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ANNUAL REPORT
SHASTA AND SCOTT RIVER
JUVENILE SALMONID OUTMIGRANT STUDY,
2006

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Abstract

2006 was the seventh consecutive year of rotary trapping on the Shasta and Scott rivers. The goals of the project were to determine emigration abundance and timing of all age classes of juvenile salmonids emigrating from the Shasta and Scott rivers between early February and mid July 2006 and to investigate the relationships between instream conditions and emigration patterns of juvenile salmonids.

We determined trap efficiencies for all age classes of salmonids in the catch and calculated weekly production estimates for each age class. We estimated the weekly mean fork length at age of salmonids in the catch from a measured sub-sample. The number of 0+ Chinook (*Oncorhynchus tshawytscha*) produced was the lowest for the period of record for both the Shasta and the Scott rivers. We estimated that only 3.57% and 2.68% of the previous five year average were produced respectively. We believe this is due to high flows in December 2005 and the resultant destruction of redds. We estimated the number of coho (*Oncorhynchus kisutch*) smolts produced per returning adult and the smolt to adult survival for Shasta River coho, brood years 2001 through 2004. We projected a downward trend in the number of returning adult coho and have identified habitat concerns that may affect the survival of juvenile coho.

Background

2006 was the seventh consecutive year of rotary trapping on the Shasta and Scott rivers. The goals of the project were:

- To determine emigration abundance and timing of all age classes of juvenile salmonids emigrating from the Shasta and Scott rivers between early February and mid July 2006.
- To investigate the relationships between instream conditions and emigration patterns of juvenile salmonids.

The specific objectives were:

- To determine the age structure of emigrating salmonids using scale analysis and to establish approximate fork length cutoffs for established time periods.
- To estimate the weekly mean fork length at age of salmonids in the catch from a measured sub-sample.
- To estimate weekly rotary trap efficiencies for all age classes of salmonids in the catch and produce weekly production estimates for each age class.
- To monitor stream flow and temperature at the traps.

Shasta River Rotary Screw Trap Summary

Methods

We sampled the Shasta River with a modified five foot rotary screw trap manufactured by EG Solutions, Corvallis, Oregon. Dan Byrd from the Yreka Screen Shop increased the size of the live car to 86 inches long by 48 inches wide, 22 inches deep and equipped it with an electric drum screen designed to help remove debris. The trap was operated six days per week: Sunday afternoon through Saturday morning, directly downstream of the Shasta River Fish Counting Facility at 041° 49' 46.38" N, 122° 35' 35.38" W. The catch in the trap was processed daily at approximately 0800 hrs. We also checked the operation of the trap and removed debris from the live car at approximately 1700 hrs daily. We measured the velocity of the water entering the cone at the beginning and end of each set with a flow meter manufactured by General Oceanics model 2030R and calculated the total volume sampled 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. Scale samples and fork length data were collected from a random sample of the catch.

Age Determination

Age-length cut-offs for salmonids were determined from fork length frequency distributions and by estimating the age of scales in the 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 cutoffs between age classes were determined for appropriate time intervals and updated throughout the season. We recognize that the cutoffs are not absolute and that as a result of variable growth, some individuals may be larger or smaller than the cutoff fork length. The fork length cutoffs and the number of scales examined to determine the cutoffs are shown in Appendices 34 and 35.

Trap Efficiency Determinations and Production Estimates

When sufficient fish were in the catch, we conducted multiple trap efficiency trials to determine the mean weekly trap efficiency for 0+ Chinook (*Oncorhynchus tshawytscha*), 0+, 1+, 2+, and 3+ steelhead (*Oncorhynchus mykiss*), and 0+ and 1+ coho (*Oncorhynchus kisutch*). 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. 0+ Chinook, coho and steelhead were dyed by placing them in a solution of 0.6 grams of Bismarck brown mixed with 19 liters of water for 45 minutes. The older age fish were marked with a caudal fin margin clip. Three different caudal fin margin clips were used in a weekly rotation allowing us to determine if marked fish were being recaptured outside of the week in which they were marked. Fish marked in the morning processing were held in live cars until the afternoon in order to assess their condition prior to release. For each species and age class, the number of fish recaptured during the week divided by the total number marked equals the estimated trap efficiency for the week. An estimate of the total number of outmigrants per week was determined using a stratified mark and recapture technique (Carlson 1998). We used zero for the lower confidence limit if the calculated lower confidence limit for the estimate was negative. In weeks when marked fish were released but none were recaptured, we used the average trap efficiency for the season or the seasonal trap efficiency to expand the number of fish trapped to an estimate of the total migrants for the week (ODFW Salmonid Lifecycle Monitoring Project).

Water temperature and flow monitoring

Hourly water temperatures were recorded with an Onset Optic StowAway temperature logger attached to the downstream end of the trap. Stream flow measurements presented in this report are preliminary data from the United States Geological Survey (USGS) stream gauge number 11517500.

Results

The Shasta River rotary trap began sampling six days per week on 2/12/06. Trapping ended after 22 weeks on 7/15/2006. The trap fished 140 sets for a total of 3,218.6 hours. We estimate that 885,886,152 cubic feet of water were sampled. The number of fish trapped, marked and recaptured by week, and weekly estimates with a 95% Confidence Interval (CI) for all age classes of salmonids with population estimates are shown in Appendices 1-8. Weekly mean fork length, sample size, minimum and maximum size and standard deviation is shown in Appendices 16-24.

Chinook 0+

We estimate a total of 83,387 0+ Chinook (95% CI, 76,439 – 90,335) left the Shasta River during the period sampled. The greatest number of Chinook emigrated during week 20 (32,600, 95% CI, 27,314 - 37,886). This is equal to 39.1% of the total estimate (Charts 1 and 2). The mean fork length for 0+ Chinook during week 20 was 94 mm (Appendix 16).

Coho 0+

An estimated 870 0+ coho (95% CI, 571 – 1,169) emigrated from the Shasta River between weeks 18 through 28. The greatest number left during week 23 (275, 95% CI, 83 – 465) (Chart 4). This is equal to 31.8% of the total estimate (Chart 5). The mean fork length for 0+ coho during week 23 was 96 mm (Appendix 18).

Coho 1+

An estimated 10,833 1+ coho (95% CI, 4,912 – 16,755) emigrated from the Shasta River from weeks 7 through 23 (Chart 6). The greatest number left during week 17 (6,699, 95% CI, 881– 12,517) (Chart 6). This is equal to 61.8% of the total estimate (Chart 7). The mean fork length for 1+ coho during week 17 was 146 mm (Appendix 19).

Coho 2+

A total of 30 2+ coho were trapped from weeks 11-20. No estimates of the total number of 2+ coho are possible due to small number trapped and no recapture of marked fish. The greatest number was trapped in week 17 (10). The mean fork length for 2+ coho during week 17 was 175 mm (Appendix 20).

Steelhead 0+

An estimated 46,463 0+ steelhead (95% CI, 41,107 – 51,819) emigrated from the Shasta River between weeks 18 through 28. The greatest number left during week 26 (23,059, 95% CI, 18,270 – 27,848) (Chart 9). This is equal to 49.6% of the total estimate for the period sampled (Chart 10). The mean fork length for 0+ steelhead during week 26 was 78 mm (Appendix 21).

Steelhead 1+

An estimated 2,379 1+ steelhead (95% CI, 1,807 – 2,950) emigrated from the Shasta River in weeks 8-10, 13, 17-23, 25 and 26. The greatest number left during week 25 (1,883, 95% CI, 1,369 – 2,397) (Chart 11). This is equal to 79.2% of the total estimate for the period sampled (Chart 12). The mean fork length by week is shown in Appendix 22.

Steelhead 2+

An estimated 32,616 2+ steelhead (95% CI, 17,478 – 47,754) emigrated from the Shasta River during weeks 7, 8, 10, 11, 12 and 14-26. The mean fork length by week is shown in Appendix 23.

Steelhead 3+

We trapped a total of 113 3+ steelhead between weeks 7 and 26. Week 18 was the only week during which we had a recapture of a marked fish and were able to produce and estimate of 718 3+ steelhead (95% CI, 0 – 1,525). The mean fork lengths for 3+ steelhead are shown by week in Appendix 24.

Chart 1

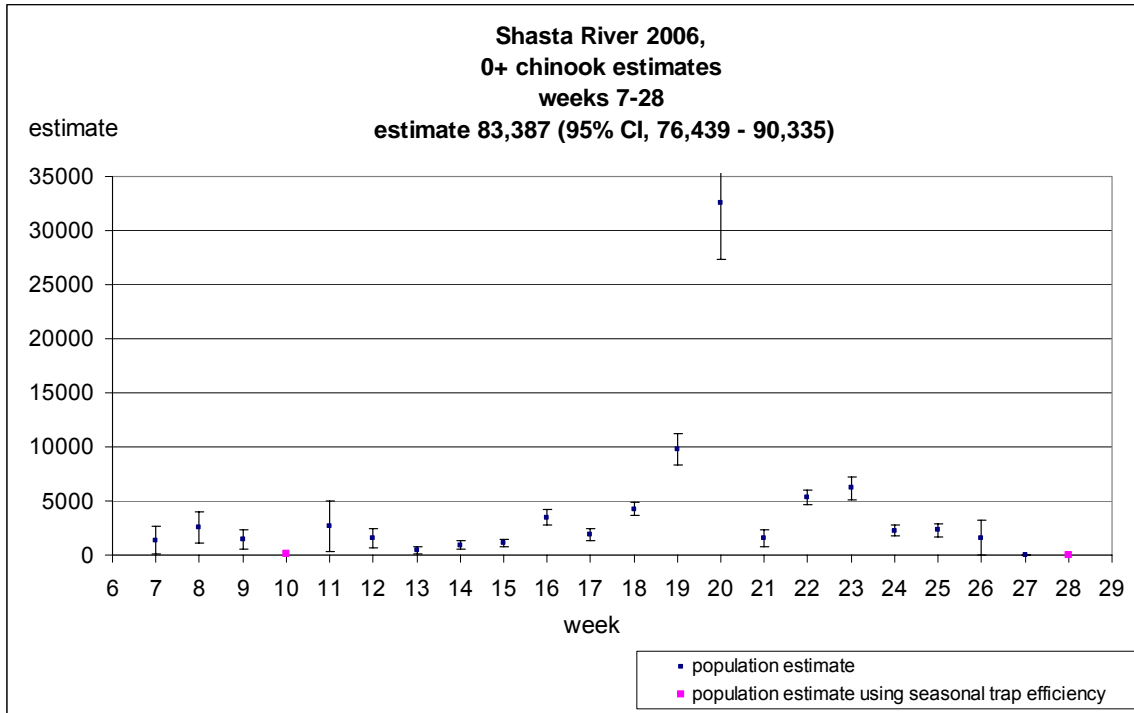


Chart 2

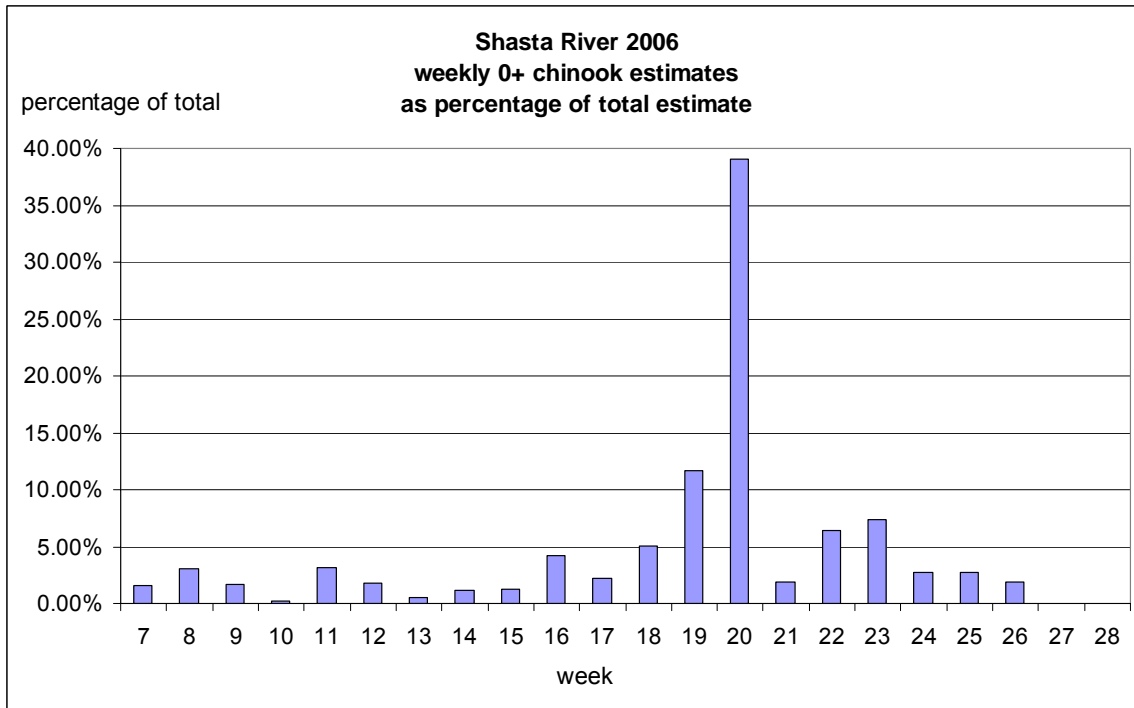


Chart 3

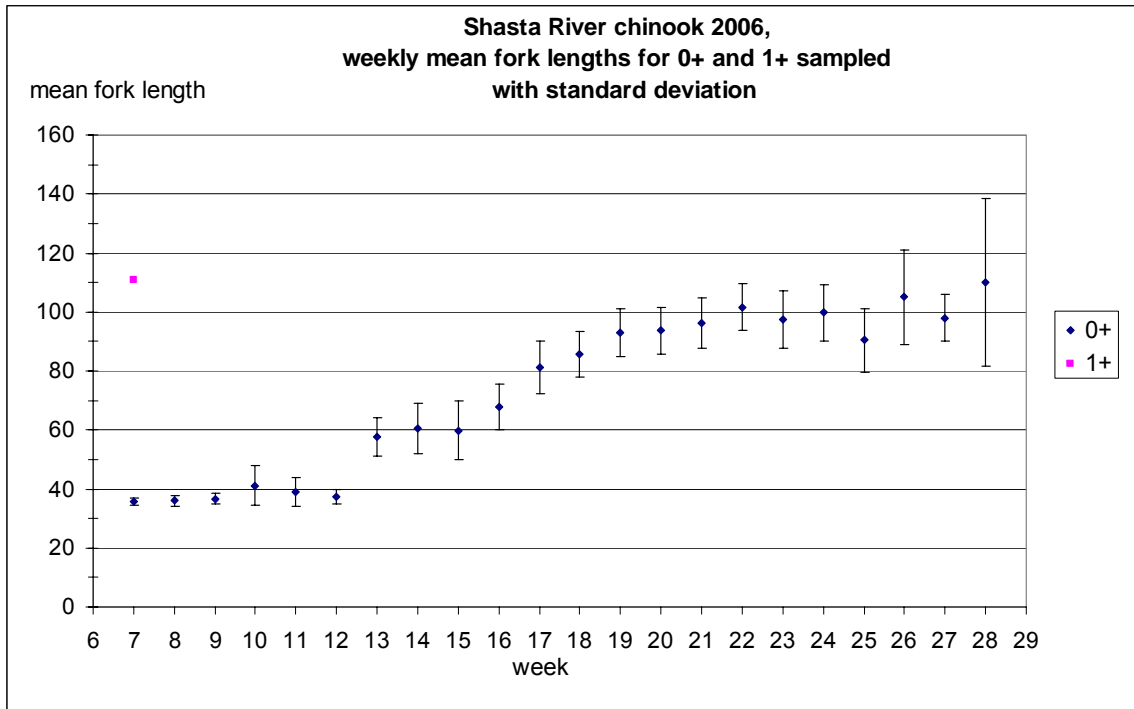


Chart 4

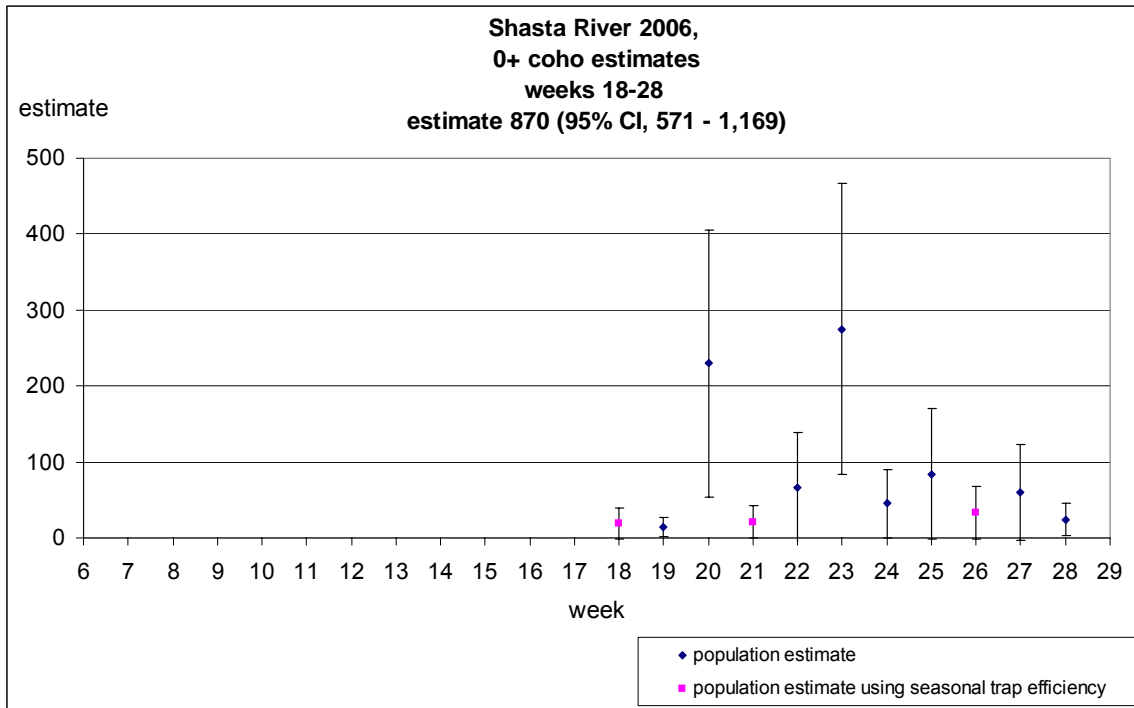


Chart 5

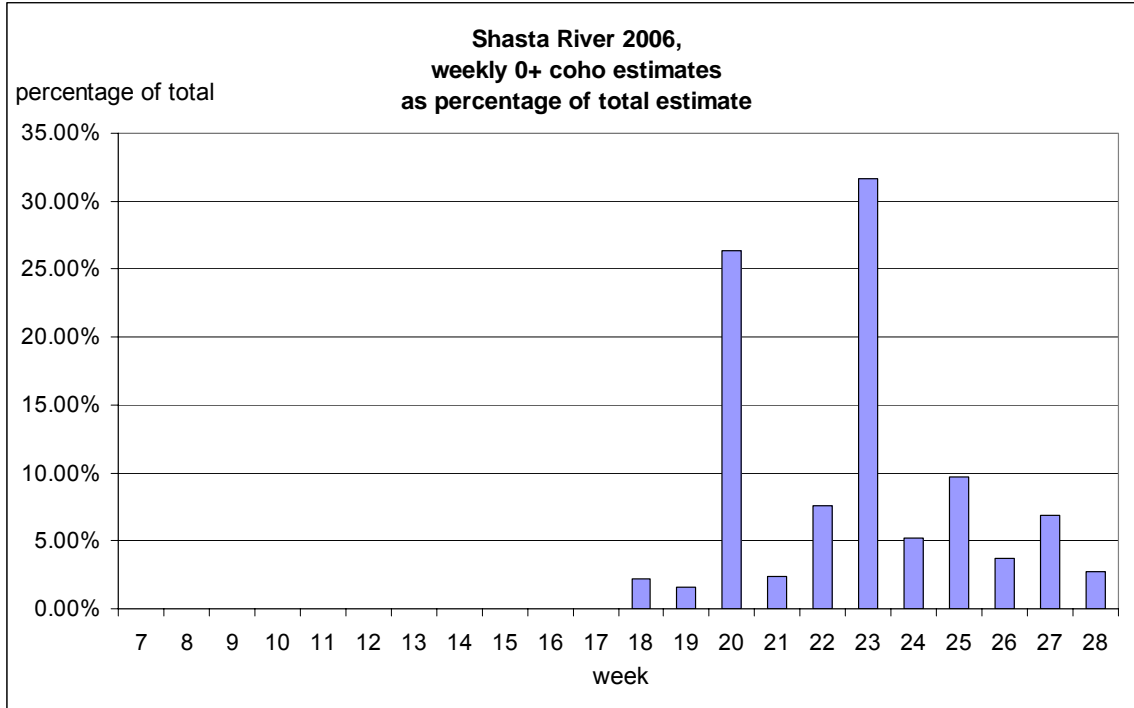


Chart 6

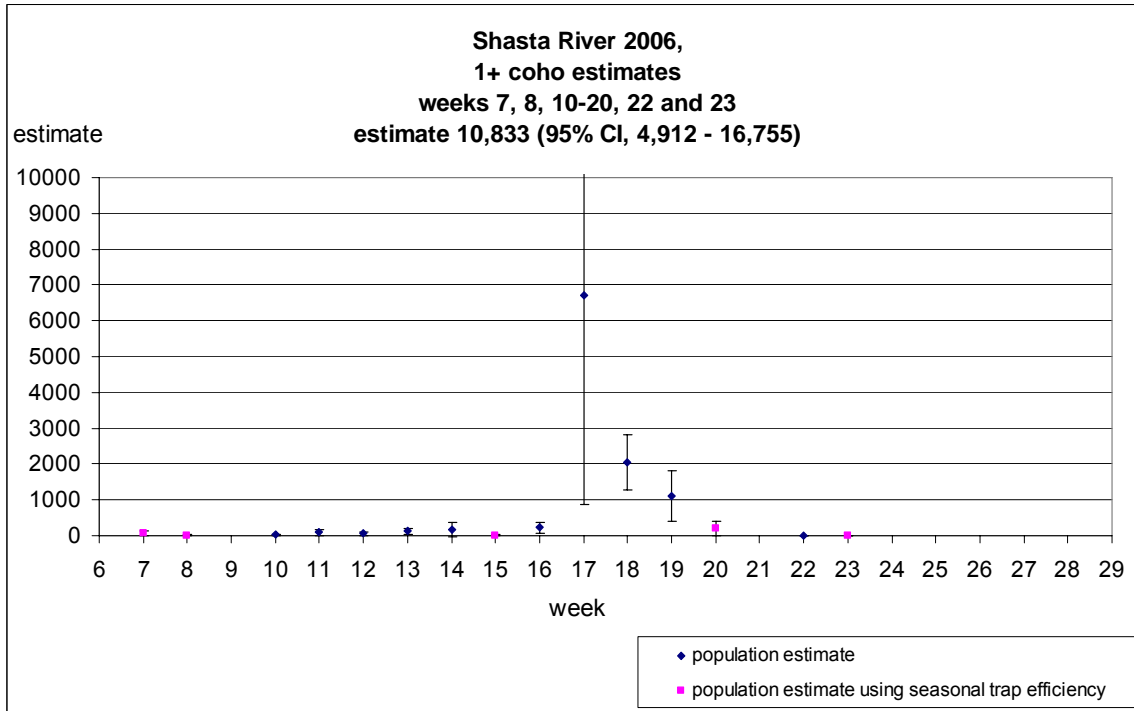


Chart 7

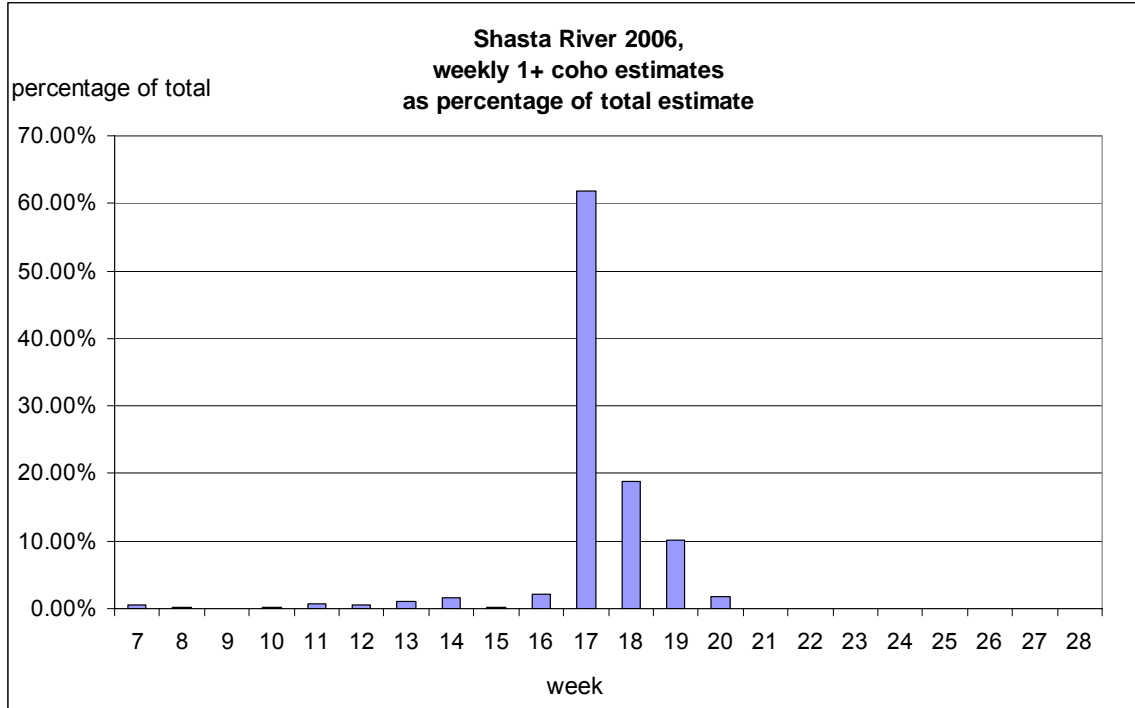


Chart 8

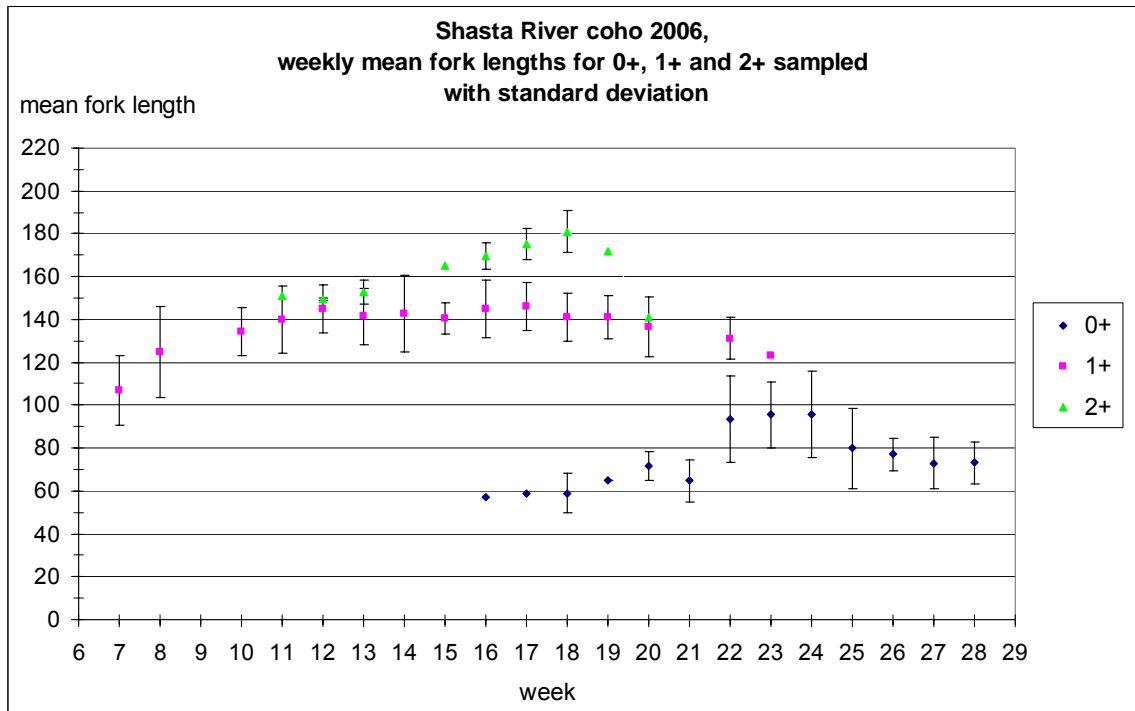


Chart 9

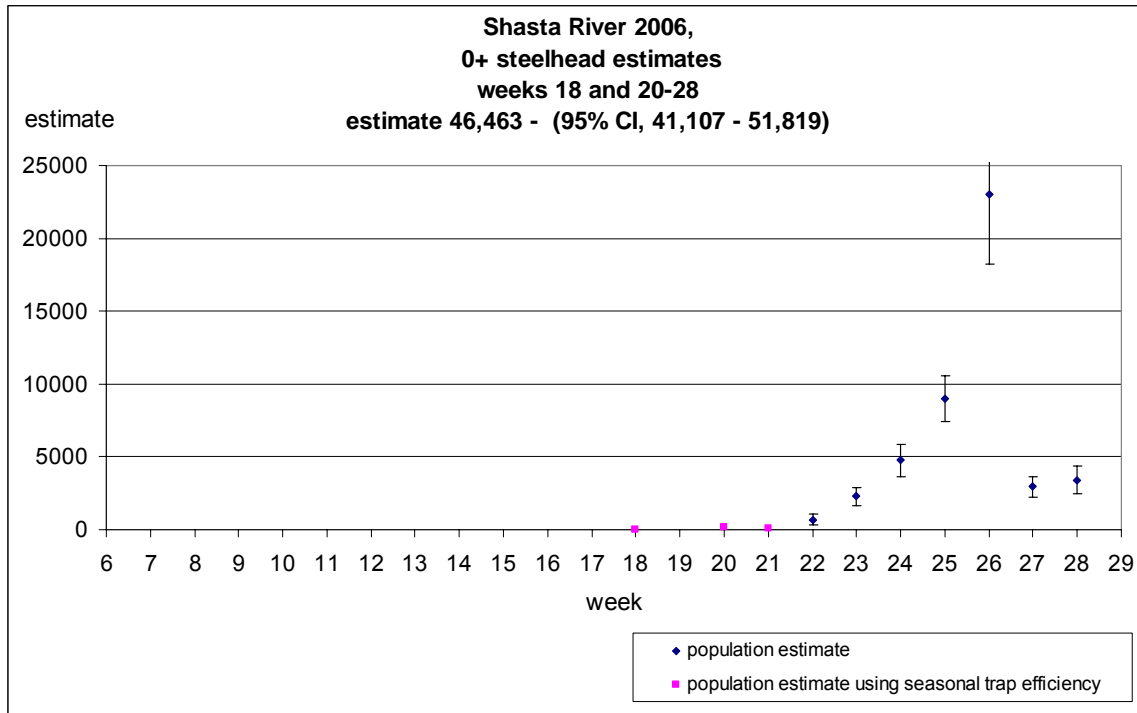


Chart 10

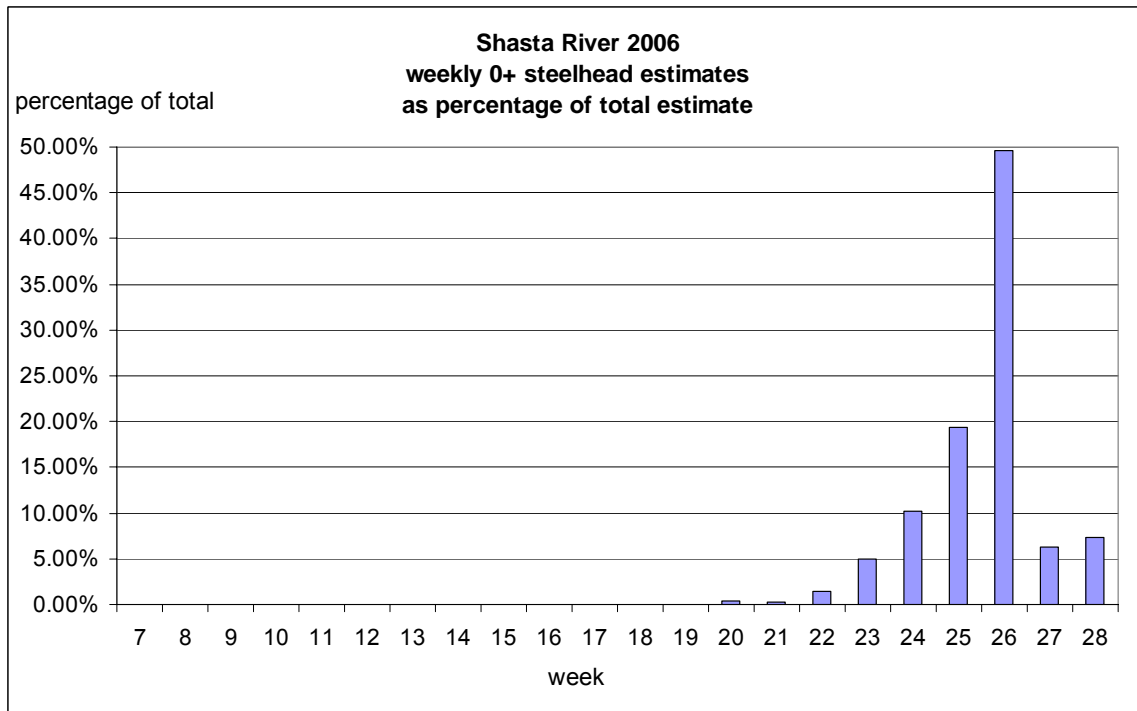


Chart 11

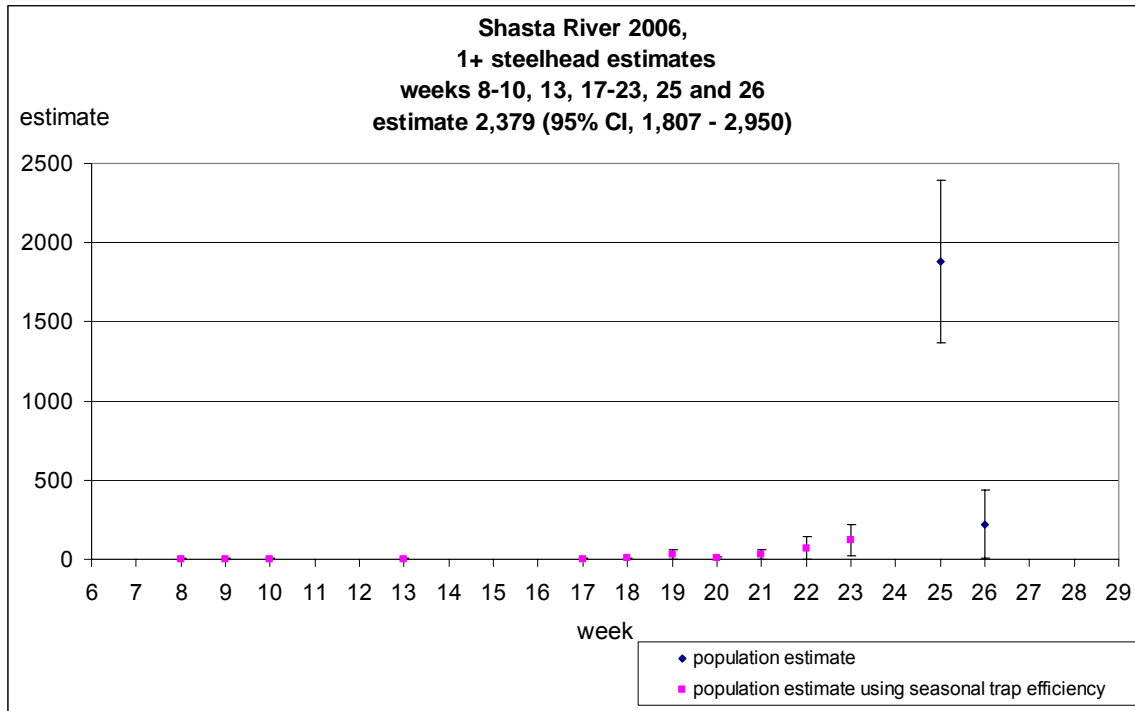


Chart 12

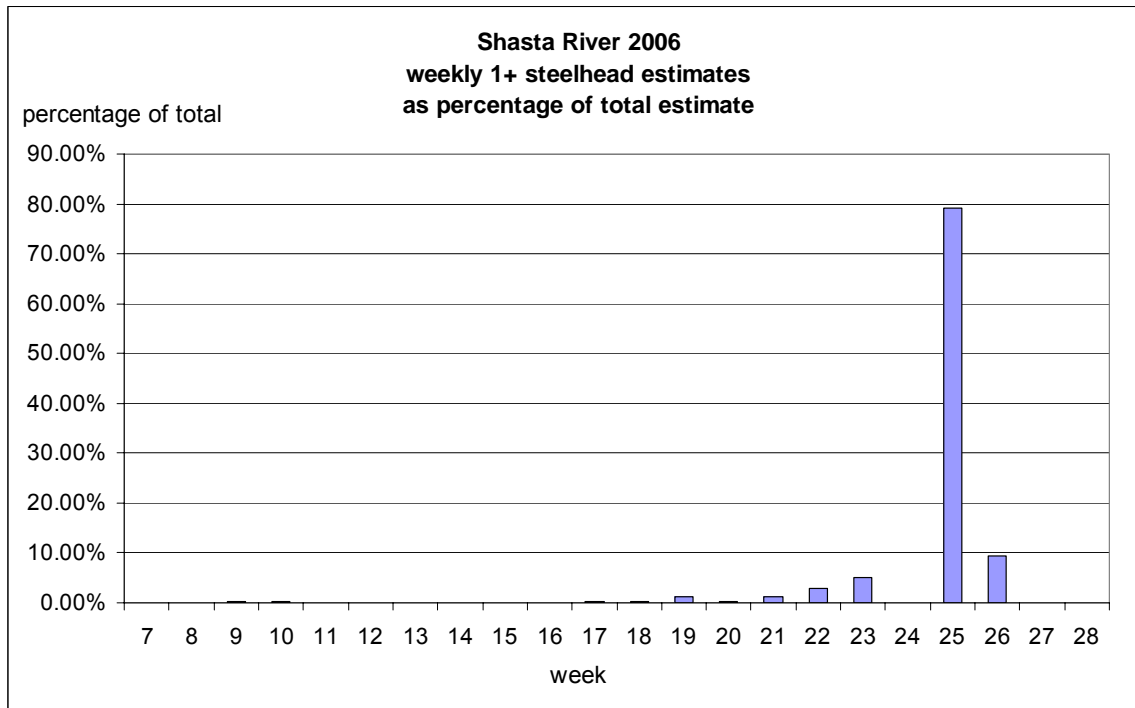


Chart 13

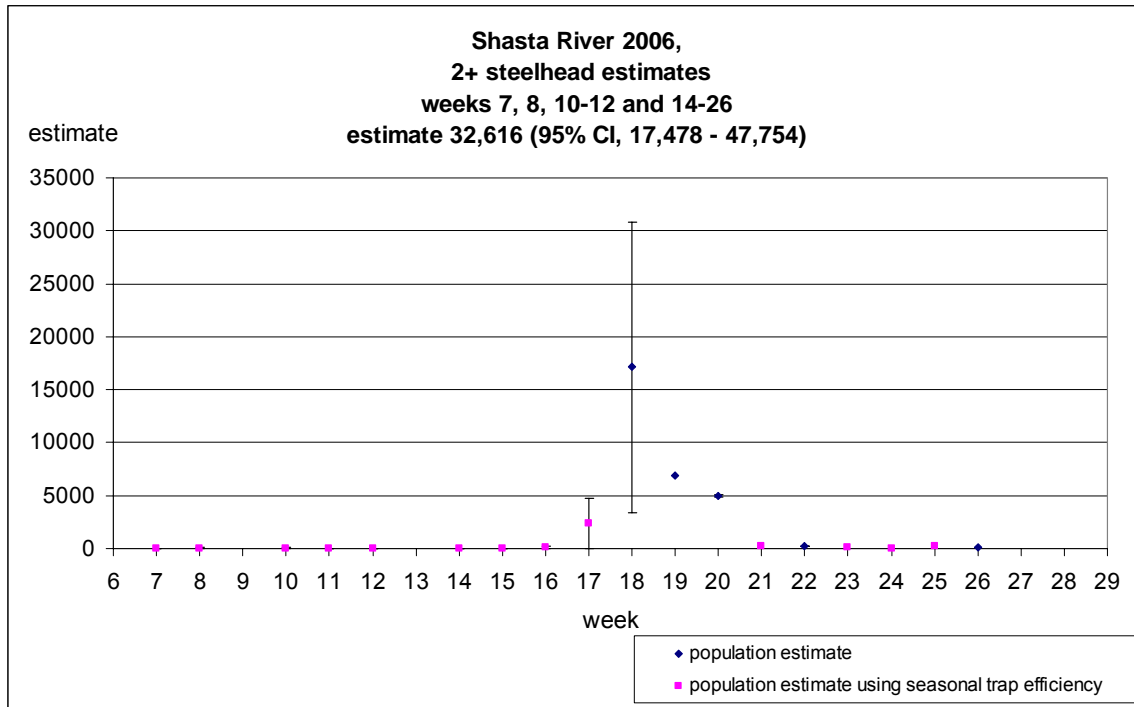


Chart 14

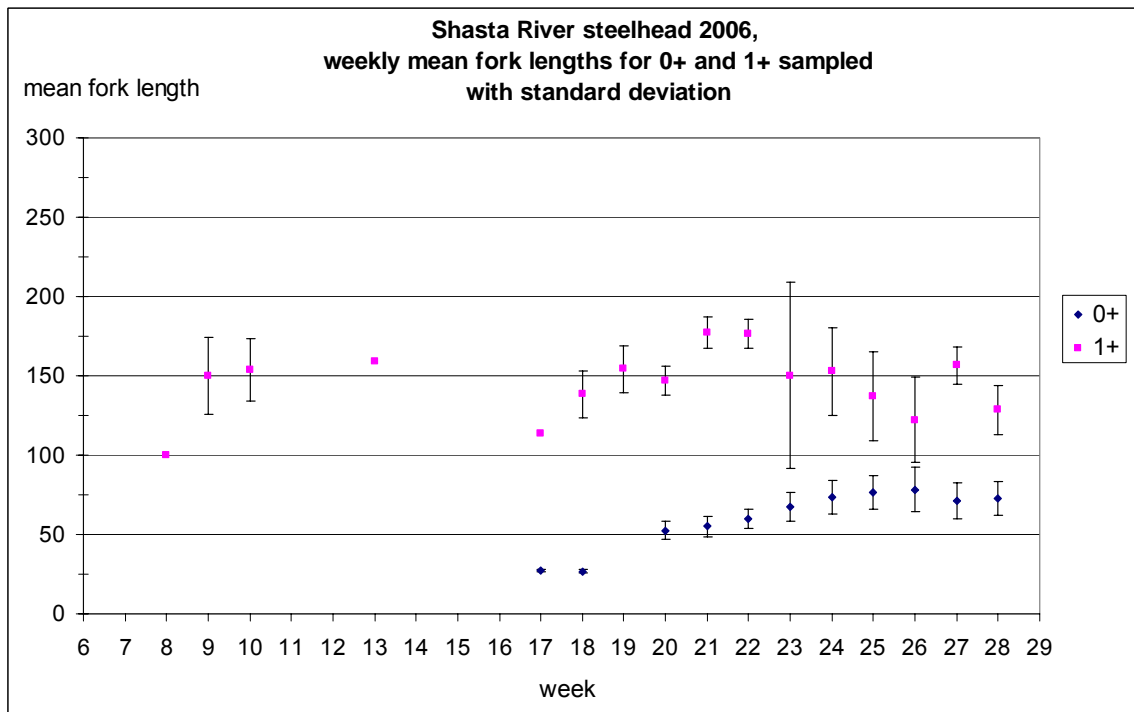
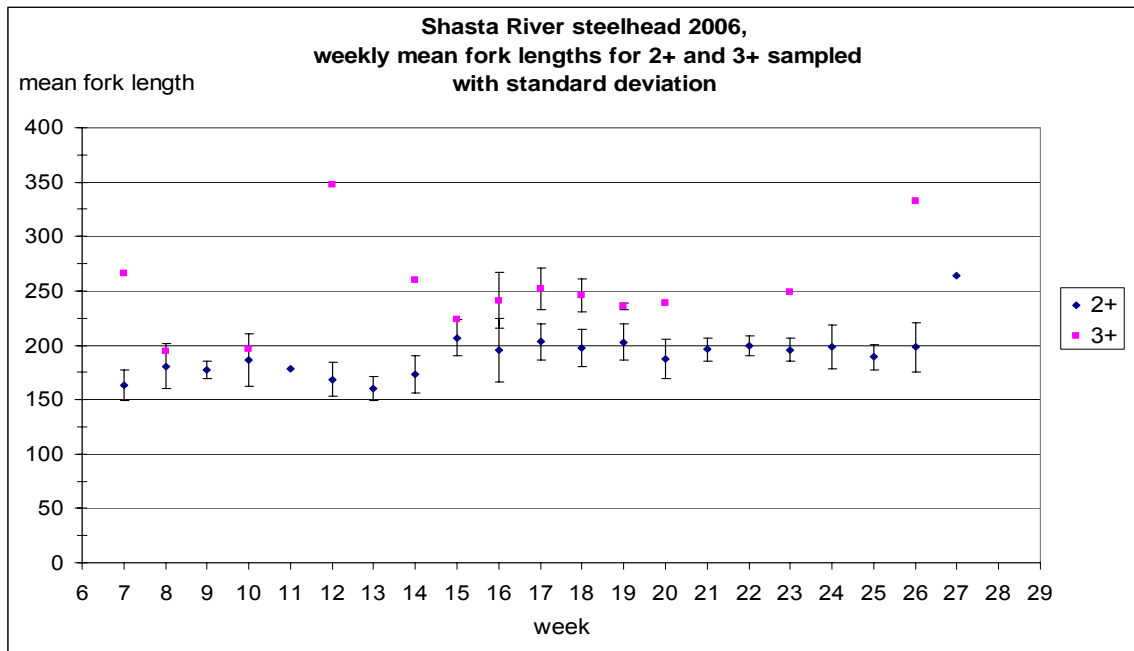


Chart 15



Discussion

Chinook

The estimate for the total number of Chinook (83,387) in 2006 was the smallest observed since the project began in 2000. This number is equal to only 3.57% of the average for the previous five years, 2001 – 2005 (Table 1). The sharp decline in production is most likely due to the destruction of redds by the high flow in late December 2005 (Chart 16, JW 52).

We have observed that fall Chinook spawning is concentrated in two general areas of the Shasta River: the canyon area from approximately the Interstate-5 (I-5) Bridge to the mouth and an upstream area referred to as the Big Springs Complex. The upstream area extends approximately from river mile 32 and includes the Shasta River below Big Springs Creek, Big Springs Creek, lower Parks Creek and the Shasta River upstream of Parks Creek. Due to limited rearing habitat and close proximity to the mouth of the Shasta River, we believe that most of the Chinook emigrating as emergent fry are produced from redds in the canyon reach.

The timing of the Chinook emigration as represented by the percentage of the total Chinook emigrating per week appeared to be later in 2006 than in previous years (Chart 17 and Chart 2). The percentage of the Chinook emigrating as emergent fry was also smaller in 2006. Chart 17 shows the average weekly percent of the total estimate of 0+ Chinook emigrants by week for the years 2001-2005. During these years, we estimated that an average of over 89% of the total 0+ Chinook produced left during weeks 7-14. During the same period in 2006, we estimate that only 14.1% of the total Chinook emigrated (Chart 2). The decline in the number of Chinook fry in the catch and the appearance of a later emigration are most likely due to the destruction of Chinook redds and loss of production in the canyon reach where water velocities were the greatest during the high flows of December 2005.

Chart 16

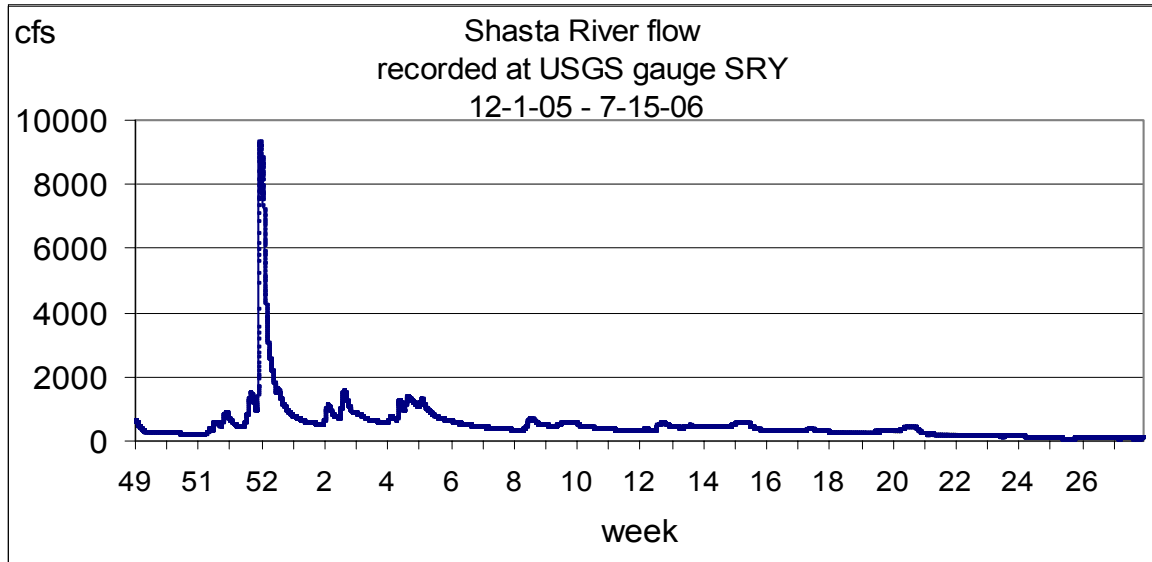
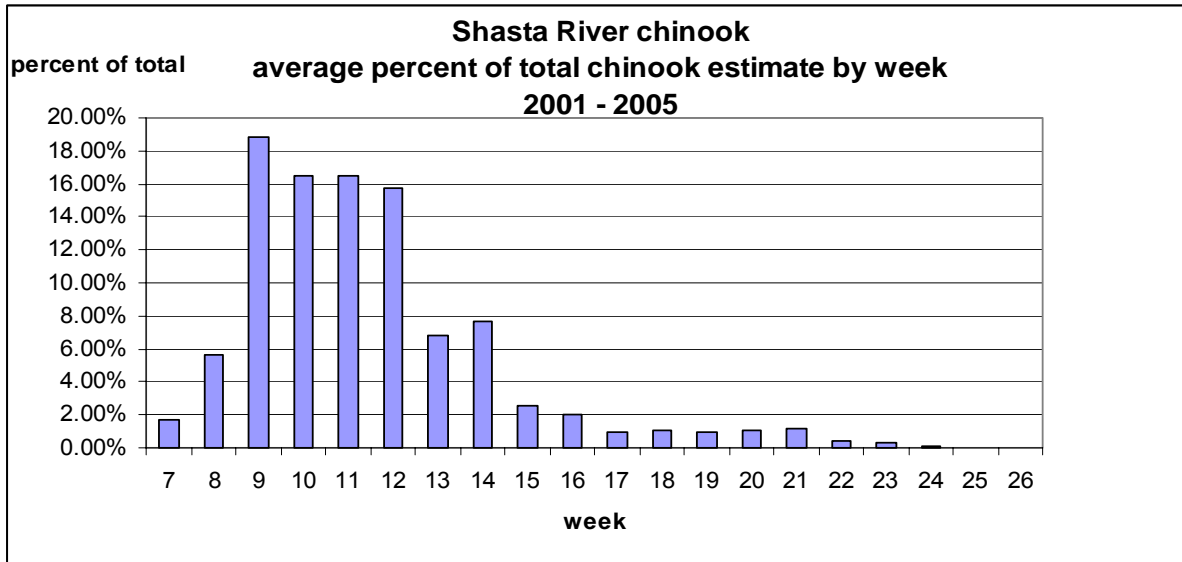


Table 1. Weekly Shasta River Chinook estimates, 2001- 2006.

	2001	2002	2003	2004	2005	average 2001- 2005	2006	% of weekly average from 2001- 2005 estimated in 2006
6	3137							
7	10546		13429	125190	14470	40909	1358	3.32%
8	17861		97358	401988	13942	132787	2545	1.92%
9	1305719	321719	144206	395915	26738	438859	1427	0.33%
10	260137	622634	143548	851550	50927	385759	154	0.04%
11	1032865	521745	86911	249353	33513	384877	2654	0.69%
12	1199398	410963	100881	107549	15256	366809	1531	0.42%
13	197368	363540	171099	46026	14719	158551	475	0.30%
14	40306	738380	55585	26906	36996	179635	939	0.52%
15	22557	148765	35821	64925	23114	59036	1087	1.84%
16	12042	148890	17697	51207	11409	48249	3499	7.25%
17	40223	23015	17879	25286	6693	22619	1886	8.34%
18	31575	24995	8626	48625	6265	24017	4243	17.67%
19	163	74983	6520	23136	3134	21587	9777	45.29%
20	19655	62352	26573	9206	9729	25503	32600	127.83%
21	7486	22535	65501	25328	18746	27919	1564	5.60%
22	1501	7407	22235	18534	4443	10824	5320	49.15%
23	264	15971	5616	9205	1921	6595	6170	93.55%
24	256	1251	539	3401	1869	1463	2261	154.55%
25	322	208	504	1609	968	722	2300	318.55%
26	345	33	173	1138	847	507	1586	312.74%
27	41	4	116				10	
28			38				3	
29			48					
Total	4203764	3509388	1020905	2486076	295699	2337229	83389	3.57%

Chart 17



Flow and Temperature

Chart 18

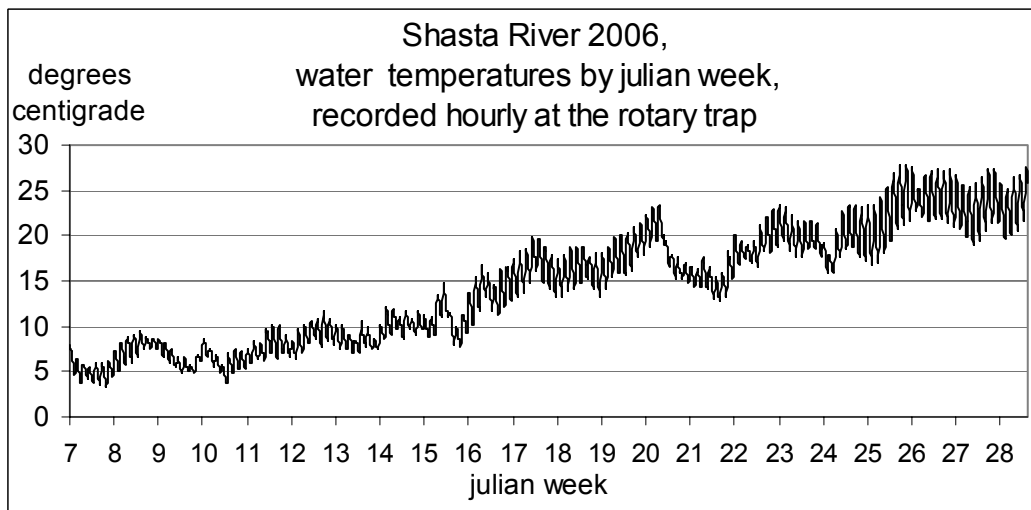
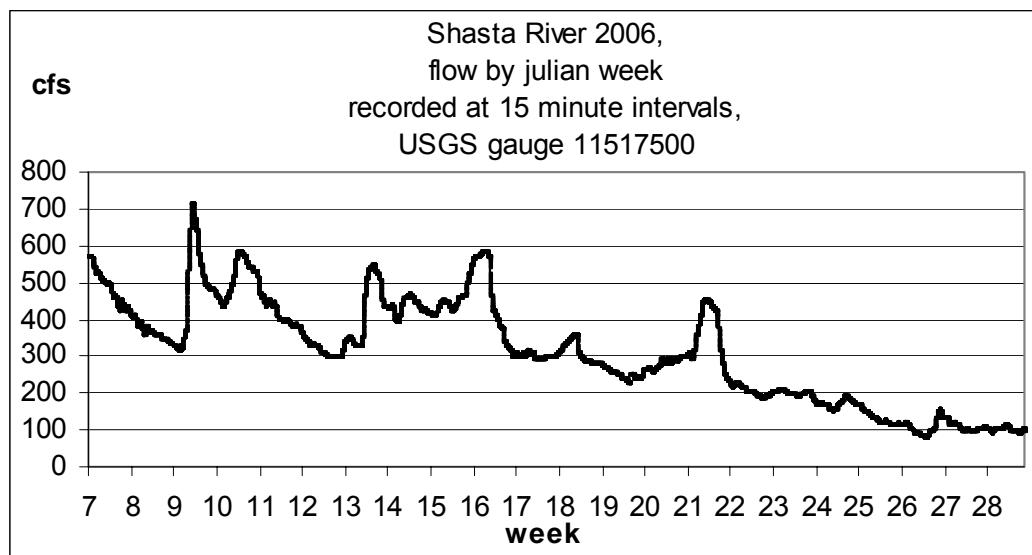


Chart 19



Historic flow conditions

The Shasta River is unique among Klamath River tributaries below Iron Gate Dam in that it has sustained summer inflow from springs in the upper watershed. Multiple authors have noted that spring Chinook were native to the Shasta River (Curtis 1922, Snyder 1930, Wales 1952, Moyle 2002). Snyder reports that they had “practically disappeared” by 1930 but had previously entered the Shasta River in June or early July. Adult spring Chinook require cool water and pools in which to hold throughout the summer. Recent estimates of present-day full natural flow in the Shasta River indicate that with the historic unimpaired hydrograph, instream conditions were more favorable for salmonids than what is seen under present day management (DWR Bulletin 87, Chesney and Yokel, 2003). These changes are significant to the understanding of factors limiting the survival of anadromous fish such as coho and steelhead which require over-summer rearing habitat.

Coho

Spawning distribution and location of over-summer rearing

In the fall of 2004, 19 wild adult coho were radio tagged as they entered the Shasta River. The tagged fish were tracked to two distinct spawning grounds; the canyon area within the lower 7 miles of the Shasta River and the Big Springs Complex (Littleton and Pisano 2006). We have observed very different flow and temperature conditions between these two areas during the summer that will affect the survival of rearing juvenile salmonids. Coho typically rear for a year in freshwater prior to immigrating to the ocean as smolts. The North Coast Water Quality Control Board (NCRWQCB) has determined that “Low dissolved oxygen concentrations and elevated water temperatures in the Shasta River, its tributaries and Lake Shastina have resulted in degraded water quality conditions that do not meet applicable water quality objectives and impair designated beneficial uses” (NCWQCB 2006). In most years, we believe springs in the Big Springs Complex maintain flows and create some refugial areas where water temperatures are suitable for over-summering salmonids. However, the

cumulative effects of numerous diversions, tail water and other causes identified in the Total Maximum Daily Loading (TMDL) Action Plan, results in low dissolved oxygen and elevated water temperatures (NCRWQCB, 2006). These conditions are especially apparent in the lower 20 miles of the Shasta River.

CDFG studies in the lower Shasta River in 2005 documented a substantial loss of suitable rearing habitat and the displacement of rearing 0+ coho as a result of stream diversion (CDFG 2005, Chesney, CDFG files 2005). As flows decrease we have observed an increase in the number of 0+ coho moving into the Klamath River (Chesney et.al. 2004). As with the Chinook fry, it is likely that the emigrating 0+ fry and parr are the progeny of the coho spawning in the canyon. Based on the distribution of spawning and the successful emergence of 3,247 fry from a capped coho redd in the canyon, we believe that the number of 0+ coho produced in the canyon may be equal to half of the annual production of the entire Shasta River. Under present water management conditions, we believe 0+ coho parr are unable to survive in the canyon and are unable to migrate upstream to refugial areas due to thermal and physical barriers. At this time we have no information regarding the survival of 0+ coho parr that emigrate from the Shasta River to the Klamath River, but elevated water temperatures and low flows during the summer along with the high incidence of infection of juvenile Chinook in the Klamath River with myxozoan parasites (Nichols and Foott 2005) indicate survival may be low.

1+ Production Estimates and Projected Adult Returns

Because coho salmon have a strong tendency to mature at age three, returning adults are almost all from the same cohort. In 2006 we generated estimates for 1+ coho: the progeny of the largest of the three cohorts (Brood Year 2004). The annual estimates for 1+ coho since 2003 and the estimates for the number of returning adult coho produced by the CDFG's Shasta River Fish Counting Facility enables us to estimate the relationship between the number of returning adults and the subsequent number of 1+ smolts produced from that same brood year (Table 2).

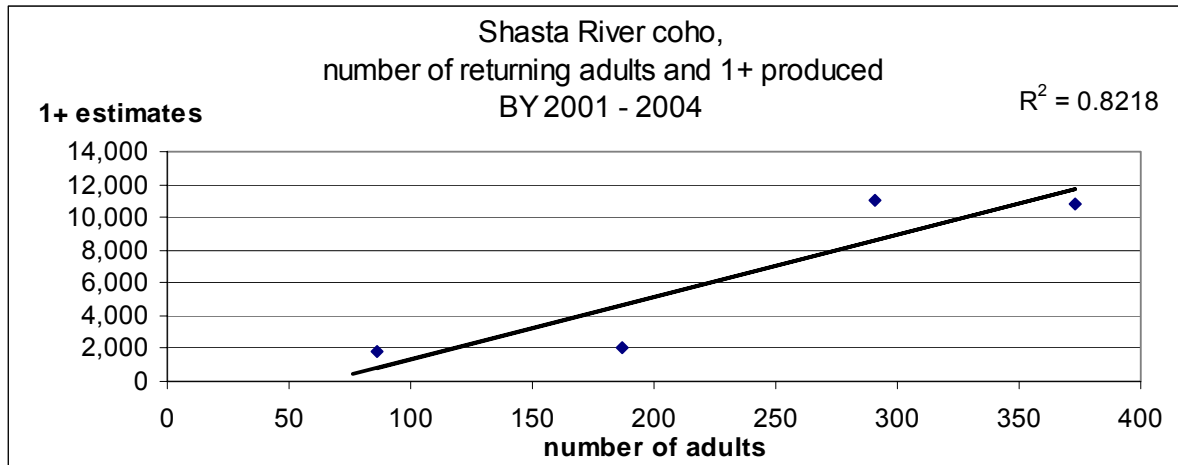
Table 2. Relationship between the number of returning adults and the number of 1+ smolts produced.

Brood year	adults	1+ produced in	Year	smolts per adult
2001	291	11,052	2003	38.0
2002	86	1,799	2004	20.9
2003	187	2,054	2005	11.0
2004	373	10,833	2006	29.0
2005	69	1,706 *	2007	24.7
2006	47	1,162 *	2008	24.7

***Projected production based on average of 24.7 smolts per adult**

In brood years 2001 through 2004 we observed an average of 24.7 1+ smolts produced per returning adult, with a low of 11.0 from Brood Year 2003 and a high of 38.0 from brood year 2001. Using the average value of 24.7 smolts per returning adult, we have projected the expected smolt production for 2007 and 2008 in Table 2. In Chart 20 we have plotted the number of the returning adult coho, brood years 2001 – 2004 against the number of 1+ produced by that cohort. The coefficient of determination, R^2 , is equal to 0.8218.

Chart 20



We have projected the number of returning adults expected to return in 2007 and 2008 using the mean estimated smolt-to-adult survival of 3.17% observed in 2004, 2005, and 2006, and the adult coho counts from 2005 and 2006 (Table 3). The projection for the number of returning adults in 2008 and 2009 is extremely low at 54 and 37 adults, respectively.

Table 3. Number of 1+ produced and observed and projected adult returns.

Brood year	adults	emigration year	1+ produced	% return	adults returning in	Brood Year
2001	291	2003	11,052	3.37%	373	2004
2002	86	2004	1,799	3.84%	69	2005
2003	187	2005	2,054	2.29%	47	2006
2004	373	2006	10,833	3.17%	343 *	2007
2005	69	2007	1,706 *	3.17%	54 *	2008
2006	47	2008	1,162 *	3.17%	37 *	2009

*Projected smolts produced from adult returns in 2005 and 2006 using the mean smolt per adult value and projected survival to returning adults, (based on an average return rate of 3.17 %.)

During the period of record for which we have adult returns, 1+ production estimates, and smolt to adult survival, one cohort has increased in size and two have decreased. The number of 1+ produced per returning adult has ranged from 38.0 to 11.0. We do not understand the factors responsible for this variability in survival.

Over-summer rearing conditions in 2006

We expect that the survival of coho 1+ from Brood Year 2005 will be less than average due to the previously discussed redd scouring flows in December of 2005. Additionally, elevated water temperatures in the upper Shasta River as a result of high flows in Parks Creek in May of 2006 may have also contributed to poor survival. The Parks Creek channel is poorly defined in several locations along its seven mile course between I-5 and where it enters the Shasta River, making it susceptible to flooding (Photo 1). Warm weather in early May caused rapid melting of an above-average snow pack in the Parks Creek watershed. High flows

observed on 5/19/06 caused the creek to go over its banks (Photos 1 and 2). The temperature of Parks Creek increased from 11 °C at the I-5 Bridge to an unknown high temperature which raised the Shasta River to over 24 °C at the Nature Conservancy's Nelson Ranch. The temperature of the Shasta River upstream of the mouth of Parks Creek (within the Lake Shastina subdivision) was measured at 12 °C. We were unable to obtain permission from the land owner to measure the temperature of Parks Creek at the mouth or Big Springs Creek.

Other factors in addition to Parks Creek are affecting water quality in the upper Shasta River. Chart 21 shows that maximum weekly temperatures again increased to 25 °C during week 26 (June 25 – July 1). One possible source of warm water was identified by thermal imagery surveys conducted as part of the NCWQCB TMDL investigations in 2003. These surveys documented cold water springs in upper Big Springs Creek warming rapidly under current management practices (Watershed Sciences 2004). An analysis of the impacts of water temperatures on the distribution of rearing coho in Redwood Creek, Humboldt County identified possible thermal rearing restrictions for juvenile coho (Madej 2005). Brett (1952) determined that temperatures above 25 °C were lethal and that sudden increases from 20 to 25 °C resulted in high mortality. Due to limited access, our understanding of the factors affecting water quality in this critical rearing area of the Shasta is very limited.

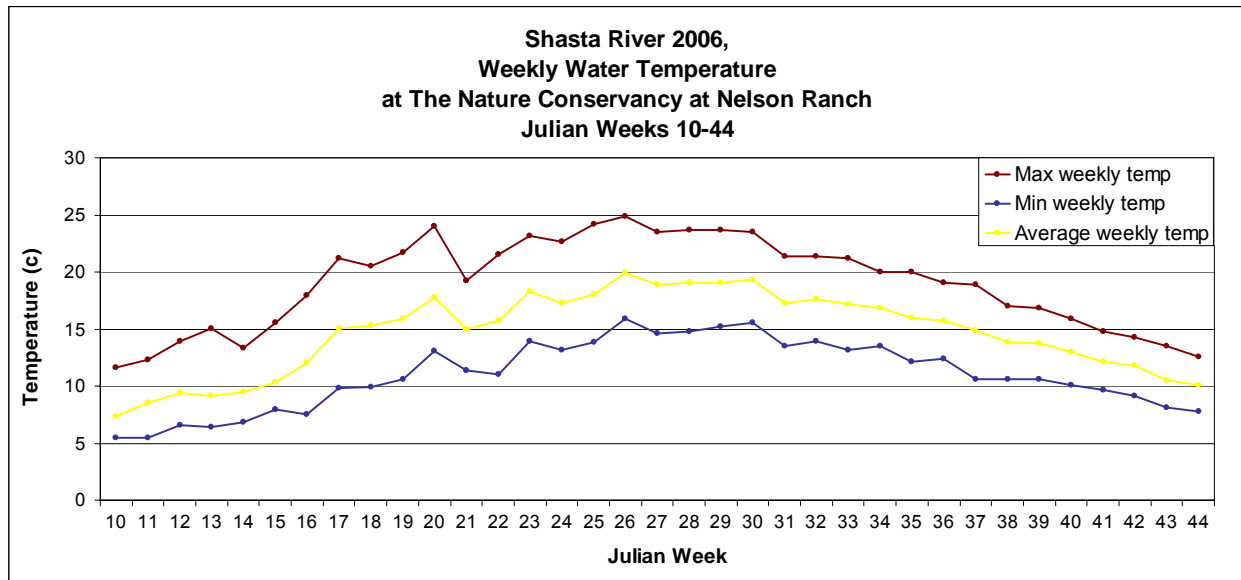
Photo 1. Looking west up Parks Creek, I-5 in the background 5/19/06



Photo 2. Parks Creek entering the Shasta River



Chart 21



Comparison of the emigration timing and rearing distribution of 1+ coho in the Shasta and Scott rivers

In 2006 we observed a distinct difference in the abundance and emigration timing of 1+ coho leaving the Shasta and Scott rivers. During weeks 17 through 19, over 90 percent of the total 1+ coho left the Shasta River (Chart 7). In contrast the 1+ coho emigrations from the Scott River extended over a 19 week period with no more than 20 percent leaving in any one week (Chart 28). This may be due, in part, to the wider distribution and variety of rearing habitat available to coho in the Scott River than seen in the Shasta River. Within the Scott River watershed, under present water management, coho will rear over the summer in Mill Creek (near Scott Bar), Kelsey Creek, Canyon Creek, Shackleford Creek, Kidder Creek, Patterson Creek, Etna Creek, French Creek, Miners Creek, Sugar Creek South Fork of the Scott River, East Fork Mill Creek as well as sections of the main stem. Under present day water management for the Shasta River, we believe summer rearing is limited to the upper portions of the main stem, possibly Big Springs Creek, Yreka Creek and the Little Shasta River. We would expect to see a greater variety of growth and development rates in the Scott River coho population due to the larger variety and broader spatial distribution of habitat available within the Scott River watershed.

0+ Coho Smolts

In 2002, 2004, 2005 and 2006 we observed a distinct emigration of smaller coho smolts from the Shasta River beginning around week 21(5/21/06). An analysis of scale samples from all years indicates that most of these fish are 0+ (Reader and Chesney, unpublished data, 2006). We believe that early emergence of fry in the Big Springs Complex resulting from the relatively warm spring inflow during the winter and the rapid growth of 0+ coho due to optimal conditions during the spring permits these fish to achieve the length necessary to smolt. A 98 mm coho smolt was PIT tagged at the Nature Conservancy's Nelson Ranch on 6/13/06. The fish was released on 6/14/06 and recaptured 31.7 miles downstream at the lower trap on 6/17/06. Examination of the scales and otoliths confirmed that the fish was a 0+.

Unlike the 0+ coho parr in the canyon that are leaving the Shasta River due to loss of habitat, 0+ smolts appear to be actively migrating. Analysis of the scales and otoliths from returning adult carcasses proposed in the Shasta and Scott River Monitoring Plan will allow us to determine the success of the 0+ smolt life history.

Recommendations

Coho

- Support implementation of CDFG's Shasta and Scott Rivers Coho Monitoring Plan. This plan has been designed to identify factors limiting coho survival and increase our understanding of coho life history needs. Among others, proposed methods of study include radio tagging, PIT tagging, mark and recapture population estimates, and scale and otolith micro chemistry analysis. These studies will have the largest sample size to work with and be most effective if they are implemented to coincide with the return of the largest cohort in the fall of 2007.

Scott River Rotary Screw Trap Summary

Methods

We sampled the Scott River with a five foot and an eight foot rotary screw trap manufactured by EG Solutions, Corvallis, Oregon. The traps were operated six days per week, Sunday afternoon through Saturday morning, at approximately 4.75 miles upstream of the confluence with the Klamath River at 041° 43' 34.87" N, 123° 00' 30.11" W. The catch in the trap was processed daily at approximately 0800 hrs. We measured the velocity of the water entering the cone at the beginning and end of each set with a flow meter manufactured by General Oceanics model 2030R and calculated the total volume sampled 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. Scale samples and fork length data were collected from a random sample of the catch.

Water temperature and flow monitoring

Hourly water temperatures were recorded with an Onset Optic StowAway temperature logger attached to the downstream end of the trap. Stream flow measurements presented in this report are made using preliminary data from the United States Geological Survey (USGS) recorded at stream gauge number 11519500. This gauge is located approximately 19.5 miles upstream of the trap. Several large, ungauged tributaries and numerous small streams enter the Scott River between the gauge and the trap and not included in the flow measurements.

Results

The eight-foot Scott River rotary trap began sampling six days per week on 2/21/06. Trapping ended after 21 weeks on 7/15/2006. The trap fished 120 sets for a total of 2,703 hours. We estimate that 1,071.2 million cubic feet of water were sampled. The number of fish trapped, marked and recaptured by week, and weekly estimates with 95% CI for all age classes of salmonids with population estimates are shown in Appendices 9-15. Weekly mean fork length, sample size, minimum and maximum size and standard deviation is shown in Appendices 25-33. The five-foot Scott River rotary trap began sampling six days per week on 3/14/06. After 18 weeks, trapping ended on 7/15/06. The trap fished 70 sets for a total of 1,648 hours. We estimate that 198.2 million cubic feet of water were sampled. The number of fish trapped, marked and recaptured by week, and weekly estimates with 95% CI for all age classes of salmonids with population estimates are shown in Appendices 9-15. Weekly mean fork length, sample size, minimum and maximum size and standard deviation is shown in Appendices 25-33.

Chinook 0+

An estimated 10,890 0+ Chinook (95% CI, 6,982 – 14,797) left the Scott River during the period sampled. The greatest number of Chinook emigrated during week 27 (4,961, 95% CI, 2,906 – 7,015) (Chart 2). This is equal to 51.2% of the total estimate (Charts 17 and 18). The mean fork length for 0+ Chinook during week 27 was 105 mm (Appendix 25).

Coho 0+

An estimated 1,772 0+ coho (95% CI, 1,119 – 2,424) emigrated from the Scott River during weeks 13-20, 22 and 24-28. The greatest number left during week 27 (648, 95% CI, 134 – 1,162) (Chart 20). This is equal to 36.6% of the total estimate (Chart 21). Mean fork length for 0+ coho during week 27 was 79 mm (Appendix 27).

Coho 1+

We estimate that a total of 75,097 1+ coho (95% CI, 59,768 – 90,425) emigrated from the Scott River between weeks 8 through 27 (Chart 22). The greatest number of 1+ coho left during week 22 (16,486, 95% CI, 9,925– 23,046). This is equal to 22.0% of the total estimate (Chart 23). The mean fork length for 1+ coho during week 22 was 118 mm (Appendix 28).

Coho 2+

A total of 19 2+ coho were trapped from weeks 8-21. No estimates of the total number of 2+ coho are possible due to small number trapped and low recapture of marked fish. The greatest number was trapped in week 8 (8). The mean fork length for 2+ coho during week 8 was 132 mm (Appendix 29).

Steelhead 0+

An estimated 11,082 0+ steelhead (95% CI, 7,735 – 14,429) emigrated from the Scott River during weeks 17, 22 and 24-28. The greatest number left during week 27 (4,125, 95% CI, 2,358 – 5,892) (Chart 25). This is equal to 37.2% of the total estimate for the period sampled (Chart 26). The mean fork length for 0+ steelhead during week 27 was 69 mm (Appendix 30).

Steelhead 1+

An estimated 55,512 1+ steelhead (95% CI, 40,318 – 70,706) left the Scott River between weeks 8 through 28. The greatest number left during week 22 (13,536, 95% CI, 4,173 – 22,899) (Chart 27). This is equal to 24.4% of the total estimate for the period sampled (Chart 28). The mean fork length for 1+ steelhead during week 22 was 106 mm (Appendix 31).

Steelhead 2+

A total of 396 2+ steelhead were trapped in the Scott River in weeks 8 through 28. The mean fork lengths by week are shown in Appendix 32.

Chart 22

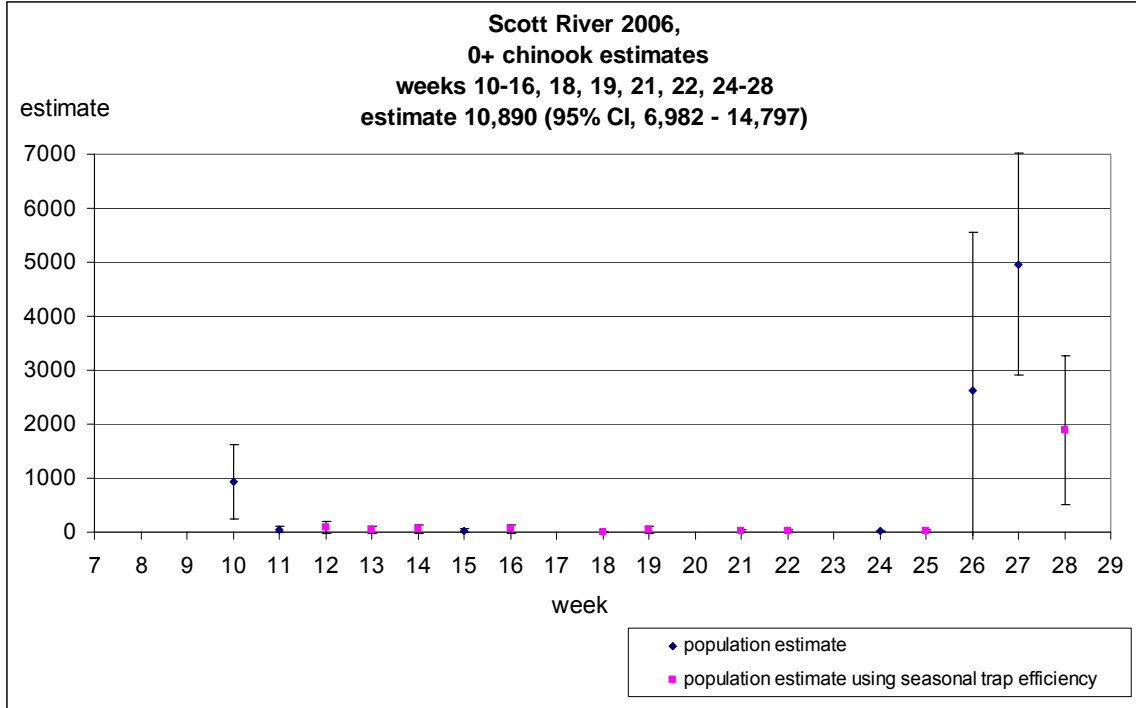


Chart 23

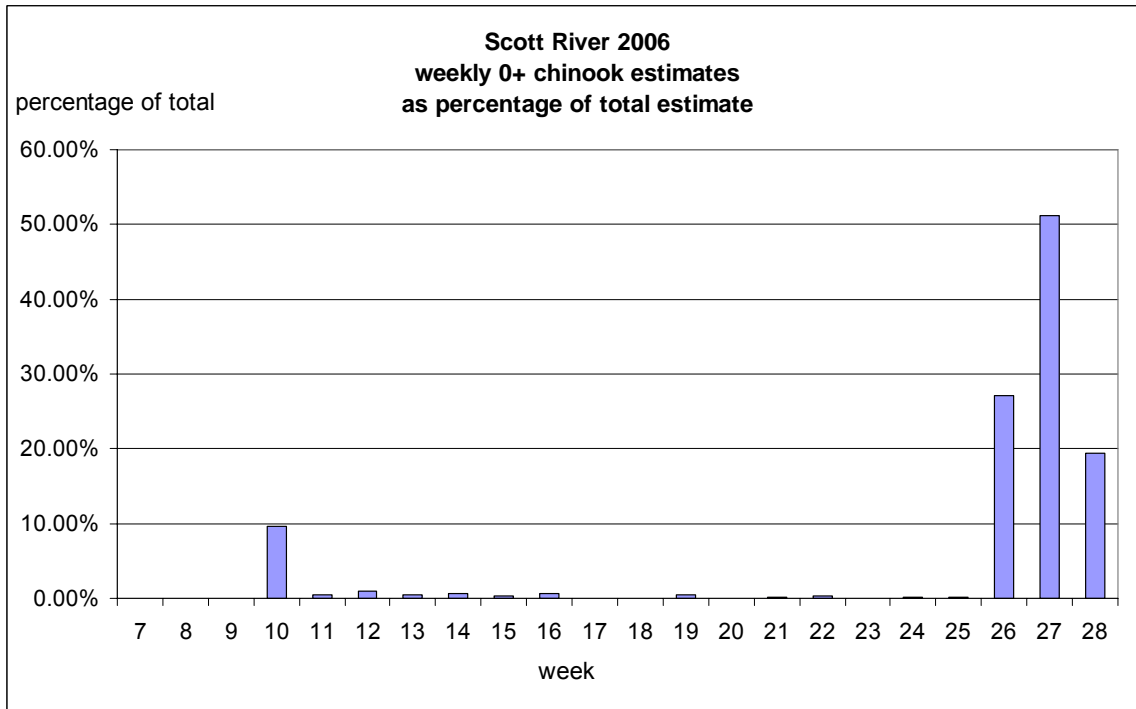


Chart 24

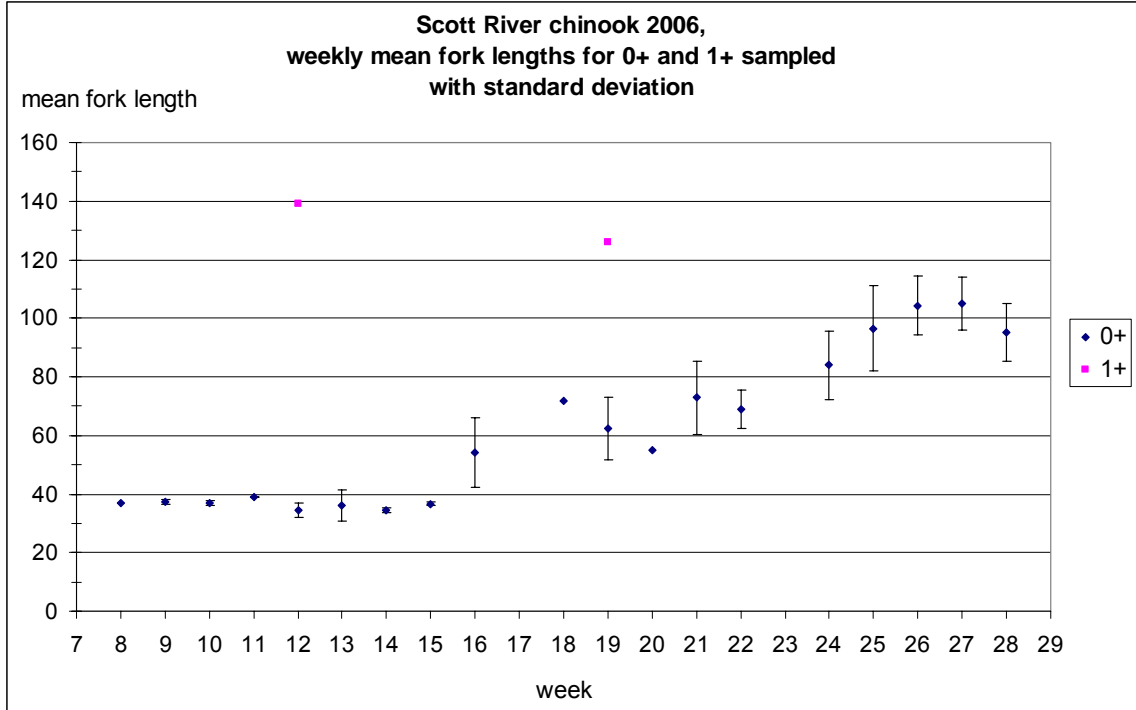


Chart 25

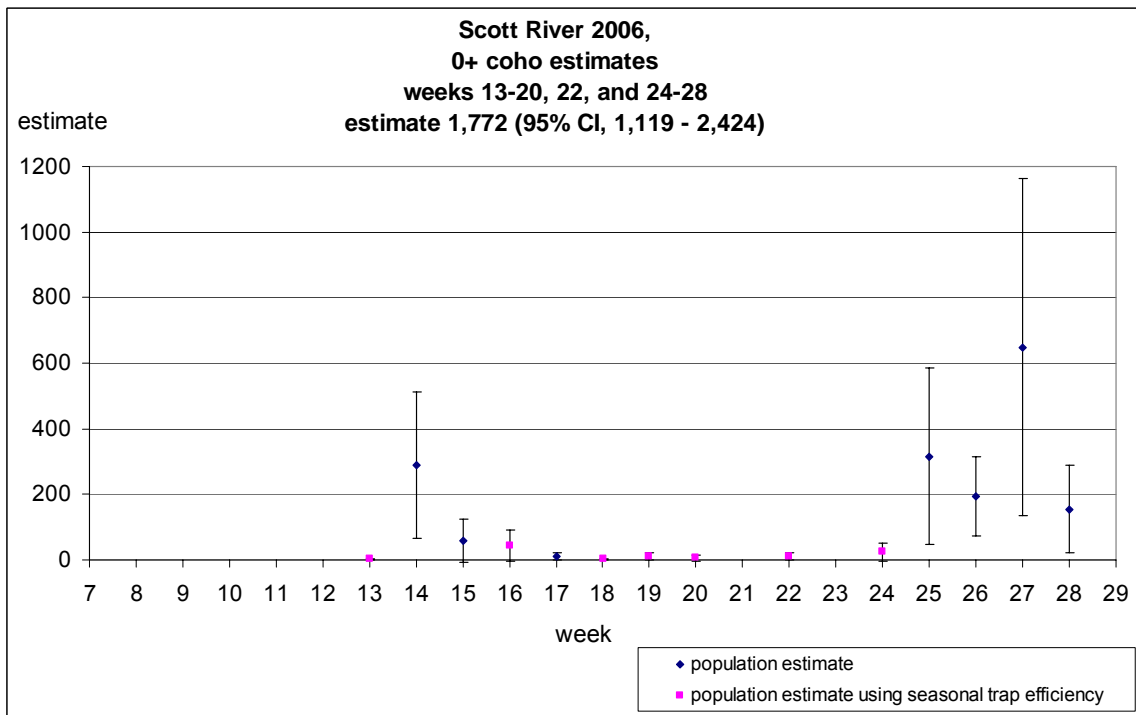


Chart 26

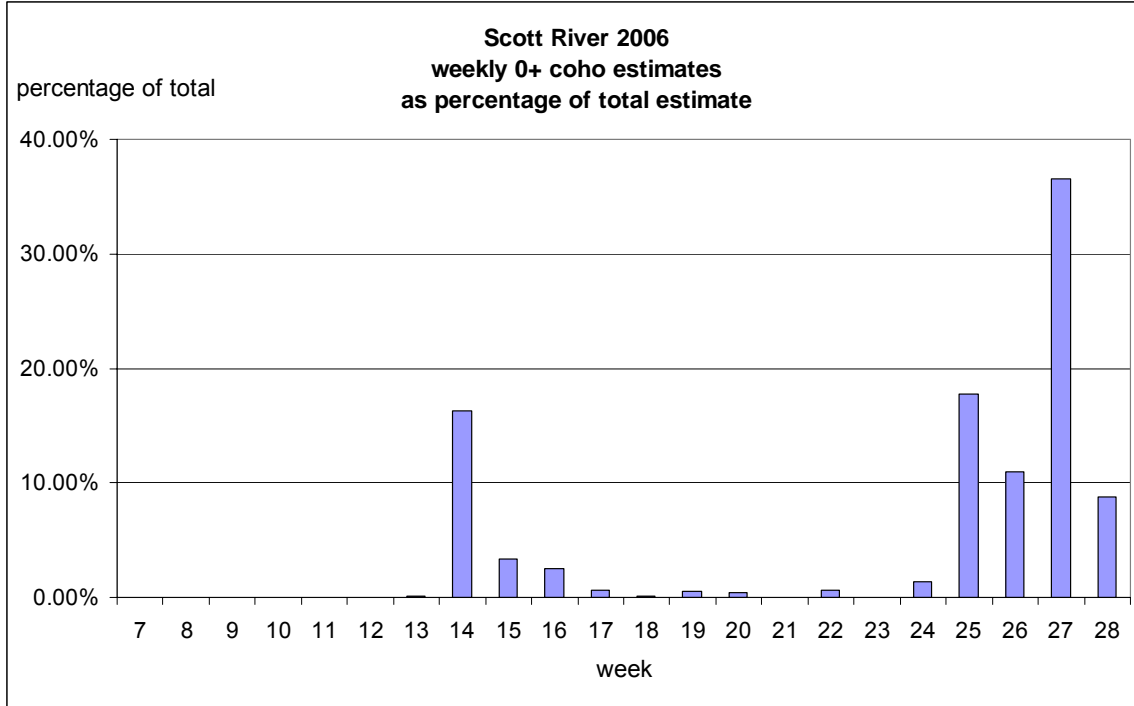


Chart 27

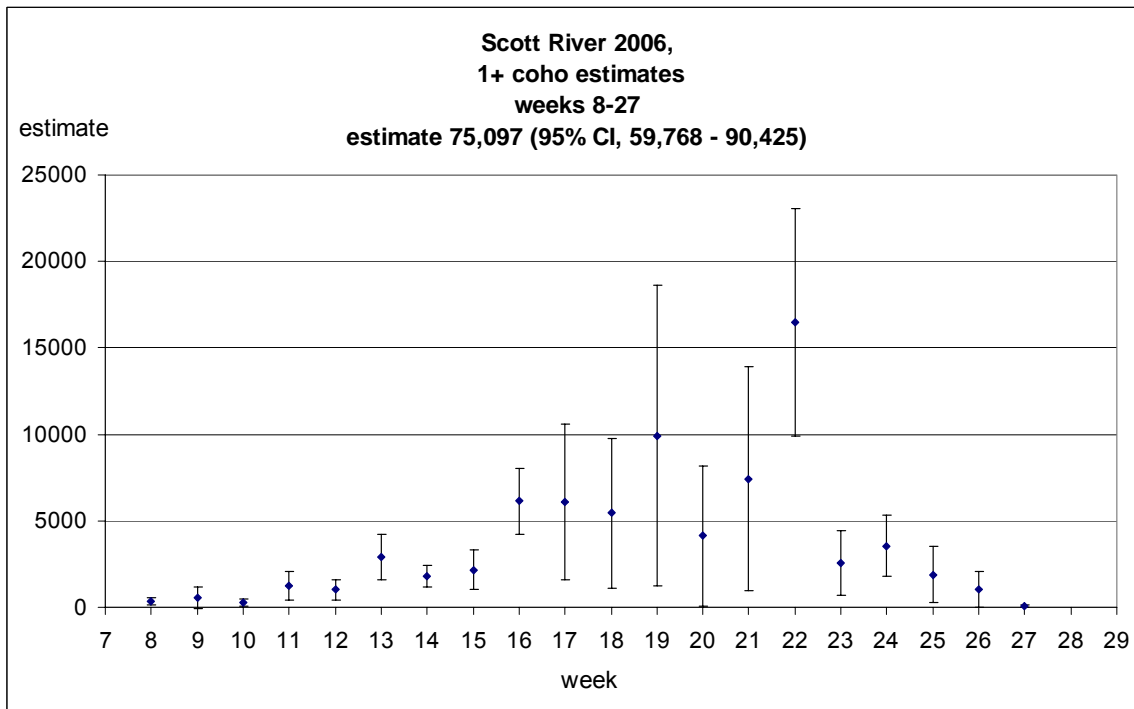


Chart 28

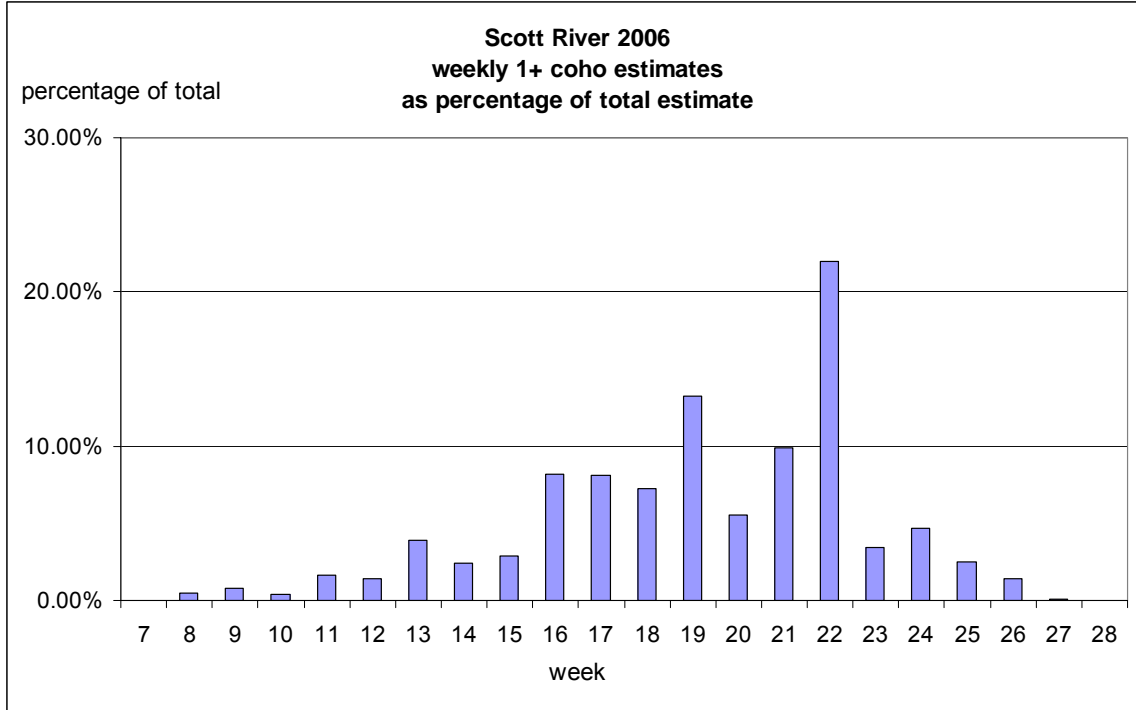


Chart 29

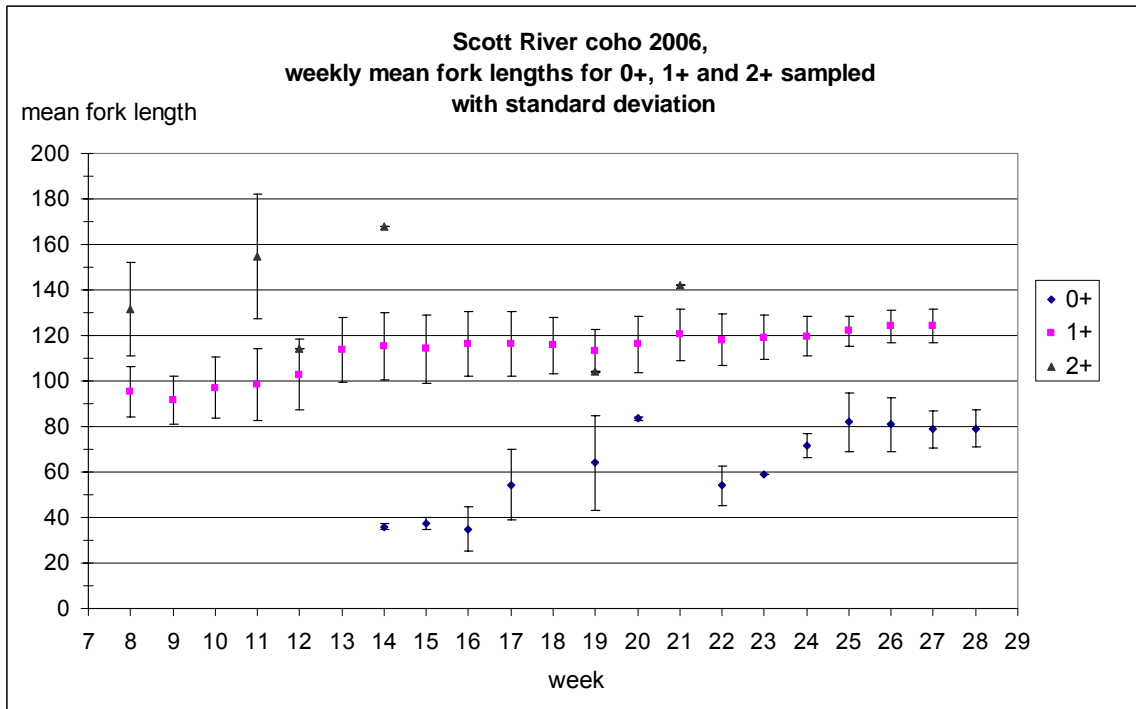


Chart 30

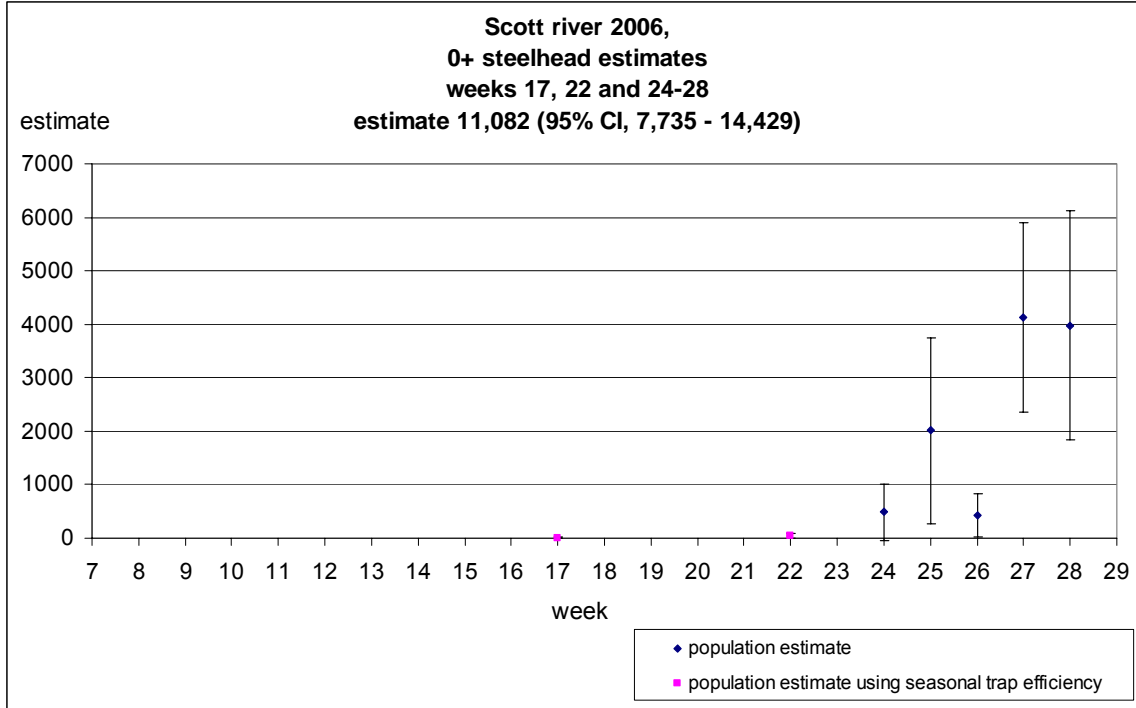


Chart 31

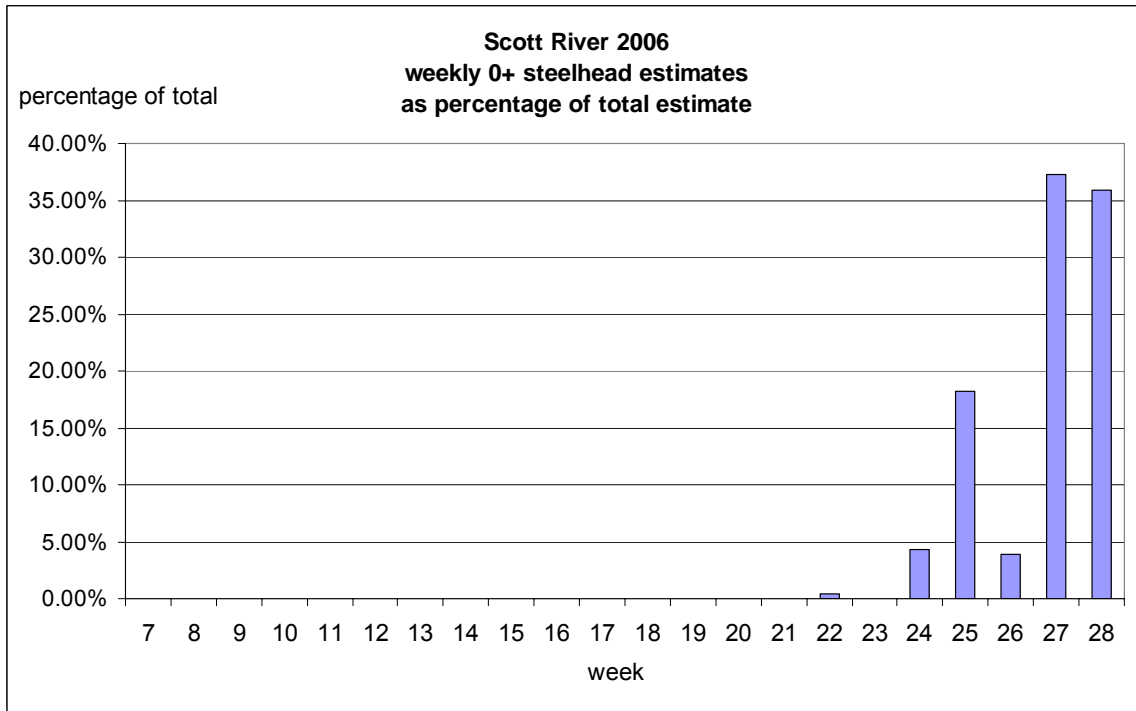


Chart 32

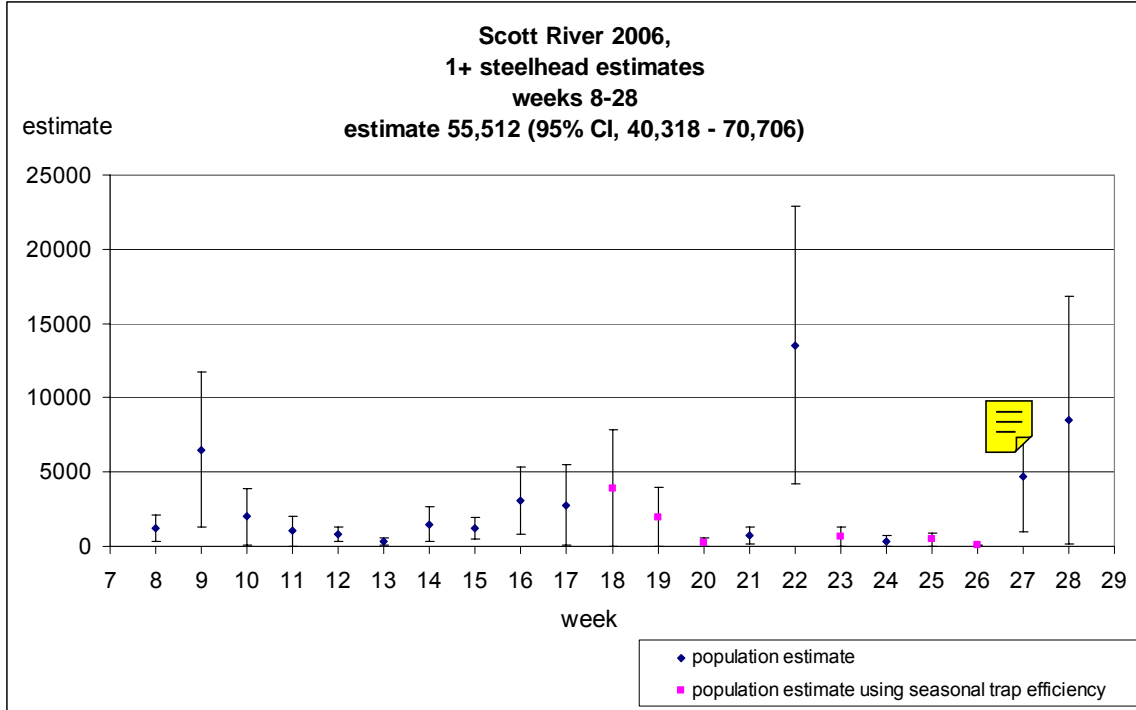


Chart 33

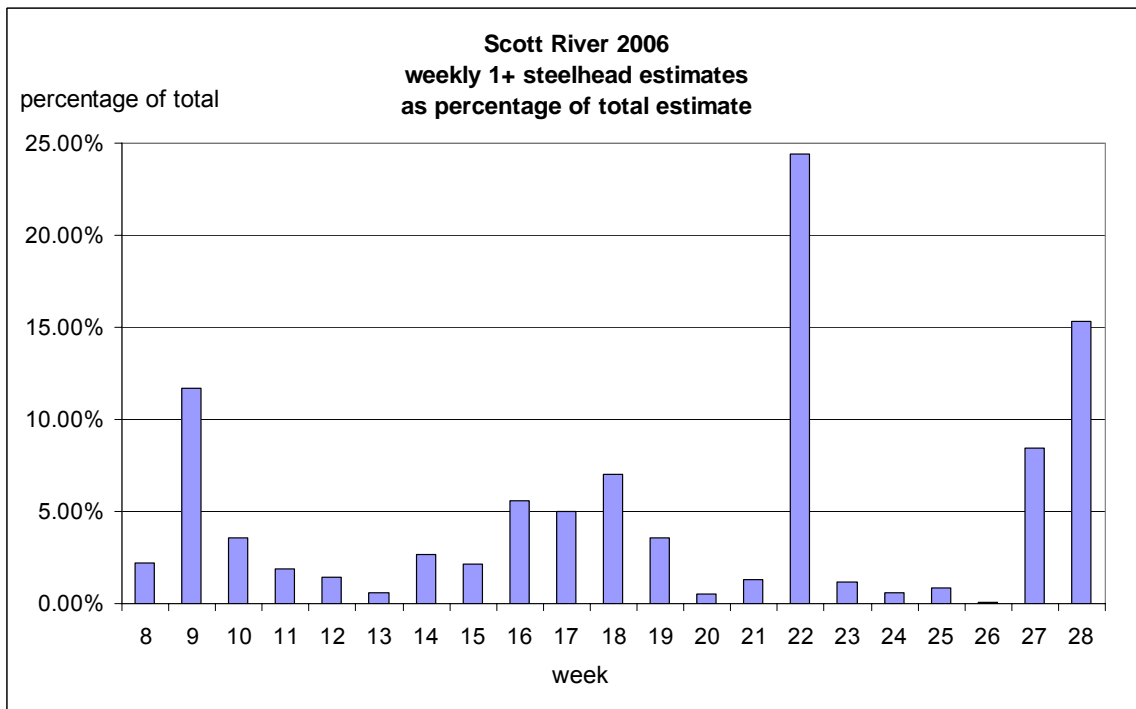


Chart 34

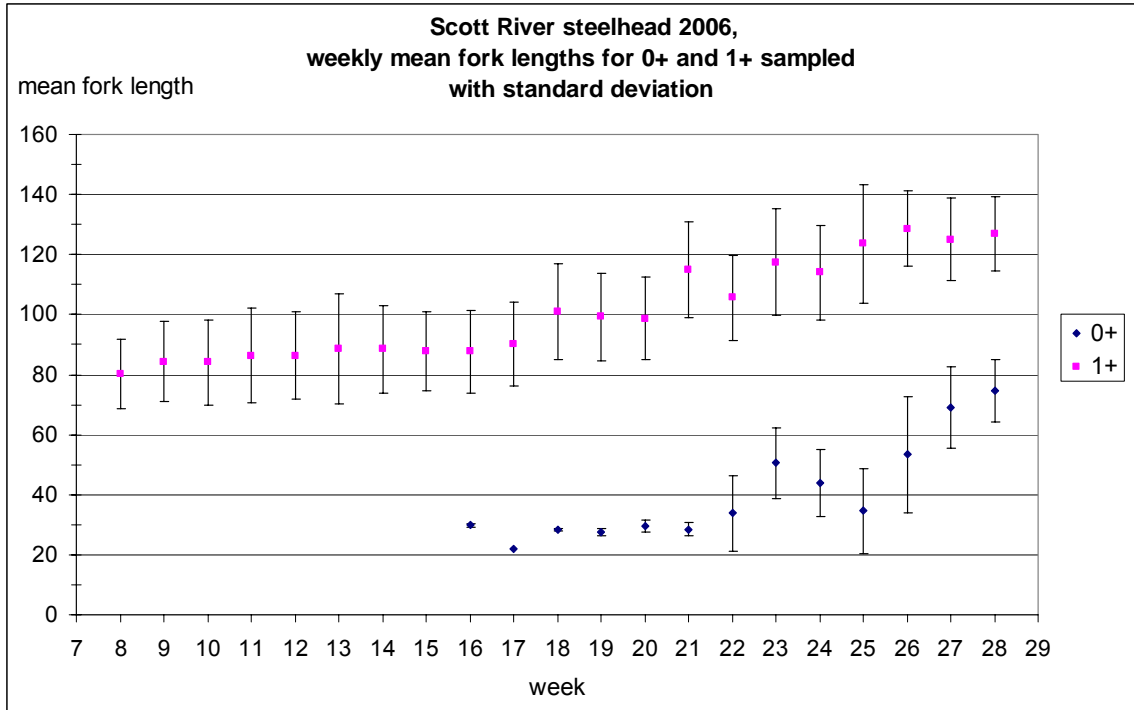


Chart 35

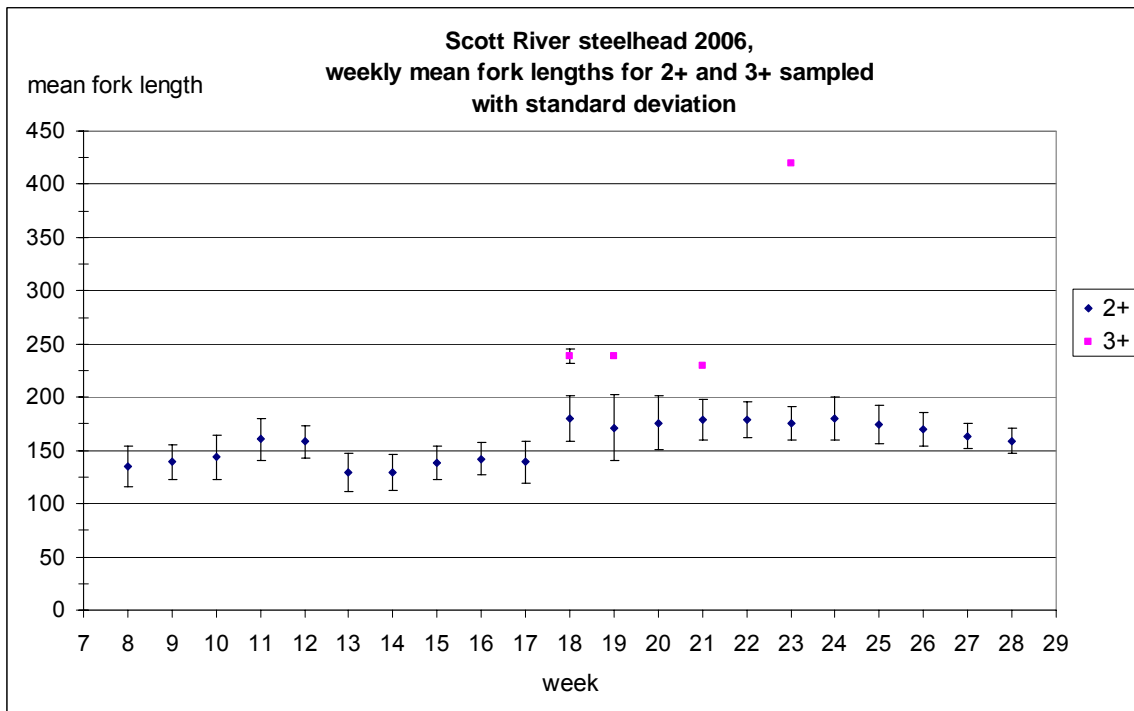


Chart 36

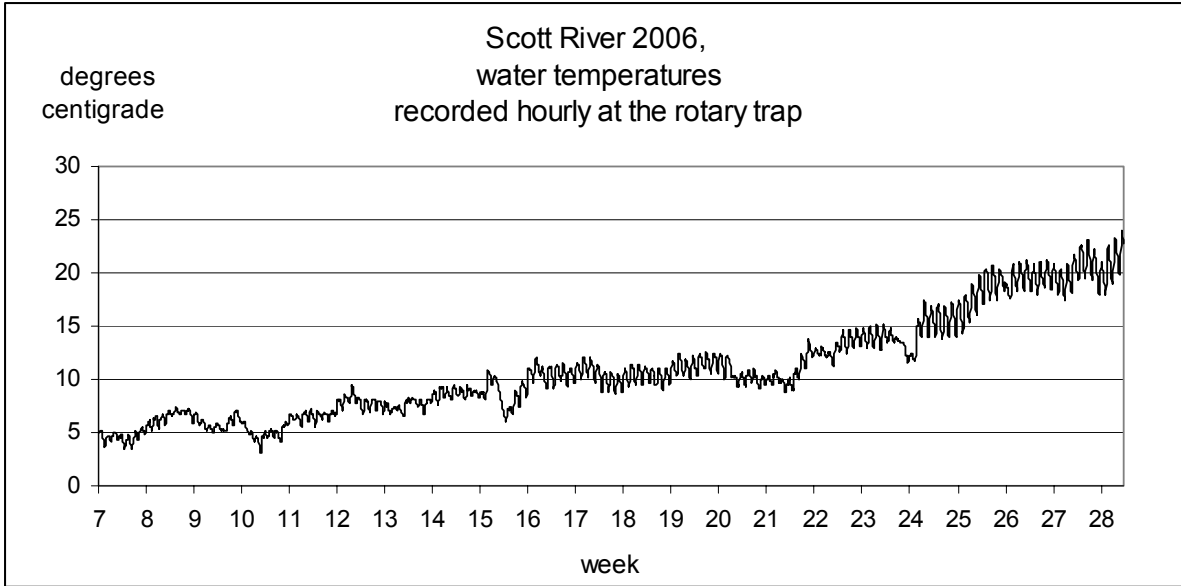
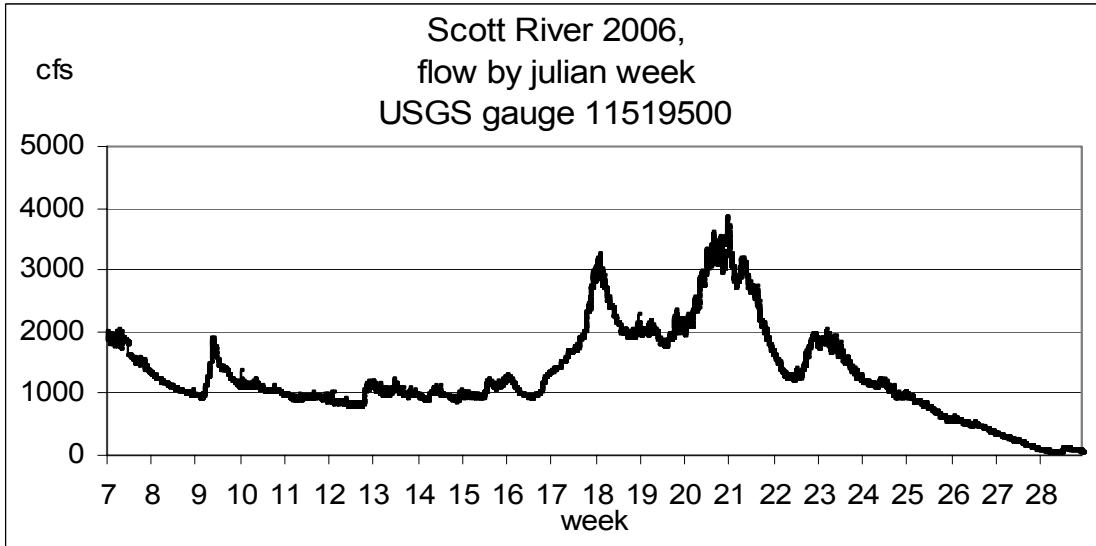


Chart 37



Discussion

The Scott River watershed has an estimated average annual runoff of 615,808 acre feet as compared to an estimated 136,793 acre feet for the Shasta River (National Academies Press 2004). Due to the larger volume of water, it has been more difficult to achieve the trap efficiency necessary to produce estimates with the desired confidence interval. Since 2005 we have simultaneously operated two rotary traps at the Scott River resulting in increased trap efficiencies and improvement in the quality of the population estimates.

Adult Estimates

Since 1978, annual estimates of the total number of fall Chinook returning to the Scott River have been produced by the CDFG Klamath River Project and other agencies, organizations and tribes participating in the Klamath River Fall Chinook Cooperative Spawning Ground Surveys. Less information is available regarding the number of returning steelhead and coho due to the higher flows present when these species spawn and limited access to streams passing through private land where spawning occurs.

Since 2001, redd counts have been conducted for as much as 44 percent of the estimated 92 miles of available coho spawning habitat (Siskiyou RCD 2007, Maurer 2002). We are unable to determine the relationship between the number of returning adult coho and steelhead and the number of juveniles produced because the estimates generated by the rotary trap are from the entire watershed and the estimates for the number of adults is only from that portion of the watershed where redd surveys were conducted.

Chinook

The estimate for the total number of 0+ Chinook produced in 2006 was 10,890 (95% CI, 6,982 – 14,797). This was the smallest estimate since we began sampling in 2000 (Chart 38 and Table 4). As with the Shasta River Chinook, we believe that this is due to the destruction of redds from high flows during week 52, 2005.

Chart 38

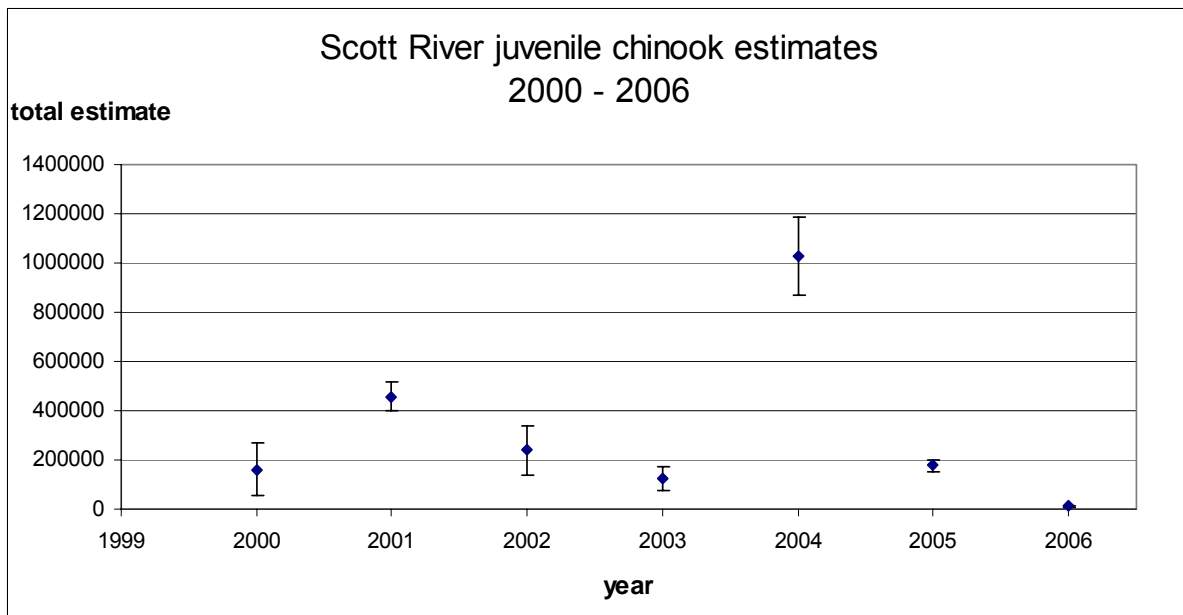


Table 4. Scott River juvenile Chinook estimates 2000 – 2006.

year	total estimate	LCL	UCL
2000	160,906	52,719	269,093
2001	457,800	398,422	517,177
2002	239,483	140,620	338,346
2003	125,909	78,709	173,109
2004	1,029,696	870,359	1,189,033
2005	178,863	154,908	202,818
2006	10,890	6,982	14,797

Coho 1+

The estimates for 1+ coho in Table 5 give a relative measure of the size of the three cohorts. As with the coho run in the Shasta River, Brood Year 2002 appears to be the weakest. The estimate for the number 1+ in 2006 (Brood Year 2004) shows a substantial increase from the previous estimate for the cohort in 2003.

Table 5. Scott River 1+ coho estimates 2003 – 2006.

Brood Year	1+ coho estimates	Year of trap operation
2001	34,149 (95% CI, 22,611 – 45,688)	2003
2002	93 trapped, 76 marked, 0 recaptured, no estimate possible	2004
2003	1,160 (95% CI, 1,077-2,242)	2005
2004	75,097 (95% CI, 59,768 – 90,425)	2006

We suspect that high water during week 52, 2005 impacted coho redds, particularly those in higher gradient locations like the canyon, and that there will be a further decline to what we believe is the weakest cohort (brood year 2005).

Recommendations

- Support the implementation of the California Department of Fish and Game Shasta and Scott Monitoring Plan to substantially improve our understanding of the biological needs of coho salmon and the factors limiting their production and survival.

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Appendix 1. Catch table with weekly data for Chinook 0+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	95	2	97	17.98	97	41	2	4.88%	1358	56	2660
8	199	3	202	20.94	202	125	9	7.20%	2545	1067	4024
9	110	3	113	-----	113	100	7	7.00%	1427	501	2352
10	38	0	38	14.72	38	22	5	21.26%	154*	45	263
11	122	0	122	32.50	122	86	3	3.49%	2654	345	4962
12	158	0	158	29.69	158	125	12	9.60%	1531	741	2322
13	69	4	73	12.52	73	38	5	13.16%	475	138	811
14	173	2	175	15.81	175	117	21	17.95%	939	572	1306
15	205	2	207	13.12	207	188	35	18.62%	1087	745	1428
16	604	3	607	12.77	607	414	68	16.43%	3499	2727	4270
17	421	0	421	10.20	421	214	50	23.36%	1886	1395	2377
18	998	0	998	13.59	998	658	154	23.40%	4243	3617	4869
19	1849	2	1851	7.92	1851	860	162	18.84%	9777	8372	11183
20	6479	41	6520	17.81	6520	589	117	19.86%	32600	27314	37886
21	210	29	239	17.08	239	71	10	14.08%	1564	731	2398
22	1966	3	1969	17.50	1969	488	180	36.89%	5320	4679	5960
23	1886	28	1914	-----	1914	302	93	30.79%	6170	5114	7225
24	746	12	758	-----	758	169	56	33.14%	2261	1769	2753
25	556	19	575	18.55	575	159	39	24.53%	2300	1669	2931
26	54	7	61	19.60	61	51	1	1.96%	1586	0	3374
27	5	0	5	15.51	5	3	1	33.33%	10	1	19
28	2	0	2	10.97	2	1	0	21.26%	3*	0	7
Totals	16945	160	17105	318.76	17105	4821	1030		83387	76439	90335

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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.

* Estimates based on seasonal trap efficiency of 21.26%.

Appendix 2. Catch table with weekly data for coho 0+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	17.98	0	0	0	-----	-----	-----	-----
8	0	0	0	20.94	0	0	0	-----	-----	-----	-----
9	0	0	0	-----	0	0	0	-----	-----	-----	-----
10	0	0	0	14.72	0	0	0	-----	-----	-----	-----
11	0	0	0	32.50	0	0	0	-----	-----	-----	-----
12	0	0	0	29.69	0	0	0	-----	-----	-----	-----
13	0	0	0	12.52	0	0	0	-----	-----	-----	-----
14	0	0	0	15.81	0	0	0	-----	-----	-----	-----
15	0	0	0	13.12	0	0	0	-----	-----	-----	-----
16	2	0	2	12.77	2	0	0	-----	-----	-----	-----
17	1	0	1	10.20	1	0	0	-----	-----	-----	-----
18	4	3	7	13.59	7	3	1	15.60%	19*	0	40
19	6	0	6	7.92	6	6	2	33.33%	14	1	27
20	40	1	41	17.81	41	27	4	14.81%	230	53	406
21	8	1	9	17.08	9	2	0	15.60%	21*	0	42
22	12	0	12	17.50	12	10	1	10.00%	66	0	139
23	50	5	55	-----	55	29	5	17.24%	275	83	467
24	14	1	15	-----	15	5	1	20.00%	45	1	89
25	19	2	21	18.55	21	7	1	14.29%	84	0	170
26	7	2	9	19.60	9	6	1	15.60%	32*	0	65
27	15	0	15	15.51	15	7	1	14.29%	60	0	123
28	8	1	9	10.97	9	7	2	28.57%	24	3	45
Totals	186	16	202	318.76	202	109	19		870	571	1169

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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.

* Estimates based on seasonal trap efficiency of 15.60%.

Appendix 3. Catch table with weekly data for coho 1+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	12	0	12	17.98	12	8	1	9.87%	60*	0	128
8	4	0	4	20.94	4	4	0	9.87%	14*	0	32
9	0	0	0	-----	0	0	0	-----	-----	-----	-----
10	6	0	6	14.72	6	5	1	20.00%	18	0	37
11	16	0	16	32.50	16	15	2	13.33%	85	3	167
12	11	0	11	29.69	11	9	1	11.11%	55	0	116
13	32	0	32	12.52	31	26	6	23.08%	120	41	199
14	23	0	23	15.81	23	14	1	7.14%	173	0	362
15	6	0	6	13.12	6	2	0	9.87%	15*	0	32
16	51	0	51	12.77	51	30	6	20.00%	226	79	373
17	231	2	233	10.20	233	114	3	2.63%	6699	881	12517
18	254	2	256	13.59	256	199	24	12.06%	2048	1276	2820
19	108	1	109	7.92	109	80	7	8.75%	1104	394	1813
20	29	1	30	17.81	30	17	2	9.87%	202*	3	400
21	0	0	0	17.08	0	0	0	-----	-----	-----	-----
22	4	0	4	17.50	4	3	1	33.33%	8	0	16
23	4	0	4	-----	4	1	0	9.87%	7*	0	15
24	0	0	0	-----	0	0	0	-----	-----	-----	-----
25	0	0	0	18.55	0	0	0	-----	-----	-----	-----
26	0	0	0	19.60	0	0	0	-----	-----	-----	-----
27	0	0	0	15.51	0	0	0	-----	-----	-----	-----
28	0	0	0	10.97	0	0	0	-----	-----	-----	-----
Totals	791	6	797	318.76	796	527	55		10833	4912	16755

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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.

* Estimates based on seasonal trap efficiency of 9.87%.

Appendix 4. Catch table with weekly data for coho 2+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	17.98	0	0	0	----	----	----	----
8	0	0	0	20.94	0	0	0	----	----	----	----
9	0	0	0	----	0	0	0	----	----	----	----
10	0	0	0	14.72	0	0	0	----	----	----	----
11	1	0	1	32.50	1	1	0	----	----	----	----
12	2	0	2	29.69	2	2	0	----	----	----	----
13	2	0	2	12.52	2	2	0	----	----	----	----
14	0	0	0	15.81	0	0	0	----	----	----	----
15	1	0	1	13.12	1	1	0	----	----	----	----
16	8	0	8	12.77	8	6	0	----	----	----	----
17	10	0	10	10.20	10	5	0	----	----	----	----
18	4	0	4	13.59	4	5	0	----	----	----	----
19	1	0	1	7.92	1	1	0	----	----	----	----
20	1	0	1	17.81	1	1	0	----	----	----	----
21	0	0	0	17.08	0	0	0	----	----	----	----
22	0	0	0	17.50	0	0	0	----	----	----	----
23	0	0	0	----	0	0	0	----	----	----	----
24	0	0	0	----	0	0	0	----	----	----	----
25	0	0	0	18.55	0	0	0	----	----	----	----
26	0	0	0	19.60	0	0	0	----	----	----	----
27	0	0	0	15.51	0	0	0	----	----	----	----
28	0	0	0	10.97	0	0	0	----	----	----	----
Totals	30	0	30	318.76	30	24	0	----	----	----	----

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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 5. Catch table with weekly data for steelhead 0+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	17.98	0	0	0	-----	-----	-----	-----
8	0	0	0	20.94	0	0	0	-----	-----	-----	-----
9	0	0	0	-----	0	0	0	-----	-----	-----	-----
10	0	0	0	14.72	0	0	0	-----	-----	-----	-----
11	0	0	0	32.50	0	0	0	-----	-----	-----	-----
12	0	0	0	29.69	0	0	0	-----	-----	-----	-----
13	0	0	0	12.52	0	0	0	-----	-----	-----	-----
14	0	0	0	15.81	0	0	0	-----	-----	-----	-----
15	0	0	0	13.12	0	0	0	-----	-----	-----	-----
16	0	0	0	12.77	0	0	0	-----	-----	-----	-----
17	15	0	15	10.20	15	0	0	-----	-----	-----	-----
18	11	4	15	13.59	15	1	0	16.82%	26*	3	49
19	0	0	0	7.92	0	0	0	-----	-----	-----	-----
20	37	1	38	17.81	38	27	5	16.82%	192*	51	333
21	24	0	24	17.08	24	17	3	16.82%	112*	17	207
22	102	0	102	17.50	102	65	9	13.85%	673	289	1057
23	421	2	423	-----	423	248	45	18.15%	2290	1667	2912
24	938	4	942	-----	942	276	54	19.57%	4744	3600	5889
25	2080	4	2084	18.55	2084	436	100	22.94%	9017	7446	10588
26	3242	83	3325	19.60	3325	533	76	14.26%	23059	18270	27848
27	473	9	482	15.51	482	353	57	16.15%	2942	2215	3668
28	458	5	463	10.97	463	345	46	13.33%	3408	2468	4349
Totals	7801	112	7913	318.76	7913	2301	395		46463	41107	51819

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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.

* Estimates based on seasonal trap efficiency of 16.82%.

Appendix 6. Catch table with weekly data for steelhead 1+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	0	0	0	17.98	0	0	0	-----	-----	-----	-----
8	1	0	1	20.94	1	1	0	15.64%	2*	0	4
9	2	0	2	-----	2	1	0	15.64%	3*	0	7
10	2	0	2	14.72	2	1	0	15.64%	3*	0	7
11	1	0	1	32.50	1	0	0	-----	-----	-----	-----
12	0	0	0	29.69	0	0	0	-----	-----	-----	-----
13	1	0	1	12.52	1	1	0	15.64%	2*	0	4
14	0	0	0	15.81	0	0	0	-----	-----	-----	-----
15	1	0	1	13.12	1	0	0	-----	-----	-----	-----
16	0	0	0	12.77	0	0	0	-----	-----	-----	-----
17	2	0	2	10.20	2	1	0	15.64%	3*	0	7
18	2	0	2	13.59	2	2	0	15.64%	5*	0	10
19	8	0	8	7.92	8	7	1	15.64%	31*	0	63
20	4	0	4	17.81	4	1	0	15.64%	7*	0	14
21	8	1	9	17.08	9	4	1	15.64%	28*	0	58
22	16	1	17	17.50	17	9	1	15.64%	71*	1	140
23	22	1	23	-----	23	22	3	15.64%	119*	21	217
24	11	0	11	-----	11	0	0	-----	-----	-----	-----
25	378	2	380	18.55	380	222	44	19.82%	1883	1369	2397
26	27	2	29	19.60	29	22	2	9.09%	222	9	436
27	3	0	3	15.51	3	0	0	-----	-----	-----	-----
28	3	1	4	10.97	4	0	0	-----	-----	-----	-----
Totals	492	8	500	318.76	500	294	52		2379	1807	2950

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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.

* Estimates based on seasonal trap efficiency of 15.64%.

Appendix 7. Catch table with weekly data for steelhead 2+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	5	0	5	17.98	5	4	0	3.25%	22*	0	51
8	8	0	8	20.94	8	5	0	3.25%	41*	0	94
9	1	1	2	-----	2	0	0	-----	-----	-----	-----
10	6	0	6	14.72	6	4	0	3.25%	27*	0	61
11	1	0	1	32.50	1	1	0	3.25%	2*	0	5
12	4	0	4	29.69	4	3	0	3.25%	15*	0	34
13	2	0	2	12.52	2	0	0	-----	-----	-----	-----
14	2	0	2	15.81	2	2	0	3.25%	6*	0	13
15	1	1	2	13.12	2	1	0	3.25%	4*	0	8
16	16	0	16	12.77	16	6	0	3.25%	94*	0	211
17	119	0	119	10.20	119	55	2	3.25%	2391*	16	4766
18	301	5	306	13.59	306	279	4	1.43%	17136	3437	30835
19	225	0	225	7.92	225	153	4	2.61%	6930	1415	12445
20	338	3	341	17.81	341	247	16	6.48%	4975	2702	7247
21	19	0	19	17.08	19	13	0	3.25%	187*	0	418
22	29	0	29	17.50	29	18	1	5.56%	276	0	580
23	21	1	22	-----	22	5	0	5.17%	105**	0	230
24	8	1	9	-----	9	3	0	5.17%	31**	0	68
25	25	2	27	18.55	27	16	1	5.17%	251**	0	537
26	20	2	22	19.60	22	16	2	12.50%	125	6	243
27	1	0	1	15.51	1	0	0	-----	-----	-----	-----
28	0	0	0	10.97	0	0	0	-----	-----	-----	-----
Totals	1152	16	1168	318.76	1168	831	30		32616	17478	47754

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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.

* Estimates based on seasonal trap efficiency of 3.25%. ** Estimates based on seasonal trap efficiency of 5.17%.

Appendix 8. Catch table with weekly data for steelhead 3+, Shasta River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
7	1	0	1	17.98	1	0	0	-----	-----	-----	-----
8	1	0	1	20.94	1	1	0	-----	-----	-----	-----
9	0	0	0	-----	0	0	0	-----	-----	-----	-----
10	1	0	1	14.72	1	1	0	-----	-----	-----	-----
11	0	0	0	32.50	0	0	0	-----	-----	-----	-----
12	1	0	1	29.69	1	0	0	-----	-----	-----	-----
13	0	0	0	12.52	0	0	0	-----	-----	-----	-----
14	1	0	1	15.81	1	0	0	-----	-----	-----	-----
15	1	0	1	13.12	1	0	0	-----	-----	-----	-----
16	11	0	11	12.77	11	3	0	-----	-----	-----	-----
17	45	0	45	10.20	45	25	0	-----	-----	-----	-----
18	41	0	41	13.59	41	34	1	2.94%	718	0	1525
19	4	0	4	7.92	4	3	0	-----	-----	-----	-----
20	4	0	4	17.81	4	3	0	-----	-----	-----	-----
21	0	0	0	17.08	0	0	0	-----	-----	-----	-----
22	0	0	0	17.50	0	0	0	-----	-----	-----	-----
23	1	0	1	-----	1	1	0	-----	-----	-----	-----
24	0	0	0	-----	0	0	0	-----	-----	-----	-----
25	0	0	0	18.55	0	0	0	-----	-----	-----	-----
26	1	0	1	19.60	1	0	0	-----	-----	-----	-----
27	0	0	0	15.51	0	0	0	-----	-----	-----	-----
28	0	0	0	10.97	0	0	0	-----	-----	-----	-----
Totals	113	0	113	318.76	113	71	1		718	0	1525

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 9, 23 and 24, there is no data available due to flow meter failure.)

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 9. Catch table with weekly data for Chinook 0+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	1	0	1	32.97	1	0	0	-----	-----	-----	-----
9	13	2	15	40.82	15	0	0	-----	-----	-----	-----
10	76	2	78	49.19	78	71	5	7.04%	936	247	1625
11	11	1	12	59.59	12	8	1	12.50%	54	0	112
12	12	1	13	76.80	13	9	0	5.29%	88*	0	195
13	9	2	11	97.88	11	5	0	5.29%	52*	0	116
14	11	0	11	77.04	11	6	0	5.29%	58*	0	130
15	9	0	9	80.88	9	6	1	16.67%	32	0	65
16	12	0	12	91.39	12	6	0	5.29%	64*	0	142
17	0	0	0	74.21	0	0	0	-----	-----	-----	-----
18	2	0	2	38.30	2	1	0	5.29%	4*	0	8
19	8	2	10	55.58	10	6	0	5.29%	53*	0	119
20	1	0	1	37.47	1	0	0	-----	-----	-----	-----
21	5	1	6	64.98	6	2	0	5.29%	16*	0	35
22	9	0	9	67.61	9	2	0	5.29%	24*	0	52
23	0	0	0	60.86	0	0	0	-----	-----	-----	-----
24	10	2	12	-----	12	3	2	66.67%	16	7	25
25	6	1	7	-----	7	2	0	5.29%	19*	0	41
26	91	8	99	59.90	99	52	1	1.92%	2624	0	5565
27	348	10	358	-----	358	290	20	6.90%	4961	2906	7015
28	115	3	118	44.89	118	98	5	5.29%	1889*	517	3260
Totals	749	35	784	1110.36	784	567	35		10890	6982	14797

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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.

* Estimates based on seasonal trap efficiency of 5.29%.

Appendix 10. Catch table with weekly data for coho 0+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	0	0	0	32.97	0	0	0	-----	-----	-----	-----
9	0	0	0	40.82	0	0	0	-----	-----	-----	-----
10	0	0	0	49.19	0	0	0	-----	-----	-----	-----
11	0	0	0	59.59	0	0	0	-----	-----	-----	-----
12	1	0	0	76.80	1	0	0	-----	-----	-----	-----
13	1	0	1	97.88	1	1	0	11.79%	2*	0	4
14	45	0	1	77.04	45	31	4	12.90%	288	65	511
15	12	0	45	80.88	12	9	1	11.11%	60	0	126
16	10	0	12	91.39	10	7	1	11.79%	44*	0	93
17	4	2	10	74.21	6	3	1	33.33%	12	1	23
18	1	0	6	38.30	1	1	0	11.79%	2*	0	4
19	2	2	1	55.58	4	2	0	11.79%	10*	0	21
20	3	0	4	37.47	3	2	0	11.79%	7*	0	16
21	0	0	3	64.98	0	0	0	-----	-----	-----	-----
22	3	3	0	67.61	6	1	0	11.79%	11*	0	21
23	0	1	6	60.86	1	0	0	-----	-----	-----	-----
24	10	0	1	-----	10	2	0	11.79%	24*	0	50
25	42	0	10	-----	42	29	3	10.34%	315	46	584
26	45	2	42	59.90	47	32	7	21.88%	194	75	313
27	60	0	47	-----	60	53	4	7.55%	648	134	1162
28	27	0	60	44.89	27	22	3	13.64%	155	23	288
Totals	266	10	276	1110.36	276	195	24		1772	1119	2424

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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.

* Estimates based on seasonal trap efficiency of 11.79%.

Appendix 11. Catch table with weekly data for coho 1+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	57	2	59	32.97	59	38	6	15.79%	329	110	547
9	33	3	36	40.82	36	30	1	3.33%	558	0	1185
10	42	0	42	49.19	42	32	4	12.50%	277	61	493
11	105	0	105	59.59	105	81	6	7.41%	1230	388	2072
12	113	0	113	76.80	113	90	9	10.00%	1028	430	1626
13	251	0	251	97.88	251	208	17	8.17%	2914	1617	4211
14	268	0	268	77.04	268	209	30	14.35%	1815	1202	2429
15	193	1	194	80.88	194	133	11	8.27%	2166	1008	3324
16	527	2	529	91.39	529	451	38	8.43%	6131	4249	8013
17	197	0	197	74.21	197	185	5	2.70%	6107	1589	10625
18	197	0	197	38.30	197	137	4	2.92%	5437	1112	9762
19	222	0	222	55.58	222	178	3	1.69%	9935	1247	18622
20	123	8	131	37.47	131	94	2	2.13%	4148	102	8195
21	207	1	208	64.98	208	142	3	2.84%	7436	948	13924
22	694	3	697	67.61	697	543	22	4.05%	16486	9925	23046
23	146	1	147	60.86	147	103	5	5.88%	2548	679	4417
24	246	8	254	-----	254	194	13	7.25%	3538	1766	5310
25	96	4	100	-----	100	74	3	4.05%	1875	244	3506
26	63	4	67	59.90	67	47	2	3.45%	1072	32	2112
27	11	0	11	-----	11	11	1	9.09%	66	0	140
28	0	0	0	44.89	0	0	0	-----	-----	-----	-----
Totals	3791	37	3828	1110.36	3828	2980	185		75097	59768	90425

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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 12. Catch table with weekly data for coho 2+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	8	0	8	32.97	8	6	1	16.67%	28	0	58
9	0	0	0	40.82	0	0	0	-----	-----	-----	-----
10	0	0	0	49.19	0	0	0	-----	-----	-----	-----
11	3	0	3	59.59	3	2	0	-----	-----	-----	-----
12	1	0	1	76.80	1	1	0	-----	-----	-----	-----
13	2	0	2	97.88	2	0	0	-----	-----	-----	-----
14	1	0	1	77.04	1	1	0	-----	-----	-----	-----
15	0	0	0	80.88	0	0	0	-----	-----	-----	-----
16	0	0	0	91.39	0	0	0	-----	-----	-----	-----
17	0	0	0	74.21	0	0	0	-----	-----	-----	-----
18	1	0	1	38.30	1	1	0	-----	-----	-----	-----
19	2	0	2	55.58	2	1	0	-----	-----	-----	-----
20	0	0	0	37.47	0	0	0	-----	-----	-----	-----
21	1	0	1	64.98	1	1	0	-----	-----	-----	-----
22	0	0	0	67.61	0	0	0	-----	-----	-----	-----
23	0	0	0	60.86	0	0	0	-----	-----	-----	-----
24	0	0	0	-----	0	0	0	-----	-----	-----	-----
25	0	0	0	-----	0	0	0	-----	-----	-----	-----
26	0	0	0	59.90	0	0	0	-----	-----	-----	-----
27	0	0	0	-----	0	0	0	-----	-----	-----	-----
28	0	0	0	44.89	0	0	0	-----	-----	-----	-----
Totals	19	0	19	1110.36	19	13	1		28	0	58

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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 13. Catch table with weekly data for steelhead 0+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	0	0	0	32.97	0	0	0	-----	-----	-----	-----
9	0	0	0	40.82	0	0	0	-----	-----	-----	-----
10	0	0	0	49.19	0	0	0	-----	-----	-----	-----
11	0	0	0	59.59	0	0	0	-----	-----	-----	-----
12	0	0	0	76.80	0	0	0	-----	-----	-----	-----
13	0	0	0	97.88	0	0	0	-----	-----	-----	-----
14	0	0	0	77.04	0	0	0	-----	-----	-----	-----
15	0	0	0	80.88	0	0	0	-----	-----	-----	-----
16	9	0	9	91.39	9	0	0	-----	-----	-----	-----
17	2	1	3	74.21	3	1	0	6.84%	6*	0	12
18	0	3	3	38.30	3	0	0	-----	-----	-----	-----
19	5	4	9	55.58	9	0	0	-----	-----	-----	-----
20	0	6	7	37.47	6	0	0	-----	-----	-----	-----
21	0	12	11	64.98	12	0	0	-----	-----	-----	-----
22	12	12	24	67.61	24	1	0	6.84%	45*	2	88
23	11	2	13	60.86	13	0	0	-----	-----	-----	-----
24	44	2	46	-----	46	20	1	5.00%	483	0	1014
25	113	2	115	-----	115	69	3	4.35%	2013	270	3755
26	45	10	55	59.90	54	23	2	8.70%	432	25	839
27	369	6	375	-----	375	208	18	8.65%	4125	2358	5892
28	246	4	250	44.89	250	190	11	5.79%	3979	1835	6123
Totals	856	64	920	1110.36	919	512	35		11082	7735	14429

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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.

* Estimates based on seasonal trap efficiency of 6.84%.

Appendix 14. Catch table with weekly data for steelhead 1+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	100	1	101	32.97	101	72	5	6.94%	1229	331	2126
9	185	3	188	40.82	188	172	4	2.33%	6505	1308	11702
10	87	2	89	49.19	89	66	2	3.03%	1988	52	3923
11	64	1	65	59.59	65	47	2	4.26%	1040	31	2049
12	93	1	94	76.80	94	66	7	10.61%	787	284	1290
13	51	1	52	97.88	51	37	5	13.51%	323	91	555
14	100	0	100	77.04	100	73	4	5.48%	1480	308	2652
15	130	0	130	80.88	130	82	8	9.76%	1199	473	1924
16	160	0	160	91.39	160	115	5	4.35%	3093	820	5366
17	95	1	96	74.21	96	86	2	2.33%	2784	62	5506
18	173	1	174	38.30	174	124	5	3.69%	3904*	940	6868
19	96	0	96	55.58	96	80	3	3.69%	1969*	243	3696
20	22	1	23	37.47	23	20	1	3.69%	278*	0	605
21	66	4	70	64.98	70	50	4	8.00%	714	152	1276
22	326	3	329	67.61	329	287	6	2.09%	13536	4173	22899
23	46	0	46	60.86	46	28	1	3.69%	656*	0	1385
24	33	5	38	-----	38	17	1	5.88%	342	0	716
25	32	3	35	-----	35	24	1	3.69%	464*	0	993
26	10	9	19	59.90	19	2	0	3.69%	53*	0	113
27	183	7	190	-----	190	122	4	3.28%	4674	963	8385
28	175	7	182	44.89	182	139	2	1.44%	8493	192	16795
Totals	2227	50	2277	1110.36	2276	1709	72		55512	40318	70706

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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.

* Estimates based on seasonal trap efficiency of 3.69%.

Appendix 15. Catch table with weekly data for steelhead 2+, Scott River 2006.

Julian week	Live fish trapped ¹	Mortalities	Total	Volume sampled, MCF ²	Adjusted total trapped ³	Adjusted marked & released ⁴	Recaptured	% trap efficiency ⁵	Weekly population estimate	Lower CI	Upper CI
8	12	0	12	32.97	12	9	----	----	----	----	----
9	11	0	11	40.82	11	9	----	----	----	----	----
10	8	0	8	49.19	8	7	----	----	----	----	----
11	11	0	11	59.59	11	8	----	----	----	----	----
12	3	0	3	76.80	3	1	----	----	----	----	----
13	23	0	23	97.88	23	21	1	4.76%	253	0	538
14	34	0	34	77.04	34	29	1	3.45%	510	0	1084
15	22	0	22	80.88	22	13	----	----	----	----	----
16	17	0	17	91.39	17	15	----	----	----	----	----
17	2	0	2	74.21	2	2	----	----	----	----	----
18	10	0	10	38.30	10	8	----	----	----	----	----
19	8	0	8	55.58	8	5	1	20.00%	24	0	49
20	10	2	12	37.47	12	8	----	----	----	----	----
21	29	0	29	64.98	29	17	----	----	----	----	----
22	69	0	69	67.61	69	50	----	----	----	----	----
23	37	0	37	60.86	37	31	1	3.23%	592	0	1258
24	21	0	21	----	21	9	----	----	----	----	----
25	17	0	17	----	17	14	----	----	----	----	----
26	4	1	5	59.90	5	2	----	----	----	----	----
27	14	0	14	----	14	7	----	----	----	----	----
28	30	1	31	44.89	31	27	1	3.70%	434	0	922
Totals	392	4	396	1110.36	396	292	5		1813	0	6904

¹ Does not include recaptured fish.

² Million cubic feet. (Note: For weeks 8-11, 18-21 & 23, the volume sampled does not include the Scott 5' trap as it was not in operation at this time or due to high flow (week 23). In addition, for weeks 24, 25 & 27, there is no data available as the readings were discarded due to outlier velocities.)

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 16. Shasta River 2006 average fork length by Julian week for Chinook 0+.

Julian week	average	s.d.	n	min	max
7	36	1.23	51	33	39
8	36	1.83	66	31	40
9	37	1.87	9	34	40
10	41	6.81	12	34	54
11	39	5.01	31	32	58
12	37	2.47	28	35	46
13	58	6.63	30	36	68
14	60	8.66	56	37	75
15	60	9.94	18	44	80
16	68	7.72	109	48	84
17	81	8.78	38	60	100
18	86	7.70	148	62	110
19	93	8.08	300	46	113
20	94	8.08	353	42	112
21	96	8.59	147	77	117
22	102	8.08	288	63	123
23	97	9.73	211	75	121
24	100	9.48	195	72	122
25	90	10.83	149	68	128
26	105	16.05	56	73	155
27	98	8.04	4	87	106
28	110	28.28	2	90	130

Appendix 17. Shasta River 2006 average fork length by Julian week for Chinook 1+.

Julian week	average	s.d.	n	min	max
7	111	-----	1	111	111
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	0	-----	0	0	0
13	0	-----	0	0	0
14	0	-----	0	0	0
15	0	-----	0	0	0
16	0	-----	0	0	0
17	0	-----	0	0	0
18	0	-----	0	0	0
19	0	-----	0	0	0
20	0	-----	0	0	0
21	0	-----	0	0	0
22	0	-----	0	0	0
23	0	-----	0	0	0
24	0	-----	0	0	0
25	0	-----	0	0	0
26	0	-----	0	0	0
27	0	-----	0	0	0
28	0	-----	0	0	0

Appendix 18. Shasta River 2006 average fork length by Julian week for coho 0+.

Julian week	average	s.d.	n	min	max
7	0	-----	0	0	0
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	0	-----	0	0	0
13	0	-----	0	0	0
14	0	-----	0	0	0
15	0	-----	0	0	0
16	57	-----	1	57	57
17	59	-----	1	59	59
18	59	9.02	4	46	66
19	65	0.00	2	65	65
20	72	6.55	37	61	94
21	65	9.63	9	53	78
22	94	20.30	11	63	117
23	96	15.51	52	60	119
24	96	20.33	15	61	117
25	80	18.79	20	57	126
26	77	7.68	9	69	92
27	73	12.22	15	54	98
28	73	9.82	9	58	93

Appendix 19. Shasta River 2006 average fork length by Julian week for coho 1+.

Julian week	average	s.d.	n	min	max
7	107	16.24	11	83	136
8	125	21.31	4	100	152
9	0	-----	0	0	0
10	134	11.04	6	119	147
11	140	15.64	16	112	160
12	145	11.23	11	129	161
13	141	12.98	28	109	170
14	143	17.87	19	111	181
15	141	7.23	3	136	149
16	145	13.46	34	124	183
17	146	11.17	121	116	168
18	141	11.19	143	114	175
19	141	9.94	88	118	169
20	136	13.99	19	111	161
21	0	-----	0	0	0
22	131	9.74	4	121	141
23	123	-----	1	123	123
24	0	-----	0	0	0
25	0	-----	0	0	0
26	0	-----	0	0	0
27	0	-----	0	0	0
28	0	-----	0	0	0

Appendix 20. Shasta River 2006 average fork length by Julian week for coho 2+.

Julian week	average	s.d.	n	min	max
7	0	-----	0	0	0
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	151	-----	1	151	151
12	150	0.71	2	149	150
13	153	5.66	2	149	157
14	0	-----	0	0	0
15	165	-----	1	165	165
16	170	6.18	7	162	175
17	175	7.11	7	165	187
18	181	9.90	2	174	188
19	172	-----	1	172	172
20	141	-----	1	141	141
21	0	-----	0	0	0
22	0	-----	0	0	0
23	0	-----	0	0	0
24	0	-----	0	0	0
25	0	-----	0	0	0
26	0	-----	0	0	0
27	0	-----	0	0	0
28	0	-----	0	0	0

Appendix 21. Shasta River 2006 average fork length by Julian week for steelhead 0+.

Julian week	average	s.d.	n	min	max
7	0	-----	0	0	0
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	0	-----	0	0	0
13	0	-----	0	0	0
14	0	-----	0	0	0
15	0	-----	0	0	0
16	0	-----	0	0	0
17	27	1.01	15	25	29
18	27	1.07	14	25	28
19	0	-----	0	0	0
20	52	5.70	33	33	62
21	55	6.52	24	36	67
22	60	5.77	79	43	72
23	67	9.40	151	40	98
24	73	10.49	221	49	104
25	77	10.49	281	43	99
26	78	14.21	216	52	176
27	71	11.18	115	51	104
28	73	10.65	130	44	102

Appendix 22. Shasta River 2006 average fork length by Julian week for steelhead 1+.

Julian week	average	s.d.	n	min	max
7	0	-----	0	0	0
8	100	-----	1	100	100
9	150	24.04	2	133	167
10	154	19.80	2	140	168
11	0	-----	0	0	0
12	0	-----	0	0	0
13	159	-----	1	159	159
14	0	-----	0	0	0
15	0	-----	0	0	0
16	0	-----	0	0	0
17	114	-----	1	114	114
18	139	14.85	2	128	149
19	154	14.67	8	126	178
20	147	9.03	4	135	156
21	177	9.79	9	158	189
22	177	9.12	16	158	189
23	150	58.59	3	84	195
24	153	27.62	3	122	175
25	137	27.97	10	101	168
26	122	26.91	17	101	180
27	157	11.85	3	143	164
28	129	15.63	4	113	150

Appendix 23. Shasta River 2006 average fork length by Julian week for steelhead 2+.

Julian week	average	s.d.	n	min	max
7	163	13.83	5	149	184
8	181	20.89	8	156	209
9	178	7.78	2	172	183
10	186	24.39	6	143	205
11	178	-----	1	178	178
12	169	16.03	4	150	184
13	160	11.31	2	152	168
14	173	16.97	2	161	185
15	207	16.97	2	195	219
16	196	28.91	16	138	267
17	203	16.86	87	153	238
18	197	17.12	153	150	238
19	203	16.58	142	161	260
20	187	18.23	144	131	234
21	196	10.45	18	172	211
22	199	8.64	25	189	219
23	196	10.92	21	181	227
24	199	20.21	8	180	236
25	189	11.50	21	170	217
26	198	22.58	20	172	259
27	264	-----	1	264	264
28	0	-----	0	0	0

Appendix 24. Shasta River 2006 average fork length by Julian week for steelhead 3+.

Julian week	average	s.d.	n	min	max
7	266	-----	1	266	266
8	194	-----	1	194	194
9	0	-----	0	0	0
10	196	-----	1	196	196
11	0	-----	0	0	0
12	348	-----	1	348	348
13	0	-----	0	0	0
14	260	-----	1	260	260
15	224	-----	1	224	224
16	241	26.06	11	225	314
17	252	19.34	39	230	302
18	246	14.80	29	221	285
19	236	2.83	4	232	238
20	239	-----	1	239	239
21	0	-----	0	0	0
22	0	-----	0	0	0
23	249	-----	1	249	249
24	0	-----	0	0	0
25	0	-----	0	0	0
26	332	-----	1	332	332
27	0	-----	0	0	0
28	0	-----	0	0	0

Appendix 25. Scott River 2006 average fork length by Julian week for Chinook 0+.

Julian week	average	s.d.	n	min	max
8	37	-----	1	37	37
9	37	0.93	14	35	39
10	37	0.82	4	36	38
11	39	0.00	2	39	39
12	34	2.52	3	32	37
13	36	5.29	3	32	42
14	35	0.71	2	34	35
15	37	0.58	3	36	37
16	54	11.87	4	37	64
17	0	-----	0	0	0
18	72	-----	1	72	72
19	62	10.69	4	48	73
20	55	-----	1	55	55
21	73	12.34	6	60	91
22	69	6.68	8	61	80
23	0	-----	0	0	0
24	84	11.64	9	61	96
25	97	14.74	5	81	115
26	104	9.99	98	68	124
27	105	8.93	332	80	129
28	95	9.83	116	69	118

Appendix 26. Scott River 2006 average fork length by Julian week for Chinook 1+.

Julian week	average	s.d.	n	min	max
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	139	-----	1	139	139
13	0	-----	0	0	0
14	0	-----	0	0	0
15	0	-----	0	0	0
16	0	-----	0	0	0
17	0	-----	0	0	0
18	0	-----	0	0	0
19	126	-----	1	126	126
20	0	-----	0	0	0
21	0	-----	0	0	0
22	0	-----	0	0	0
23	0	-----	0	0	0
24	0	-----	0	0	0
25	0	-----	0	0	0
26	0	-----	0	0	0
27	0	-----	0	0	0
28	0	-----	0	0	0

Appendix 27. Scott River 2006 average fork length by Julian week for coho 0+.

Julian week	average	s.d.	n	min	max
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	0	-----	0	0	0
13	0	-----	0	0	0
14	36	1.41	12	33	38
15	37	2.52	3	35	40
16	35	9.90	2	28	42
17	54	15.47	5	42	77
18	0	-----	0	0	0
19	64	20.81	3	51	88
20	84	0.71	2	83	84
21	0	-----	0	0	0
22	54	8.86	5	47	66
23	59	-----	1	59	59
24	72	5.22	9	62	80
25	82	13.02	21	71	109
26	81	11.68	47	65	109
27	79	8.05	60	60	105
28	79	8.15	27	69	99

Appendix 28. Scott River 2006 average fork length by Julian week for coho 1+.

Julian week	average	s.d.	n	min	max
8	95	10.89	59	71	126
9	91	10.50	36	72	115
10	97	13.52	42	75	121
11	98	15.76	100	74	140
12	103	15.64	114	58	130
13	114	14.25	185	74	143
14	115	14.91	164	75	148
15	114	14.90	152	80	146
16	116	14.13	220	78	148
17	116	14.08	137	87	142
18	116	12.22	95	77	143
19	113	9.48	143	87	136
20	116	12.42	71	90	151
21	120	11.36	145	96	156
22	118	11.15	219	91	153
23	119	9.76	116	95	151
24	120	8.70	168	99	139
25	122	6.49	89	110	135
26	124	6.87	64	110	139
27	124	7.27	11	110	134
28	0	----	0	0	0

Appendix 29. Scott River 2006 average fork length by Julian week for coho 2+.

Julian week	average	s.d.	n	min	max
8	132	20.58	8	118	181
9	0	----	0	0	0
10	0	----	0	0	0
11	155	27.43	3	123	171
12	114	----	1	114	114
13	0	----	0	0	0
14	168	----	1	168	168
15	0	----	0	0	0
16	0	----	0	0	0
17	0	----	0	0	0
18	0	----	0	0	0
19	104	----	1	104	104
20	0	----	0	0	0
21	142	----	1	142	142
22	0	----	0	0	0
23	0	----	0	0	0
24	0	----	0	0	0
25	0	----	0	0	0
26	0	----	0	0	0
27	0	----	0	0	0
28	0	----	0	0	0

Appendix 30. Scott River 2006 average fork length by Julian week for steelhead 0+.

Julian week	average	s.d.	n	min	max
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	0	-----	0	0	0
13	0	-----	0	0	0
14	0	-----	0	0	0
15	0	-----	0	0	0
16	30	0.46	8	29	30
17	0	-----	1	22	22
18	8	0.58	3	28	29
19	28	1.20	8	26	30
20	30	1.95	5	28	33
21	29	2.27	10	25	32
22	34	12.60	22	27	75
23	51	11.77	12	28	67
24	44	11.34	24	26	67
25	35	14.34	34	22	69
26	53	19.34	32	23	135
27	69	13.46	150	24	99
28	75	10.44	236	49	99

Appendix 31. Scott River 2006 average fork length by Julian week for steelhead 1+.

Julian week	average	s.d.	n	min	max
8	80	11.58	85	62	116
9	84	13.41	134	62	130
10	84	14.27	72	62	118
11	86	15.75	65	59	129
12	86	14.56	92	54	115
13	89	18.27	50	58	157
14	88	14.41	99	62	146
15	88	13.20	107	61	119
16	88	13.89	155	60	121
17	90	13.95	92	60	134
18	101	16.06	100	70	158
19	99	14.52	95	69	136
20	99	13.78	23	74	126
21	115	15.85	69	74	153
22	106	14.29	162	74	152
23	117	17.78	45	84	155
24	114	15.62	35	74	153
25	124	19.78	35	94	179
26	129	12.57	18	102	147
27	125	13.74	152	101	182
28	127	12.29	149	100	152

Appendix 32. Scott River 2006 average fork length by Julian week for steelhead 2+.

Julian week	average	s.d.	n	min	max
8	135	19.26	11	113	182
9	139	16.54	11	118	166
10	144	20.92	8	124	187
11	161	19.92	11	136	188
12	158	15.31	3	149	176
13	129	17.92	23	108	170
14	129	16.94	34	110	170
15	138	15.59	20	121	175
16	142	15.27	17	126	172
17	139	19.80	2	125	153
18	180	21.34	10	142	206
19	172	30.77	8	132	224
20	176	25.07	12	138	206
21	179	19.60	28	119	207
22	179	17.07	64	147	223
23	175	15.84	37	151	210
24	180	20.27	20	150	220
25	174	18.16	17	152	226
26	170	15.82	5	155	195
27	164	12.00	12	150	188
28	159	11.89	27	150	203

Appendix 33. Scott River 2006 average fork length by Julian week for steelhead 3+.

Julian week	average	s.d.	n	min	max
8	0	-----	0	0	0
9	0	-----	0	0	0
10	0	-----	0	0	0
11	0	-----	0	0	0
12	0	-----	0	0	0
13	0	-----	0	0	0
14	0	-----	0	0	0
15	0	-----	0	0	0
16	0	-----	0	0	0
17	0	-----	0	0	0
18	239	6.36	2	234	243
19	238	-----	1	238	238
20	0	-----	0	0	0
21	230	-----	1	230	230
22	0	-----	0	0	0
23	420	-----	1	420	420
24	0	-----	0	0	0
25	0	-----	0	0	0
26	0	-----	0	0	0
27	0	-----	0	0	0
28	0	-----	0	0	0

Appendix 34. Age Length cut-offs for Shasta River juvenile salmonids

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

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

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

Julian Weeks	Age-Length Cut-offs			n
	Age 0+	Age 1+	Age 2+	
7 - 8	≤ 79	80 - 149	≥ 150	14
9 - 12	≤ 99	100 - 159	≥ 160	34
13 - 16	≤ 79	80 - 169	≥ 170	47
17 - 20	≤ 89	90 - 169	≥ 170	35
21 - 28	≤ 119	120 - 149	≥ 150	49

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

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

Appendix 35. Age Length cut-offs for Scott River juvenile salmonids

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

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

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

Julian Weeks	Age-Length Cut-offs			n
	Age 0+	Age 1+	Age 2+	
7 - 8	≤ 49	50 - 119	≥ 120	24
9 - 12	≤ 49	50 - 149	≥ 150	49
13 - 14	≤ 59	60 - 149	≥ 150	20
15 - 16	≤ 69	70 - 149	≥ 150	22
17 - 20	≤ 69	70 - 159	≥ 160	31
21 - 28	≤ 109	110 - 159	≥ 160	96

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

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

Appendix 36. Additional fish species collected in the Shasta and Scott River rotary traps in 2006.

Additional fish species collected in the Shasta River rotary trap, 2006.

Common Names	Scientific Names	Number trapped
black crappie	<i>Pomoxis nigromacrolatus</i>	1
bluegill	<i>Lepomis macrochirus</i>	3
brown bullhead	<i>Ameiurus nebulosus</i>	34
western brook lamprey	<i>Lampetra richardsoni</i>	1
fathead minnow	<i>Pimephales promelas</i>	9
goldfish	<i>Carassius auratus</i>	1
golden shiner	<i>Notemigonus crysoleucas</i>	23
green sunfish	<i>Lepomis cyanellus</i>	35
Japanese pond smelt	<i>Hypomesus nipponensis</i>	35
Klamath River lamprey	<i>Lampetra similis</i>	24
Klamath small scale sucker	<i>Catostomus rimiculus</i>	160
large mouth bass	<i>Micropterus salmoides</i>	1
Pacific Lamprey	<i>Lampetra tridentata</i>	24
river lamprey	<i>Lampetra ayresi</i>	6
sculpin	<i>Cottus spp.</i>	16
speckled dace	<i>Rhinichthys osculus</i>	103
yellow bullhead	<i>Ameiurus natalis</i>	63

Additional fish species collected in the Scott River rotary traps, 2006.

Common Names	Scientific Names	Number trapped
fathead minnow	<i>Pimephales promelas</i>	35
golden shiner	<i>Notemigonus crysoleucas</i>	1
green sunfish	<i>Lepomis cyanellus</i>	3
Japanese pond smelt	<i>Hypomesus nipponensis</i>	1
Klamath River lamprey	<i>Lampetra similis</i>	18
Klamath small scale sucker	<i>Catostomus rimiculus</i>	322
large mouth bass	<i>Micropterus salmoides</i>	1
marbled sculpin	<i>Cottus klamathensis</i>	1
Miller Lake lamprey	<i>Lampetra (Entosphenus) minima</i>	21
Pacific Lamprey	<i>Lampetra tridentata</i>	48
river lamprey	<i>Lampetra ayresi</i>	3
speckled dace	<i>Rhinichthys osculus</i>	195
brook stickleback	<i>Culaea inconstans</i>	51
yellow bullhead	<i>Ameiurus natalis</i>	3

Appendix 37. List of Julian weeks and calendar equivalents

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

* = eight days only during leap years

** = eight day Julian week