



**Scott River Brood Year 2013 Juvenile Coho Salmon PIT Tagging Study**

**California Department of Fish and Wildlife**

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## Executive Summary

Extremely low flow conditions occurred in the Scott River watershed during the summer and fall of 2013 and 2014, due to the combined effects of drought and irrigation water withdraws. Low flows and disconnected tributaries limited the extent of upstream migration of a relatively large adult coho return ( $n \approx 2,731$ ) in 2013. Most spawning occurred in the mainstem Scott River rather than in the tributaries where it is more commonly documented. This resulted in a situation where large numbers of juvenile coho were likely to be subject to high mortality rates in drying reaches of the Scott River. The California Department of Fish and Wildlife (CDFW), in collaboration with other organizations, agencies and landowners undertook a fish relocation effort to remove juvenile salmonids from drying sections of the Scott River and place them in other locations in an attempt to reduce the rate of mortality.

Based on snorkel survey observations, over 118,250 juvenile coho were estimated to be present in the mainstem Scott River between Etna Creek and the Fay Lane Bridge in May 2014. An estimated 115,999 juvenile coho were relocated from the Scott River mainstem to tributary locations. A total of 1,872 of the relocated coho were implanted with passive integrated transponder (PIT) tags and CDFW operated six instream PIT tag detection stations in the watershed to evaluate the movements and survival of PIT tagged fish. A sample of 1,423 juvenile coho were also PIT tagged and released at the point of capture (981 were PIT tagged prior to September 1, 2014 and 442 were PIT tagged on September 1, 2014 or later) so that we could compare movements and survival between tagged fish that were relocated and those that were not. In addition, a total of 4,447 juvenile coho were taken to Iron Gate Hatchery (IGH) to rear in circulating round tanks. Of those fish, 390 were PIT tagged. These fish were returned to the mainstem Scott River and French Creek in October 2014.

A total of 96 of the relocated coho and 25 of the non-relocated coho were detected on September 1, 2014 or later (known to have survived the summer). In 2014, the total number of brood year (BY) 2013 PIT tagged coho (age-0) detected at the antenna array located at the RKM 8 (rotary screw trap site) was 8 individuals (2 that had been relocated to Canyon Creek and 6 that were released at capture locations in the upper Scott River). In 2015, a total of 12 PIT tagged BY2013 coho smolts were detected outmigrating through the PIT tag antenna array located at RKM 8 (10 that had been relocated to sites in the upper Scott River and 2 that were held IGH and released back to the Scott River in October 2014). High water events from December 2014 through February 2015 damaged a number of the detection stations and resulted in some uncertainty about the survival estimates of PIT tagged fish. It is unknown how many PIT tagged coho may have outmigrated from the Scott River without being detected.

Some of the key finding of this study:

1. Coho exhibited movements in both upstream and downstream directions prior to the disconnection of flows in the Scott River mainstem and tributaries.
2. Based on snorkel surveys, rearing habitat for juvenile coho salmon that persisted in the mainstem Scott River through the summer and fall of 2014 was limited to a few isolated pools that appeared to have groundwater input.
3. Very few of the coho PIT tagged during the summer of 2014 were encountered after September 1, 2014 (96 of the 1872 PIT tagged coho that were relocated and 25 of the 981 PIT tagged coho that were not relocated were detected after September 1, 2014), suggesting poor summer survival of both tag groups.

4. Given the relatively large number of coho adults that entered the Scott River in 2013, there were low catches of juvenile coho at the rotary screw traps. Based on the rotary screw trap data, population estimates of age-1 coho smolts outmigrating from the Scott River watershed in the spring of 2015 was 7,253 (95% CI, 4,689-9,816) individuals.
5. High flows occurred in December 2014 and February 2015 damaging the antenna station network and resulting in uncertainty about survival estimates due to poor detection capability.
6. Detections of outmigrating smolts suggest that the majority of surviving fish outmigrated during April and May 2015, when PIT tag antennas and rotary screw traps were in operation.
7. Three of the coho tagged and relocated in the Scott River were found rearing in locations downstream in other Klamath River tributaries.
8. The coho adult return in 2016 will indicate overall survival of the BY2013 cohort.

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## 1. Introduction

An estimated 2,731 adult coho entered into the Scott River valley to spawn between October 21, 2013 and February 5, 2014, based on observations at a counting weir located at river kilometer (RKM) 29 (Knechtle and Chesney 2014). This was the largest adult coho run documented in the Scott River since the California Department of Fish and Wildlife (CDFW) began operation of the counting weir in 2007. Extremely low flows in the mainstem Scott River and tributaries in the fall of 2013 prevented coho from reaching typical spawning locations in the tributaries (less than 50 cfs at the Fort Jones gaging station in November). As a result, most spawning activity was documented in the mainstem Scott River.

The Siskiyou Resource Conservation District (Yokel 2014) reported that, “Of the 454 documented redds, 97% of the spawning occurred in the mainstem Scott River, although this accounts for only approximately 27% of the live coho observations through counting weir. Superimposition of redds was observed in most locations, so the actual count of spawning adults is likely higher. Spawning was observed in a total of two tributary locations: French Creek and Shackleford Creek. These locations are the same reaches where coho salmon have been observed spawning annually since 2001. French Creek and Shackleford Creek were the only tributary locations accessible to salmonids during much of the spawning season.”

Extreme drought conditions coupled with water use practices in the Scott River watershed were anticipated to result in a lack of surface water connection between the tributaries and the mainstem Scott River. Almost the entire valley reach of the mainstem Scott River was dewatered in 2014. These events led to the potential for large numbers of juvenile coho to be stranded in drying pools, or pools with poor water quality, and perishing. CDFW, in collaboration with a number of other organizations and landowners, embarked on a large-scale fish relocation project during which fish were captured from locations that were anticipated to become inhospitable and then trucked to locations in the watershed that were thought to have more favorable aquatic habitat conditions with the intention of minimizing overall mortality of the 2013 brood class.

A document was prepared by participants in the Scott River relocation effort that describes much of the planning, decision making processes, and logistics that were necessary; the document is titled *Cooperative Report of the Scott River Coho Salmon Rescue and Relocation Effort; 2014 Drought Emergency*. To evaluate the success of the effort and increase our understanding of juvenile coho habitat use in the Scott River, a sample of both relocated and non-relocated coho were tagged with Passive Integrated Transponder (PIT) tags and six in-stream PIT tag antenna stations were operated in the watershed. This report presents the findings from the PIT tag monitoring effort for brood year 2013 (BY2013) juvenile coho salmon in the Scott River.

## 2. Study Site

The Scott River is one of four main tributaries to the Klamath River in California. It enters the Klamath River at RKM 230 at an elevation of 1,580 feet and drains a watershed of approximately 812 square miles. Major tributaries to the Scott River include Shackleford/Mill, Kidder, Etna, French, and Moffett creeks and the South and East Forks of the Scott River. The Scott River is a part of the Klamath Mountain Province, which encompasses land in both southern Oregon and northern California. The Scott River watershed is bounded in the southwest by the Salmon Mountains, to the west by the Marble Mountains, to the northwest by the Scott Bar Mountains, and to the east by lower hills collectively known as the Mineral Range. The Scott River originates in the Scott Mountains to the south (Figure 1).

The Scott Valley is predominated by a Mediterranean climate characterized by warm, dry summers and cold, wet winters. Precipitation is mainly concentrated in the winter months and falls primarily as rain on the valley floor, while significant snowfall occurs on the surrounding mountain ranges resulting in snowmelt runoff during the early spring months. Average annual precipitation for the entire area is about 36 inches, yet annual rainfall, snowfall, and temperature can vary widely from one year to the next and from one part of the watershed to another. Most of the tributaries to the Scott River become disconnected to the mainstem in the summer months. Discharge of the Scott River as measured at the Fort Jones USGS gage (site no. 11519500, approximately 10 miles downstream from Fort Jones) during the period of time this study was conducted is provided in Figure 2.

The mainstem Scott River (approximately 53 percent of the watershed acreage) is predominantly surrounded by farm and rangeland. Field crops, including alfalfa and other hay crops, and raising livestock are the principal agricultural pursuits. All surface water rights upstream of the USGS gaging station near Fort Jones are adjudicated according to one of three decrees: The Shackleford Creek Decree (1950), the French Creek Decree (1958), and the Scott River Decree (1980). According to hydrologic analyses conducted by USGS (2006), the total allotment of water under the decrees is greater than the average monthly flow of the Scott River from June through December based on 64 years of record.

The Scott River has been significantly modified by anthropogenic causes and is not a naturally functioning geomorphic system. Stream channels in the watershed have been altered almost since the first occupation of the watershed by Europeans. Through legacy effects as well as existing practices, activities such as beaver trapping, alluvial gold dredging, river straightening, bank protection, levee construction, streamflow manipulations, and upland land management continue to dominate geomorphic function of the Scott River and a number of its main tributaries. Channel alteration began in the 1830's with the removal of most of the beaver population, causing channel incision and simplification of channel morphology.

Most of the fish that were relocated during this study were trapped on the mainstem reach between the Etna Creek confluence and the "tailings", upstream of the Fay Lane Bridge. Significant portions of the Scott River in this reach have been straightened, banks have been stabilized using riprap to prevent erosion, and levees prevent channel access to the flood plain. Riparian canopy throughout this reach is limited, even though fencing has been installed on 95% of the sections where livestock grazing occurs. Although spawning gravels do exist in this reach, coho salmon typically spawn in the tributaries. In most years, the primary coho salmon habitat function of this mainstem reach of the river is that of a migration corridor.

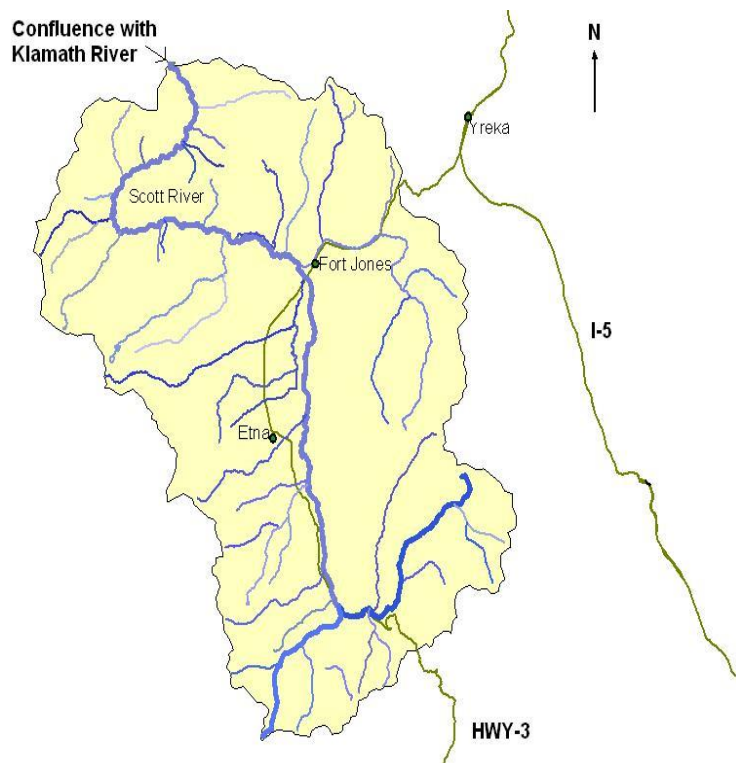


Figure 1. Scott River Watershed

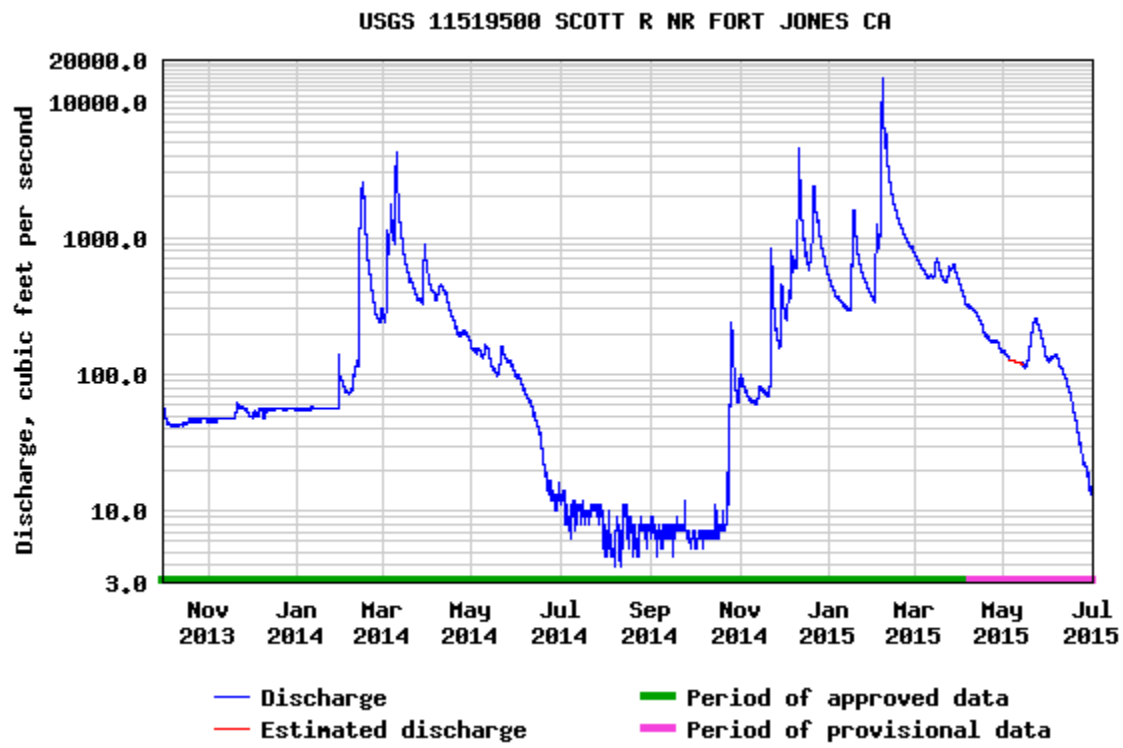


Figure 2. Discharge measured by USGS at the Fort Jones gage from November 2013 to July 2015.

### **3. Methods**

#### **a. Abundance surveys**

Beginning in late April 2014, weekly snorkel surveys were conducted in the mainstem Scott River in the area where the majority of coho spawning was documented the previous fall (Etna Creek upstream to Fay Lane), to identify rearing locations and relative abundance of BY2013 coho. During these surveys, a team of two to three observers snorkeled reaches of the river (spawning survey reaches established by CDFW and the Siskiyou Resource Conservation District) with one observer swimming along each bank and, when necessary, one observer in the middle of the channel. Surveys were conducted in a downstream direction. Counts of species and age-classes observed were approximated and communicated to a person recording data located on the bank of the river.

#### **b. PIT Tagging**

For PIT tagging purposes, captured juvenile coho that met the minimum size criteria were anesthetized with CO<sub>2</sub> and scanned with a hand-held PIT tag reader to determine if they had been previously tagged. PIT tags and 14-gage needles were disinfected with isopropyl alcohol prior to use. An incision was made approximately 10 mm anterior to the base of the left pectoral fin with the needle and the PIT tag was then inserted by hand. Coho 50-59 mm fork length were implanted with 9 mm PIT tags while those 60 mm or larger were implanted with 12 mm tags. Fish were measured for fork length, sampled for scales then held in aerated recovery containers before releasing them.

#### **c. PIT Tag Detection**

Six PIT tag detection stations were operated in the Scott River watershed during the course of this study (Figures 3 and 4, Appendix A). These antenna systems were custom built in collaboration with Mauro Engineering (Mt. Shasta, California). Antennas were made of a wire conductor threaded through PVC pipe for structure and secured to t-posts driven into the bed of the river. A variety of antenna dimensions were used depending on channel characteristics at a given site. A data logger powered by a solar panel and batteries recorded PIT tag detections onto an SD card along with a date and time stamp. Data was uploaded to a Microsoft Access database for analysis.

Most PIT tag antenna stations were checked on a weekly basis to verify operation and perform any needed maintenance. During each visit, antenna station performance was rated on a 0-3 scale based on the portion of the rivers transect that was covered by a PIT tag detection field (Appendix B). This served to qualitatively track detection efficiency at each site throughout the study. Stations operated consistently through the summer and early fall of 2014. Several high water events in the winter caused some periods of non-operation because equipment was damaged or removed to avoid damage. A particularly high water event in February caused all stations to be non-operational for approximately two weeks.

#### **d. Rotary screw trap operation**

CDFW operates one or two rotary screw traps in the Scott River near Pat Ford Creek (RKM 8) from February to June annually when flows are not prohibitive. The purpose of this field study is to develop estimates of salmonid



productivity. Juvenile coho captured at this location are routinely scanned for PIT tags to determine if they were PIT tagged prior to outmigration.

#### **e. PIT tagging of coho that were not relocated**

Once the BY2013 coho were large enough to PIT tag (50 mm), efforts were made to capture them using seine nets, PIT tag them, and release them back to their capture location to obtain information on natural early season movements prior to the occurrence of removal and relocation. Even after relocation efforts were initiated, while the majority of the valley reach of the Scott River was still connected, some juvenile coho were PIT tagged and returned to the capture location. This was done in order to make comparisons of the movements and survival of relocated versus non-relocated juvenile coho. In locations where fish were being removed from aquatic habitat where the fish were at risk of being stranded (shrinking isolated pools), no fish were returned to the capture site.

Snorkel surveys and PIT tagging efforts continued after the last relocation event occurred (August 12, 2014) to obtain additional information on juvenile coho movement and survival during the fall, winter, and smolt outmigration period. These post-relocation period tagging events took place in Sugar Creek, French Creek, Etna Creek, and at Scott RKM 68. In Etna Creek, all of the coho tagged later in the study were likely fish that had been relocated there during the summer, since this location was well upstream of any documented coho spawning. In the French Creek and Sugar Creek locations it is unknown if the fish tagged later in the season had been previously relocated or if they occurred there naturally.

#### **f. Relocation capture**

The first relocation effort took place on June 3, 2014. Although aquatic habitat conditions had not yet deteriorated to a point where movement and survival was critically limited, the parties involved decided to initiate proactive relocation efforts due to concerns that conditions might degrade rapidly. It was unknown how fast conditions would change and snorkel surveys suggested that the density of coho in some areas was high enough that a large-scale die off could occur if conditions quickly deteriorated. Seines were used to capture fish for relocation during these early efforts.

Once flows decreased to a point where conditions in the Scott River downstream of Etna Creek prevented downstream migration, McBain traps were installed at two locations: downstream of Youngs Dam (RKM 74) and downstream of the French Creek confluence (RKM 76). McBain traps are designed to capture all downstream migrating fish. The McBain traps were fished four days per week from June 24 through July 10, 2014. After July 10, flow was reduced to a point where the mainstem Scott River was disconnected upstream of the trap locations and catches were limited.

McBain traps were also operated in Shackleford Creek from June 5 to July 8, 2014. Capture efforts in other locations were guided by snorkel surveys which identified locations where coho were concentrated in areas where conditions were poor (drying pools, high densities). Fish were captured using seine nets in these locations. The last relocation effort took place at RKM 81 (between Fay Lane and the tailings) on August 12, 2014.

Numbers and species of fish relocated were estimated by identifying and counting out the number of fish in a three-ounce sample of the catch and multiplying that figure by the total weight of the catch. A sample of the coho that were relocated received PIT tags. Relocated fish were transported in aerated water tank trucks filled

with river water at the capture location. Ice was added to the holding water so that the temperature was reduced to within several degrees Celsius of the water temperature at the release location.

### g. Relocation release

Release locations were selected because they were thought to provide habitat conditions that were of higher quality than the locations from where the fish were being removed and because landowner approval for access to the sites had been obtained. Most of the release sites were located in tributaries upstream of the removal locations. Five tributaries in the upper portion of the watershed were utilized; Etna Creek, French Creek, Sugar Creek, South Fork Scott River, and Grouse Creek. Two tributaries in the lower Scott River were also utilized as release locations; Canyon Creek and Kelsey Creek. Release locations are identified in Figures 3 and 4. Juvenile coho were also relocated to Iron Gate Hatchery (IGH) where they were held in circulating round tanks during the summer and released back to the Scott River in October to two locations; the mainstem Scott River at RKM 71 and in French Creek at RKM 3.

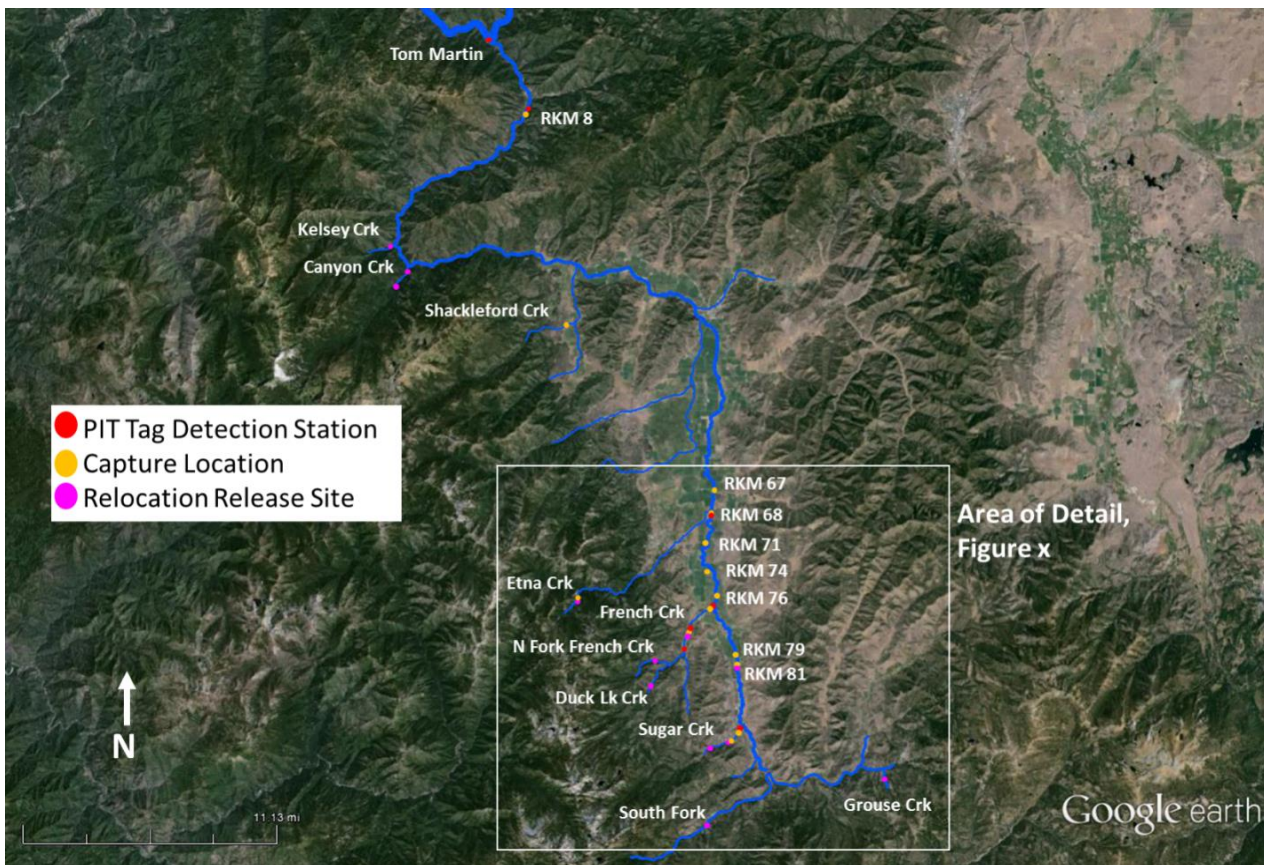
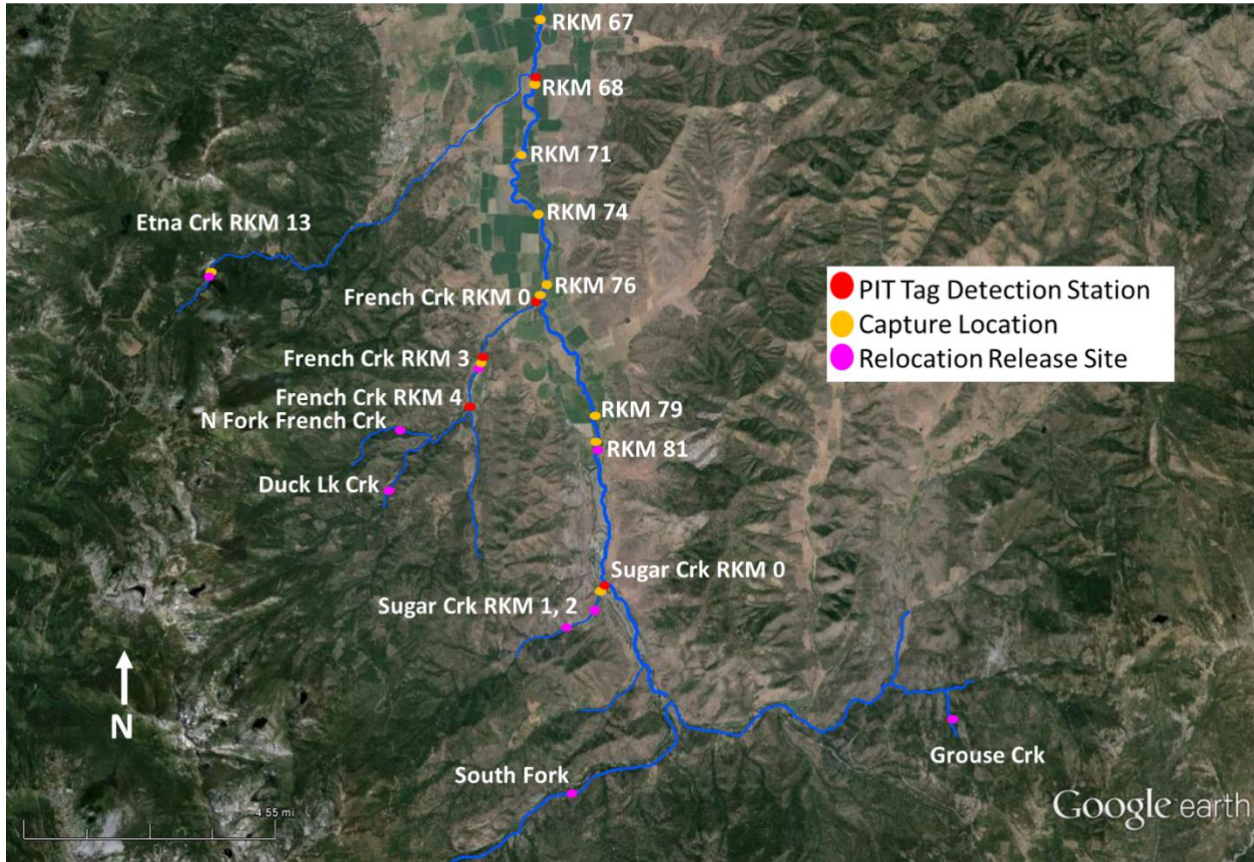


Figure 3. Locations where fish were captured, release sites of relocated fish, and PIT tag antenna stations in the Scott River.



**Figure 4.** Location where fish were captured, release sites of relocated fish, and PIT tag antenna stations in the Scott River.

## 4. Results

### a. Abundance surveys

During snorkel surveys in May 2014 an estimated 118,250 juvenile coho were observed in the Scott River between Etna Creek and Fay Lane, with the highest abundances occurring in the vicinity of the French Creek confluence (Table 1, Appendix C). Over time the number of coho estimated during the snorkel surveys was reduced. The reduction in numbers of fish observed in the mainstem Scott River was likely due to a combination of the effects of upstream and downstream migration, relocation, and mortality. By September the estimated number of coho observed in the mainstem was less than 10% of the original estimates (an estimated 11,640 individual coho were observed in September 2014). Snorkel counts were approximations and should be interpreted as such. Achieving precise counts of populations ranging in the tens of thousands of fish is not possible. Also, it is likely that movements took place between survey reaches and out of the reaches surveyed, and since snorkel surveys occurred over several days to cover all of the reaches, some fish may have been counted multiple times and some may have been missed completely.

**Table 1.** Total estimated coho in the upper mainstem Scott River based on snorkel survey counts.

Month	Reach Surveyed	Date Range (2014)	Total Estimated Coho
May	Etna Creek to Fay Lane	5/2-5/8	118,250
June	Eller Lane to Fay Lane	6/3-6/19	127,445
July	Eller Lane to Tailings	6/30-7/9	71,943
August	Eller Lane to Tailings	8/11-8/15	45,160
September	Eller Lane to Tailings	9/8-9/12	11,640

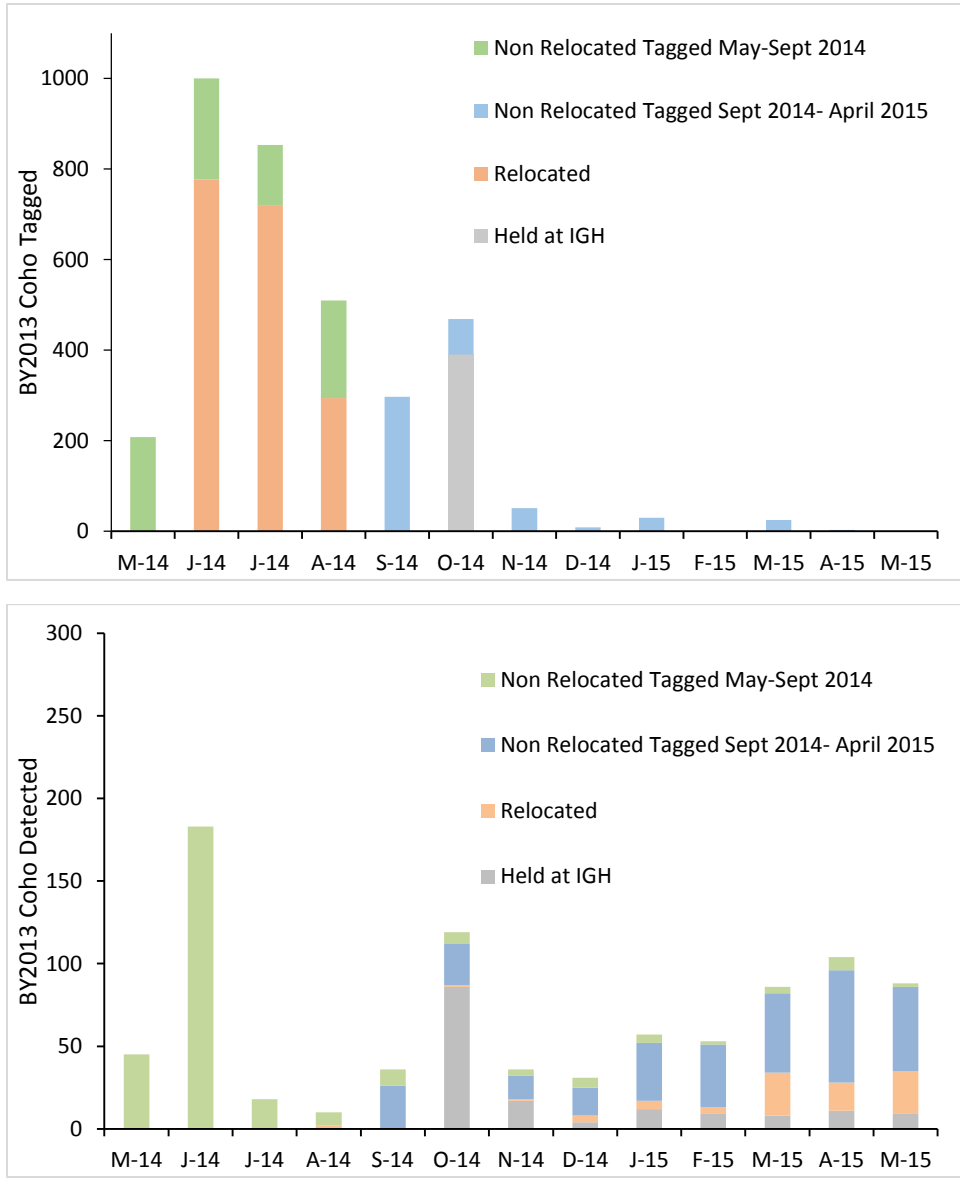
**b. Summary of PIT tagged coho detections**

Of the 3,685 total coho tagged in the Scott River Valley, only 652 were encountered after their release. Of the 1,872 tagged relocated coho (excluding those held at IGH), 96 (5.1%) were encountered September 1, 2014 or later (known to survive the summer), 72 (3.8%) were encountered February 1, 2015 or later (known to survive to smolt outmigration period), and 10 (0.5%) were encountered at Scott RKM 8 as they were outmigrating in the spring of 2015. Of the 981 coho tagged and released without being relocated prior to September 1, 2014, 6 (0.6%) were encountered at Scott RKM 8 in 2014, 25 (2.5%) were encountered September 1, 2014 or later, 13 (1.3%) were encountered February 1, 2015 or later, and 0 were encountered during outmigration at Scott RKM 8 in the spring of 2015 (Table 2). Data summarizing re-encounters of tagged coho from each detection station is located in Appendix D and the daily capture and relocation data is provided in Appendix E.

The majority of tag re-encounters occurred in May and June 2014 prior to river disconnection and was comprised of coho that had been tagged and released back to the mainstem Scott River at or near the mouth of French Creek (where an antenna station was in place). Detection frequency was lowest from mid-summer through mid-winter (except for the coho held at IGH that were released near the French RKM 3 station in October). Detection frequency increased when coho outmigrated from the Scott River as age-1 smolts (Figure 5, Figure 6). No detections occurred after May 2015. The monthly total detected at each station is shown in Appendix F.

**Table 2.** Summary of re-encounters of tagged BY2013 coho in the Scott River.

Tag Group	Total Tagged	Encountered at Scott RKM 8 in 2014 (known to emigrate from Scott Valley at age-0)	Encountered Sept. 2014 or later (known to survive summer)	Encountered Feb. 2015 or later in Scott Valley (known to survive to smolt outmigration period)	Encountered at Scott RKM 8 2015 (known to survive to outmigrate from Scott River)
Tagged and released in capture location prior to Sept. 2014 (not relocated)	981	6 (0.6%)	25 (2.5%)	13 (1.3%)	0 (0.0%)
Relocated and Tagged	1872	2 (0.1%)	96 (5.1%)	72 (3.8%)	10 (0.5%)
Held at IGH	390	x	x	36 (9.2%)	2 (0.5%)
Tagged and released Sept 2014-April 2015 (not relocated)	442	x	x	125 (28.3%)	6 (1.4%)
<b>Total</b>	<b>3685</b>	<b>8</b>	<b>121</b>	<b>246</b>	<b>18</b>



**Figure 5.** Total monthly number of BY2013 coho tagged in the upper Scott River (top). Total number of tagged BY2013 coho detected each month at all Scott River antenna stations combined (bottom). Color indicates tag group: tagged and released in capture location May-August 2014 (Green), tagged and released in capture location September 2014-April 2015 (blue), relocated (orange), and held at IGH then released in October (gray).

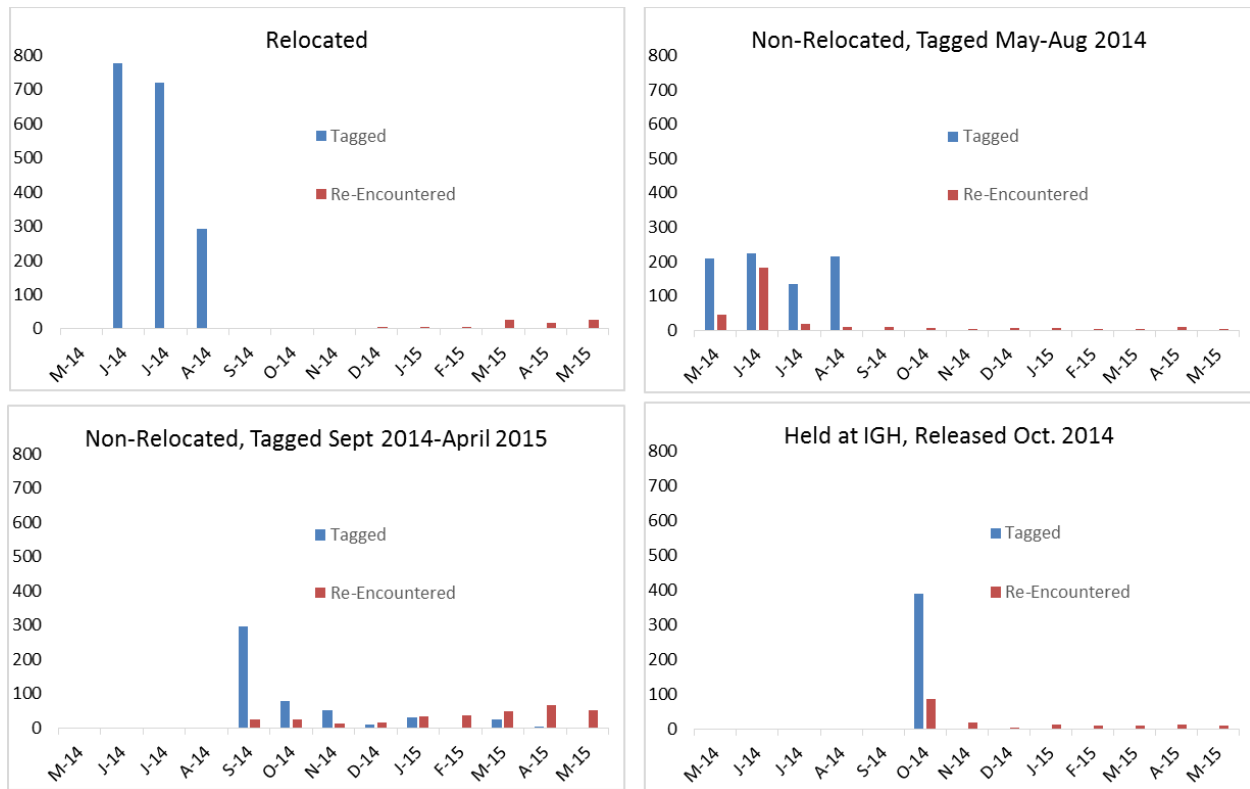
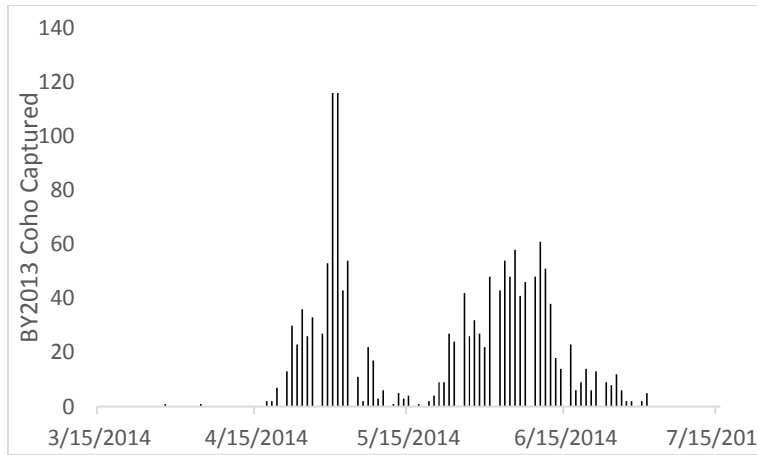


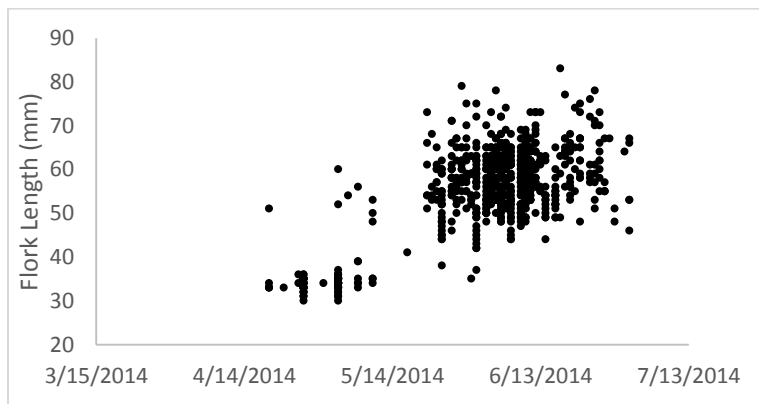
Figure 6. Monthly total BY2013 coho tagged in the Scott River and monthly total re-encountered at any location.

**c. BY2013 coho catch at the rotary screw traps 2014**

A total of 1,565 unmarked BY2013 coho were captured at the rotary screw traps located at Scott RKM 8 in 2014 (Figures 7 and 8), and the estimated number of age-0 coho outmigrants based on a mark-recapture model was 16,962 (95% CI, 12,457-21,647) (Debrick and Stenhouse 2014). None of the age-0 coho captured at the rotary screw traps were identified as having been previously tagged in the upper Scott River. A sample of age-0 BY2013 coho (n= 388) were PIT tagged at the rotary screw trap site in 2014 for the purposes of a separate research project.



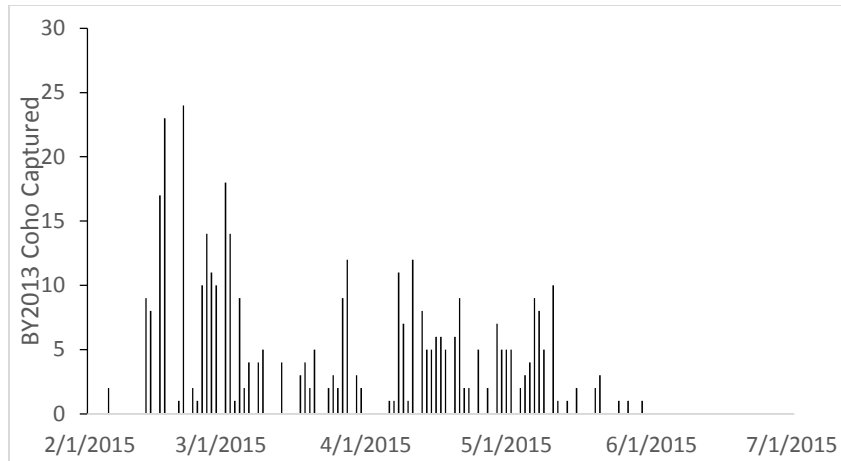
**Figure 7.** Daily catch of BY2013 coho at the rotary screw traps at RKM 8 in 2014 (excluding recaptured marked fish). n=1,565



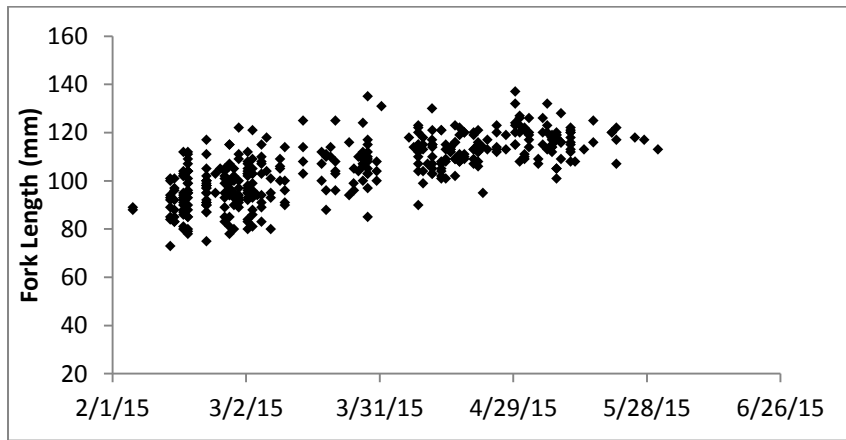
**Figure 8.** Fork length of BY2013 captured and measured at the rotary screw traps at RKM 8 in 2014. n=706

**d. BY2013 coho catch at the rotary screw traps 2015**

A total of 521 unmarked BY2013 coho were captured at the RKM 8 rotary screw traps in 2015 (Figures 9 and 10), and the estimated number of age-1 coho outmigrants based on a mark-recapture model was 7,253 (95% CI, 4,689-9,816) (Debrick et al 2015). Two BY2013 coho were identified as being previously tagged in the upper Scott River. One of these individuals, captured on March 27, 2015, was tagged at Etna Creek RKM 13 on September 10, 2014. It is likely that this fish had been relocated to Etna Creek from the mainstem Scott River during the summer. The other individual, captured at RKM 8 on March 14, 2015, was held at IGH for the summer and released at RKM 71 (Horn Lane Bridge) on October 14, 2014.



**Figure 9.** Daily catch of BY2013 coho at the rotary screw traps at RKM 8 in 2015. n=521



**Figure 10.** Fork length of unmarked BY2013 captured and measured at the rotary screw traps at RKM 8 in 2015. n=402

Figure 11 below shows the number of age-1 coho smolts produced per returning adult for brood years 2007-2012. These data show a strong correlation between the number of adults returning to the Scott River and the estimate of the number of age-1 smolts produced by those adults ( $r=0.96868$ ). In fall of 2013, we observed 2,731 adult coho returning to the Scott River. Figure 12 shows the number of coho smolts produced per returning adult for brood years 2007-2013. Based on the previous six years of tracking the relationship between adults and juveniles produced, we did not see the expected number of smolts produced. Rotary trap estimates indicate that the return of 201 adults in 2012 produced more smolts than the return of 2,731 adults in 2013 (Table 3) (Debrick et al 2015).



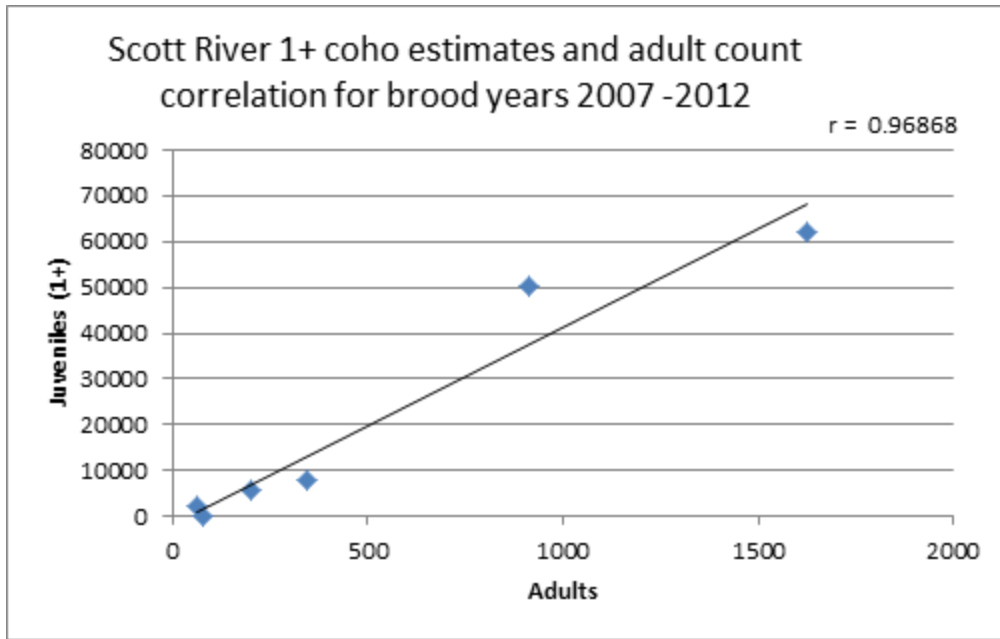


Figure 11. Scott River age-1 coho estimates and adult count correlation for brood years 2007 to 2012.

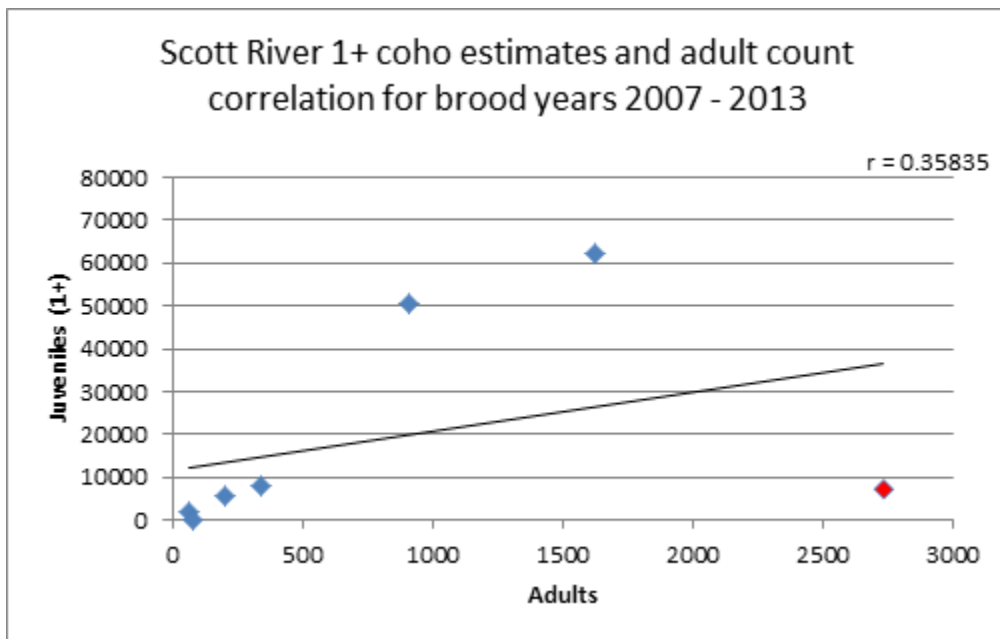


Figure 12. Scott River age-1 coho estimates and adult count correlations for brood years 2007 to 2013. Red diamond indicates the brood year 2013 production estimate

**Table 3.** Scott River age-1 coho produced per returning adult

Scott River Coho					
		1+			
Brood Year	Adults	Emigration	caught	Estimate	smolts/adult
2001		2003	1414	34149	
2002		2004	91	91	
2003		2005	248	1660	
2004		2006	3828	75097	
2005		2007	352	3931	
2006		2008	160	941	
2007	1622	2009	5340	62207	38
2008	62	2010	185	2174	35
2009	81	2011	78	261	3
2010	911	2012	2926	50315	55
2011	344	2013	633	7927	23
2012	201	2014	591	5708	28
2013	2731	2015	529	7253	3

**e. PIT tagged coho that were not relocated**

A total of 208 juvenile coho were PIT tagged between May 7 and May 28 2014, prior to the first relocation event. These fish were captured in three locations; the Scott River just downstream of French Creek (RKM 76), within the first 100 meters of French Creek (French RKM 0), and just downstream of Youngs Dam (RKM 74). A total of 773 coho were tagged and returned to their capture locations between June 3 and August 20, 2014 (the relocation period), and from the fall of 2014 through the spring 2015 (after the relocation period). A total of 442 coho were tagged in Sugar Creek, French Creek, and Etna Creek and returned to their capture locations (Table 4, Appendix F).

**Table 4.** Numbers of BY2013 coho PIT tagged in Scott River valley that were not relocated.

Period	Date Range	Number of coho tagged	Locations
Pre-relocation	May 7 – May 28, 2014	208	RKM 74, RKM 76, French RKM 0
During relocation (not relocated)	June 3 – August 20, 2014	773	RKM 67, RKM 68, RKM 74, RKM 76, RKM 79
Post relocation	September 5, 2014 - April 2, 2015	442	RKM 68, Sugar Creek, French Creek, Etna Creek
Total number of coho PIT tagged that were not relocated		1423	

**f. Detections of coho that were not relocated**

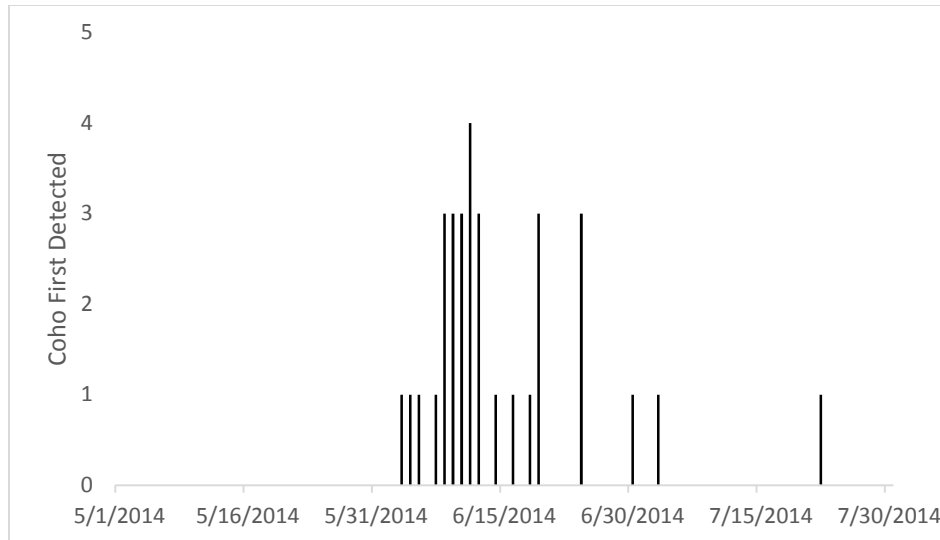
Detections and recaptures of coho that were tagged and released at the place of capture from May to August 2014 indicate that at least some coho in the Scott River valley make extensive movements in both upstream and downstream directions. Of the 510 coho tagged and released at the Scott RKM 67, 74, 76 and French RKM 0 sites, 14 were encountered downstream of their tagging location and 48 were encountered upstream of their tagging location prior to October 2014 (Table 5). This included six individuals that were detected at the RKM 8 antenna station in May and June 2014 (Table 6), indicating that a portion of the upper Scott River population migrated downstream to the canyon reach or out of the Scott River. Individuals tagged at RKM 67 were encountered as far upstream as French RKM 3 and Scott RKM 79 (an upstream movement of 12 kilometers). A total of 32 tagged coho were detected at French RKM 3 in June and July 2014 that had been previously tagged at French RKM 0 or in the mainstem Scott River (Figure 13).

**Table 5.** Locations furthest from release location where tagged coho were encountered prior to September 1, 2014.

		<b>Location Re-Encountered Furthest From Tagging Location, Prior to September 2014</b>								
<b>Tag Location</b>	<b>Total Tagged</b>	<b>Scott RKM 8</b>	<b>Scott RKM 71</b>	<b>Scott RKM 74</b>	<b>Scott RKM 76</b>	<b>Scott RKM 79</b>	<b>Scott RKM 80</b>	<b>French RKM 0</b>	<b>French RKM 3</b>	<b>French RKM 4</b>
Scott RKM 67	45		1	1		1			1	
Scott RKM 74	300	3	7				1	5		
Scott RKM 76	57					2			9	
French RKM 0	108	3		1		3	1		21	2

**Table 6.** Detections of upper Scott River non-relocated tagged coho at Scott RKM 8 in 2014.

<b>Tag/Release Data</b>			
<b>Location</b>	<b>Date</b>	<b>Fork Length</b>	<b>Date Detected at RKM 8</b>
Scott RKM 74	5/22/2014	79	5/30/2014
Scott RKM 74	5/22/2014	78	6/3/2014
Scott RKM 74	5/22/2014	64	6/4/2014
French RKM 0	5/28/2014	59	6/7/2014
French RKM 0	5/28/2014	60	6/8/2014
French RKM 0	5/19/2014	53	6/25/2014



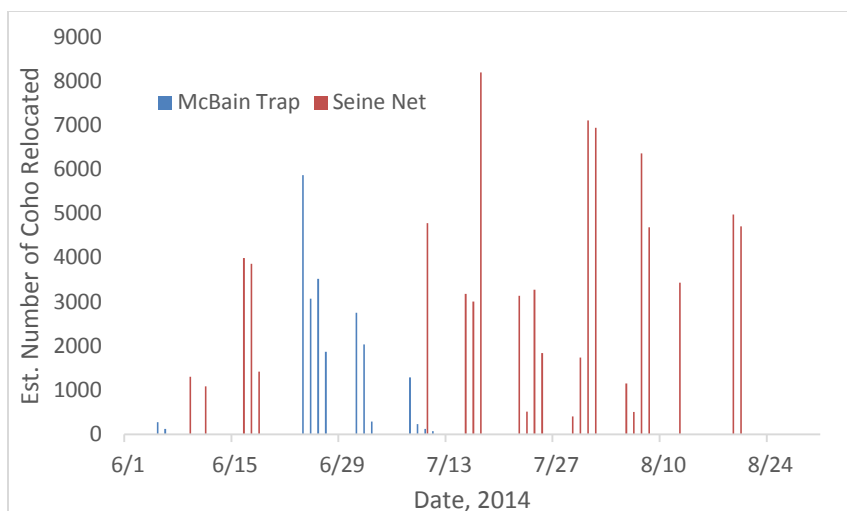
**Figure 13.** French RKM 3 date of first detection of BY2013 coho tagged at downstream locations (Scott RKM 67, 74, 76, and French RKM 0).

**g. Capture and relocation of BY 2013 coho**

An estimated total of 115,999 age-0 coho were captured and relocated in the Scott River watershed in 2014, 1,872 of which were PIT tagged prior to release (Table 7, Figure 14, Appendix D). An estimated 4,447 coho were transported and held at IGH, 390 of which were PIT tagged prior to release in the Scott River watershed. The coho held at IGH were released on October 23 and 24, 2014 at French RKM 3 (180 tagged) and RKM 71 (210 tagged), respectively. The total number of estimated coho released at each site and the number PIT tagged is shown in Table 8, and the daily capture and release numbers are shown in Appendix D.

**Table 7.** Total estimated number of coho removed from each capture site.

Location	Total Estimated Coho Removed	Date of First Removal	Date of Last Removal
Scott RKM 67	1300	6/3/2014	6/3/2014
Scott RKM 68	7369	7/9/2014	7/25/2014
Scott RKM 71	20850	7/29/2014	8/1/2014
Scott RKM 74	43537	6/24/2014	7/17/2014
Scott RKM 76	6830	6/14/2014	7/11/2014
Scott RKM 79	15486	8/5/2014	8/7/2014
Scott RKM 81	17064	7/10/2014	8/12/2014
Shackleford	427	6/5/2014	7/11/2014
French RKM 0	3136	7/16/2014	7/16/2014
<b>Total</b>	<b>115999</b>	<b>6/3/2014</b>	<b>8/12/2014</b>



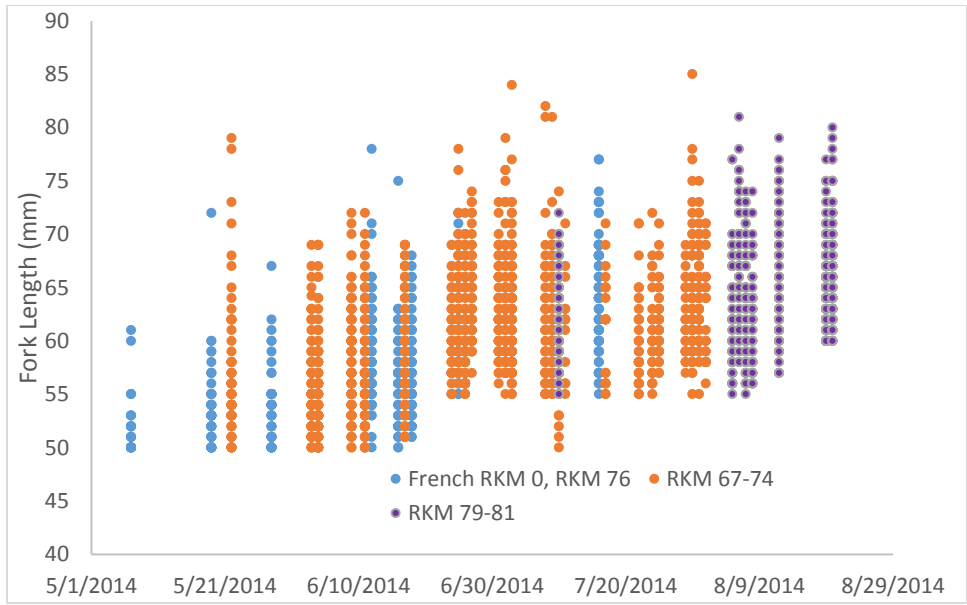
**Figure 14.** Estimated number of coho relocated each day with capture method indicated by color.

**Table 8.** Estimated total number of coho released at each relocation site and the number PIT tagged at each site. \* Coho held at IGH were released at French RKM 3 and Scott RKM 71 in October 2014. \*\* Coho were removed from drying pools at RKM 81 and moved to deeper pools in the same reach.

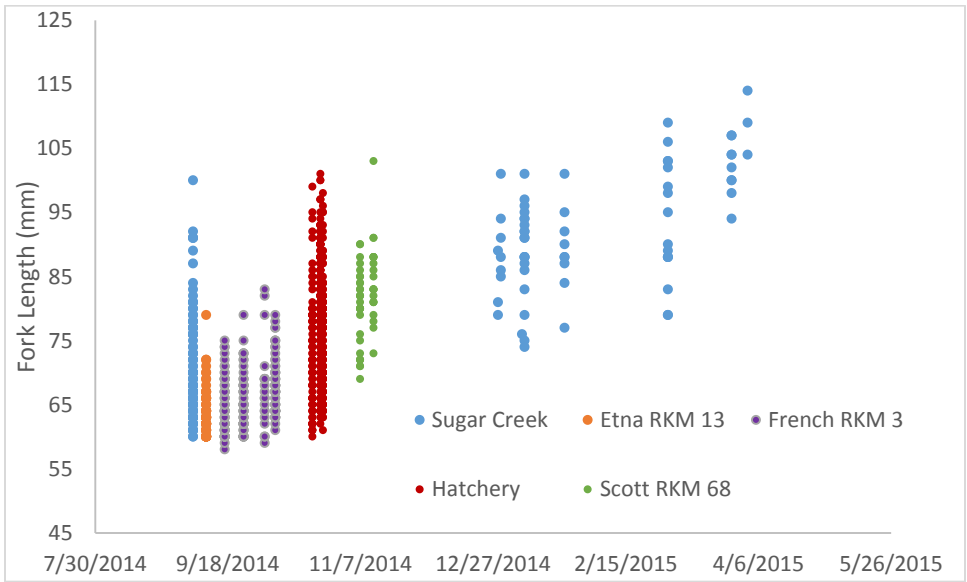
Release Location	Estimated Total Coho Released	Total Number of Coho Tagged
Etna Crk	22531	279
Duck Lake Crk	8332	202
Canyon Crk	15434	287
South Fork Scott R	28601	437
Grouse Crk	5511	119
Sugar Crk RKM 1	3321	149
Sugar Crk RKM 2	4709	90
Kelsey Crk	11046	114
North Fork French	3266	101
French RKM 3	7868	94
Iron Gate Hatchery*	4447	390
Scott RKM 81**	933	0
Total	115999	2262

#### h. Fork length of tagged coho

The fork length of tagged coho varied greatly at each site throughout the summer of 2014, with fish ranging from less than 50 mm to over 70 mm in nearly each sample of captured coho (Figure 15). Overall, size did not increase substantially throughout the summer, and many of the coho tagged in August 2014 at RKM 79 and 81 were smaller than coho tagged further downstream in May and June 2014. Fish tagged that had been held at IGH showed the greatest variability in size (Figure 16). The most noticeable increase in length occurred in Sugar Creek during the winter (Figure 16). The low end of the size range of captured coho is not represented in these figures, since coho that did not meet the minimum size criteria were not PIT tagged.



**Figure 15.** Fork length of BY2013 coho PIT tagged in the Scott River March-August 2014.



**Figure 16.** Fork length of BY2013 coho PIT tagged in the Scott River September 2014-April 2015. Note the range in size measured in the coho reared at the hatchery.

**i. Detections of relocated BY2013 coho**

Of the 1,872 tagged and relocated coho (not including those held at IGH), only 99 were encountered again (Table 9, Appendix G). The majority of these encounters occurred during the smolt outmigration period from March to May 2015. Two of the relocated coho were encountered within several days of their release; one released at Duck Lake Creek on June 11 and encountered at French RKM 0 on June 14, 2014, and one tagged and released at Etna Creek RKM 13 that was recaptured at RKM 68 the next day. Five of the coho tagged and relocated to Canyon Creek were encountered at Scott River RKM 8, in August and October 2015, and March and April 2015. Several relocated coho were detected during the fall and winter, when some coho appeared to

redistribute among rearing locations. Four of the tagged coho released in the South Fork Scott River were encountered moving into Sugar Creek in December 2014 and January 2015. Three of the tagged and relocated BY 2013 coho were detected at antenna stations located outside of the Scott River watershed (Table 10).

**Table 9.** Re-encounters of tagged relocated BY2013 Scott River coho.

Release Location	Total Tagged/Released	Re-encountered prior to September 2014		Re-encountered September 2014-January 2015		Re-encountered February-May 2015	
		Total	Locations	Total	Locations	Total	Locations
Canyon Creek	287	1	Scott RKM 8	3	Scott RKM 8, Lower Klamath	3	Scott RKM 8
Kelsey Creek	114	0		0		0	
Etna RKM 13	279	1	Scott RKM 71	1	Etna RKM 13	3	Scott RKM 8
French RKM 3	94	1	French RKM 3	16	French RKM 3	3	French RKM 0
North Fork French	101	0		5	French RKM 3, French RKM 4	9	Scott RKM 8, French RKM 0, French RKM 3
Duck Lake Creek	202	1	French RKM 0	2	Scott RKM 68, French RKM 0	5	Scott RKM 76, French RKM 0, French RKM 3
Sugar RKM 1	149	0		0		22	Sugar RKM 0, Scott RKM 76, Scott RKM 8
Sugar RKM 2	90	0		0		18	Sugar RKM 0, Scott RKM 76, Scott RKM 8
Grouse Creek	119	0		0		2	Scott RKM 8, Scott RKM 76
South Fork Scott River	437	0		2	Sugar RKM 0	7	Scott RKM 76, Sugar RKM 1
<b>Total</b>	<b>1872</b>	<b>4</b>		<b>29</b>		<b>72</b>	

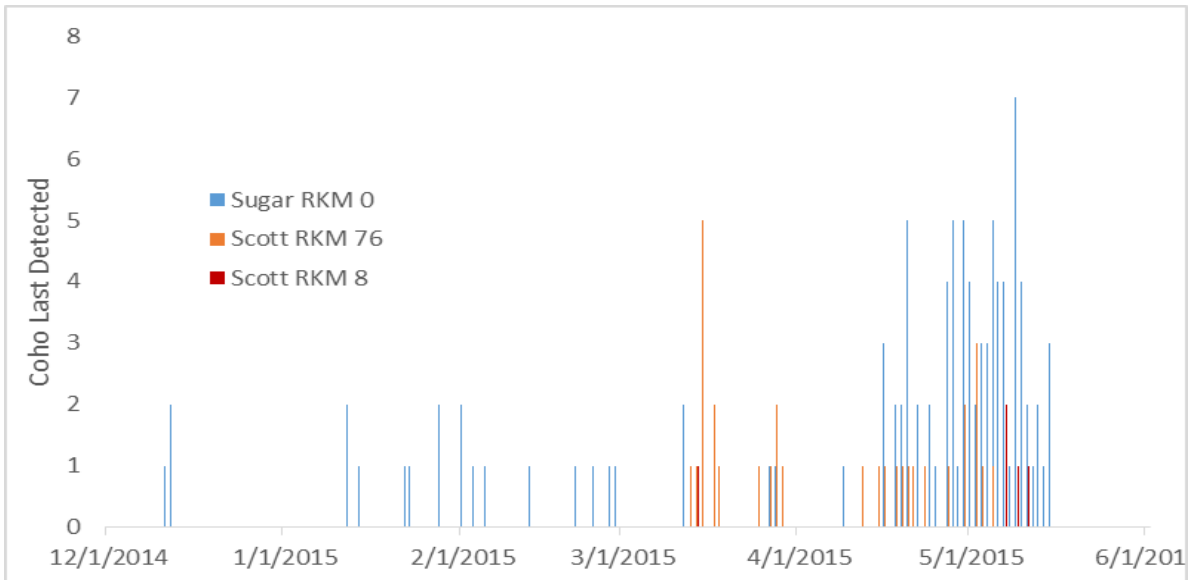
**Table 10.** Tagged BY2013 Scott River coho detected outside of the Scott River watershed.

PIT Number	Capture Location	Release Location	Tag/Release Date	Detection Location	Detection Date
989001003425946	Scott RKM 74	Canyon RKM 0	6/27/2014	Farley Pond	1/16/2015
985153000363795	Shackleford Crk	Canyon RKM 0	6/5/2014	McGarvey Crk	2/12/2015
989001003425859	From RKM74	Grouse Creek	6/26/2014	Salt Creek	5/3/2015

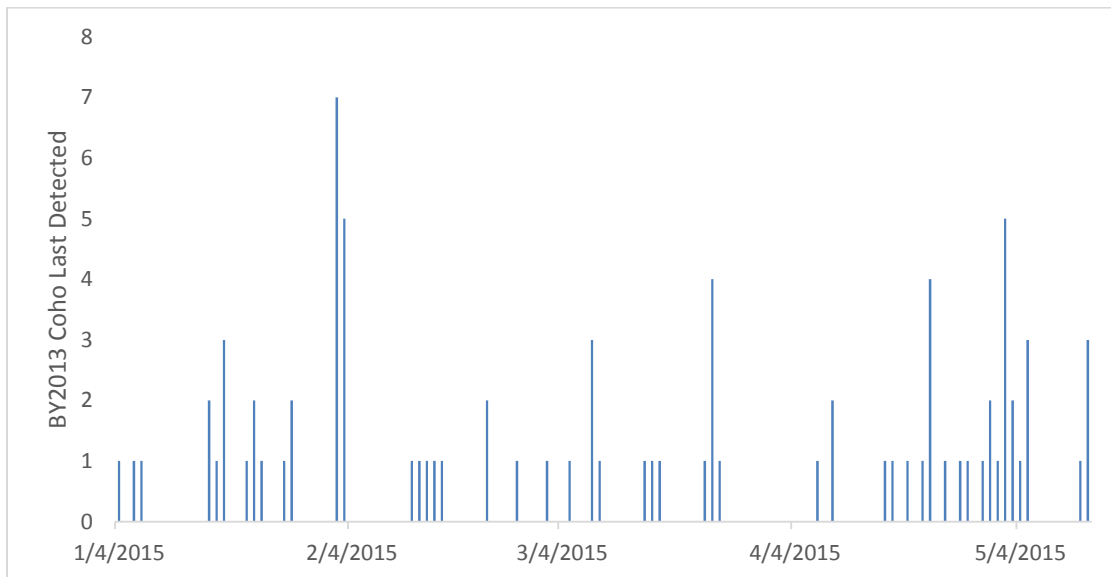
**j. Smolt outmigration**

Based on the date of last detection for individuals tagged and released in Sugar Creek (where antenna stations were in place), the primary smolt outmigration period occurred from mid-April through mid-May 2015 (Figure 17). Outmigration from French Creek tended to be more bi-modal, based on the date of last detection of PIT tagged coho that were released there (Figure 18). Twelve individuals were last detected in early February in

French Creek, just before a high water event occurred. The highest catches of BY2013 coho smolts at the RKM 8 rotary screw traps occurred in early March, however catches remained fairly stable there through mid-May (Figure 9).



**Figure 17.** Date of last detection of tagged coho released in Sugar Creek and detected at least once at any location.



**Figure 18.** Date of last detection of tagged coho released in French Creek and detected at least once at any location.

## 5. Discussion

CDFW has been conducting fish rescue efforts during summer low flows in the Scott River watershed for over 50 years. However, the effort to rescue fish, specifically coho, during the summer of 2014 was different than previous years. With the exception of French and Shackleford creeks, tributary streams in the watershed where



coho salmon typically spawn were not connected to the mainstem Scott River until mid-February. Most of the ~2,731 adult coho salmon that ascended the Scott River from the Klamath River to spawn during the 2013-2014 spawning season spawned within a 10-mile reach of the Scott River mainstem.

Due to the concern regarding the potential for high mortality of juvenile coho from stranding in the mainstem Scott River, CDFW committed more resources to fish rescue during 2014 than had ever occurred previously. Juvenile coho in the Scott River were actively managed through extensive relocation efforts for two purposes:

1. To minimize the mortality rate of juvenile coho, if possible, and
2. To use PIT tag technology to make inferences about the effectiveness of the rescue effort.

Snorkel surveys conducted during May and June were limited to Scott River mainstem reach between Etna Creek and Fay Lane. While it is likely that this area contained most of the age-0 coho in the Scott River valley (based on spawning surveys), coho spawning was also documented in French and Shackelford Creeks (Yokel 2014). The reach between Fay Lane and the tailings was surveyed later in the summer and large numbers of age-0 coho (estimate = 16,750) were documented there. Upstream movements of coho may have not been possible past the tailings section since this area became dewatered in June. Snorkel survey estimates in this study likely underestimated the overall abundance of juvenile BY2013 coho present in the Scott River valley.

The aquatic habitat quality in locations from which fish were removed varied greatly and, in hindsight, we should have measured physical characteristics of the areas more carefully. Isolated pools from which fish were removed ranged in size, cover, fish abundance, and water temperature. These differences likely effected the survival of fish that were PIT tagged, removed, and relocated; fish removed from habitats with poorer quality (less prey, higher fish abundance, higher temperatures) may have survived at lower rates than those removed from habitats of higher quality. Throughout the summer, overall fork lengths of measured coho remained relatively constant, and in some locations such as the isolated pools at Scott RKM81, BY2013 coho had not reached 55mm fork length by mid-August (Figure 15).

Successful operation of the McBain traps located at Scott RKM 74 and 76 documented that many age-0 coho were moving in a downstream direction. McBain traps were deployed to capture all downstream migrating fish. While this is an effective way to collect large numbers of fish, it does prohibit the natural downstream movement, which if allowed to take place, may have resulted in some juvenile coho finding suitable summer habitat downstream. McBain traps also inhibit upstream movements and could have blocked coho from reaching more suitable habitats upstream of the trap sites. McBain traps should be used only during times when it is unlikely that migrating fish will be able to reach suitable habitat on their own.

In addition to coho salmon, other species of fish were relocated, including steelhead/rainbow trout, Chinook salmon, speckled dace, marbled sculpin, three spine stickleback, Klamath small scale suckers, and lamprey. The impacts that these species may have had on coho salmon in the release locations is unknown. Naturally occurring fish populations in the release sites also were undoubtedly effected by the relocation, but no information was obtained regarding those effects.

Juvenile coho that were removed from the Scott River and reared in circular tanks at IGH showed substantial variability in size and condition (PIT tagged fish ranged from 60 to 101 mm in October) (Figure 16). This stratification in size is common in hatchery settings, as dominant fish consume the majority of the food. This may have been particularly prevalent in the fish relocated from the Scott River, since they were already variable in size. If coho are raised in captivity again, documentation of the growth rate should be considered and

perhaps efforts should be made to segregate fish based on size. Only healthy-looking coho were PIT tagged, and so information on the re-encounters of these fish may be misleading as to the overall success of hatchery-held fish.

Limited PIT tag detection capability in the mainstem Scott River throughout the study makes it difficult to have certainty about the survival of BY 2013 PIT tagged coho. Particularly during the high water event in February, tagged and untagged BY2013 coho could have moved out of the Scott River without being detected. Additional PIT tag detection stations located downstream of release sites would have provided valuable information on the survival and movement patterns of the relocated fish. Very few re-encounters of either relocated or non-relocated coho suggest that both groups of coho experienced low survival rates. Catches and population estimates of outmigrating age-1 coho at the rotary screw traps also suggest very low overall survival of BY2013 coho in the Scott River. Coho tagged September 1, 2014 or later were re-encountered at higher rates than coho tagged prior to that time, suggesting that summer survival may have been lower than winter survival.

In Sugar Creek, we were able to document that smolt outmigration peaked in between mid-March and mid-May, which is consistent with findings from previous PIT Tag studies in Sugar Creek (Olswang 2015, CDFW Unpublished Data). This smolt outmigration period was not evident in French Creek nor at the rotary screw traps. Habitat in lower Sugar Creek, where most coho in that tributary were tagged, is characterized by low gradient deep pools, possibly providing velocity refuge for coho during the February high water event. These types of habitat may not have been available in other locations where coho spent the winter. Since the rotary screw traps were not in operation during the high flows, it is unknown how many coho may have moved downstream and out of the Scott River during that time. When the rotary screw traps were back in place, BY2013 coho catches were highest immediately upon re-deployment (late February 2015), and gradually declined throughout the remainder of the trapping season. This suggests that some BY2013 coho may have outmigrated from the Scott River during the high flow event in February.

Of the 3,685 juvenile coho that were PIT tagged during the 2014 relocation effort, only 246 (7%) are known to have survived to February (the beginning of the smolt outmigration season). Based on the results from juvenile coho PIT tag research conducted in the Shasta River watershed by the Yreka Fisheries Program, known survival from age-0 coho to smolt outmigration for BY2012 and BY2013 were 33% and 22%, respectively (Adams and Bean 2015, 2016). If the poor detection results are primarily attributed to mortality, there could be a number of causative factors including PIT tag effects, poor conditions prior to relocation, poor conditions at relocation sites (too much competition, not enough prey), and the potential for stranding in flood plain areas after high flows during the winter and early spring receded. We are unable to document specific causes of mortality.

While this report may be considered premature in that we do not yet know the number of BY2013 PIT tagged coho that will survive to adult and return this fall, due to ocean conditions and average survival to spawning of coho under good conditions, it is not likely that detections will be high. We will operate a PIT tag detection station at the video weir site where estimates of the adult coho run size are developed annually and will be able to report the results after the run is over in February 2017.

## 6. References

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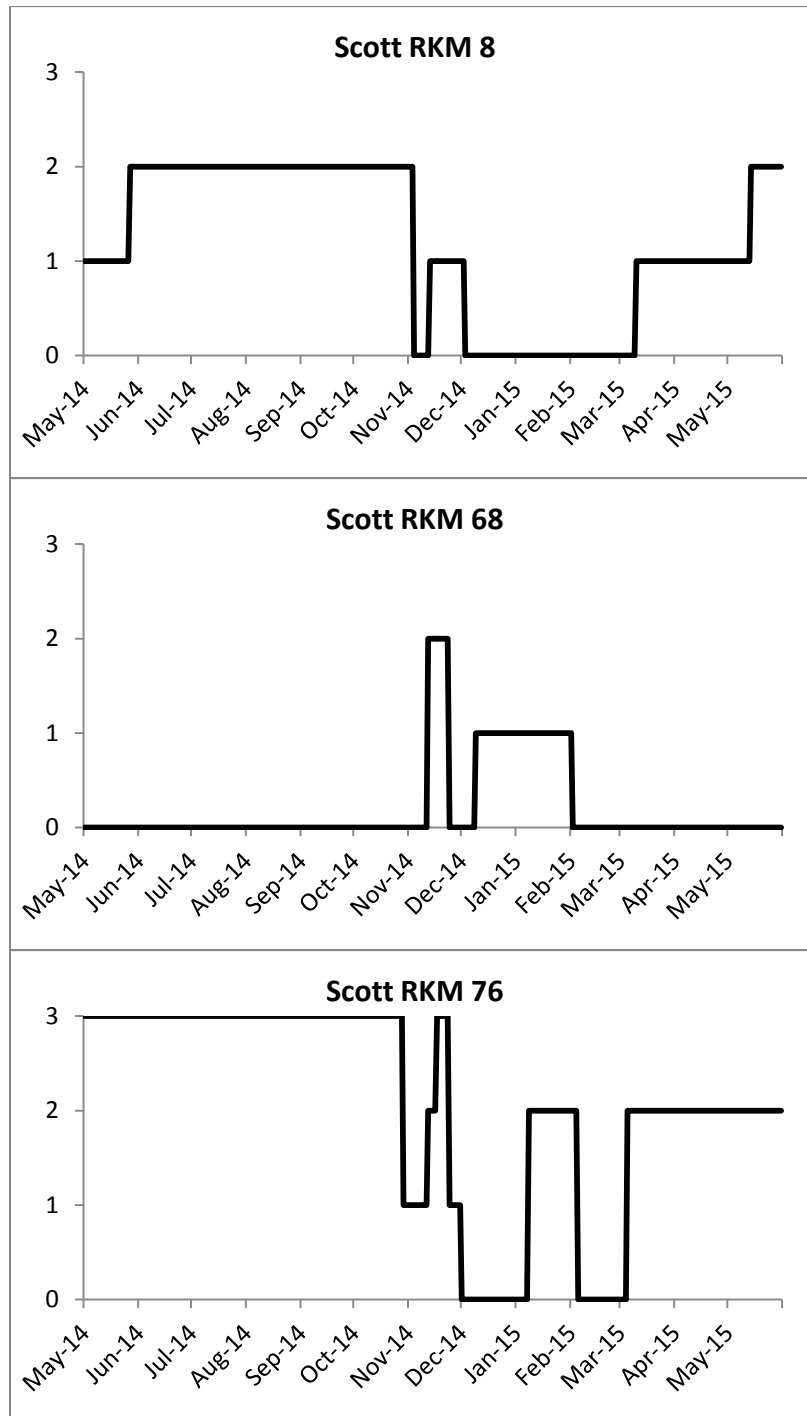
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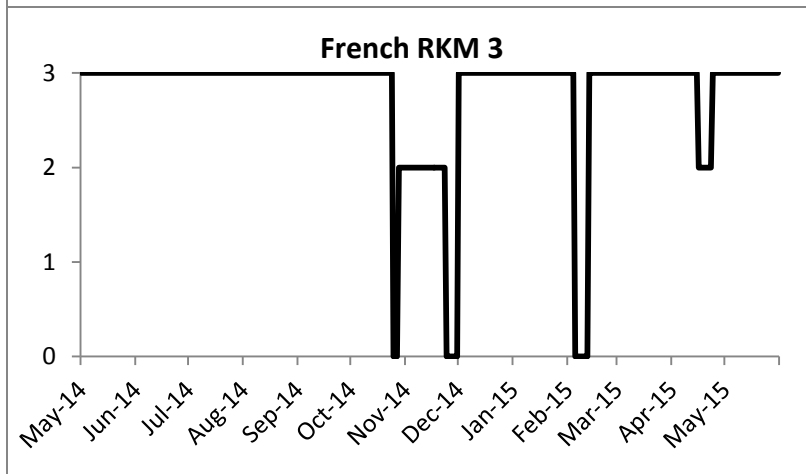
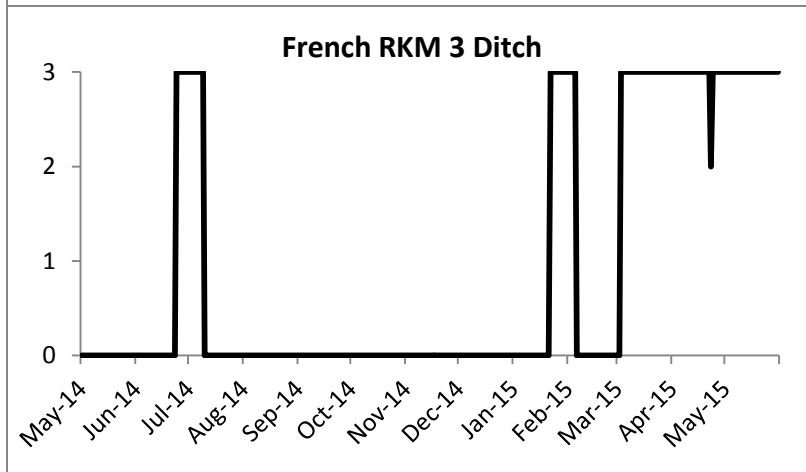
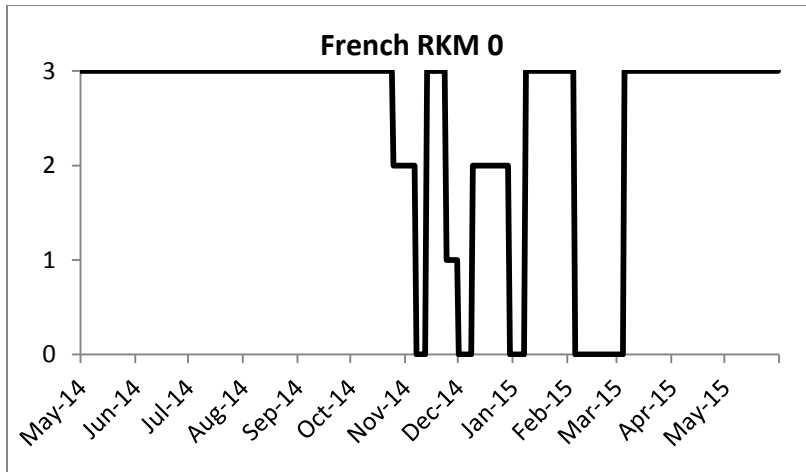
## 7. Appendices

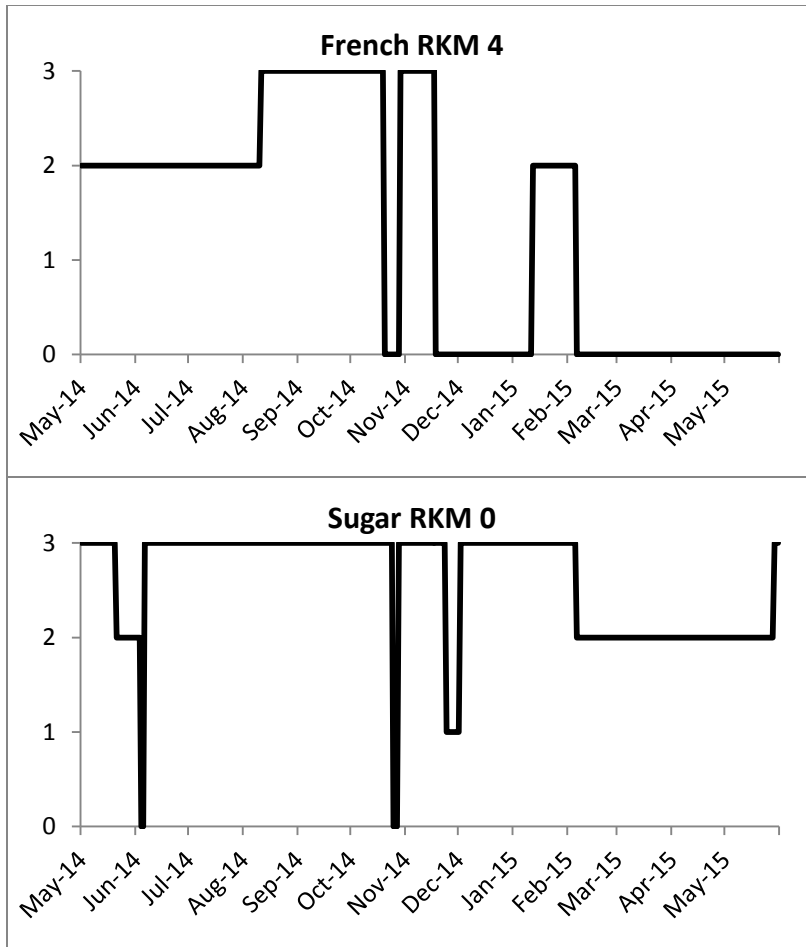
### Appendix A. List of study sites with descriptions and activities at each.

River Kilometer	Description	Activity	Latitude	Longitude
Scott RKM 8	Near Pat Ford Creek	Rotary Screw Trap, PIT Antennas	41°43'35.93"N	123° 0'34.51"W
Scott RKM 67	Sweezy Ranch	Capture Location	41°29'26.03"N	122°50'48.52"W
Scott RKM 68	Near Etna Creek	Capture Location, PIT Antennas	41°28'34.07"N	122°50'57.44"W
Scott RKM 71	Horn Lane Bridge	Capture Location, Release Site	41°27'27.93"N	122°51'8.40"W
Scott RKM 74	Downstream of Youngs Dam	Capture Location, McBain Trap Set	41°26'23.01"N	122°50'52.51"W
Scott RKM 76	Near French Creek	Capture Location, McBain Trap Set, PIT Antennas	41°25'7.98"N	122°50'47.27"W
Scott RKM 79	Downstream of Fay Lane	Capture Location	41°23'51.66"N	122°50'1.11"W
Scott RKM 81	Barnes Ranch	Capture Location, Release Site	41°23'17.84"N	122°49'42.17"W
South Fork Scott R.	Near Road Crossing	Release Site		
Kelsey Creek	Road Crossing Near Spawning Channel	Release Site	41°38'43.36"N	123° 6'59.66"W
Canyon Creek RKM 0	Lower Road Crossing	Release Site	41°37'56.00"N	123° 6'16.78"W
Canyon Creek RKM 3	Upper Road Crossing	Release Site	41°36'27.55"N	123° 7'28.04"W
Shackleford Creek		McBain Trap Set		
Etna Creek RKM 13	Near Road Crossing	Release Site, Capture Location	41°25'43.02"N	122°57'53.41"W
French Creek RKM 0	Near Scott River Confluence	Capture Location, PIT Antennas	41°24'57.77"N	122°50'53.33"W
French RKM 3	Stapleton Ranch	Capture Location, PIT Antennas, Release Site	41°24'2.70"N	122°52'3.17"W
French RKM 4	Just Downstream of Miners Crk	PIT Antennas	41°23'17.01"N	122°52'19.99"W
North Fork French Crk	Near Diversion	Release Site	41°22'54.92"N	122°53'24.06"W
Duck Lake Creek	At Road Crossing	Release Site	41°20'8.93"N	122°55'22.81"W
Sugar Creek RKM 0	Between Hwy 3 and Scott River	Capture Site, PIT Antennas	41°20'28.65"N	122°49'28.40"W
Sugar Creek RKM 1	Near Gazzarino Road Crossing	Release Site, Capture Location	41°20'3.13"N	122°49'43.99"W
Sugar Creek RKM 2	Marx	Release Site	41°19'42.52"N	122°50'35.81"W
Grouse Creek	Near Road Crossing	Release Site	41°18'58.08"N	122°41'56.57"W
Tom Martin	Tom Martin Creek Between HWY 96 and Klamath R.	PIT Antennas	41°47'1.19"N	123° 2'31.95"W

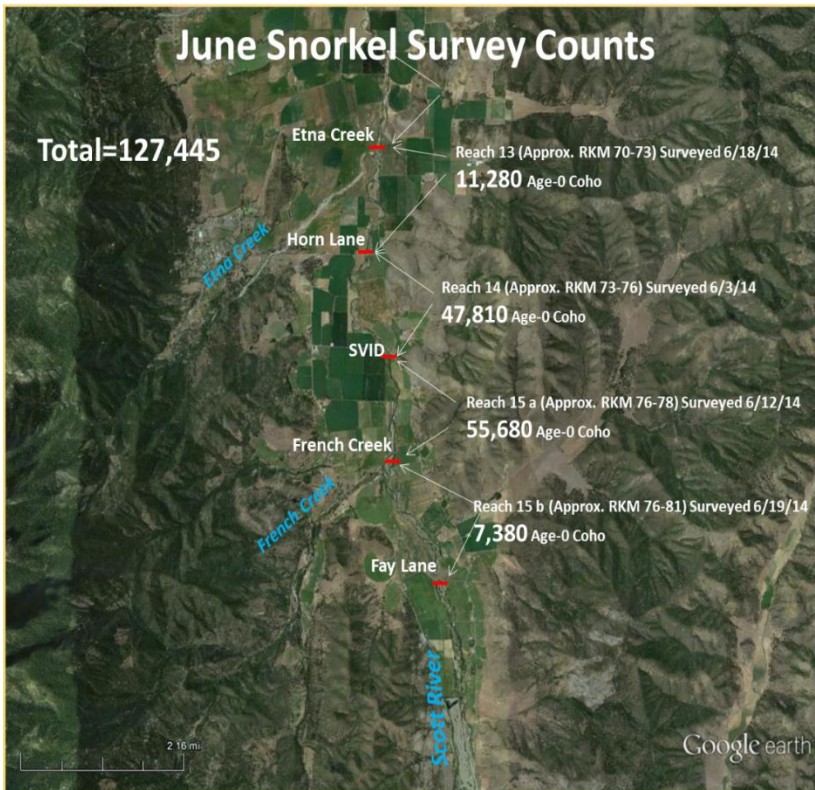
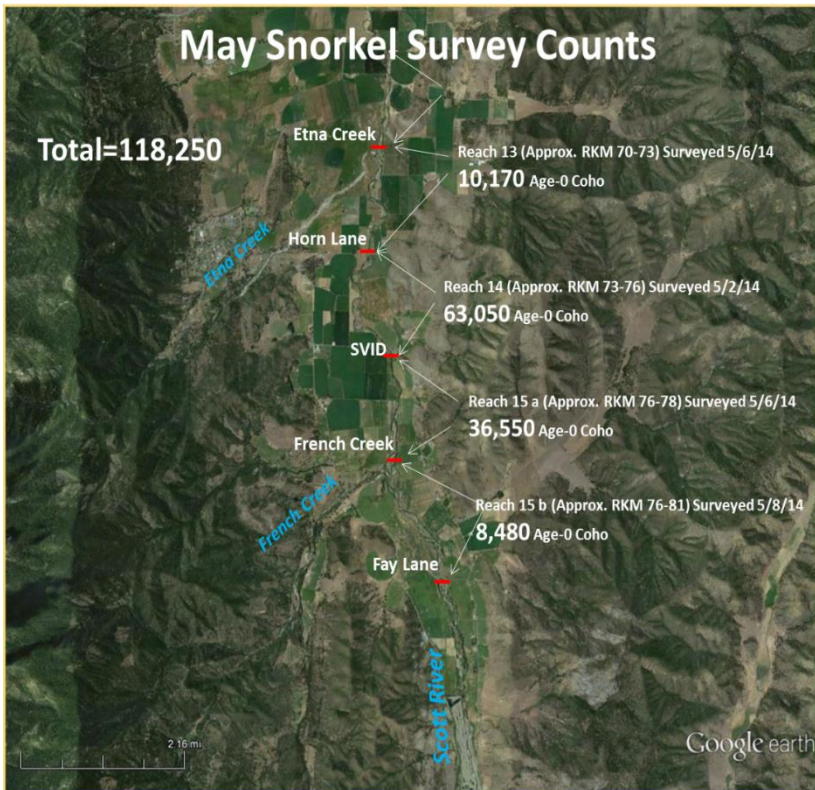
**Appendix B. Daily PIT tag antenna station operation, based on percentage of river transect covered by PIT tag detection field (3=67-100%, 2=34-66%, 1=1-33%)**





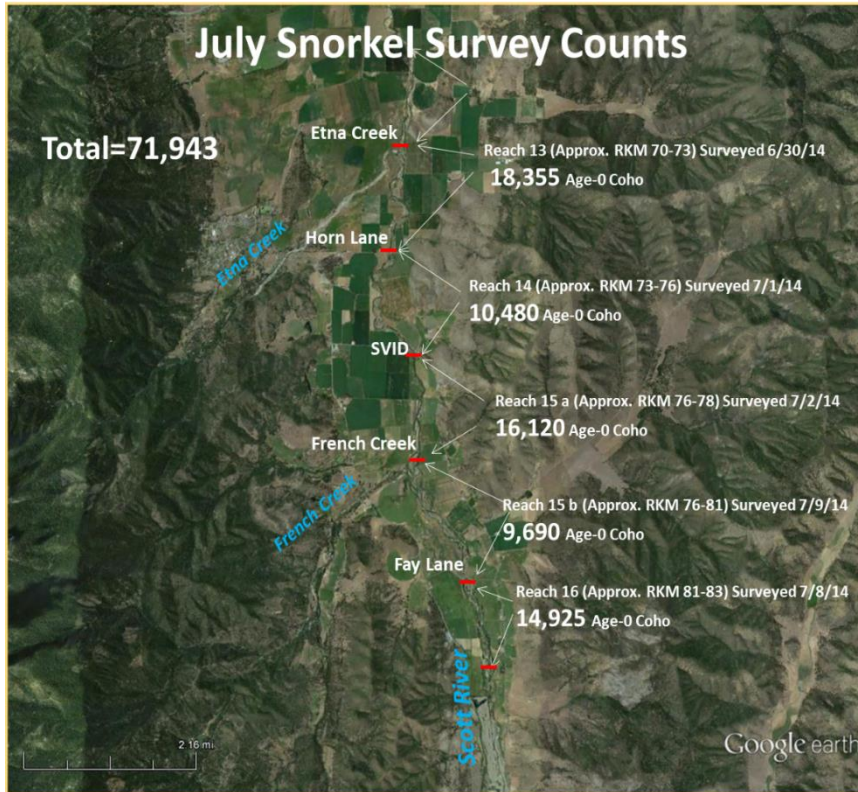


Appendix C. Snorkel survey estimates of BY2013 coho abundance.



Note: The June total includes 5,295 coho observed in Reach 12 (Eller Lane to Etna Bridge).





Note: Total includes an additional 2,373 coho observed in Reach 12 (Eller Lane to Etna Bridge).



# September Snorkel Survey Counts

Total=11,640

Etna Creek

Reach 13 (Approx. RKM 70-73) Surveyed 9/12/14  
1,135 Age-0 Coho

Horn Lane

Reach 14 (Approx. RKM 73-76) Surveyed 9/8/14  
2,450 Age-0 Coho

SVID

French Creek

Reach 15 a (Approx. RKM 76-78) Surveyed 9/9/14  
4,160 Age-0 Coho

Reach 15 b (Approx. RKM 76-81) Surveyed 9/10/14  
3,025 Age-0 Coho

Fay Lane

Reach 16 (Approx. RKM 81-83) Surveyed 9/11/14  
8,700 Age-0 Coho

2.16 mi.

Google earth

## Appendix D. Re-encounters of tagged BY2013 Scott River coho at each release site.

	Location	First Date	Last Date	Total Tagged	Detected at Scott RKM 8 in 2014	Relocated Later	Detected September 2014 or Later (Known to Survive Summer)	Detected at Scott RKM 8 2015
Tagged and released in capture location prior to Sept. 2014 (not relocated)	RKM 67	6/3/2014	6/4/2014	47	0	2	0	0
	RKM 68	7/9/2014	7/9/2014	14	0	0	0	0
	RKM 74	5/22/2014	7/8/2014	310	3	11	1	0
	RKM 76	5/7/2014	6/18/2014	69	0	3	4	0
	RKM 79	8/5/2014	8/5/2014	6	0	0	0	0
	RKM 81	8/8/2014	8/20/2014	300	0	0	9	0
	RKM 85 Pond	7/9/2014	7/9/2014	11	0	0	1	0
	French RKM 0	5/7/2014	6/25/2014	224	3	11	10	0
	Total			981	6	27	25	0
	<b>Total %</b>				<b>0.6%</b>	<b>2.8%</b>	<b>2.5%</b>	<b>0.0%</b>
Tagged and relocated to:	Canyon RKM 0	6/5/2014	7/29/2014	214	2	0	2	1
	Canyon RKM 3	6/25/2014	6/25/2014	73	0	0	2	2
	Duck Lake Creek	6/4/2014	7/9/2014	202	0	0	7	0
	Etna RKM 13	6/3/2014	7/30/2014	278	0	1	4	3
	French RKM 3	7/25/2014	8/8/2014	94	0	0	17	0
	North Fork French	7/11/2014	7/16/2014	101	0	0	14	1
	Grouse Creek	6/9/2014	6/26/2014	119	0	0	3	1
	Kelsey Creek	8/5/2014	8/6/2014	114	0	0	0	0
	South Fork	6/9/2014	8/7/2014	438	0	0	7	0
	Sugar RKM 1	7/3/2014	7/10/2014	149	0	0	22	1
	Sugar RKM 2	8/12/2014	8/12/2014	90	0	0	18	1
	Total			1872	2	1	96	10
	<b>Total %</b>				<b>0.1%</b>	<b>0.1%</b>	<b>5.1%</b>	<b>0.5%</b>
Held at IGH	French 3 from IGH	10/23/2014		180	x	x	x	1
	RKM 71 from IGH	10/24/2014		210	x	x	x	1
	Total			390	x	x	x	2
<b>Total %</b>							<b>0.5%</b>	
Tagged and Released Sept 2014-April 2015	Etna RKM 13	9/10/2014	10/2/2014	92	x	x	x	1
	French RKM 3	9/17/2014	10/6/2014	177	x	x	x	0
	Scott RKM 68	11/7/2014	11/12/2014	51	x	x	x	1
	Sugar RKM 0	9/5/2015	4/3/2015	127	x	x	x	4
	Sugar RKM 1	9/5/2014		47	x	x	x	0
	Total			494				6
<b>Total %</b>							<b>1.2%</b>	

## Appendix E. Table of daily capture and relocation activities.

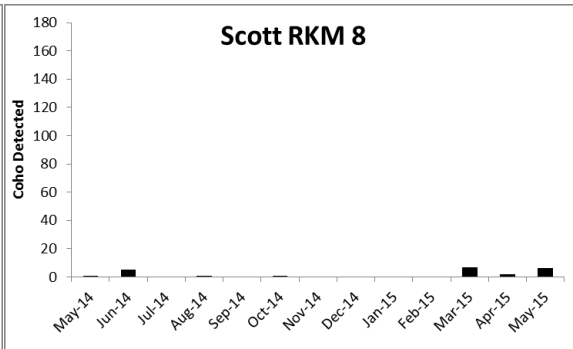
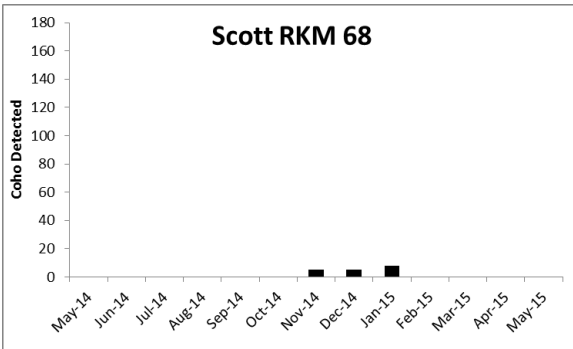
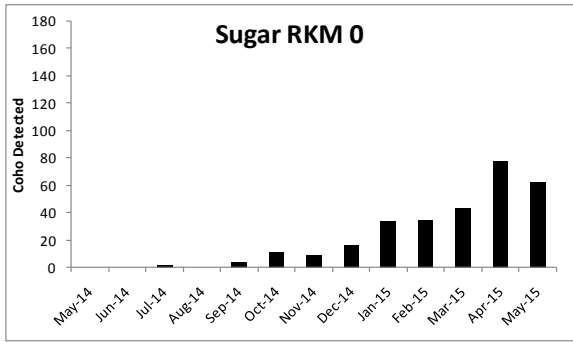
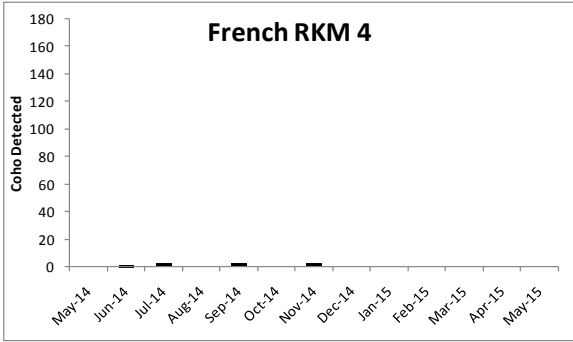
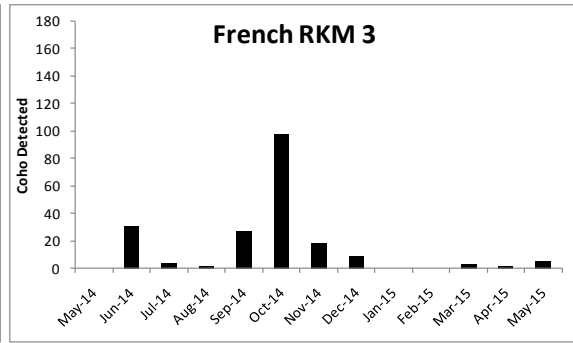
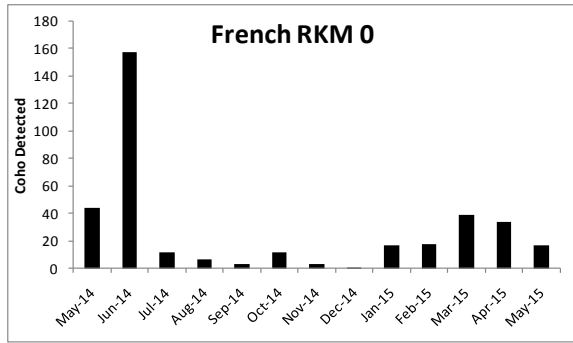
\*Asterisk indicates coho that were transported to and held at IGH. \*\*Coho were captured in drying pools from RKM 81 and moved upstream to deeper pools in the same reach.

Date	Capture Location	Gear	Count Method	Relocation Release Site	Estimated Total Coho Relocated	Relocated and Tagged	Tagged and Released at Capture Site
					115999	2262	1475
5/7/2014	Scott RKM 76	Seine	Actual		0	0	27
5/19/2014	French RKM 0	Seine	Actual		0	0	55
5/22/2014	Scott RKM 74	Seine	Actual		0	0	73
5/28/2014	French RKM 0	Seine	Actual		0	0	53
6/3/2014	Scott RKM 67	Seine	Actual	Etna RKM 13	1300	41	46
6/4/2014	Scott RKM 74	Seine	Actual	Duck Lk Crk	1082	68	55
6/5/2014	Shackleford	McBain	Weight	Canyon Creek	272	53	0
6/6/2014	Shackleford	McBain	Weight	Canyon Creek	122	16	0
6/9/2014	Scott RKM 74	Seine	Weight	South Fork	2000	40	32
6/9/2014	Scott RKM 74	Seine	Weight	Grouse Creek	1988	30	0
6/11/2014	Scott RKM 74	Seine	Weight	Duck Lk Crk	1930	33	24
6/11/2014	Scott RKM 74	Seine	Weight	South Fork	1929	49	0
6/12/2014	French RKM 0	Seine	Actual		0	0	80
6/16/2014	Scott RKM 76	Seine	Actual	Etna RKM 13	1422	50	0
6/17/2014	Scott RKM 74	Seine	Weight	South Fork	4781	48	31
6/18/2014	Scott RKM 76	Seine	Weight	Etna RKM 13	3178	38	42
6/24/2014	Scott RKM 74	McBain	Weight	Etna RKM 13	5866	60	0
6/24/2014	Scott RKM 76	McBain	Weight	Etna RKM 13	694	0	0
6/24/2014	Shackleford	McBain	Weight		0	0	0
6/25/2014	French RKM 0	Seine	Actual		0	0	36
6/25/2014	Scott RKM 74	McBain	Weight	Canyon Creek	3068	73	0
6/25/2014	Scott RKM 76	McBain	Weight	Canyon Creek	348	0	0
6/25/2014	Shackleford	McBain	Actual	Canyon Creek	7	0	0
6/26/2014	Scott RKM 74	McBain	Weight	Grouse Creek	3523	89	0
6/26/2014	Scott RKM 76	McBain	Weight	Duck Lk Crk	450	0	0
6/27/2014	Scott RKM 74	McBain	Weight	Canyon Creek	1870	60	0
6/27/2014	Scott RKM 76	McBain	Weight	Canyon Creek	432	0	0
6/27/2014	Shackleford	McBain	Actual	Canyon Creek	4	0	0
7/1/2014	Scott RKM 74	McBain	Weight	South Fork	2750	59	0
7/1/2014	Scott RKM 76	McBain	Weight	South Fork	90	0	0
7/1/2014	Shackleford	McBain	Actual	South Fork	2	0	0
7/2/2014	Scott RKM 74	McBain	Weight	Canyon Creek	2035	60	16
7/2/2014	Scott RKM 76	McBain	Weight	Canyon Creek	168	0	0
7/2/2014	Shackleford	McBain	Actual	Canyon Creek	4	0	0

7/3/2014	Scott RKM 74	McBain	Weight	Sugar Crk RKM 1	285	74	29
7/3/2014	Scott RKM 76	McBain	Weight	Sugar Crk RKM 1	25	0	0
7/3/2014	Shackleford	McBain	Weight	Sugar Crk RKM 1	3	0	0
7/8/2014	Scott RKM 74	McBain	Weight	Etna RKM 13	1288	30	30
7/8/2014	Scott RKM 76	McBain	Actual	Etna RKM 13	3	0	0
7/8/2014	Shackleford	McBain	Actual	Etna RKM 13	2	0	0
7/9/2014	Scott RKM 83 Pond	Seine	Actual		0	0	11
7/9/2014	Scott RKM 74	McBain	Weight	Duck Lk Crk	230	72	0
7/9/2014	Scott RKM 74	McBain	Actual	Duck Lk Crk	16	0	0
7/9/2014	Scott RKM 76	McBain	Actual	Duck Lk Crk	10	0	0
7/9/2014	Scott RKM 76	McBain	Actual	Duck Lk Crk	3	0	0
7/9/2014	Scott RKM 68	McBain	Actual	Duck Lk Crk	10	0	14
7/9/2014	Shackleford	McBain	Actual	Duck Lk Crk	1	0	0
7/10/2014	Scott RKM 74	McBain	Weight	South Fork	123	83	0
7/10/2014	Scott RKM 74	McBain	Actual	South Fork	10	0	0
7/10/2014	Scott RKM 76	McBain	Actual	South Fork	6	0	0
7/10/2014	Scott RKM 68	McBain	Actual	South Fork	38	0	0
7/10/2014	Shackleford	McBain	Actual	South Fork	6	0	0
7/10/2014	Scott RKM 81	Seine	Actual	Sugar Crk RKM 1	3008	75	0
7/11/2014	Scott RKM 74	McBain	Actual	North Fork French Crk	57	13	0
7/11/2014	Scott RKM 74	McBain	Actual	North Fork French Crk	0	0	0
7/11/2014	Scott RKM 76	McBain	Actual	North Fork French Crk	1	0	0
7/11/2014	Scott RKM 68	McBain	Actual	North Fork French Crk	68	0	0
7/11/2014	Shackleford	McBain	Actual	North Fork French Crk	4	0	0
7/15/2014	Scott RKM 74	Seine	Weight	South Fork	4000	0	0
7/15/2014	Scott RKM 74	Seine	Weight	Duck Lk Crk	4196	0	0
7/16/2014	French RKM 0	Seine	Weight	North Fork French Crk	3136	88	0
7/17/2014	Scott RKM 74	Seine	Actual	IGH*	510	0	21
7/22/2014	Scott RKM 68	Seine	Weight	South Fork	3276	38	0
7/23/2014	Scott RKM 68	Seine	Weight	Etna RKM 13	1837	0	0
7/24/2014	Scott RKM 68	Seine	Weight	Duck Lk Crk	404	29	0
7/25/2014	Scott RKM 68	Seine	Weight	French Crk RKM 3	1736	35	0
7/29/2014	Scott RKM 71	Seine	Weight	Canyon Creek	7104	25	0
7/30/2014	Scott RKM 71	Seine	Weight	Etna RKM 13	6941	60	0
7/31/2014	Scott RKM 71	Seine	Weight	South Fork	5150	60	0
8/1/2014	Scott RKM 71	Seine	Weight	French Crk RKM 3	1152	29	0
8/1/2014	Scott RKM 71	Seine	Actual	IGH*	503	0	0
8/5/2014	Scott RKM 79	Seine	Weight	Kelsey Creek	6360	54	6
8/6/2014	Scott RKM 79	Seine	Weight	Kelsey Creek	4686	60	0
8/7/2014	Scott RKM 79	Seine	Weight	South Fork	4440	60	0
8/8/2014	Scott RKM 81	Seine	Weight	IGH*	3434	0	0
8/8/2014	Scott RKM 81	Seine	Weight	French Crk RKM 3	4980	30	30

8/12/2014	Scott RKM 81	Seine	Weight	Sugar RKM 2	4709	90	0
8/19/2014	Scott RKM 81	Seine	Actual	Scott RKM 81**	933	0	120
8/20/2014	Scott RKM 81	Seine	Actual		0	0	150
9/5/2014	Sugar RKM 0	Seine	Actual		0	0	60
9/5/2014	Sugar RKM 1	Seine	Actual		0	0	47
9/10/2014	Etna RKM 13	Seine	Actual		0	0	72
9/17/2014	French RKM 3	Seine	Actual		0	0	58
9/24/2014	French RKM 3	Seine	Actual		0	0	60
10/2/2014	Etna RKM 13	Seine	Actual		0	0	20
10/6/2014	French RKM 3	Seine	Actual		0	0	59
10/23/2014	Fench RKM 3*	*	Actual		0	180	0
10/24/2014	Scott RKM 71*	*	Actual		0	210	0
11/7/2014	Scott RKM 68	Trap	Actual		0	0	29
11/12/2014	Scott RKM 69	Trap	Actual		0	0	22
12/29/2014	Sugar RKM 0	Seine	Actual		0	0	3
12/30/2014	Sugar RKM 0	Seine	Actual		0	0	6
1/7/2015	Sugar RKM 0	Trap	Actual		0	0	1
1/8/2015	Sugar RKM 0	Trap	Actual		0	0	20
1/23/2015	Sugar RKM 0	Trap	Actual		0	0	9
3/3/2015	Sugar RKM 0	Trap	Actual		0	0	16
3/27/2015	Sugar RKM 0	Trap	Actual		0	0	9
4/2/2015	Sugar RKM 0	Trap	Actual		0	0	3

**Appendix F. Monthly total number of tagged Scott RiverBY2013 coho detected at each PIT tag antenna station.**



**Appendix G. Capture, release, and re-encounter information for all tagged relocated BY2013 Scott River coho that were re-encountered.**

<b>Release Site</b>	<b>Removed From</b>	<b>Date</b>	<b>Fork Length (mm)</b>	<b>Gear</b>	<b>Last Encounter Date</b>	<b>Last Encounter Location</b>
Canyon RKM 0	RKM 74	6/27/2014	62	McBain	8/17/2014	Scott RKM 8
Canyon RKM 0	Shackleford	6/5/2014	59	McBain	10/24/2014	Scott RKM 8
Canyon RKM 0	RKM 74	7/2/2014	57	McBain	4/4/2015	Scott RKM 8
Canyon RKM 3	RKM 74	6/25/2014	76	McBain	3/24/2015	Scott RKM 8
Canyon RKM 3	RKM 74	6/25/2014	58	McBain	3/28/2015	Scott RKM 8
Duck Lake Creek	RKM 74	6/11/2014	65	Seine	6/14/2014	French RKM 0
Duck Lake Creek	RKM 74	6/4/2014	61	Seine	11/7/2014	French RKM 3
Duck Lake Creek	RKM 74	6/11/2014	64	Seine	12/30/2014	Scott RKM 68
Duck Lake Creek	RKM 74	6/4/2014	52	Seine	2/14/2015	French RKM 0
Duck Lake Creek	RKM 74	7/9/2014	60	McBain	4/8/2015	Scott RKM 76
Duck Lake Creek	RKM 74	6/11/2014	57	Seine	5/13/2015	French RKM 3
Duck Lake Creek	RKM 74	6/4/2014	59	Seine	5/13/2015	French RKM 3
Duck Lake Creek	RKM 74	6/4/2014	56	Seine	5/13/2015	French RKM 3
Etna RKM 13	RKM 68	7/30/2014	62	Seine	7/31/2014	RKM 71
Etna RKM 13	RKM 68	7/30/2014	71	Seine	10/2/2014	Etna RKM 13
Etna RKM 13	RKM 76	6/16/2014	57	Seine	3/27/2015	Scott RKM 8
Etna RKM 13	RKM 67	6/3/2014	52	Seine	3/29/2015	Scott RKM 8
Etna RKM 13	RKM 76	6/16/2014	75	Seine	4/6/2015	Scott RKM 8
French RKM 3	RKM 81	8/8/2014	65	Seine	8/10/2014	French RKM 3
French RKM 3	RKM 68	7/25/2014	61	Seine	9/25/2014	French RKM 3
French RKM 3	RKM 68	7/25/2014	65	Seine	9/25/2014	French RKM 3
French RKM 3	RKM 71	8/1/2014	65	Seine	9/25/2014	French RKM 3
French RKM 3	RKM 68	7/25/2014	63	Seine	9/25/2014	French RKM 3
French RKM 3	RKM 81	8/8/2014	64	Seine	10/18/2014	French RKM 3
French RKM 3	RKM 71	8/1/2014	60	Seine	10/24/2014	French RKM 3
French RKM 3	RKM 68	7/25/2014	61	Seine	11/12/2014	French RKM 3
French RKM 3	RKM 81	8/8/2014	66	Seine	11/19/2014	French RKM 3
French RKM 3	RKM 71	8/1/2014	66	Seine	12/21/2014	French RKM 3
French RKM 3	RKM 71	8/1/2014	69	Seine	12/21/2014	French RKM 3
French RKM 3	RKM 68	7/25/2014	61	Seine	12/22/2014	French RKM 3
French RKM 3	RKM 81	8/8/2014	74	Seine	12/25/2014	French RKM 3
French RKM 3	RKM 68	7/25/2014	69	Seine	1/18/2015	French RKM 0
French RKM 3	RKM 71	8/1/2014	70	Seine	1/26/2015	French RKM 0
French RKM 3	RKM 68	7/25/2014	60	Seine	2/2/2015	French RKM 0
French RKM 3	RKM 68	7/25/2014	59	Seine	4/7/2015	Scott RKM 76
French RKM 3	RKM 71	8/1/2014	70	Seine	4/30/2015	French RKM 0
Grouse Creek	RKM 74	6/26/2014	66	McBain	3/15/2015	Scott RKM 76
Grouse Creek	RKM 74	6/26/2014	62	McBain	5/6/2015	Scott RKM 8



North Fork French	French RKM 0	7/16/2014	68	Seine	9/26/2014	French RKM 4
North Fork French	French RKM 0	7/16/2014	73	Seine	10/26/2014	French RKM 3
North Fork French	French RKM 0	7/16/2014	55	Seine	11/13/2014	French RKM 4
North Fork French	French RKM 0	7/16/2014	61	Seine	11/13/2014	French RKM 4
North Fork French	French RKM 0	7/16/2014	77	Seine	1/6/2015	French RKM 3
North Fork French	French RKM 0	7/16/2014	77	Seine	2/3/2015	French RKM 3
North Fork French	French RKM 0	7/16/2014	64	Seine	2/12/2015	French RKM 0
North Fork French	French RKM 0	7/16/2014	72	Seine	2/22/2015	French RKM 0
North Fork French	French RKM 0	7/16/2014	67	Seine	2/26/2015	French RKM 3
North Fork French	French RKM 0	7/16/2014	60	Seine	3/15/2015	French RKM 0
North Fork French	French RKM 0	7/16/2014	73	Seine	3/24/2015	French RKM 0
North Fork French	French RKM 0	7/16/2014	59	Seine	3/25/2015	French RKM 3
North Fork French	French RKM 0	7/16/2014	64	Seine	4/24/2015	French RKM 0
North Fork French	French RKM 0	7/16/2014	62	Seine	5/13/2015	Scott RKM 8
South Fork	RKM 74	6/9/2014	56	Seine	3/13/2015	Scott RKM 76
South Fork	RKM 74	6/9/2014	62	Seine	3/16/2015	Scott RKM 76
South Fork	RKM 74	6/11/2014	52	Seine	3/24/2015	Scott RKM 76
South Fork	RKM 68	7/22/2014	68	Seine	5/2/2015	Sugar RKM 0
South Fork	RKM 79	8/7/2014	67	Seine	5/3/2015	Sugar RKM 0
South Fork	RKM 74	7/10/2014	62	McBain	5/3/2015	Sugar RKM 0
South Fork	RKM 74	7/1/2014	64	McBain	5/10/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	63	Seine	3/12/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	64	Seine	3/12/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	63	Seine	3/14/2015	Scott RKM 8
Sugar RKM 1	RKM 74	7/3/2014	60	McBain	3/14/2015	Scott RKM 76
Sugar RKM 1	RKM 81	7/10/2014	64	Seine	3/17/2015	Scott RKM 76
Sugar RKM 1	RKM 81	7/10/2014	68	Seine	3/27/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	57	Seine	3/29/2015	Scott RKM 76
Sugar RKM 1	RKM 81	7/10/2014	63	Seine	4/20/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	62	Seine	4/27/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	68	Seine	4/30/2015	Scott RKM 76
Sugar RKM 1	RKM 74	7/3/2014	57	McBain	4/30/2015	Scott RKM 76
Sugar RKM 1	RKM 81	7/10/2014	65	Seine	4/30/2015	Sugar RKM 0
Sugar RKM 1	RKM 74	7/3/2014	77	McBain	5/1/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	68	Seine	5/3/2015	Sugar RKM 0
Sugar RKM 1	RKM 74	7/3/2014	71	McBain	5/4/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	60	Seine	5/5/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	58	Seine	5/7/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	72	Seine	5/9/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	65	Seine	5/9/2015	Sugar RKM 0
Sugar RKM 1	RKM 74	7/3/2014	59	McBain	5/9/2015	Sugar RKM 0
Sugar RKM 1	RKM 81	7/10/2014	57	Seine	5/11/2015	Sugar RKM 0
Sugar RKM 1	RKM 74	7/3/2014	61	McBain	5/14/2015	Sugar RKM 0

Sugar RKM 2	RKM 81	8/12/2014	71	Seine	3/12/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	74	Seine	3/13/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	75	Seine	3/13/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	68	Seine	3/15/2015	Scott RKM 8
Sugar RKM 2	RKM 81	8/12/2014	70	Seine	3/15/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	62	Seine	3/17/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	66	Seine	3/26/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	64	Seine	3/30/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	77	Seine	4/28/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	72	Seine	4/29/2015	Scott RKM 76
Sugar RKM 2	RKM 81	8/12/2014	66	Seine	5/1/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	72	Seine	5/1/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	64	Seine	5/2/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	58	Seine	5/6/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	64	Seine	5/7/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	65	Seine	5/8/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	68	Seine	5/13/2015	Sugar RKM 0
Sugar RKM 2	RKM 81	8/12/2014	64	Seine	5/13/2015	Sugar RKM 0

**Appendix H. Photos**



**Photo 1.** French RKM 3, 1/25/14



**Photo 2.** Sugar RKM 0 PIT antenna station, 2/14/14



**Photo 3.** Adult Steelhead in Scott River approximately 200 meters upstream of Sugar Creek, 4/2/14



**Photo 4.** Scott River at French Creek confluence, 4/8/14



**Photo 5.** Adult steelhead in Scott River at French Creek confluence, 4/8/14



**Photo 6.** Scott River downstream of SVID, 5/2/14



**Photo 7.** Juvenile Chinook in Scott River downstream of SVID, 5/2/14



**Photo 8.** Juvenile coho in Scott River downstream of SVID, 5/2/14



**Photo 9.** French Creek mouth (French Creek RKM 0, Scott River RKM 76), 5/6/14



**Photo 10.** French Creek RKM 3 PIT tag antennas, 5/6/14



**Photo 11.** French Creek RKM 3, 5/19/14



**Photo 12.** Scott RKM 8 PIT tag antennas, 6/2/14





**Photo 13.** Scott River at Sugar Creek confluence, 6/2/14



**Photo 14.** Etna Creek release site, 6/3/14



**Photo 15.** Scott RKM 67, 6/3/14



**Photo 16.** French Creek RKM 3, 6/24/14



**Photo 18.** French RKM 0 (approximately 200 meters upstream of Scott River), 5/24/14



**Photo 19.** North Fork French Creek, 5/28/14



**Photo 20.** Scott RKM 71 (Horn Lane Bridge), 6/2/14



**Photo 21.** Adult suckers at Scott RKM 71 (Horn Lane), 6/2/14



**Photo 22.** French RKM 0 (approximately 200 meters upstream of Scott River) 6/5/14



**Photo 23.** Snorkel surveying Scott River downstream of French Creek, 6/12/14



**Photo 24.** Grouse Creek Release Site, 6/23/114



**Photo 25.** South Fork Scott River near release site, 6/23/14



**Photo 26.** Juvenile coho near South Fork Scott River release site, 6/23/14



**Photo 27.** French Creek RKM 0 PIT tag antennas, 6/24/14



**Photo 28.** French Creek RKM 0 PIT tag antennas, 6/24/14



**Photo 29.** French Creek RKM 0 (approximately 100 meters upstream of Scott River, 6/24/14





**Photo 30.** McBain Traps at Scott RKM 74 looking upstream, 6/24/24



**Photo 31.** McBain Traps at Scott RKM 74 looking downstream, 6/24/24



**Photo 32.** Canyon Creek Release Site 6/27/14



**Photo 33.** Scott RKM 8 PIT tag antennas, 7/8/14



**Photo 34.** RKM 81 7/10/14



**Photo 35.** RKM 81 (Upstream of Fay Lane), 7/10/14



**Photo 36.** Scott River fish in small transport tank, 7/10/14



**Photo 37.** Canyon Creek release site 7/25/14



**Photo 38.** Removing fish from an isolated pool at RKM 81 (upstream of Fay Lane), 8/12/14



**Photo 39.** Isolated pool at RKM 81 (upstream of Fay Lane), 8/12/14



**Photo 40.** Sugar RKM 0 PIT tag antennas, 8/13/14



**Photo 41.** Scott River upstream of French Creek 8/14/15



**Photo 42.** Isolated pool at RKM 81, 8/15/14



**Photo 43.** Scott RKM 71 (Horn Lane), 9/3/14



**Photo 44.** Beaver dam on Sugar Creek upstream of Hwy 3, 9/5/14



**Photo 45.** PIT tagging fish at Sugar RKM 1, 9/5/14





**Photo 46.** Scott RKM 75 (upstream of SVID), 9/9/14



**Photo 47.** Scott RKM 74 at SVID diversion site, 9/9/14



**Photo 48.** Scott Valley 9/11/14



**Photo 49.** Isolated pool at Scott RKM 81 (upstream of Fay Lane), 9/11/14



**Photo 50.** Isolated pool at Scott RKM 81 underwater (upstream of Fay Lane), 9/11/14



**Photo 51.** Bullfrog in isolated pool at RKM 81, 9/11/14



**Photo 52.** Duck Lake Creek release site, 9/13/14



**Photo 53.** Sugar Creek RKM 0, 10/6/14



**Photo 54.** French Creek RKM 3 10/6/14



**Photo 55.** Scott River fish in large transport tank, 10/24/14



**Photo 56.** Fish in holding tank at Iron Gate Hatchery, 10/24/14



**Photo 57.** Weighing Scott River fish at Iron Gate Hatchery, 10/24/14



**Photo 58.** Releasing fish held at IGH from Horn Lane Bridge 10/24/14



**Photo 59.** French RKM 3 2/14/15



**Photo 60.** RKM 8 Rotary Screw Trap 3/10/15



**Photo 61.** Scott RKM 8, 3/10/15