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November 6, 2012

**Subject: 2011 Scott River Salmon Studies, Final Report, September 17, 2012**

All,

Please find attached a copy of the subject report. This report describes our fall Chinook and coho sampling efforts on the Scott River. Should you have any questions regarding this report, please direct inquiries to either Senior Environmental Scientist Wade Sinnen at (707) 822-5119, [wsinnen@dfg.ca.gov](mailto:wsinnen@dfg.ca.gov), or Environmental Scientist Morgan Knechtle at (530) 842-3109, [mknechtle@dfg.ca.gov](mailto:mknechtle@dfg.ca.gov)

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# 2011 SCOTT RIVER SALMON STUDIES

## FINAL REPORT



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## 2011 SCOTT RIVER SALMON STUDIES

California Department of Fish and Game  
Northern Region  
Klamath River Project

### ABSTRACT

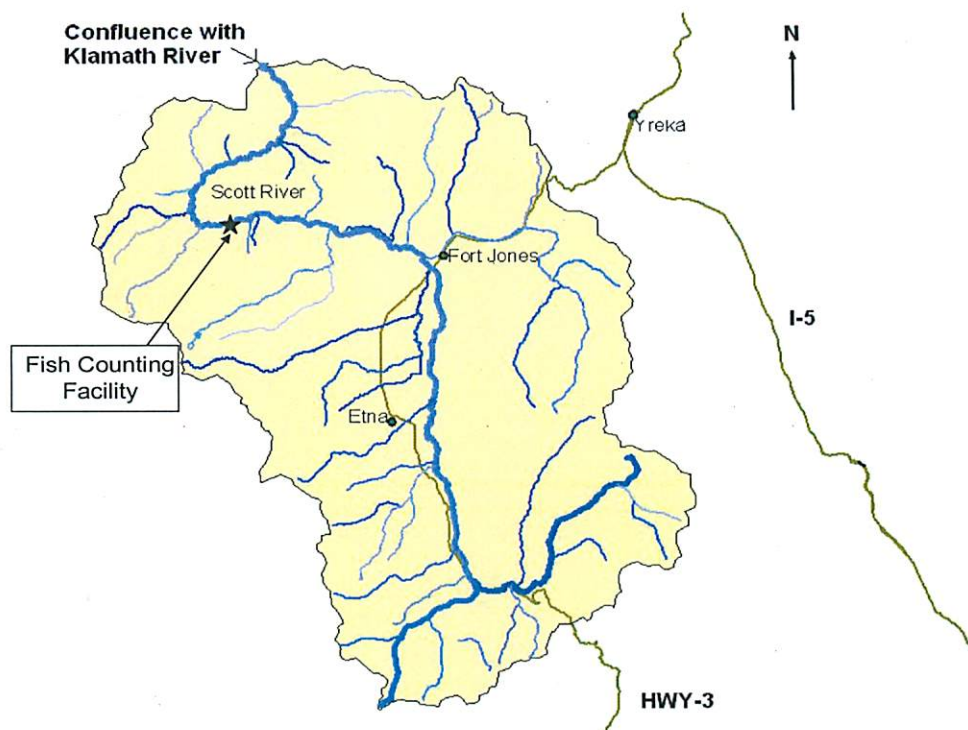
The California Department of Fish and Game's (Department) Klamath River Project (KRP) operated a video fish counting facility and conducted cooperative spawning ground surveys (carcass surveys) on the Scott River during the 2011 fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*) spawning season. The purpose of these surveys is to describe the run characteristics of adult fall-run Chinook salmon and coho salmon into the Scott River. Video fish counting operations began on September 23, 2011, and ended on January 11, 2012. The total number of Chinook salmon that entered the Scott River during the 2011 season is estimated to be 5,521 fish. Based on the proportion of male and female Chinook salmon that were sampled during the spawning ground surveys, the run was comprised of approximately 3,865 (70.0%) males and 1,656 (30.0%) females. Based on a scales age analysis, adults comprised approximately 55.0% (3,037 fish) and grilse comprised 45.0% (2,484 fish) of the run. Males ranged in fork length (FL) from 32cm to 103cm and averaged 61.8cm. Females ranged in FL from 45cm to 94cm and averaged 74.9cm. KRP staff estimated that 20 (0.36%) of the Chinook salmon that returned were of hatchery origin.

The first adult coho salmon was observed at the Scott River Fish Counting Facility (SRFCF) on October 19, 2011, and the last coho salmon was observed on December 31, 2011. A total of 344 coho salmon were observed moving upstream through the SRFCF during the season. Three coho redds were estimated in areas below the counting facility representing an estimated six coho. In addition, five coho salmon carcasses were observed in carcass surveys downstream of the SRFCF. The total number of coho salmon that entered the Scott River during the 2011 season is estimated to be 355. Based on the proportion of male and female coho salmon that were sampled during the season, the run was comprised of approximately 183 (51.6%) males and 172 (48.4%) females. Based on video data, adults comprised approximately 96.9% (344 fish) and grilse comprised 3.1% (11 fish) of the run. Males ranged in fork length FL from 39cm to 86cm and averaged 71.1cm. Females ranged in FL from 56cm to 71cm and averaged 67.5cm. None of the coho salmon were estimated to be of hatchery origin.

### INTRODUCTION

#### STUDY LOCATION AND RUN TIMING

The Scott River is a major tributary of the Klamath River located in Siskiyou County, and enters the Klamath River at river mile 143 (Figure 1). The SRFCF is located at river mile 18.2 near the downstream edge of Scott Valley between the Indian Scotty Campground and Jones Beach picnic area (041° 38' 10.93" N; 123° 04' 3.08" W). Fall-run Chinook salmon typically return to the Scott River to spawn from mid-September to late December. The coho salmon spawning run occurs from mid-October to early January, and steelhead run from November to March.



**Figure 1. Location of the Scott River, tributary to the Klamath River, Siskiyou County.**

#### **KLAMATH RIVER PROJECT AND THE SCOTT RIVER STUDY**

The Scott River study is one component of the KRP (initiated in 1978). The goals of the KRP include obtaining information on species composition, spawning distribution, FL frequency, and sex ratios for salmonids, primarily fall-run Chinook salmon (Chinook), in various tributaries to the Klamath River including the Salmon, Scott, and Shasta rivers, as well as Bogus Creek and a dozen other smaller tributaries. The Scott River is particularly important because it is a major salmon spawning tributary. For example, during the 1996-98 spawning seasons, an average of 30.6% (8,914) of the total number of natural area Klamath River adult Chinook salmon spawners above the Trinity River confluence were estimated to have entered the Scott River to spawn. Therefore, a significant portion of natural escapement to the Klamath Basin would be unaccounted for if the Scott River studies were not conducted. In addition to providing valuable escapement estimates to the Pacific Fisheries Management Council for the effective management and allocation of fall Chinook salmon originating from the Klamath River Basin, the Scott River studies provide an opportunity to monitor an independent population within the state and federally-listed Southern Oregon/Northern California Coast coho salmon (SONCC) range.

In the early years of the KRP, spawning ground surveys were conducted in the major spawning areas of the river which included about 5.5 miles of the Scott River near Etna and 4.75 miles of river downstream of the State Highway 3 Bridge crossing near Fort Jones. From 1989 through 1991 spawning ground surveys were limited to the lower river. In 1985 a temporary fish marking weir was installed on the lower river at river mile 1.6 and was operated during each spawning season until 1991. Operation of the

weir was often hampered by high flows, and beginning in 1992, operation of the weir was dropped in favor of conducting more intensive mark recapture spawning ground surveys in cooperation with US Forest Service (USFS) fisheries staff.

In 1994 the California State Legislature passed the Leslie Amendment (SB 779). The passage of SB 779 required Department staff to obtain landowner permission prior to accessing private lands to conduct biological investigations. The entire length of the Scott River within the Scott Valley (above river mile 24) passes through privately owned agricultural lands. As a result, since 1994, spawning ground surveys have been limited to those areas of the river on private land where landowner permission has been granted each year. The level of cooperation from local landowners has varied over the years. However, since the 2001 and 2002 spawning seasons, the number of landowners that have denied permission for access has increased dramatically. Controversies associated with the listing of SONCC coho salmon under the California Endangered Species Act and other regulatory actions have substantially reduced the amount of cooperation provided by local landowners to the extent the Department has been denied permission to survey a large portion of the Chinook spawning reaches present in the Scott Valley. As a result of the limited landowner access to the valley reaches, the Department proposed installation of a fish counting facility to be located at the upper end of the canyon reach. The location of the fish counting station allows for monitoring fish abundance into the valley. The counting facility is also located upstream of several tributaries that can produce significant fall and winter stream flows, thereby reducing the probability of having the counting facility inoperable due to high flow events.

#### **SCOTT RIVER STUDY OBJECTIVES SUMMARIZED**

- A) Determine the in-river run-size (escapement) of Chinook and coho salmon returning to the Scott River.
- B) Determine run timing, spawning distribution, length frequency distribution, and sex ratio for Chinook and coho salmon in the Scott River.
- C) Collect scale samples and recover heads (containing coded-wire tags) from ad-clipped Chinook in order to determine age composition and hatchery contribution rates of the run.
- D) Collect biological data for all steelhead observed during the Chinook and coho salmon spawning seasons.

### **METHODS**

#### **OPERATION OF THE SCOTT RIVER FISH COUNTING FACILITY**

The video fish counting system was installed at the SRFCF on September 23, 2011, at 1436 hours Pacific Standard Time. A temporary resistance board weir was installed to direct migrating fish into a flume where they pass in front of a video camera (Figure 2). The underwater video system consisted of a digital color video camera, waterproof camera housing, viewing window, and counting flume which allowed for recording unimpeded fish passage through the facility. The facility was operated 24 hours a day, seven days a week, throughout the Chinook and coho salmon migration period. A Splash Cam digital color video camera equipped with a 3.6mm wide angle lens with an auto iris was used to collect the photo image and an Ever Focus Digital Video Recorder (Model EDSR100) was used to record the image to external hard drives. The time lapse DVR was set to record continuously and drive changes were made at least twice a week.



**Figure 2. Scott River Fish Counting Facility located in Siskiyou County, California, 2011.**

All hard drives were immediately returned to the office where each was subsequently downloaded and reviewed by project staff in the video lab. During each review, staff recorded the date, time (hour:min:sec), and species of each fish observed on each video image. If the species could not be determined due to poor visibility or picture quality, staff recorded that observation as fish unknown. Staff also noted any ad-clipped fish observed and recorded the presence of lamprey scars and any other distinguishable marks that were visible on the tape. All data was then entered into computer files and each data file was subjected to one independent edit prior to commencement of data analysis.

### **SPAWNING GROUND SURVEYS**

Spawning ground surveys were conducted twice a week on Mondays and Thursdays throughout the Chinook salmon spawning season starting October 10, 2011, and ending December 12, 2011. A total of 17 surveys were performed during the spawning season. On the morning of each survey, crews of at least two people were given daily instructions, data sheets, field equipment, vehicle assignments, and were assigned a survey reach. Crews walked their assigned reach in a downstream direction looking for salmon carcasses and spawning redds. All new redds were mapped once a week, recorded on USGS topographic maps, and the information was provided to the Klamath National Forest. All carcasses recovered were

identified to species and gender, checked for marks or tags, measured (FL), a scale sample was collected for age composition analysis, and females were examined for spawning success.

For purposes of the mark recapture estimate, each carcass was categorized into one of four pathways (Path). Fresh carcasses, those with clear eyes and/or firm flesh, were designated as Path 1. Individually numbered jaw tags were attached to the lower right jaw of all Path 1 carcasses and returned to the river for potential recapture during later surveys. Older carcasses, those with cloudy eyes and/or mushy flesh, were categorized as Path 2. All Path 2 carcasses were cut in half and returned to the river after all biological data was collected. Path 3 carcasses included all of the Path 1 carcasses (with jaw tag) that were recaptured during subsequent surveys. Any carcasses that could be observed by a survey crew but could not be retrieved for data collection, because they were located in inaccessible or unsafe locations, were designated as Path 4. Path 4 designations were rarely encountered during the survey.

The final Chinook salmon run-size estimate for reaches below the counting facility was calculated using the Schafer Method as follows (Ricker 1975):

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

Where:

- $M_i$  = The number of fish marked in period  $i$
- $R_i$  = The total number of marked fish recaptured in period  $i$
- $R_j$  = The total number of marked fish recaptured in period  $j$
- $R_{ij}$  = The number of fish recaptured during the  $i^{\text{th}}$  and  $j^{\text{th}}$  period
- $C_j$  = The total number of fish recaptured in period  $j$

## SURVEY REACHES

Survey reaches have remained fairly consistent since the beginning of the cooperative spawning ground survey in 1992. During the Chinook salmon spawning season, decisions regarding which reaches should be surveyed were based on the known distribution of the Chinook salmon run each week, the available labor force present during each survey, and on private lands, was limited to those areas where permission has been granted by private landowners.

A total of 16 survey reaches, covering approximately 53.6 river miles, have been identified on the Scott River (Table 1, Figure 3). Access to private lands along the Scott River is critically important to the survey in those spawning areas that are present in Scott Valley. The highest observed densities of Chinook salmon spawning areas within Scott Valley are located downstream of the State Highway 3 Bridge crossing (rm 34.6) to the USGS gauging station located at river mile 21 (Reaches 8, 9, and 10), and in that reach of the river located downstream of Young's Dam, river mile 46, to about river mile 42 located upstream of the Eller Lane Bridge crossing (Reaches 12, 13, and 14).

To assist in developing stock identification baseline information, the KRP collected both genetic tissue and otolith samples during the season. DNA samples were collected from 314 Chinook salmon and 17 coho salmon (tissue collected from the first three Chinook from each reach and each survey date, and all coho salmon). All samples were collected following protocols provided by the National Oceanic Atmospheric Administration's (NOAA) Southwest Fisheries Science Center. Samples were sent to the Salmonid Genetic Tissue Repository located at the NOAA Santa Cruz Laboratory for archiving and analysis. Otoliths were collected from 301 Chinook salmon and 15 coho salmon (otoliths collected from the first three Chinook from each reach and each survey date, and all coho salmon). All otoliths

collected were archived for future microchemistry analysis. All otolith samples were collected following standard protocols described by Stevenson (1992).

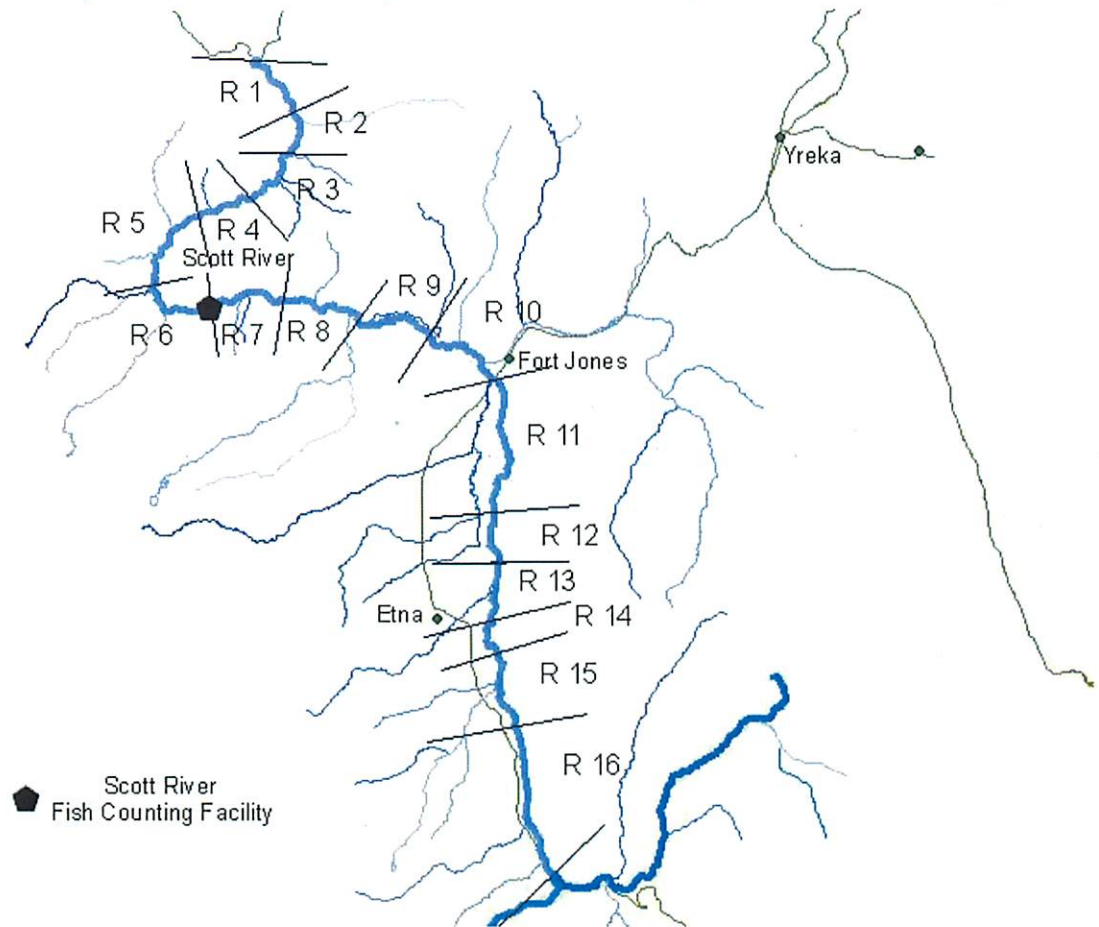
**Table 1. Description of cooperative spawning ground survey reach locations along the Scott River during the 2011 season.**

Reach Number	Downstream Limit	RM	Upstream limit	RM	Length (miles)
1	Mouth	0.00	Mid Point	2.60	2.60
2	Mid Point	2.60	Pat Ford Ck	4.90	2.30
3	Pat Ford Ck	4.90	George Allen Gulch	7.80	2.90
4	George Allen Gulch	7.80	Townsend Gulch	10.50	2.70
5	Townsend Gulch	10.50	Bridge Flat	14.20	3.70
6	Bridge Flat	14.20	Counting Weir	18.20	4.00
7	Counting Weir	18.20	USGS Stream Gage	21.00	2.80
8	USGS Stream Gage	21.00	Meamber Bridge	24.40	3.40
9	Meamber Bridge	24.40	Dunlop	29.50	5.10
10	Dunlop	29.50	Highway 3 Bridge	35.60	6.10
11	Highway 3 Bridge	35.60	Eller Lane	41.10	5.50
12	Eller Lane	41.10	Sweezy Bridge	42.10	1.00
13	Sweezy Bridge	42.10	Horn Lane	43.90	1.80
14	Horn Lane	43.90	Young's Dam	46.00	2.10
15	Young's Dam	46.00	Fay Lane	49.60	3.60
16	Fay Lane	49.60	East Fork Confluence	53.60	4.00

## POPULATION ESTIMATE

The Chinook salmon spawner escapement for the area of Scott River upstream of the counting facility was derived from a direct count of all Chinook salmon observed at the video counting facility. To estimate total escapement in the Scott River, the number of Chinook salmon carcasses derived from the Schaffer estimate (utilizing data from reach 1 through reach 6 only) were added to the count of all Chinook salmon observed passing through the video counting facility. The coho salmon spawner escapement for the area of the Scott River upstream of the counting facility was also derived from a direct count of all coho salmon observed at the video counting facility. Spawning ground surveys were conducted through late December in the mainstem and the beginning of January in tributaries (Tompkins, Kelsey Creek, and Canyon Creek) below the counting facility to add these fish to the video count for a total estimate.





**Figure 3. Location of the fish counting facility and spawning ground survey reaches on the Scott River used during the 2011 field season.**

To estimate total escapement in the Scott River, the number of coho salmon redds multiplied by two (utilizing data from tributary reaches and mainstem reaches below the weir only) for adults was added to the count of all coho salmon observed passing through the video counting facility. The grilse component from below the counting facility was then added back into the total (total run = adults/1-%jacks estimated).

## RESULTS

### OPERATION OF THE SCOTT RIVER FISH COUNTING FACILITY

The SRFCF began recording fish movements on September 23, 2011. The first Chinook salmon was observed at the SRFCF on September 24, 2011, and the last Chinook salmon was observed on November 28, 2011. The run peaked between October 6, 2011, and October 18, 2011, when 55.5% of the Chinook migration was observed (Figure 4). The majority of Chinook salmon passed through the SRFCF during daylight hours and peaked in the afternoon between 1200 and 1700 hours (Figure 5).

A total of 4,538 Chinook salmon were estimated to have passed through the SRFCF during the 2011 season. Three hundred and thirty-two (332) Chinook were included in the total as an expansion for periods of time when the camera was not functioning. During the Chinook observation period, the camera was not functioning on five separate occasions for a total of 142 hours and 46 minutes (Table 2).

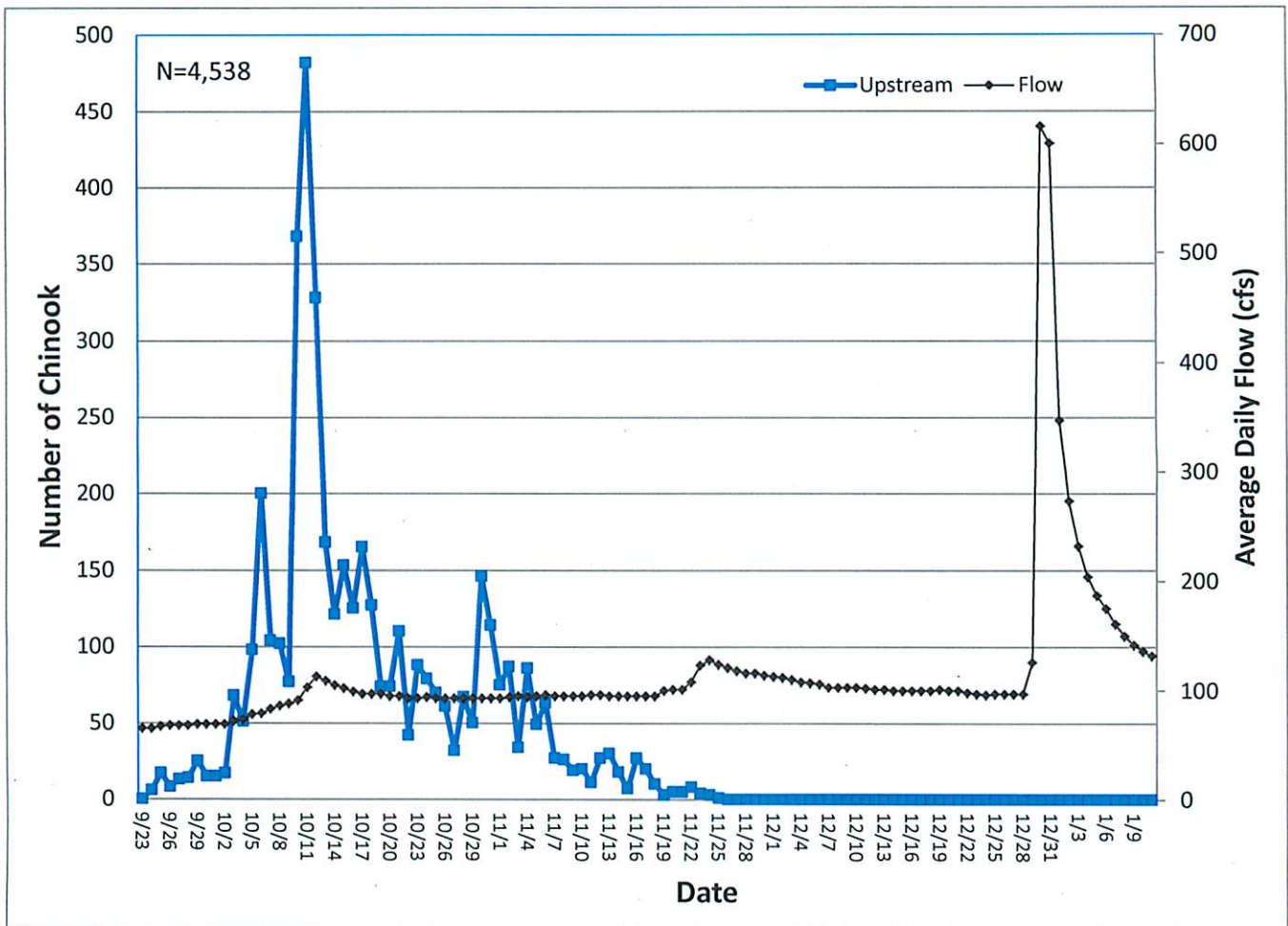


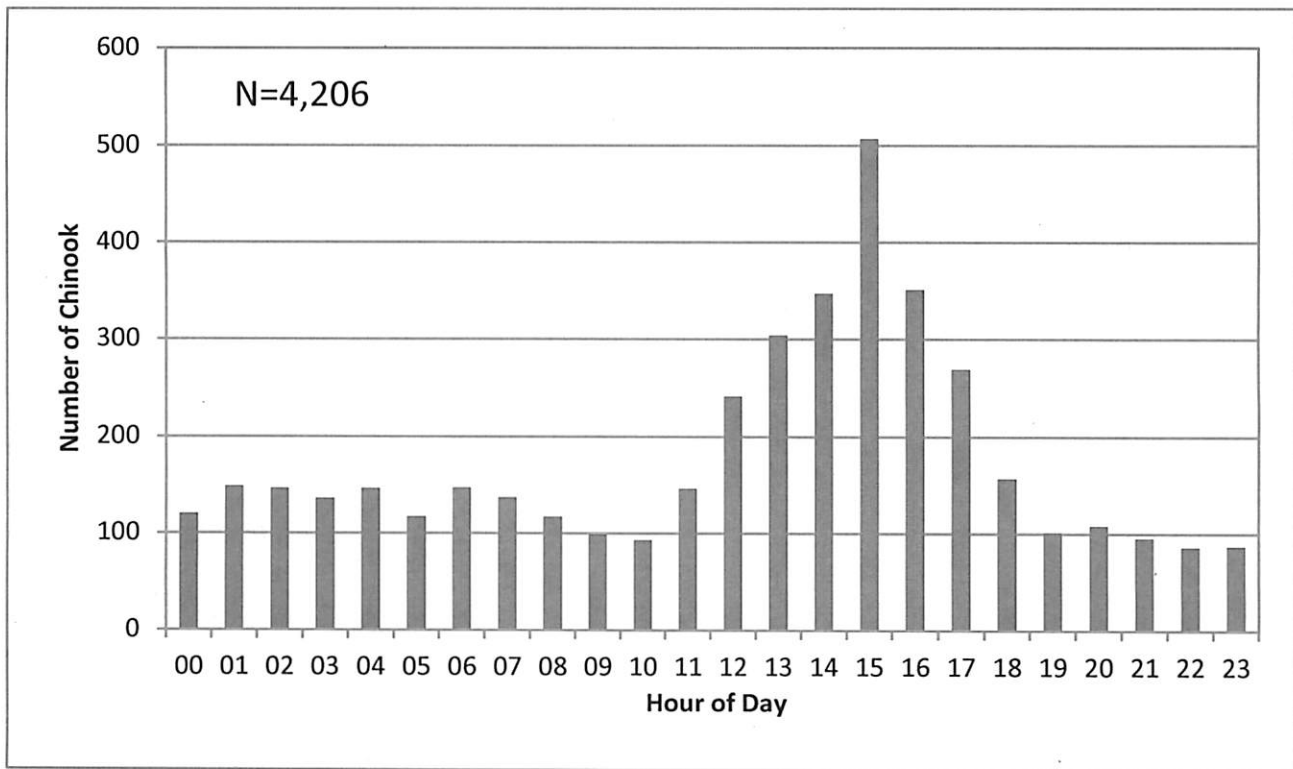
Figure 4. Run timing of Chinook salmon through the SRFCF during the 2011 season. (N=4,538).

**SPAWNING GROUND SURVEYS**

A total of 2,203 Chinook carcasses were sampled during the spawning ground survey as Path 1 or Path 2 carcasses. Of these, 1,538 (70.0%) were male and 658 (30.0%) were female (seven unknown sex). Males ranged in FL from 32cm to 103cm and averaged 61.8cm (Figure 6). Females ranged in FL from 45cm to 94cm and averaged 74.9cm (Figure 7). Two ad-clipped Chinook were observed during the spawning ground survey, one from Reach 1 and the other from Reach 2. The heads collected from these ad-clipped Chinook contained coded-wire tags. Both the coded wire tags recovered were from fingerling releases at Iron Gate Hatchery (IGH) in 2007 and 2008, respectively, and expanded to represent 20 hatchery fish (Table 3). After examination of the length frequency distribution and scales age analysis of Path 1 and Path 2 carcasses, a grilse cut-off of < 63cm was established for Scott River.

**Table 2. Specific dates and times when the filming stopped and restarted, the number of hours without data and the number of Chinook and coho estimated during that time.**

	Date	Time	Number of hours without data	Number of Chinook estimated	Number of Coho estimated
Filming Stopped	10/8/2011	0000	0	0	0
Filming Started	10/8/2011	0846	8.76	25	0
Filming Stopped	10/14/2011	1422	9.63	71	0
Filming Started	10/15/2011	0103	1.05	10	0
Filming Stopped	10/25/2011	0809	15.85	38	0
Filming Started	10/26/2011	1553	15.88	38	0
Filming Stopped	11/1/2011	1550	8.16	30	0
No Data available	11/2/2011		24	87	1
Filming Started	11/3/2011	0854	8.9	33	0
Filming Stopped	12/30/2011	1146	12.23	0	0
No Data available	12/31/2011		24	0	1
Filming Started	1/1/2012	0942	14.3	0	0
Totals			142.76	332	2



**Figure 5. Summary of daily run timing of Chinook salmon observed at the SRFCF during 2011 (N=4,206).**

A total of 658 Chinook salmon female carcasses were observed during the spawning ground survey. Each female carcass was examined to determine if it had successfully spawned prior to death. Spawning status was defined as un-spawned (many eggs remaining in the body) or spawned (few or no eggs remaining). Of the 658 female Chinook salmon carcasses examined, 654 females (99.4%) were found to have spawned, and four females (0.6%) were identified as unspawned.

**Table 3. Summary information of coded-wire tags recovered in the 2011 Scott River spawning ground surveys.**

Spawning Ground Surveys										
Coded Wire Tag	Location	Release Type	Brood Year	Age	Sample Number	Production Multiplier	Production Estimate	Sample Expansion	Total Estimate	
608020003	IGH	F	2007	4	1	16.17	16	1.00	16	
068643	IGH	F	2008	3	1	4.02	4	1.00	4	
Sub Total=					2	Sub Total=			20	
Estimated contribution of lost CWT's					0	Sub Total=			0	
					Total Estimated Hatchery Contribution=					20
a/ Release type; Ff=Fall fingerling, Fy=Fall Yearling										
b/ Production Multiplier value is the inverse of the proportion of effectively tagged and total release from IGH										

In 2011 the Schaffer mark recapture data generated from the spawning ground survey was segregated by reaches and analyzed independently for three areas: (1) reaches 1-6, (2) all reaches, (3) reaches 7-8, and (4) reach 8 alone. The basin estimate was derived by adding the Schaffer estimate generated from reaches 1-6 to the total number of Chinook observed passing through the counting facility. The Schaffer estimate for reaches 1-6, all reaches, reaches 7-8, and reach 8 alone were 983, 4,021, 2,255, and 1,819, respectively. For reaches 1-6, 336 Chinook were recovered, 199 were marked, and 64 were subsequently recaptured yielding a recapture rate of 32.2%. For all reaches, 2,139 Chinook were recovered, 1,266 were marked, and 667 were subsequently recaptured yielding a recapture rate of 52.7%. For reaches 7-8, 1,147 Chinook were recovered, 643 were marked, and 323 were recaptured yielding a recapture rate of 50.2%. For reach 8 alone, 1,008 Chinook were recovered, 562 were marked, and 303 were recaptured yielding a recapture rate of 53.9%. The total Chinook salmon run-size estimate (based on summing the video estimate and the Schaffer estimate from below the weir) was 5,521 fish. Based on scale age analysis, adults comprised approximately 55.0% (3,037 fish) and grilse comprised 45.0% (2,484 fish) of the run (KRTAT 2012).

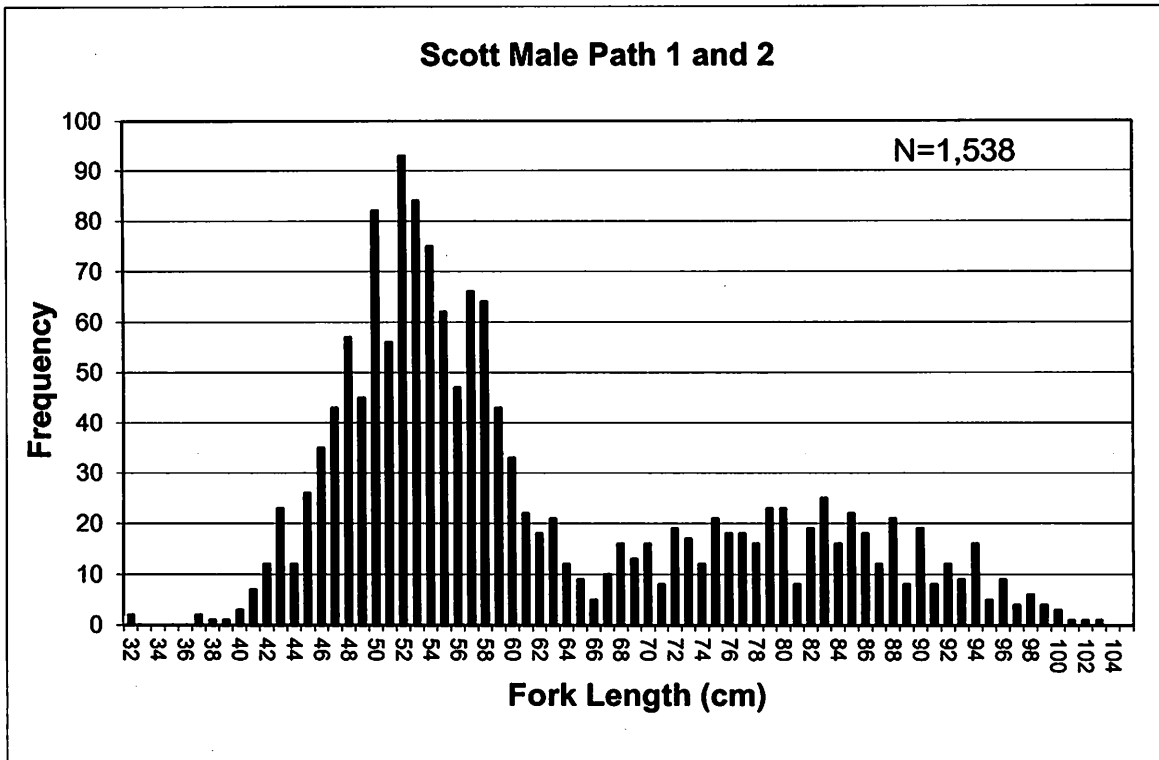


Figure 6. Length Frequency distribution of Path 1 and Path 2 male Chinook salmon observed during spawning ground surveys in the Scott River, 2011 (N=1,538).

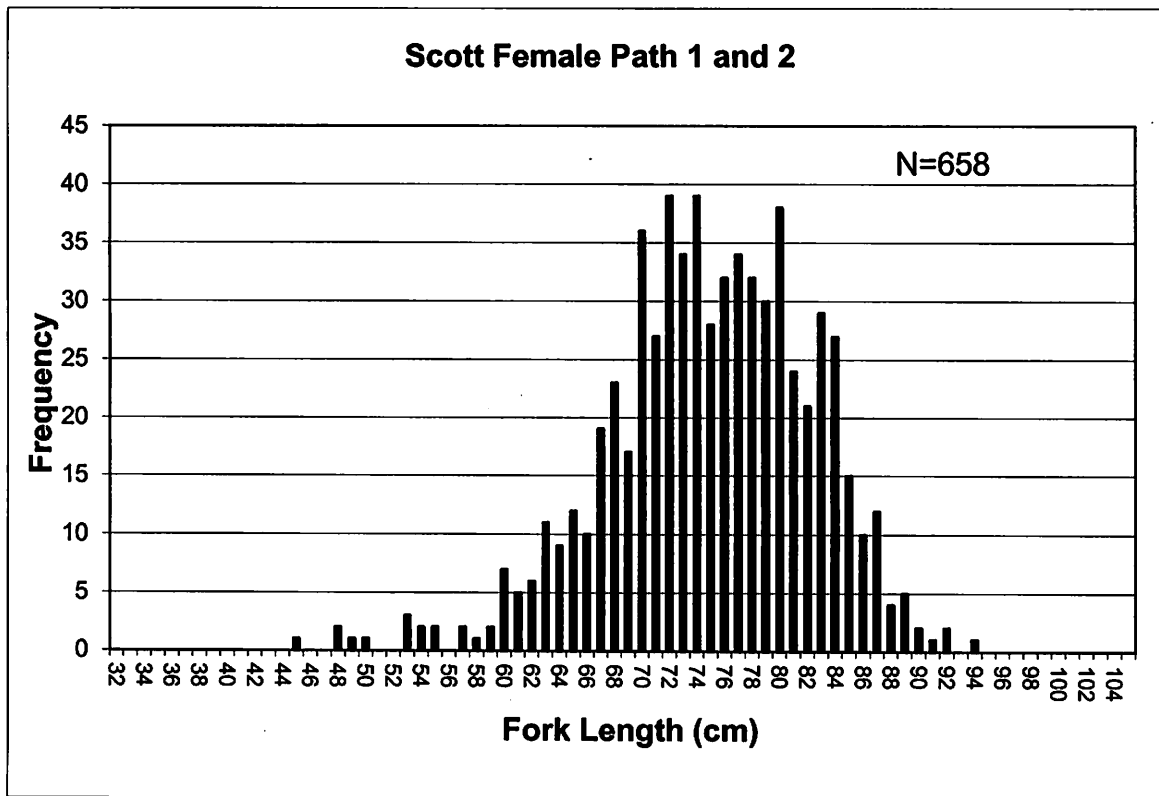
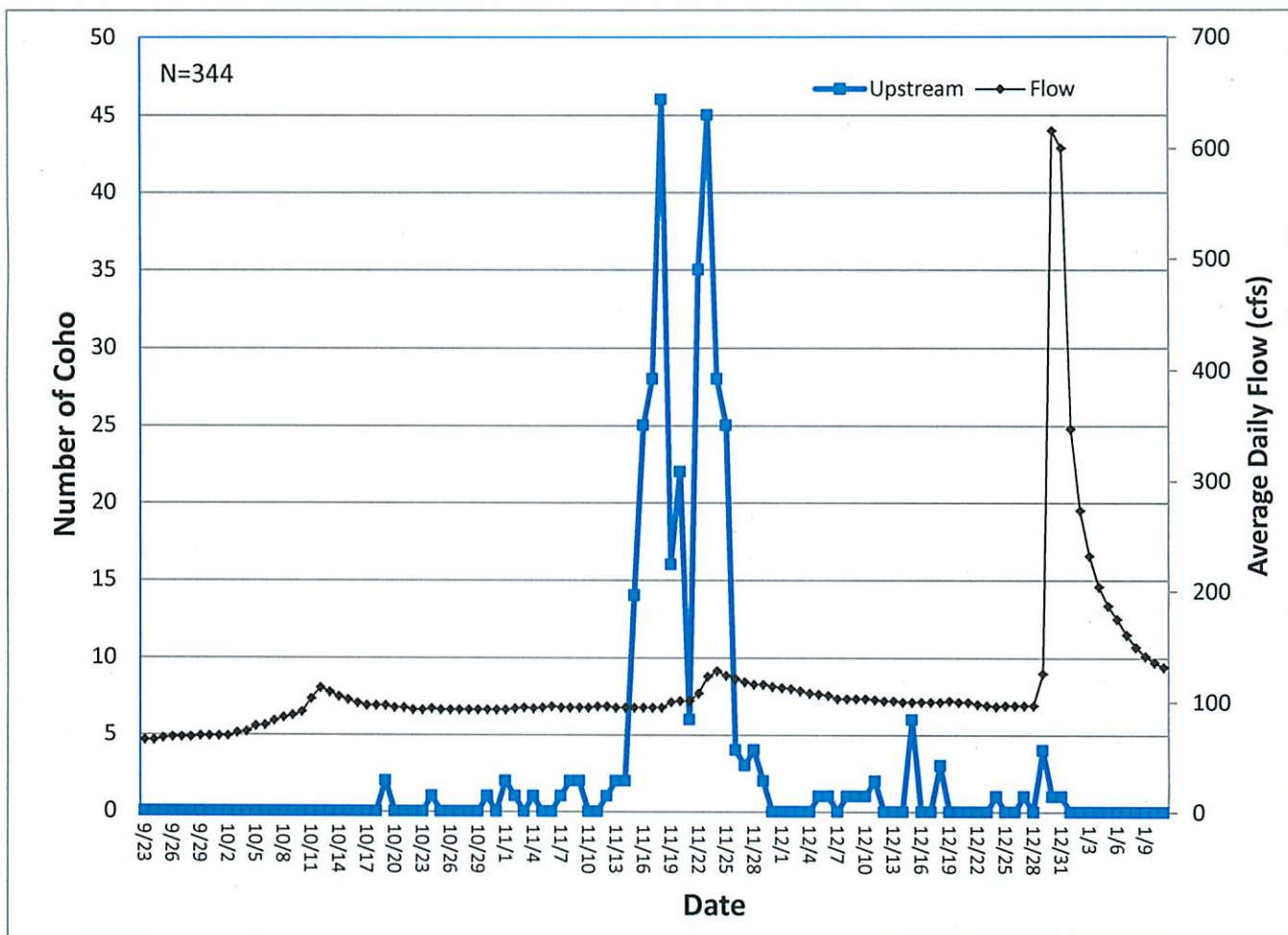


Figure 7. Length frequency distribution of Path 1 and Path 2 female Chinook salmon observed during spawning ground surveys in the Scott River, 2011 (N= 658).

**COHO SALMON**

The first adult coho salmon was observed at the counting facility on October 19, 2011, and the last coho salmon was observed on December 31, 2011. A total of 342 coho salmon were observed moving upstream through the SRFCF during the season (Figure 8). Coho salmon migration peaked during the 11 day period from November 15, 2011, through November 25, 2011, when 290 or 84.3% of the coho were observed. Three coho salmon were observed swimming downstream during the season. During the coho migration, the weir was inoperable on three occasions for a total of 123 hours and 20 minutes. Specific periods in which the counting facility was inoperable and the number of coho added are listed in Table 2. A total of two coho was added to the estimate during periods when the counting facility was not operational, for a total of 344. None of the 342 coho salmon observed were coho salmon that previously entered IGH and were subsequently released (released coho from IGH were internally marked with PIT tags for identification). During 2011 KRP staff attempted to estimate the number of grilse in the Scott River by enumerating the number of coho observed in the video flume that were shorter or longer than 56cm. Utilizing this method, KRP staff identified 96.9% adults and 3.1% grilse.



**Figure 8. Run timing of coho salmon observed passing through the SRFCF during the 2011 season (N=344).**

Diel movements of coho salmon through the SRFCF were higher in the evening hours and peaked between 1800 hours and 2100 hours (Figure 9). Migrations were generally low after midnight through the early afternoon and increased from the afternoon through midnight. Between 0800 and 1100 was generally the time during the day when the crew was at the weir conducting daily maintenance.

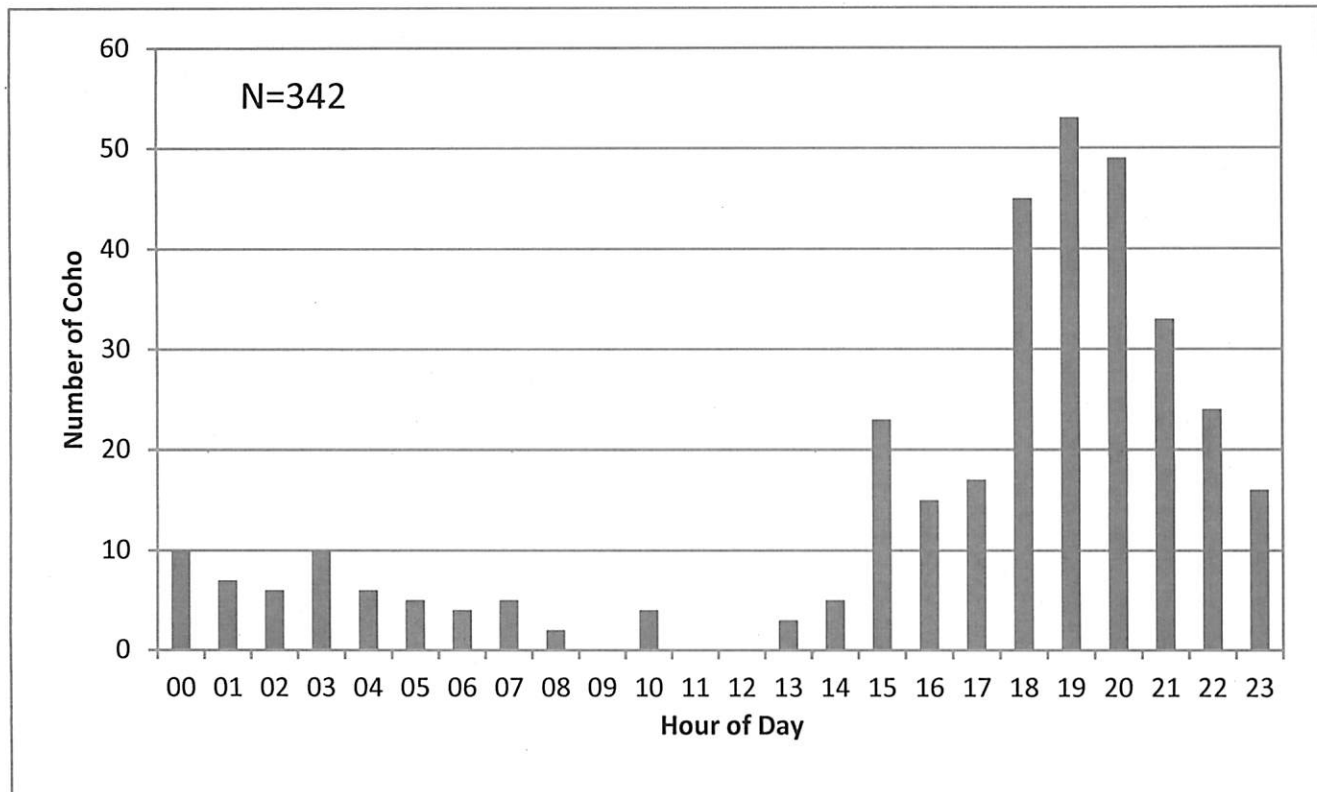
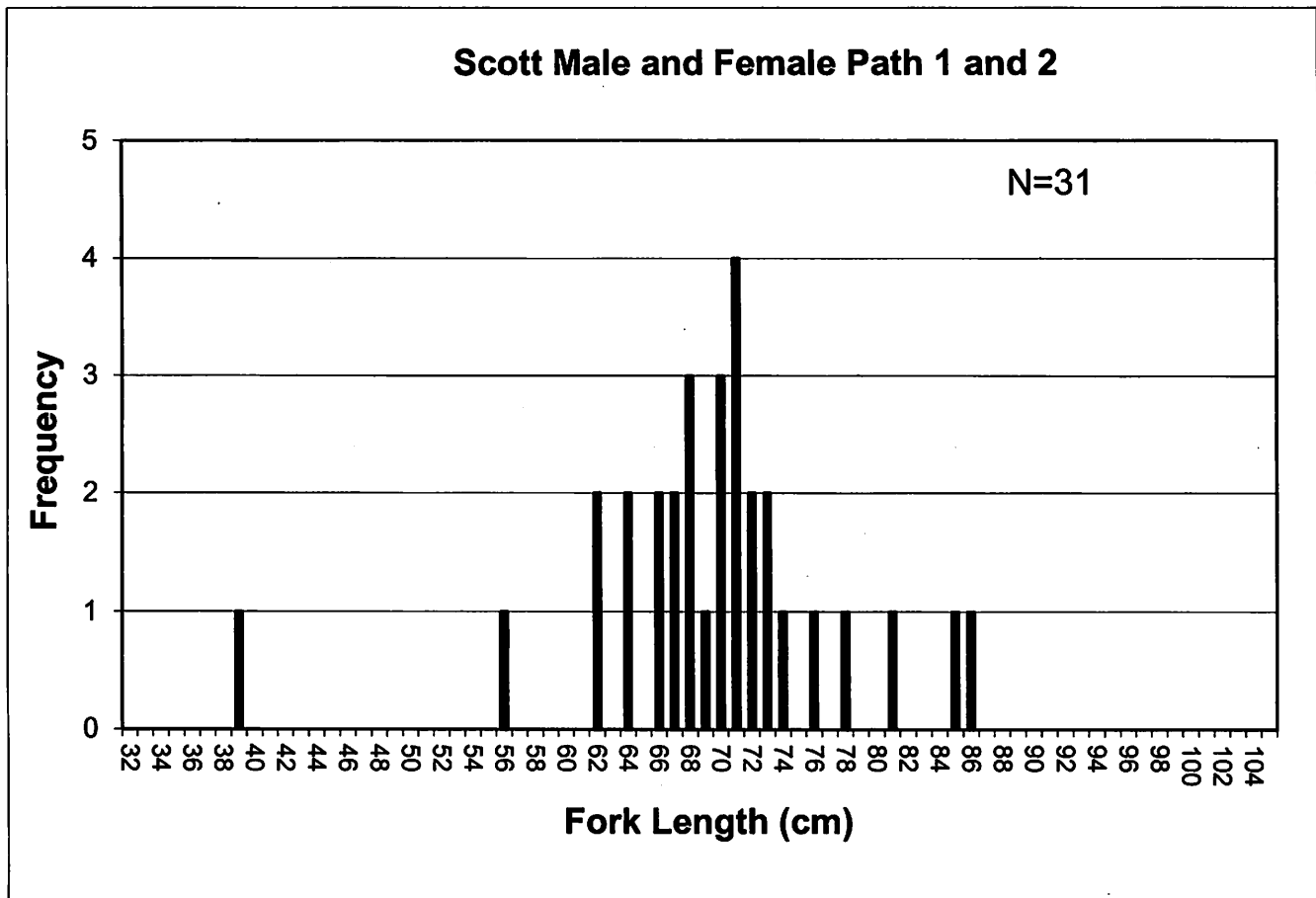


Figure 9. Diel migration patterns of coho salmon observed moving through the SRFCF in 2011 (N=342).

### SPAWNING GROUND SURVEYS

Ten coho carcasses were observed during the cooperative spawning ground survey on the mainstem Scott River (five below the weir and five above the weir). Coho redds were observed in Canyon Creek (1) and Kelsey Creek (2) but not in Tompkins Creek. The three redds observed below the weir were estimated to represent six adult coho. No additional jacks were estimated to accompany the three observed redds (estimated 0.19 jacks was rounded to zero). Fifteen coho carcasses were observed in the Scott River during surveys coordinated by the Siskiyou Resource Conservation District above the counting facility (Franklin, 2012). Six additional coho carcasses were collected as washbacks at the counting facility (Figure 10). Utilizing all of the recoveries throughout all areas, the sex ratio of observed coho salmon carcasses in the Scott River during 2011 was 48.4% (15) female and 51.6% (16) male. None of the 31 carcasses examined had a maxillary clip indicating that the 2011 run was comprised of 100% natural origin returns. Based on the FL frequency distribution of the limited number of carcasses collected during the season, all but one of the fish would have been estimated to be age three (see video section for further information on age structure). All of the carcasses examined were sampled for tissue, and collected samples were supplied to the NOAA Southwest Fisheries Science Center located in Santa Cruz, California, for stock identification purposes.



**Figure 10. Length frequency distribution of male and female coho salmon observed during cooperative spawning ground surveys (10), RCD spawning ground surveys ((15); Franklin 2012) and as washbacks (six) on the SRFCF, during the 2011 spawning season (N = 31).**

An estimated total of 344 coho salmon were observed moving upstream through the SRFCF during the season. Five coho carcasses were observed in spawning ground surveys below the SRFCF. Three coho redds were estimated in areas below the counting facility representing an estimated six coho. The total number of coho salmon that entered the Scott River during the 2011 season is estimated to be 355. Utilizing the observed age proportions derived from video data, the resulting number of age two and three fish are 11 and 344, respectively.

**STEELHEAD**

In 2011 a net total of 251 adult (>16") steelhead (Figure 11) and 198 sub-adult (<16") steelhead (Figure12) were estimated to have entered and remained in the Scott River during the video recording season from September 23, 2011, to January 11, 2012. Three peaks of migration for adult steelhead were observed, all associated with increases in flow (Figure 11). Lines on the back of the video flume were set at 16 inches (40.64 cm) to delineate sub-adults versus adults. The 2011 season was the second year that lines delineating adult steelhead and sub-adults were used. As additional years of data are collected, annual comparisons will be presented.



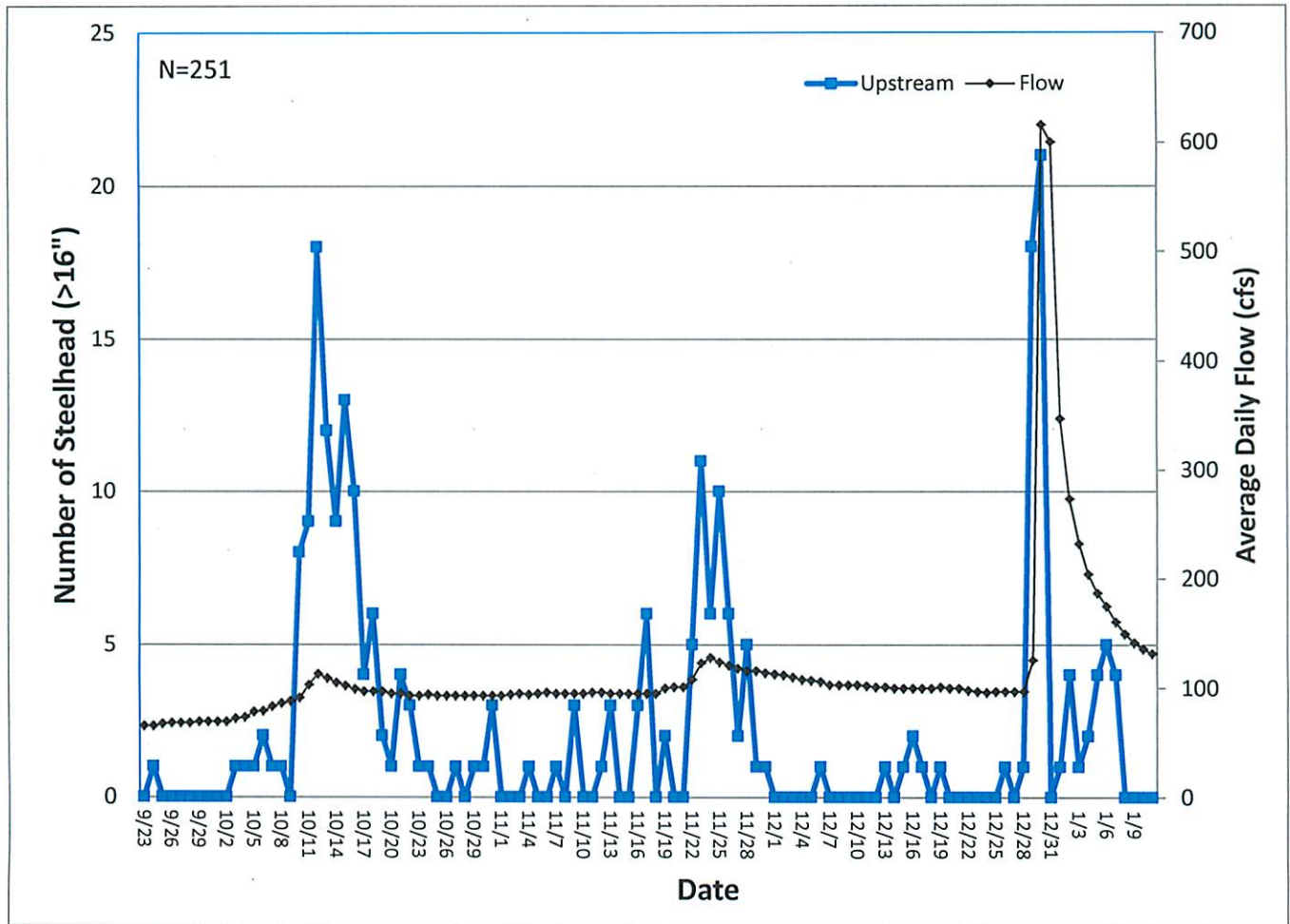


Figure 11. Run timing of steelhead trout (>16") observed passing through the SRFCF during the 2011 season (N=251).

## DISCUSSION

### CHINOOK SALMON RUNS

Since 1978 the Chinook salmon run in the Scott River has ranged from 14,477 fish (1995) to 467 fish (2004) and has averaged 5,209 fish (Figure 13). The 2011 Chinook salmon run in the Scott River ranks 11th (5,521 fish) out of 34 years of population estimates. The 2011 run was 5.6% higher than the 34-year average. A total of 4,538 Chinook salmon were estimated to have passed through the SRFCF during the 2011 season. A total of 983 Chinook salmon carcasses were estimated in reach 1 through reach 6, yielding a total run-size estimate of 5,521 Chinook salmon. A total of 2,255 Chinook salmon were estimated in reaches 7-8. If the total number of Chinook estimated in reaches 7-8 are subtracted from the weir estimate, the proportion of the run that utilized areas upstream of reach 8 can be estimated. During 2011, 41.3% (2,283) of the Chinook run utilized areas of the watershed above Member Bridge. Reach 8, a 3.4 mile section of the river, between Member Bridge and the USGS gauging station, accounted for 1,819 Chinook salmon. These 1,819 fish that utilized reach 8 accounted for 40.1% and 32.9% of the total spawning above the weir and total spawning throughout the entire watershed, respectively. The Schaffer mark recapture carcass estimate for the entire watershed surveyed was 4,021 fish. This estimate of 4,021 fish underestimates the total estimate by 28.2%. The addition of the fish counting facility has yielded a more accurate estimate of the total number of Chinook in the Scott River and has allowed for accurate estimation of Chinook utilization in the valley reaches without having to survey these reaches.

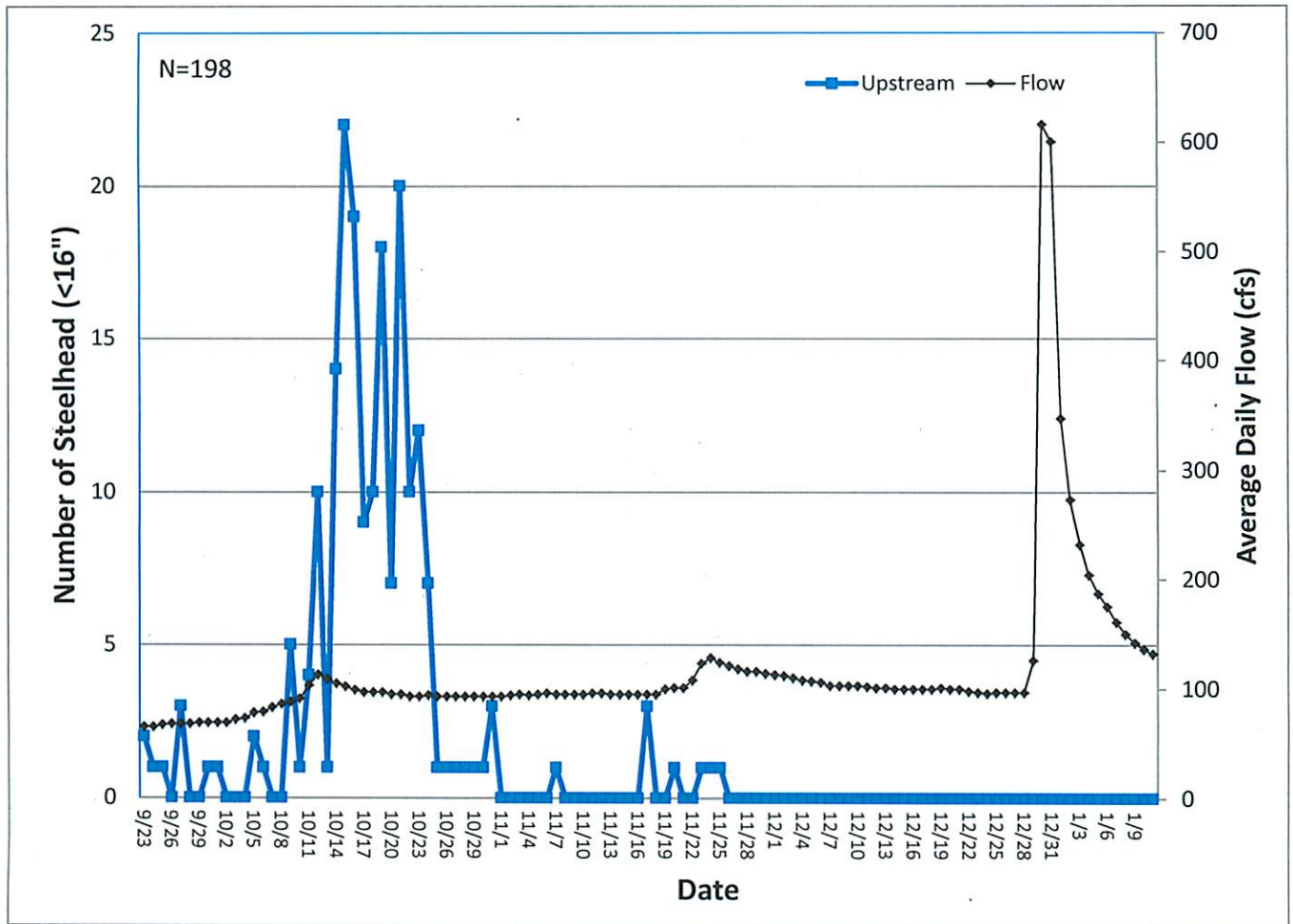


Figure 12. Run timing of steelhead trout (<16") observed passing through the SRFCF during the 2011 season (N=198).

The Scott River is an important component of the Klamath Basin Chinook runs. Table 4 shows that the Scott River has contributed an average of 10% of the basin-wide natural spawning escapement to the Klamath River during the period from 1978 to 2011. The production of emigrating 0+ Chinook has been estimated in the Scott River since Brood Year 1999 (Chesney et al., 2011). The number of 0+ Chinook produced per adult has been calculated for brood years 1999 through 2010 and has ranged from a low of 14.4 to a high of 383.0 and averaged 118.8 (Figure 14). The number of 0+ Chinook produced per adults is a direct measure of in-river productivity, and as habitat conditions improve or diminish, this measure will reflect those conditions.

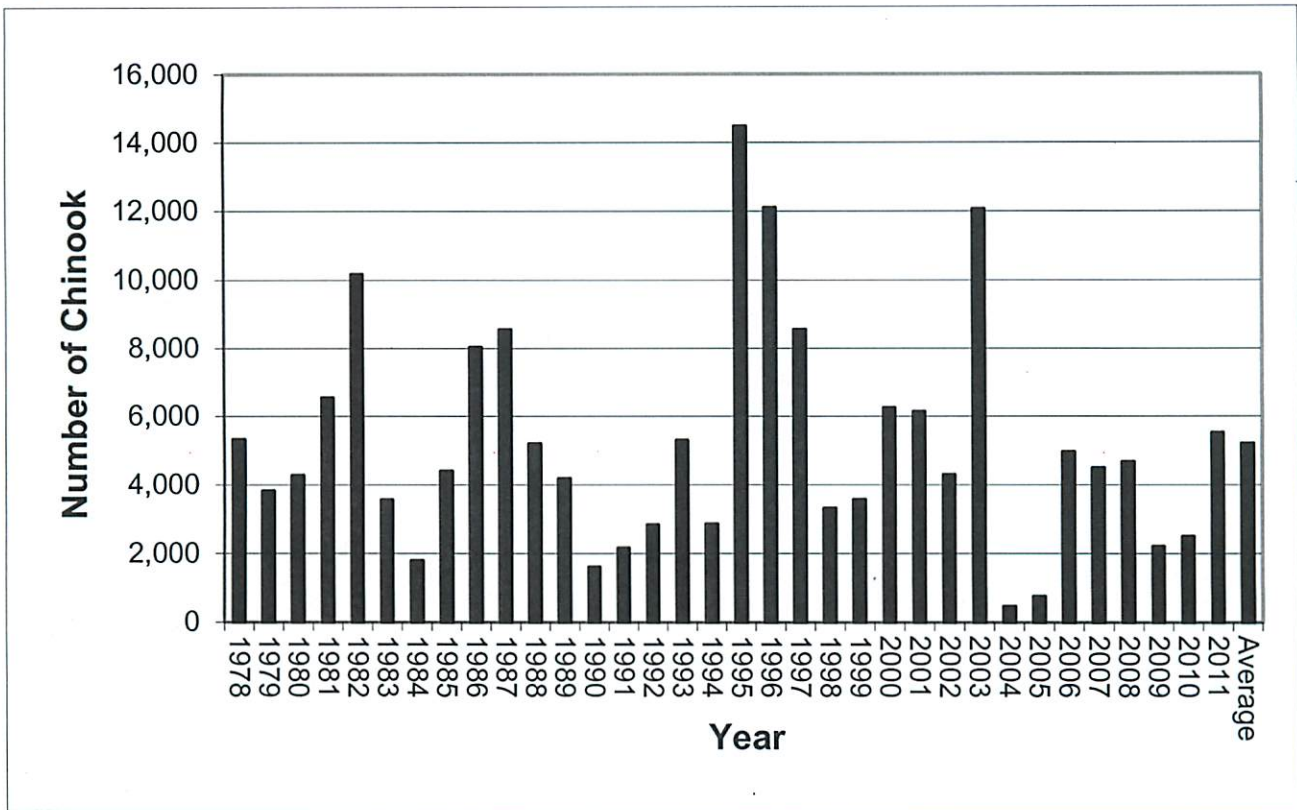


Figure 13. Estimated escapement of Chinook salmon returning to the Scott River from 1978 to 2011.

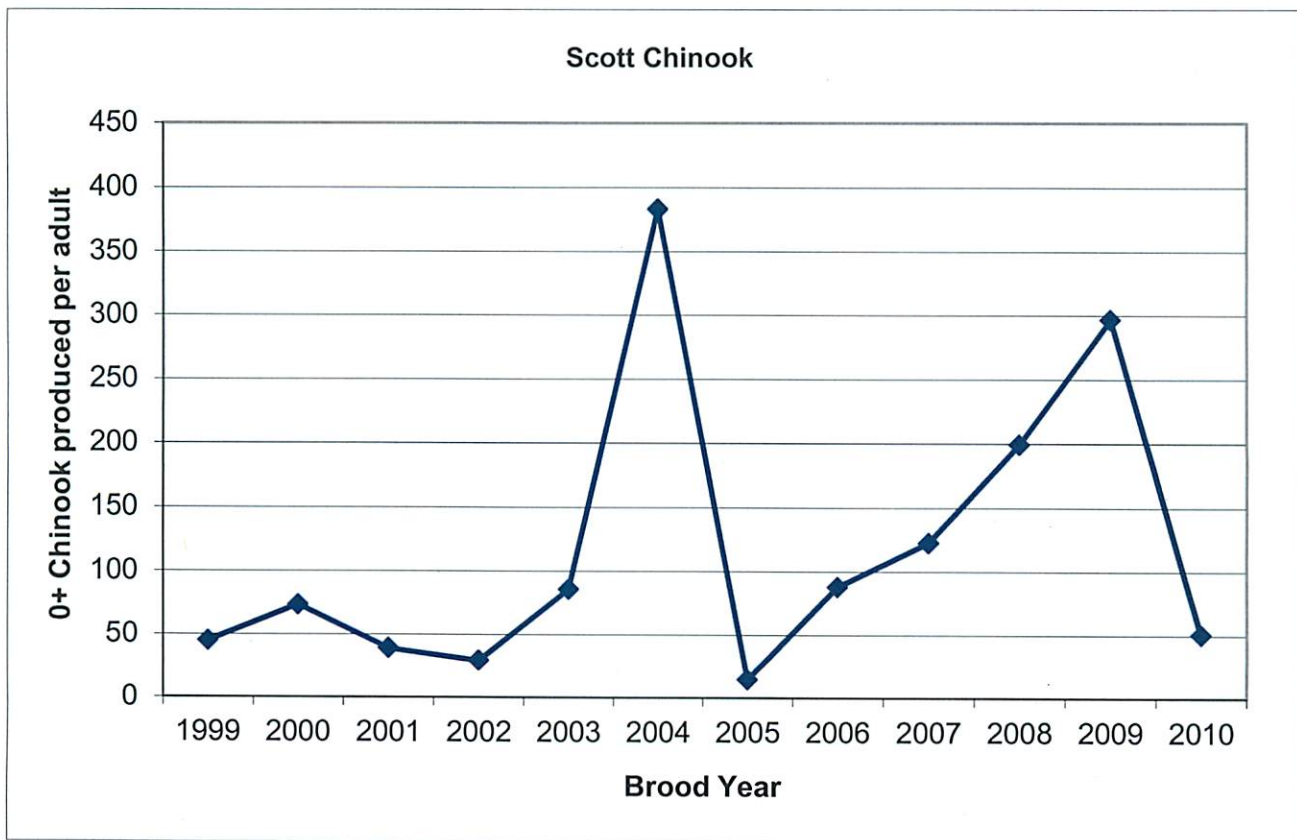


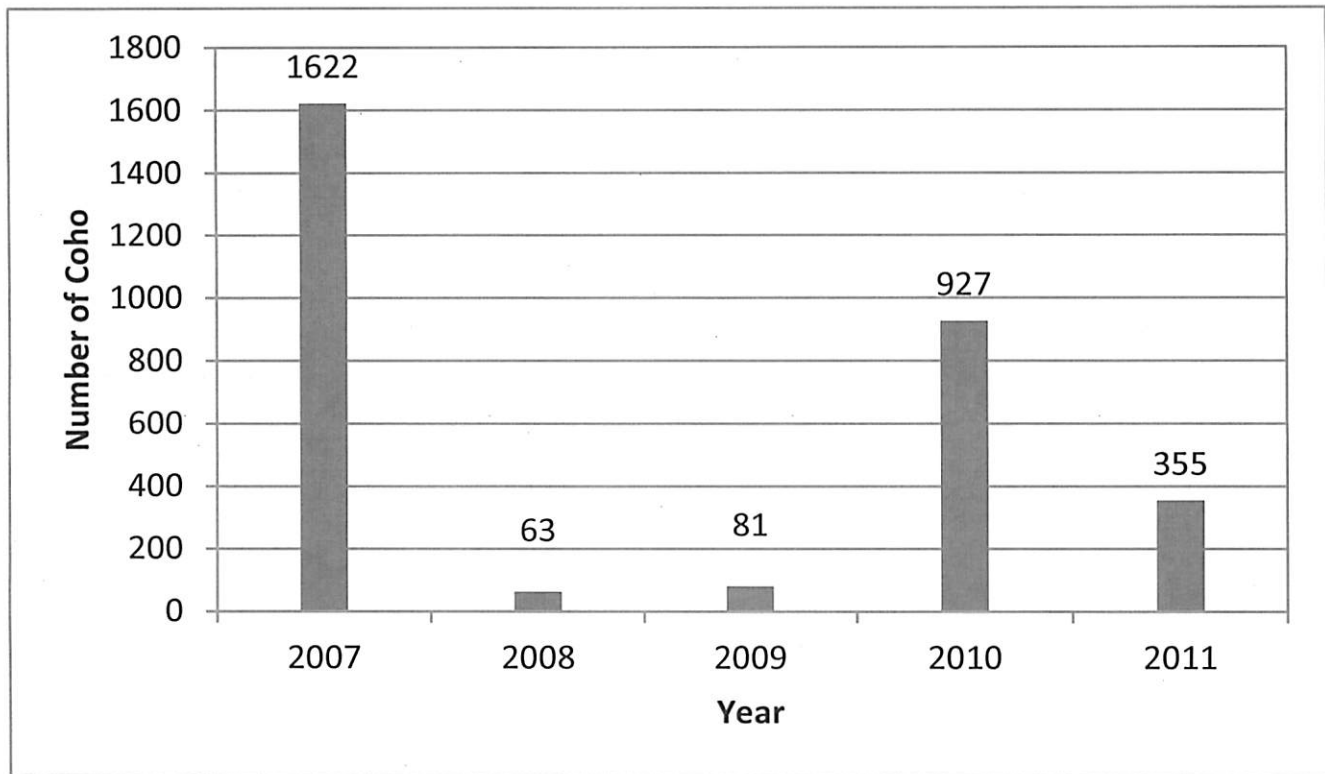
Figure 14. Number of 0+ Chinook produced per adult spawner in the Scott River by brood year, for Brood Years 1999-2010.

**Table 4. Klamath Basin and Scott River Chinook natural spawner escapements (age 2-5), 1978-2011.**

Year	Chinook Natural Spawner Escapement		% Scott
	Klamath Basin	Scott River	
1978	74,906	5,332	7%
1979	37,398	3,824	10%
1980	48,465	4,277	9%
1981	50,364	6,556	13%
1982	50,597	10,176	20%
1983	33,310	3,568	11%
1984	21,349	1,801	8%
1985	61,628	4,408	7%
1986	142,302	8,041	6%
1987	110,489	8,566	8%
1988	91,930	5,200	6%
1989	49,377	4,188	8%
1990	16,946	1,615	10%
1991	12,367	2,165	18%
1992	17,171	2,838	17%
1993	25,683	5,300	21%
1994	38,578	2,863	7%
1995	179,118	14,477	8%
1996	87,500	12,097	14%
1997	50,369	8,561	17%
1998	45,343	3,327	7%
1999	28,904	3,584	12%
2000	89,122	6,253	7%
2001	85,581	6,142	7%
2002	69,502	4,308	6%
2003	89,744	12,053	13%
2004	28,516	467	2%
2005	27,931	756	3%
2006	45,002	4,960	11%
2007	61,741	4,505	7%
2008	48,073	4,673	10%
2009	52,702	2,211	4%
2010	49,027	2,508	5%
2011	110,554	5,521	5%
<b>Average</b>	<b>59,753</b>	<b>5,209</b>	<b>10%</b>

**COHO SALMON**

Since video operations began in 2007, the estimated escapement of coho salmon in the Scott River has been 1,622, 63, 81, 927 and 355 for 2007, 2008, 2009, 2010, and 2011, respectively (Figure 15). The adult run-size of coho salmon prior to 2007 was unknown, and with the addition of the counting facility, the Department's ability to monitor this listed run has greatly improved. Although recent adult run-size data is sparse on the Scott River, monitoring of the yearling juvenile emigration has taken place since 2003. The emigration data generated from 2003 through 2011 indicates significant variation in brood year strength (Chesney, 2011). Results of the first five years of adult monitoring at the SRFCF support this observation. The cohort that returned in 2011 is not the strongest year class but one of the two weaker year classes in the Scott River. In one generation, the 2011 coho salmon returns of 355 were 5.64 times greater than the 2008 returns of 63, an increase in brood year strength of 292 fish. It is very encouraging to see a positive growth rate in one of the three brood years of coho salmon in the Scott River.



**Figure 15. Estimated escapement of adult coho (age 2 and age 3) salmon returning to the Scott River from 2007 to 2011.**

Utilizing the number of coho smolts produced in the Scott River (Chesney, 2012 personal communication) and the results of the adult abundance estimates allows for analysis of Scott River freshwater production and out-of-basin survival by brood year. For brood years 2004, 2005, and 2007, the number of coho smolts that were required to produce a single adult coho averaged 58.94 and ranged from a low of 46.30 to a high of 67.11. The corresponding out-of-basin survival has averaged 1.74% and ranged from a low of 1.49% to a high of 2.16% (Table 5). Due to the difficulty in estimating abundance of smolts at low abundance levels, data from brood years 2006 and 2008 has been omitted from this analysis. Although the proportion of smolts that survive outside the Scott River watershed is largely driven by uncontrollable factors, it is important to track this survival metric to accurately evaluate ongoing restoration efforts taking place within the watershed.

**Table 5. Coho smolt outmigrant abundance point estimates, adult coho abundance estimates, ratio of outmigrant smolts to adult returns, and proportion of outmigrant smolts that returned as adults by brood year for the Scott River, Brood Years 2004-2008.**

Brood Year	Smolt Year	Smolt point Estimate	Adult Year	Adult Estimate	Smolts to adult	Percent smolt survival
2004	2006	75097	2007	1622	46.30	2.16
2005	2007	3931	2008	62	63.40	1.58
2006	2008	941	2009	81	11.62	8.61
2007	2009	62207	2010	927	67.11	1.49
2008	2010	1979	2011	355	5.57	17.94

Analyzing the comparisons of coho smolt production estimates to estimated adult coho returns produces freshwater survival estimates in the form of coho smolts produced per adult return. In brood years 2007, 2008, and 2009, the numbers of coho smolts produced per returning adult are 38.35, 34.51 and 3.40, respectively (Table 6). Due to the difficulty in estimating abundance of outmigrants at low abundance

levels, it is unclear if the smolts produced per adult ratio generated for brood year 2009 is a result of decreased freshwater productivity or a result of sampling difficulty. As additional years of data become available the freshwater production of coho salmon in the Scott River can be further evaluated. To give some context to the smolts produced per adult in the Scott River, this value in the Shasta River has averaged 18.6 and ranged from a low of 4.4 to a high of 38.0 for brood years 2001-2007. The number of smolts produced per returning adult by brood year is a direct measure of freshwater survival. For levels below carrying capacity, it can be stated that as the number of smolts produced per returning adult increases, it can be inferred that in-river conditions for coho salmon are improving. Conversely, as the number of smolts produced per returning adult decreases, it can be inferred that in-river conditions for coho salmon are getting worse. The number of smolts produced per returning adult can be influenced by inter annual variation in sex ratios, and in future years, attempts will be made to further refine this analysis.

**Table 6. Adult coho estimate, coho smolt production point estimate, and ratio of coho smolts produced per adult return for the Scott River, Brood Years 2007, 2008, and 2009.**

Adult Year Brood Year	Adult Estimate	Smolt Year	Smolt point Estimate	Smolts produced per adult
2007	1622	2009	62207	38.35
2008	63	2010	1979	31.41
2009 <sup>/1</sup>	81	2011	275	3.40

<sup>/1</sup> Smolt point estimate preliminary.

### ACKNOWLEDGEMENTS

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