



Long-term Coho Salmon & Steelhead Trout Monitoring in Coastal Marin County

Smolt Trapping 2010 Progress Report

Natural Resource Data Series NPS/SFAN/NRDS—2010/200



ON THE COVER

Redwood Creek smolt trap live box, spring 2010.
Photograph by: Cassandra Liu.

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The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Contents

	Page
Figures.....	v
Tables.....	vii
Abstract.....	ix
1 - Introduction	1
1.1 Introduction and History of the Spring Outmigrant Smolt Trapping Program	1
<i>1.1.1 Spring Outmigrant Trapping Monitoring Questions</i>	2
<i>1.1.2 Spring Outmigrant Trapping Monitoring Objective</i>	2
1.2 Fish Resources	3
2 - Sampling Design and Methods.....	5
2.1 Fyke/Pipe Trap Construction.....	5
2.2 Mark/Recapture Techniques.....	5
2.3 Processing 1+ Aged Fish	7
2.4 Processing Young-of-Year Salmonids	8
2.5 Processing Other Species.....	8
2.6 Fish Recovery and Release.....	8
3 - Results	9
3.1 Olema Creek	9
3.2 Redwood Creek	10
3.3 Pine Gulch Creek.....	12
3.4 Timing.....	14
3.5 Rainfall	15
3.6 Water Temperature	16
3.7 Watershed Production Estimate.....	17

Contents (continued)

	Page
3.8 Non-salmonid Captures	18
3.9 Smolt Size and Condition	18
<i>3.9.1 Coho Smolt Passive Integrated Transponder Summary</i>	22
Literature Cited	25
Appendix A. Annual Catch Totals.....	29
Appendix B. Julian Week Table	31

Figures

	Page
Figure 1. Location of smolt traps on SFAN streams in Marin County, CA. Olema Creek and Pine Gulch Creek are located in PORE while Redwood Creek is located in GOGA.....	6
Figure 2. DARR analysis of coho smolt data for Redwood Creek, 2010. Estimated number of smolts (line) is compared to trap efficiency (points).....	11
Figure 3. DARR analysis of coho smolt data for Pine Gulch Creek, 2010. Estimated number of smolts (line) is compared to trap efficiency (points).....	13
Figure 4. Percent of total coho smolts captured by Julian week for Pine Gulch, Redwood, and Olema Creeks, 2010.	14
Figure 5. Cumulative daily rainfall totals for Water Year 2010 for Olema Creek during the 2010 smolt trapping season, 19 March – 28 May 2010, starting in October 2009.....	15
Figure 6. Daily rainfall totals for Redwood Creek between 17 March – 28 May 2010. Cumulative data not available for this site due to lack of consecutive data.	15
Figure 7. Olema Creek trap box Hobo temperature logger readout, spring 2010.....	16
Figure 8. Redwood Creek trap box Hobo temperature logger readout, spring 2010.	16
Figure 9. Pine Gulch Creek trap box Hobo temperature logger readout, spring 2010.	17
Figure 10. Coho smolt fork lengths in 5 mm bins for Olema Creek, 2010.....	19
Figure 11. Steelhead smolt fork lengths in 5 mm bins for Olema Creek, 2010.....	19
Figure 12. Coho smolt fork lengths in 5 mm bins for Redwood Creek, 2010.....	20
Figure 13. Steelhead smolt fork lengths in 5 mm bins for Redwood Creek, 2010.	20
Figure 14. Coho smolt lengths in 5 mm bins for Pine Gulch Creek, 2010.....	21
Figure 15. Steelhead smolt fork lengths in 5 mm bins for Pine Gulch Creek, 2010.	21

Tables

	Page
Table 1. Olema Creek smolt trapping summary, 19 March 2010 – 21 May 2010.....	9
Table 2. Redwood Creek mainstem smolt trapping summary, 19 March 2010 – 28 May 2010.....	11
Table 3. Measurements of coho tagged as juveniles in summer 2009 and recaptured as smolts in spring 2010.	12
Table 4. Pine Gulch Creek mainstem smolt trapping summary, 24 March 2010—28 May 2010.....	14
Table 5. Summary of salmonid information for Pine Gulch Creek, Redwood Creek, and Olema Creek trap operations, 2010.	17
Table 6. Summary of non-salmonid information for Pine Gulch Creek, Redwood Creek, and Olema trap operations, 2010.	18
Table 7. Coho mean and median length, weight, and K factor calculated during 2010 for the trapping locations at Pine Gulch, Redwood, and Olema Creeks.	22
Table 8. Steelhead mean and median length, weight, and K factor calculated during 2010 for the trapping locations at Pine Gulch, Redwood, and Olema Creeks.	22

Abstract

The National Park Service has conducted multiple life stage monitoring of coho salmon (*Oncorhynchus kisutch*) in coastal Marin watersheds since 1998. An integrated protocol for monitoring salmonids, which includes outmigrant smolt trapping, was developed by the National Park Service Inventory and Monitoring program in 2010. Performed in conjunction with winter surveys of spawning adults and summer juvenile surveys, the spring outmigrant surveys permit an evaluation of abundance and survival associated with the freshwater portion of the coho life-cycle. During this period of a salmonids life they are called “smolts”, referring to the process of smoltification which involves a series of transformations in juvenile salmonids in preparation for life in a marine environment. In 2010, smolt trapping was conducted on Olema Creek, Redwood Creek, and Pine Gulch Creek.

Trap installation occurred during Julian week 12 (12 March 2010 – 18 March 2010) and ended in week 22 (28 May 2010 – 3 June 2010). A total of five smolt traps were operated during the 2010 trapping season: one on Olema Creek, three on Redwood Creek, and one on Pine Gulch Creek. A series of storms in early April raised water levels high enough that the mainstem traps had to be completely removed on two occasions.

The peak outmigration for coho smolts was observed during Julian week 13 (26 March – 1 April) for Olema Creek, week 17 (23 April – 29 April) for Redwood Creek, and week 18 (30 April – 5 May) for Pine Gulch Creek. As only 10 coho smolts were captured on Olema Creek no production estimate could be produced. Comparisons of total catch suggest that this represents a 97% decline in smolt production for this cohort in Olema Creek. Using a mark/recapture study, a Darroch Analysis with Rank Reduction was performed for Redwood Creek, providing an estimate of 389 ± 409 coho smolts. Although the calculated variance was high, both the estimated production and total catch suggest a decline in smolt production of over 60% for this cohort in Redwood Creek. On Pine Gulch Creek, the calculated Darroch Analysis with Rank Reduction estimate was 374 ± 132 coho smolts. This represents a 29% increase in smolt production for this cohort in Pine Gulch Creek. In addition to facilitating the mark/recapture study, Passive Integrated Transponder tags were used to track individual coho and steelhead smolt movements in greater detail than prior to the implementation of Passive Integrated Transponder tags in juvenile coho. For example, on Olema Creek, one coho smolt during the spring of 2010 had originally been tagged as a smolt in spring 2009, indicating that some smolts may reside in freshwater for an additional year.

1 - Introduction

The mission of the National Park Service (NPS) is “to conserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment of this and future generations” (NPS 1999). To uphold this goal, the Director of the NPS approved the Natural Resource Challenge to encourage national parks to focus on the preservation of the nation’s natural heritage through science, natural resource inventories, and expanded resource monitoring (NPS 1999). Through the Natural Resource Challenge, 270 parks in the national park system were organized into 32 inventory and monitoring networks.

The San Francisco Bay Area Network (SFAN) includes Golden Gate National Recreation Area (GOGA), John Muir National Historic Site (JOMU), Pinnacles National Monument (PINN), and Point Reyes National Seashore (PORE). The network has identified indicators of ecosystem health, known as Vital Signs, which represent a broad suite of ecological phenomena operating across multiple temporal and spatial scales. Our intent is to monitor a balanced and integrated “package” of Vital Signs that meets the needs of current park management, but will also be able to accommodate unanticipated environmental conditions in the future. Salmonids represent a particular high priority Vital Sign for SFAN because they are ecologically significant, have endangered or threatened status, and are of high interest to the public.

Smolt trapping is performed in conjunction with winter surveys of adult spawners and summer juvenile surveys as part of an integrated salmonid monitoring protocol. The spring outmigrant surveys provide a sample of the salmonid smolts leaving a watershed and permit an evaluation of abundance during three of five distinct freshwater salmonid life history stages. When evaluated as part of a comprehensive monitoring program, the smolt trap information can be compared with adult spawner indices to describe potential ocean productivity and survival and can be compared with summer juvenile population estimates to assess rates of survival through the winter season. This type of comprehensive monitoring information is rare in this region, as most of this research has been in the Pacific Northwest.

The outmigrant program is conducted in selected salmonid-bearing watersheds where the National Park Service (NPS) is also performing basinwide population estimates. The program requires intensive monitoring at specific locations for a period of two to three months during the spring of each year. This report documents results of the spring 2010 trapping season at Olema, Pine Gulch, and Redwood Creeks.

1.1 Introduction and History of the Spring Outmigrant Smolt Trapping Program

A significant body of literature documents life-stage bottlenecks and survival rates for salmonid populations. Many of these studies describe how alterations to watershed connectivity and condition affect these species at different freshwater life stages (Moyle 2002, NMFS 2010). At the time of smoltification, coho salmon (*Oncorhynchus kisutch*) have spent more than 14 months in the watershed, while smolting steelhead trout (*O. mykiss*) can be 1-4 years old. Smolt production, therefore, is the best aggregate measure of watershed condition and fish productivity. The response of coho and steelhead populations to changes in habitat quality cannot be properly assessed without a measure of smolt production.

Smolt trap monitoring, in conjunction with other life stage monitoring activities, allows the NPS to characterize aggregate watershed productivity for salmonids, and is a valuable resource for directing long-term management and restoration actions, as well as having direct management utility (California Department of Fish and Game 2004). Trapping results can help quantify dates of migration and growth rates through the winter and spring. Traps also provide presence/absence information and size data for other species during periods not covered by summer/fall monitoring activities.

The NPS has conducted smolt trapping operations at selected sites since 1998. Between 1998 and 2004, the NPS operated an outmigrant trapping on the John West Fork, an important tributary of Olema Creek (PORE), immediately upstream of the State Route 1 culvert. The results of these efforts showed increases in watershed productivity in response to fish passage restoration efforts in summer 1999 (Reichmuth et al. 2006).

In 2002 the NPS initiated smolt trapping on Pine Gulch Creek (PORE) to monitor the size and condition of the coho population that had recently re-colonized this watershed. In order to obtain an estimate of total coho smolt production from the Olema Creek watershed, the NPS initiated trapping at the downstream end of Olema Creek in 2004. In Redwood Creek (GOGA) smolt trapping was first conducted during the spring of 1998 and continued during the spring of 1999. In 2005 smolt trapping operations were once again initiated in Redwood Creek.

In 2006, downstream migrant trapping operations were initiated on Lagunitas Creek as part of a Limiting Factors Analysis grant through the Marin Resource Conservation District. The trapping conducted in 2006 by Stillwater Sciences, Inc. included multiple trapping locations along the mainstem of Lagunitas Creek. Since 2007 Marin Municipal Water District (MMWD) has conducted smolt trapping on the mainstem of Lagunitas Creek at one downstream trapping location. In addition, the Salmon Protection and Watershed Network (SPAWN) has conducted smolt trapping operations on San Geronimo Creek since 2006. Information from all three smolt trapping programs will fill an important information gap linking summer juvenile coho salmon density to adult returns one or two winters later.

1.1.1 Spring Outmigrant Trapping Monitoring Questions

1. What is the relative health/condition factor of salmonid smolts within Olema, Redwood, and Pine Gulch Creeks?
2. What is the annual production of juvenile coho salmon outmigrants in Olema, Redwood, and Pine Gulch Creeks?

1.1.2 Spring Outmigrant Trapping Monitoring Objective

Field and analytical methods used for this report are documented in the Salmonid Monitoring Protocol for the San Francisco Bay Area Network version 4.0 (Reichmuth et al. 2010). This 2010 Spring Outmigrant Smolt Trapping Program Summary addresses Objective 2:

Determine long-term trends in abundance and condition of coho salmon smolts by conducting spring smolt trapping near mouths of Olema, Pine Gulch, and Redwood Creeks.

1.2 Fish Resources

The primary species monitored through this program are coho salmon. However, other aquatic species including steelhead trout, sculpin (*Cottus* spp.), California roach (*Lavinia symmetricus*), lamprey (*Lampetra* spp.), Sacramento suckers (*Catostomus occidentalis*) and threespine stickleback (*Gasterosteus aculeatus*) are captured and documented through our monitoring efforts.

The general biology of coho salmon is described in detail in Hassler (1987) and Sandercock (1991). The coho salmon is an anadromous, semelparous fish species, migrating from the marine environment back to freshwater for a single chance at reproduction. Natural populations of coho salmon are known to exist in the Lagunitas, Olema, Pine Gulch, and Redwood Creek watersheds (Brown and Ketcham 2002, NMFS 2010). Coho salmon were listed as a threatened species within the central California coast coho salmon evolutionarily significant unit (CCCESU) in 1996 by National Marine Fisheries Service (NMFS) (Federal Register 1996) and the ESU was downgraded in status (upgraded listing protection) to Endangered in 2005 (Federal Register 2005). The CCCESU includes all naturally spawned populations of coho salmon from Punta Gorda in northern California south to and including the San Lorenzo River in central California, as well as populations in tributaries to San Francisco Bay, excluding the Sacramento-San Joaquin River system.

Steelhead are the anadromous form of rainbow trout. Steelhead are iteroparous, meaning they can spawn more than once. Steelhead fry reside in near-shore areas, while juveniles tend to inhabit riffles and pool margins. Steelhead are known to exist in most perennial watersheds within Marin County. Because of dramatic declines in population numbers, NMFS was petitioned to list this species throughout much of the California coast. Steelhead were listed as a threatened species in 1997 (Federal Register 1997). The central California coast steelhead Distinct Population Segment (DPS) includes all naturally spawned populations of steelhead (and their progeny) in California streams from the Russian River (inclusive) to Aptos Creek (inclusive), and the drainages of San Francisco, San Pablo, and Suisun Bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin Rivers; excluding the Sacramento-San Joaquin River Basin. The artificially propagated stocks from the Don Clausen Fish Hatchery and the Kingfisher Flat Hatchery/Scott Creek are also included (Federal Register 2006).

2 - Sampling Design and Methods

For a detailed description of methods used during the outmigrant smolt trapping season, please refer to SOP 3, SOP 4, SOP 6, SOP 9, and SOP 11 of the San Francisco Bay Area Network Salmonid Monitoring Protocol version 4.0 (Reichmuth et al. 2010).

2.1 Fyke/Pipe Trap Construction

Trapping is conducted continually for a 2-3 month period during the spring and requires daily visits by field staff. The fyke/pipe traps used by this program are based on methods developed in northern California for trapping small streams (Manning and Roelofs 1996, Manning 2001) and have proven effective for the current monitoring sites. They are designed to catch fish moving downstream and allow for a thorough sampling of smolt outmigration. Trap sites were determined by location within each watershed, suitable channel morphology, and access (Figure 1).

The fyke/pipe trap used on Olema, Redwood, and Pine Gulch Creeks is based on a design used by California Department of Fish and Game (CDFG) on the Noyo River (Gallagher 2000, Barrineau and Gallagher 2001). A 5' x 4' x 20' fyke net is supported by t-posts. Several weir panels are constructed consisting of ½" mesh hardware cloth secured with t-posts and baling wire to direct fish into the mouth of the fyke net. A small gap is left between the weir panels and the streambank on one side as a bypass channel to allow adult steelhead to migrate upstream during higher flows and downstream following spawning. The throat of the fyke net is attached to a series of 6" x 20' PVC pipes, which empty into a plywood trap box.

Traps are generally installed in mid-March, once winter flows have subsided. In some years, spring rains occasionally raise flows enough to compromise trap operation. Stream flows typically drop substantially by late May or early June, so traps are usually removed at this time. A Hobo-brand temperature logger is deployed and left in each trap box for the duration of operation.

2.2 Mark/Recapture Techniques

Mark/recapture methods are used to estimate trap efficiency and smolt population size. Mark-recapture methods are useful for the fyke net trap operations on Olema, Redwood, and Pine Gulch Creeks since fish can avoid the trap and pass through the bypass channel left open for adult steelhead coming back to spawn. Daily, no more than 30 coho smolts (or up to 50% of the catch that day) are anesthetized with carbon dioxide and marked with Passive Integrated Transponder (PIT) tags. Marked smolts are released immediately after recovering from anesthetization at a predetermined site approximately 100 m or at least three habitat units above the trap site. After being measured, all recaptured smolts and unmarked smolts are released immediately in low velocity areas below the trap.

Studies using similar methods of marking and tagging have demonstrated little marking mortality and no fish are held for retention or survival tests (Thedinga et al. 1994, Gries and Letcher 2002). A study using the same trapping methodology on five northwestern California streams revealed that trap mortality was less than one percent for smolts and less than three percent for fry (Manning 2001). The highest mortality rates were associated with high flow.



Figure 1. Location of Inventory and Monitoring smolt traps on SFAN streams in Marin County, CA. Olema Creek and Pine Gulch Creek are located in PORE while Redwood Creek is located in GOGA.

Mark/recapture data is analyzed using DARR (Darroch Analysis with Rank Reduction), a software application developed by Eric Bjorkstedt at the NMFS Southwest Fisheries Science Center (Bjorkstedt 2005, 2010). The software facilitates analysis of temporally stratified mark/recapture data based on methods developed by Darroch (1961). Using the efficiency method to estimate population could result in overestimates of population. Estimates reported through this method require the following assumptions: 1) there is no mortality of released fish; 2) there is no residualization or behavior change (far more probable in steelhead than coho); and 3) released fish are redistributed and have a constant probability of capture.

2.3 Processing 1+ Aged Fish

Salmonids are identified to species and life stage (fry, parr, smolt, or adult) prior to being measured. Fry are less than one year old and can be identified by the presence of distinct parr marks and small body size. Age 1+ steelhead and coho are separated into the following morphological categories: parr (smaller size, parr marks present) or smolt (faint or absent parr marks, silver body, deciduous scales, black fin margins) (Bratovich and Kelley, 1988, Nelson 1994). Occasional runback steelhead spawners are trapped on their way back out to sea; they are generally greater than 40 cm long and are classified as adults. Any mortality or injury is recorded, as well as the probable cause of death.

Daily, a random sub-sample of up to 10 individuals of coho smolts and steelhead parr and smolts are measured (fork length is measured nose to fork of caudal fin) to the nearest millimeter, and weighed to the nearest 0.01 g using an electronic scale. This sub-sample is normally 10 individuals of each species, however, fish are also measured to the nearest millimeter and weighed if they are anesthetized for mark/recapture purposes. All coho and steelhead 1+ aged fish are identified and counted. Any adult steelhead encountered in the trap is released downstream immediately without being measured.

Selected age 1+ salmonids are sedated using carbon dioxide to facilitate handling and minimize stress to the fish. A clean five-gallon bucket is filled with approximately two inches of fresh stream water and then half of an Alka-Seltzer® tablet is added (plain, unmedicated). The alka-seltzer adds carbon dioxide to the water, effectively sedating the fish. No more than two fish at a time are placed into the treated water. Fish are determined to be adequately sedated when they are sluggish enough for easy handling but before they begin to turn over. The water is changed periodically, particularly on hot days and when processing large numbers of fish.

In general, coho measuring more than 70 mm in the spring are assumed to be one year old and potential smolts. It is the judgment of the field staff to determine whether the fish is a smolt. Typically, coho entering the trap are actively migrating downstream. Smolts undergo physical change in their body, becoming silvery, and developing black tips on their caudal fin (this is true of both coho and steelhead). Smolts also have looser scales and are losing their parr marks and spots. While the monitoring protocol details descriptions of characteristics of fish in various life stages, a decision in the field is not always obvious. In cases such as these, the decision between smolt and other life-stages is based on the experience and professional judgment of monitoring staff based on overall field indicators present on the fish.

2.4 Processing Young-of-Year Salmonids

All fry are identified to species and counted. Daily, random sub-samples of 10 coho fry and 10 steelhead fry are measured (fork length to the nearest millimeter) and individuals greater than 40 mm are weighed to the nearest 0.01 g using an electronic scale. Sub-samples are obtained by taking blind scoops out of the holding bucket with a small aquarium dip net.

Although identification of salmonid fry can be difficult, it is important in order to address the objectives of this monitoring program that the species (coho and steelhead) are differentiated. As long as both species are present, it is rather simple to see the distinct differences. Problems may arise when only one or the other is present. The best reference for field identification between species is the “Field Identification of Coastal Juvenile Salmonids” (Pollard et al. 1997). This reference includes color photographs and descriptions of each species at the 40 to 50 mm size. In general, the coho at all sizes have a pinker hue, while steelhead have an orange or yellow hue. In addition, the dorsal and anal fins of coho are longer, sickle-shaped, and more pointed than those of steelhead. For the few individuals that can’t be identified by overall appearance or shape of fins, counting the anal fin rays can differentiate between coho (12 to 17 rays) and steelhead (8 to 12 rays) fry.

2.5 Processing Other Species

Other species encountered through this program are documented. Daily, random sub-samples of 10 individuals of each species are measured and fish over 40 mm are weighed. All other species are counted and released downstream. We have observed that sculpin, as ambush predators, will predate on smolt sized fish in the trap. Once removed from the trap, sculpin are held in a separate bucket to avoid predation.

2.6 Fish Recovery and Release

After processing, each fish is placed in an aerated recovery bucket, keeping larger sculpin in separate buckets to avoid predation on smaller fish. The recovery bucket is a different color (preferably blue or other dark color) and located away from the holding buckets to avoid mixing fish that have and haven’t been processed. The dark colored bucket allows the fish to darken their color, which is beneficial when they are released back into the stream. Fish in the recovery bucket are monitored to insure sedated fish recover fully before being released.

3 - Results

Smolt trapping was conducted between 19 March 2010 (Julian week 12) and 28 May 2010 (Julian week 22). Smolt trapping results are reported using Julian weeks to allow for analysis across years. For specific dates, refer to the Appendix B, Table B1.

3.1 Olema Creek

During the 2010 outmigrant trapping study, the Olema Creek trap was in place for 64 days (19 March 2010—21 May 2010) but was only fully operational for 42 days. Storms throughout the trapping season interfered with normal trap operations; the trap was partially operational for a total of seven days and was non-operational for 15 days. A series of storms in early April resulted in temporary removal of the trap on two occasions.

The trap captured a total of 10 coho smolts, 34 steelhead smolts, and 26 steelhead parr. Due to the low number of coho smolts, steelhead smolts were also marked using PIT tags in an attempt to estimate trap efficiency. No marked steelhead were recaptured, however and the numbers of both coho smolts and steelhead smolts were too low to use a DARR analysis to obtain a population estimate. The overall recapture rate for marked coho smolts was 20% (1/5) and the overall recapture rate for steelhead smolts was 0% (0/24).

Peak capture for coho smolts occurred in late March, during Julian week 13 (Table 1).

Table 1. Olema Creek smolt trapping summary, 19 March 2010 – 21 May 2010.

Julian Week #	From	To	Steelhead Juvenile			Steelhead Adult Ocean Run	Coho	
			Smolt	Parr	Fry		Smolt	Fry
Week 12	19-Mar	25-Mar	3	1	10	0	1	3
Week 13	26-Mar	1-Apr	15	3	663	0	6	0
Week 14	2-Apr	8-Apr	0	1	9	0	0	0
Week 15	9-Apr	15-Apr	4	10	1	0	2	4
Week 16	16-Apr	22-Apr	4	4	1	0	1	3
Week 17	23-Apr	29-Apr	0	2	13	0	0	1
Week 18	30-Apr	6-May	2	0	29	0	0	1
Week 19	7-May	13-May	5	3	48	0	0	0
Week 20	14-May	20-May	1	2	84	0	0	1
TOTALS			34	26	858	0	10	13

Totals include mortalities.

Smolt, parr, and fry refer to life stages within the freshwater portion of the salmonid life-cycle.

PIT tag recapture data show that the one marked coho that was recaptured spent three days in the system before continuing its outward migration. This coho smolt had been PIT tagged during the 2009 smolt trapping season and was recaptured in March of 2010, showing that it had remained in the creek for an additional year rather than continuing its migration to the ocean. The fish was originally tagged on 12 May 2009 and had a fork length of 116 mm and a weight of 14.06 g. It was captured again on 30 March 2010 and had a fork length of 149 mm and a weight of 33.04 g.

The trap also captured 13 coho fry and 858 steelhead fry during the trapping season. Coho fry capture was low throughout the season, with a peak in mid-April during Julian week 15. Steelhead fry capture peaked in late March, during Julian week 13. The mortality rate for coho fry

was 8% (1/13) and the mortality rate for steelhead fry was 3% (25/858). No adult steelhead were captured in the trap on Olema Creek.

3.2 Redwood Creek

A total of three traps were operated on Redwood Creek during the 2010 season. In addition to the primary Inventory and Monitoring Program outmigrant trap detailed in the approved protocol, a second trap (Banducci Trap) was installed approximately 1 km upstream (just downstream of the Banducci restoration area) to support a mark/recapture study. A third trap (backwater trap) was installed on a backwater downstream of the primary trap with the intent of trapping the large backwater habitat in this section of the watershed. Both the backwater and Banducci traps were operated in association with current restoration activities on lower Redwood Creek.

The primary outmigrant trap in Redwood Creek was in place for 71 days (from 19 March 2010—28 May 2010) and was fully operational for 59 days and partially operational for a total of six days. It was compromised twice due to a series of storms in early April and was non-operational for a total of six days over the course of the season. The Banducci trap was first operational on 17 April and was removed on 28 May. It was fully operational for 40 days and partially operational for two days. Because the Banducci trap was installed after the early April storms, it was at least partially operational for all 42 days it was in place. The numbers reported for Redwood Creek include fish taken from both mainstem traps. The backwater trap was in place for 56 days (3 April 2010 – 28 May 2010) and was fully operational for 52 days. During one of the early April storms, the trap was non-operational for four days and one wing wall section was removed to allow fish access to the backwater for refugia. Fish collected from the backwater trap were not used for the mark/recapture study.

The mainstem traps captured a total of 120 coho smolts, 51 steelhead smolts, and 62 steelhead parr. To avoid double-counting unmarked fish that were caught at both mainstem traps, smolt totals include all fish captured at the bottom mainstem trap and fish that were marked at the upper Banducci trap. For steelhead parr and non-salmonids, all fish captured at both traps are counted because these fish are assumed not to be moving down to the Pacific Ocean. Of the 62 steelhead parr caught on Redwood Creek, 22 (36%) were caught in the Banducci trap while 40 (64%) were caught on the lower mainstem trap. The mortality rate for both coho and steelhead smolts was zero. Both steelhead and coho smolts were marked with PIT tags in the 2010 season. The overall recapture rate for marked coho smolts, including fish marked and recaptured at the lower mainstem trap and fish marked at the Banducci trap and recaptured at the lower trap, was 18% (15/83). The overall recapture rate for marked steelhead smolts was 12% (4/33).

DARR analysis of the coho smolt data stratified by week (Figure 2) estimated capture probability at approximately 83% for the first six weeks before dropping to approximately 14% for the last four weeks of trapping operations. The total Redwood Creek coho smolt production estimate is 389 ($\pm$ 409). Peak capture for coho smolts occurred in late April, during Julian week 17 (Table 2).

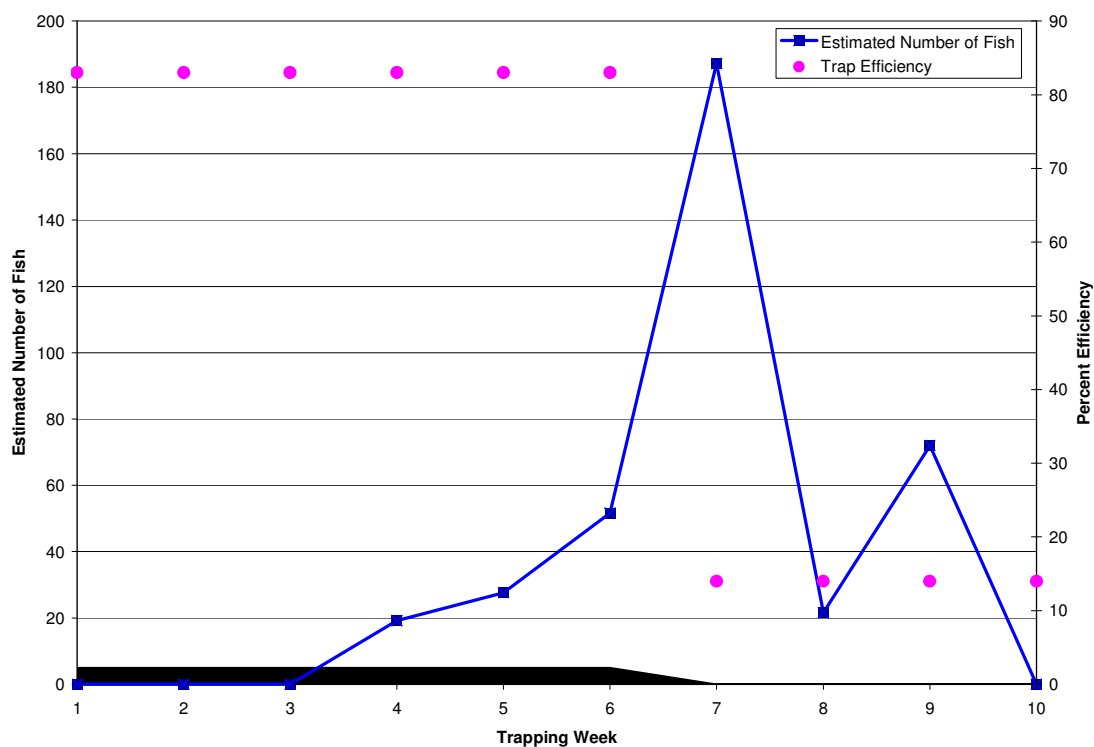


Figure 2. DARR analysis of coho smolt data for Redwood Creek, 2010. Estimated number of coho smolts (squares with line) is compared to trap efficiency (points). Darkened bars along bottom show recapture bins. The sum of the estimated number of coho smolts per week equals the production estimate of 389 coho smolts.

Table 2. Redwood Creek mainstem smolt trapping summary, 19 March 2010 – 28 May 2010.

Julian Week #	From	To	Steelhead Juvenile			Steelhead Adult		Coho	
			Smolt	Parr	Fry	Ocean Run		Smolt	Fry
Week 12	19-Mar	25-Mar	0	1	0	0		0	40
Week 13	26-Mar	1-Apr	0	1	14	0		0	1
Week 14	2-Apr	8-Apr	1	1	4	0		0	2
Week 15	9-Apr	15-Apr	3	4	4	0		1	9
Week 16	16-Apr	22-Apr	22	22	1	0		32	6
Week 17	23-Apr	29-Apr	18	6	0	0		45	1
Week 18	30-Apr	6-May	5	12	0	0		27	1
Week 19	7-May	13-May	1	8	8	0		4	4
Week 20	14-May	20-May	1	3	20	0		8	23
Week 21	21-May	27-May	0	2	2	0		3	4
Week 22	28-May	3-Jun	0	2	0	0		0	7
TOTALS			51	62	53	0		120	98

Totals include mortalities.

Smolt, parr, and fry refer to life stages within the freshwater portion of the salmonid life-cycle.

The mainstem traps also captured 98 coho fry and 53 steelhead fry. Forty-five of the 98 coho fry and 29 of the 53 steelhead fry were caught in the Banducci trap. The coho fry mortality rate over the entire trapping season was 2% (2/98) and the steelhead fry mortality rate was also 2% (1/53). Steelhead fry capture peaked in mid-May, during Julian week 20, and coho fry capture peaked at

the beginning of the trapping season, during Julian week 12. No adult steelhead were caught in either mainstem trap during the 2010 trapping season.

Smolts captured on the backwater trap were not included in the total counts or population estimate. While no coho or steelhead smolts were captured, one coho fry and three steelhead parr were caught on the backwater trap in 2010.

During summer 2009 surveys, 18 juvenile coho were PIT tagged. Four of these fish were later captured during the 2010 smolt trap season. Information about the overwinter growth of these coho is provided below (Table 3). In addition to providing information about the growth of fish tagged in the summer, PIT tags also showed the unusual migration path of one tagged smolt. Tagged on 27 April on the lower mainstem trap, the coho smolt swam upstream approximately 1 km and around the Banducci trap and was recaptured on the Banducci trap on 3 May. PIT tag recapture data show that marked fish spent an average of 8.2 days in the system after being marked before continuing their outward migration. The time spent upstream of the lower mainstem trap ranged from 1 to 21 days, with a median of 6 days.

Table 3. Measurements of coho tagged as juveniles in summer 2009 and recaptured as smolts in spring 2010.

Date tagged	Fork length (mm)	Weight (g)	Date recaptured	Fork length (mm)	Weight (g)
8/13/09	87	6.78	4/22/10	125	18.22
8/18/09	83	5.80	4/17/10 ^a	122	N/A
8/19/09	82	5.73	5/3/10	124	16.33
8/20/09	82	6.32	5/3/10	121	15.68

^a Recaptured on the lower mainstem trap. All others recaptured on the Banducci trap.

3.3 Pine Gulch Creek

Pine Gulch Creek did not have a smolt trap installed during the 2008 or 2009 seasons due to a lack of observed juvenile coho in summer 2007 and summer 2008. With the observation of coho juveniles on Pine Gulch Creek during summer surveys in 2009, a trap was installed for the 2010 outmigrant season. During the 2010 smolt trapping season, the Pine Gulch Creek trap was in place for 66 days (24 March 2010 – 28 May 2010). It was fully operational for 45 days and partially operational for eight days during the season. The trap was non-operational for 13 days of the season. Storms in early April caused large amounts of debris to block the pipe in-flow and resulted in the removal of the trap on two occasions.

The trap captured a total of 72 coho smolts, five steelhead smolts, and five steelhead parr. Both steelhead and coho smolts were marked using PIT tags but no marked steelhead were recaptured. The overall recapture rate for marked coho smolts was 21% (8/39).

DARR analysis of the coho smolt data stratified by week (Figure 3) estimated capture probability at approximately 17% for the first six weeks before increasing to approximately 27% for the last four weeks of trapping operations. The total Pine Gulch Creek coho smolt production estimate is 374 ($\pm$ 132). Peak capture for coho smolts occurred in late April and early May, during Julian weeks 16-18 (Table 4).

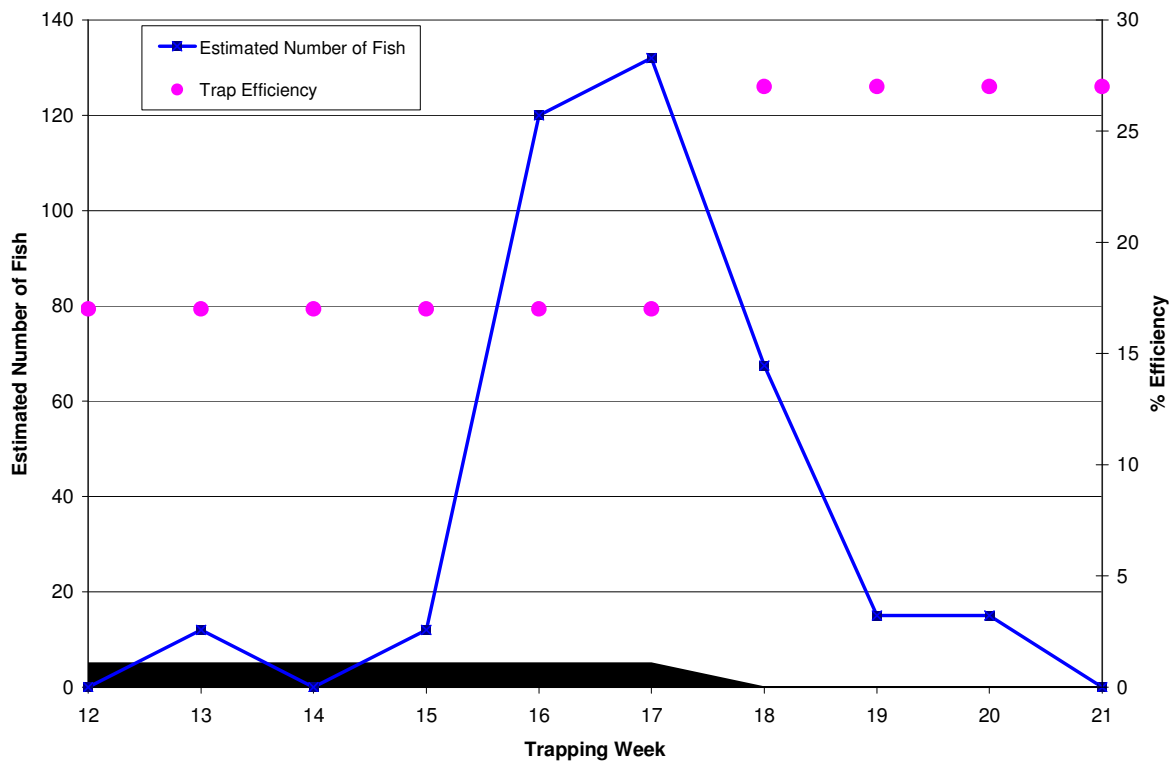


Figure 3. DARR analysis of coho smolt data for Pine Gulch Creek, 2010. Estimated number of smolts (line) is compared to trap efficiency (points). Darkened bars along bottom show recapture bins.

Darkened bars along bottom show recapture bins.

PIT tag recapture data show that the time marked fish spent in the system before continuing their outward migration ranged from 4 to 16 days, with a mean of 7.3 days and a median of 5.5 days.

The trap also captured 73 steelhead fry. Steelhead fry capture peaked in early April (Julian week 15). The mortality rate for steelhead fry was 15% (11/73). This high level of mortality was due in part to the high levels of debris that accumulated in the trap box with the high flows. Fry mortalities halted with the decrease of storm events. No coho fry were caught in the trap, nor were any adult steelhead captured in the trap on Pine Gulch Creek.

Table 4. Pine Gulch Creek mainstem smolt trapping summary, 24 March 2010—28 May 2010.

Julian Week #	From	To	Smolt	Steelhead Juvenile		Steelhead Adult	Coho	
				Parr	Fry	Ocean Run	Smolt	Fry
Week 12	19-Mar	25-Mar	2	0	0	0	0	0
Week 13	26-Mar	1-Apr	0	0	0	0	2	0
Week 14	2-Apr	8-Apr	0	2	12	0	0	0
Week 15	9-Apr	15-Apr	0	1	40	0	0	0
Week 16	16-Apr	22-Apr	1	1	9	0	21	0
Week 17	23-Apr	29-Apr	2	1	8	0	11	0
Week 18	30-Apr	6-May	0	0	1	0	29	0
Week 19	7-May	13-May	0	0	2	0	3	0
Week 20	14-May	20-May	0	0	1	0	5	0
Week 21	21-May	27-May	0	0	0	0	1	0
Week 22	28-May	3-Jun	0	0	0	0	0	0
TOTALS			5	5	73	0	72	0

Totals include mortalities.

Smolt, parr, and fry refer to life stages within the freshwater portion of the salmonid life-cycle.

3.4 Timing

Olema Creek had a different migration pattern when compared to Pine Gulch Creek and Redwood Creek. On Olema Creek, the few coho smolts that were captured migrated downstream between Julian weeks 12 and 16, with a peak in week 13. On Pine Gulch Creek and Redwood Creek, there was very little smolt movement before Julian week 16. For Pine Gulch Creek and Redwood Creek, over 80% of coho smolts migrated downstream during Julian weeks 16 through 18 (Figure 4).

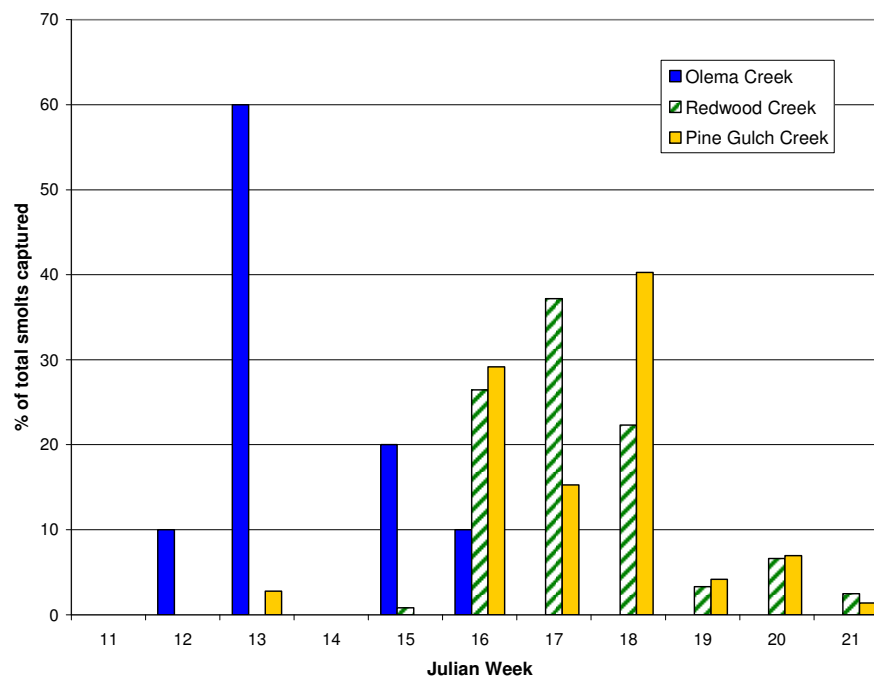


Figure 4. Percent of total coho smolts captured by Julian week for Pine Gulch, Redwood, and Olema Creeks, 2010.

3.5 Rainfall

Rainfall amounts were collected from rain gages located at the Bear Valley Visitor Center for Olema Creek and at the Highway One bridge on Redwood Creek. The following graphs are representations of daily cumulative rainfall amounts at the two rain gage locations (Figure 5 and Figure 6). Rainfall was higher than the historical average during March, April, and May. At the Bear Valley Visitor Center gage, the total monthly rainfall in each of the three trapping season months was higher in 2010 than the monthly average since 1965. For April and May, the 2010 monthly totals were more than twice the monthly average total with April 2010 totaling 6.00 in compared to a 1965-2009 average of 2.41 in and May 2010 totaling 2.8 in compared to a 1965-2009 average of 0.99 in.

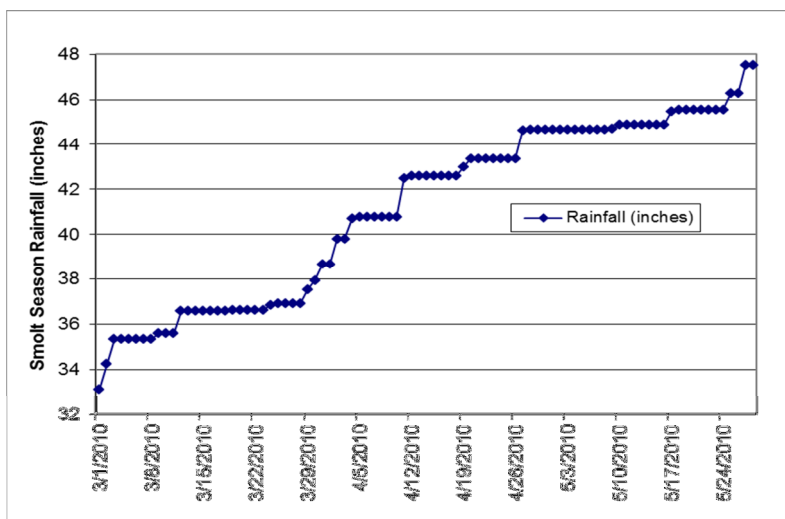


Figure 5. Cumulative daily rainfall totals for Olema Creek during the 2010 smolt trapping season, 19 March – 28 May 2010. The cumulative rainfall total on 19 March 2010 reflects the Water Year 2010 cumulative rainfall total from 1 October 2009 through 18 March 2010.

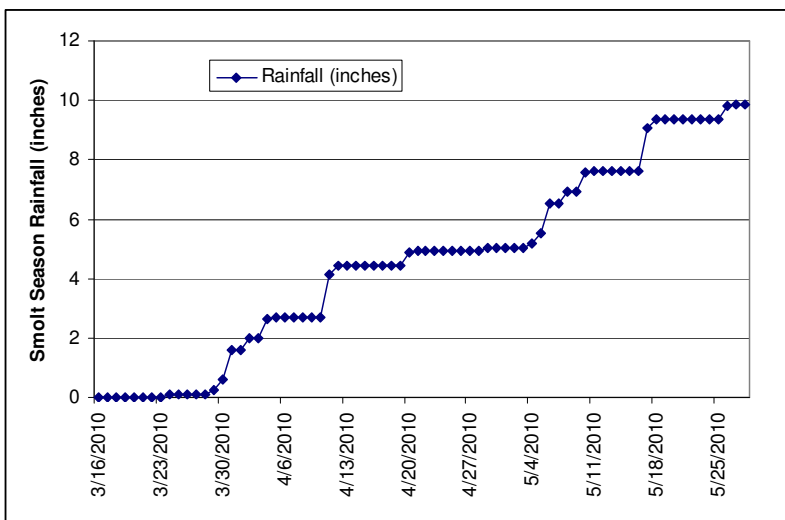


Figure 6. Cumulative daily rainfall totals for Redwood Creek during the 2010 smolt trapping season, 17 March – 28 May 2010. Cumulative Water Year 2010 data not available for this site due to lack of consecutive data.

3.6 Water Temperature

Water temperatures within trap boxes were within the tolerable temperature range (less than 22 °C) for coho salmon (Moyle 2002) during the entire trapping season at all three trapping locations (Figures 7, 8, 9). Olema Creek had the highest average temperature at 11.8 °C (1.3 SD) for the trapping season. Pine Gulch Creek had the lowest average temperature at 11.3 °C (1.0 SD) and Redwood Creek had an average temperature of 11.5 °C (1.1 SD). The lowest minimum temperature and the highest maximum temperature were 8.7 °C and 15.1 °C, respectively, and were both recorded on Olema Creek.

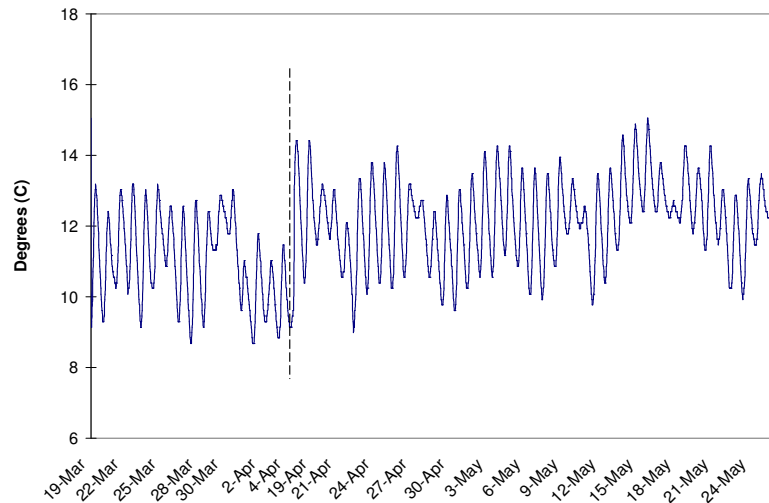


Figure 7. Olema Creek trap box Hobo temperature logger readout, spring 2010. The logger was installed on 12 March 2010 and removed on 4 April 2010 due to storms. It was reinstalled on 17 April 2010 and was removed on 21 May 2010 when the trap was removed for the season. Dashed line shows break.

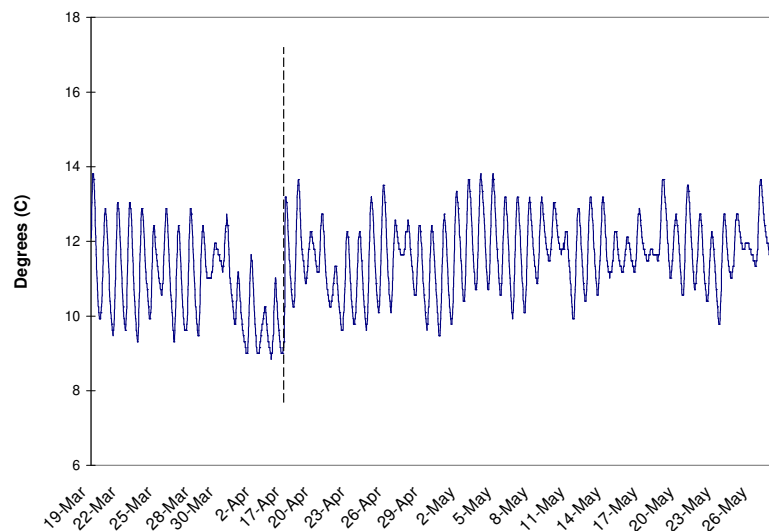


Figure 8. Redwood Creek trap box Hobo temperature logger readout, spring 2010. The logger was installed on 20 March 2010 and removed on 4 April 2010 due to storms. It was reinstalled on 17 April 2010 and was removed on 28 May 2010 when the trap was removed for the season. Dashed line shows break.

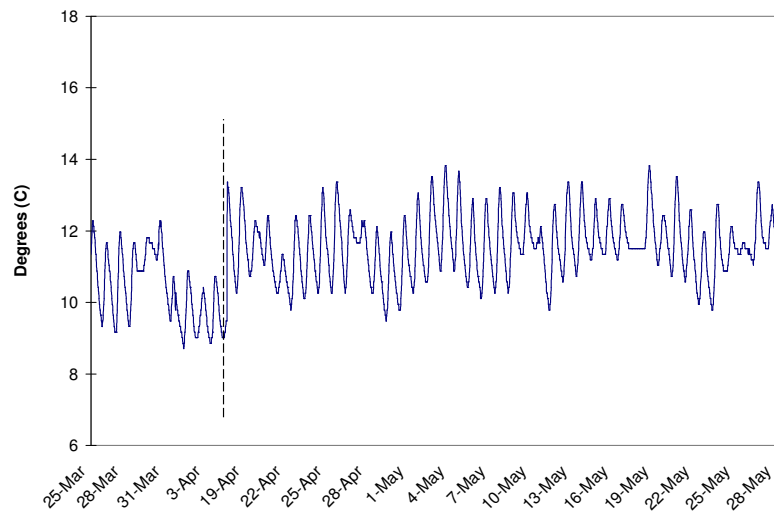


Figure 9. Pine Gulch Creek trap box Hobo temperature logger readout, spring 2010. The logger was installed on 25 March 2010 and removed on 4 April 2010 due to storms. It was reinstalled on 17 April 2010 and was removed on 28 May 2010 when the trap was removed for the season. Dashed line shows break.

3.7 Watershed Production Estimate

With only 10 coho smolts captured on Olema Creek, the sample size was not large enough to calculate a production estimate. On Redwood Creek 120 coho smolts were captured with a production estimate of 389 (± 409) coho smolts. The large confidence interval calculated for Redwood Creek may have been a result of taking out the Redwood Creek traps on several occasions due to storm events, when high numbers of fish are likely to move through and thus be missed. On Pine Gulch Creek 72 coho smolts were captured with a production estimate of 374 (± 132) coho smolts. Steelhead and salmonid fry totals are variable between streams with the majority of the steelhead fry captured on Olema Creek and the majority of steelhead smolts captured on Redwood Creek (Table 5). For a summary of salmonid information for smolt trapping operations from 1999 to 2009 see Table A1 in Appendix A.

Table 5. Summary of salmonid information for Pine Gulch Creek, Redwood Creek, and Olema Creek trap operations, 2010.

Watershed	Year	Trap Operation Dates		Steelhead				Coho		Coho Production Estimate	
		From	To	Juvenile		Fry	Adult ocean-run	smolt	fry	Estimate	SD
				smolt	parr						
Olema Creek	2010	19-Mar	21-May	34	26	858	0	10	13	N/A	N/A
Redwood Creek ^a	2010	19-Mar	28-May	51	62	53	0	120	98	389	± 409
Pine Gulch Creek	2010	24-Mar	28-May	5	5	73	0	72	0	374	± 132

^a Includes totals from both mainstem trap sites.

3.8 Non-salmonid Captures

An annual summary of total catch for non-salmonid species is represented in Table 6. Non-native mosquito fish (*Gambusia affinis*) were found in the Olema Creek trap for the first time in 2009 but no observations were recorded in 2010. No non-native species were trapped in Redwood Creek. In the backwater trap on Redwood Creek, a total of 405 rough-skinned newts (*Taricha granulosa*) were captured. Twenty rough-skinned newts were captured in the two mainstem Redwood Creek traps. The only non-native fish captured during the 2010 trapping season was on Pine Gulch. A total of seven green sunfish (*Lepomis cyanellus*) were captured. Surveys during the summer of 2010 will be utilized to assess the expansion of this species in the mainstem of Pine Gulch. For a summary of non-salmonid species information for trapping operations from 1999 to 2009 see Table A2 in Appendix A.

Table 6. Summary of non-salmonid information for Pine Gulch Creek, Redwood Creek, and Olema trap operations, 2010.

Watershed	Year	Trap Dates		GSF	LAM	RO	SCU	STK	SUC	Totals
		From	To							
Olema Creek	2010	19-Mar	21-May	0	27	3,187	110	1,353	7	4,684
Redwood Creek ^a	2010	19-Mar	28-May	0	0	0	340	193	0	533
Pine Gulch Creek	2010	24-Mar	28-May	7	26	0	315	18	0	366

Species Code: GSF = Green Sunfish (non-native), LAM = Lamprey spp., RO = California Roach, SCU = Sculpin spp., STK = Threespine Stickleback, SUC = Sacramento Sucker.

^a Includes totals from both mainstem trap sites.

3.9 Smolt Size and Condition

Length and weight data provide critical information that contributes to the understanding of fish health, survival, and condition factors. In addition, length and weight data allow for estimating fork length frequency, growth rates, and biomass production. Throughout the 2010 smolt trap operations, staff recorded fork lengths and weights of a subsample of fish captured in the trap. Histograms of salmonid fork length frequencies are presented for Olema Creek coho (Figure 10) and steelhead smolts (Figure 11), Redwood Creek coho (Figure 12) and steelhead smolts (Figure 13), and Pine Gulch Creek coho (Figure 14) and steelhead smolts (Figure 15).

On Olema Creek, the coho fork lengths ranged from 126 mm to 149 mm and the peak length frequency was in the 131 mm to 135 mm range, representing 40% of the coho smolts measured. On Redwood Creek, coho smolt fork lengths ranged from 104 mm to 145 mm. The peak length frequency of coho smolts on Redwood Creek was in the 121 mm to 125 mm range, representing 27% of the coho smolts measured. The coho smolt fork lengths recorded throughout the spring monitoring efforts on Pine Gulch Creek ranged from 98 mm to 149 mm. The highest frequency of smolts on Pine Gulch Creek occurred in the 116 mm to 120 mm range, representing 20% of the coho smolts measured.

Olema Creek steelhead smolt fork lengths ranged from 119 to 212 mm and the highest frequency of steelhead smolt fork lengths were in the 166 to 170 mm range and the 181 to 185 mm range, representing 28% of the steelhead smolts measured. Steelhead smolt fork lengths on Redwood Creek ranged from 139 to 196 mm. The highest frequencies of steelhead smolt fork lengths on Redwood Creek occurred in the 156 mm to 160 mm range and the 166 mm to 170 mm range,

each accounting for 17% of the steelhead smolts measured. The steelhead smolt fork lengths recorded throughout the spring monitoring efforts on Pine Gulch Creek ranged between 143 mm and 180 mm, with 20% of the steelhead in the 156 mm to 160 mm range.

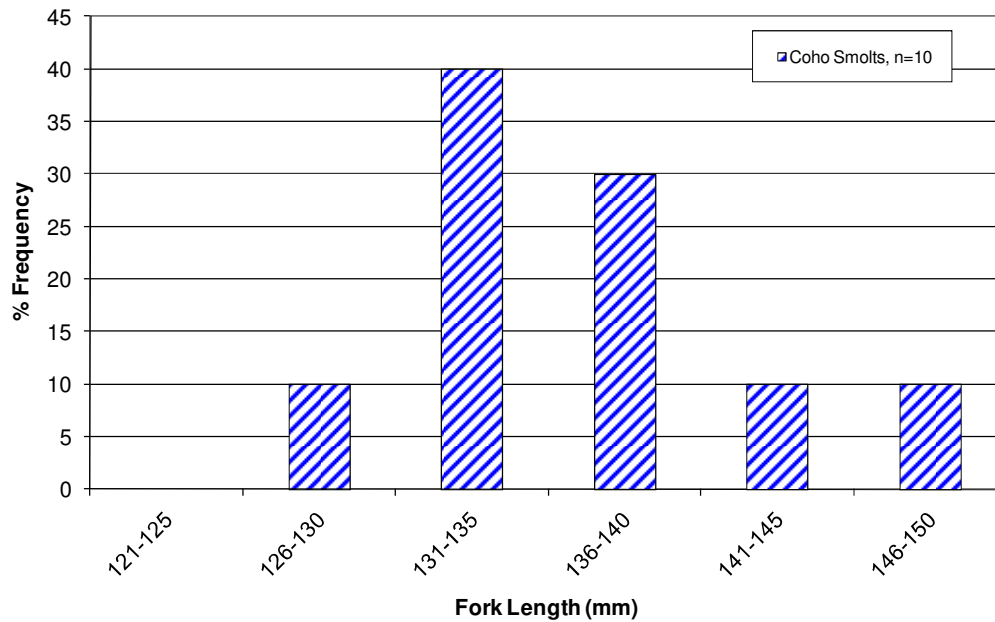


Figure 10. Coho smolt fork lengths in 5 mm bins for Olema Creek, 2010.

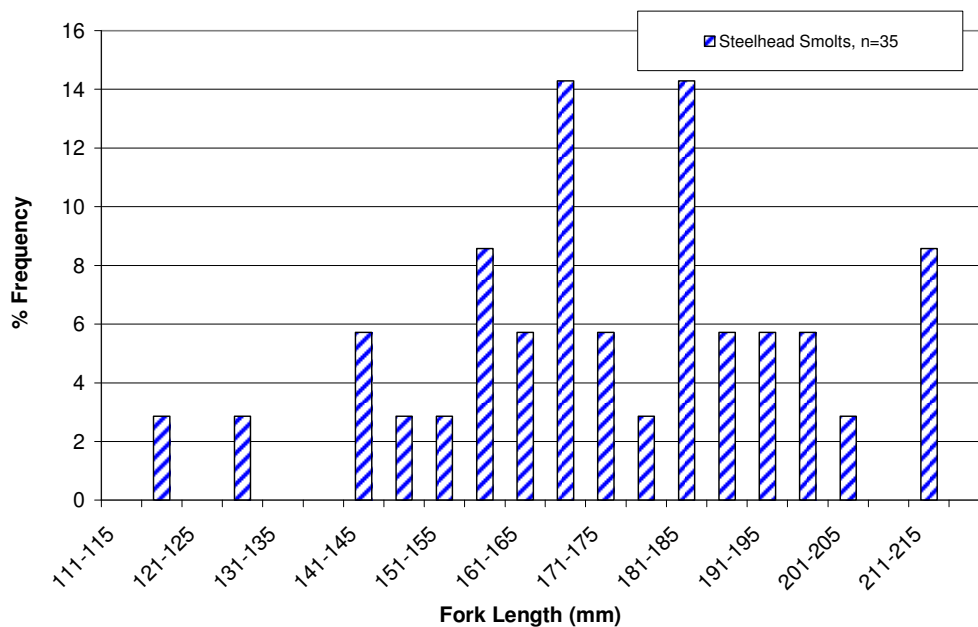


Figure 11. Steelhead smolt fork lengths in 5 mm bins for Olema Creek, 2010.

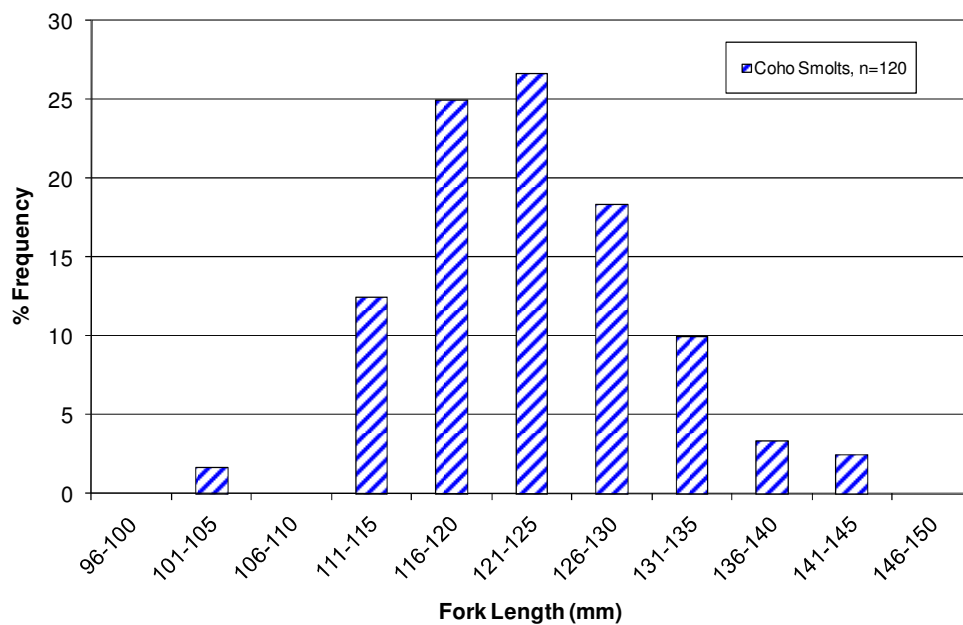


Figure 12. Coho smolt fork lengths in 5 mm bins for Redwood Creek, 2010.

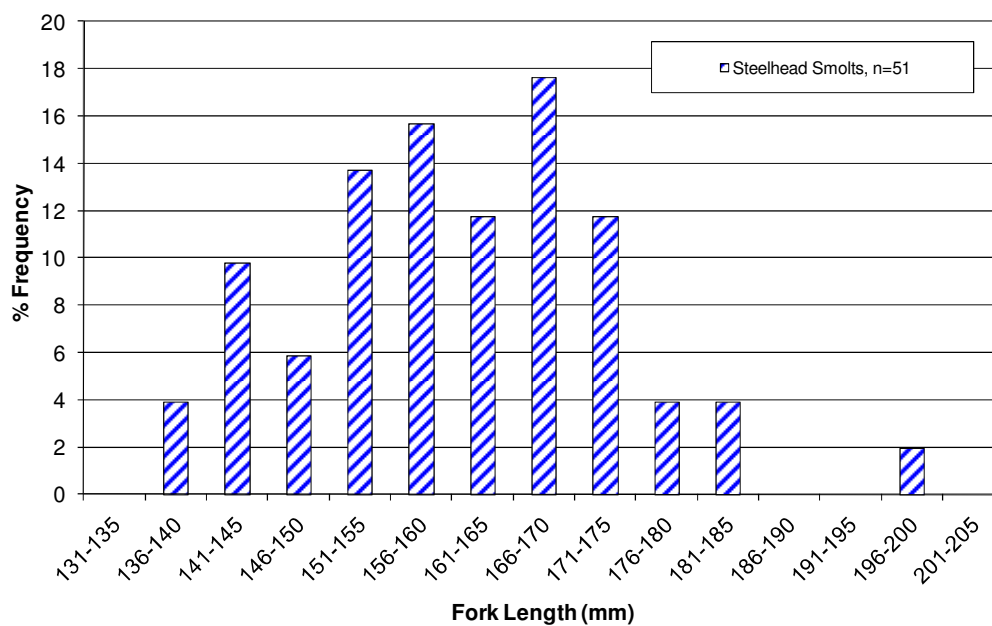


Figure 13. Steelhead smolt fork lengths in 5 mm bins for Redwood Creek, 2010.

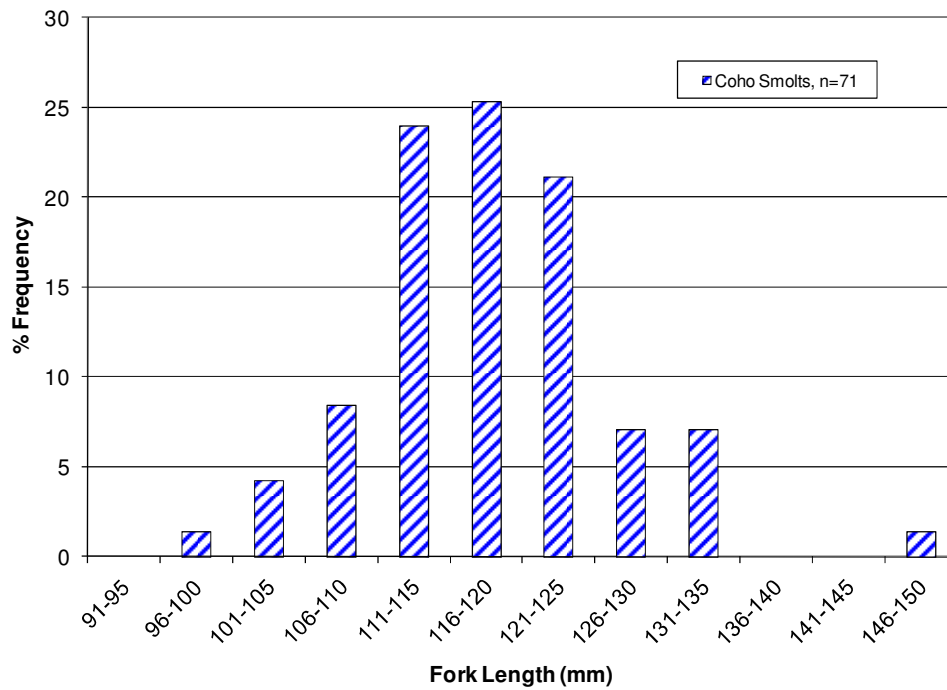


Figure 14. Coho smolt lengths in 5 mm bins for Pine Gulch Creek, 2010.

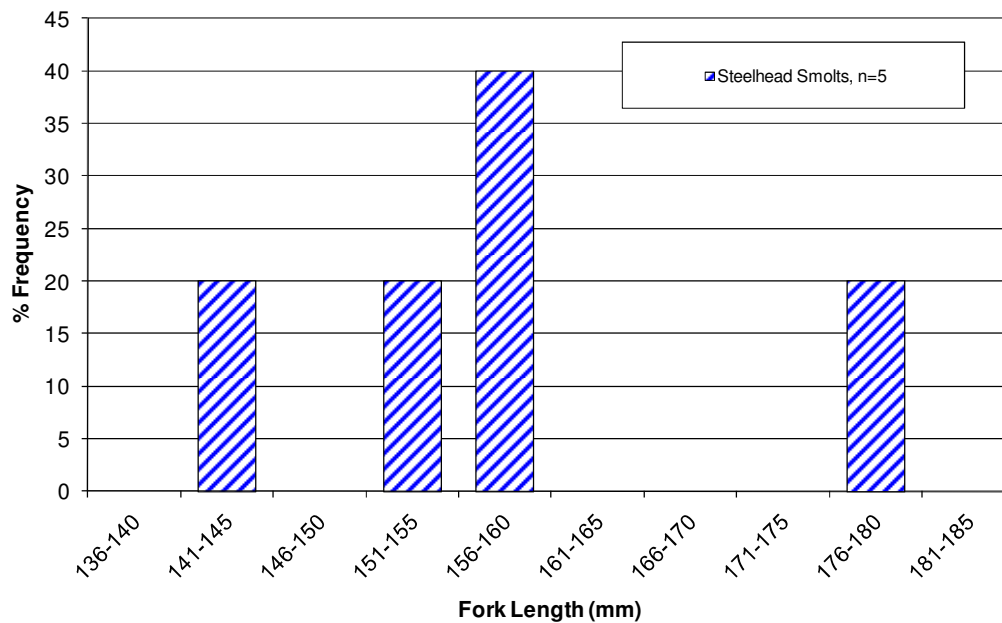


Figure 15. Steelhead smolt fork lengths in 5 mm bins for Pine Gulch Creek, 2010.

Length is the principal factor affecting the weight of fishes. In spite of this, there can be significant differences in weight distribution between similar size fish of the same species within

a particular watershed and surrounding region. In order to compare length-weight relationships, we applied the Fulton Condition Factors (K) to establish comparable indices of condition (Murphy and Willis 1996). Condition factors are a ratio relating fish length to fish weight therefore measuring the relative biomass of a fish, with a higher length to weight ratio denoting a better over-all condition. Table 7 shows the comparisons between coho smolt length and K-factors at Olema, Redwood, and Pine Gulch Creeks. Table 8 shows the comparisons between steelhead smolt length and K-factors at Olema, Redwood, and Pine Gulch Creeks.

In 2010, the average coho smolt fork length was 136.20 mm in Olema Creek, 122.96 mm in Redwood Creek, and 118.43 mm in Pine Gulch Creek. The mean weight of coho smolts was 24.06 g in Olema Creek, 16.23 g in Redwood Creek and 14.81 g in Pine Gulch Creek. The mean K-factor was 0.94 in Olema Creek, 0.86 in Redwood Creek and 0.88 in Pine Gulch Creek.

Table 7. Coho mean and median length, weight, and K factor calculated during 2010 for the trapping locations at Pine Gulch, Redwood, and Olema Creeks.

Watershed	Sample Size	Mean Length (mm)	Median Length (mm)	Length Standard Deviation	Mean Weight (g)	Median Weight (g)	Weight Standard Deviation	Mean K-Factor	K-Factor Standard Deviation
Olema Creek	10	136.20	135.00	6.70	24.06	23.64	4.17	0.94	0.06
Redwood Creek	106	122.96	122.50	7.72	16.23	15.66	3.16	0.86	0.05
Pine Gulch Creek	67	118.43	119.00	8.47	14.81	14.54	3.40	0.88	0.05

The average steelhead smolt fork length was 173.88 mm in Olema Creek, 160.48 mm in Redwood Creek, and 157.60 mm in Pine Gulch Creek. The mean weight of steelhead smolts was 48.20 g in Olema Creek, 34.54 g in Redwood Creek, and 33.13 g in Pine Gulch Creek. The mean K-factor was 0.88 in Olema Creek and 0.83 in both Pine Gulch and Redwood Creeks.

Table 8. Steelhead mean and median length, weight, and K factor calculated during 2010 for the trapping locations at Pine Gulch, Redwood, and Olema Creeks.

Watershed	Sample Size	Mean Length (mm)	Median Length (mm)	Length Standard Deviation	Mean Weight (g)	Median Weight (g)	Weight Standard Deviation	Mean K-Factor	K-Factor Standard Deviation
Olema Creek	31	173.88	175.00	22.66	48.20	44.86	17.80	0.88	0.07
Redwood Creek	46	160.48	160.50	11.15	34.54	34.72	7.10	0.83	0.06
Pine Gulch Creek	5	157.60	157.00	13.78	33.13	32.62	9.09	0.83	0.02

3.9.1 Coho Smolt Passive Integrated Transponder Summary

During the course of the trapping operation, five coho smolts were implanted with PIT tags on Olema Creek as part of the smolt trapping mark/recapture study. Tagged individuals had an average fork length of 133 mm with a median fork length of 134 mm and an average weight of 21.90 g and a median weight of 22.18 g. Of the five tagged individuals, one PIT tagged coho smolt was subsequently recaptured. Additionally, one coho that had been PIT tagged as a smolt in 2009 was captured again in 2010. The fish had gained 33 mm in fork length and 18.98 g in

weight, more than doubling its weight, between its tagging date of 12 May 2009 and recapture date of 30 March 2010.

On Redwood Creek a total of 83 coho salmon were marked with PIT tags and 15 fish were subsequently recaptured. Tagged individuals implanted at either the lower mainstem trap or at the Banducci trap, had an average fork length of 123 mm with a median of 122 mm and an average weight of 16.21 g with a median weight of 15.44 g. The largest growth observed on Redwood Creek for a PIT tagged individual was an increase of 0.42 g and 3 mm over a 10 day period from mark to recapture. Some tagged fish lost weight between mark and recapture: the greatest weight loss was 2.12 g over a 21 day period.

Four coho that had been PIT tagged as juveniles in summer 2009 and were captured again as smolts on the mainstem Redwood Creek traps. Overwinter growth information for these individuals is provided in Table 3 (p. 12). PIT tags also showed the movement of one coho smolt that was tagged at the lower mainstem trap on 27 April 2010, swam upstream past the Banducci trap, and was captured at the Banducci trap on 3 May 2010.

On Pine Gulch Creek, 39 coho smolts were implanted with PIT tags as part of the smolt trapping mark/recapture study. Tagged individuals had an average fork length of 120 mm with a median fork length of 119 mm and an average weight of 15.26 g with a median weight of 14.79 g. Of the 39 tagged individuals, eight PIT tagged coho smolts were subsequently recaptured. All recaptured smolts on Pine Gulch Creek were within 1 mm of their fork length when initially tagged and measured.

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Appendix A. Annual Catch Totals

Table A1. Summary of salmonid information for Olema, Redwood, and Pine Gulch Creeks trap operations, 1999-2009.

Watershed	Year	Trap Operation Dates		Days In Operation ^c	Steelhead			Adult ocean-run	Coho		Coho Production Estimate	
		From	To		smolt	parr	fry		smolt	fry	Estimate	SD
Olema Creek	2004	30-Mar	28-May	28	13	5	140	0	228	31	831	± 167
	2005 ^a	1-Apr	9-May	31	9	8	1,218	1	88	14	362	± 145
	2006	10-Apr	9-Jun	45	6	19	497	0	368	51	3,793	± 784
	2007	14-Mar	27-May	66	233	135	462	12	330	739	1,485	± 207
	2008	18-Mar	30-May	72	62	9	38	3	934	8	2,885	± 336
	2009	12-Mar	29-May	62	117	104	32	0	1,072	1	4,088	± 1,041
Redwood Creek	2005	27-Mar	31-May	35	1	1	344	0	299	535	1,977	± 430
	2006	18-Apr	9-Jun	49	18	0	24	0	1,048	27	2,502	± 257
	2007	16-Mar	27-May	66	17	5	585	1	330	97	1,353	± 307
	2008	19-Mar	30-May	70	18	3	151	0	890	3	2,046	± 163
	2009 ^b	11-Mar	29-May	65	69	16	199	2	163	4	N/A	N/A
Pine Gulch	1999	16-Apr	24-May	20	62	40	68	1	0	0	N/A	N/A
	2002	28-Mar	29-May	50	27	25	240	5	249	0	N/A	N/A
	2003	28-Mar	30-May	10	283	121	235	1	576	1	N/A	N/A
	2004	25-Mar	28-May	35	50	51	57	0	147	0	737	± 144
	2005	31-Mar	31-May	43	28	10	200	0	8	0	N/A	N/A
	2006	26-Apr	9-Jun	43	11	12	2	0	93	1	367	± 69
	2007	14-Mar	27-May	69	45	37	3,147	7	76	0	290	± 62

Coho and steelhead presmolts are included in the coho and steelhead smolt totals.

^a Trapping discontinued May 9 due to high flows. Trap was not reinstalled. Population estimate calculated using Chapman (1951)

^b During 2009 coho smolts were marked at both the Banducci and mainstem traps on Redwood Creek. The smolt total presented in this table includes all unmarked fish caught at the mainstem trap, including those that were then marked, and the fish marked at Banducci to avoid double-counting fish that were not marked at Banducci and later caught downstream in the mainstem trap. A population estimate is not available for Redwood Creek in 2009 due to the lack of variation in timing of recaptured smolts.

^c Does not include days where trap was only partially functioning.

Table A2. Summary of non-salmonid information for Olema, Redwood, and Pine Gulch Creeks trap operations, 1999-2009.

Watershed	Year	Trap Dates		CH	GSF	GSH	LAM	PL	RO	SCU	STK	SUC	Totals
		From	To										
Olema Creek	2004	30-Mar	28-May	2	1	1	15	0	274	243	3,083	144	3,763
	2005	1-Apr	9-May	0	0	0	33	0	1,006	117	648	58	1,862
	2006	10-Apr	9-Jun	0	0	0	5	1	420	644	2,998	3	4,071
	2007	15-Mar	26-May	0	0	0	35	0	3,190	356	1,110	140	4,839
	2008	18-Mar	30-May	0	0	0	2	3	158	228	30	2	423
	2009	12-Mar	29-May	0	0	0	109	0	554	335	782	8	1,788
Redwood Creek	2005	27-Mar	31-May	0	0	0	0	0	0	24	5,343	0	5,367
	2006	18-Apr	9-Jun	0	0	0	0	0	0	133	117	0	250
	2007	18-Mar	26-May	0	0	0	0	0	0	93	57	0	150
	2008	19-Mar	30-May	0	0	0	0	0	0	151	38	0	189
	2009 ^a	11-Mar	29-May	0	0	0	0	0	0	220	74	0	294
Pine Gulch	1999	16-Apr	24-May	0	0	0	5	0	18	43	4	52	122
	2002	28-Mar	29-May	0	15	0	2	0	11	94	6	0	128
	2003	28-Mar	30-May	0	10	0	4	0	0	99	9	1	123
	2004	25-Mar	28-May	0	1	0	2	0	0	101	47	0	151
	2005	31-Mar	31-May	0	22	0	7	0	1	83	43	0	156
	2006	26-Apr	9-Jun	0	2	0	2	0	0	149	9	0	162
	2007	15-Mar	26-May	0	3	0	46	0	0	193	69	1	312

Species Code: CH = Chinook Salmon (*Oncorhynchus tshawytscha*), GSF = Green Sunfish (non-native), GSH = Golden Shiner (*Notemigonus crysoleucas*, non-native), LAM = Lamprey spp., PL = Pacific Lamprey (*Lampetra tridentata*), RO = California Roach, SCU = Sculpin spp., STK = Threespine Stickleback, SUC = Sacramento Sucker.

^a Includes Banducci trap site.

Appendix B. Julian Week Table

Table B1. List of Julian weeks and their calendar equivalents non-leap year.

Julian week Number	Inclusive Dates	Julian week Number	Inclusive Dates
1	Jan 01 - Jan 07	27	Jul 02 - Jul 08
2	Jan 08 - Jan 14	28	Jul 09 - Jul 15
3	Jan 15 - Jan 21	29	Jul 16 - Jul 22
4	Jan 22 - Jan 28	30	Jul 23 - Jul 29
5	Jan 29 - Feb 04	31	Jul 30 - Aug 05
6	Feb 05 - Feb 11	32	Aug 06 - Aug 12
7	Feb 12 - Feb 18	33	Aug 13 - Aug 19
8	Feb 19 - Feb 25	34	Aug 20 - Aug 26
9	Feb 26 - Mar 04	35	Aug 27 - Sep 02
10	Mar 05 - Mar 11	36	Sep 03 - Sep 09
11	Mar 12 - Mar 18	37	Sep 10 - Sep 16
12	Mar 19 - Mar 25	38	Sep 17 - Sep 23
13	Mar 26 - Apr 01	39	Sep 24 - Sep 30
14	Apr 02 - Apr 08	40	Oct 01 - Oct 07
15	Apr 09 - Apr 15	41	Oct 08 - Oct 14
16	Apr 16 - Apr 22	42	Oct 15 - Oct 21
17	Apr 23 - Apr 29	43	Oct 22 - Oct 28
18	Apr 30 - May 06	44	Oct 29 - Nov 04
19	May 07 - May 13	45	Nov 05 - Nov 11
20	May 14 - May 20	46	Nov 12 - Nov 18
21	May 21 - May 27	47	Nov 19 - Nov 25
22	May 28 - Jun 03	48	Nov 26 - Dec 02
23	Jun 04 - Jun 10	49	Dec 03 - Dec 09
24	Jun 11 - Jun 17	50	Dec 10 - Dec 16
25	Jun 18 - Jun 24	51	Dec 17 - Dec 23
26	Jun 25 - Jul 01	52	Dec 24 - Dec 31