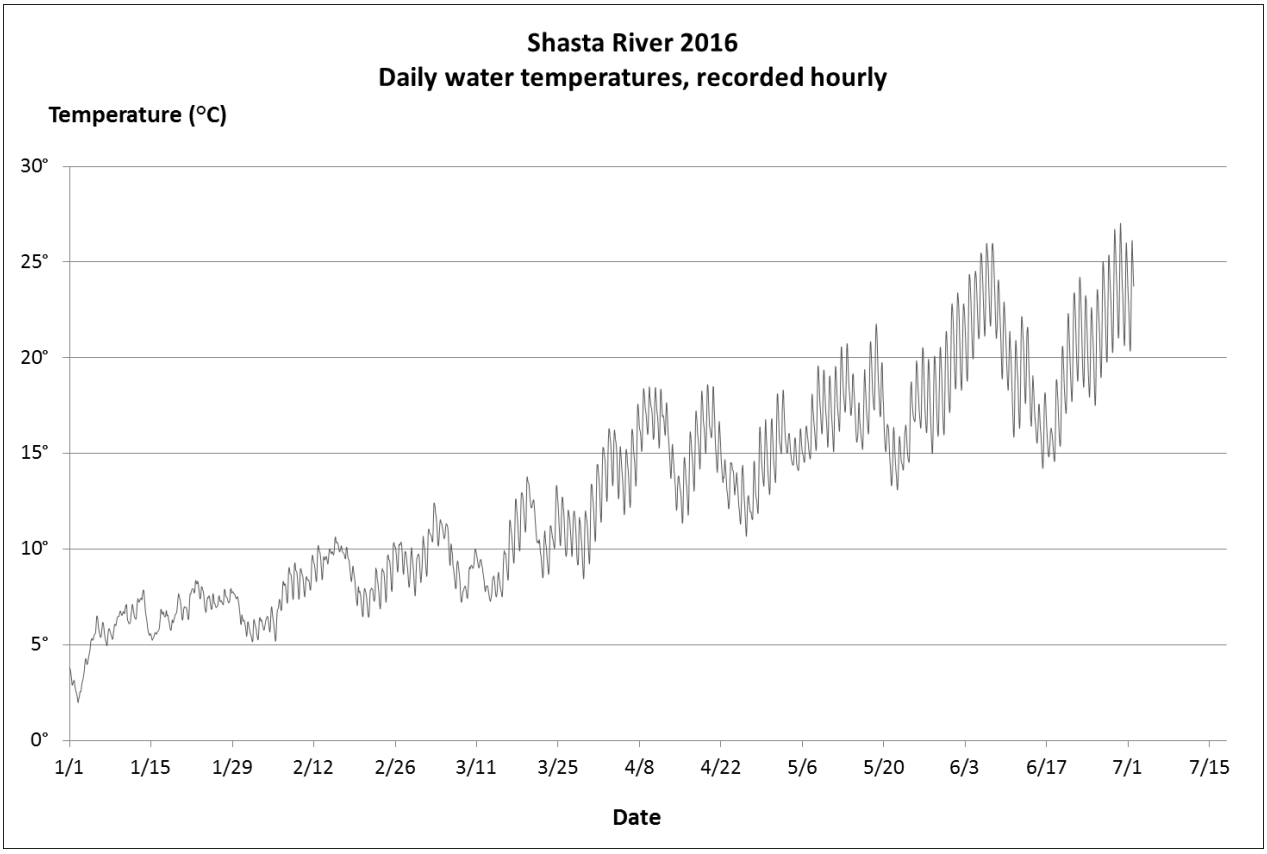

Figure 30. *Shasta River 2016 daily water temperatures*

3.3.0 Discussion

3.3.1 Trap Operation

2016 was the seventh season in which an extended live-car 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 age 0+ fish. During the 2016 season, these accumulations were minimal for the majority of the season. The exception was the month of May, were debris greatly increased. However, debris did not have a significant correlation with mortality rates due to lower catches during this time.

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 manipulated by changing the volume of water sampled (Figure 31). This can be done by moving the trap out of the thalweg, or installing and removing dam boards immediately upstream of the trap. Both of these methods change the amount of water that is sampled in the trap.

As previously described, Bismark Brown is used to mark age 0+ salmonids. In 2015, 0.6 -0.9 grams was only faintly retained by the fish. In 2016.the concentration of Bismarck Brown was increased to 1.2 grams with no observed ill-effects on the fish. Mark-retention was excellent, and allowed us to positively identify marked fish in the catch.

Dam boards were used throughout the season to maintain a balance between efficiencies, catch totals, mortalities, and filamentous algae load. As the stream flow dropped, additional boards were added to keep the trap cone spinning at a speed which would maintain at least 10% trap efficiency. Dam boards were removed during periods of high flow in order to minimize fish mortality due to debris and high water velocity.

As stream flow decreased, dam boards became less effective. Once water level dropped below a certain point, the trap was operated with the cone partially raised to prevent the cone from hitting the stream bottom. However, this did not significantly impact our ability to fish (Figure 32).

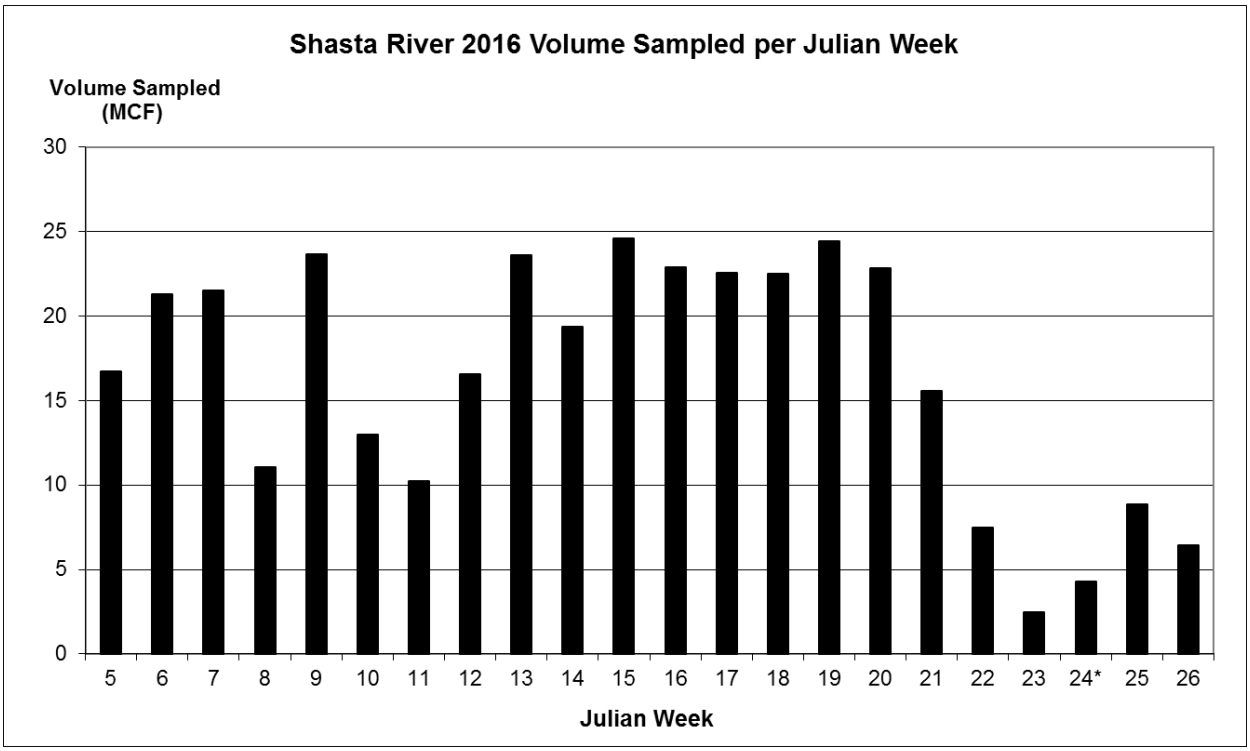

Figure 31. *Shasta River 2016 volume fished per week (Asterisk indicates weeks when cone was partially raised)*

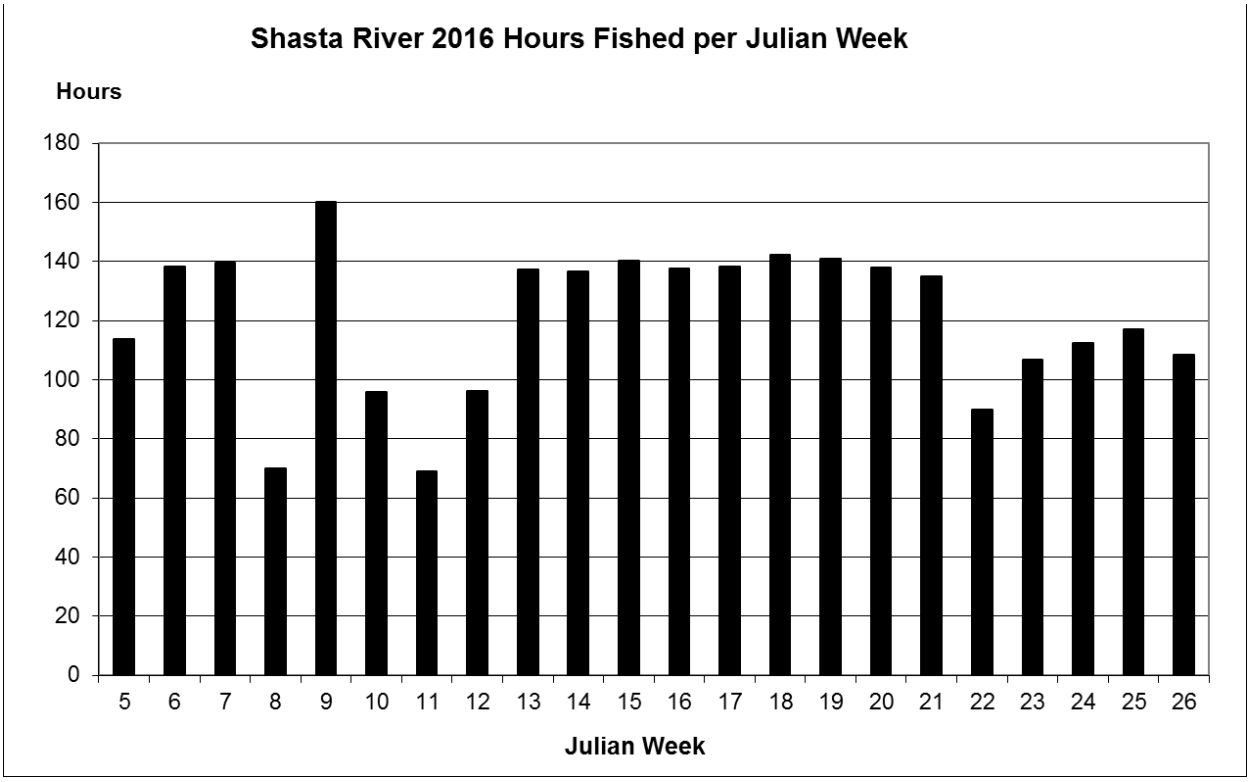

Figure 32. *Shasta River 2016 hours fished per week*

3.3.2 Flow

Shasta River flow was consistently above the fifteen year average throughout the season (Table 1), excluding June which was equal to the monthly average. The flow peaked during Julian week 11 with a maximum of 830 cfs on March 14th at 15:30. The flow was lowest during Julian week 26 on June 30th at 21:15 (35 cfs) (Table 2). Referring to Figure 33a and 33b, there was one high flow event previously mentioned, as well as high flows during Julian week 5. After this the flow dropped throughout the season, most noticeably at the start of irrigation season in Julian week 14.

Table 1: 2001 - 2016 Shasta River Flow Data

YEAR	2001 - 2016 Shasta River Flow Data During Months Sampled				
	Feb	Mar	Apr	May	Jun
2001	175	171	102	44	26
2002	215	170	98	106	44
2003	289	306	245	195	89
2004	334	296	131	109	62
2005	219	200	123	216	94
2006	629	444	418	288	152
2007	319	320	161	109	60
2008	259	225	125	95	75
2009	172	173	69	67	71
2010	158	159	147	107	80
2011	217	500	374	223	194
2012	197	225	227	86	48
2013	185	171	103	55	25
2014	166	167	65	32	21
2015	511	179	94	88	44
2016	271	386	179	139	72
2001 - 2016 Average	**270**	**256**	**166**	**122**	**72**
2016 Percent of Average	**100%**	**151%**	**108%**	**114%**	**100%**

Table 2: 2016 Shasta River Average Flow Data by Julian Week

Julian Week	Minimum	Average	Maximum
5	244	429	812
6	214	233	259
7	205	243	374
8	244	298	410
9	226	248	278
10	229	451	616
11	370	555	830
12	309	357	400
13	232	276	325
14	164	213	256
15	170	188	211
16	105	149	196
17	144	166	187
18	130	151	187
19	133	164	211
20	105	135	175
21	110	131	147
22	76	96	121
23	55	69	78
24	47	60	85
25	61	103	144
26	35	47	63

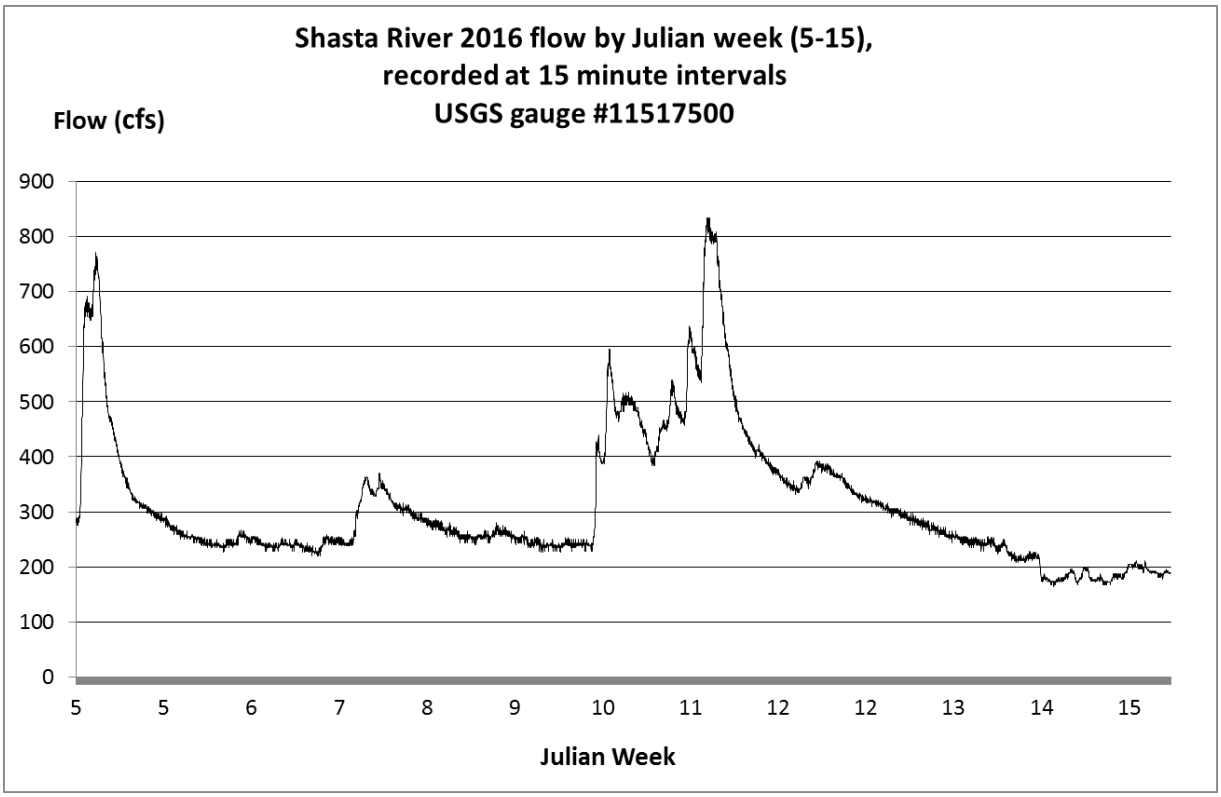

Figure 33a. *Shasta River 2016 Flow by Julian Week (5-15)*

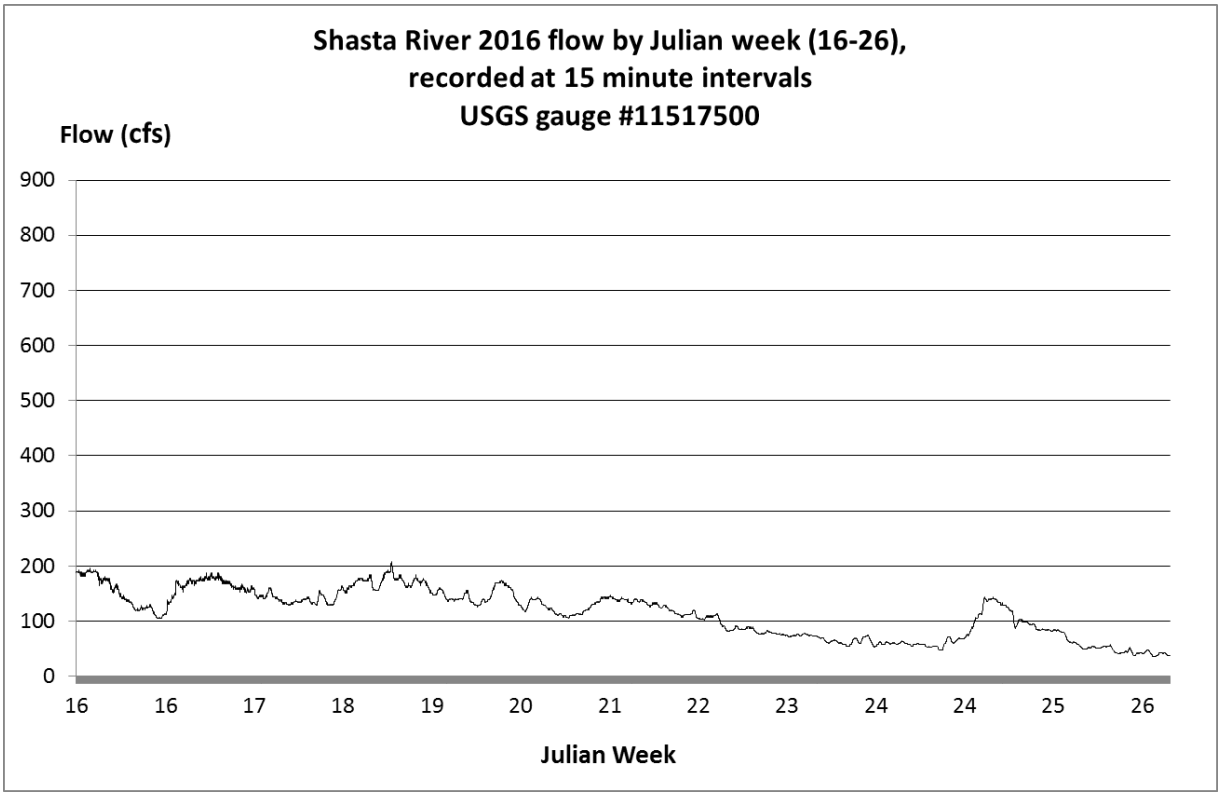

Figure 33b. *Shasta River 2016 Flow by Julian Week (16-26)*

3.3.3 Multi-Year Estimates

Annual estimation of the number of juvenile salmonids produced in the Shasta 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 methods described on page 2 of this report. 95% confidence intervals are available for the weekly estimates with the exception of weeks without recapture data. Estimates for these weeks were developed by expanding the catch using the seasonal trap efficiency.

Annual estimates for 1+ and 2+ steelhead were first possible in 2004 with the development of age length cutoffs (Appendix 33). Prior to 2004 estimates were produced for 1+ and 2+ steelhead combined. 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 2016 were compared with the data from the previous fifteen years of sampling (Figure 34, Table 3). The estimate of 2,757,850 for 2016 was found to be sixth largest in the sixteen years of trap operation.

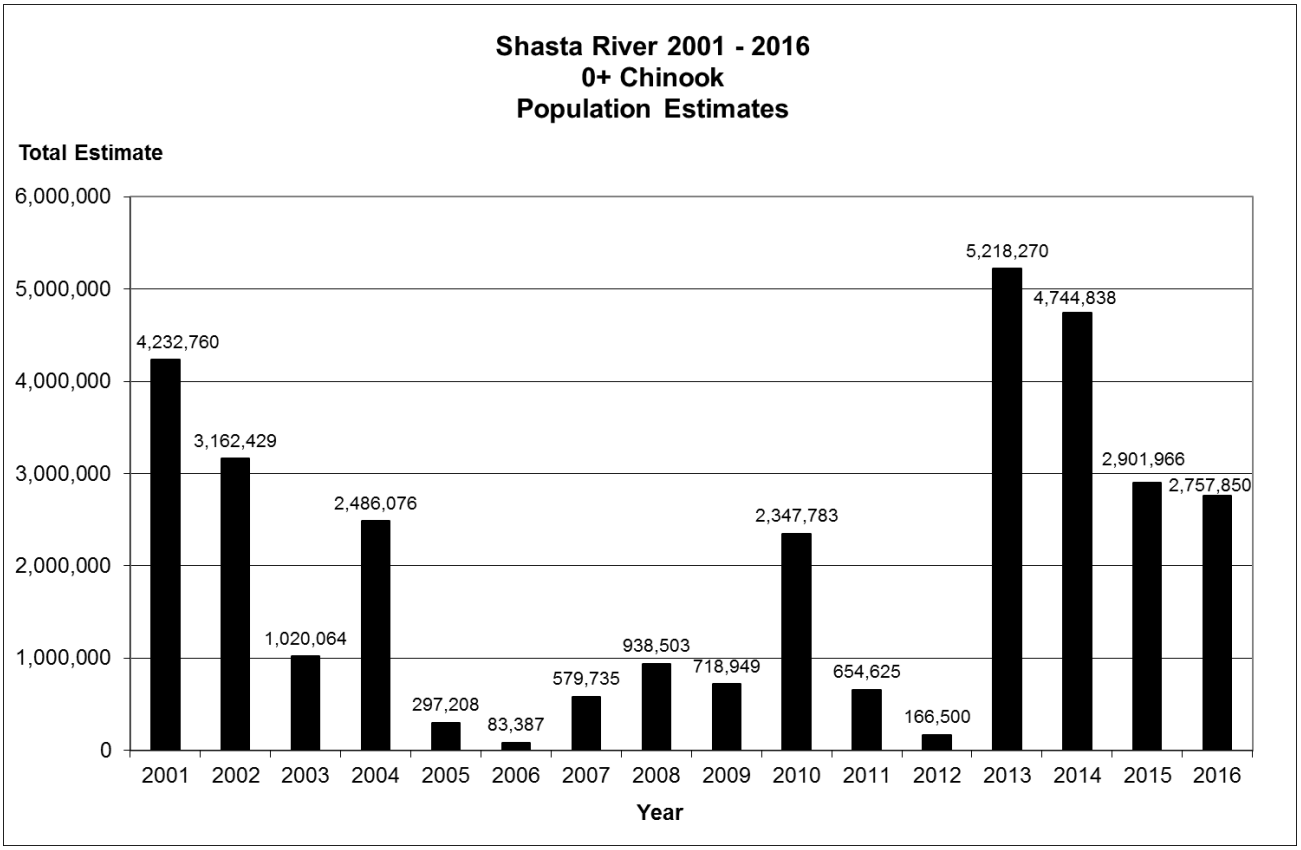

Figure 34. *Shasta River 2001 – 2016 0+ Chinook population estimates*

Table 3: Shasta River 2001 - 2016 Weekly Population Estimates for 0+ Chinook Salmon

Julian Week	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Multi-year
5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	234	34,053	660	318,043	97,971	**90,192**
6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	28,626	126	119,444	1,203	127,277	345,754	**103,738**
7	-----	-----	13,429	125,190	14,341	1,358	35,803	13,923	4,325	441,313	26,279	1,683	371,890	8,596	656,496	569,484	**163,151**
8	-----	-----	97,358	401,988	13,861	2,545	40,407	19,727	50,745	375,871	41,113	10,571	188,867	131,281	646,487	79,963	**150,056**
9	1,305,719	-----	144,206	395,915	26,646	1,427	20,975	75,909	77,894	236,497	55,084	8,712	466,674	734,141	297,764	424,614	**284,812**
10	260,137	622,634	143,548	851,550	50,775	154	57,729	108,321	7,729	311,342	42,272	12,944	1,145,377	1,002,487	222,348	177,577	**313,558**
11	1,032,865	521,745	86,911	249,353	31,221	2,654	93,418	190,442	58,276	361,561	13,363	5,969	1,418,318	455,396	118,978	43,161	**292,727**
12	1,199,398	410,963	100,881	107,549	25,110	1,531	71,841	126,495	112,832	225,694	20,505	11,344	270,025	1,063,015	41,841	140,045	**245,567**
13	197,368	363,540	171,099	46,026	14,686	475	35,228	66,258	72,436	35,699	106,690	7,423	456,736	286,937	34,218	363,538	**141,147**
14	40,306	738,380	55,585	26,906	31,202	939	26,158	48,899	47,558	56,144	90,416	14,837	230,002	239,544	67,550	204,828	**119,953**
15	22,557	148,765	35,821	64,925	23,113	1,087	41,542	28,825	49,827	43,479	52,960	16,993	203,175	100,555	64,216	130,341	**64,261**
16	12,042	148,890	17,697	51,207	11,401	3,499	20,847	46,142	62,195	50,989	35,358	27,355	58,686	115,081	66,160	25,730	**47,080**
17	40,223	23,015	17,879	25,286	6,683	1,886	18,986	47,836	67,316	30,493	42,339	15,110	40,076	167,299	77,732	28,015	**40,636**
18	31,575	-----	8,626	48,625	6,373	4,243	28,892	40,133	10,433	37,111	22,015	4,761	83,524	82,930	35,606	14,318	**30,611**
19	70,917	74,983	6,520	23,136	3,093	9,777	24,774	33,531	8,912	38,185	10,415	4,426	58,228	62,081	36,276	29,086	**30,896**
20	19,655	62,352	26,573	9,206	9,689	32,600	32,279	59,803	59,298	36,462	12,735	12,777	21,149	179,482	19,458	34,957	**39,280**
21	-----	22,535	65,501	25,328	18,696	1,564	17,974	7,757	15,681	22,772	8,642	2,942	14,979	55,455	41,047	21,536	**22,827**
22	-----	7,407	22,235	18,534	4,431	5,320	10,172	1,187	6,813	13,636	10,109	4,183	23,174	18,094	19,728	18,686	**12,247**
23	-----	15,971	5,616	9,205	1,962	6,170	1,365	6,757	2,325	9,913	15,064	2,334	13,060	8,475	7,830	6,029	**7,472**
24	-----	1,251	539	3,401	1,875	2,261	1,011	7,744	1,868	15,052	13,671	1,204	586	11,707	2,891	1,522	**4,439**
25	-----	-----	-----	1,609	967	2,300	334	3,226	1,698	3,402	6,286	414	245	19,771	13	523	**3,137**
26	-----	-----	-----	1,138	841	1,586	-----	5,591	787	2,167	682	157	-----	646	9	172	**1,252**
27	-----	-----	-----	-----	146	10	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	**78**
28	-----	-----	38	-----	96	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	**46**
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**	**654,625**	**166,500**	**5,218,270**	**4,744,838**	**2,901,966**	**2,757,850**	**2,019,434**

3.3.5 Coho

Yearly and weekly estimates of 1+ coho from the Shasta River in 2016 were compared with data from the previous thirteen years of sampling (Figure 35, Table 4). The estimate of 229 for 2016 was found to be the fourth lowest estimate in the fourteen years of 1+ coho population estimates.

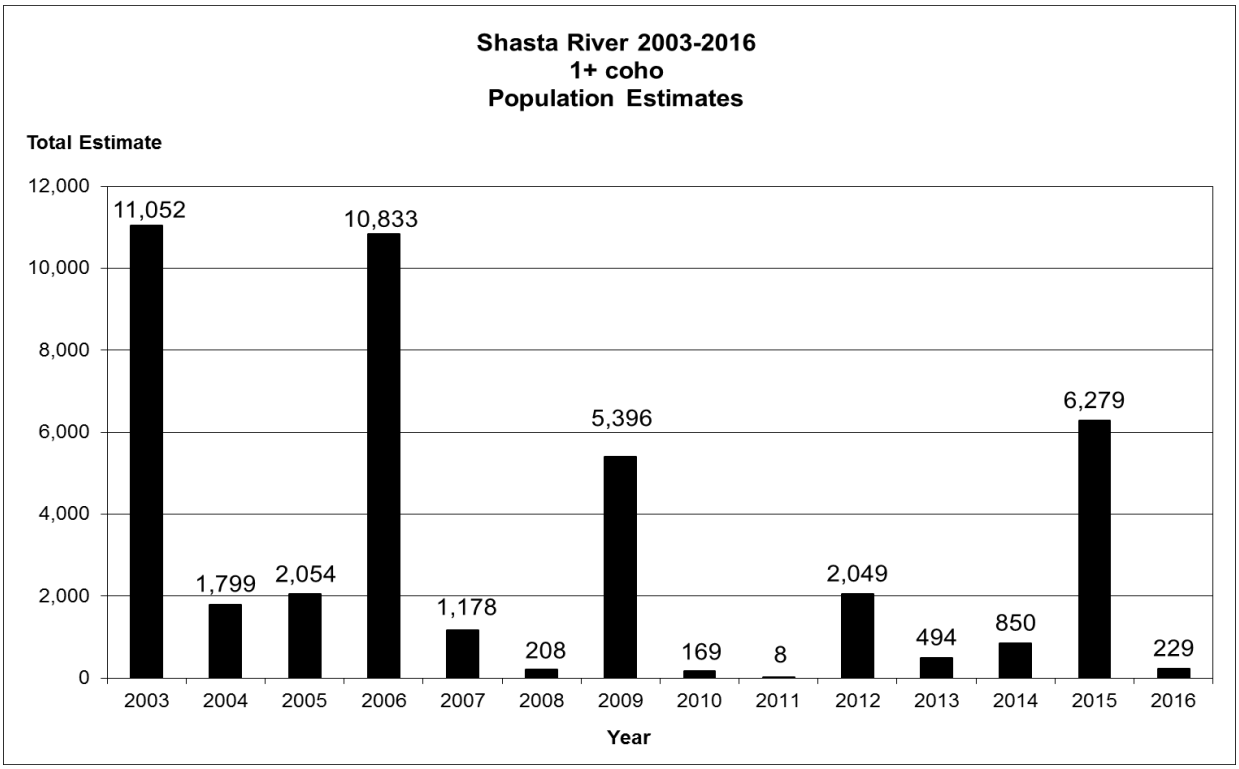

Figure 35. *Shasta River 2003 – 2016 1+ coho population estimates*

Table 4: Shasta River 2003 - 2016 Weekly Population Estimates for 1+ Coho Salmon

Julian Week	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Multi-year
5	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	2	-----	---	5	**3**
6	-----	-----	-----	-----	-----	-----	-----	-----	0	0	2	-----	---	5	**2**
7	21	-----	-----	60	-----	-----	-----	0	0	2	4	-----	3	0	**11**
8	60	7	9	14	-----	-----	16	0	0	0	0	-----	1	0	**10**
9	400	15	-----	-----	-----	-----	10	0	2	0	0	-----	1	5	**48**
10	58	5	18	18	4	-----	18	0	0	0	6	-----	11	0	**11**
11	100	78	46	85	-----	-----	20	0	0	0	0	1	36	0	**30**
12	386	135	25	55	12	-----	66	0	0	10	11	4	229	0	**72**
13	2,262	54	128	120	15	-----	381	6	4	0	2	14	370	8	**259**
14	2,937	261	117	173	326	-----	306	10	0	2	16	187	1,869	26	**479**
15	739	417	218	15	146	-----	1246	5	2	153	64	139	2,230	114	**422**
16	1,762	337	266	226	232	-----	2110	112	0	356	149	315	803	56	**517**
17	845	368	539	6,699	289	-----	681	28	0	730	170	149	320	10	**833**
18	950	98	222	2,048	63	-----	144	0	0	182	53	31	215	0	**308**
19	274	4	-----	1,104	53	-----	287	4	0	301	16	8	111	0	**180**
20	224	7	3	202	12	-----	75	4	0	131	0	1	61	0	**55**
21	29	-----	-----	-----	4	-----	21	0	0	154	0	-----	16	0	**25**
22	4	-----	-----	8	12	-----	5	0	0	24	0	-----	5	0	**6**
23	-----	-----	3	7	8	-----	10	0	0	2	0	-----	---	0	**3**
24	-----	14	107	-----	4	-----	-----	0	0	0	0	-----	---	0	**16**
25	-----	-----	129	-----	-----	-----	-----	0	0	0	0	-----	---	0	**22**
26	-----	-----	224	-----	-----	-----	-----	0	0	2	0	-----	---	0	**38**
27	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---	-----
TOTAL	**11,052**	**1,799**	**2,054**	**10,833**	**1,178**	**208**	**5,396**	**169**	**8**	**2,049**	**494**	**850**	**6,279**	**229**	**3,043**

3.3.6 Coho Smolt Production and Return Rate

We estimate that 4.98 smolts were produced per adult that returned in 2014 (Table 5) and that the average number of smolts per adult produced for brood years 2001 through 2014 is 18.18. The smolt to adult survival by year is shown for Shasta River coho 1+ in Table 5. The average survival of 4.10% does not include the adult percent return reflected in 2011 and 2012 due to the high rate of IGH strays in those years. With 2015 being a recent exception, adult coho numbers returning in the fall have usually reflected more IGH strays. The estimate of IGH strays into the Shasta River for 2011 was 71%, and in 2012, 70% (Table 6). Table 6 displays adult coho numbers returning to the Shasta, with percent of IGH strays for brood years 2011 – 2015. Due to this, percent return in Table 5 from brood years 2011 to 2014 is an overestimation and does not accurately represent wild coho populations. due to continuing declining numbers of wild coho, the effect of IGH strays exaggerates the actual percent return.

Table 5: Shasta River coho 1+ produced per returning adult and percent return of total adults

Brood year	Adults	year of emigration	1+ produced	smolts per adult	% Return	Adults Returning in	Brood Year
2001	291	2003	11,052	37.98	3.37%	373	2004
2002	86	2004	1,799	20.92	3.84%	69	2005
2003	187	2005	2,054	10.98	2.29%	47	2006
2004	373	2006	10,833	29.04	2.35%	255	2007
2005	69	2007	1,178	17.07	2.63%	31	2008
2006	47	2008	208	4.43	4.33%	9	2009
2007	255	2009	5,396	21.16	0.82%	44	2010
2008	31	2010	169	5.45	36.69%	62	2011
2009	9	2011	19	2.11	605.26%	115	2012
2010	44	2012	2,049	46.57	7.96%	163	2013
2011	62	2013	494	7.97	9.31%	46	2014
2012	115	2014	850	7.39	4.12%	35	2015
2013	163	2015	6,279	38.52	4.09%	257	2016
2014	46	2016	229	4.98	***4.10%***	***9***	2017
			Average	**18.18**			

Table 6: Shasta River 2011-2015 Iron Gate Hatchery and wild adult coho returns

Total Adults Returning in	Brood Year	% IGH Strays	IGH Adults	Wild Adults
62	2011	71%	44	18
115	2012	70%	81	35
163	2013	62%	101	62
46	2014	83%	38	8
45	2015	13%	6	39

(Data from the above table composed from Chesney & Knechtle 2012, Chesney & Knechtle 2013, Chesney & Knechtle 2014, Chesney & Knechtle 2015, and Chesney & Knechtle 2016)

3.3.7 Steelhead

Both yearly and weekly estimates of the number of 2+ steelhead trout produced from the Shasta River for 2016 were compared with the data from the previous twelve years of sampling (Figure 36, Table 7). The estimate of 30,501 for 2016 was found to be fifth largest in the thirteen years of trap operation.

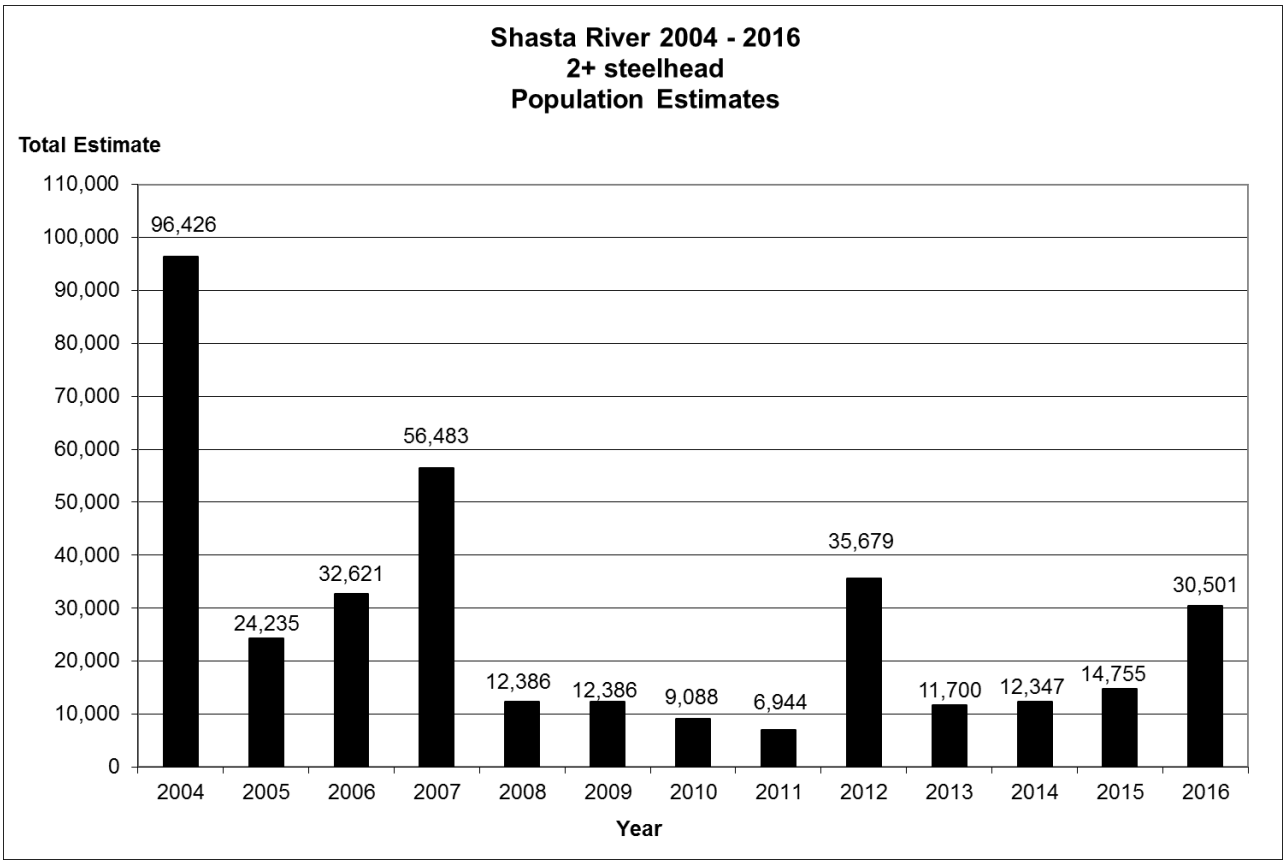

Figure 36. *Shasta River 2004 – 2016 2+ steelhead population estimates*

Table 7: Shasta River 2004 – 2016 Weekly Population Estimates for 2+ steelhead

Julian Week	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Multi-year
5	-----	-----	-----	-----	-----	-----	-----	-----	-----	16	10	12	30	**17**
6	-----	-----	-----	-----	-----	-----	-----	0	1	3	7	2	105	**20**
7	-----	4	22	9	14	45	8	0	8	-----	10	2	45	**15**
8	-----	-----	41	125	10	114	2	6	2	5	24	0	0	**30**
9	112	7	2	10	38	83	0	0	24	12	57	2	105	**35**
10	612	89	27	143	252	279	49	2	50	12	27	12	90	**126**
11	4,125	760	2	1,732	191	377	367	0	10	95	84	58	60	**605**
12	8,458	538	15	5,382	164	698	620	6	102	186	209	30	45	**1,265**
13	1,938	376	2	2,472	920	2,806	30	55	192	380	331	61	316	**760**
14	5,962	1,043	6	2,626	1,901	1,329	105	26	120	172	804	521	663	**1,175**
15	7,500	1,262	4	1,890	1,739	2,989	120	14	810	498	905	1,456	5,000	**1,860**
16	15,893	763	94	2,616	857	10,327	2,060	964	1,370	1,016	2,283	1,343	4,176	**3,366**
17	27,048	3,278	2,391	7,637	1,731	3,511	223	78	7,490	3,787	2,213	3,060	2,659	**5,008**
18	8,886	5,648	17,136	4,541	1,177	798	650	3,616	16,268	2,329	2,804	3,387	7,100	**5,718**
19	6,120	4,015	6,930	19,421	2,017	1,595	1,898	1,139	1,403	2,723	676	2,451	7,151	**4,426**
20	6,398	3,718	4,975	6,543	1,264	2,134	2,221	572	5,372	315	1,119	974	2,186	**2,907**
21	1,195	2,289	187	449	82	219	462	433	1,932	110	435	1,097	423	**716**
22	1,291	278	276	722	18	66	224	21	317	10	140	187	92	**280**
23	704	119	105	57	7	14	13	11	181	29	60	79	120	**115**
24	36	33	31	82	-----	2	15	1	2	2	55	15	75	**29**
25	150	17	251	28	-----	9	4	0	13	-----	44	6	30	**50**
26	-----	-----	125	-----	5	-----	18	1	12	-----	52	2	30	**31**
27	-----	-----	1	-----	-----	-----	-----	-----	0	-----	-----	-----	-----	**1**
TOTAL	**96,426**	**24,235**	**32,621**	**56,483**	**12,386**	**27,395**	**9,088**	**6,944**	**35,679**	**11,700**	**12,347**	**14,755**	**30,501**	**28,505**

4.0 Scott River Rotary Screw Trap Summary

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 eight foot trap is fitted with the same modified, extended live car as on the Shasta River. The extended live car's dimensions are 15' x 3'4" x 1'10". 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 041º 43' 34.87" N, 123º 00' 30.11" W (WGS 84). The catch in the trap was processed daily at approximately 0900 hrs. Water velocity at each trap was measured 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 2 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 34). 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 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, coho 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 Chinook, coho and steelhead were conducted on the Scott River in 2016.

4.1.4 Water Temperature and Flow Monitoring

Stream flow measurements presented in this report were made using preliminary data from a USGS stream gauge, number 11519500, located approximately 19.5 miles upstream of the trap. Several tributaries without stream gauges 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 4.

4.1.5 Data Entry and Analysis

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

4.2.0 Results

The eight-foot rotary trap began sampling six days per week on February 5, 2016, the beginning of Julian week 6. Trapping ended after 12 weeks on April 27, 2016. The eight-foot trap fished 46 sets for a total of 1,084.68 hours. An estimated 88,325,323.44 cubic feet of water was sampled. The five-foot trap began sampling six days per week on February 22, 2016, the beginning of Julian week 8. Trapping ended after 15 weeks on June 3, 2016. The trap fished 41 sets for a total of 947.67 hours. An estimated 148,135,365.8 cubic feet of water was sampled by the five-foot trap. During weeks when the cones were partially raised, flow was taken, however the number reported is an estimate. The number of salmonids trapped, marked and recaptured by Julian week was recorded, and weekly population estimates with 95% confidence intervals were produced (Appendices 9 – 15). Weekly mean fork lengths with standard deviation, sample size, and as well as minimum and maximum sizes were also recorded (Appendices 25 – 31).

4.2.1 Chinook

Chinook 0+

An estimated 56,634 0+ Chinook emigrated from the Scott River during the period sampled (Figure 37). The greatest number of Chinook emigrated during Julian week 16 (10,229). This is equal to 18.06% of the total estimate (Figure 38). The mean fork length for 0+ Chinook during Julian week 14 was 39 mm (Appendix 25). A total of 1,208 0+ Chinook were trapped during sampling (Figure 39, Appendix 9).

Chinook 1+

A total of 28 1+ Chinook were captured during sampling (Figure 40, Appendix 10). There was only one recapture out of the 21 marked trials. The greatest number left during Julian week 9. The weekly mean fork length for 1+ Chinook during Julian week 9 was 90 mm (Appendix 26).

In the sub-sample, 265 0+ Chinook and 28 1+ Chinook were measured and aged (Figure 41); 21 scale samples were taken from 1+ Chinook.

4.2.2 Coho

Coho 0+

A total of 14 0+ coho were captured during sampling (Figure 42, Appendix 11). There were no recaptures out of the two marked trials. The weekly mean fork lengths for 0+ coho during sampling are presented in Appendix 27.

Coho 1+

An estimated 2,411 1+ coho emigrated from the Scott River during Julian weeks 6 – 22 (Figure 43). The greatest number left during Julian week 14 (630). This is equal to 26.14% of the total estimate (Figure 44). The mean fork length for 1+ coho during Julian week 13 was 111 mm (Appendix 28). A total of 175 1+ coho were trapped during sampling (Figure 45, Appendix 12).

Coho 2+
A total of 1 2+ coho was captured during sampling (Figure 46) in Julian week 13. There was not a recapture.

In the sub-sample, 7 0+ coho, 169 1+ coho, and 1 2+ coho were measured and aged (Figure 47); 1 otolith samples was taken from 0+ coho; 44 scale, 2 otolith and 88 tissue samples were taken from 1+ coho; 1 scale and 2 tissue samples were taken from a 2+ coho.

4.2.3 Steelhead

Steelhead 0+
A total of 97 0+ steelhead emigrated from the Scott River during Julian weeks 6 – 21 (Figure 48). The greatest number left during Julian week 6 (23). The mean fork length for 0+ steelhead for Julian week 6 was 56 mm (Appendix 29).

Steelhead 1+
An estimated 73,540 1+ steelhead emigrated from the Scott River Julian weeks 6 - 22 (Figure 49). The greatest number left during Julian week 14 (36,828 95% CI, 7,441 – 66,215). This is equal to 50.08% of the total estimate for the period sampled (Figure 50). The mean fork length for 1+ steelhead during Julian week 14 was 81mm (Appendix 30). A total of 2,163 1+ steelhead were trapped during sampling (Figure 51, Appendix 14).

Steelhead 2+
A total of 44 2+ steelhead were captured during sampling (Figure 53, Appendix 15). There were no recaptures out of the 13 marked trials. The greatest number left during Julian week 14 (15). The weekly mean fork length for 2+ steelhead during Julian week 14 was 138 mm (Appendix 31).

A total of 43 0+ steelhead, 1,073 1+ steelhead, 39 2+ steelhead, and no 3+ steelhead were measured and aged in the sub-sample (Figure 52, Figure 54); 8 scale samples were taken from 0+ steelhead; 84 scale, 1 tissue, and 1 otolith sample were taken from 1+ steelhead; 26 scale samples were taken from 2+ steelhead.

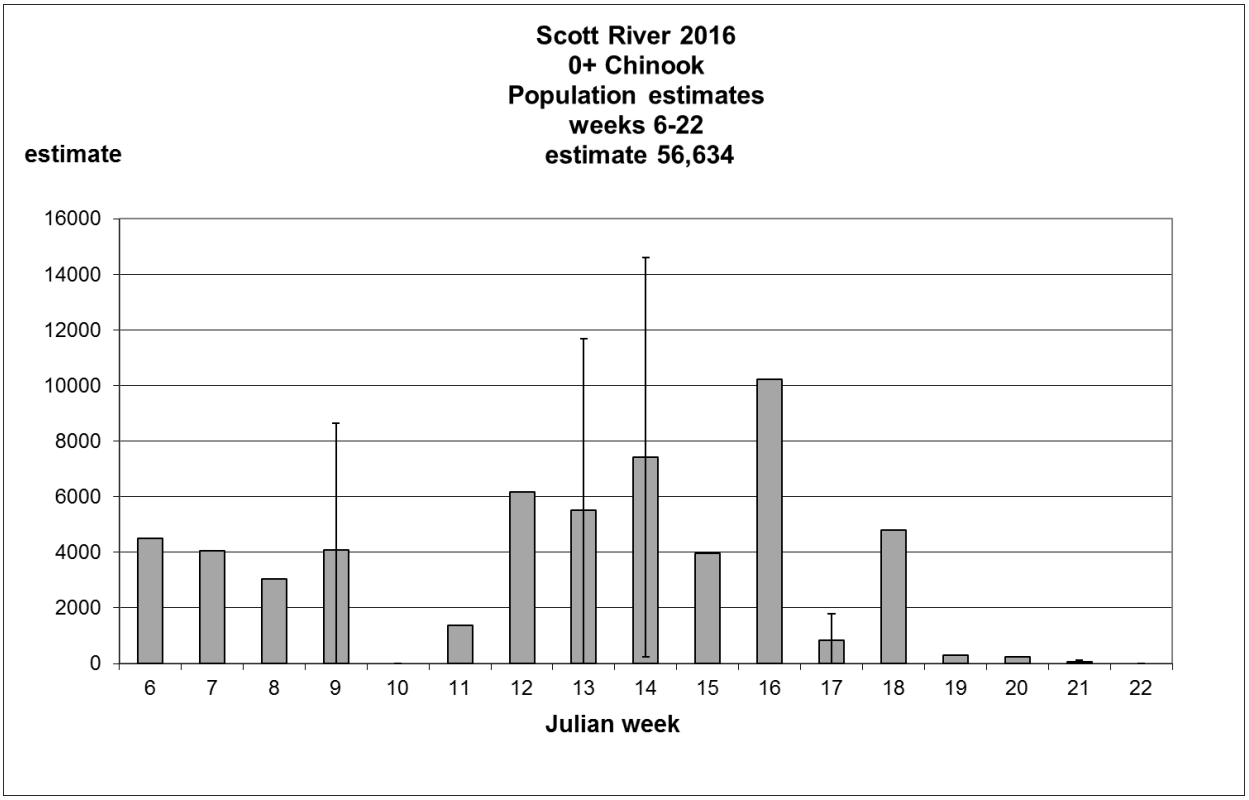

Figure 37. *Scott River 0+ Chinook estimates, 2016*

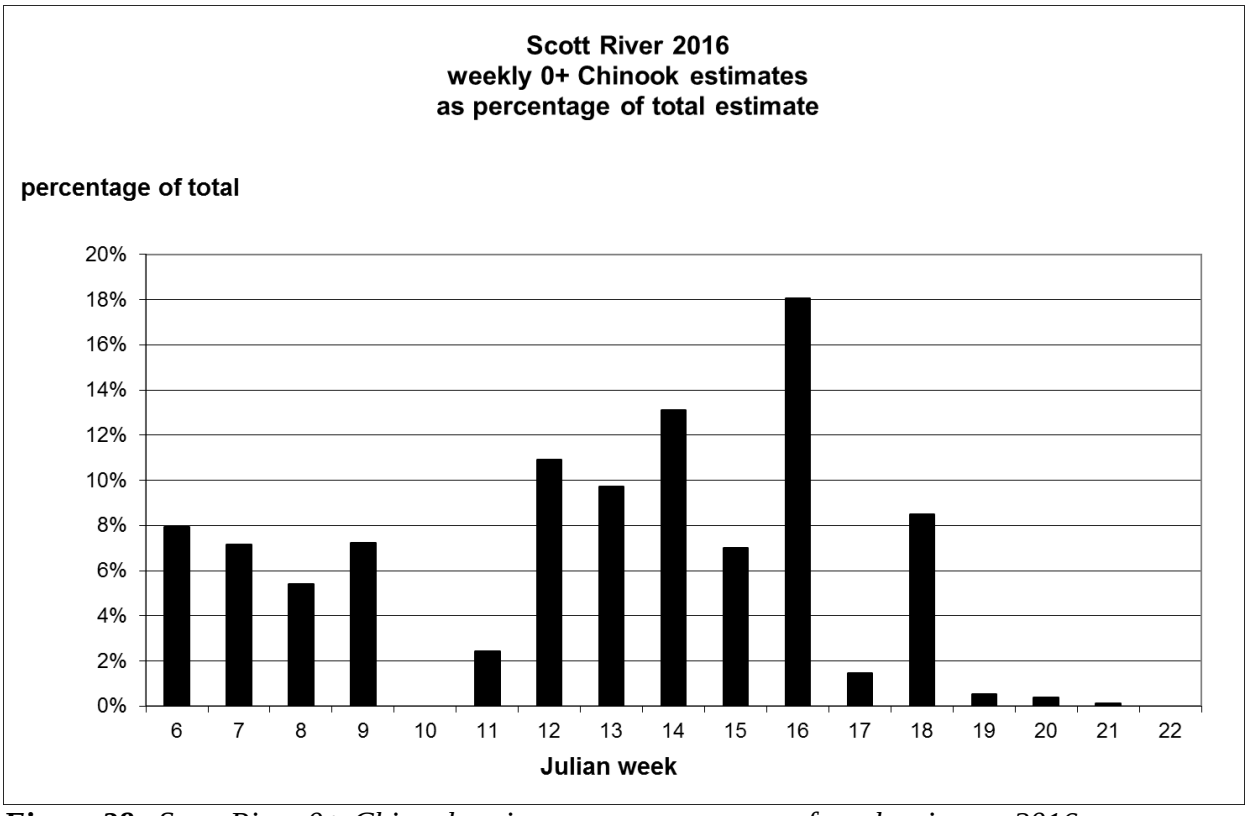

Figure 38. *Scott River 0+ Chinook estimates, as percentage of total estimate, 2016*

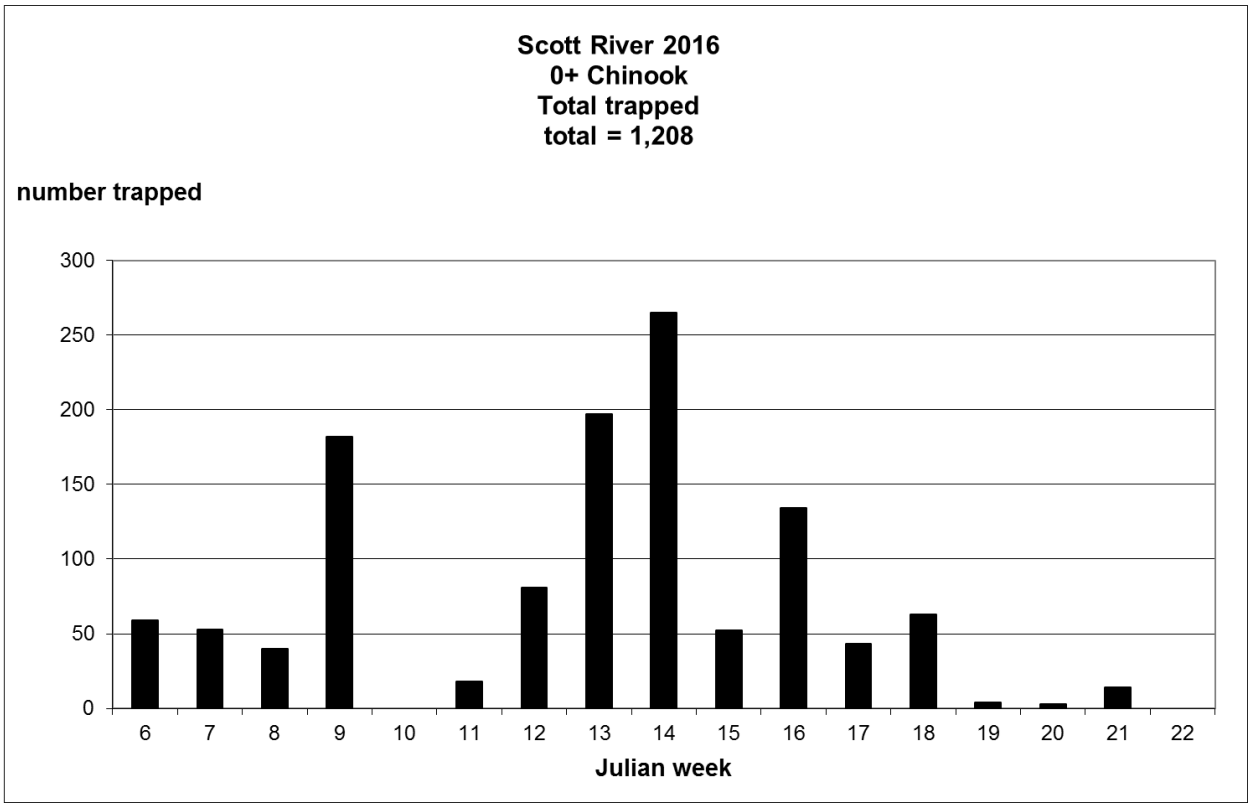

Figure 39. *Scott River 0+ Chinook total trapped, 2016*

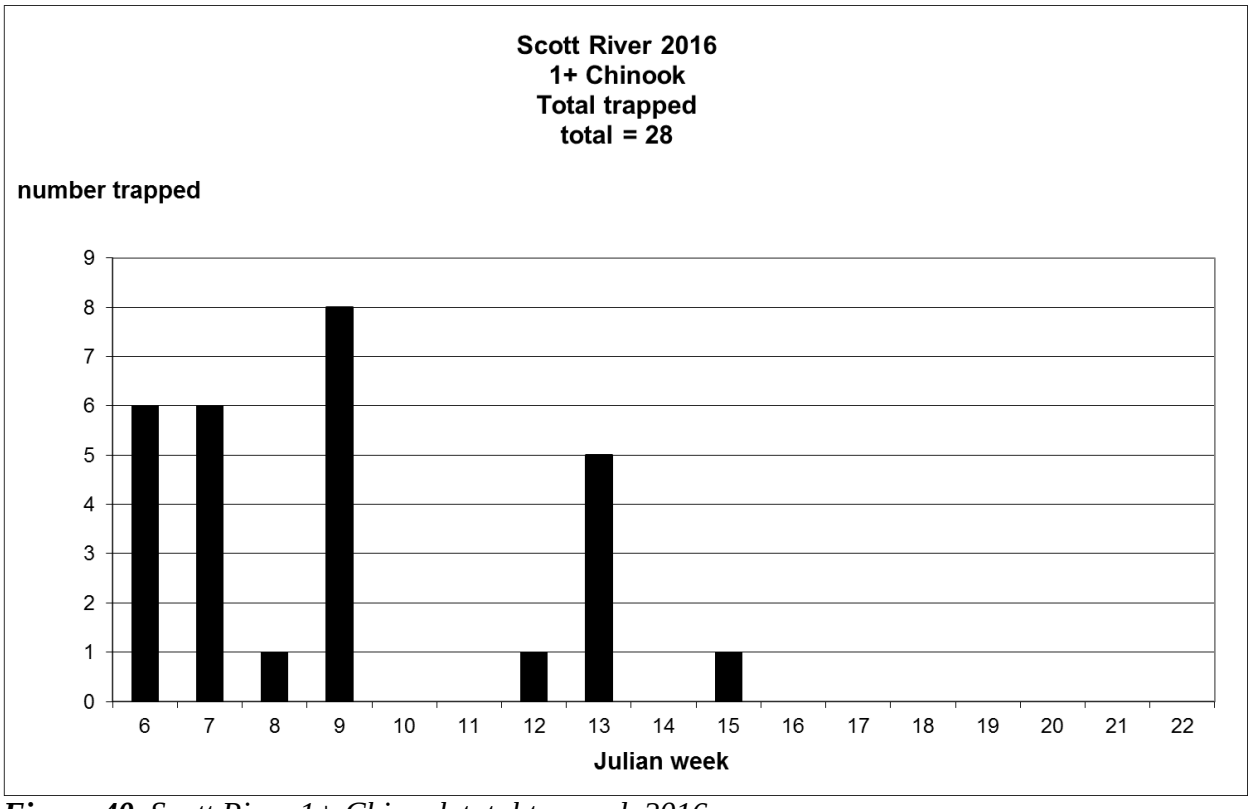

Figure 40. *Scott River 1+ Chinook total trapped, 2016*

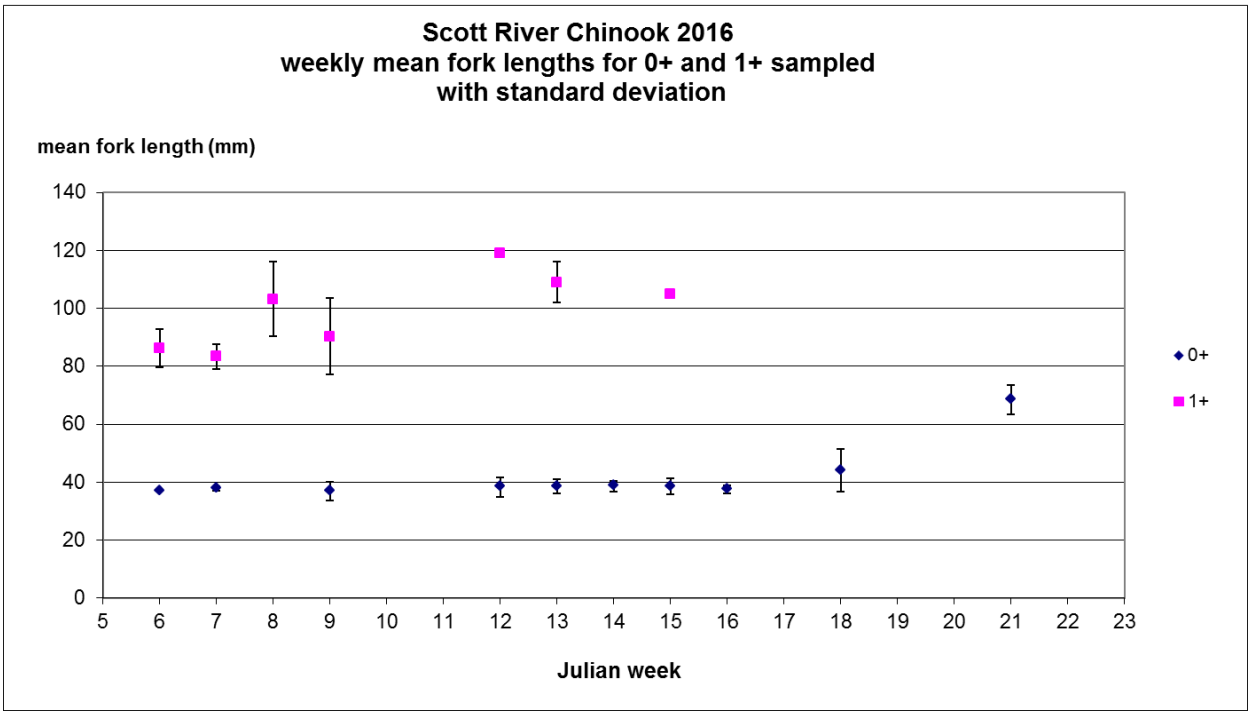

Figure 41. *Scott River 0+, 1+ chinook weekly mean fork lengths, 2016*

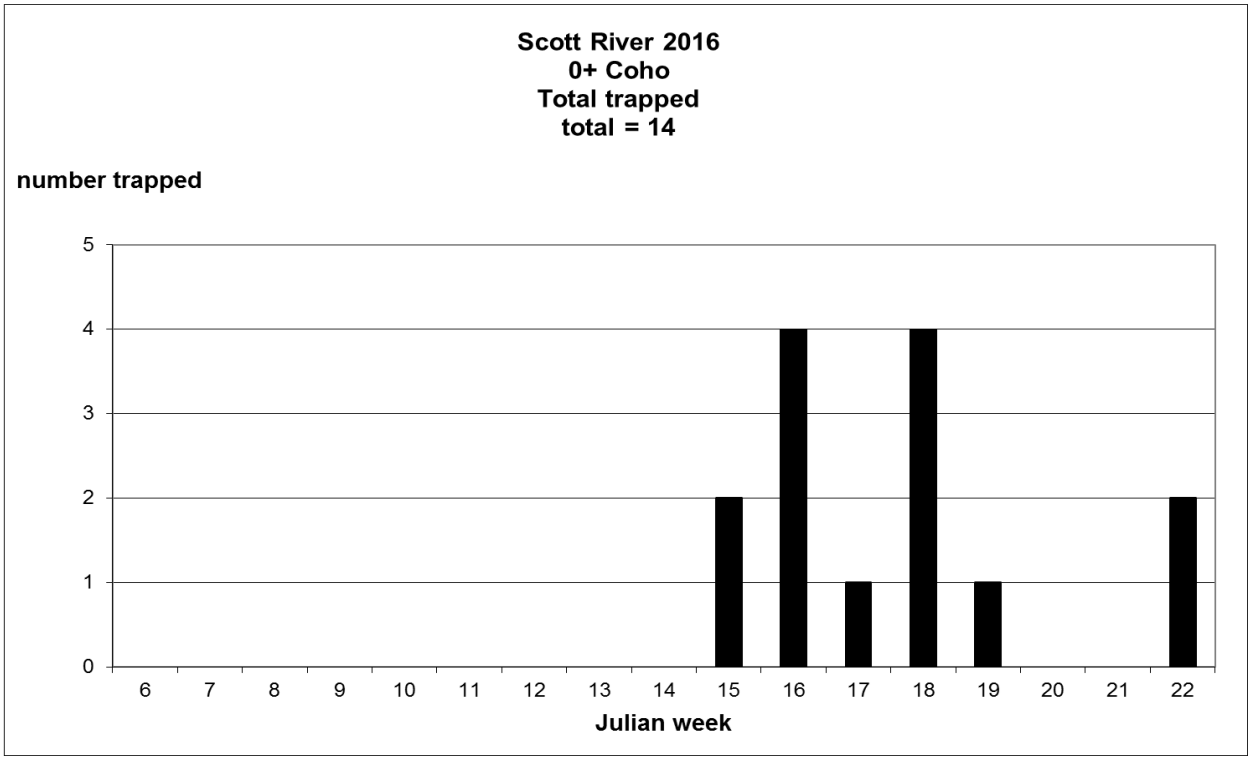

Figure 42. *Scott River 0+ coho total trapped, 2016*

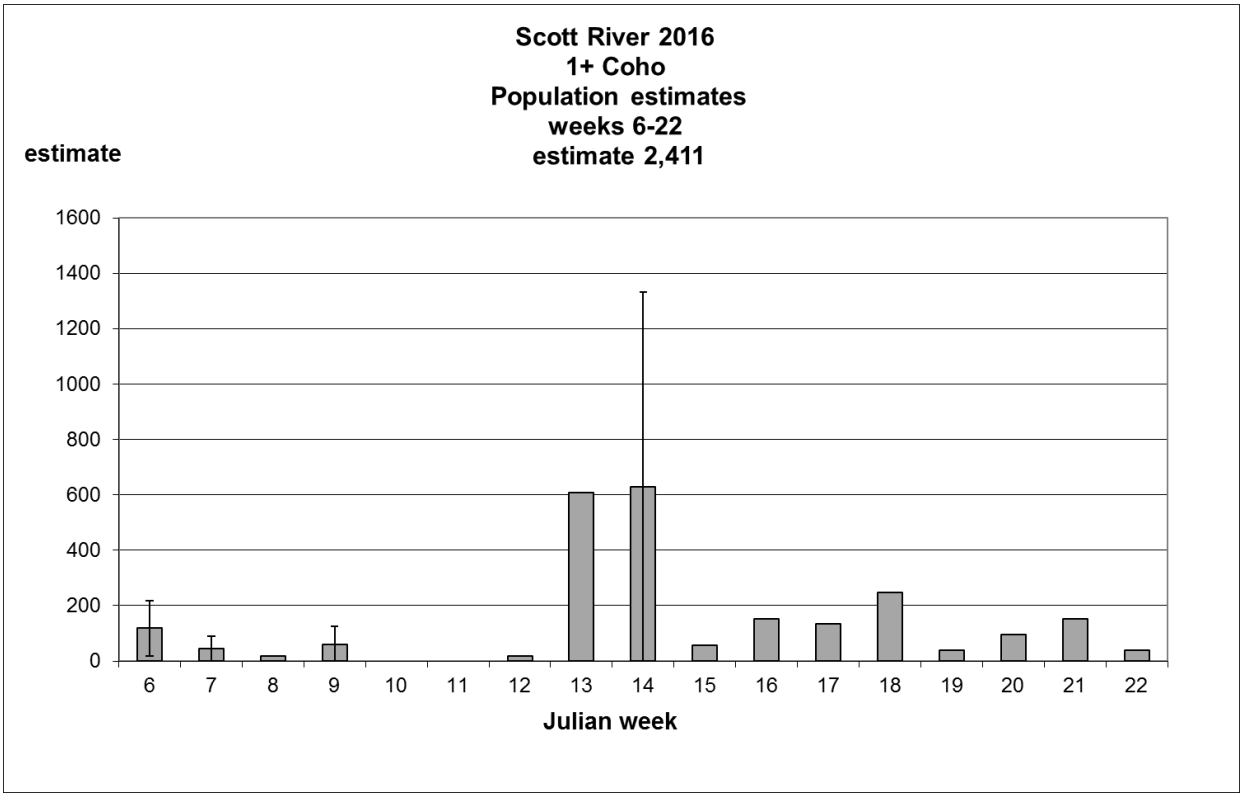

Figure 43. *Scott River 1+ coho estimates, 2016*

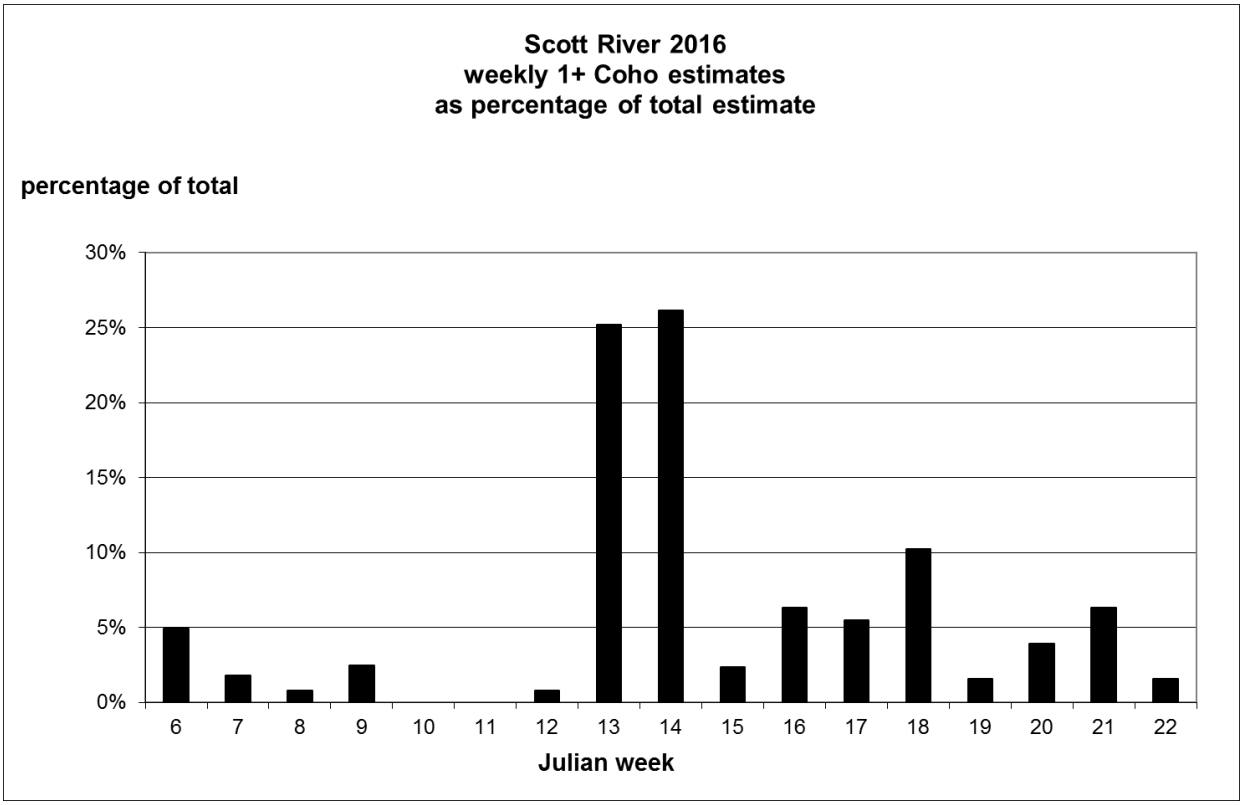

Figure 44. *Scott River 1+ coho estimates, as percentage of total estimate, 2016*

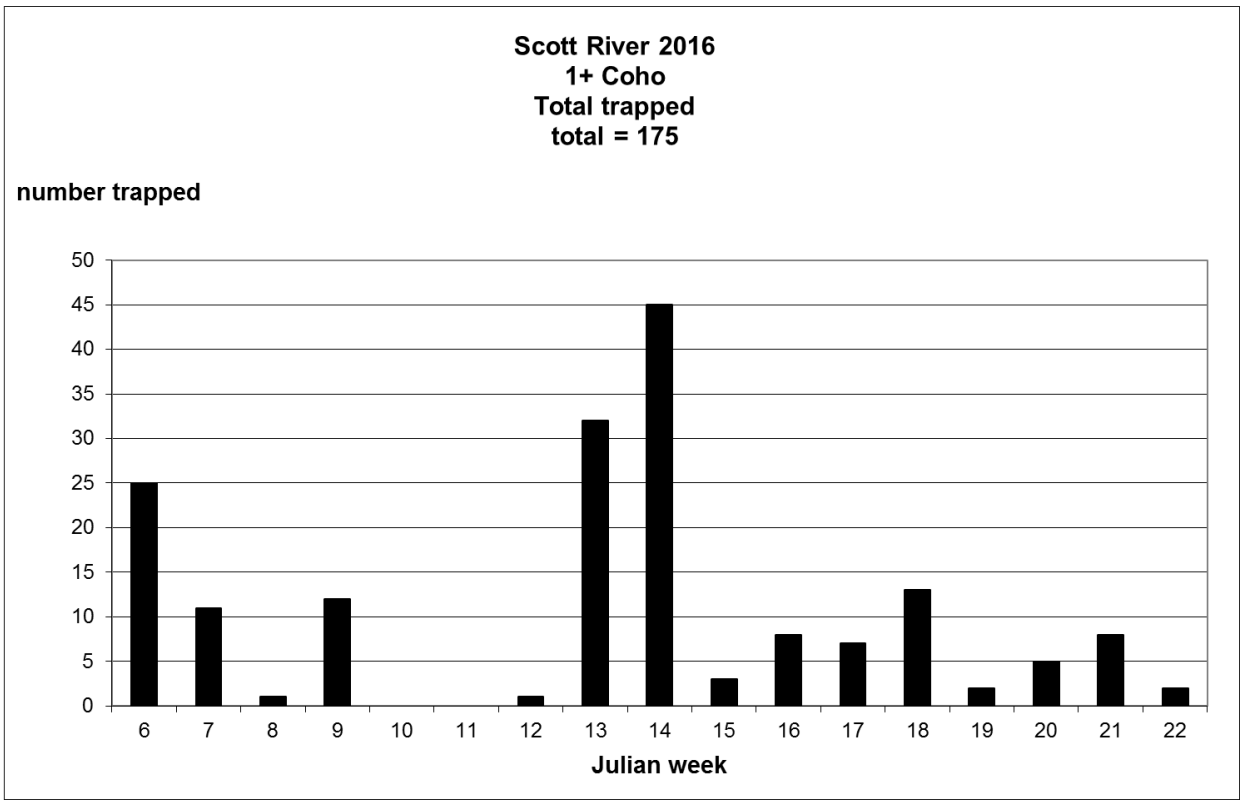

Figure 45. *Scott River 1+ coho total trapped, 2016*

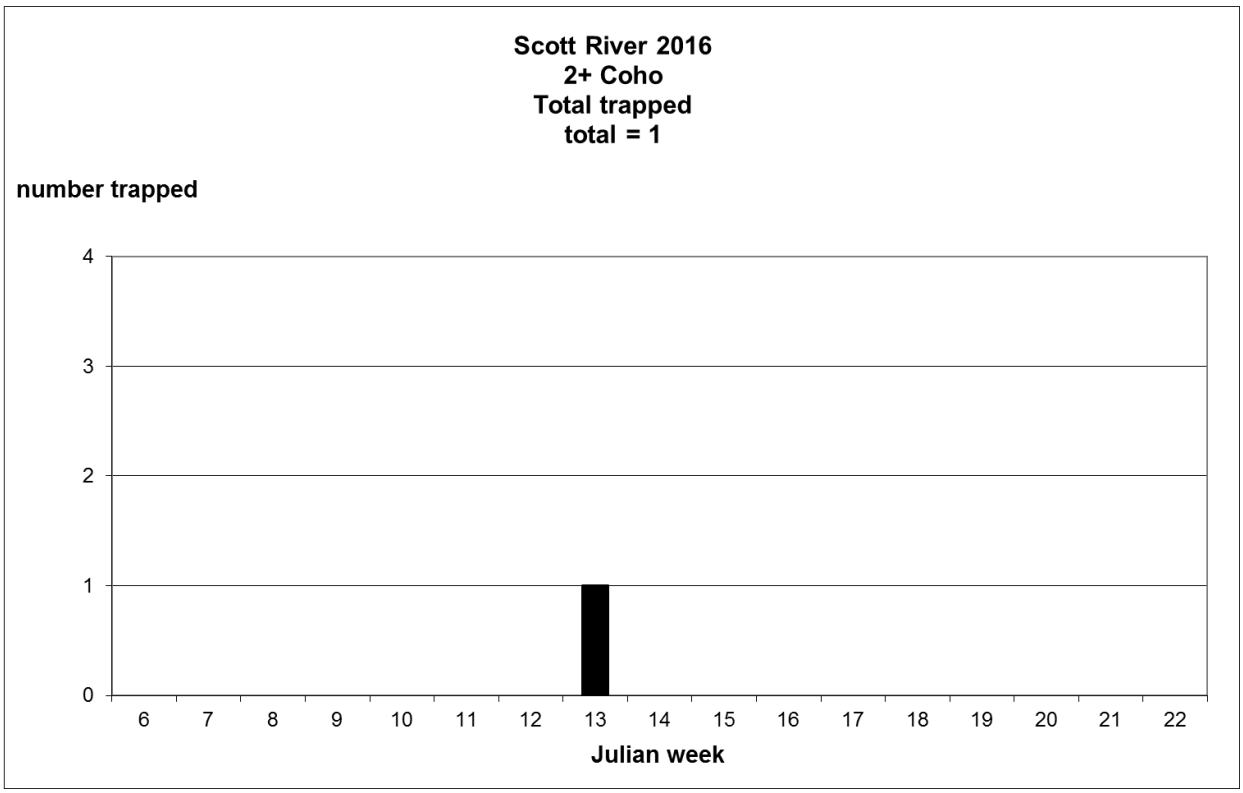

Figure 46. *Scott River 2+ coho total trapped, 2016*

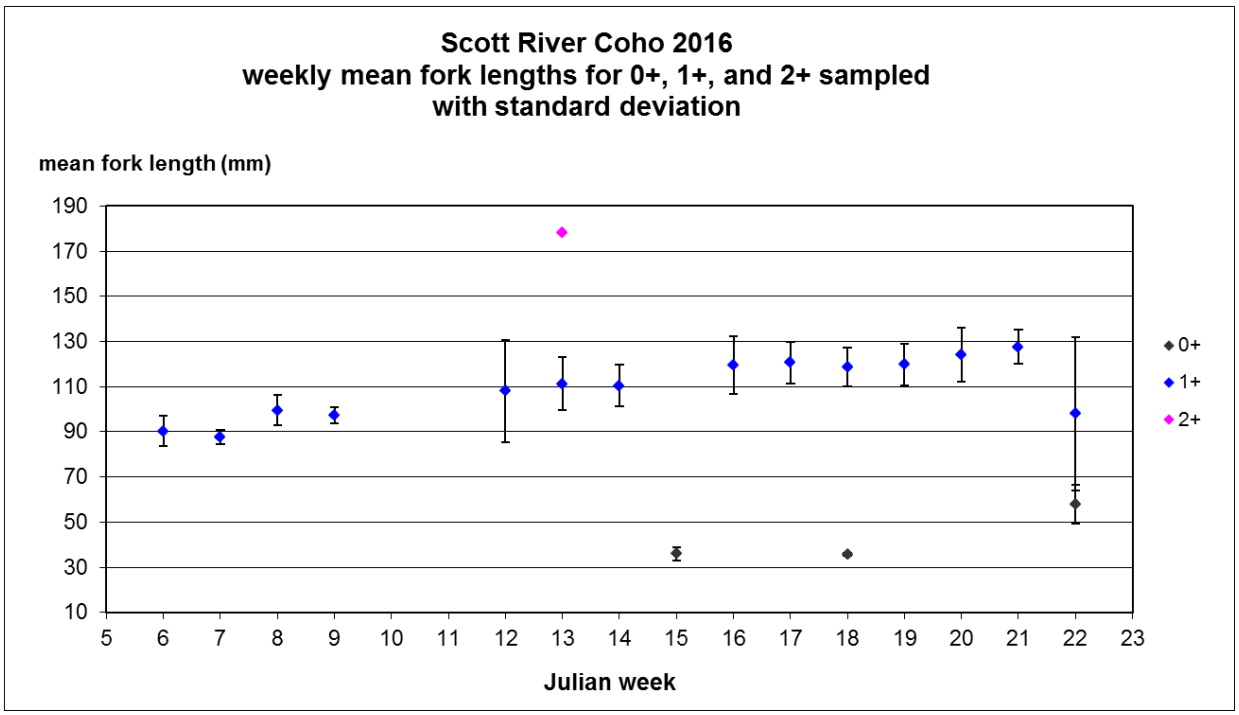

Figure 47. *Scott River 0+, 1+, 2+coho weekly mean fork lengths, 2016*

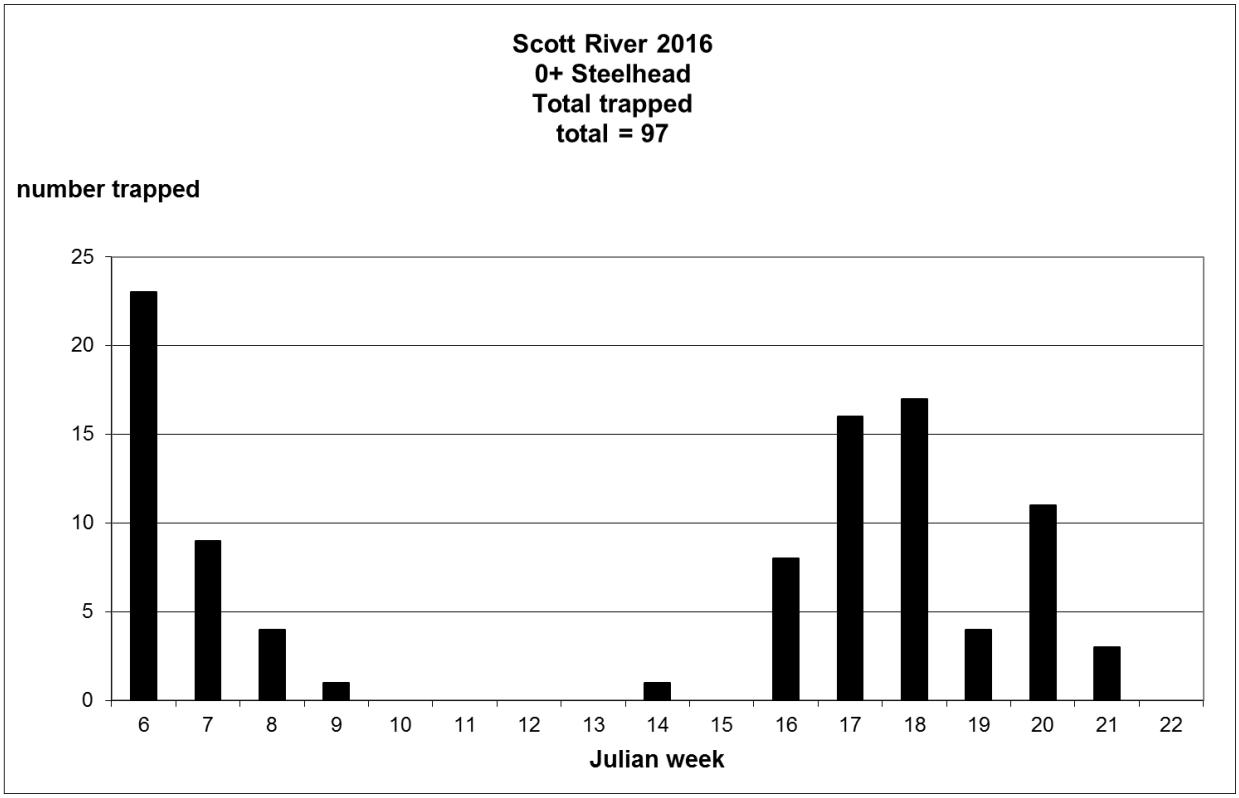

Figure 48. *Scott River 0+ steelhead total trapped, 2016*

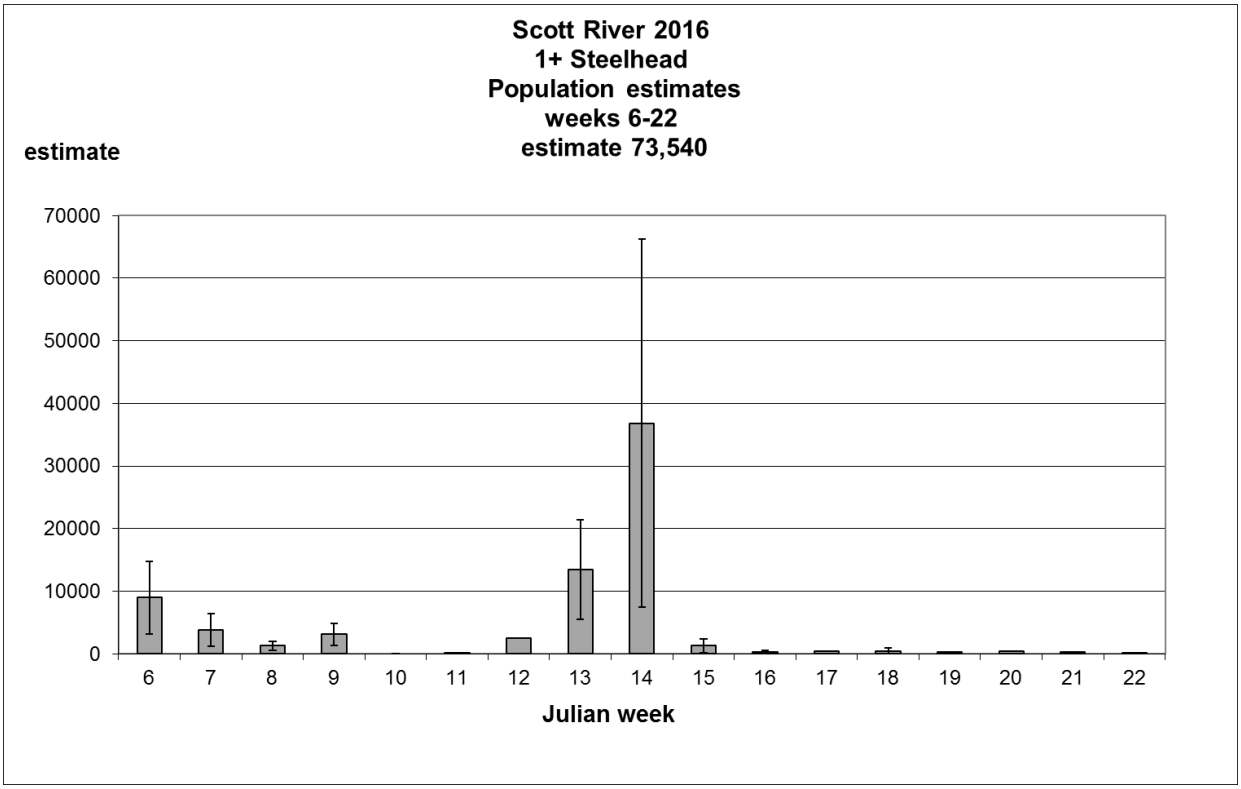

Figure 49. *Scott River 1+ steelhead estimates, 2016*

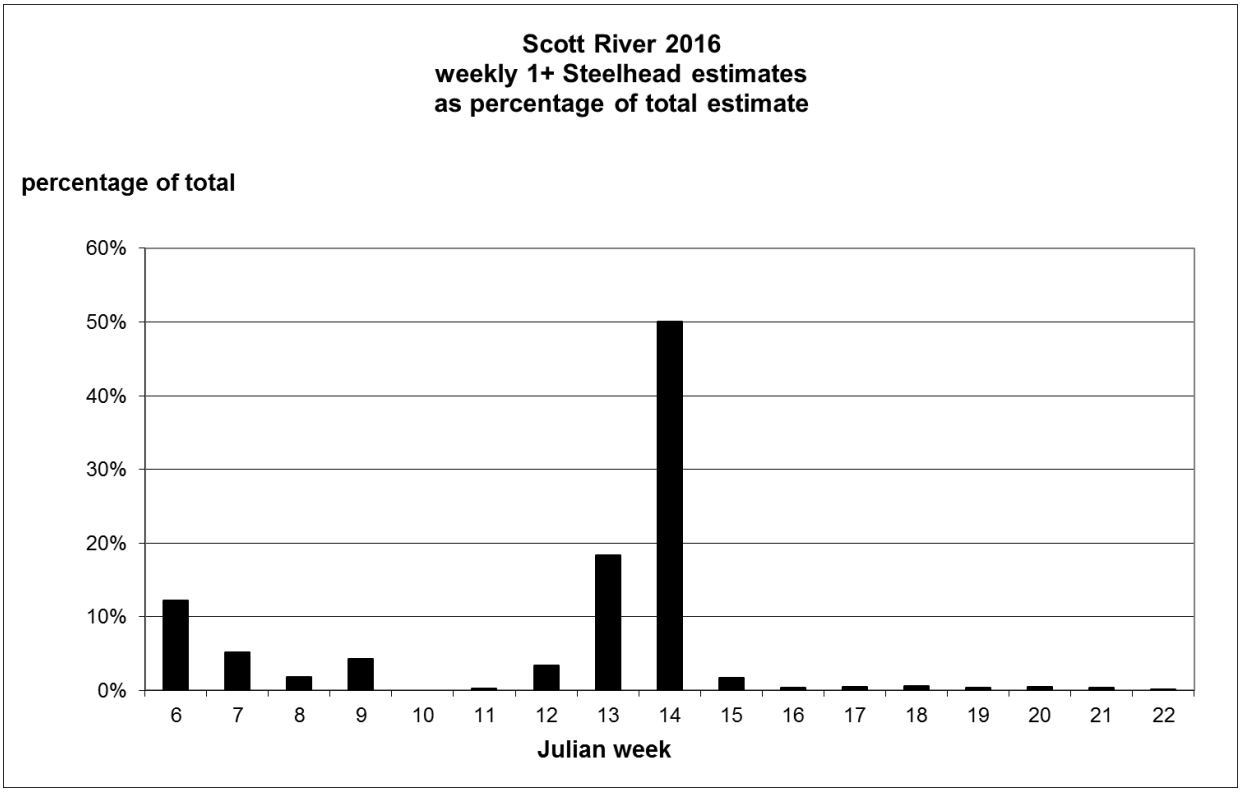

Figure 50. *Scott River 1+ steelhead estimates as percentage of total estimate, 2016*

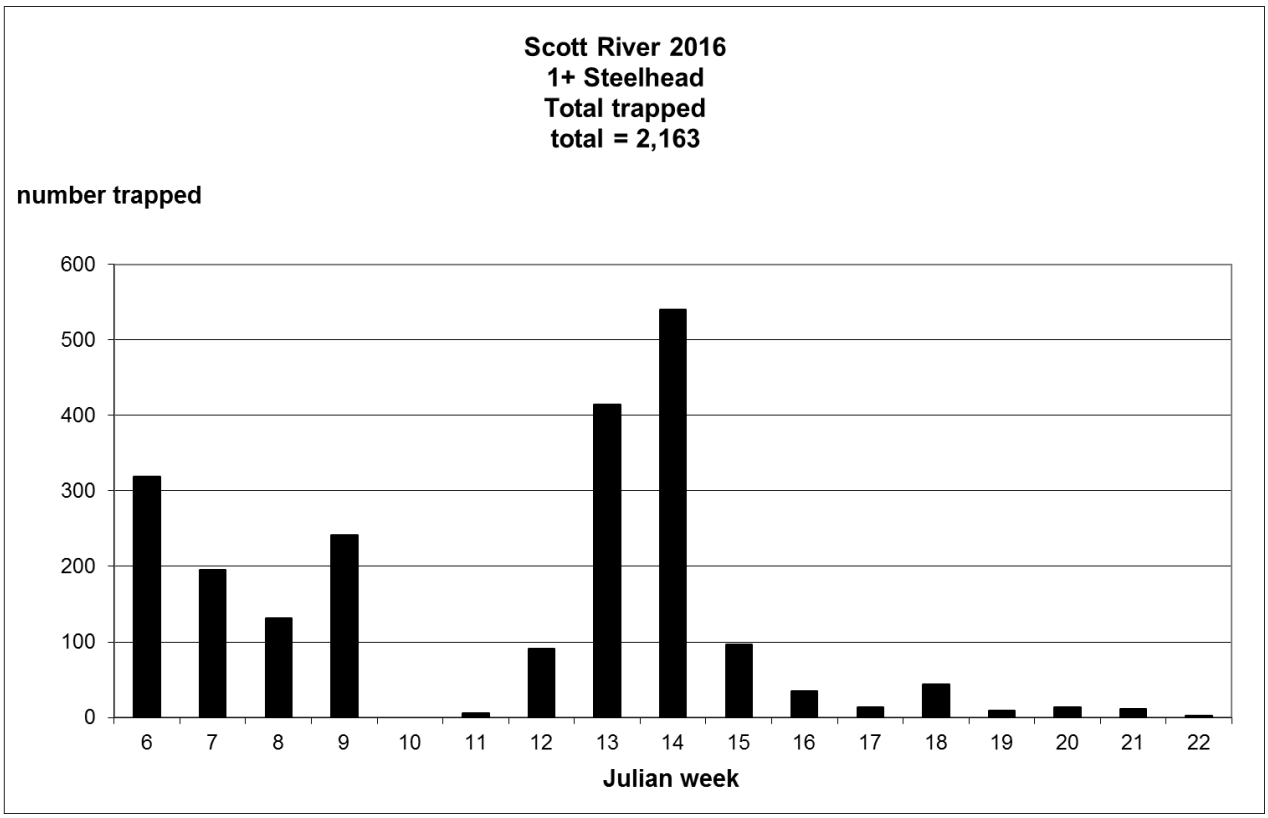

Figure 51. *Scott River 1+ steelhead total trapped, 2016*

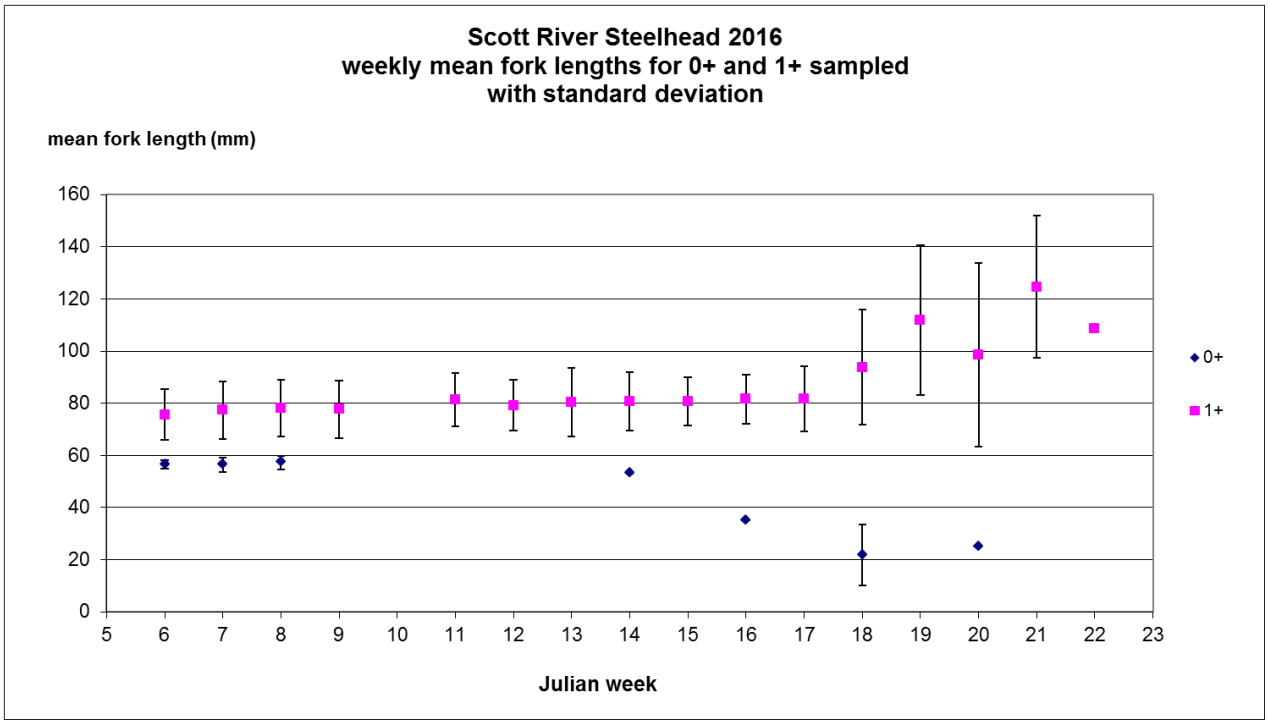

Figure 52. *Scott River 0+, 1+ steelhead weekly mean fork length, 2016*

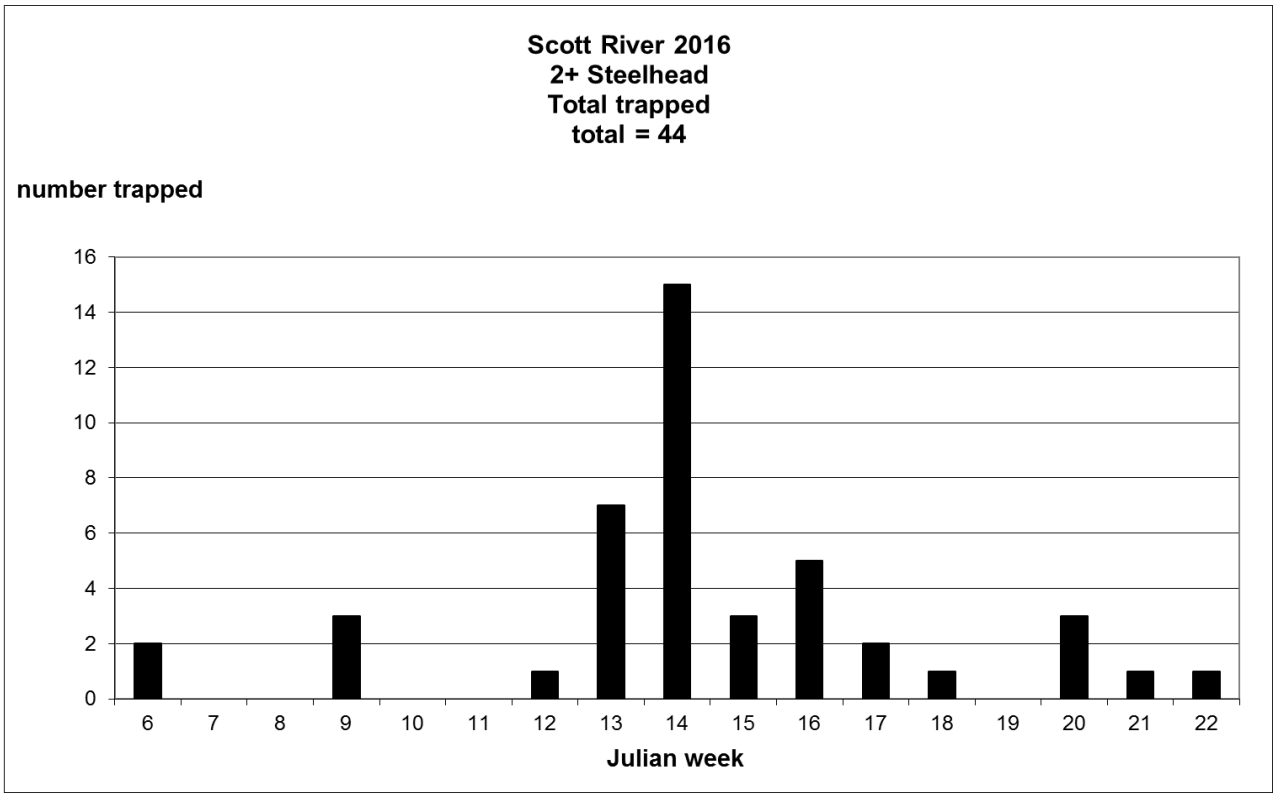

Figure 53. *Scott River 2+ steelhead total trapped, 2016*

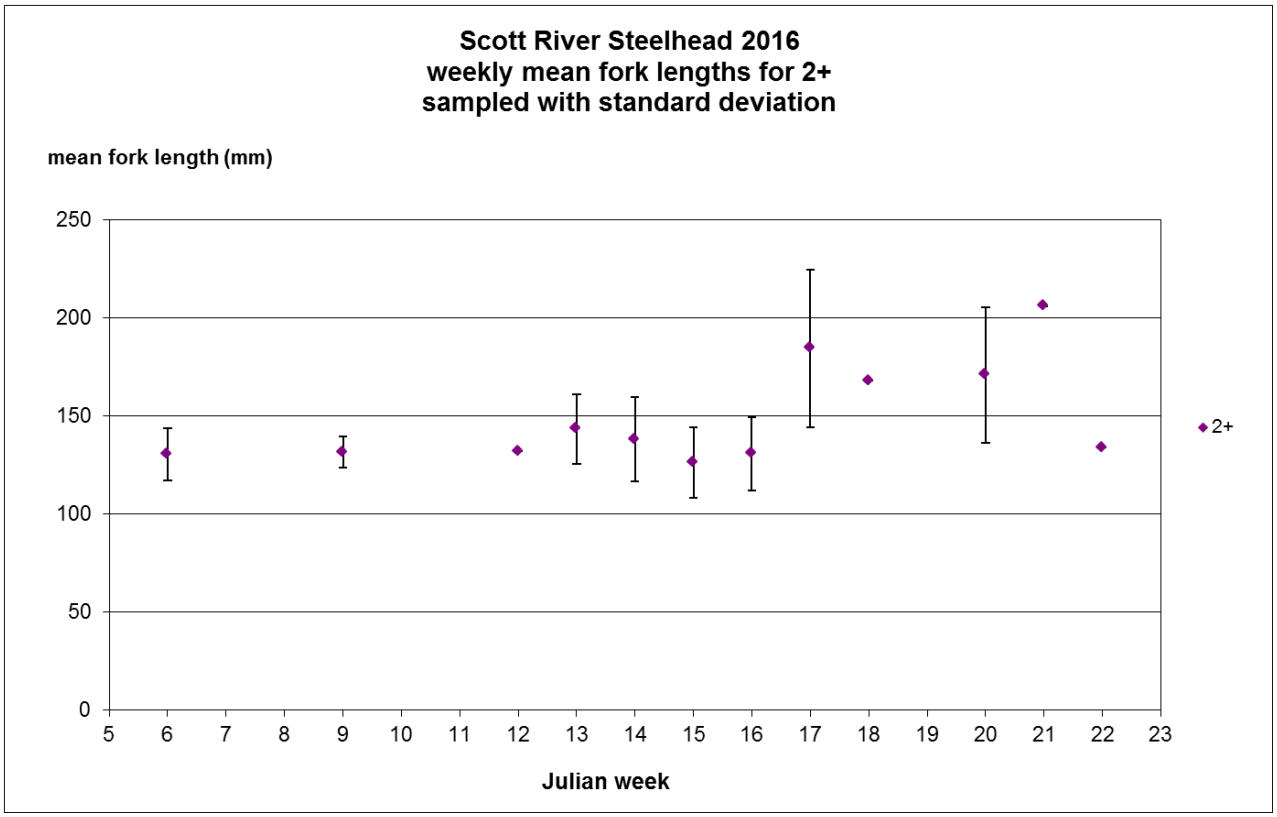

Figure 54. *Scott River 2+ steelhead weekly mean fork length, 2016*

4.2.4 Temperature Monitoring

The Maximum Weekly Maximum Temperature (maximum average of daily maximum temperatures for each week) occurred in Julian week 22 with a temperature of 17.44°C. The Maximum Weekly Average Temperature also occurred in Julian week 22 with a temperature of 15.97°C. The seasonal maximum temperature was 18.99°C occurring on June 3rd at 17:00. Hourly water temperatures were recorded from February 4th to June 3st and graphed in Figure 55.

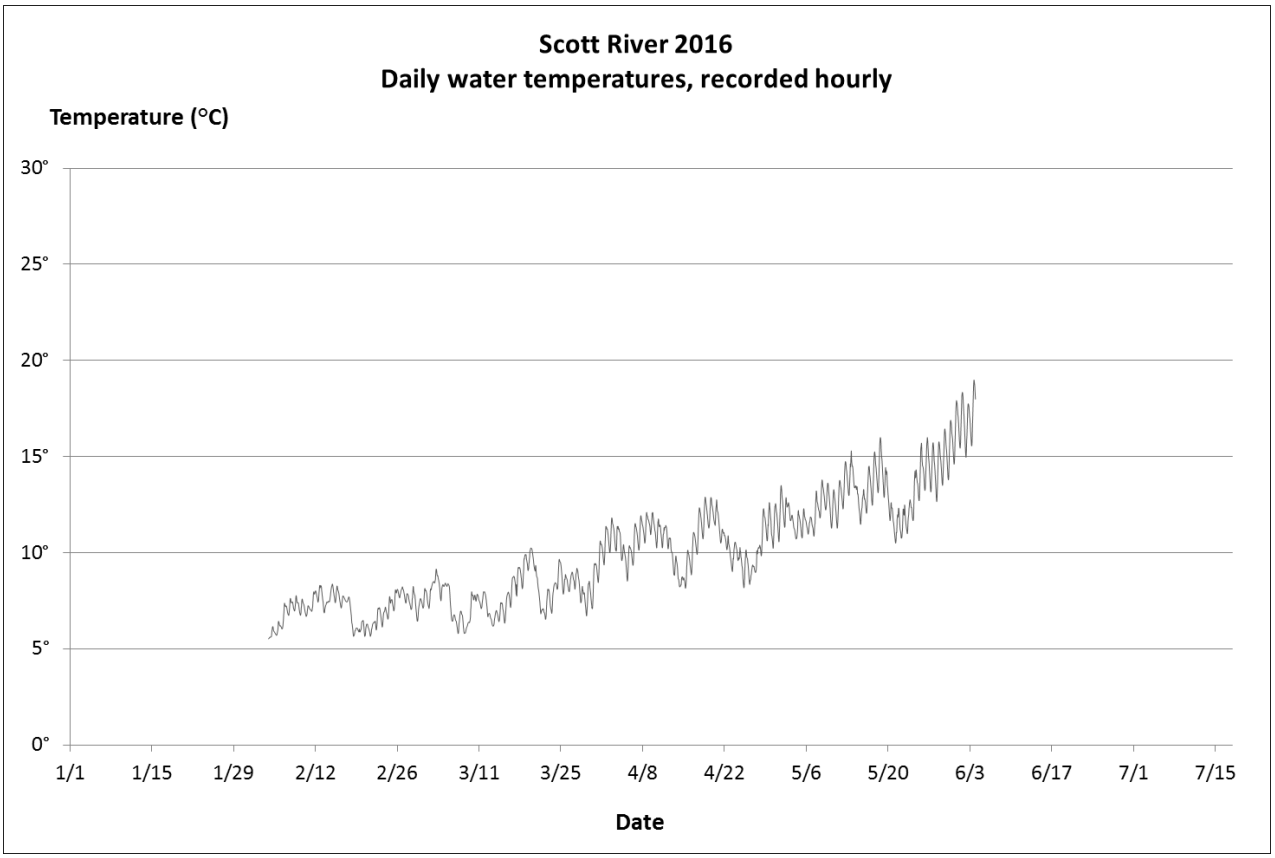

Figure 55. *Scott River 2016 daily water temperatures*

4.3.0 Discussion

4.3.1 Trap Operation

2016 is the third year an extended live car was used on the Scott River. Trapping effort on the Scott River varies greatly as the flow can fluctuate considerably. Fishing two traps in different locations creates further variability; the 8' trap is located in slower moving water on river left while the 5' trap is in swift moving water on river right. Even though the 5'trap is smaller than the 8' trap, it consistently samples more water than the 8' trap (Figure 56). There are few means to manipulate the amount of water being sampled by the traps.

When the flow increases rapidly the traps cannot be sampled due to the risk of increased fiah mortalities and the loss of equipment. When hours fished per week (Figure 57) are compared to flow, the reasons for variations in trapping effort become evident. Julian week 10 had a high flow event where the 8' and 5' traps could not fish at all. The flow reached a season high of 6,500 cfs at the USGS gauge (Table 8, Figure 58a). Julian weeks 11 and 12 continued to have high flows and the 8' trap could only fish partially during the week, while the 5' trap could not fish at all. The 5' trap could not begin fishing again until the end of Julian week 13.

Due to unrepairable damage to the 8' trap "A" frame, the trap was permanently raised and lowered downstream in Julian week 17, the last fished day was April 27, 2016. The 5' trap was moved downstream that same day from its position on river right, to the previous location of the 8' trap on river left. Newly positioned, it fished in that location until the end of the season. The early removal of the 8' trap from the Scott River reduced our efficiencies for all age-classes.

Similar to the past two years, decreasing flows (Figure 58b) forced the removal of the 5' trap prematurely. The 5' trap ceased operation on June 3rd, at the end of Julian week 22.

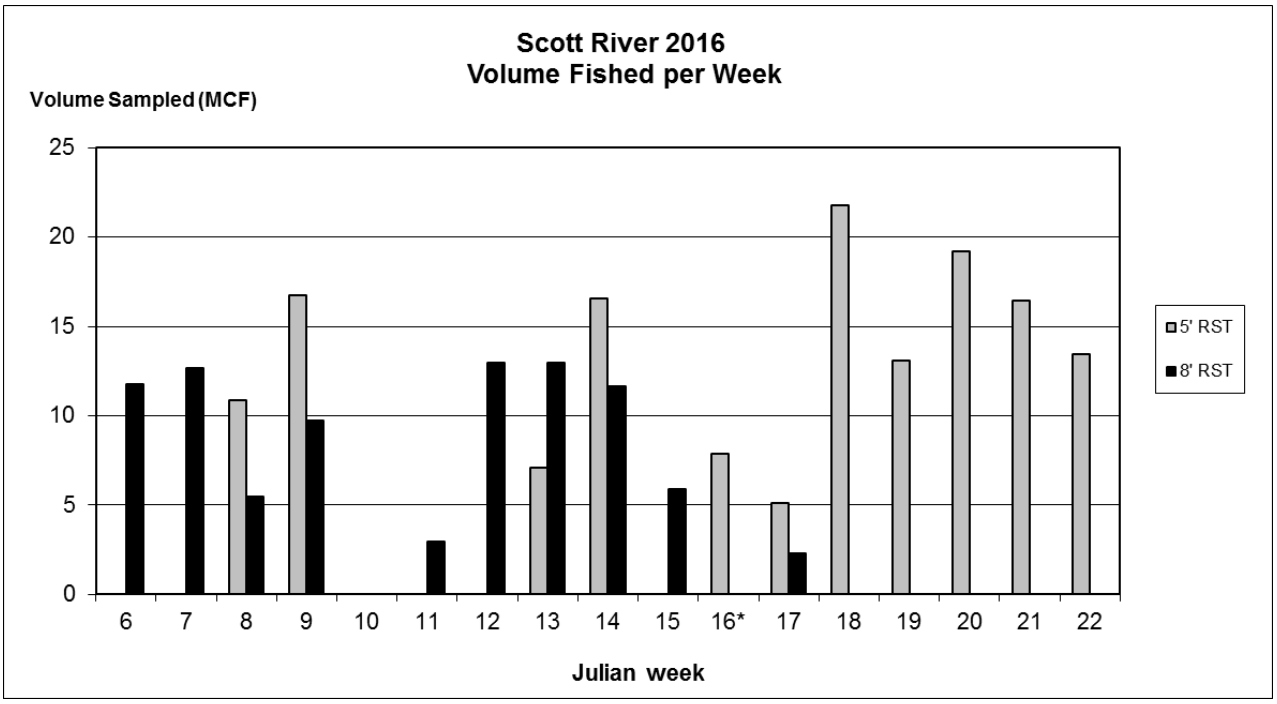

Figure 56. *Scott River 2016 volume fished per week (Asterisk indicates week when flow meter malfunctioned on 8' trap)*

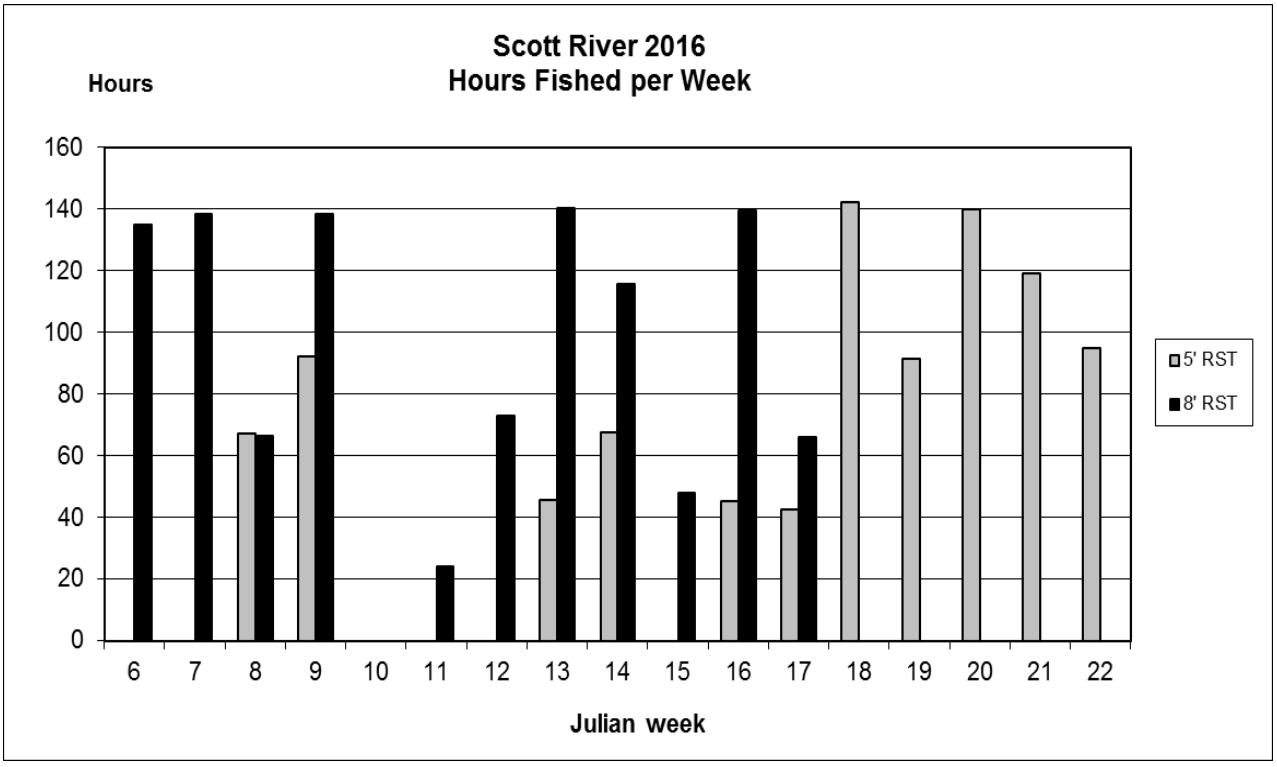

Figure 57. *Scott River 2016 hours fished per week*

4.3.2 Flow

Scott River flow was consistently above the fifteen year average throughout the season (Table 9), excluding June which was below the monthly average. The flow peaked during Julian week 10 with a maximum of 6500 cfs on March 6th at 19:00. The flow was lowest during Julian week 26 on June 3th at 11:15 (528 cfs) (Table 8).

Table 8: 2016 Scott River Average Flow Data by Julian Week

Julian Week	Minimum	Average	Maximum
6	1020	1108	1320
7	1160	1496	2960
8	1060	1427	2240
9	1060	1280	1610
10	1460	3373	6500
11	1900	2711	3730
12	1810	2237	2960
13	1290	1521	1830
14	1160	2177	6300
15	1290	2116	4500
16	1290	1460	1840
17	952	1236	1780
18	883	1024	1320
19	1140	1359	1600
20	854	1003	1280
21	603	685	854
22	528	560	599

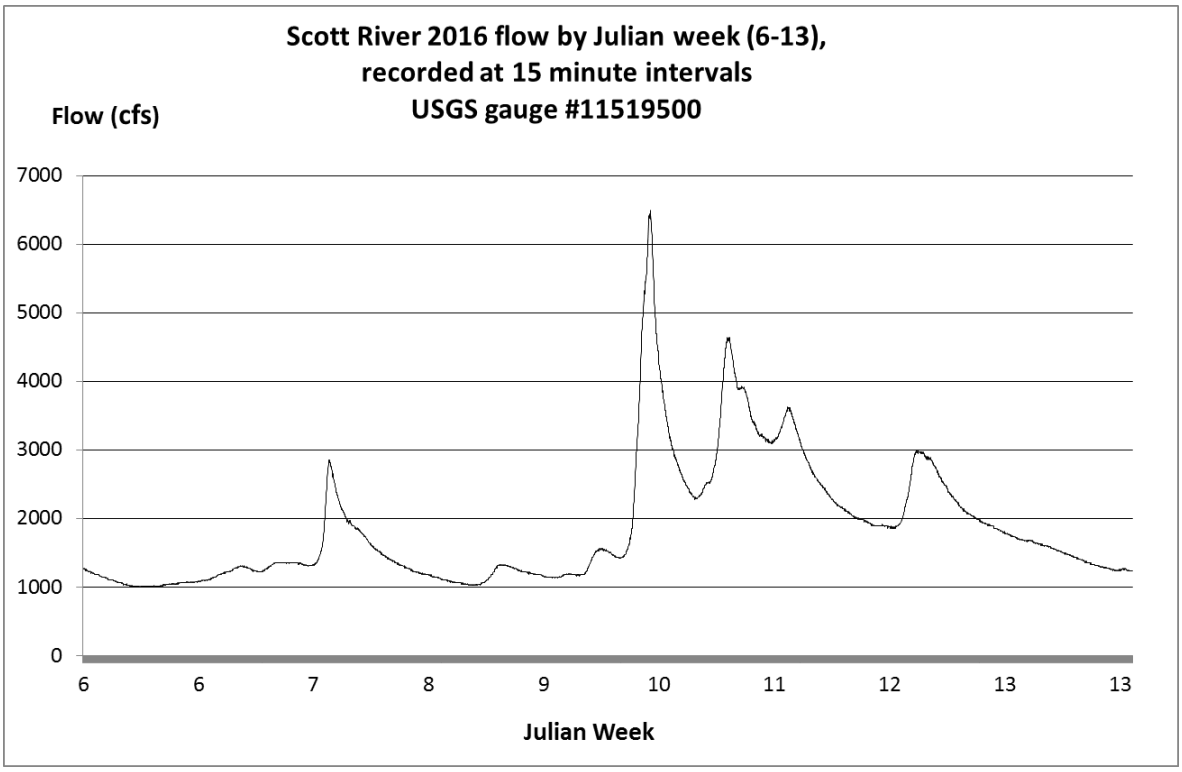

Figure 58a. *Scott River 2016 flow by Julian Week (6-13)*

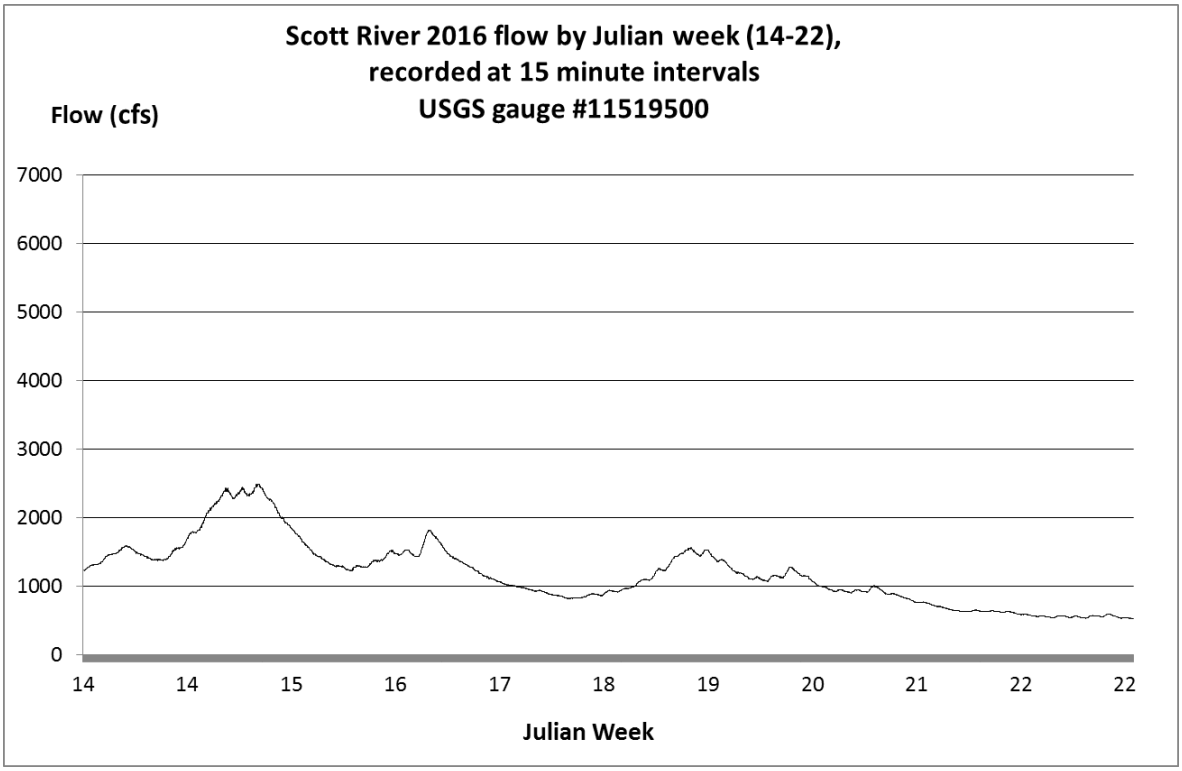

Figure 58b. *Scott River 2016 flow by Julian Week (14-22)*

Table 9: Scott River 2001 – 2016 Average Monthly Flow

YEAR	2001 - 2016 Scott River Flow Data During Months Sampled				
	Feb	Mar	Apr	May	Jun
2001	127	386	276	401	50
2002	644	570	1018	707	395
2003	4406	1200	1199	1502	1047
2004	1082	1185	1050	969	412
2005	492	549	649	1453	656
2006	2343	1101	1360	2344	1155
2007	524	1074	634	539	142
2008	497	749	657	1459	568
2009	287	613	497	929	309
2010	437	529	863	1123	1617
2011	529	1168	1452	1204	1580
2012	293	789	1630	1134	410
2013	365	552	788	500	129
2014	488	845	310	131	44
2015	2235	582	253	157	80
2016	1341	2331	1511	937	307
2001 - 2016 Average	**1006**	**889**	**884**	**968**	**556**
2016 Percent of Average	**133%**	**262%**	**171%**	**97%**	**55%**

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 previously. 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 using the seasonal trap efficiency.

Annual estimation of 1+ and 2+ steelhead began in 2004 with the development of age length cutoffs (Appendix 34). 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 2016 were compared with the data from the previous fifteen years of sampling (Figure 59, Table 10). The estimate of 56,634 for 2016 was found to be well below the average catch over sixteen years.

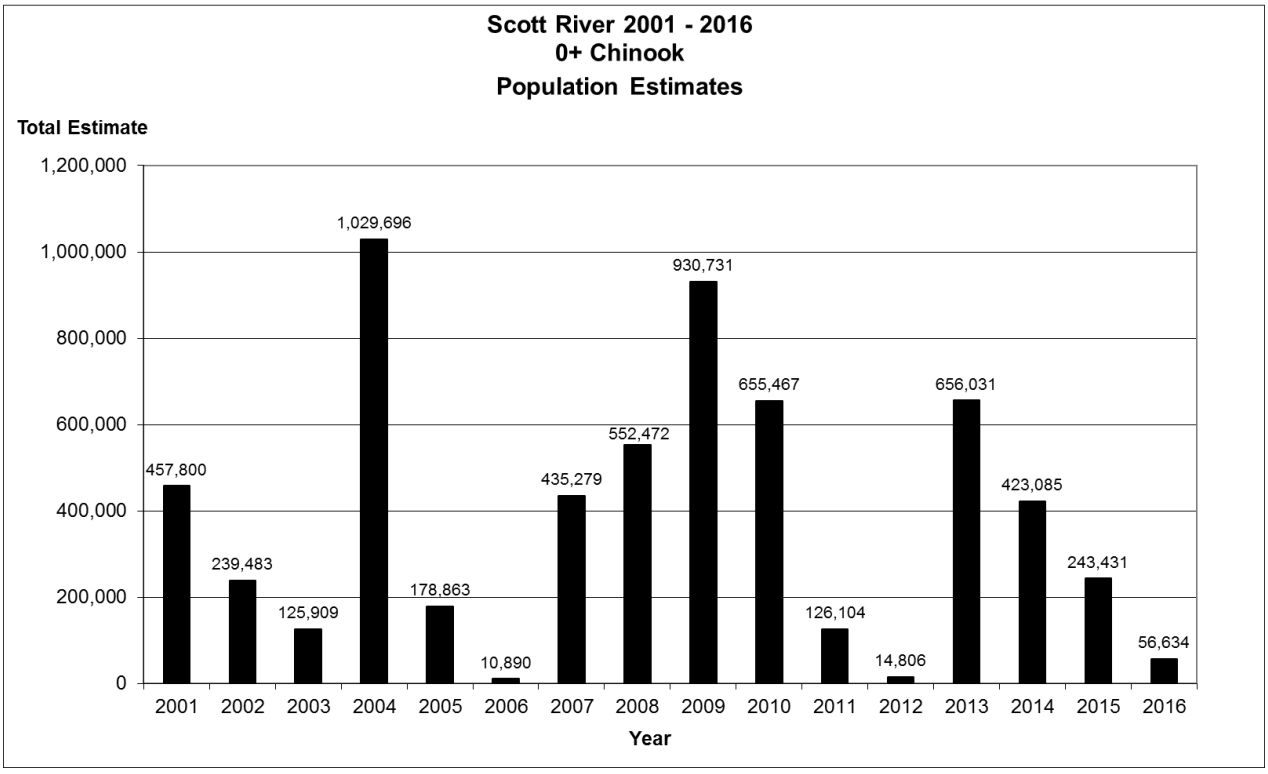

Figure 59. *Scott River 2001-2016 0+ Chinook population estimates*

Table 10: Scott River 2001 - 2016 Weekly Population Estimates for 0+ Chinook Salmon

Julian Week	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Multi-year
6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	24	4,504	**2,264**
7	-----	-----	-----	5,481	-----	-----	454	242	-----	1,111	22	37	4,354	1	789	4,046	**1,654**
8	-----	-----	-----	-----	-----	-----	1,661	150	456	1,869	2,573	97	2,419	120	4,248	3,053	**1,664**
9	-----	-----	-----	12,739	-----	-----	710	3,477	-----	11,270	6,699	152	23,719	3,679	1,855	4,095	**6,839**
10	-----	-----	-----	47,188	2,027	936	5,293	32,328	394	17,331	9,560	93	19,420	97	7,239	-----	**11,826**
11	6,206	-----	-----	83,499	9,898	54	418	10,634	8,892	60,754	1,140	158	28,493	321	23,134	1,374	**16,784**
12	23,734	-----	-----	89,822	12,142	88	13,422	12,371	27,839	40,399	4,671	95	15,972	7,747	18,476	6,183	**19,497**
13	4,871	-----	-----	137,491	3,936	52	10,690	30,274	74,382	57,542	15,703	182	26,989	36,908	5,966	5,516	**29,322**
14	16,111	35,654	-----	105,677	21,349	58	10,594	37,632	88,192	33,123	16,474	135	780	92,256	5,783	7,420	**31,416**
15	27,991	14,961	15,164	92,404	14,631	32	26,439	79,632	173,797	69,870	17,370	270	20,932	35,840	6,014	3,969	**37,457**
16	71,627	24,864	16,113	41,057	7,370	64	58,945	14,303	275,700	76,337	8,415	524	27,461	26,415	8,936	10,229	**41,773**
17	56,980	20,868	3,638	26,080	4,316	-----	12,274	32,757	82,772	37,065	13,175	28	12,868	57,357	24,991	839	**25,734**
18	48,857	32,824	-----	9,860	3,060	4	14,088	35,167	51,991	14,985	7,899	592	28,158	25,560	21,413	4,809	**19,951**
19	17,888	3,852	-----	16,935	3,987	53	5,154	20,304	-----	79,256	4,276	283	29,730	27,909	21,255	305	**16,513**
20	10,236	5,192	-----	7,739	4,171	-----	12,732	5,197	37,849	45,904	4,902	162	24,580	25,379	21,181	229	**14,675**
21	143,777	3,680	-----	4,661	3,187	16	14,795	29,825	42,249	24,727	2,157	138	13,969	40,896	9,121	63	**22,217**
22	29,522	3,241	-----	5,650	6,006	24	3,838	52,534	12,252	16,036	1,130	110	43,476	23,764	14,850	0	**14,162**
23	-----	31,065	-----	15,028	10,498	-----	22,321	32,651	6,014	0	368	353	93,991	9,402	26,077	---	**20,647**
24	-----	63,282	-----	44,100	3,894	16	51,526	33,061	11,171	19,194	7	968	188,464	7,439	17,464	---	**33,891**
25	-----	-----	-----	230,377	2,436	19	117,746	36,622	20,068	28,713	3,763	4,610	32,026	1,551	4,346	---	**40,190**
26	-----	-----	14,050	50,803	16,578	2,624	52,180	53,310	16,714	19,980	5,800	5,819	18,230	446	271	---	**19,754**
27	-----	-----	34,802	3,107	42,808	4,961	-----	-----	-----	-----	-----	-----	-----	-----	-----	---	**21,419**
28	-----	-----	42,142	-----	6,592	1,889	-----	-----	-----	-----	-----	-----	-----	-----	-----	---	**16,874**
TOTAL	**457,800**	**239,483**	**125,909**	**1,029,696**	**178,885**	**10,890**	**435,279**	**552,472**	**930,731**	**655,467**	**126,104**	**14,806**	**656,031**	**423,085**	**243,431**	**56,634**	**383,544**

4.3.5 Coho

Both yearly and weekly estimates of the number of 1+ coho salmon produced from the Scott River for 2016 were compared with the data from the previous thirteen years of sampling (Figure 60, Table 11). The estimate of 2,411 for 2016 was found to be the fourth lowest in the fourteen years of 1+ coho population estimates.

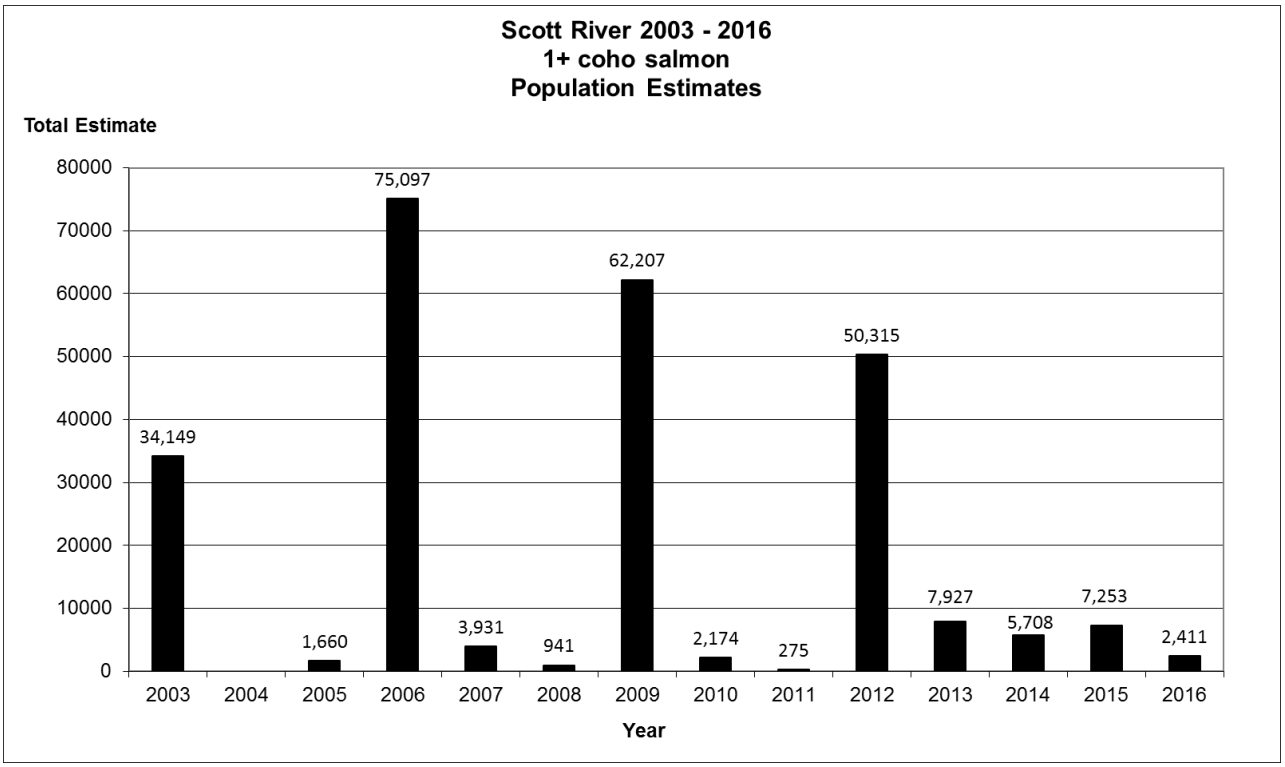

Figure 60. *Scott River 2003-2016 1+ coho population estimates*

Table 11: Scott River 2003 – 2016 Weekly Population Estimates for 1+ Coho Salmon

Julian Week	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Multi-year
6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	119	60
7	-----	-----	6	-----	-----	11	476	24	2	1,773	7	7	1,280	44	363
8	-----	-----	10	329	-----	10	1,558	24	2	2,396	18	1,040	1,570	19	634
9	489	-----	27	558	-----	5	4,805	71	3	370	26	1,216	1,386	60	751
10	272	-----	43	277	-----	-----	13,029	71	3	1,692	46	27	180	-----	1,564
11	2,367	-----	162	1,230	-----	37	12,939	82	2	2,104	18	144	181	0	1,606
12	10,136	-----	61	1,028	-----	28	6,510	47	2	2,472	38	925	103	19	1,781
13	1,677	-----	91	2,914	-----	55	6,252	12	2	1,827	16	210	292	608	1,163
14	3,600	-----	294	1,815	-----	179	2,866	106	----	2,465	5	72	208	630	1,113
15	4,068	-----	268	2,166	-----	109	4,976	223	2	4,500	300	357	481	57	1,459
16	1,338	-----	148	6,131	-----	150	4,389	176	3	6,275	374	338	333	152	1,651
17	1,261	-----	181	6,107	-----	108	2,261	223	38	1	1,624	294	455	133	1,057
18	771	-----	200	5,437	-----	158	1,553	71	17	541	421	570	297	247	857
19	506	-----	48	9,935	-----	5	-----	447	70	8,457	2,750	286	449	38	2,090
20	3,967	-----	100	4,148	-----	16	437	270	21	1,120	775	188	20	95	930
21	800	-----	-----	7,436	-----	-----	48	71	84	2,822	935	31	14	152	1,239
22	1,613	-----	21	16,486	-----	36	68	259	22	7,168	486	5	2	38	2,184
23	961	-----	-----	2,548	-----	17	47	0	2	851	65	-----	---	---	561
24	312	-----	-----	3,538	-----	17	5	0	-----	3,080	21	-----	---	---	996
25	11	-----	-----	1,875	-----	2	-----	0	-----	330	-----	-----	---	---	444
26	-----	-----	-----	1,072	-----	-----	-----	0	-----	72	-----	-----	---	---	381
27	-----	-----	-----	66	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	66
28	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
TOTAL	**34,149**	**0**	**1,660**	**75,097**	**3,931**	**941**	**62,220**	**2,174**	**275**	**50,315**	**7,927**	**5,708**	**7,253**	**2,411**	**18,147**

4.3.6 Steelhead

Both yearly and weekly total trapped numbers of 2+ steelhead trout produced from the Scott River for 2016 were compared with the data from the previous twelve years of sampling (Figure 61, Table 12). Sampling for 2016 did not produce any recaptures in our marked trials, so total trapped for the season is reported with the previous year's estimates. The total of 44 for 2016 was found to be the lowest in the thirteen years of 2+ steelhead population estimates.

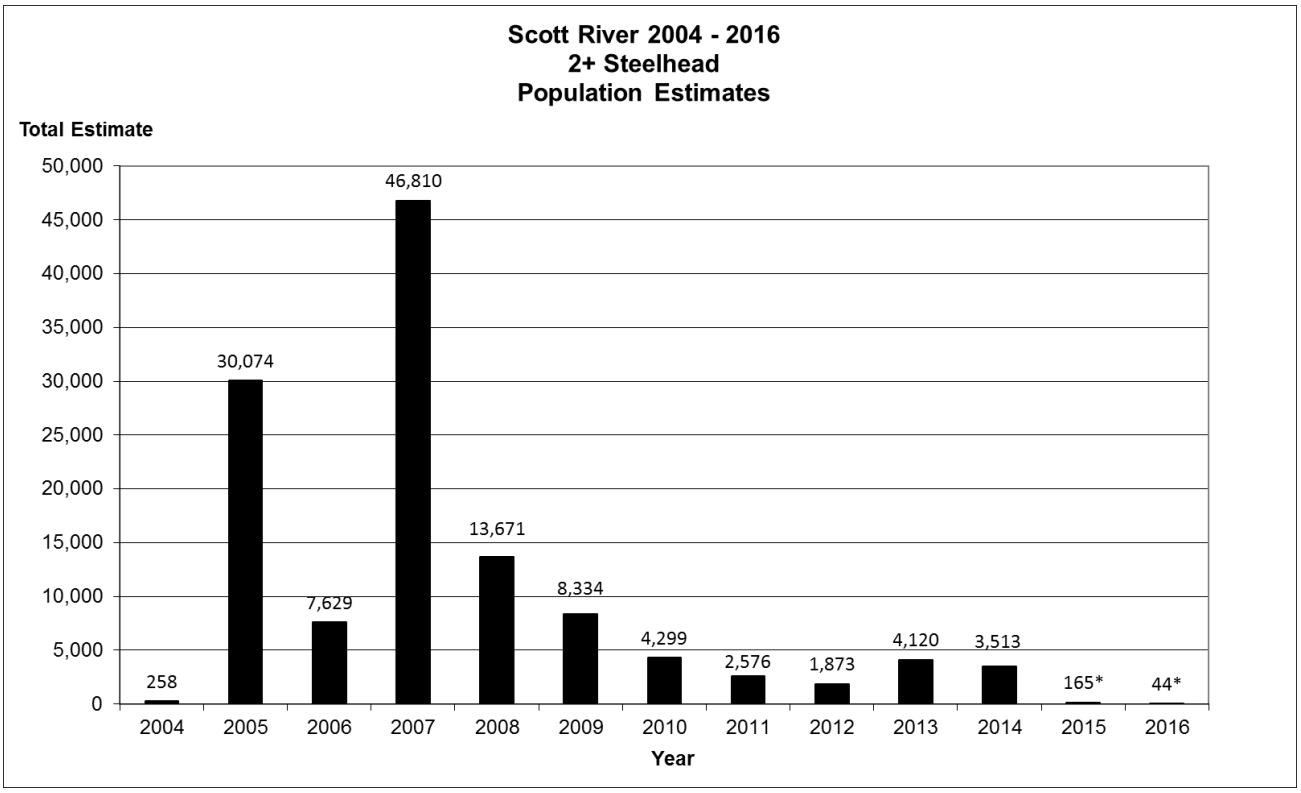

Figure 61. *Scott River 2004-2016 2+ steelhead population estimates (Asterisk indicates year in which reported numbers are just total trapped and not a population estimate).*

Table 12: Scott River 2004 - 2016 Weekly Population Estimates for 2+ steelhead *(Asterisk indicates year in which reported numbers are just total trapped and not a population estimate)*

Julian Week	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015*	2016*	Multi-year
6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----
7	3	82	120	309	68	31	1	42	69	9	3	8	0	**57**
8	3	79	110	104	17	99	3	71	105	9	252	11	0	**66**
9	3	744	64	-----	560	608	123	198	50	10	939	11	3	**276**
10	22	1,270	99	2,016	949	736	196	594	13	98	107	8	---	**509**
11	12	1,788	6	2,283	1,990	61	951	156	29	33	49	8	0	**567**
12	8	1,114	253	12,642	468	375	1806	142	43	106	242	4	1	**1,323**
13	5	1,588	510	4,946	1,213	1020	274	439	27	45	317	3	7	**800**
14	10	3,000	308	2,461	3,952	429	81	28	132	5	93	1	15	**809**
15	6	2,242	272	4,302	3,631	2423	387	425	186	589	268	22	3	**1,135**
16	23	4,988	6	1,554	616	2518	377	113	1144	974	182	28	5	**964**
17	12	2,182	90	429	89	32	2	14	6	212	28	7	2	**239**
18	7	529	24	256	55	4	0	14	5	31	235	5	1	**90**
19	11	569	108	540	3	-----	10	71	1	280	352	12	0	**163**
20	26	132	522	11,100	-----	-----	3	57	0	227	445	26	3	**1,140**
21	23	51	3,519	2,875	8	-----	4	42	25	746	0	5	1	**608**
22	21	242	592	782	22	-----	61	85	15	392	1	1	1	**185**
23	21	1,353	210	86	6	-----	-----	57	6	351	1	0	-----	**209**
24	22	1,426	255	61	22	-----	2	-----	11	4	-----	0	-----	**200**
25	10	175	15	28	4	-----	14	-----	5	0	-----	0	-----	**28**
26	6	41	112	35	0	-----	6	28	1	0	-----	0	-----	**23**
27	4	1,457	434	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	**632**
28	-----	5,022	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	**5,022**
TOTAL	**258**	**30,074**	**7,629**	**46,810**	**13,671**	**8,334**	**4,299**	**2,576**	**1,873**	**4,120**	**3,513**	**165**	**44**	**9,490**

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Appendices

Appendix 1. Catch Table Chinook 0+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	6481	103	16.71	6086	1480	91	6.15%	97,971	78,543	117,400
6	61459	434	21.30	61895	2496	446	17.87%	345,754	316,639	374,868
7	82744	333	21.51	83573	2493	365	14.64%	569,484	515,546	623,421
8	10859	29	11.05	10388	992	128	12.90%	79,963	67,062	92,865
9	68377	267	23.66	68646	2999	484	16.14%	424,614	389,927	459,302
10	14453	114	12.99	15065	1496	126	8.42%	177,577	148,024	207,131
11	5361	21	10.26	4882	777	87	11.20%	43,161	34,641	51,682
12	14776	212	16.56	15488	1500	165	11.00%	140,045	119,906	160,184
13	42,403	473	23.60	42876	2,000	235	11.75%	363,538	319,949	407,126
14	34,845	528	19.37	34873	1,996	339	16.98%	204,828	184,928	224,727
15	23,412	911	24.59	24526	2,247	422	18.78%	130,341	119,067	141,616
16	8,441	125	22.88	8565	1,489	495	33.24%	25,730	23,829	27,630
17	9,848	369	22.59	10215	1,469	535	36.42%	28,015	26,077	29,953
18	5,054	316	22.54	5471	1,195	456	38.16%	14,318	13,245	15,391
19	9,353	357	24.44	9809	681	229	33.63%	29,086	25,997	32,175
20	10,982	290	22.86	11272	489	157	32.11%	34,957	30,454	39,461
21	7,469	144	15.58	7713	496	177	35.69%	21,536	18,979	24,092
22	5,338	112	7.50	5450	287	83	28.92%	18,686	15,317	22,055
23	1,125	29	2.47	1154	255	48	18.82%	6,029	4,495	7,563
24	384	8	4.27	392	197	50	25.38%	1,522	1,143	1,901
25	208	6	8.84	214	148	60	40.54%	523	409	636
26	54	7	6.42	61	47	16	34.04%	172	100	245
Totals	**423,426**	**5,188**	**361.99**	**428,614**	**27,229**	**5,194**	**19.08%**	**2,757,850**	**2661219**	**2854481**

[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 Chinook 1+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	2	0	16.71	2	1	0	*18.52%*	11*	---	---
6	1	0	21.30	1	1	1	100.00%	1	1	1
7	1	1	21.51	2	0	0	*18.52%*	11*	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	5	0	23.66	5	5	1	20.00%	15	0	31
10	2	0	12.99	2	1	0	*18.52%*	11*	---	---
11	1	0	10.26	1	1	0	*18.52%*	5*	---	---
12	3	0	16.56	1	1	0	*18.52%*	5*	---	---
13	10	0	23.60	12	10	2	20.00%	44	3	85
14	2	1	19.37	3	0	0	*18.52%*	16*	---	---
15	5	0	24.59	5	2	1	50.00%	8	2	13
16	6	0	22.88	6	4	0	*18.52%*	32*	---	---
17	0	0	22.59	0	0	0	---	0	---	---
18	1	0	22.54	1	1	0	*18.52%*	5*	---	---
19	0	0	24.44	0	0	0	---	0	---	---
20	0	0	22.86	0	0	0	---	0	---	---
21	0	0	15.58	0	0	0	---	0	---	---
22	0	0	7.50	0	0	0	---	0	---	---
23	0	0	2.47	0	0	0	---	0	---	---
24	0	0	4.27	0	0	0	---	0	---	---
25	0	0	8.84	0	0	0	---	0	---	---
26	0	0	6.42	0	0	0	---	0	---	---
Totals	**39**	**2**	**361.99**	**41**	**27**	**5**	**18.52%**	**164**	---	---

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 3. Catch Table coho 0+, Shasta River, 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	0	0	16.71	0	0	0	---	0	---	---
6	0	0	21.30	0	0	0	---	0	---	---
7	0	0	21.51	0	0	0	---	0	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	0	0	23.66	0	0	0	---	0	---	---
10	0	0	12.99	0	0	0	---	0	---	---
11	0	0	10.26	0	0	0	---	0	---	---
12	0	1	16.56	1	0	0	*16.67%*	6*	---	---
13	0	1	23.60	1	0	0	*16.67%*	6*	---	---
14	3	3	19.37	6	0	0	*16.67%*	36*	---	---
15	4	2	24.59	6	0	0	*16.67%*	36*	---	---
16	1	0	22.88	1	0	0	*16.67%*	6*	---	---
17	2	0	22.59	2	0	0	*16.67%*	12*	---	---
18	1	1	22.54	2	1	0	*16.67%*	12*	---	---
19	6	0	24.44	5	3	0	*16.67%*	30*	---	---
20	9	1	22.86	11	9	1	11.11%	55	0	116
21	7	0	15.58	7	4	1	25.00%	18	0	35
22	26	0	7.50	26	21	2	9.52%	191	7	374
23	12	0	2.47	12	6	1	16.67%	42	0	85
24	3	0	4.27	3	2	1	50.00%	5	1	8
25	5	0	8.84	5	2	2	100.00%	5	5	5
26	6	0	6.42	6	6	1	16.67%	21	0	44
Totals	**85**	**9**	**361.99**	**94**	**54**	**9**	**16.67%**	**480**	**---**	**---**

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 4. Catch Table coho 1+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	1	0	16.71	1	0	0	*19.35%*	5*	---	---
6	1	0	21.30	1	1	0	*19.35%*	5*	---	---
7	0	0	21.51	0	0	0	---	0	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	1	0	23.66	1	1	0	*19.35%*	5*	---	---
10	0	0	12.99	0	0	0	---	0	---	---
11	0	0	10.26	0	0	0	---	0	---	---
12	0	0	16.56	0	0	0	---	0	---	---
13	6	0	23.60	6	3	2	66.67%	8	3	13
14	7	0	19.37	5	4	0	*19.35%*	26*	---	---
15	20	0	24.59	19	11	1	9.09%	114	0	238
16	11	0	22.88	14	11	2	18.18%	56	4	108
17	2	0	22.59	2	0	0	*19.35%*	10*	---	---
18	0	0	22.54	0	0	1	---	0	---	---
19	0	0	24.44	0	0	0	---	0	---	---
20	0	0	22.86	0	0	0	---	0	---	---
21	0	0	15.58	0	0	0	---	0	---	---
22	0	0	7.50	0	0	0	---	0	---	---
23	0	0	2.47	0	0	0	---	0	---	---
24	0	0	4.27	0	0	0	---	0	---	---
25	0	0	8.84	0	0	0	---	0	---	---
26	0	0	6.42	0	0	0	---	0	---	---
Totals	**49**	**0**	**361.99**	**49**	**31**	**6**	**19.35%**	**229**	---	---

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 5. Catch Table steelhead 0+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	0	0	16.71	0	0	0	---	0	---	---
6	0	0	21.30	0	0	0	---	0	---	---
7	0	0	21.51	0	0	0	---	0	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	0	0	23.66	0	0	0	---	0	---	---
10	0	0	12.99	0	0	0	---	0	---	---
11	2	0	10.26	1	0	0	*28.19%*	3*	---	---
12	5	0	16.56	6	1	0	*28.19%*	21*	---	---
13	11	2	23.60	13	0	0	*28.19%*	46*	---	---
14	55	4	19.37	59	0	0	*28.19%*	209*	---	---
15	35	8	24.59	43	0	0	*28.19%*	152*	---	---
16	1	0	22.88	1	0	0	*28.19%*	3*	---	---
17	8	1	22.59	9	3	0	*28.19%*	11*	---	---
18	16	1	22.54	12	6	1	16.67%	42	0	85
19	28	2	24.44	34	10	3	30.00%	94	24	163
20	51	2	22.86	50	40	8	20.00%	228	92	363
21	200	0	15.58	204	136	27	19.85%	998	653	1,344
22	872	6	7.50	878	398	95	23.87%	3649	2,983	4,316
23	1,081	13	2.47	1094	200	79	39.50%	2749	2,268	3,230
24	483	8	4.27	491	200	79	39.50%	1234	1,009	1,458
25	221	4	8.84	225	138	30	21.74%	1009	680	1,338
26	343	9	6.42	352	184	49	26.63%	1302	976	1,629
Totals	**3,412**	**60**	**361.99**	**3,472**	**1,316**	**371**	**28.19%**	**11,749**	**---**	**---**

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 6. Catch Table steelhead 1+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	1	0	16.71	1	1	0	*7.02%*	14*	---	---
6	4	0	21.30	4	3	0	*7.02%*	57*	---	---
7	0	0	21.51	0	0	0	---	0	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	0	0	23.66	0	0	0	---	0	---	---
10	0	0	12.99	0	0	0	---	0	---	---
11	0	0	10.26	0	0	0	---	0	---	---
12	3	0	16.56	2	2	0	*7.02%*	28*	---	---
13	4	1	23.60	6	4	0	*7.02%*	85*	---	---
14	6	0	19.37	5	4	0	*7.02%*	71*	---	---
15	5	0	24.59	6	4	0	*7.02%*	85*	---	---
16	1	0	22.88	1	1	0	*7.02%*	14*	---	---
17	11	0	22.59	10	7	2	28.57%	27	3	50
18	11	0	22.54	9	7	1	14.29%	36	0	75
19	9	0	24.44	10	6	1	16.67%	35	0	72
20	3	0	22.86	5	5	1	20.00%	15	0	31
21	29	0	15.58	29	13	1	7.69%	203	0	423
22	39	0	7.50	39	29	0	*7.02%*	555*	---	---
23	18	0	2.47	18	13	0	*7.02%*	256*	---	---
24	13	0	4.27	13	9	1	11.11%	65	0	136
25	7	0	8.84	7	4	0	*7.02%*	100*	---	---
26	13	0	6.42	13	2	1	50.00%	20	6	33
Totals	**177**	**1**	**361.99**	**178**	**114**	**8**	**7.02%**	**1,665**	**---**	**---**

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 7. Catch Table steelhead 2+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	4	0	16.71	2	2	0	*6.64%*	30*	---	---
6	4	1	21.30	7	3	0	*6.64%*	105*	---	---
7	2	1	21.51	3	2	0	*6.64%*	45*	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	7	1	23.66	7	5	0	*6.64%*	105*	---	---
10	5	0	12.99	6	4	0	*6.64%*	90*	---	---
11	4	0	10.26	4	4	0	*6.64%*	60*	---	---
12	4	0	16.56	3	1	0	*6.64%*	45*	---	---
13	24	0	23.60	21	17	0	*6.64%*	316*	---	---
14	62	0	19.37	44	31	0	*6.64%*	663*	---	---
15	291	1	24.59	283	211	11	5.21%	5000	2,304	7,695
16	292	0	22.88	261	223	13	5.83%	4176	2,076	6,276
17	241	1	22.59	223	154	12	7.79%	2659	1,287	4,030
18	508	1	22.54	542	392	29	7.40%	7100	4,632	9,568
19	398	4	24.44	413	328	18	5.49%	7151	4,040	10,263
20	173	2	22.86	203	139	12	8.63%	2186	1,061	3,311
21	60	0	15.58	69	48	7	14.58%	423	156	689
22	23	0	7.50	23	19	4	21.05%	92	22	162
23	7	1	2.47	8	7	0	*6.64%*	120*	---	---
24	4	1	4.27	5	3	0	*6.64%*	75*	---	---
25	2	0	8.84	2	2	0	*6.64%*	30*	---	---
26	2	0	6.42	2	1	0	*6.64%*	30*	---	---
Totals	**2,117**	**14**	**361.99**	**2,131**	**1,596**	**106**	**6.64%**	**30,501**	---	---

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 8. Catch Table steelhead 3+, Shasta River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
5	0	1	16.71	1	0	0	*2.67%*	37*	---	---
6	1	0	21.30	1	0	0	*2.67%*	37*	---	---
7	0	0	21.51	0	0	0	---	0	---	---
8	0	0	11.05	0	0	0	---	0	---	---
9	1	0	23.66	1	1	0	*2.67%*	37*	---	---
10	0	0	12.99	0	0	0	---	0	---	---
11	1	0	10.26	1	1	0	*2.67%*	37*	---	---
12	2	0	16.56	2	1	0	*2.67%*	75*	---	---
13	13	0	23.60	13	1	0	*2.67%*	487*	---	---
14	24	0	19.37	24	4	0	*2.67%*	899*	---	---
15	70	0	24.59	63	25	0	*2.67%*	2359*	---	---
16	63	0	22.88	69	12	1	8.33%	449	0	922
17	19	0	22.59	13	2	1	50.00%	20	6	33
18	19	0	22.54	22	14	0	*2.67%*	823*	---	---
19	16	0	24.44	20	13	0	*2.67%*	749*	---	---
20	1	0	22.86	1	1	0	*2.67%*	37*	---	---
21	0	0	15.58	0	0	0	---	0	---	---
22	0	0	7.50	0	0	0	---	0	---	---
23	0	0	2.47	0	0	0	---	0	---	---
24	0	0	4.27	0	0	0	---	0	---	---
25	0	0	8.84	0	0	0	---	0	---	---
26	0	0	6.42	0	0	0	---	0	---	---
Totals	**230**	**1**	**361.99**	**231**	**75**	**2**	**2.67%**	**6,045**	---	---

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 9. Catch Table Chinook 0+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
6	30	29	11.76	59	16	0	*1.31%*	4,504*	---	---
7	21	32	12.67	53	11	0	*1.31%*	4,046*	---	---
8	27	23	16.31	40	2	0	*1.31%*	3,053*	---	---
9	122	50	26.45	182	44	1	2.27%	4,095	0	8,650
10	---	---	---	---	---	---	---	---	---	---
11	38	3	2.95	18	0	0	*1.31%*	1,374*	---	---
12	45	26	12.95	81	23	0	*1.31%*	6,183*	---	---
13	102	112	20.04	197	55	1	1.82%	5,516	0	11,677
14	115	129	28.20	265	83	2	2.41%	7,420	239	14,601
15	41	2	5.91	52	9	0	*1.31%*	3,969*	---	---
16	131	3	7.87	134	108	0	*1.31%*	10,229*	---	---
17	81	1	7.44	43	38	1	2.63%	839	0	1,784
18	24	0	21.76	63	55	0	*1.31%*	4,809*	---	---
19	5	0	13.07	4	4	0	*1.31%*	305*	---	---
20	4	0	19.20	3	3	0	*1.31%*	229*	---	---
21	11	1	16.44	14	8	1	12.50%	63	0	130
22	0	0	13.43	0	0	0	---	---	---	---
Totals	**797**	**411**	**236.45**	**1,208**	**459**	**6**	**1.31%**	**56,634**	**16799**	**63880**

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 10. Catch Table Chinook 1+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate*	Lower CI	Upper CI
6	7	0	11.76	6	4	0	---	---	---	---
7	5	0	12.67	6	5	0	---	---	---	---
8	4	0	16.31	1	1	1	---	---	---	---
9	5	0	26.45	8	5	0	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---
11	0	0	2.95	0	0	0	---	---	---	---
12	1	0	12.95	1	1	0	---	---	---	---
13	5	0	20.04	5	5	0	---	---	---	---
14	0	0	28.20	0	0	0	---	---	---	---
15	1	0	5.91	1	0	0	---	---	---	---
16	0	0	7.87	0	0	0	---	---	---	---
17	0	0	7.44	0	0	0	---	---	---	---
18	0	0	21.76	0	0	0	---	---	---	---
19	0	0	13.07	0	0	0	---	---	---	---
20	0	0	19.20	0	0	0	---	---	---	---
21	0	0	16.44	0	0	0	---	---	---	---
22	0	0	13.43	0	0	0	---	---	---	---
Totals	**28**	**0**	**236.45**	**28**	**21**	**1**	**4.76%**	---	---	---

[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.
* Low trapped and recaptured totals make confidence in weekly population estimates unsatisfactory.

Appendix 11. Catch Table coho 0+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate*	Lower CI	Upper CI
6	0	0	11.76	0	0	0	---	---	---	---
7	0	0	12.67	0	0	0	---	---	---	---
8	0	0	16.31	0	0	0	---	---	---	---
9	0	0	26.45	0	0	0	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---
11	0	0	2.95	0	0	0	---	---	---	---
12	0	0	12.95	0	0	0	---	---	---	---
13	0	0	20.04	0	0	0	---	---	---	---
14	0	0	28.20	0	0	0	---	---	---	---
15	2	0	5.91	2	0	0	---	---	---	---
16	4	0	7.87	4	0	0	---	---	---	---
17	0	1	7.44	1	0	0	---	---	---	---
18	4	0	21.76	4	1	0	---	---	---	---
19	1	0	13.07	1	1	0	---	---	---	---
20	0	0	19.20	0	0	0	---	---	---	---
21	0	0	16.44	0	0	0	---	---	---	---
22	1	1	13.43	2	0	0	---	---	---	---
Totals	**12**	**2**	**236.45**	**14**	**2**	**0**	**0.00%**	---	---	---

[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.
* Low trapped and recaptured totals make confidence in weekly population estimates unsatisfactory.

Appendix 12. Catch Table coho 1+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
6	28	0	11.76	25	18	3	16.67%	119	19	218
7	7	1	12.67	11	7	1	14.29%	44	0	91
8	5	0	16.31	1	1	0	*5.26%*	19*	---	---
9	8	0	26.45	12	9	1	11.11%	60	0	126
10	---	---	---	---	---	---	---	---	---	---
11	0	0	2.95	0	0	0	---	---	---	---
12	3	0	12.95	1	0	0	*5.26%*	19*	---	---
13	36	1	20.04	32	28	0	*5.26%*	608*	---	---
14	37	4	28.20	45	27	1	*3.70%*	630	0	1,332
15	0	0	5.91	3	3	0	*5.26%*	57*	---	---
16	7	1	7.87	8	4	0	*5.26%*	152*	---	---
17	7	0	7.44	7	5	0	*5.26%*	133*	---	---
18	13	0	21.76	13	4	0	*5.26%*	247*	---	---
19	3	1	13.07	2	1	0	*5.26%*	38*	---	---
20	2	1	19.20	5	2	0	*5.26%*	95*	---	---
21	7	1	16.44	8	5	0	*5.26%*	152*	---	---
22	2	0	13.43	2	0	0	*5.26%*	38*	---	---
Totals	**165**	**10**	**236.45**	**175**	**114**	**6**	**5.26%**	**2,411**	**537**	**3486**

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 13. Catch Table steelhead 0+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate*	Lower CI	Upper CI
6	25	0	11.76	23	16	0	---	---	---	---
7	6	1	12.67	9	4	0	---	---	---	---
8	5	0	16.31	4	4	0	---	---	---	---
9	0	0	26.45	1	1	0	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---
11	0	0	2.95	0	0	0	---	---	---	---
12	0	0	12.95	0	0	0	---	---	---	---
13	0	0	20.04	0	0	0	---	---	---	---
14	1	0	28.20	1	0	0	---	---	---	---
15	0	0	5.91	0	0	0	---	---	---	---
16	8	0	7.87	8	3	0	---	---	---	---
17	19	0	7.44	16	11	0	---	---	---	---
18	14	0	21.76	17	9	0	---	---	---	---
19	5	0	13.07	4	3	0	---	---	---	---
20	11	0	19.20	11	10	0	---	---	---	---
21	2	0	16.44	3	3	0	---	---	---	---
22	0	0	13.43	0	0	0	---	---	---	---
Totals	**96**	**1**	**236.45**	**97**	**64**	**0**	**0.00%**	---	---	---

[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.
* Low trapped and recaptured totals make confidence in weekly population estimates unsatisfactory.

Appendix 14. Catch Table steelhead 1+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate	Lower CI	Upper CI
6	351	4	11.76	319	224	7	3.13%	8,972	3,144	14,800
7	154	5	12.67	195	135	6	4.44%	3,789	1,186	6,391
8	173	6	16.31	131	109	10	9.17%	1,310	578	2,042
9	191	2	26.45	241	141	10	7.09%	3,111	1,382	4,840
10	---	---	---	---	---	---	---	---	---	---
11	32	0	2.95	6	0	0	*3.62%*	166*	---	---
12	87	1	12.95	91	53	0	*3.62%*	2,514*	---	---
13	435	33	20.04	414	324	9	2.78%	13,455	5,533	21,377
14	479	36	28.20	540	340	4	1.18%	36,828	7,441	66,215
15	44	1	5.91	97	52	3	5.77%	1,285	180	2,391
16	31	4	7.87	35	24	2	8.33%	292	12	571
17	25	0	7.44	14	10	0	*3.62%*	387*	---	---
18	31	2	21.76	44	19	1	5.26%	440	0	923
19	10	1	13.07	9	1	0	*3.62%*	248*	---	---
20	10	2	19.20	14	5	0	*3.62%*	386*	---	---
21	7	4	16.44	11	0	0	*3.62%*	303*	---	---
22	2	0	13.43	2	0	0	*3.62%*	55*	---	---
Totals	**2,062**	**101**	**236.45**	**2,163**	**1,437**	**52**	**3.62%**	**73,540**	**42761**	**106580**

[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.
* Estimated weekly population based on seasonal trap efficiency (adjusted total trapped/average trap efficiency)

Appendix 15. Catch Table steelhead 2+, Scott River 2016

Julian week	Live fish trapped[1]	Mortalities	Volume sampled, MCF[2]	Adjusted total trapped[3]	Adjusted marked & released[4]	Recaptured	% Trap efficiency[5]	Weekly population estimate*	Lower CI	Upper CI
6	2	0	11.76	2	0	0	---	---	---	---
7	0	0	12.67	0	0	0	---	---	---	---
8	0	0	16.31	0	0	0	---	---	---	---
9	3	0	26.45	3	2	0	---	---	---	---
10	---	---	---	---	---	---	---	---	---	---
11	0	0	2.95	0	0	0	---	---	---	---
12	1	0	12.95	1	1	0	---	---	---	---
13	7	0	20.04	7	2	0	---	---	---	---
14	15	0	28.20	15	4	0	---	---	---	---
15	3	0	5.91	3	0	0	---	---	---	---
16	3	2	7.87	5	1	0	---	---	---	---
17	2	0	7.44	2	1	0	---	---	---	---
18	1	0	21.76	1	0	0	---	---	---	---
19	0	0	13.07	0	0	0	---	---	---	---
20	2	1	19.20	3	1	0	---	---	---	---
21	1	0	16.44	1	1	0	---	---	---	---
22	0	1	13.43	1	0	0	---	---	---	---
Totals	**40**	**4**	**236.45**	**44**	**13**	**0**	**0.00%**	---	---	---

[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.
* Low trapped and recaptured totals make confidence in weekly population estimates unsatisfactory.

Appendix 16. Weekly Fork Length Data Chinook 0+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	38	1.62	219	32	44
6	38	1.79	299	33	45
7	38	2.65	300	33	49
8	41	4.93	150	35	58
9	40	4.85	349	34	58
10	45	6.84	200	32	63
11	46	8.33	110	34	62
12	55	6.71	199	39	73
13	51	8.56	299	28	74
14	55	8.98	275	34	85
15	61	10.33	306	37	92
16	67	12.05	250	36	97
17	68	12.21	251	48	102
18	71	14.03	353	38	115
19	82	14.08	300	49	119
20	89	11.61	301	9	118
21	91	9.71	297	62	113
22	91	7.74	150	72	107
23	89	8.94	252	63	116
24	93	10.12	162	70	125
25	90	10.25	55	68	131
26	97	4.79	4	91	102

Appendix 17. Weekly Fork Length Data Chinook 1+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	90	1.41	2	89	91
6	108	16.46	3	89	118
7	136	26.16	2	117	154
8	---	---	---	---	---
9	123	9.90	6	110	136
10	135	21.21	2	120	150
11	134	---	1	134	134
12	125	22.81	3	105	150
13	130	23.01	12	81	160
14	118	31.50	3	86	149
15	139	8.11	5	130	152
16	122	18.80	6	96	141
17	---	---	---	---	---
18	121		1	121	121
19	---	---	---	---	---
20	---	---	---	---	---
21	---	---	---	---	---
22	---	---	---	---	---
23	---	---	---	---	---
24	---	---	---	---	---
25	---	---	---	---	---
26	---	---	---	---	---

Appendix 18. Weekly Fork Length Data coho 0+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	---	---	---	---	---
6	---	---	---	---	---
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	33	---	1	33	33
13	34	---	1	34	34
14	---	---	---	---	---
15	---	---	---	---	---
16	44	---	1	44	44
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	60.5	9.19	2	54	67
21	---	---	---	---	---
22	---	---	---	---	---
23	79	1.41	2	78	80
24	67	---	1	67	67
25	91	20.55	3	78	115
26	---	---	---	---	---

Appendix 19. Weekly Fork Length Data coho 1+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	95	---	1	95	95
6	147	---	1	147	147
7		---			
8	136	---	1	136	136
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	139	15.04	8	122	156
14	148	13.86	7	127	172
15	143	12.10	19	122	169
16	144	11.53	11	122	154
17	140	28.28	2	120	160
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---
21	---	---	---	---	---
22	---	---	---	---	---
23	---	---	---	---	---
24	---	---	---	---	---
25	---	---	---	---	---
26	---	---	---	---	---

Appendix 20. Weekly Fork Length Data coho 2+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	---	---	---	---	---
6	---	---	---	---	---
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	---	---	---	---	---
14	---	---	---	---	---
15	165	---	1	165	165
16	202	1.41	2	201	203
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---
21	---	---	---	---	---
22	---	---	---	---	---
23	---	---	---	---	---
24	---	---	---	---	---
25	---	---	---	---	---
26	---	---	---	---	---

Appendix 21. Weekly Fork Length Data steelhead 0+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	---	---	---	---	---
6	---	---	---	---	---
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	26	0.84	5	25	27
14	28	0.58	3	27	28
15	32	7.78	2	26	37
16	---	---	---	---	---
17	46	11.02	3	35	57
18	70	---	1	70	70
19	69	---	1	69	69
20	62	7.25	8	53	73
21	73	---	1	73	73
22	108	---	1	108	108
23	76	9.92	126	60	101
24	78	8.85	125	61	105
25	82	7.87	61	69	103
26	81	9.63	84	57	105

Appendix 22. Weekly Fork Length Data steelhead 1+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	125	---	1	125	125
6	97	24.37	4	71	129
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	129	7.23	3	121	134
13	136	30.73	5	110	188
14	117	13.51	6	102	136
15	120	18.81	5	101	141
16	138	---	1	138	138
17	145	14.04	11	114	159
18	151	7.03	10	136	157
19	146	13.79	9	110	155
20	156	1.73	4	153	157
21	163	13.39	29	131	179
22	156	15.98	39	118	178
23	150	13.26	18	131	174
24	153	32.33	13	112	214
25	131	15.81	7	112	154
26	131	21.56	13	110	170

Appendix 23. Weekly Fork Length Data steelhead 2+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	179	19.85	4	159	198
6	169	15.41	5	145	186
7	152	3.21	3	150	156
8	---	---	---	---	---
9	166	15.18	8	145	185
10	181	9.65	5	171	195
11	185	19.36	4	165	209
12	167	28.90	4	144	205
13	180	18.99	24	142	213
14	195	44.20	59	143	492
15	188	18.29	149	133	237
16	192	18.31	141	107	219
17	195	15.85	143	161	229
18	193	17.17	150	114	231
19	193	18.54	150	101	228
20	189	15.50	128	162	229
21	198	14.30	55	178	253
22	190	9.90	23	180	218
23	196	22.79	7	180	244
24	191	20.09	5	180	227
25	200	0.71	2	199	200
26	185	0.71	2	184	185

Appendix 24. Weekly Fork Length Data steelhead 3+, Shasta River 2016

Julian week	Average	s.d.	n	Min	Max
5	255	---	1	255	255
6	375	---	1	375	375
7	---	---	---	---	---
8	---	---	---	---	---
9	299	---	1	299	299
10	---	---	---	---	---
11	210	---	1	210	210
12	227	12.02	2	218	235
13	294	27.71	13	250	330
14	276	44.17	23	230	370
15	248	27.46	67	220	340
16	234	27.81	63	220	440
17	256	51.00	19	231	450
18	241	16.04	18	230	300
19	256	22.38	16	230	300
20	240	---	1	240	240
21	---	---	---	---	---
22	---	---	---	---	---
23	---	---	---	---	---
24	---	---	---	---	---
25	---	---	---	---	---
26	---	---	---	---	---

Appendix 25. Weekly Fork Length Data Chinook 0+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	37		2	37	37
7	38	0.76	7	37	39
8	---	---	---	---	---
9	37	3.14	90	22	42
10	---	---	---	---	---
11	---	---	---	---	---
12	38	3.35	22	34	49
13	38	2.50	43	30	48
14	39	1.81	55	34	43
15	39	2.71	32	36	48
16	38	1.29	4	36	39
17	---	---	---	---	---
18	44	7.39	8	36	54
19	---	---	---	---	---
20	---	---	---	---	---
21	69	4.95	2	65	72
22	---	---	---	---	---

Appendix 26. Weekly Fork Length Data Chinook 1+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	86	6.57	7	77	96
7	83	4.22	5	77	88
8	103	12.87	4	85	115
9	90	13.13	5	74	110
10	---	---	---	---	---
11	---	---	---	---	---
12	119		1	119	119
13	109	7.04	5	100	115
14	---	---	---	---	---
15	105	---	1	105	105
16	---	---	---	---	---
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---
21	---	---	---	---	---
22	---	---	---	---	---

Appendix 27. Weekly Fork Length Data coho 0+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	---	---	---	---	---
7	---	---	---	---	---
8	---	---	---	---	---
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	---	---	---	---	---
14	---	---	---	---	---
15	36	2.83	2	34	38
16	---	---	---	---	---
17	---	---	---	---	---
18	36	0.58	3	35	36
19	---	---	---	---	---
20	---	---	---	---	---
21	---	---	---	---	---
22	58	8.49	2	52	64

Appendix 28. Weekly Fork Length Data coho 1+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	90	6.88	28	73	105
7	88	3.11	8	84	93
8	100	6.88	5	89	108
9	97	3.70	8	91	103
10	---	---	---	---	---
11	---	---	---	---	---
12	108	22.54	3	94	134
13	111	11.73	37	91	153
14	110	9.22	37	91	129
15	---	---	---	---	---
16	119	12.78	7	92	128
17	121	9.22	7	108	131
18	119	8.74	13	102	134
19	120	9.32	4	110	132
20	124	12	3	112	136
21	128	7.55	7	118	141
22	98	33.94	2	74	122

Appendix 29. Weekly Fork Length Data steelhead 0+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	56	1.73	23	53	59
7	56	2.69	7	52	59
8	57	2.49	5	54	59
9	---	---	---	---	---
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	---	---	---	---	---
14	53	---	1	53	53
15	---	---	---	---	---
16	35	---	1	35	35
17	---	---	---	---	---
18	22	11.73	5	1	29
19	---	---	---	---	---
20	25	---	1	25	25
21	---	---	---	---	---
22	---	---	---	---	---

Appendix 30. Weekly Fork Length Data steelhead 1+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	76	9.79	132	60	108
7	77	10.94	105	60	113
8	78	10.85	86	61	110
9	78	11.04	132	50	106
10	---	---	---	---	---
11	81	10.18	25	67	102
12	79	9.85	72	63	101
13	80	13.08	172	54	115
14	81	11.18	196	52	114
15	81	9.15	37	63	106
16	82	9.45	33	62	104
17	82	12.42	25	57	118
18	94	22.14	31	67	145
19	112	28.74	10	55	145
20	99	35.14	12	12	145
21	125	27.15	3	96	150
22	109	0.71	2	108	109

Appendix 31. Weekly Fork Length Data steelhead 2+, Scott River 2016

Julian week	Average	s.d.	n	Min	Max
6	131	13.44	2	121	140
7	---	---	---	---	---
8	---	---	---	---	---
9	132	8.02	3	124	140
10	---	---	---	---	---
11	---	---	---	---	---
12	132	---	1	132	132
13	143	17.71	7	122	167
14	138	21.29	11	121	197
15	126	18.15	3	113	147
16	131	18.80	4	111	156
17	185	40.31	2	156	213
18	168	---	1	168	168
19	---	---	---	---	---
20	171	34.64	3	151	211
21	206	---	1	206	206
22	134	---	1	134	134

Appendix 32. Age Length cut-offs for Shasta River juvenile salmonids

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

Chinook	Julian Week	Age 0+	Age 1+	Age 2+	Age 3+
	1-8	≤ 49	≥ 50		
	9-12	≤ 79	≥ 80		
	13-14	≤ 79	≥ 80		
	15-16	≤ 89	≥ 90		
	17-20	≤ 119	≥ 120		
	21-28	≤ 159	≥ 160		
Coho	**Julian Week**	**Age 0+**	**Age 1+**	**Age 2+**	**Age 3+**
	1-8	≤ 39	40 -149	≥ 150	
	9-12	≤ 49	50 - 189	≥ 190	
	13-14	≤ 59	60 - 219	≥ 220	
	15-16	≤ 99	100 - 159	≥ 160	
	17-20	≤ 99	100 - 169	≥ 170	
	21-28	≤ 119	120 - 149	≥ 150	
Steelhead	**Julian Week**	**Age 0+**	**Age 1+**	**Age 2+**	**Age 3+**
	1-8	≤ 39	40 - 139	140 - 229	≥ 230
	9-12	≤ 39	40 - 139	140 - 209	≥ 210
	13-14	≤ 89	90 - 139	140 - 229	≥ 230
	15-16	≤ 79	80 - 139	140 - 219	≥ 220
	17-20	≤ 79	80 - 159	160 - 229	≥ 230
	21-28	≤ 109	110 - 179	180 - 269	≥ 270

Appendix 33. Age Length Cut-Offs for Scott River juvenile salmonids

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

Chinook	Julian Week	Age 0+	Age 1+	Age 2+	Age 3+
	1-8	≤ 49	≥ 50		
	9-12	≤ 69	≥ 70		
	13-14	≤ 79	≥ 80		
	15-16	≤ 99	≥ 100		
	17-20	≤ 119	≥ 120		
	21-28	≤ 129	≥ 130		
Coho	**Julian Week**	**Age 0+**	**Age 1+**	**Age 2+**	**Age 3+**
	1-8	≤ 49	50 - 119	≥ 120	
	9-12	≤ 49	50 - 149	≥ 150	
	13-14	≤ 59	60 - 149	≥ 150	
	15-16	≤ 69	70 - 149	≥ 150	
	17-20	≤ 69	70 - 159	≥ 160	
	21-28	≤ 109	110 - 159	≥ 160	
Steelhead	**Julian Week**	**Age 0+**	**Age 1+**	**Age 2+**	**Age 3+**
	1-8	≤ 59	60 - 119	120 - 189	≥ 190
	9-12	≤ 49	50 - 119	120 - 229	≥ 230
	13-14	≤ 49	50 - 119	120 - 259	≥ 260
	15-16	≤ 59	60 - 109	110 - 219	≥ 220
	17-20	≤ 59	60 - 149	150 - 229	≥ 230
	21-28	≤ 79	80 - 179	180 - 229	≥ 230

Appendix 34. Additional species collected in the Shasta rotary trap, 2016

Common Name	Scientific Name	Total Caught
Brown Bullhead	*Ameiurus nebulosus*	24
Bluegill	*Lepomis macrochirus*	2
Bull Frog	*Rana catesbeiana*	6
Crayfish	*Astacoidea*	2
Fathead Minnow	*Pimephales promelas*	15
Golden Shiner	*Notemigonus crysoleucas*	26
Green Sunfish	*Leponis cyanellus*	60
Japanese Smelt	*Hypomesus nipponensis*	54
Kangaroo Rat	*Dipodomys*	1
Klamath River Lamprey	*Entosphenus similis*	100
Klamath Small Scale Sucker	*Catostomus rimiculus*	277
Marbled Sculpin	*Cottus klamathensis*	51
Mosquito Fish	*Gambusia affinis*	1
Muskrat	*Ondatra zibethicus*	1
Pacific Lamprey	*Entosphenus tridentatus*	2594
Perch	*Perca*	1
Pumpkin Seed	*Lepomis gibbosus*	4
Pond Turtle	*Actinemys marmorata*	1
River Lamprey	*Lampetra fluviatilis*	1
Speckled Dace	*Rhinichthys osculus*	164
Tui Chub	*Siphateles bicolor*	33
Yellow Bullhead	*Ameiurus natalis*	531
Unknown Lamprey	----	55

Appendix 35. Additional species collected in the Scott rotary trap, 2016

Common Name	Scientific Name	Total Caught
Brook Stickleback	*Culaea inconstans*	11
Bull Frog	*Rana catesbeiana*	90
Crayfish	*Astacoidea*	29
Fathead Minnow	*Pimephales promelas*	6
Green Sunfish	*Leponis cyanellus*	1
Klamath River Lamprey	*Entosphenus similis*	18
Klamath Small Scale Sucker	*Catostomus rimiculus*	2047
Marbled Sculpin	*Cottus klamathensis*	16
Miller Lamprey	*Entosphenus cf. minimus*	1
Pacific Lamprey	*Entosphenus tridentatus*	26
Pacific Giant Salamander	*Dicamptodon*	1
Speckled Dace	*Rhinichthys osculus*	328
Stickleback	*Gasterosteidae*	50
Western Toad	*Anaxyrus boreas*	5
Yellow Bullhead	*Ameiurus natalis*	1
Unknown Fish	----	25
Unknown Frog	----	1
Unknown Lamprey	----	2579

Appendix 36. Life Stages

Sac Fry	Young salmon from hatching. Yolk sac not yet absorbed.
Fry	Stage between sac fry and parr. Parr marks are not yet visible but sac is fully absorbed; For this study any fish that is under 55mm length is considered a fry
Parr	Parr marks visible on fish
Smolt	Sliver scales and no parr marks visible
Rosy Post Smolt	A colorful fish larger than the usual smolt size; possibly resident
Adult	A sexually mature fish

Appendix 37. List of Julian Weeks and Calendar Equivalents

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

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

*** = eight days only during leap years**
**** = eight day Julian week**